City of Moore / Moore Public Schools

Hazard Mitigation Plan

2020-2025

TABLE OF CONTENTS

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CHAPTER ONE: INTRODUCTION

Hazard mitigation planning is any sustained action taken to reduce or eliminate long-term risk to people and property from natural and manmade hazards and their effects. This definition distinguishes actions that have a long-term impact from those that are more closely associated with immediate preparedness, response, and recovery activities. Mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage.

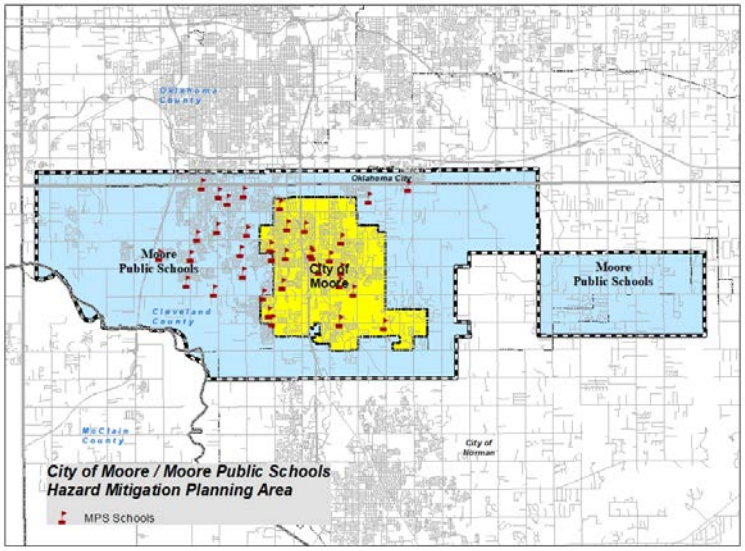
The purpose of this plan is to identify the hazards that impact the City of Moore and Moore Public School District, to identify actions and activities to reduce any losses from those hazards, and to establish a coordinated process to implement this plan, taking advantage of a wide variety of resources.

1.1 Participating Jurisdictions

The jurisdictions participating in this plan are the City of Moore and the Moore Public School District (MPS). This plan addresses all of the hazards and assets within the City of Moore, as well as all of the Moore Public Schools locations located in both Moore and Oklahoma City. This plan does not address any other locations or assets in Oklahoma City, as those are addressed in the Hazard Mitigation Plan for the City of Oklahoma City.

1.2 Overview of Planning Area

The City of Moore is located immediately south of Oklahoma City in northern Cleveland County, and contains 21.82 square miles. Oklahoma City surrounds Moore on three sides, and the southernmost side borders the City of Norman. The population of the City of Moore is estimated at 62,103.



City of Moore & Moore Public Schools Planning Area
See Appendix A for larger version

The Moore Public School district encompasses 159 square miles in Moore, south Oklahoma City, and north Norman. MPS is the third largest school system in the state, with a census of approximately 25,000 students and 1,000 certified educators. The District offers education at 35 schools including 3 high schools, 6 junior high schools, 25 elementary schools, and an academy for nontraditional students. Several additional locations support the educational venues, including administration, technology, nutrition, transportation, maintenance facilities.

The planning area is located in central Oklahoma, making it susceptible to a wide range of weather related risks/extremes that include high winds, tornadoes, hail, flooding, drought, wildfire, and severe winter storms. The area is also susceptible to a variety of other natural, technological and man-made hazards.

1.3 Community Profile

The population growth rate in the City of Moore has been among the fastest in Oklahoma during the past decade. According to the Census the annual growth rate for the city was 2.6% between 2000 and 2014. This is higher than Norman (1.5%), Oklahoma City (1.2%), Edmond (1.9%) and Broken Arrow (2.4%). [1]

The Oklahoma City Metropolitan Region grew by over 150,000 people from 2000 to 2010. The City of Moore grew by almost 15,000 people over this same period. Moore has grown by 47% since 1990. This growth is expected to continue due to Moore's prime location in the region, great schools and relatively low cost of living.[2]

For planning purposes, population projections were produced based on a linear rate of population growth experienced between 1990 and 2015. These projections indicate that the city may grow by over 19,000 people in the next 25 years. This represents a growth of 33% and could translate into a demand for an additional 7,900 housing units.[3]

There are approximately 22,762 housing units in Moore. The areas with the highest median housing values (~$200-250,000) are in the east and southwest parts of the city. The areas of the lowest median housing value ($~$80,000) are areas with the oldest housing stock, including just east of Old Town and the west-central part of the city. There has been a 44% increase in housing units between 2000 and 2015 (an addition of 6,961 units).

The great majority (86%) of housing units in the city are single family homes. Approximately 12.5% of the housing stock includes duplexes, townhomes and apartments. Demand for rentals are up and rental of single family homes exceed apartments.

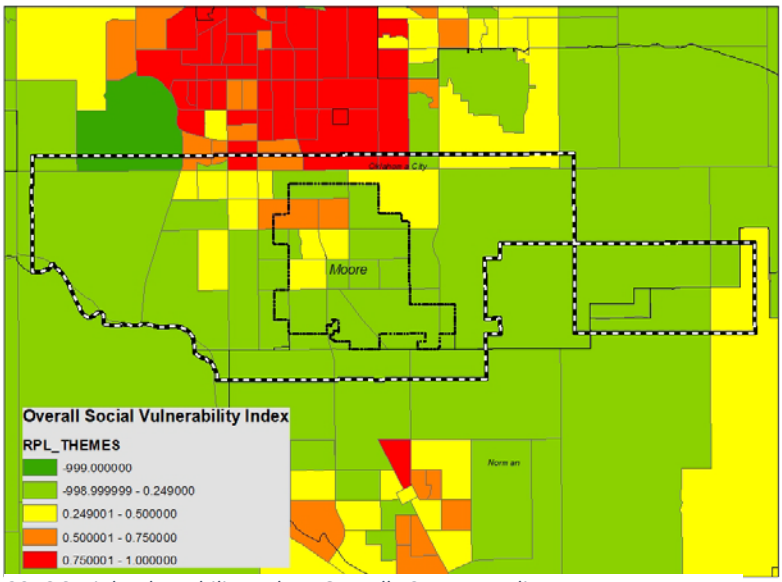
Demographic information supports hazard mitigation planning to identify geographic areas where social factors increase vulnerability to some or all hazards. In Moore, 9.0 percent of persons under age 65 identified as having some type of disability, and 11 percent do not have health insurance. A language other than English is spoken in 7.3 percent of the homes[4].

In relation to the rest of the state, demographics in Moore are comparatively higher for population growth, high school graduates, and median household income. Indicators are comparatively lower for language other than English spoken at home, persons under age 65 with a disability, persons without health insurance, and persons in poverty.

Indicator	State	Moore
Population Change 2010-2018	+5.1%	+12.7%
Language Other than English spoken at home	10.1%	7.3%
High School Graduate or higher	87.5%	91.7%
With a disability, under age 65	11.4%	9.0%
Without health insurance	16.7%	11.0%
Median Household Income	$49,767	$62,347
Persons in Poverty	15.6%	9.5%

[1] Envision Moore 2040, p. 17.
[2] Envision Moore 2040, p. 13.
[3] Envision Moore 2040, p. 18.
[4] https://www.census.gov/quickfacts/fact/table/moorecityoklahoma,US/PST045218

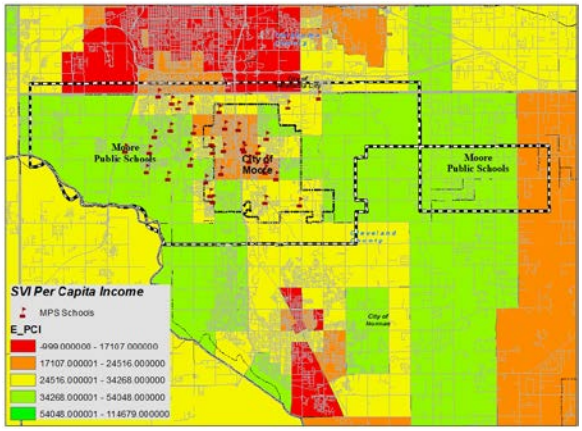
Social vulnerability refers to the resilience of communities when confronted by external stresses on human health, stresses such as natural or human-caused disasters, or disease outbreaks. Reducing social vulnerability can decrease both human suffering and economic loss. CDC's Social Vulnerability Index uses 15 U.S. census variables at tract level to help local officials identify communities that may need support in preparing for hazards; or recovering from disaster. The 2016 SVI shows several sections of the planning area to be in either the 0.25-0.5 or 0.5-0.75 range[5].



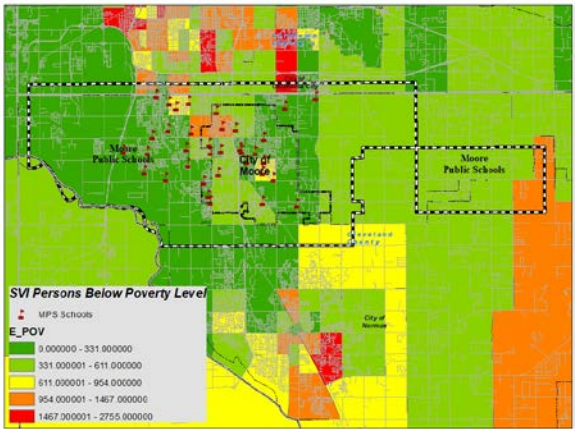
2016 Social Vulnerability Index - Overall. See Appendix B.

Moore has a diverse economy and is experiencing strong growth. New commercial prospects appear frequently, significant commercial growth is occurring along the Interstate 35 corridor, and the newer residential developments include larger, executive type housing and gated communities.[6] Sales tax revenues have steadily increased over the past ten years.

Per capita income in the area is strong compared to the region; poverty level is low.[7]



2016 Social Vulnerability Index - Per Capita Income



2016 Social Vulnerability Index - Persons Below Poverty Level

[5] Social Vulnerability Index 2016, Centers for Disease Control
[6] http://www.moorechamber.com/discover/city-of-moore
[7] Social Vulnerability Index 2016, Centers for Disease Control

Employers within the City of Moore with over 100 employees[8].

Employer	Employee Count
Moore Public Schools	2,812
Walmart Supercenter	400-500
City of Moore	375
Hyatt Shared Service Center	240
Sam's Club	180
Silver Star Construction	160
Lowe's Home Improvement	150
Target	150
Winco Foods	150
Kohl's	125
JC Penney	115
At Home	103
Mid Con Carriers Corp.	101
Best Buy	100

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[8] Source: City of Moore Economic Development Department, 2019

CHAPTER TWO: PLANNING PROCESS

2.1 Overview of Planning Process

The City of Moore and Moore Public Schools have previously participated in a Hazard Mitigation Plan with Cleveland County and other jurisdictions within the county. However for the current plan cycle, the City of Moore and MPS will produce a hazard mitigation plan that is specific to City of Moore and MPS only.

The following is a listing of significant events surrounding the HMP update planning process.

Date	HMP Update Process Event
April 2014	Adoption of Cleveland County Hazard Mitigation Plan
May 14, 2015	A public meeting was held as part of the development of the City's Stormwater Master Plan. Over 70 people were recorded on sign-in sheets, over 120 were counted in attendance. Approximately one week prior to the public meeting, the City of Moore had experienced a significant rainfall event resulting in substantial flooding across the City. Maps of the City were used to identify the locations of flooding. Consultant staff visited with citizens and recorded concerns including descriptions of the problem areas along with pictures and videos.[9]
January 2016	Adoption of City of Moore Stormwater Management Plan
May 15, 2017	Adoption of City of Moore Comprehensive Plan. City staff had worked with citizens and consultants over a period of approximately 14 months to update this plan to set forth a vision for the future of the community. City leaders, key stakeholder, and citizens were engaged to help clarify the issues and opportunities.[10]
March 29, 2018	Initial planning meeting for HMP update. Decision was made to produce a plan specific to the City of Moore and Moore Public Schools. Preliminary discussion was held concerning which hazards threaten the planning area and what the mitigation priorities should be.
October 23, 2018	Moore EM staff, MPS Safety Director, and Oklahoma Dept. of Emergency Management planners met to discuss the planning process and next steps to take.
December 11, 2018	A public hearing for the HMP update was held as part of a City of Moore Planning Commission meeting. A presentation was given by the lead planner; public input was invited.
December 12, 2018	An invitation to complete a hazard mitigation survey was posted on the Moore Emergency Management Facebook page, city website, and distributed by MPS. Reminders were posted on December 17, 19, and January 15. Each post contained contact information for obtaining a hardcopy, and this information was specifically posted on December 27.
January 10, 2019	Planning team met and reviewed results from the survey. They also worked on rating severity and discussed potential impacts.

[9] City of Moore Comprehensive Stormwater Management & Master Drainage Plan, p.2.
[10] Envision Moore Plan 2040, p. 10.

January 23, 2019	Lead planner sent a hazard severity worksheet to planning team members, community stakeholders, and neighboring jurisdictions.
March 14, 2019	Lead planner sent list of action items to city and school leadership for review and input.
March 28, 2019	The Planning team met and voted on prioritization of mitigation action items. The Oak Ridge Drainage project was added as an additional action item. A lengthy discussion followed regarding each department's readiness and procedures for spring severe weather.
July 25, 2019	Moore EM and Community Development staff met with Meshek and Associates to review Little River Dam project.
August 24, 2019	Eighteen MPS athletics administrators and City public safety managers met to discuss public safety response to large-attendance MPS outdoor events. Weather mitigation plans were reviewed.
September 12, 2019	Moore EM staff met with State Hazard Mitigation Officer to review plan progress.
September 26, 2019	Planning Team met to discuss progress and sharing draft with the public.
Oct-Nov, 2019	Several informal discussions with city administrators concerning projects and HMP draft. Lead planner changed due to personnel changes.
December 4, 2019	Final review of HMP draft by City of Moore and MPS staff and administration.
December 5, 2019	HMP draft posted on city and MPS websites; social media posts encouraging public comment
December 16, 2019	Public hearing on HMP draft at Moore City Council meeting. A presentation was given by the lead planner; public input was invited.
December 17, 2019	Final revisions based upon public comment; draft HMP submitted to OEM for State review.

2.2 Planning Participants

The City of Moore and Moore Public Schools involved a wide variety of community leaders, local and regional subject matter experts, and local and state agencies in the development of this Plan. The planning process began in in the Emergency Management Department of the City of Moore, and was assisted via an existing all-hazards, whole community Emergency Planning Group composed of city and schools leadership, local non-governmental organizations, businesses and community leaders. This effort then expanded to include representatives of the City's Planning Commission, neighboring cities and counties, and others representing local, regional and state agencies and organizations. These stakeholders participated in the process through participation in meetings, telephone calls, email, and conversations with the primary planners. The general public was also invited to assist in the development of the plan, via participation in surveys, invitations to comment via social media, and during public hearings.

Specific stakeholders and participants contributing to the development of this Hazard Mitigation Plan include the following.

Name	Participation	Contribution to Planning Process
Brooks Mitchell *City Manager, City of Moore*	Emergency Planning Group	Participated in planning team meetings; provided administrative leadership; input on hazards/risk assessment, action items.
Stan Drake *Assistant City Manager, City of Moore*	Emergency Planning Group	Participated in planning team meetings; input on hazards/risk assessment, action items.
Todd Jenson *Assistant City Manager, City of Moore*	Emergency Planning Group	Participated in planning team meetings; input on hazards/risk assessment, action items.
Jerry Ihler *Assistant City Manager, City of Moore*	Emergency Planning Group	Participated in planning team meetings; input on hazards/risk assessment, action items.
Elizabeth Weitman *Community Development Director, City of Moore*	Emergency Planning Group	Facilitated public hearing with Planning Commission; participated in risk assessment and developing mitigation strategies
Richard Sandefur *Public Works Director, City of Moore*	Emergency Planning Group	Participated in planning team meetings; input on hazards/severity ranking, action items.
Ava Zrenda *Floodplain Administrator, City of Moore*	Emergency Planning Group	Provided risk assessment information.
Gayland Kitch *Emergency Management Director, City of Moore*	Emergency Planning Group	Participated in planning team meetings; led initial discussion of the planning process; final plan author.
Debra Wagner *Assistant Emergency Management Dir., City of Moore*	Emergency Planning Group	Lead planning team; created and monitored online survey; coordinated public outreach; initial plan author.
Gary Bird *Fire Chief, City of Moore*	Emergency Planning Group	Participated in planning team meetings; input on hazards/risk assessment, action items.
Greg Herbster *Deputy Fire Chief, City of Moore*	Emergency Planning Group	Participated in planning team meetings; input on hazards/risk assessment, action items.
Jerry Stillings *Police Chief, City of Moore*	Emergency Planning Group	Participated in planning team meetings; input on hazards/risk assessment, action items.
Todd Strickland *Assistant Police Chief, City of Moore*	Emergency Planning Group	Participated in planning team meetings; input on hazards/risk assessment, action items.
Betty Koehn *Finance Director, City of Moore*	Emergency Planning Group	Participated in risk assessment and developing mitigation strategies
Deidre Ebrey *Economic Development Dir. City of Moore*	Emergency Planning Group	Participated in risk assessment and developing mitigation strategies; input on community
Brian Miller *Risk Manager, City of Moore*	Emergency Planning Group	Provided information via email and telephone on critical facilities
Randy Brink *City Attorney, City of Moore*	Emergency Planning Group	Assisted with legal review of document
David Thompson *Information Technology Dir, City of Moore*	Emergency Planning Group	Provided input and technical assistance on technology hazards
Kent Sanmann *GIS Specialist, City of Moore*	Planning Team	Provided mapping and GIS technical assistance
Tammy Koehn *Communications Supervisor, City of Moore*	Planning Team	Participated in planning team meetings; provided plan input.
Dustin Horstkoetter *Safety and Security Director, Moore Public Schools*	Emergency Planning Group	Primary MPS liaison; participated in planning team meetings; input on hazards/risk assessment, action items.
Robert Romines *District Superintendent, Moore Public Schools*	Emergency Planning Group	Provided administrative leadership; input on hazards/risk assessment, action items.
Brian Fitzgerald *Athletics Facilitator, Moore Public Schools*	Planning Team	Participated in planning team meetings; input on hazards/risk assessment, action items.

John Marren *Director of Operations, Moore Public Schools*	Planning Team	Provided information via email on critical facilities.
Jun Kim *Director of Technology, Moore Public Schools*	Planning Team	Provided info and input via email on cyber incident hazard, vulnerability and impacts
Scott Bryant *Director of Transportation, Moore Public Schools*	Planning Team	Provided input via telephone concerning hazard vulnerabilities to student transportation
Gary Lunow *Planning Commission, City of Moore*	Planning & Development Commission	Participated in planning team meeting; provided plan input; assisted with hazard severity worksheet.
Steve Shawn *Silver Star Construction*	Emergency Planning Group	Participated in planning team meetings; input on hazards/risk assessment, action items.
MaryJane Coffman *Disaster Program Manager, American Red Cross*	Emergency Planning Group	Participated in planning team meetings; input on hazards/risk assessment, action items.
Lauree Beth Marshall *Deputy Emergency Manager, Cleveland County*	Neighboring Community	Assisted in person/phone/email with survey and planning process guidance; integration with county HMP
Frank Barnes *Emergency Manager, City of Oklahoma City*	Neighboring Community	Assisted in person/phone/email in risk assessment; provided HVA examples and guidance; integration with neighboring HMP
David Barnes *Emergency Manager, Oklahoma County*	Neighboring Community	Assisted in person/phone/email in risk assessment; integration with neighboring HMP
David Grizzle *Emergency Management Coordinator, City of Norman*	Neighboring Community	Assisted in person/phone/email with survey and planning process guidance; integration with county HMP
Dale Ellis *Emergency Mgt. Volunteer, City of Moore*	Stakeholder	Assisted via email with hazard survey
Lyle Milby *Cleveland Co. Local Emer. Planning Comm.*	Regional Mitigation Group	Assisted via email with hazard survey
Eva Smith *Cleveland Co. disABILITY Coalition*	Regional Mitigation Group	Assisted via phone/email in developing mitigation strategies
Glenda Ford-Lee *Access/Functional Needs Coordinator, Oklahoma State Dept. of Health*	Regional Mitigation Group	Assisted via phone/email in developing mitigation strategies
Leslie Ross *Project Director, Pathway to Recovery*	Regional Mitigation Group	Assisted via phone/email in developing mitigation strategies
Janet Meshek *Principal Engineer, Meshek & Associates*	City Technical Consultant	Assisted in person with technical guidance concerning flood/dam section
Kyle Miller *Project Engineer, Meshek & Associates*	City Technical Consultant	Assisted in person/phone\email with technical guidance concerning flood/dam section
Annie Vest *Planning/Grants Administrator, Meshek & Associates*	City Technical Consultant	Assisted in person/phone/email with technical guidance concerning flood/dam section
Rick Smith *Warning Coordination Meteorologist, National Weather Service, Norman OK*	Federal Agency Assistance	Provided information via text and email concerning extent of several hazards
Mark Gower *Director, Oklahoma Emergency Management*	State Agency Assistance	Provided input via email concerning cyber incident hazard, vulnerability and impacts
Laquetta Russell *Cybersecurity Advisor, Oklahoma Emergency Management*	State Agency Assistance	Provided input via email concerning cyber incident hazard, vulnerability and impacts

Matthew Rollins *State Hazard Mitigation Officer,* *Oklahoma Emergency Management*	State Agency Assistance	Provided overall technical assistance, via meetings, phone, email
Jennifer Pendley *Hazard Mitigation Planner,* *Oklahoma Emergency Management*	State Agency Assistance	Provided overall technical assistance, via meetings, phone, email
Jim Rosser *Hazard Mitigation Planner,* *Oklahoma Emergency Management*	State Agency Assistance	Provided overall technical assistance, via meetings, phone, email
Shimeka Mack *Central Area Coordinator,* *Oklahoma Emergency Management*	State Agency Assistance	Provided overall technical assistance, via meetings, phone, email
Rachel Nutter *Deputy Planner,* *Choctaw Nation of Oklahoma*	Tribal Agency Assistance	Provided overall technical assistance, via meetings, phone, email
Emma Moradi *Environmental Specialist II,* *Oklahoma Water Resources Board*	State Agency Assistance	Provided technical guidance via phone/email, assisted with dam inundation maps and emergency action plans

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2.3 Public Involvement

Date	HMP Public Involvement
May 14, 2015	A public meeting was held as part of the development of the City's Stormwater Master Plan. Over 70 people were recorded on sign-in sheets, over 120 were counted in attendance. Approximately one week prior to the public meeting, the City of Moore had experienced a significant rainfall event resulting in substantial flooding across the City. Maps of the City were used to identify the locations of flooding. Consultant staff visited with citizens and recorded concerns including descriptions of the problem areas along with pictures and videos.
May 15, 2017	Adoption of City of Moore Comprehensive Plan. City staff had worked with citizens and consultants over a period of approximately 14 months to update this plan to set forth a vision for the future of the community. City leaders, key stakeholder, and citizens were engaged to help clarify the issues and opportunities.
December 11, 2018	A public hearing for the HMP update was held as part of a City of Moore Planning Commission meeting. A presentation was given by the lead planner; public input was invited.
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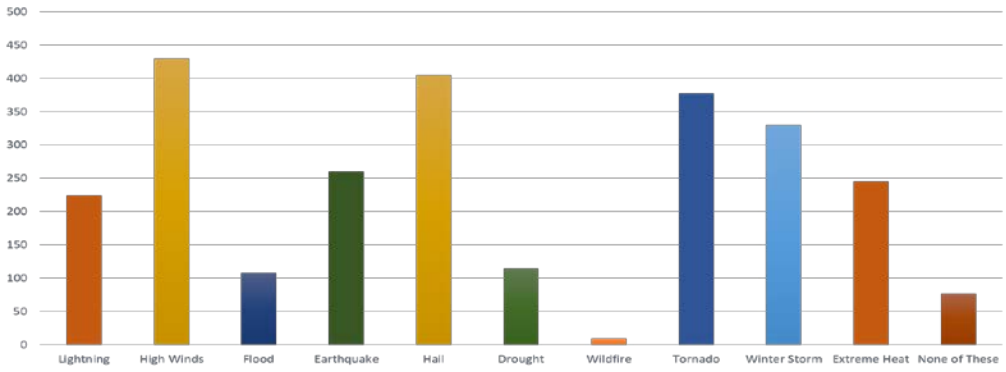
January 23, 2019	A hazard severity worksheet was sent to planning team members, community stakeholders, and neighboring jurisdictions.
December 5, 2019	The public was invited to comment on the draft hazard mitigation plan. The draft was posted on the City of Moore web page; invitations were posted on social media.
December 16, 2019	A public hearing was held on the draft HMP as part of a Moore City Council meeting.

2.3.1 Public Survey Results

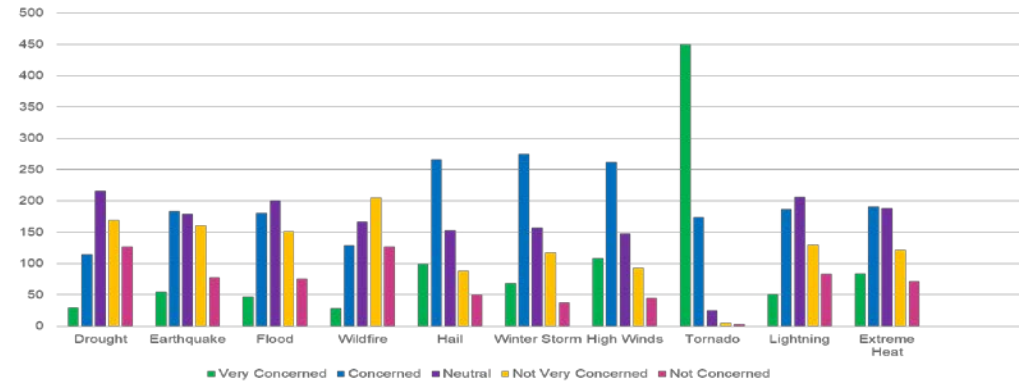
The citizens of Moore and patrons of the school district had the opportunity to complete a 10-question survey regarding hazards that threaten our area. The survey was posted to the Moore Emergency Management and City of Moore Facebook pages, and the City website; MPS distributed it to their personnel. An option to complete a paper survey was also offered. More than 700 responses to the survey were received. See *Appendix L* for a list of the questions and a tabulation of responses.

Following is a summary of responses to two of the questions:

"IN THE PAST 5 YEARS, HAVE YOU OR SOMEONE IN YOUR HOUSEHOLD EXPERIENCED ANY OF THESE NATURAL DISASTERS?"



"HOW CONCERNED ARE YOU ABOUT THE FOLLOWING NATURAL DISASTERS AFFECTING THE CITY/SCHOOL DISTRICT IN THE FUTURE?"



2.4 Plans, Documents, and Literature Reviewed

Agency/Document	Relevant Information Incorporated into Plan
Cleveland County Hazard Mitigation Plan, 2013-2018	Previous plan. Applicable hazards, location information, mitigation action items.
City of Moore Emergency Operations Plan	Capability Assessment for response and recovery
Moore Public Schools Crisis Management Manual	Potential hazards, emergency procedures
Moore High School, Sports Medicine Dept., Emergency Action Plan	Hazards and procedures used by MPS
Oklahoma Secondary Schools Athletics Association Emergency Action Plan	Lightning hazard information used by MPS
OSSAA Board of Director's Policies	Lightning hazard information used by MPS
OSSAA 2019-2020 Rules	Lightning hazard information used by MPS
NFHS Sports Medicine Committee, Guidelines for Lightning Safety	Lightning hazard information used by MPS
Envision Moore 2040, City Comprehensive Plan	Outreach Strategy, Initial Planning, Extreme Heat, Flooding
City of Moore Comprehensive Stormwater Management & Master Drainage Plan	Flood vulnerability and planning information

City of Moore Dam Breach Analysis and Inundation Mapping	Little River Park Dam information
Moore Emergency Management 10-Year Siren Plan	Mitigation Actions
City of Moore Code of Ordinances, Section 5-204 (c), “Adoption of residential wind code”	Information on additional construction requirements for high wind resistance
Cleveland County Hazard Mitigation Plan (2019 draft)	Hazard information, location specific information
Advisory/Warning Guidelines, NWS WFO Norman	Natural hazard extent information
44 CFR § 201	Mitigation planning regulations and requirements
FEMA Local Mitigation Planning Handbook	Foundational information
FEMA IS-393B: Introduction to Hazard Mitigation, and IS-318: Mitigation Planning for Local and Tribal Communities	Foundational information
FEMA 386-2, "Mitigation Planning How-To Guide"	Hazard profiling information
Oklahoma Gas and Electric Position Paper on Burying Utility Lines	Potential cost and complications for burying existing utility lines
Oklahoma State Hazard Mitigation Plan	Hazard information, previous occurrence data, state goals, PRI information
Oklahoma City Hazard Mitigation Plan	Hazard information
Oklahoma City Hazard Vulnerability Analysis	Hazard probability and impact information for man-made hazards.
Muskogee County Hazard Mitigation Plan	Format, Components
CDC: Social Vulnerability Index	Community Profile and vulnerable population information
CDC: Planning for an Emergency: Strategies for Identifying and Engaging At-Risk Groups	Planning concerns regarding vulnerable populations
Cleveland County Pandemic Response Annex	Epidemic/Pandemic hazard, vulnerability and planning information
Southern Wildfire Risk Assessment Summary Report - MPS boundary planning area	Wildfire hazard, vulnerability and planning information

2.5 Additional Information Incorporated into Plan

The City’s building codes were augmented in 2014 to require a higher wind standard of construction; these were reviewed and incorporated into this Plan.

Although not required, the planning team chose to utilize an all-hazards planning approach to this Plan; therefore it includes man-made and technological hazards.

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CHAPTER THREE: HAZARD IDENTIFICATION AND RISK ASSESSMENT

3.1 Identified Hazards

Based on local history and public input, this Hazard Mitigation Plan will address the following hazards:

Natural Hazards

- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Flooding
- Hail
- High Winds
- Lightning
- Tornado
- Wildfires
- Winter Storms

Manmade Hazards

- Civil Disorder
- Cyber Incident
- School Violence
- Terrorism
- Workplace Violence

Technological Hazards

- Epidemic/Pandemic
- Hazardous Materials - fixed facility
- Hazardous Materials - transportation
- Transportation Accidents - *auto, truck, rail, air, and pipeline*

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3.2 Hazard Probabilities and Risk Index

Risk analysis involves evaluating vulnerable assets, describing potential impacts, and estimating losses for each hazard. The purpose is to illustrate clearly the greatest risks facing the planning area.

One method of measuring risk is use a calculation formula. One such formula is the Priority Risk Index (PRI). The PRI used by the Planning Team includes weighted factors including the probability of occurrence, the magnitude and severity of events, the amount of warning time, and the typical duration of events. The following table describes the criteria and shows the assigned index value for each level of the factors, and provides the assigned weighting factor for each category.

PRI Category	Degree of Risk			Weighting Factor
	Level	Criteria	Index Value	
Probability of Occurrence	Highly Likely	Event is probable within each calendar year; *a 1 in 1 year chance of occurring.*	4	0.45
	Likely	Event is probable within the next three years; *a 1 in 3 year chance of occurring.*	3	
	Possible	Event is probable within the next five years; *a 1 in 5 year chance of occurring.*	2	
	Unlikely	Event is probable within the next ten years; *a 1 in 10 year chance of occurring.*	1	
Magnitude/ Severity	Catastrophic	Multiple deaths Complete shutdown of facilities for 30 days or more More than 50% of property is severely damaged	4	0.3
	Critical	Injuries/illnesses result in permanent disability Complete shutdown of facilities for 2-4 weeks 25-50% of property is severely damaged	3	
	Limited	Injuries/illnesses do not result in permanent disability Complete shutdown of facilities 1-2 weeks 10-25% of property is severely damaged	2	
	Negligible	Injuries/illnesses treatable with first aid Shutdown of facilities less than 1 week Less than 10% of property is severely damaged	1	
Warning Time	< 6 hours	Less than six hours	4	0.15
	6-12 hours	Six to twelve hours	3	
	12-24 hours	Twelve to twenty-four hours	2	
	> 24 hours	More than 1 day	1	
Duration	> 1 week	More than one week	4	0.1
	< 1 week	Two to seven days	3	
	< 1 day	6 hours to a full day	2	
	< 6 hours	Less than six hours	1	

The Planning Team assigned values for each factor based upon experience of the team members and numbers of previous occurrences. The magnitude and severity of previous occurrences was considered along with the potential magnitude and severity of an event. The results were then placed into a matrix where the PRI was calculated.

Priority Risk Index for Each Profiled Hazard

Hazard	Probability	Magnitude / Severity	Warning Time	Duration	PRI
Natural Hazards					
Hail	Highly Likely	Limited	< 6 hours	< 6 hours	3.1
Lightning	Highly Likely	Limited	< 6 hours	< 6 hours	3.1
Tornadoes	Possible	Catastrophic	< 6 hours	< 6 hours	2.8
Extreme Heat	Highly Likely	Negligible	12-24 hours	< 1 week	2.7
High Winds	Likely	Limited	< 6 hours	< 6 hours	2.65
Flooding	Likely	Limited	6-12 hours	< 1 day	2.6
Winter Storms	Likely	Limited	12-24 hours	< 1 week	2.55
Dam Failure	Unlikely	Critical	< 6 hours	< 1 week	2.25
Earthquake	Possible	Limited	< 6 hours	< 6 hours	2.2
Drought	Possible	Limited	> 24 hours	> 1 week	2.05
Wildfires	Unlikely	Limited	< 6 hours	< 6 hours	1.75
Manmade Hazards					
Cyber Incident	Likely	Critical	< 6 hours	> 1 week	3.25
School Violence	Likely	Critical	< 6 hours	< 6 hours	2.95
Workplace Violence	Likely	Critical	< 6 hours	< 6 hours	2.95
Terrorism	Possible	Critical	< 6 hours	< 6 hours	2.5
Civil Unrest	Unlikely	Critical	12-24 hours	< 1 week	1.95
Technological Hazards					
HazMat - trans	Highly Likely	Limited	< 6 hours	< 1 day	3.2
Transportation Accident	Likely	Limited	< 6 hours	< 1 day	2.75
Epidemic/Pandemic	Possible	Critical	> 24 hours	> 1 week	2.35
HazMat - fixed	Unlikely	Limited	< 6 hours	< 1 day	1.85

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3.5 Profiled Hazards

Natural Hazards		
Hazard	**How Reviewed**	**Why Identified**
Dam Failure	Oklahoma Water Resources Board City of Moore Master Drainage Plan	A high-hazard dam is located within the City of Moore and several others are located in the planning area
Drought	Oklahoma Climatological Survey Historical Data	Historical occurrences; drought occurs throughout the region
Earthquake	United States Geological Survey Oklahoma Geological Survey	Historical occurrences in the region; existing faults in/near the planning area
Extreme Heat	National Weather Service Oklahoma Climatological Survey	Historical occurrences; extreme heat occurs throughout the region
Flood	FEMA Declarations Envision Moore 2040 Plan	Historical occurrences; flash flooding occurs in the planning area
Hail	Oklahoma Mesonet	Historical occurrences; hail occurs in the planning area
High Winds	National Weather Service Oklahoma Mesonet	Historical occurrences; high winds occur in the planning area
Lightning	National Lightning Detection Network	Historical occurrences; lightning occurs in the planning area
Tornado	Emergency Management records FEMA Declaration National Weather Service	Historical occurrences, including several large/violent tornadoes within past 20 years
Wildfire	Moore Fire Department	Historical occurrences; wildfires occur throughout the region
Winter Storms	FEMA Declarations National Weather Service	Historical occurrences; winter storms occur throughout the region
Manmade Hazards		
Hazard	**How Reviewed**	**Why Identified**
Civil Unrest	Moore Police records	Historical occurrences; civil unrest is a threat through the country
Cyber Incident	City and School history	Historical occurrences; cyber incidents are a threat throughout the country
School Violence	Moore Public Schools records	School violence is a threat throughout the country
Terrorism	Historical Records	Historical occurrences; terrorism is a threat throughout the country
Workplace Violence	Moore Police records	Historical occurrences; workplace violence is a threat throughout the country

Technological Hazards		
HazMat – fixed facility	Moore Fire Records	Historical occurrences; hazardous materials are transported through and stored in facilities within the planning area
HazMat - transportation	Rail Commodity Flow Study Pipeline Company information	Historical occurrences; hazardous materials are transported by rail through the planning area
Epidemic/Pandemic	Historical Records	Historical occurrences within the region
Transportation Accidents	BNSF Railway information USDOT records Airport records	A Class-1 railroad, Interstate highway, and a state highway bisect the planning area; multiple pipelines are in the planning area; a commercial and a general aviation airport are near.

The hazards of landslide, expansive soils and subsidence are addressed in the Oklahoma State Hazard Mitigation Plan, but do not pertain to this planning area. There have been no landslide, expansive soils or subsidence related events in the planning area.

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3.5.1 Dam Failure

Description

A dam is an artificial barrier constructed across a stream channel to impound water. Most dams in Oklahoma are built of concrete or earth. Dams must have spillway systems to safely convey normal stream and flood flows over, around, or through the dam; these are commonly constructed of non-erosive materials such as concrete.

A dam impounds water in the upstream area, referred to as a pond, lake or reservoir. The amount of water impounded is measured in acre-feet, which is the volume of water that covers an acre of land to a depth of one foot. Two factors influence the potential severity of a full or partial dam failure: the amount of water impounded, and the density, type, and value of development and infrastructure located downstream.

Structural deficiencies include undermining, seepage, erosion, cracking, poor compaction, sliding, and overturning, mainly caused by the age of a dam, lack of maintenance, and past stresses. A dam's stability may be compromised due to inadequate spillway capacity, which could result in overtopping the dam during a heavy rainfall event. Also, the collection of debris or ice blocking a spillway could place extra force on the dam during rising water level and result in a failure. Other failures might be the result of terrorist acts designed to weaken the structure or alter flow rates, or natural hazard events such as earthquakes.

The Oklahoma Water Resources Board classifies dams as high, significant, or low hazard[11].

Hazard-Potential Classification	Risk Involved with Dam Failure	Inspection Frequency
High	Probable loss of human life	Annually, by a registered professional engineer
Significant	No probable loss of human life, but can cause economic loss or disruption of lifeline facilities	Every three years, by a registered professional engineer
Low	No probable loss of human life and low economic loss	Every five years

Location

There is one high-hazard dam within Moore, located in Little River Park. Another high-hazard dam is just north of the city limits west of Sunnylane Rd; the Huddleston Lake dam's inundation area is primarily within Moore.

There are seven additional high-hazard dams located within the Moore School District boundaries. Analysis of inundation maps for all high-hazard dams in the planning area shows that no MPS facilities would be affected by dam failures, therefore, dam failure is not included as a hazard for the Moore Public Schools.

A map of all dams within the planning area as inventoried by the Oklahoma Water Resources Board can be found in *Appendix C*. Additional information on the high-hazard dams within the planning area is below.

[11] http://www.owrb.ok.gov/damsafety/index.php

High Hazard Dams within the Planning Area

Dam ID / Name	Year Completed	General Location / Ownership	Dam Length (ft)	Dam Height (ft)
OK30561 Little River Park	2019	SW 10th & Janeway City of Moore	821	23
OK12568 Huddleston Lake	1955	SE 108th & Sunnylane private	1,120	24
OK02580 Stanley Draper	1962	SE 149th & Post Rd City of Oklahoma City	7250	111
OK 11070 Lightning Creek "A"	1977	SE 89th and Santa Fe City of Oklahoma City	6,000	18
OK11071 Lightning Creek "C"	1977	SW 83rd & Indiana City of Oklahoma City	4,000	16
OK02584 Shadow Lake	1930	SW 104th & Penn private	751	11
OK12563 Goldco Operating	1960	S. May & Portsmouth private	745	19
OK11089 Templo de Alabanza	1940	11000 S. Western private	618	20
OK30153 Turtle Lake	2003	SE 149th & Sooner Rd. private	280	20.5

Extent

Hydrological modeling is used to determine the approximate areas that would be inundated after a dam failure. Output of this modeling generally displayed on maps, which typically indicate the extent of flood inundation that would affect residences and businesses for each dam as well as the extent of areas where transportation would be affected.

The Breach Inundation Report for the Little River Dam *(See Appendix D)* indicates that there are approximately 64 homes and 25 businesses within the inundation area. The Breach Inundation Map for the Huddleston Lake Dam *(see Appendix E)* shows five residences in the inundation area. No critical infrastructure facilities are located in the breach inundation area for either dam. As noted above, no MPS facilities are located within the inundation area of any of the seven high-hazard dams.

The inundation mapping for the Little River Park dam includes an analysis of the potential flood depths at locations within the inundation area. Structures within the inundation area might potentially experience flood depths up to 10'. Potential flood depth information is not available for the Huddleston Lake Dam. The City of Moore recognizes this as a data deficiency and will add an Action Item to resolve the issue.

The Little River Park dam mapping also includes notations of "warn times" at selected locations downstream of the dam. It should be noted that the "warn times" calculations are based upon time of peak flow from the breach and do not indicate actual time of arrival of dangerous flooding. The planning team has determined that 9 minutes should be subtracted from each notation to indicate the time of water arrival. These times include 1-6 minutes for the residential areas, and 6-16 minutes for the downstream commercial areas.

The planning team considers the extent of a dam failure event to be:

- *Minor*, when seepage or small breach occurs where the water stays within the downstream channel, and there is little immediate threat to life.
- *Major*, when a breach occurs where the water exceeds the capacity of the downstream channel and poses an immediate threat to life.

Previous Occurrences

There are no documented events of dam failures within the planning area.

Probability of Future Events: UNLIKELY

The Little River Dam is designed as a dry detention basin, which means no permanent pool of water exists and the basin is designed to empty completely in less than 24 hours after rainfall[12]. Having very limited times that water is impounded behind the dam vastly reduces the amount of time that a breach would be physically possible, and also greatly reduces the possibility of seepage or other water erosion (reducing potential causes for dam failure). Note also that this dam was constructed in 2019, so fatigue or age of the dam should not be a factor towards failure.

The Huddleston Dam is unlikely to cause a major extent event, as the inundation area is primarily in wooded areas along the downstream channel, with threat to only a limited number of residences.

Vulnerability and Impacts

All structures and persons in locations in and near the inundation area for a dam are vulnerable to dam failure. Persons driving along roadways in the inundation area may also be vulnerable to rapidly flowing water.

Vulnerability: Some of the issues associated with a breach of the Little River Dam also occur during normal flooding/heavy rains, and are outlined in the City's Master Drainage Plan.

- *Mitigation:* Implement recommendations of the City's Master Drainage Plan, to provide better stormwater flow and reduce amount of flooding.

There are approximately 64 homes and 25 businesses vulnerable to flooding after a breach of the Little River Park dam; persons in these would need to immediately evacuate. Five residences are vulnerable to a breach of the Huddleston Lake dam. No critical infrastructure facilities and no Moore Public Schools facilities are located in the breach inundation areas of any of the high-hazard dams within the planning area.

Vulnerability: Persons residing or driving in/near the inundation area are at an immediate risk if a dam breach were to occur. Warning time is very short, ranging from immediate to 16 minutes for the Little River Dam and immediate to 5 minutes for the Huddleston Dam.

- *Mitigation:* Install, upgrade, maintain and operate warning system devices to provide immediate warning capability to those in the inundation area.

Vulnerability: Commercial power to warning system devices may be interrupted by the flood (poles washed away, etc.)

- *Mitigation 1:* Collaborate with local power utilities to move electrical lines underground.
- *Mitigation 2:* Upgrade all warning system devices to solar power.

[12] https://www.stormwaterassociation.com/detention-retention-ponds

The median value of a home in Moore is $133,900. The potential residential loss to flooding from a breach of the Little River Dam is approximately $8,569,600. Total market value (2019) of the five properties that would be affected by a breach of the Huddleston Lake dam is $2,014,734.[13]

Vulnerability: Residents may be unaware of living in or near inundation areas; may be unaware of actions to take if warning of a dam breach is given; may be unaware of mitigation they might be able to do to minimize their risk during a dam breach.

- *Mitigation 1:* Create and resent comprehensive mitigation education programs for both the City of Moore and Moore Public Schools.
- *Mitigation 2:* Produce visual media with mitigation information for airing on City and Schools cable channels, websites, video board and other locations.

Five roadways would be overtopped by a breach of the Little River dam. The list of affected roadway crossings, upstream to downstream is as follows:

- SW 17th Street, generally between Telephone Rd. and Dressen Dr.
- SW 19th Street, generally from I-35 to the 600 block west.
- S. Telephone Rd., generally from SW 17th to the 2300 block south.
- SW 25th Street, generally from Telephone Rd. to the West I-35 Service Rd.
- Interstate 35, generally between the 2700-3600 blocks.

Two roadways would be overtopped by a breach of the Huddleston Lake dam:

- NE 12th Street, in the area around Clear Creek Rd.;
- Clear Creek Rd. north from NE 12th St.

Vulnerability: Persons driving in the area of a dam breach will likely be unable to see flood waters covering roadways, or that roadways and bridges/drainage structures that have been washed away.

- *Mitigation:* Acquire, maintain and deploy portable motorist information signs to convey information to motorists.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Dam Failure	Unlikely	Critical	0-6 hours	< 1 week	2.25

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[13] 2019 Market Value, Cleveland County Assessor data

3.5.2 Drought

Description

Drought is a shortage of precipitation over an extended period. A normal part of the climate cycle, an extended drought can affect municipal water supplies, increase wildfire danger, and damage the environment. Drought conditions can be accelerated by above average temperatures; however, drought is as likely to occur in the winter months if snowfall and/or rainfall is below average amounts.

Location

Drought conditions can affect the entire planning area.

Extent

The extent of drought is measured using the U.S. Drought Monitor classification scale.

U.S. Drought Monitor

			Ranges				
Category	**Description**	**Possible Impacts**	**Palmer Drought Severity Index (PDSI)**	**CPC Soil Moisture Model (percentiles)**	**USGS Weekly Streamflow (percentiles)**	**Standardized Precipitation Index (SPI)**	**Objective Drought Indicator Blends (percentiles)**
D0	Abnormally Dry	Going into drought: • short-term dryness slowing planting, growth of crops or pastures Going out of drought: • some lingering water deficits • pastures or crops not fully recovered	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate	• Some damage to crops, pastures • Streams, reservoirs, or wells low, some water shortages developing or imminent • Voluntary water-use restrictions requested	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe	• Crop or pasture losses likely • Water shortages common • Water restrictions imposed	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme	• Major crop/pasture losses • Widespread water shortages or restrictions	-4.0 to -4.9	3 to 5	4 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional	• Exceptional and widespread crop/pasture losses • Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

The scale is based on drought impact guidelines, indicators, and index and model thresholds. A percentile ranking approach serves as the objective scientific backbone allowing the weekly report's rotating authors to compare different parameters having different units and lengths of record regardless of location. In addition, the scientists also take into account the duration and both regional and seasonal

influences, as well as whether a given location is improving or getting worse in terms of drought condition.

Drought conditions are mapped weekly by the U.S. Drought Monitor.[14]

As seen in the previous occurrences section below, the planning area may experience all values of drought.

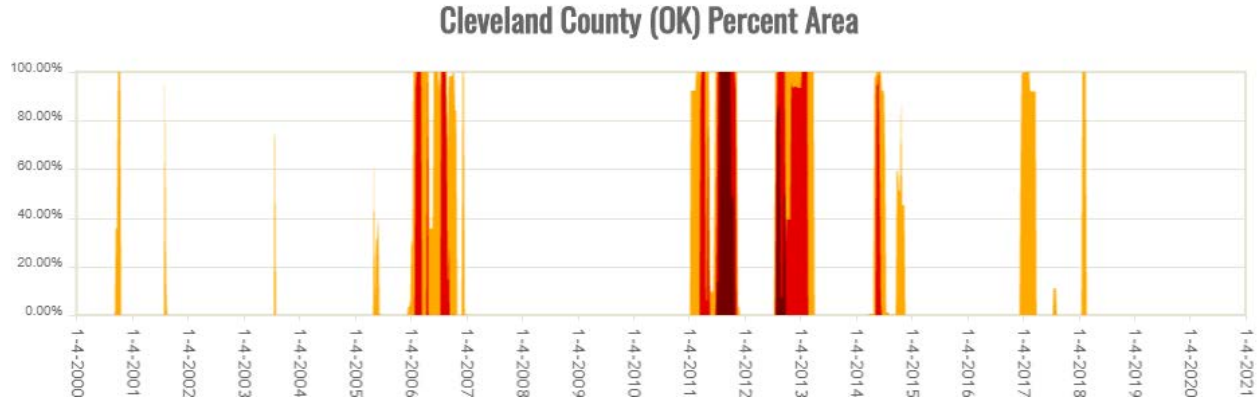
The planning team considers the extent of drought conditions to be:

- *Minor*, when the U.S. Drought Monitor classification for the planning area is at or below D1;
- *Major*, when the U.S. Drought Monitor classification for the planning area is at or above D2.

Previous Occurrences

According to the Oklahoma Water Resources Board, the state of Oklahoma typically has 5 to10 year cycles of wet and dry. While there have been significant periods of drought in Oklahoma, there have been unusually wet periods in between.

Central Oklahoma, including the planning area, has a history of extended periods of drought. The periods of the 1910s, late 1930s, 1950s, late 1960s, early 1980s, and early 2010s were times of exceptional dryness in central Oklahoma. The graph below depicts the annual drought cycles within Cleveland County, including the planning area, since January 2000[15].



Orange:D2 Drought Red: D3 Drought) Dark Red: D4 Drought

Probability of Future Events: POSSIBLE

Drought events are a part of the normal climate cycle, historically occurring every 5-10 years as noted above.

Vulnerability and Impacts

The greatest vulnerability during a drought is the availability of water.

Drought causes reduced rainfall runoff to fill reservoirs; reduced reservoir levels require water conservation. The City of Moore receives approximately 60% of its water from Oklahoma City's Lake Stanley Draper and the remainder from groundwater wells; MPS facilities receive water from either Moore or Oklahoma City. Oklahoma City and surrounding communities, including Moore, have implemented a system for managing water supply based on Progressive Water Conservation Stages. Mandatory odd/even watering (Stage 1) is permanently in effect for all residents of these communities.

[14] https://droughtmonitor.unl.edu/
[15] https://droughtmonitor.unl.edu/Data/Timeseries.aspx

Additional conservation measures are implemented as warranted based on current drought conditions.[16]

Vulnerability: Residents and students may be unaware of issues related to water conservation during a drought.

- *Mitigation 1:* Create and present comprehensive mitigation education programs for both the City of Moore and Moore Public Schools.
- *Mitigation 2:* Produce visual media with mitigation information for airing on City and Schools cable channels, websites, video boards and other locations with preparedness information.
- *Mitigation 3:* Acquire, maintain and deploy portable motorist information signs to convey information to residents on enhanced water conservation stages.

Lack of precipitation also affects the recharge rate of groundwater supplies; this also affects the supply of water available to the groundwater wells of the City of Moore.

Vulnerability: Drought may cause a lack of available water from both Lake Stanley Draper and City water well supplies.

- *Mitigation:* Make improvements to the City's water system to increase production (supply) and delivery capacity (efficiency).

The City of Moore identifies some water users as "critical"; these facilities and their populations have a greater vulnerability to the lack of water. These include medical centers, schools, long term care facilities, and day cares. In rationing situations, the needs of these locations are a priority. Current information on critical facilities is maintained in the City's Emergency Operations Plan.

Water is critical to the well-being of all Moore residents and MPS students/staff. Lack of adequate water may lead to lack of proper hygiene and therefore an increase in illness. Lack of adequate drinking water leads to dehydration and other illnesses, and may cause death.

Drought conditions decrease the amount of moisture in plants, increasing their vulnerability to fire. Wildfire danger is also increased due to the reduced amount of water available to fight fires.

Vulnerability: Limited water supplies are used during droughts to maintain landscaping, decreasing the amount available for drinking and personal hygiene.

- *Mitigation:* Incorporate drought tolerant or xeriscape practices for all City and Moore Public Schools properties, therefore reducing the amount of water used for landscape maintenance and setting an example for our communities.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Drought	Possible	Limited	>24 hours	> 1 week	2.05

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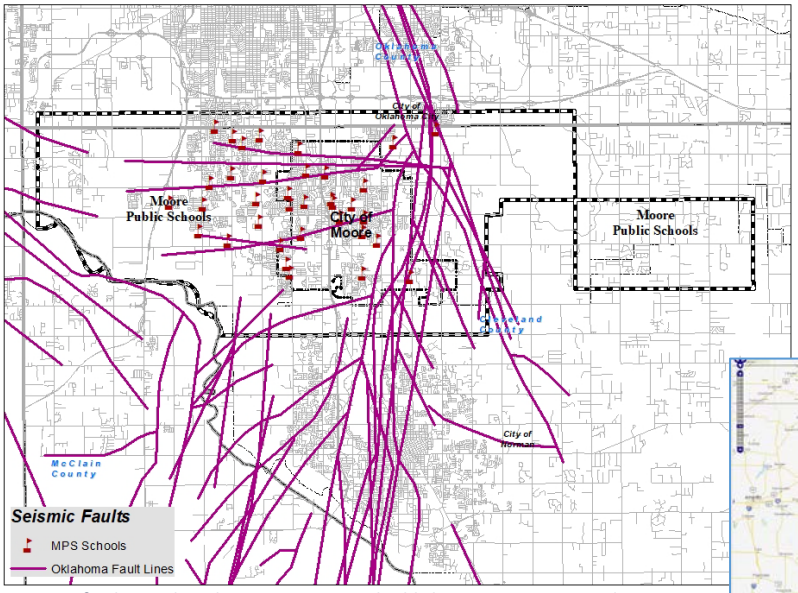
[16] City of OKC Hazard Mitigation Plan 2017

3.5.3 Earthquake

Description

An earthquake occurs when two blocks of the earth suddenly slip past one another. Most earthquakes occur as the result of slowly accumulating pressure that causes the ground to slip abruptly along a geological fault plane on or near a plate boundary. The resulting waves of vibration within the earth create ground motion at the surface that vibrates in a very complex manner.

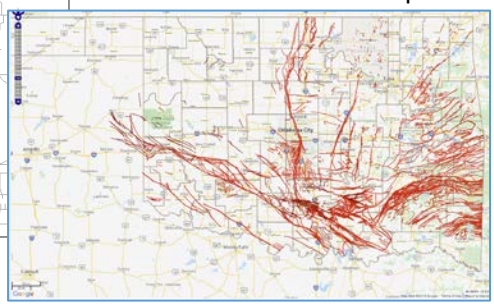
Both state and federal science agencies such as the Oklahoma Geological Survey (OGS) and United States Geological Survey (USGS) have linked large volume wastewater injection wells to an increase in earthquake frequency and an increase in the occurrence of damaging earthquakes since 2008. A significant decrease in earthquake activity since 2015 has been driven by market forces and regulatory actions within Oklahoma.



Seismic faults in the Planning Area and Oklahoma. See Appendix F.

Location

Oklahoma has many fault lines beneath its surface; therefore the entire planning area could be affected by a major earthquake.[17] Of note, the Nemaha Ridge zone extends from southeastern Nebraska through Kansas and into central Oklahoma. This fault is in the northern and eastern parts of the City of Moore/Moore Public Schools planning area. The Nemaha fault line varies in width from 4 to 15 miles.



While not located in the state, the New Madrid fault zone centered in Missouri experienced several large earthquakes in the early 1800s that were widely felt in Oklahoma and the region. It is widely held that a major earthquake is possible on the New Madrid; if this were to occur, the planning area could be subject to indirect effects.

Extent

Earthquakes are measured by both *magnitude* - the amount of seismic energy released, classified via the Richter scale - and *intensity* -the effects of an earthquake (damage, injury), classified via the Modified Mercalli scale. It should be noted that a whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value. See the following table for a description of each magnitude classification.

[17] Oklahoma Geological Survey

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

The planning area typically has experienced earthquakes with values of below 4.0, but all values are possible. The strongest recorded earthquake in Oklahoma was 5.8, occurring near Pawnee on September 3, 2016.

The planning team considers the extent of an earthquake affecting the planning area to be:

- *Minor*, when an earthquake occurs measuring less than IV on the Mercalli Scale;
- *Major*, when an earthquake occurs measuring IV or greater on the Mercalli Scale.

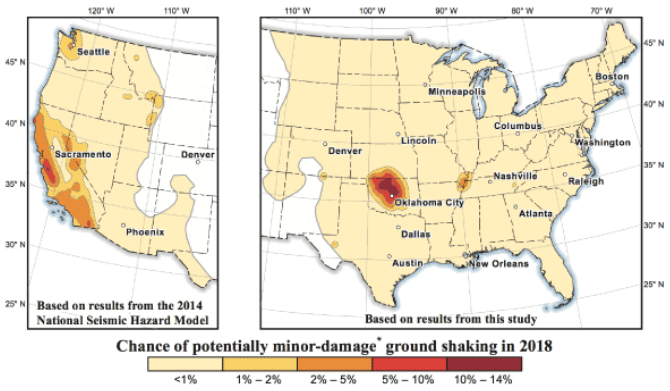
Previous Occurrences

Few earthquakes have been recorded in the planning area since 2000. The strongest in the general area was recorded October 13, 2010, with magnitude measured at 4.4 on the Richter scale[18]. The epicenter of this event was located near State Highway 9 at 84th Ave. SE within the City of Norman, approximately 10 miles south of the planning area.

[18] https://earthquake.usgs.gov/learn/glossary/?term=Richter%20scale

Probability of Future Events: POSSIBLE

In 2018, USGS rated the City of Moore/MPS planning area at between a 5 and 10 percent chance of "minor damaging shaking"[19].



Vulnerability and Impacts

A major earthquake centered in or near the City of Moore/MPS planning area could have wide reaching impact. People, structures, property, transportation, utilities, and the economy are vulnerable to the effects of earthquakes.

People are vulnerable to both the initial effects of an earthquake as well as after effects. People may experience severe injury or death due to the collapse of structures; persons in transit may also be vulnerable to the collapse of transportation structures such as bridges.

Vulnerability: Residents and students may be unaware of issues related to earthquakes.

- *Mitigation 1:* Create and present comprehensive mitigation education programs for both the City of Moore and Moore Public Schools.
- *Mitigation 2:* Produce visual media with mitigation information for airing on City and Schools cable channels, websites, video boards and other locations with preparedness information.

Persons may also be impacted by earthquake events by damage to or complete loss of their homes, as well as loss of vehicles and/or personal property. Adding to the impact is the potential loss of wages or employment due to extended injury, time away from work while dealing with damaged/destroyed homes, loss of transportation, and/or the loss of employment due to destruction of their employer's property.

Vulnerability: Structures are vulnerable to damage or total collapse during earthquakes. One source states, "There is an often-repeated saying, 'Earthquakes don't kill people, buildings do.'"[20]

- *Mitigation:* Residential building codes within the City of Moore were strengthened in 2014 to require newly constructed residential structures to withstand wind speeds up to 135 mph. The codes require the use of additional wall/rafter and wall/foundation mechanical connections, narrower spacing between roof joists, increased sheathing requirements, and more durable garage doors. While intended for greater resiliency to winds, the strengthening should offer increased resiliency to earthquakes as well.

Hospitals, schools, grocery stores and other critical need and economically important facilities are vulnerable to damage or destruction and be closed for extended periods. Impacts include a loss of health care services, particularly impacting already vulnerable populations; food shortages; and both personal and commercial financial losses.

Transportation systems are vulnerable to earthquakes. Impacts may last for days when drainage structures, bridges, and/or roadways are damaged or destroyed. Control systems such as traffic lights, rail block occupancy detector systems, and air traffic control systems may also be directly damaged, or be inoperable due to the lack of power and communications utilities. Pipelines may be damaged,

[19] https://earthquake.usgs.gov/hazards/induced/index.php#2018
[20] FEMA, "The Importance of Building Codes in Earthquake-Prone Communities"

causing both immediate hazardous materials events as well as longer-term issues with the normal supply of fuels and other critical materials. These transportation vulnerabilities can impede the normal flow of both vehicular and rail traffic, cause financial loss to drivers due to increased travel times and fuel usage, financial and time-critical losses to shippers and receivers, and financial loss to governments responsible for repairs.

Vulnerability: Vehicle transportation infrastructure will be damaged.

- *Mitigation:* Acquire, maintain and deploy portable motorist information signs to convey information to motorists.

Both above- and below-ground utilities are vulnerable to shaking of the ground, and may be damaged or destroyed. Utility disruption may impact persons and businesses with loss of power and/or connectivity, causing fires, injury from being in the dark, temporary loss of business and therefore financial loss. It also impacts utility providers with financial loss due to overtime, equipment and supplies needed for repairs to their systems.

Vulnerability: Commercial power may be interrupted by the earthquake (poles/lines downed, damage to generation and transmission facilities etc.)

- *Mitigation 1:* Collaborate with local power utilities to move electrical lines underground.
- *Mitigation 2:* Install backup power generators at critical infrastructure locations.
- *Mitigation 3:* Install Master UPS systems at critical infrastructure facilities.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Earthquake	Possible	Limited	< 6 hours	< 6 hours	2.2

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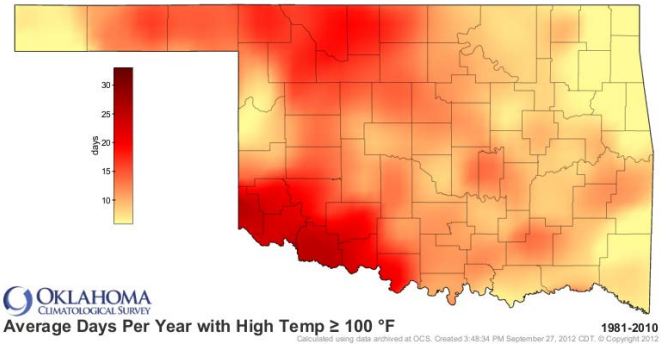
3.5.4 Extreme Heat

Description

Extreme heat may be defined as air temperatures that hover 10 degrees or more above the average high temperature for an area and last for several days or longer. Humid or muggy conditions can add to the danger and discomfort of high temperatures.

Location

The entire planning area is susceptible to extreme heat events.

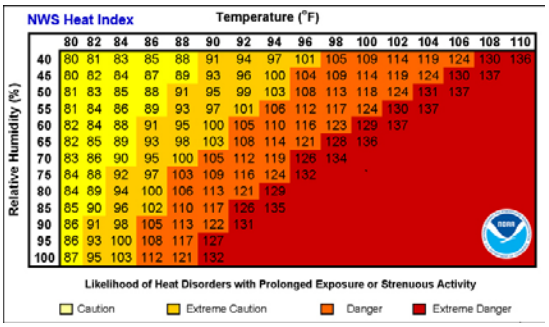


Extent

There are three methods of measuring the extent of extreme heat:

- Actual air temperature;
- Heat Index (HI);
- Wet bulb globe temperature (WBGT).

The local National Weather Service criteria for issuing a "Heat Advisory" is air temperatures at or above 103° F; the criteria for an "Excessive Heat Warning" is at or above 105° F.[21] As seen in the accompanying maps, the planning area averages 10-15 days per year of actual air temperatures at or above 100° F. The maximum recorded air temperature at the Norman Mesonet site is 111°F.



The Heat Index is a measure of how hot it feels when relative humidity is factored in with the actual air temperature, as is shown on the chart. The local National Weather Service criteria for issuing a "Heat Advisory" also includes the HI at or above 105° F; the criteria for an "Excessive Heat Warning" is HI at or above 110° F.

The Wet Bulb Globe Temperature is a comprehensive human heat stress index based on air temperature, relative humidity, wind speed, and sunlight. It was developed to better assess outdoor human heat risk. While the wet bulb globe temperature helps persons avoid dangerous heat conditions, it can also be used as a guide to safely acclimate to heat and to better pace outdoor work or play.

The extent of human heat stress related WBGT values are as follows. All ranges of WBGT are possible in the planning area.

Unacclimated and Acclimated Work/Rest and Water Intake Chart

Heat Risk Category		Wet Bulb Globe Temp	Light Work Work/Rest	Light Work Water Intake (quart/hr)	Moderate Work Work/Rest	Moderate Work Water Intake (quart/hr)	Heavy Work Work/Rest	Heavy Work Water Intake (quart/hr)
No Risk	Unacclimated	78 – 79.9	50/10 min	½	40/20 min	¾	30/30 min	¾
	Acclimated	78 – 79.9	continuous	½	continuous	¾	50/10 min	¾
Low	Unacclimated	80 – 84.9	40/20 min	½	30/30 min	¾	20/40 min	1
	Acclimated	80 – 84.9	continuous	½	50/10 min	¾	40/20 min	1
Moderate	Unacclimated	85 – 87.9	30/30 min	¾	20/40 min	¾	10/50 min	1
	Acclimated	85 – 87.9	continuous	¾	40/20 min	¾	30/30 min	1
High	Unacclimated	88 – 90	20/40 min	¾	10/50 min	¾	avoid	1
	Acclimated	88 – 90	continuous	¾	30/30 min	¾	20/40 min	1
Extreme	Unacclimated	> 90	10/50 min	1	avoid	1	avoid	1
	Acclimated	> 90	50/10 min	1	20/40 min	1	10/50 min	1

[21] Advisory/Warning Guidelines, National Weather Service Forecast Office, Norman Oklahoma.

Air temperature (alone) also impacts non-human related factors, such as stress on asphalt or concrete roadways, functioning of machinery and electronics, and skin burns when in contact with items heated by the air and sun.

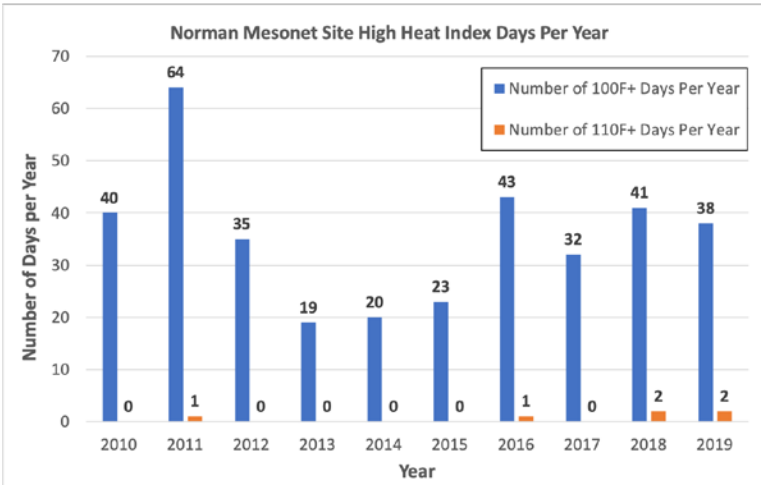
The planning team considers the extent of an extreme heat event to be:

- *Minor,* when WBGT values are below 88 ° F and/or air temperature values are below 100 ° F
- *Major*, when WBGT values are at/above 89 ° F or air temperature values are at/above 100 ° F

Previous Occurrences

Data concerning the number of occurrences of WBGT values exceeding high risk levels in the planning area is not available. However, similar data is available for heat index values.

This data indicates that there have been at least 19 days annually over the past ten years where heat index values have exceeded 100° F. Heat index values exceeded 110 ° F for at least one day in four of those years.



In particular, there were 64 days in 2011 where the heat index exceeded 100 ° F; one of those days exceeded 110 ° F. There were 40 days exceeding 100 ° F in 2010, 43 days in 2016, and 41 days in 2018. There were two days where values exceeded 110 ° F in both 2018 and 2019.[22]

Of note is that on September 4, 2019, MPS moved the kickoff of the District's highest profile football game back 30 minutes, "in observance of the MPS heat policy and with the high temps forecasted". This allowed additional time for afternoon high temperatures to cool into a less dangerous range.

Probability of Future Events: HIGHLY LIKELY

Air temperatures exceed 100° and WBGT values approach or exceed high risk levels in the planning area on an annual basis.

Vulnerability and Impact

People with respiratory or cardio-vascular diseases, diabetes, chronic mental disorders or other pre-existing medical conditions are at greatest risk of being negatively affected by extreme heat events. Individuals who are elderly, are socially isolated, have a low income, are uneducated, or live in low-income housing are also at greater risk.[23] All persons are susceptible to heat related illness if they lack proper hydration and cooling, particularly if performing strenuous physical activities. Impacts to persons may include serious heat-related illness requiring medical care, and potentially death.

Vulnerability: Residents and students may be unaware of issues or solutions related to extreme heat events.

[22] Oklahoma Climatological Survey
[23] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4515652/

- *Mitigation 1:* Create and present comprehensive mitigation education programs for both the City of Moore and Moore Public Schools.
- *Mitigation 2:* Produce visual media with mitigation information for airing on City and Schools cable channels, websites, video boards and other locations with preparedness information.

Vulnerability: Families with low income and/or that live in low-income housing may be of greater vulnerability as they may not be able to afford the costs of air conditioning, in terms of the equipment costs and/or repairs, and also in terms of electrical costs.

- *Mitigation 1:* The City of Moore's Community Center building is designated as an emergency mass-care facility, which includes temporary cooling and warming shelter. It has a backup power generator and limited cooking facilities.
- *Mitigation 2:* Install backup power generators at critical infrastructure locations. The Moore Public Library, Brand Senior Center, MPS and local church facilities may also be used as cooling shelters, but are dependent upon commercial power.
- *Mitigation 3:* Collaborate with local power utilities to move electrical lines underground. This typically includes other necessary power transmission equipment, which are vulnerable to the effects of extreme heat when on poles.

Vulnerability: Moore Public Schools are generally not in session during the normal times of extreme heat events; however students may be at MPS facilities for summer school or summer activities. Staff may also be working, particularly maintenance, information technology and administrative staffs. Students and staff may therefore be vulnerable to the effects of extreme heat.

- *Mitigation:* All MPS facilities are air-conditioned (excepting warehouse and garage areas), reducing the vulnerability of students and staff to extreme heat events.

Vulnerability: MPS students and staff participating in athletics, marching band, or other outside activities are vulnerable to the effects of extreme heat events.

- *Mitigation:* MPS follows the Board policies of the Oklahoma Secondary Schools Activities Association; Policy #LIII specifically addresses "Extreme Heat". This policy provides rules for acclimatization to heat, limits the number, times and length of practices, requires an "open water" policy and availability of cooling stations, and requires a heat-related emergency plan. It also requires the checking and recording of the heat index immediately prior to any football practice (with guidelines and suggestions available for other activities).[24]

Prolonged extreme heat is typically associated with drought; the combination of these decreases the moisture levels of fuels, which increases both the vulnerability of grass and brush to fire starts, and the intensity of fires once started.

Vulnerability: The strenuous physical activity of fighting fires combined with the personal protective clothing/equipment (PPE) that must be worn significantly increases the vulnerability of firefighters to extreme heat events and heat-related health issues.

- *Mitigation:* Acquire specialized wildland firefighting PPE for the Moore Fire Department.

Vulnerability: Electrical service is vulnerable to extreme heat events. Extreme heat events will cause additional volume demand for electricity as cooling equipment is used. However, extreme heat also

[24] OSSAA Board Policies 2019-2020.

stresses electrical production and distribution systems. Impacts may be reduced at critical and MPS facilities by the presence (and use if needed) of backup power generators.

- *Mitigation 1:* Install backup power generators at critical infrastructure locations. The Moore Public Library, Brand Senior Center, MPS and local church facilities may also be used as cooling shelters, but are dependent upon commercial power.
- *Mitigation 2:* Collaborate with local power utilities to move electrical lines underground. This typically includes other necessary power transmission equipment, which are vulnerable to the effects of extreme heat when on poles.

Extreme heat events may impact transportation. Asphalt surfaces may soften to the point where small flecks of asphalt adhere to shoes, tires, and anything else moving across the surface; extreme heat may also cause cracking and oxidation of asphalt surfaces.[25] Concrete expands and contracts with temperature; extreme heat can cause expansion beyond design and result in buckling of the surface between two joints in a roadway. In extreme heat, a length of continuous welded rail may suffer compressive stress, causing a length of railway to buckle laterally (known as a "sun-kink"). While rail is altered prior to installation to lessen the effects of extreme environmental temperatures, a rail may still reach its "critical rail temperature" during extreme heat events and kink. These transportation vulnerabilities can impede the normal flow of both vehicular and rail traffic, cause financial loss to drivers due to increased travel times and fuel usage, financial and time-critical losses to shippers and receivers, and financial loss to governments and railroads responsible for repairs.

Vulnerability: Vehicle transportation infrastructure may be damaged.

- *Mitigation:* Acquire, maintain and deploy portable motorist information signs to convey information to motorists.

Vulnerability: Vehicles, including those of the City and MPS, may experience heat-related failures if left in direct sunlight during extreme heat events.

- *Mitigation:* Install covers over vehicle parking areas.

Structural damage is generally unlikely in extreme heat events.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Extreme Heat	Highly Likely	Negligible	12-24 hours	< 1 week	2.7

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[25] https://www.pavemax.com/how-hot-weather-affects-concrete-asphalt/

3.5.5 Flood

Description

River flooding is when a river or creek rises to its flood stage and spills over the banks. The amount of flooding is usually a function of the amount of precipitation in the local or upstream area, the amount of time it takes for rainfall to accumulate, previous saturation of local soils, and the terrain around the river system.

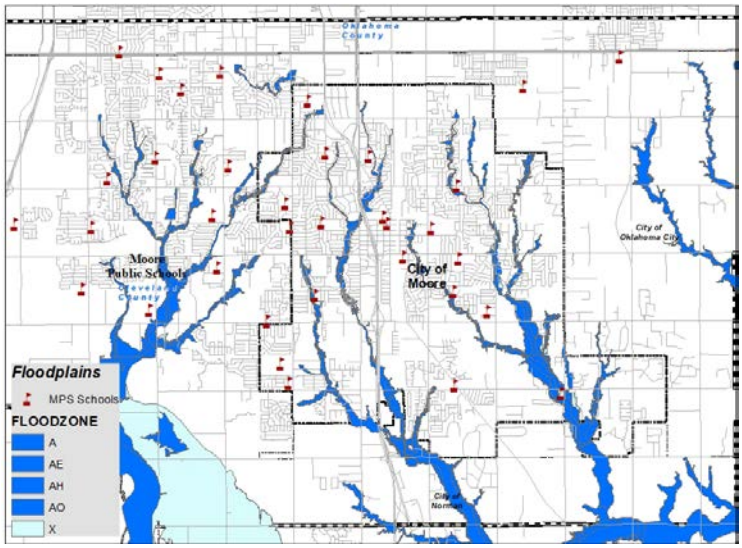
Flash flooding occurs when the precipitation rate becomes so large that local drainage cannot evacuate the runoff. It can develop very quickly during or immediately after a nearby heavy rainfall.

The primary threat from flash flooding is often to human life and safety, while the slower onset and more widespread nature of river flooding creates greater economic and property damage threats.

Location

The entire planning area is affected by flash flooding. There is no threat from river flooding as the only river in the planning area is in a more sparsely populated area along the far western boundary of the school district.

Locations within the planning area that are likely to be affected by flash flooding can be seen on the floodplain maps located in *Appendix G*. No critical facilities are located within a floodplain.



Timber Creek Elementary is located within a floodplain area, however the building is constructed above flood elevation.

Extent

FEMA flood zones are geographic areas that have been defined according to varying levels of flood risk. Zone A (A, AE, AH, AO), or the 100 year flood plain, is a Special Flood Hazard Area (SFHA) with a 1% chance of flooding in a given year. Zone B (X), or the 500 year flood plain, is a Special Flood Hazard Area with a 0.2% chance of flooding in a given year.

Within the flood zones, potential flood depths during a 1% annual chance storm event as estimated by FEMA's Base Level Engineering from less than 1 foot to greater than 5 feet above land surface. The planning area reasonably expects to experience a range of flooding of 1-3 feet. See flood depth map in *Appendix G*.

The planning team considers the extent of a flooding event to be:

- *Minor*, if the event remains in the 0.1% SFHA
- *Major*, if the event exceeds the 0.1% SFHA

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FEMA also measures the extent of repeated flooding of properties by the designation as Severe Repetitive Loss properties. The SRL designation consists of any National Flood Insurance Program (NFIP) insured residential property that has had:

- Four or more separate claim payments of more than $5,000 each; or
- Two or more separate claim payments where the total of the payments exceeds the current value of the property.

There has previously been one property in Moore that has been designated as SRL. This property has been purchased by the City of Moore and the structures on it demolished, as part of a bridge construction project.

Previous Occurrences

Flood Events, 2010-2019 *(source: National Climatic Data Center)*		
Date	**Type**	**Description**
May 25, 2019	Flash Flood	Scattered supercells merged into a linear system that produced a variety of severe weather on the 25th. An excessive amount of water covered the roads on Santa Fe between SW 19th St. and NW 27th St., with some areas of 4 inches.
September 6, 2018	Flash Flood	Numerous unorganized showers and storms formed under the influence of southwest flow on the afternoon of the 6th. Heavy rain and training storms resulted in some flash flooding. Foot deep water was reported at SE 19th St. and Meadow Run Dr. Numerous additional reports of high water were received from eastern Moore and southeast Oklahoma City.
August 8, 2018	Flash Flood	A mass of training storms formed overnight into the morning of the 8th over northern Oklahoma and moved southward. These storms produced flash flooding, especially across Central Oklahoma. A possible flood related car accident occurred due to ponding water on roadway *(location not stated in cited data)*. Injuries were unknown.
June 7, 2018	Flash Flood	Moore experienced flash flooding up to wheel well height during a series of storms. The SE 19th St. rail underpass was closed due to flooding.
May 6, 2015	Flash Flood	A potent spring storm system took shape across the Southern and Central Plains. There was widespread severe storm development, and the slow moving nature of storms lead to several occurrences of flash flooding. Storms continued well into the night. High water beneath railroad overpass made SE 19th St. impassable. Numerous water rescues were performed by the fire department.
June 14, 2010	Flash Flood	Moore experienced flash flooding as the result of thunderstorms that produced rainfall averaging one to 2 inches per hour, some even up to 3 inches per hour. The initial storms began about 3 a.m. and the heavy rainfall finally tapered off around noon.

Probability of Future Events: LIKELY

As noted above, flash flooding occurs on a regular basis in the planning area.

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Vulnerability and Impacts

Persons in or near floodplain areas are vulnerable to flash flooding. In particular, this relates to two primary issues: those driving through water covered roadways, and children and adults playing in or around floodwaters. Local emergency management agencies, the National Weather Service and local media all distribute messages on the dangers of driving through or playing in/around floodwaters, however emergency responders are regularly called on to perform water rescues during flash flood events.

Vulnerability: Residents and students may be unaware of issues and dangers related to flood events.

- *Mitigation 1:* Create and present comprehensive mitigation education programs for both the City of Moore and Moore Public Schools.
- *Mitigation 2:* Produce visual media with mitigation information for airing on City and Schools cable channels, websites, video boards and other locations with preparedness information.

The impacts of persons driving into flooded roadways include:

- Damage to vehicles caused by water being ingested into engines;
- Damage to vehicles being swept away by flowing flood waters;
- Damage to vehicles dropping into creeks or drainage channels in areas where roadways or bridges have been washed away;
- Drowning or severe injury to persons trapped in vehicles swept away and/or dropped into water;
- Drowning or severe injury to bystanders and professionals attempting rescue of others swept into water.

Flash flood events severely impact transportation. Particularly in the southern and eastern portions of the planning area, there are many locations where it is difficult to find a route into or out of an area that is surrounded by flooded creeks and drainage channels. Impacts may last for days when drainage structures, bridges, and/or roadways are washed out from the flowing water. These transportation vulnerabilities can impede the normal flow of both vehicular and rail traffic, cause financial loss to drivers due to increased travel times and fuel usage, financial and time-critical losses to shippers and receivers, and financial loss to governments responsible for repairs.

Vulnerability: Vehicle transportation infrastructure may be damaged and/or typical routes closed. This vulnerability also extends to MPS, which runs approximately 80 routes twice per day.

- *Mitigation:* Acquire, maintain and deploy portable motorist information signs to convey information to motorists.

In the planning area, damage to structures from flash flooding is typically limited. City of Moore ordinances require all new construction and substantially improved structures to be built at a minimum of 12 inches above the Base Flood Elevation (BFE), therefore flash flood waters typically travel around the structures rather than into. However, there are many locations in the City of Moore where flooding and drainage issues impact garages, outbuilding and other property items.

Vulnerability: There are numerous drainage and flooding issues throughout the City as outlined in the City's Master Drainage Plan.

- *Mitigation:* Implement recommendations of the City's Master Drainage Plan, to provide better stormwater flow and reduce amount of flooding.

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Vulnerability: The City of Moore and several private residential property owners located in the Oakridge Addition have reported severe flooding in roadways, yards, and residential structures. A detention pond, located on the southeast corner of the Southmoore High School property and adjacent to residential structures on Oak Drive has previously overtopped and discharged through the southern spillway. Additionally, storm sewer systems may have surcharged into roadways due to the high water surface elevation in the detention pond. It appears spillway discharge and a storm sewer system with an inadequate hydraulic capacity have been the causes of flooding in the area.

- *Mitigation:* Implement the Oakridge Drainage Project as recommended in the City's Master Drainage Plan.

Vulnerability: Timber Creek Elementary School is located within a floodplain area. While the school building is elevated above base flood elevation, the surrounding parking lots and streets are not. The school - with over 500 students and 50 staff - becomes inaccessible during flooding events, due mostly to uncontrolled drainage upstream. The generalized issue has been noted in the Stormwater Master Plan; however, a detailed action plan for improvements is needed.

Floodplain Area surrounding MPS Timber Creek Elementary School

- *Mitigation 1*: Commission a study of the Southeast Drainage Basin of the North Fork River to determine needed improvements to reduce downstream flooding.
- *Mitigation 2:* Implement improvements recommended for the Southeast Drainage Basin.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Flood	Likely	Limited	6-12 hours	< 24 hours	2.6

3.5.6 Hail

Description

Hail is a form of precipitation consisting of solid ice that forms inside thunderstorm updrafts and falls to the ground. Hail can damage aircraft, homes and cars, and can be deadly to livestock and people.

Location

Hail storms may occur anywhere in the planning area.

Extent

The extent of a hail event is determined by the size of the individual stones, as measured using a ruler, calipers or tape measure. Duration of the event may also be used as an additional measure, providing an estimate of the amount or volume of hail.

One of the three criteria used nationwide by the National Weather Service to classify thunderstorms as "severe" is when they produce hail of 1" diameter or greater. It should be noted that In Oklahoma, hail of 1" diameter occurs very regularly in thunderstorms. However this hail normally does not cause major damage. While very large hail is possible and has occurred (see below picture), most storms occurring in the planning area produce 1" hail or smaller.

The planning team considers the extent of hail events to be:

- *Minor*, when relatively minor property damage or injuries not requiring a professional emergency response occur, typically associated with hail sizes below 1.5" diameter;
- *Major*, when significant property damage or life-threatening injuries occur. These events are typically associated with hail sizes at or above 1.5" diameter.

It should be noted that hail size is popularly estimated by comparing it to other (mostly) spherical or round objects such as marbles, coins, balls or eggs. This method of measurement is largely disregarded in professional circles, as the size of objects used as the comparison may widely vary.

Previous Occurrences[26]

Recorded 1.5" or Larger Hail Instances, 2010-2019		
Date	**Location**	**Hail Size (in)**
21 October 2017	2 miles WSW of Moore	1.5
27 May 2016	Central Oklahoma	1.75
23 May 2013	SW 104th and Council	1.75
19 May 2013	2 miles SW of Moore	1.5
24 April 2011	Moore	1.75
10 May 2010	Just ESE of Moore	2.75

Hailstone that fell in Moore during a severe thunderstorm/tornado event on 5/10/2010 (courtesy Adrienne Gonzales)

Probability of Future Events: HIGHLY LIKELY

Hail events are a part of the normal climate cycle and regularly occur in the planning area.

[26] https://www.ncdc.noaa.gov/stormevents/

Vulnerability and Impact

People, structures and vehicles are vulnerable to hail events.

Persons who are outside, typically at recreational or sporting venues, are most vulnerable to hail events. Personal injury is possible if adequate shelter is not taken during hail events.

Vulnerability: Residents and students may be unaware of issues and dangers related to hail events.

- *Mitigation 1:* Create and present comprehensive mitigation education programs for both the City of Moore and Moore Public Schools.
- *Mitigation 2:* Produce visual media with mitigation information for airing on City and Schools cable channels, websites, video boards and other locations with preparedness information.

Roofs, siding and windows of structures are highly vulnerable to hail events. Hail damage to roofs frequently results in replacement prior to the normal life of roofing material, thus costing insurance companies and property owners millions of dollars annually. Property owners on occasion may have to find temporary housing or business location due to the amount of roof damage on their structure. Businesses may experience a loss of business and in extreme cases may affect employee jobs.

Vulnerability: Windows of City and MPS facilities are vulnerable to breakage by hail.

- *Mitigation:* Install impact resistant film at critical facilities to reduce the effect of hail.

Vehicles are also vulnerable to hail storms. As with structures, hail damage to vehicles frequently results in the need for major repairs or replacement prior to the normal life of vehicles, costing insurance companies and vehicle owners.

Vulnerability: Moore Public School buses and other vehicles are parked outside with no cover and are vulnerable to hail events. Most City of Moore emergency vehicles are parked inside or under covered parking; however, other City vehicles are susceptible to hail damage. Impacts of a hail storm to MPS and the City of Moore include damage to facilities and to vehicles, potentially costing insurers and taxpayers thousands of dollars.

- *Mitigation:* Install overhead covers for parking areas at City of Moore and MPS facilities.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Hail	Highly Likely	Limited	< 6 hours	< 6 hours	3.1

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3.5.7 High Winds

Description

Straight-line or "high" winds are winds that move horizontally along the ground. Most often these are associated with thunderstorms.

Location

The entire planning area is susceptible to high winds.

Extent

The National Weather Service issues three products describing the extent of high winds:

- Wind Advisory: Sustained winds of 30-39 mph and/or frequent gusts 40-57 mph;
- High Wind Warning: Sustained winds at or above 40 mph and/or gusts at or above 58 mph.
- Severe Thunderstorm Warning: Winds associated with a thunderstorm at or above 58 mph.

High wind events in the planning area typically involve wind speeds below 70 mph; however, speeds of up to an estimated 110 mph have occurred.

The extent of high wind events in the planning area may also be defined by the duration of the event. Most high wind events associated with "normal" severe thunderstorms are from wind gusts, relatively short-lived events of only a few minutes (although several may occur during the life of the thunderstorm). However, high winds associated with derechos, downbursts and microbursts may be sustained over longer periods of 10-30 minutes.

The planning team considers the extent of a straight-line wind event to be:

- *Minor,* when wind gusts of 50-80 mph occur;
- *Major;* when wind gusts and/or prolonged sustained winds of 80 mph or greater occur.

Previous Occurrences

Recorded Winds >= 70 mph, 2010-2019 *(sources: National Climatic Data Center)*		
Date	**Location**	**Description**
May 24, 2019	SW 119th & Rockwell	**70 mph:** Fence and shingle damage
Sept 17, 2016	Moore	**70 mph:** No damage reported
May 7, 2014	SW 92nd & May	**70 mph:** Trees blown down along 92nd St. between May and Pennsylvania
May 31, 2013	SW 89th & May	**70 mph:** Roof damage noted to houses along May Ave. from SW 89th St to at least SW 96th St.
May 31, 2013	Moore	**80 mph:** Area of wind damage through Moore. Most significant roughly from NW 5th & Dillon to east of Main St. & Eastern Ave. Roof damage occurred to many homes and two strip malls. Damage occurred also to many trees, a few light stands, and a scoreboard at the Junior High School football field.

Probability of Future Events: LIKELY

High wind events are a part of the normal climate cycle and regularly occur in the planning area.

Vulnerability and Impact

People, structures and utilities are vulnerable to high straight-line wind events.

Persons who are outside, typically at recreational or sporting venues, are most vulnerable to wind events. Personal injury is possible from blowing, wind-driven debris if adequate shelter is not taken.

Vulnerability: Residents and students may be unaware of issues and dangers related to high wind events.

- *Mitigation 1:* Create and present comprehensive mitigation education programs for both the City of Moore and Moore Public Schools.
- *Mitigation 2:* Produce visual media with mitigation information for airing on City and Schools cable channels, websites, video boards and other locations with preparedness information.

Vulnerability: Persons who are outside may be without normal means of receiving information concerning the approach of high winds.

- *Mitigation 1:* Install, upgrade, maintain and operate warning system devices to provide immediate warning capability to those who are outside.
- *Mitigation 2:* Upgrade all warning system devices to solar power.

Vulnerability: Structures are vulnerable to high straight-line winds. Older built structures with weakened mechanical roof connections may be more susceptible to wind damage, as well as those with large-area garage doors that are not strengthened against high winds. Commercial structures with large roof areas and/or large amounts of exterior glass areas are also vulnerable. Failures of structures impact residents with financial loss as well as loss of personal property; failures of commercial structures impact businesses and property owners with financial and business losses, and with the loss of employee income and potentially jobs if businesses are forced to close either temporarily or permanently.

- *Mitigation 1:* Building codes in the City of Moore were strengthened in 2014, requiring new residential construction must be built to withstand 135 mph winds. This is higher than minimum code standards for the area of 115 mph[27]. The increase in the wind standard was enacted in an effort to reduce failures of pieces of buildings and therefore cause a reduction in the amount of flying debris impacting other structures.
- *Mitigation 2:* Install engineered storm shelters at all City of Moore facilities.
- *Mitigation 3:* Implement a program to provide financial incentives and assistance for the installation of engineered storm shelters at private residences.
- *Mitigation 4:* All Moore Public Schools facilities have engineered storm shelters for students and staff.

Vulnerability: Windows of City and MPS facilities are vulnerable to breakage by debris carried by high winds.

- *Mitigation:* Install impact resistant film at critical facilities to reduce the effect of debris.

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[27]Moore Municipal Code

Utilities utilizing above-ground lines are also vulnerable to the effects of high, straight-line winds. Even winds of the "minor" classification typically cause lines to snap and fall, disrupting power and/or connectivity. Winds may also cause electrical distribution lines to touch and short, possibly causing transformers to blow. Utility disruption may impact persons and businesses with loss of power and/or connectivity, causing fires, injury from being in the dark, temporary loss of business and therefore financial loss. It also impacts utility providers with financial loss due to overtime, equipment and supplies needed for repairs to their systems.

Vulnerability: Businesses are vulnerable to the effect of high winds.

- *Mitigation:* Create and implement a "StormReady Business" program to assist businesses in preparing for the effects of high winds.

Vulnerability: Electrical lines and poles are vulnerable to the effect of high winds.

- *Mitigation 1:* Install backup power generators at critical infrastructure locations.
- *Mitigation 2:* Install Master Uninterruptible Power Supply systems at critical infrastructure facilities of the City of Moore and Moore Public Schools.
- *Mitigation 3:* Collaborate with local power utilities to move electrical lines underground.

Vulnerability: Moore Public School buses and other vehicles are parked outside with no cover and are vulnerable to debris carried by high winds. Most City of Moore emergency vehicles are parked inside or under covered parking; however, other City vehicles are susceptible to wind-borne debris damage. Impacts of a wind storm to MPS and the City of Moore vehicles potentially cost insurers and taxpayers thousands of dollars.

- *Mitigation:* Install overhead covers for parking areas at City of Moore and MPS facilities.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
High Winds	Likely	Limited	< 6 hours	< 6 hours	2.65

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3.5.8 Lightning

Description

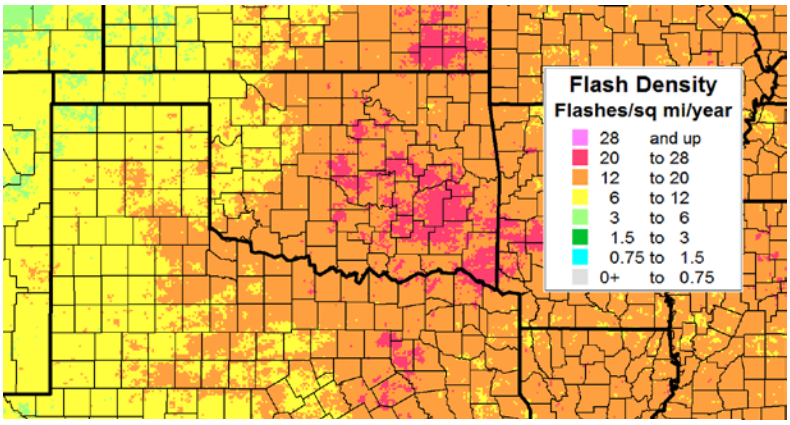
Lightning is an electrical discharge caused by a buildup of static electricity between clouds, or between clouds and the ground.

Location

The entire planning area experiences lightning.

Extent

Oklahoma has frequent thunderstorms all of which produce lightning. There are an average of 27 to 36 thunderstorm days per year in the planning area[28]; Oklahoma was second nationally in the US with over 14 million lightning strokes/pulses in 2019.[29]



Lightning Flash Density. See Appendix H.

The "Flash Density" map from the Vaisala National Lightning Detection Network indicates that the planning area received a flash density of 20 to 28 lightning flashes/sq. mile per year in the period 2009-2018. This compares to less than 2 per sq. mi. per year in the area west of the Rocky Mountains to more than 28 per year along the Gulf coast and in Florida.

The planning team considers the extent of lightning events to be:

- *Minor*, when lightning occurs in the planning area but does not cause death, injury, or widespread damage;
- *Major*, when lightning occurs in the planning area and causes death, injury, or widespread damage to structures and/or utilities.

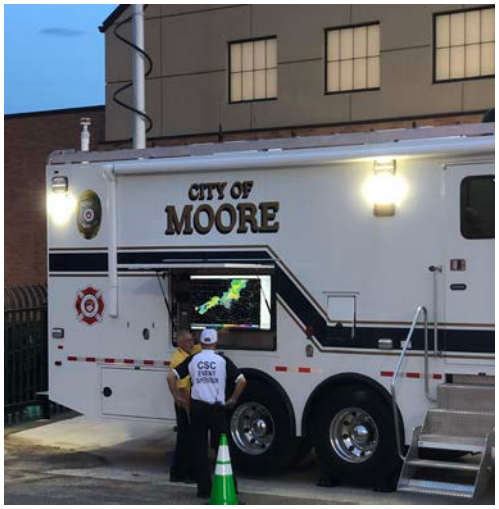
Previous Occurrences

There have been no known fatalities caused by lightning within the City of Moore/MPS planning area in the past 10 years.

There have been numerous structural fires caused by lightning within Moore. While the Moore Fire Department is unable to provide statistical data due to changes in their records software, the Fire Chief and Emergency Manager estimate there are at least 4-5 structural lightning strikes reported to the Fire Department in Moore per year. There are very likely additional strikes that are not reported, with residents finding damage only to home wiring and/or electronic devices.

[28] Koehler, Thomas L., 2019: Cloud-to-Ground Lightning Flash Density and Thunderstorm Day Distributions over the Contiguous United States Derived from NLDN Measurements: 1993-2018.
[29] Vaisala Annual Lightning Report 2019

On September 12, 2019, MPS moved the start time of a varsity football game up by an hour in an attempt to complete the contest prior to the arrival of forecast thunderstorms. On-site weather support was provided by the City's Emergency Manager. Even with a lengthy injury delay, the game was completed and athletes and spectators cleared from the stadium just before lightning began in the area.



Security personnel checking radar/ lightning during a Moore High School varsity football game, September 12, 2019.

Probability of Future Events: HIGHLY LIKELY

Lightning events are a part of the normal climate cycle and regularly occur in the planning area.

Vulnerability and Impact

People, structures and utilities are vulnerable to lightning events.

An average of 47 people are killed per year by lightning in the United States. One fatality has been recorded in Oklahoma in the period 2008-2019; this fatality did not occur within the planning area.[30] Persons who are outside, typically at recreational or sporting venues, are most vulnerable to lightning events. Death or personal injury is possible from lightning if adequate shelter is not taken.

Vulnerability: Residents and students may be unaware of issues and dangers related to lightning events.

- *Mitigation 1:* Create and present comprehensive mitigation education programs for both the City of Moore and Moore Public Schools.
- *Mitigation 2:* Produce visual media with mitigation information for airing on City and Schools cable channels, websites, video boards and other locations with preparedness information.

Vulnerability: Persons who are outside may be without normal means of receiving information concerning the approach of lightning.

- *Mitigation 1:* Install, upgrade, maintain and operate warning system devices to provide immediate warning capability to those who are outside.
- *Mitigation 2:* Upgrade all warning system devices to solar power.

Vulnerability: Persons participating in or attending MPS athletics, marching band, or other outside activities are potentially vulnerable to the effects of lightning events.

- *Mitigation:* MPS Athletics follows the guidelines of the NCAA concerning lightning; if a lightning flash is detected within five miles of the athletics venue, play is suspended and athletes/staff placed inside until 30 minutes after the last flash within that area.

Structures are vulnerable to lightning. Even with proper grounding, damage to systems and structures and/or loss of property may occur. As noted above, there have been numerous structure fires started because of lightning strikes within the planning area.

[30] https://www.weather.gov/safety/lightning

Lightning can cause significant damage to above-ground utilities. Again, statistical data from the Fire Department is not available, but the Fire Chief estimates that they make several responses per year on utility pole and/or transformer fires caused by lightning.

Vulnerability: Electrical lines and poles are vulnerable to the effect of lightning.

- *Mitigation 1:* Install backup power generators at critical infrastructure locations.
- *Mitigation 2:* Install Master Uninterruptible Power Supply systems at critical infrastructure facilities of the City of Moore and Moore Public Schools.
- *Mitigation 3:* Collaborate with local power utilities to move electrical lines underground. This typically includes other necessary power transmission equipment, which are vulnerable to the effects of extreme heat when on poles.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Lightning	Highly Likely	Limited	< 6 hours	< 6 hours	3.1

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3.5.9 Tornado

Description

Tornados are violently rotating columns of air that reach from the bottom of a thunderstorm cloud to the ground.

Location

The entire planning area may experience tornadoes.

Extent

The strength of a tornado is measured by the damage it creates, and is rated from 0 to 5 via the Enhanced Fujita scale. It uses three-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to 28 indicators, as determined by a field survey. These estimates vary with height and exposure.31

EF Rating	Wind Speeds	Expected Damage
EF-0	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.
EF-1	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.
EF-2	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.
EF-3	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.
EF-4	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.
EF-5	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.

The planning area has experienced all levels of tornadoes.

The City of Moore/MPS planning team considers the extent of tornado events in the planning area to be:

- *Minor*, when a tornado rated at EF-0 or EF-1 occurs. These typically cause damage to a limited number of structures and utilities;
- *Major*, when a tornado rated at EF-2 or EF-3 occurs. These typically cause damage to a larger number of structures and utilities;
- *Extreme*, when a tornado rated at EF-4 or EF-5 occurs. These have caused widespread damage to 800-1200 homes and businesses in the planning area on several occasions.

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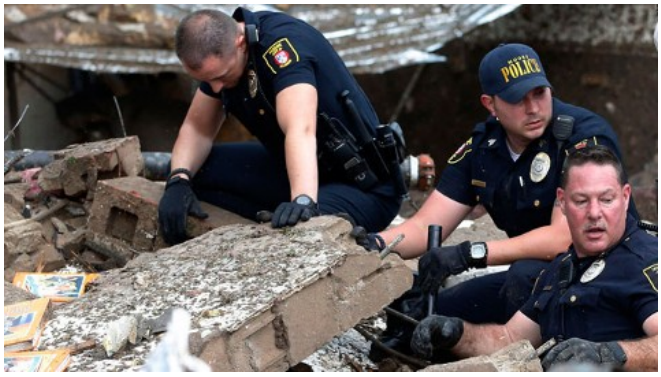
[31] http://www.spc.noaa.gov/faq/tornado/ef-scale.html

Previous Occurrences

Tornadoes within the City of Moore							
Date	**Damage Category**	**Fatalities**	**Injuries**	**Damage Estimate**	**Path Width**	**Path Length**	**FEMA Declaration**
3/25/2015	EF2	0	7		50 yd	11 mi	
5/31/2013	EF0	0	100+		500 yd	.5 mi	
5/20/2013	EF5	20	387	$2,000,000,000+	1.1 mi	14 mi	DR-4117
5/10/2010	EF4	0	2		200 yd	24 mi	
5/8/2003	F4	0	134	$3,700,000	700 yd	17.3 mi	DR-1465
5/3/1999	F5	36	583	$1,000,000,000	1760 yd	38 mi	DR-1272
10/4/1998	F2	0	0	$2,000,000	30 yd	1 mi	
8/1/1974	F1	0	0	$250,000	50 yd	1 mi	
11/19/1973	F3	5	53	$5,300,000	500 yd	24 mi	
8/31/1965	F0	0	0	$25,000	50 yd	10 mi	
5/7/1961	F0	0	0	$0			
5/19/1960	F2	0	0	$25,000			
4/28/1960	F2	0	6	$500,000	400 yd	4 mi	
4/5/1951	F2	0	0	$20,000	125 yd	8 mi	
6/9/1937	F3	4	7	$55,000	200 yd	20 mi	
4/25/1893	F4	31	100	unknown	800 yd	15 mi	

Fatalities/Injuries/Damage amounts relate to entire storm path

The F-3 tornado event of November 19, 1973 caused damage to MPS facilities at Central Junior High School and Northmoore Elementary School. The May 3, 1999 F-5 tornado destroyed the district's technology center and also Kelley Elementary School. The EF-5 tornado on May 20, 2013 destroyed Briarwood and Plaza Towers Elementary Schools, and caused significant damage to Highland East Junior High School and the district's Administrative Service Center. Seven students were killed when the storm impacted Plaza Towers.



Moore police officers search the rubble for victims at Plaza Towers Elementary in the aftermath of the May 20, 2013 EF-5 tornado.

Probability of Future Events: POSSIBLE

Tornado events are a part of the normal climate cycle and occur in the planning area.

Vulnerability and Impact

People, structures and utilities are vulnerable to tornado events.

Persons who are unable to take refuge in an engineered shelter are most vulnerable to tornado events. Persons who are outside or in vehicles are especially vulnerable.

A report from the Injury Prevention Service of the Oklahoma State Department of Health entitled, "Tornado Related Deaths and Injuries in Oklahoma due to the 3 May 1999 Tornadoes" states the following: "The most common kinds of injuries were soft-tissue injuries (cuts, bruises, and scrapes), fractures/dislocations, and brain injuries. The most common causes of injuries for survivors were being hit by flying/falling debris and being picked up or blown by the tornado. Probable causes of death

included multiple injuries (50%), head injuries (23%), chest trauma (18%), and traumatic asphyxia (10%)."[32] These statistics are similar to those from other events.

Persons may also be impacted by tornadoes by damage to or complete loss of their homes, as well as loss of vehicles and/or personal property. Adding to the impact is the potential loss of wages or employment due to extended injury, time away from work while dealing with damaged/destroyed homes, loss of transportation, and/or the loss of employment due to destruction of their employer's property.

Vulnerability: Residents and students may be unaware of issues and dangers related to tornado events.

- *Mitigation 1:* Create and present comprehensive mitigation education programs for both the City of Moore and Moore Public Schools.
- *Mitigation 2:* Produce visual media with mitigation information for airing on City and Schools cable channels, websites, video boards and other locations with preparedness information.

Providing people with information and warning concerning impending tornado events is a key mitigation strategy in the planning area. Providing warning empowers people to seek refuge in an engineered shelter, dramatically reducing their personal injury vulnerability. Persons within the City of Moore/MPS planning area are able to receive warning information concerning tornadoes in a number of ways.

Tornado Siren #23, which protects Northmoore Elementary School and the surrounding neighborhoods. This siren has been damaged in least two tornado events but still stands today

The City of Moore maintains and operates a very dense network of outdoor warning devices (generally referred to as "tornado sirens"), which provide alerting and warning information to all within the City. There are 42 warning devices in the network (current 2019), 33 of which operate from battery power and 28 of which have live and recorded voice capability in addition to siren tones. Twelve of the sirens are at or very near MPS facilities. These devices are activated by the City's Emergency Management Department whenever tornadic conditions directly threaten the City of Moore.

Vulnerability: Persons who are outside may be without normal means of receiving information concerning the approach of high winds.

- *Mitigation 1:* Install, upgrade, maintain and operate warning system devices to provide immediate warning capability to those who are outside.
- *Mitigation 2:* Upgrade all warning system devices to solar power.

The National Weather Service operates a nationwide network of radio stations broadcasting continuous weather information directly from the nearest NWS office. Known as NOAA Weather Radio, official NWS warnings, watches, forecasts and other hazard information is broadcast around the clock. Radios that receive this system may be purchased at retailers for around $40. NWR receivers are normally silent unless specifically turned on by the end user or an alert tone is sent by the NWS that activates the

[32] Sheryll Brown, Pam Archer, Elizabeth Kruger, Sue Mallonee: Tornado Related Deaths and Injuries in Oklahoma due to the 3 May 1999 Tornadoes.

units for official NWS watches and warnings. Acquisition of NOAA Weather Radios is highly and very frequently encouraged by both NWS and Moore Emergency Management; the EM Department also provides free-of-charge programming assistance. All MPS facilities are equipped with NOAA Weather Radios.

Vulnerability: Residents and students who are inside may not be able to receive warning of tornadoes from outdoor warning sirens.

- *Mitigation 1:* The City of Moore Emergency Management Dept. strongly advocates NOAA Weather Radios, and programs them for free.
- *Mitigation 2:* When NWS Tornado Warnings are issued, wireless phones receive information via the Wireless Emergency Alert system. WEA is a national public safety system that allows customers who own compatible mobile devices to receive geographically targeted, text-like messages alerting them of imminent threats to safety in their area.
- *Mitigation 3:* The Oklahoma City broadcast media prioritizes monitoring severe weather conditions within their areas, and typically interrupts their normal broadcasts to provide information and live video of severe thunderstorm and tornado events.

Vulnerability: Structures are vulnerable to both tornadic winds and to debris driven in the winds. Older built structures with weakened mechanical roof connections may be more susceptible to wind damage, as well as those with large-area garage doors that are not strengthened against high winds. Commercial structures with large roof areas and/or large amounts of exterior glass areas are also vulnerable. It should be noted that most all structures are vulnerable to destruction in the "extreme" category of tornado events. Failures of structures impact residents with financial loss as well as loss of personal property; failures of commercial structures impact businesses and property owners with financial and business losses, and with the loss of employee income and potentially jobs if businesses are forced to close either temporarily or permanently.

- *Mitigation 1:* Building codes in the City of Moore were strengthened in 2014, requiring new residential construction must be built to withstand 135 mph winds. This is higher than minimum code standards for the area of 115 mph[33]. The increase in the wind standard was enacted in an effort to reduce failures of pieces of buildings and therefore cause a reduction in the amount of flying debris impacting other structures.
- *Mitigation 2:* Install engineered storm shelters at all City of Moore facilities.

Vulnerability: Businesses are vulnerable to the effect of tornadoes.

- *Mitigation:* Create and implement a "StormReady Business" program to assist businesses in preparing for the effects of tornadoes.

Vulnerability: Windows of City and MPS facilities are vulnerable to breakage by debris carried by tornadoes.

- *Mitigation:* Install impact resistant film at critical facilities to reduce the effect of debris.

The City of Moore has an exceptionally large number of households with engineered storm shelters or safe rooms, approximately 39 percent. This is due in part to the rebate programs that were available following the 1999, 2003 and 2013 tornadoes, which partially reimbursed homeowners for the installation of shelters. More than 5,000 households added storm shelters after the 2013 tornado, with over 1,600 of those receiving rebates from a joint City of Moore/American Red Cross program. The city

[33]Moore Municipal Code

continues to study options for encouraging rental and multifamily property owners to install or construct engineered shelters.

Vulnerability: Approximately 60% of residences in the City of Moore do not have engineered storm shelters.

- *Mitigation:* Implement a program to provide financial incentives and assistance for the installation of engineered storm shelters at private residences.

Vulnerability: MPS Students and staff are vulnerable to the effects of tornadoes.

- *Mitigation 1:* Moore Public Schools adopted a District Tornado Sheltering Plan in 2015 which in part allows parents to pick up their students early on potential severe weather days. Buses will be held and not in transit when severe weather is imminent.
- *Mitigation 2:* All Moore Public Schools facilities have engineered storm shelters for students and staff.

Utilities utilizing above-ground lines are also vulnerable to the effects of tornado winds. Even winds of the "minor" classification typically cause lines to snap and fall, disrupting power and/or connectivity. Utility disruption may impact persons and businesses with loss of power and/or connectivity, causing fires, injury from being in the dark, temporary loss of business and therefore financial loss. It also impacts utility providers with financial loss due to overtime, equipment and supplies needed for repairs to their systems.

Vulnerability: Electrical lines and poles are vulnerable to the effect of tornadoes.

- *Mitigation 1:* Install backup power generators at critical infrastructure locations.
- *Mitigation 2:* Install Master Uninterruptible Power Supply systems at critical infrastructure facilities of the City of Moore and Moore Public Schools.
- *Mitigation 3:* Collaborate with local power utilities to move electrical lines underground.

Vulnerability: Moore Public School buses and other vehicles are parked outside with no cover and are vulnerable to debris carried by high winds. Most City of Moore emergency vehicles are parked inside or under covered parking; however, other City vehicles are susceptible to wind-borne debris damage. Impacts of a wind storm to MPS and the City of Moore vehicles potentially cost insurers and taxpayers thousands of dollars.

- *Mitigation:* Install overhead covers for parking areas at City of Moore and MPS facilities.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Tornado	Possible	Catastrophic	< 6 hours	< 6 hours	2.8

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3.5.10 Wildfire

Description

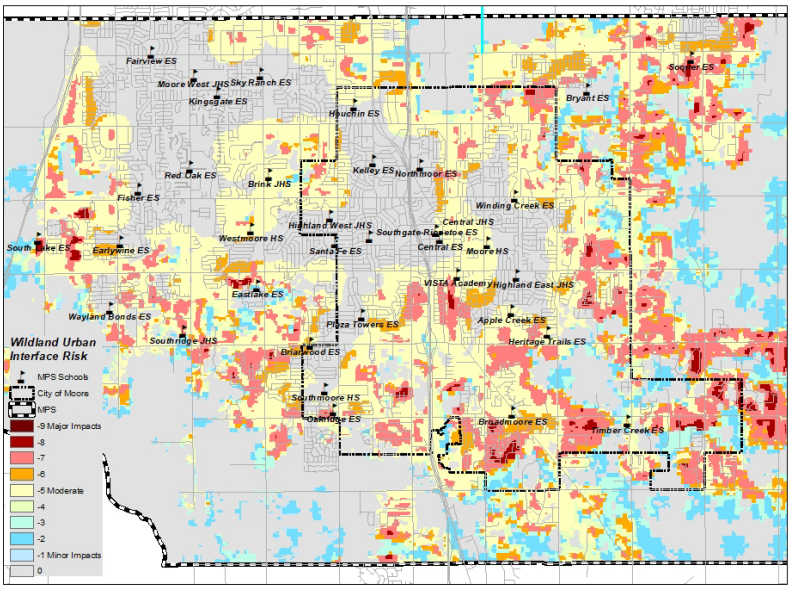
A wildfire is an uncontrolled grassland or forest fire.

Location

The entire planning area may experience wildfires. Lesser urbanized locations in the planning area are more susceptible to wildfire; these are primarily in the far eastern part of the City of Moore continuing east into Oklahoma City (which is the eastern part of the Moore Public School district), and in the far western sections of the MPS district. All MPS facilities are in urbanized areas. The map in the "Extent" section provides information concerning locations in the planning area with a higher amount of wildland-urban interface.

Extent

Wildfire risk may be rated by use of the Wildland Urban Interface Risk Index (WUI-Risk). This combines housing density data with potential flame length data and response functions. This allows determination of where the greatest potential impact to homes and people is likely to occur. While the WUI-Risk is useful in determining areas of greatest risk, it also is in direct correlation with the strength of potential wildfires. WUI-Risk provides a range of values from -1 to -9, with -1 representing the least negative impact (or potential strength) and -9 representing the most negative impact (or potential strength). 48% of the planning area exhibits no risk of wildland-urban interface risk. Of locations in the planning area do exhibit some amount of WUI-Risk, 16% of the area is classified from -7 to -9 (greatest negative impact/strength), 55.8% is classified from -4 to -6 (moderate), and 28.2% is classified from -1 to -3 (least impact/strength). These classifications can reasonably be expected to continue at current levels or decrease in impact/strength as development continues to occur



Wildland Urban Interface - Risk (WUI-Risk) for Moore/MPS planning area
See Appendix I.

An actual wildfire may be measured by the amount of land burned, the amount of structures lost, and/or the amount of time and resources needed to control and extinguish the fire. The planning team considers the extent of a wildfire to be:

- *Minor*, when a fire burns two or fewer residential or commercial structures, and the fire is controlled within a single operational period using local resources.
- *Major,* when a fire burns more than two residential or commercial structures, and/or when more than one operational period is required to control the fire, and/or when external resources are needed to control the fire.

Previous Occurrences

The Moore Fire Department responded on an average of 63 wildland fires in the period of 2009-2018. Due to a data loss when changing records systems, further information concerning the size of the fires, number of units responding, time on-scene, and other data regarding the extent of each fire is unavailable. It is the opinion of the Fire Chief that the vast majority of these fires were relatively minor, requiring only one or two fire apparatus and with an on-scene time of less than 30 minutes to control.

MFD Wildland Responses 2009-2018
(raw data from previous dispatch system)

Year	Responses
2009	70
2010	65
2011	102
2012	67
2013	39
2014	64
2015	43
2016	64
2017	61
2018	61

Probability of Future Events: UNLIKELY

A major wildfire is unlikely within the planning area. As noted above, most of the planning area is urbanized, with little undeveloped grass/brush/wooded land. The City of Moore has a full-time professional fire department with four fire stations; the average response time to a call averages less than five minutes. The City of Oklahoma City also has a full-time professional fire department with at least five stations that cover the area within the MPS boundaries; again, the wildfire threat to MPS facilities is minimal. Both cities have a water system that allows for adequate water supply for fighting fire.

Vulnerability and Impacts

The greatest vulnerability to wildfire in the planning area is to persons fighting the fires, and to residents and structures in areas adjacent to undeveloped land.

Vulnerability: Residents and students may be unaware of issues and dangers related to wildfire events.

- *Mitigation 1:* Create and present comprehensive mitigation education programs for both the City of Moore and Moore Public Schools.
- *Mitigation 2:* Produce visual media with mitigation information for airing on City and Schools cable channels, websites, video boards and other locations with preparedness information.

Wildfires typically occur during hot and dry weather conditions. The strenuous physical activity of fighting fires combined with the heat generated by the fire and the personal protective clothing that must be worn significantly increases the vulnerability of firefighters to wildfire events. Impacts to firefighters may include serious heat-related illness requiring medical care, and potentially death.

Vulnerability: The strenuous physical activity of fighting fires combined with the personal protective clothing/equipment (PPE) that must be worn significantly increases the vulnerability of firefighters to extreme heat events and heat-related health issues.

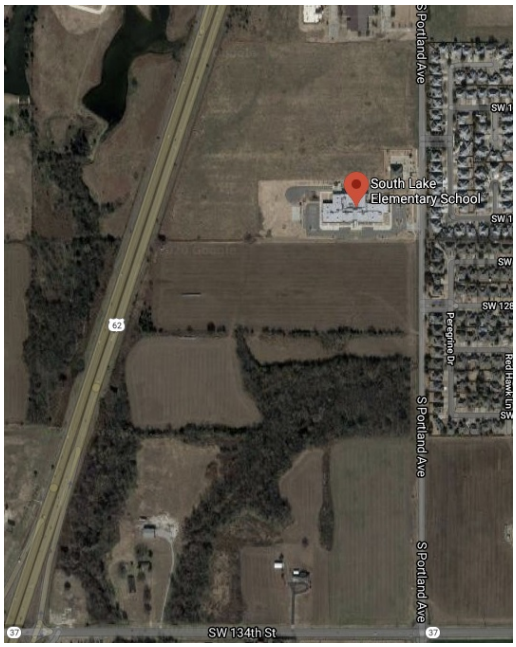
- *Mitigation:* Acquire specialized wildland firefighting PPE for the Moore Fire Department.

Wildfires threaten residential and commercial structures, along with outbuildings. The impacts include damage to/loss of these structures, loss of personal property, financial loss to residents, and possibly business/financial losses to commercial structure owners.

Vulnerability: Several MPS facilities - notably South Lakes Elementary - are in or near wildland-urban interface areas, which have higher risk of negative impacts from wildfires.

- *Mitigation:* All MPS facilities have a large amount of defensible space between buildings and high-grass or wooded areas, and the defensible space is kept mowed on a regular basis.

Utilities utilizing above-ground lines are also vulnerable to the effects of wildfires. Poles are easily destroyed by fire causing lines to fall, disrupting power and/or connectivity. Utility disruption may impact persons and businesses with loss of power and/or connectivity, injury from being in the dark, temporary loss of business and therefore financial loss. It also impacts utility providers with financial loss due to overtime, equipment and supplies needed for repairs to their systems.



South Lakes Elementary School, with defensible space

Vulnerability: Electrical lines and poles are vulnerable to the effect of wildfires.

- *Mitigation 1:* Install backup power generators at critical infrastructure locations.
- *Mitigation 2:* Install Master Uninterruptible Power Supply systems at critical infrastructure facilities of the City of Moore and Moore Public Schools.
- *Mitigation 3:* Collaborate with local power utilities to move electrical lines underground.

Vulnerability: Vehicle transportation routes may be closed due to smoke, active fire, and/or use by responders.

- *Mitigation:* Acquire, maintain and deploy portable motorist information signs to convey information to motorists.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Wildfire	Unlikely	Limited	< 6 hours	< 6 hours	1.75

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3.5.11 Winter Storm

Description

Winter Storms may refer to a number of differing events that generally include combinations of frozen precipitation - including snow, sleet and freezing rain - and/or very cold temperatures. A winter storm can range from freezing rain or sleet to moderate snow over a few hours, or to blizzard conditions and extremely cold temperatures that last several days.

Location

The entire planning area may experience winter storms.

Extent

The extent of a snow event is determined by the maximum depth of the snowfall in the planning area. The local National Weather Service criteria for a "Winter Storm" in relation to heavy snow is 4" of snowfall in a 12-hour period, or 6" in a 24-hour period. The maximum daily and storm-total snowfall for the planning area is 14.1", as recorded at Oklahoma City's Will Rogers World Airport on December 24, 2009 (the "Christmas Eve Blizzard"). The previous storm-total snowfall record was 12.1" in January 1988; the previous daily snowfall record was 11.3" on March 19, 1924. Records for this measuring station date back to 1890. Note that the extent of a snow event may also be related to wind speeds, which can blow even a smaller amount of snow and cause visibilities to decrease to just a few feet.

The local National Weather Service criteria for a "Blizzard" is visibility due to winter precipitation frequently at or below 1/4 mile and sustained/gusty winds at or above 35 mph, both for 3 hours or more.

Ice is also measured by the depth of accumulation on exposed surfaces. The local National Weather Service criteria for a "Winter Storm" in relation to ice is more than 1/2" sleet or more than 1/4" freezing rain. Accumulations of up to approximately 3" have occurred in and around the planning area. Note that the effects of ice accumulation vary widely depending upon the surface, as well as any accompanying wind or snow. For example, accumulations of more than 1/4" on roadways will cause transportation issues. Greater accumulations are generally necessary to cause issues with power transmission lines, but the extent of the issues also vary with the accompanying wind speed. An example given in a research paper, "Development and Testing of an Ice Accumulation Algorithm", states: "Utility systems may be able to handle moderate ice accumulations, but stressed lines under wind forces are more likely to break. Therefore, one inch of ice may be a Level 2 or Level 3 ice event, but if wind speed exceeds 25 mph, it becomes a Level 5 event." (referencing Sperry-Piltz Utility Ice Damage Index damage levels).

Air temperatures are measured at 120 Oklahoma Mesonet and 48 National Weather Service/Federal sites. The lowest recorded temperature at the Norman Mesonet site (closest to the planning area) is -4°F.

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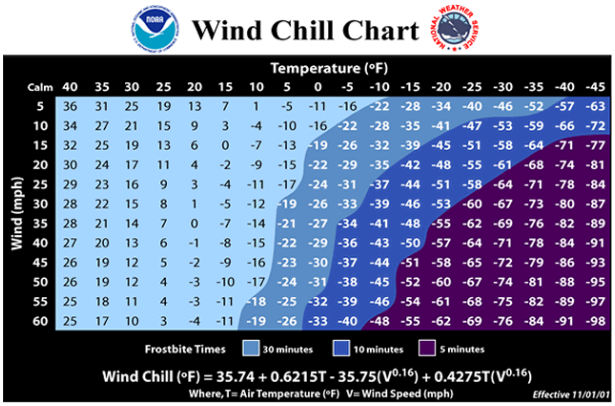

The extent of cold air temperatures may also be determined with the relationship with wind. The combination of temperature and wind speed is calculated as the Wind Chill Index (WCI); the WCI gives a determination of how cold the wind makes it feel on exposed skin. For example, the record low temperature of -4°F, combined with a wind of 25 mph, would yield a WCI value of approximately -30°F. The local National Weather Service criteria for a "Wind Chill Warning " is WCI calculated at or below -20° F.

The planning team considers the extent of a winter storm to be:

- *Minor*, when
  - Snow fall is less than four inches accumulating in a 12-hour period and/or less than six inches accumulating in a 24-hour period; and
  - Ice accumulation on roadways is less than 1/4"; and
  - Air temperature is above 0° F; and
  - Wind Chill temperature is above 0° F; and
  - Visibility due to blowing precipitation is 1/4 mile or greater.
- *Major*, when
  - Accumulated snow fall is greater than four inches in a 12-hour period or greater than six inches in a 24-hour period; or
  - Ice accumulation on roadways is 1/4" or greater; or
  - Air temperature is below 0° F; or
  - Wind Chill temperature is below 0° F; or
  - Visibility due to blowing precipitation is less than 1/4 mile.

Previous Occurrences

There are 20 winter weather events in the NCDC Storm Events Database for Cleveland County from 2010 through 2019.[34] Of these:

- 3 events classified as "Heavy Snow";
- 3 events classified as "Ice Storm";
- 2 events classified as "Winter Storm";
- 12 events classified as "Winter Weather".

There were no direct injuries or fatalities reported with any of these events.

A major winter storm that occurred on January 28, 2010 produced a variety of wintry precipitation, with the most significant impacts as result of an extended period of heavy freezing rain. Almost 90 accidents were reported resulting in over 200 non-life threatening injuries. Almost 180,000 homes and businesses statewide were without power. FEMA Disaster DR-1883 and Emergency EM-3308 were declared for this storm.

A major record-setting storm affected all of Oklahoma from January 31-February 1, 2011. Periods of heavy sleet and snow, combined with winds that gusted over 40 mph, disrupted travel and closed hundreds of schools and businesses. Around 6 inches of snow fell in and around the planning area. One fatality occurred in Moore as a result of a sledding accident. Over 150 accidents were reported

[34] National Centers for Environmental Information, Storm Events Database. Queried for "Cleveland County (OK)", 1/1/2010-12/31/2019, event types "Blizzard, Cold/Wind Chill, Extremem Cold/Wind Chill, Heavy Snow, Ice Storm, Winter Storm, Winter Weather"

statewide, as well as over 460 calls from stranded motorists. FEMA Emergency EM-3316 was declared for this storm.

Probability of Future Events: LIKELY

Winter storm events are a part of the normal climate cycle and occur in the planning area.

Vulnerability and Impact

People, structures, transportation, and utilities are all vulnerable to winter storms.

Indigent, homeless and elderly people are most vulnerable to winter storms, however all demographics of people have vulnerability. The leading cause of death during winter storms is from automobile or other transportation accidents with even small accumulations of ice causing extreme impacts to motorists in terms of both time loss and personal injury and/or death.

Vulnerability: Children are vulnerable to being struck by vehicles whose drivers cannot see crosswalk markings and/or have not properly slowed for school crossings due to reduced visibility.

- Mitigation: Install protective crosswalks on arterial streets at Moore Public School facilities.

Slips and falls due to icy surfaces impact all demographics of people, resulting in personal injury and/or death. This includes students, staff and patrons of MPS.

Prolonged exposure to bitterly cold air and will chill temperatures can cause frostbite or hypothermia and become life threatening. Outdoor recess and other outside MPS activities are disrupted by these conditions.

Those unaccustomed to physical activity and stress are vulnerable to heart issues when shoveling snow. These issues frequently result in death.

Vulnerability: Residents and students may be unaware of issues and dangers related to winter storm events.

- *Mitigation 1:* Create and present comprehensive mitigation education programs for both the City of Moore and Moore Public Schools.
- *Mitigation 2:* Produce visual media with mitigation information for airing on City and Schools cable channels, websites, video boards and other locations with preparedness information.

Structures have some additional vulnerability during winter storms. Cold temperatures may cause pipes to freeze and burst, impacting the normal supply of drinking and services water to homes and/or businesses. The potential for fires also increases as people may be using alternate means for heating. There is also an increased risk for carbon monoxide poisoning associated with the improper location and operation of backup power generators.

Heavy snow can immobilize and paralyze an urban area, stranding commuters, stopping the flow of supplies, and disrupting emergency services. Icy and/or snowpacked roads cause lengthened emergency response times, with potential impacts of increased severity of medical and/or physical security issues.

Financial loss may occur to people who are unable to reach their place of employment due to transportation issues or due to business closings.

Vulnerability: Vehicle transportation routes may be closed.

- *Mitigation:* Acquire, maintain and deploy portable motorist information signs to convey information to motorists.

Vulnerability: Response times for law enforcement responders may be lengthened due to ice and snow on vehicles while parked.

- *Mitigation:* Install overhead covers for parking areas at City of Moore and MPS facilities.

Temperatures below freezing impede firefighting efforts, with water supplies frequently freezing. Firefighters are vulnerable to winter storms, with increased danger of slips and falls as their water freezes on ground surfaces.

The cost of snow removal, repairing damages, and loss of business can have financial impacts to commercial entities. MPS also suffers the additional costs due to snow removal and damage repair. The District normally schedules several "snow days" into the academic calendar; however, if prolonged school closings occur, make up days must be added which disrupt normal schedules.

Vulnerability: Businesses are vulnerable to the effect of tornadoes.

- *Mitigation:* Create and implement a "StormReady Business" program to assist businesses in preparing for the effects of winter storms.

Above-ground utilities are particularly vulnerable to winter storms. Ice building on above-ground lines increases their weight and may cause downing of the lines. Strong winds associated with these storms also cause additional sway, again possibly causing lines to fail. Widespread power, telephone and connectivity outages frequently occur during winter storms. The widespread loss of power - in some cases for periods of days and even weeks - adds to the vulnerability of persons, who may now have no heat.

- *Mitigation 1:* The City of Moore's Community Center building is designated as an emergency mass-care facility, which includes temporary cooling and warming shelter. It has a backup power generator and limited cooking facilities.
- *Mitigation 2:* Install backup power generators at critical infrastructure locations. The Moore Public Library, Brand Senior Center, MPS and local church facilities may also be used as warming shelters, but are dependent upon commercial power.
- *Mitigation 3:* Install Master Uninterruptible Power Supply systems at critical infrastructure facilities of the City of Moore and Moore Public Schools.
- *Mitigation 4:* Collaborate with local power utilities to move electrical lines underground. This typically includes other necessary power transmission equipment, which are vulnerable to the effects of extreme heat when on poles.

Strong winds often accompany winter storms, creating blizzard conditions with blinding wind-driven snow, severe drifting, along with the dangerous wind chill temperatures. These winds simply add to the issues associated with the precipitation and air temperature variables, and create additional danger to persons, transportation, and utilities.

Priority Risk Index

Hazard	Probability	Magnitude/ Severity	Warning Time	Duration	PRI
Winter Storm	Likely	Limited	12-24 hours	< 1 week	2.55

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3.6 Manmade and Technological Hazards

There is no requirement to address manmade hazards in this plan; however, the City of Moore/MPS planning team wishes to use an "all-hazards" approach to planning. Note that it is difficult to assess variables such as probability and severity for manmade and technological types of events.

3.6.1 Civil Unrest

Description

Civil disturbance may be defined as "a civil unrest activity such as a demonstration, riot, or strike that disrupts a community and requires intervention to maintain public safety".[35]

Location

Civil unrest may occur anywhere in the planning area.

Extent

The extent of civil unrest will vary by occurrence. The City of Moore/MPS planning team considers the extent of civil unrest events to be:

- *Minor*, when the events are able to be handled by on-duty law enforcement, and do not result in mass arrests, deaths or serious injuries, or result in major destruction of property.
- *Major*, when the events require deploying additional law enforcement resources such as the Emergency Response Team, and/or result in mass arrests, deaths or serious injuries, and/or result in major destruction of property.

Previous Occurrences

There have been at least two instances of Westboro Baptist Church members protesting in Moore and near MPS. WBC is a Kansas-based group known for its use of inflammatory hate speech. Multiple sources describe it as a hate group.[36] [37] [38]

Civil Unrest Events Westboro Baptist Church	
Date	Description
March 2, 2009	The group, known for their hatred of gays, picketed outside Moore High School and outside the state Capitol. The group members said they were" tired of seeing Oklahoma children being lied to", that "they believe children in Oklahoma are being taught that being gay is OK and that it's also OK to commit sins like having sex outside of marriage". As soon as word got out the group was coming to Moore High School, local people were furious. WBC officials told a local media outlet that people from Oklahoma flooded their phones, telling them to stay out of the state. The group picketed across from the high school for an hour or two, with a thousand or more counter protestors also in attendance. Police reported no one was arrested or taken into custody.
May 20, 2013	The church tweeted "praising God for the 2013 Moore tornado" and that they would protest the funerals of the victims.

[35] https://training.fema.gov/programs/emischool/el361toolkit/glossary.htm#C
[36] "Kansas Church to Protest in Oklahoma Today". KWTV-9, March 2, 2009.
[37] "Westboro Baptist Church Tweets About Moore Oklahoma Tornado"; May 20, 2013
[38] "Counter protesters push Westboro Baptist Church members out of Moore". KOCO-5, April 7, 2014

April 7, 2014	Approximately 10 members of the group picketed near the campus of Central Junior High, where Plaza Towers Elementary students were attending until their new school could be built following the May 20, 2013 tornado. Approximately 2,000 counter-protestors were in attendance across the street. Less than 10 minutes after arriving, a few counter protestors started making their way across the street to confront the group. WBC members quickly left, throwing whatever they could inside vans as police fought to keep everyone in check. "If you come out here you're going to get all of us telling you to go home," said one Moore native. Police reported no one was arrested or taken into custody, saying despite the high tensions the crowd remained relatively respectful.

Probability of Future Events: UNLIKELY

Vulnerability and Impacts

People and property are most vulnerable to civil unrest. Most vulnerable are locations that are engaged in politically or socially controversial activities or practices, and/or facilities whose disruption would cause the most outrage and media coverage. This includes all MPS facilities, due to the presence of children. Impacts of civil unrest may include death or serious injury, and damage or destruction of property. Civil unrest may also disrupt transportation, commerce, and/or government services.

The Moore Police Department has officers specifically trained and equipped to manage civil unrest, which provides some mitigation to civil unrest events within the planning area.

It should also be noted that City leaders have trained on a civil unrest scenario. From a press release, "Monday, October 28, (2019), area law enforcement officers and community leaders will have two opportunities to participate in a program designed to improve recognition of civil unrest in their cities and to enhance peaceful resolution of these crisis scenarios. The Bridge Initiative, a program of the U.S. Department of Justice's Community Relations Office in partnership with the Divided Communities Project at The Ohio State University, engages city and county officials through simulation exercises in developing processes to de-escalate divisive conflicts." This exercise included participation from a City of Moore Councilperson, City Manager, Police Chief and a Police Captain, and both Emergency Managers, in addition to personnel representing the Cleveland County Sheriff's Office, City of Norman, and the University of Oklahoma.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Civil Unrest	Unlikely	Critical	6-12 hours	< 1 day	1.95

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3.6.2 Cyber Incident and/or Computer Network Outage

Description

A cyber incident is an event occurring on or conducted through a computer network that actually or imminently jeopardizes the integrity, confidentiality, or availability of computers, information or communications systems or networks, physical or virtual infrastructure controlled by computer or information systems, or information resident thereon. These activities include but are not necessarily limited to:

- attempts or activities interpreted by the entity as intentional attempts to gain unauthorized access to a system or its data;
- unwanted disruption or denial of service;
- unauthorized use of a system for the transmission, processing, or storage of data;
- storage and/or distribution of child pornography;
- changes to system hardware, firmware, or software characteristics without the owner's knowledge, instruction, or consent; and
- cyber-terrorism, which is the unlawful and deliberate use, modification, disruption, or destruction of computing resources to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.

Network outages may also occur due to equipment failure or non-intentional issues with software/ firmware upgrades and changes.

Location

The entire planning area is vulnerable to cyber incidents or network outage.

It is important to note that cyber threats differ from other hazards because the causes are not always related to geographic location, i.e., the cause may not be directly located within the planning area. Information systems are accessible remotely from all over the world via the Internet.

Extent

The Cyber Security and Threat Alert Levels are a national standard to indicate the current identified cyber impacts or potential for actual damage from attacks. The following matrix establishes a common framework for evaluating and assessing cyber incidents to ensure a common understanding of the severity of the incident and assist in plan of action, notification and response.

	Low	Insignificant or no malicious activity has been identified
	Guarded	Malicious activity has been identified with minor impact
	Elevated	Malicious activity has been identified with a moderate level of damage or disruption
	High	Malicious activity has been identified with a major level of damage or disruption
	Severe	Malicious activity has been identified with a catastrophic level of damage or disruption

A cyber incident and/or network outage may last anywhere from a few minutes to several months.

The City of Moore/MPS planning team considers the extent of a cyber event to be:

- *Minor*, when little or no harm to data or security occurs - low or guarded alert level;
- *Major*, when harm is done to people or infrastructure - elevated or higher alert level.

Previous Occurrences

The City of Moore has experienced at least two previous cyber incidents in the past 10 years.

In 2014, a denial of service attack disabled the city website for 2-3 hours. The city now uses a subscription service to attempt to prevent a similar attack.

In 2017, a city employee clicked on a link containing ransomware, affecting the city's network for approximately 36 hours before all data was restored from a backup. The City's Information Technology department has upgraded and increased the frequency of training for all city employees.

MPS experienced a major data and communications outage in 2013, after the District's technology center was severely damaged by a tornado. The outage was critical, as MPS had several venues destroyed and seven student fatalities caused by the tornado. The inability for normal facility telephone contact and the inability to quickly access student, staff and administrative data increased the severity of the issues.

Probability of Future Events: POSSIBLE

The probability of a cyber-attack affecting the planning area is difficult to calculate given that human behavior is unpredictable and technology evolves rapidly. As perpetrators of cyber-attacks use more sophisticated techniques, companies and other digital technology users are also keeping pace with technology advances and adding layers of protection to systems and databases.

Vulnerability and Impacts

Voice and data communications, financial systems, power systems and utilities, and emergency networks are vulnerable to cyber incidents and/or network outages.

Disabling the City of Moore's website would interrupt the ability for people to pay their utility bills online; payments could still be made in person. If the City's servers were disabled, all city finances could be disrupted potentially resulting in loss of revenues and disruption in the provision of normal city services.

Vulnerability is somewhat decreased by various measures in place to defend against cyber incidents and network outages. City and MPS servers and hardware are each located within a limited-access engineered storm shelter and have their own fire suppression system, reducing vulnerability from natural and physical hazards. Critical data and systems are regularly backed up, with files both on- and off-site.

Both the City of Moore and MPS utilize (separate) Voice-over-IP telephone systems. These could possibly be compromised during cyber incidents and/or network outages. Administrators from both entities also utilize commercial wireless telephones, which are frequently used as a companion and/or backup to the wired system.

The City of Moore also maintains a mobile command vehicle which carries voice and data systems and networks to provide connectivity, which could be used as a spontaneous backup if needed at either entity. The vehicle is typically staffed by the City's I.T. department network specialist, and also a state-qualified Communications Unit Leader/local- Communications Unit Technician (the City's Emergency Manager).

Residents and students are vulnerable to cyber-attacks on their personal computers and smart devices. People are particularly vulnerable to stolen personal information, which may destroy their financial standing. Additionally, cyber incidents can damage public trust in the institutions that were once considered stable and secure, such as financial institutions and health care. Cyber-attacks may also create fear and erode the public trust needed for private and public services to run successfully.

Utilities and transportation systems are vulnerable to cyber-attack on supervisory control and data acquisition (SCADA) systems used to monitor and control various components of their production and delivery systems.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Cyber Incident	Likely	Critical	< 6 hours	> 1 week	3.25

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3.6.3 School Violence

Description

School violence may be defined as domestic terrorism directed towards and/or occurring at an educational facility.

Location

A school violence event could occur at any Moore Public School, or any private school within the planning area.

Extent

The extent of school violence varies by occurrence. The City of Moore/MPS planning team considers the extent of a school violence act to be:

- *Minor*, when an event occurs that does not result in injuries or major property damage;
- *Major*, when an event occurs that results in death, injuries, or major property damage.

Previous Occurrences

In February, 2016, a former student made an unspecified threat to the school district. Law enforcement investigated the threat, and the District Superintendent addressed the threat in a letter to parents[39].

In the fall of 2014, an unidentified man entered Moore High School and began asking students "suspicious questions."

Multiple bomb and other threats were received by MPS in late April 1999 in the immediate aftermath of a multiple fatality/injury event at Columbine High School in Colorado. No violence occurred at any MPS locations, but the events caused significant disruption to classes (which was the likely goal of the callers, believed to be students). The events ended when the school year was cancelled early after an F-5 tornado occurred in the planning area on May 3rd.

Probability of Future Events: LIKELY

Vulnerability and Impacts

All 35 Moore Public School elementary and secondary education facilities are vulnerable to school violence. Private school facilities are also vulnerable, as well as Randall University.

Impacts of school violence might include:

- Death or serious injury to students and staff, as demonstrated at several other school facilities nationwide. Notable examples include multiple fatality/injury events at Virginia Tech University in 2007; at Sandy Hook Elementary School in 2012; and Marjory Stoneman Douglas High School in 2018.
- Disruption of educational activities. Any major event that might occur would likely cause school to be suspended for several days or perhaps weeks. Even minor events may cause disruption of classes during the normal teaching day.
- Lost feeling of security, decreased community perception and support, and other perception/mental health issues. There is a growing number of students that have some form of psychiatric disorders (such as anxiety disorders, panic attacks, etc.) or behavior-related challenges (such as Autism, Asperger's Syndrome, etc.). Changes to normal routine, alarms, or other disruptions may trigger reactions in these persons. Events of minor violence (or a single higher-severity event) often cause negative perception of the school within both the patron

[39] https://okcfox.com/news/back-to-school/how-safe-is-your-school

base and the community as a whole. And events of violence, whether at a school or elsewhere, typically cause a lost sense of security in general.

On-going activities to mitigate school violence events in the Moore Public Schools include:

- Implementation of an access control program at all facilities. Exterior doors at all facilities are locked at all times; access is gained only via key or ID-card. General public access to all facilities is controlled to only a single door. Visitors are initially screened via exterior audio and video; if allowed to enter, visitors must immediately check-in with the office and receive a visitor badge.
- Student identification badge procedures for secondary school students, requiring students to wear and display their student identification badges at all times while on campus. This policy allows school personnel and campus resource officers to identify which individuals are approved to be on campus.
- Other physical security enhancements made at all MPS venues.
- Employment of a full-time Director of Safety and Security, full-time School Resource Officers at all secondary educational venues, and off-duty law enforcement personnel as floating courtesy officers at elementary venues. Elementary venues are also frequented by on-duty law enforcement officers.
- Acquisition of an explosives and firearms detecting canine and employment of a full-time handler. The team will be at the various MPS facilities each day.
- Employment of eleven Licensed Professional Counselors (LPCs) to provide mental health and wellness services.
- Implementation of heightened security measures for entrance to sporting events at MPS facilities.

In addition to measures implemented at the district level within MPS, there are programs at the state level designed to reduce the vulnerability of all schools to violence:

- Legislation, including the "School Safety and Bullying Prevention Act"[40], which states in part, “It is the intent of the Legislature to encourage and assist the public schools of this state to address school violence through an emphasis on prevention. Preventative services shall be encouraged through greater access to mental health counseling and social services for students.”
- Creation and operation of the Oklahoma School Security Institute (OSSI), a central resource for all school security information, programs, and training in the State of Oklahoma. Any Oklahoma School (public, private, non-profit, and charter school as well as technology centers) may contact OSSI for programs and resources to enhance school security and assess risks and threats to school campuses.

  The goals and objectives of OSSI include, but are not limited to:

  - Maximizing school security training and support to Oklahoma Schools;
  - Assisting and coordinating with Oklahoma education professionals as required in the development and implementation of school safety drills;
  - Facilitating efforts of Oklahoma Schools to utilize any available programs or entities specializing in school security issues; and

[40] Title 70, Oklahoma Statutes, Sections 24-100.2 through 100.5

- Creating and coordinating partnerships when necessary to continue developing and implementing new strategies and techniques for future recommendations on school security issues.

- Operation of a 24-hour tipline to collect and disseminate reports of activity that may compromise the safety and security of any Oklahoma school.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
School Violence	Likely	Limited	< 6 hours	< 6 hours	2.2

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3.6.4 Terrorism

Description

FEMA defines terrorism as the "use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom. Terrorists often use threats to create fear among the public, try to convince citizens that their government is powerless to prevent terrorism, and get immediate publicity for their causes"[41]

Terrorism may come from overseas or from within the United States. Threats may include home-made improvised explosive devices (IEDs), biological agents, or a well-coordinated cyber-attack. Some terrorists use vehicles and simply drive into crowds of people, killing and/or injuring as many as possible.

For purposes of this document, "terrorism" differs from "workplace violence" due to the intended purpose of the act. The generalized purpose of terrorism is to foster widespread fear; the generalized purpose of workplace violence is typically to cause physical harm to a single worker and/or a group of workers.

Location

A terrorism incident may occur anywhere in the planning area.

Extent

The extent of terrorism varies by occurrence. The City of Moore/MPS planning team considers the extent of a terrorism act to be:

- *Minor*, when an event is disrupted and does not result in injuries or major property damage;
- *Major*, when an event occurs that results in death, injuries, or major property damage.

Previous Occurrences

(Note that terrorism acts do not have to actually occur at a physical location within the planning area to have significant effects on the planning area. Therefore two events are listed here that occurred within the region but outside of the defined planning area.)

On September 24, 2014, a worker was beheaded and another stabbed causing serious injury at a food processing facility in Moore. The attack was halted when he was shot by the company's CEO, who was also a reserve sheriff's deputy. The suspect, a fired former employee of the facility, claimed he was a practicing Muslim and that his actions were correct by the Quran; he was sentenced to death on December 15, 2017.

On October 24, 2015, a person intentionally drove their car through an unmanned police motorcycle, barricades and into a crowd watching the homecoming parade for Oklahoma State University–Stillwater on the university's campus. Four people were killed and 46 others were injured in the event. Police reports indicate that just prior to the event, the driver stated that she was "going home forever"; at her trial she told the court that she was having an episode of "severe psychosis" when the event occurred.[42] The incident has caused changes in planning and security for public events held on public roadways and open areas in the City of Moore/MPS planning area and nationwide.

The nation's deadliest domestic terrorism incident occurred 11 miles north of the planning area on April 19, 1995, when a vehicle-borne improvised explosive device was detonated and destroyed the 9-story Alfred P. Murrah building in Oklahoma City. A total of 168 people were killed and 850 people were

[41] https://www.fema.gov/media-library-data/20130726-1549-20490-0802/terrorism.pdf
[42] "Adacia Chambers called 'sacrificial lamb' for Oklahoma mental health treatment after getting life for OSU Homecoming parade crash". January 11, 2017, The Tulsa World

injured. Several of the victims had direct ties to the City of Moore and/or MPS; City of Moore responders spent several weeks assisting at the site. This event was one cause that led to the formation of a full-time professional Emergency Management Department in the City of Moore.

Probability of Future Events: POSSIBLE

Vulnerability and Impacts

All parts of the planning area are potentially vulnerable to acts of terrorism. Locations/events that increased vulnerability include:

- Large public events and gatherings, such as the Independence Day celebration at Buck Thomas Park;
- Schools, including all MPS venues;
- Sporting events with large number of attendees, such as high school football and basketball games, and children's sports tournaments;
- Any location hosting events that include large numbers of attendees; these could include church services and events, graduation ceremonies, large weddings or funerals;
- Facilities housing Federal government entities, including the local Social Security Office;
- Tinker Air Force Base. While not located within the planning area boundaries, significant numbers of Moore residents and MPS patrons are employed or conduct business at the base.
- Law enforcement facilities, including the City of Moore Public Safety Center and the Cleveland County Detention Center;
- Transportation vehicles carrying large numbers of passengers, including school buses, charter and cross-country buses, and Amtrak's Heartland Flyer passenger train;
- Transportation carriers and fixed facilities carrying or utilizing hazardous materials;
- Utility and communications hubs, including power substations, telephone switching facilities and distribution systems, and cable/data hubs and distribution systems.

Impacts of a terrorism event include:

- Multiple deaths and/or serious injuries;
- Disruption of normal activities. Any major event that might occur would likely cause absenteeism and potentially businesses to be closed for several days or perhaps weeks.
- Lost feeling of security, decreased community perception and support, and other perception/mental health issues. There is a growing number of people that have some form of psychiatric disorders (such as anxiety disorders, panic attacks, etc.) or behavior-related challenges (such as Autism, Asperger's Syndrome, etc.). Changes to normal routine, alarms, or other disruptions may trigger reactions in these persons. And events of violence typically cause a lost sense of security in general.

Mitigating the vulnerability is an ever-increasing consciousness of event security by both public safety professionals and "general public" event organizers. As example, the public safety team for an annual large inter-district MPS football game has evolved from consisting of a handful of law enforcement officers and an extra fire/EMS crew, to several dozen officers (including elements of an Emergency Response Team), private security, the extra fire/EMS crew, an incident tactical dispatcher, emergency management staff, and a large command vehicle. Entrance to the event is through only a few gates; all who enter are screened visually and through metal detectors. Items that are allowed into the event are restricted. Public safety and athletics administrators meet annually prior to the start of the school year to discuss and plan event safety and security; a written incident action plan is produced for the larger events.

As result of the OSU Homecoming crash and other events worldwide, there is also a heightened consciousness of event security for parades and other events held on public roadways. While in the past a parade route might be closed simply with traffic barricades and perhaps a police officer or volunteer attendant, it is now very common for an addition of a physical barrier such as concrete barriers, buses or other large vehicles, or large trailers. This has been the expectation of not only public safety officials, but also "general public" volunteers who plan such events.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Terrorism	Possible	Critical	< 6 hours	< 6 hours	2.5

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3.6.5 Workplace Violence

Description

Workplace violence may include, "any act or threat of physical violence, harassment, intimidation, or other threatening disruptive behavior that occurs at the work site. It ranges from threats and verbal abuse to physical assaults and even homicide."[43]

Location

Workplace violence may occur anywhere in the planning area.

Extent

In the United States from 1966-2010, there were 202 active threat incidents. In 55% of those incidents, the assailant had connection with the location.

The extent of workplace violence varies by occurrence. The City of Moore/MPS planning team considers the extent of a workplace violence act to be:

- *Minor*, when an event occurs that does not result in injuries or major property damage;
- *Major*, when an event occurs that results in death, injuries, or major property damage.

Previous Occurrences

On September 24, 2014, a worker was beheaded and another stabbed causing serious injury at a food processing facility in Moore. The attack was halted when he was shot by the company's CEO, who was also a reserve sheriff's deputy. The suspect, a fired former employee of the facility, claimed he was a practicing Muslim and that his actions were correct by the Quran; he was sentenced to death on December 15, 2017.

Probability of Future Events: POSSIBLE

Vulnerability and Impacts

Any workplace within the planning area is potentially vulnerable to workplace violence.

Impacts of workplace violence might include:

- Death or serious injury to employees, clients, and customers;
- Disruption of normal activities. Any major event that might occur would likely cause activities at the workplace to be suspended for several days or perhaps weeks. Even minor events may cause disruption of production and/or business, resulting in financial loss.
- Lost feeling of security, decreased community perception and support, and other perception/mental health issues. There is a growing number of people that have some form of psychiatric disorders (such as anxiety disorders, panic attacks, etc.) or behavior-related challenges (such as Autism, Asperger's Syndrome, etc.). Changes to normal routine, alarms, or other disruptions may trigger reactions in these persons. Events of minor violence (or a single higher-severity event) often cause negative perception of the entities within both the patron base and the community as a whole. And events of violence typically cause a lost sense of security in general.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Workplace Violence	Possible	Limited	< 6 hours	< 6 hours	2.2

[43] https://www.ravemobilesafety.com/blog/latest-workplace-violence-statistics

3.6.6 Hazardous Materials – Fixed Facility

Description

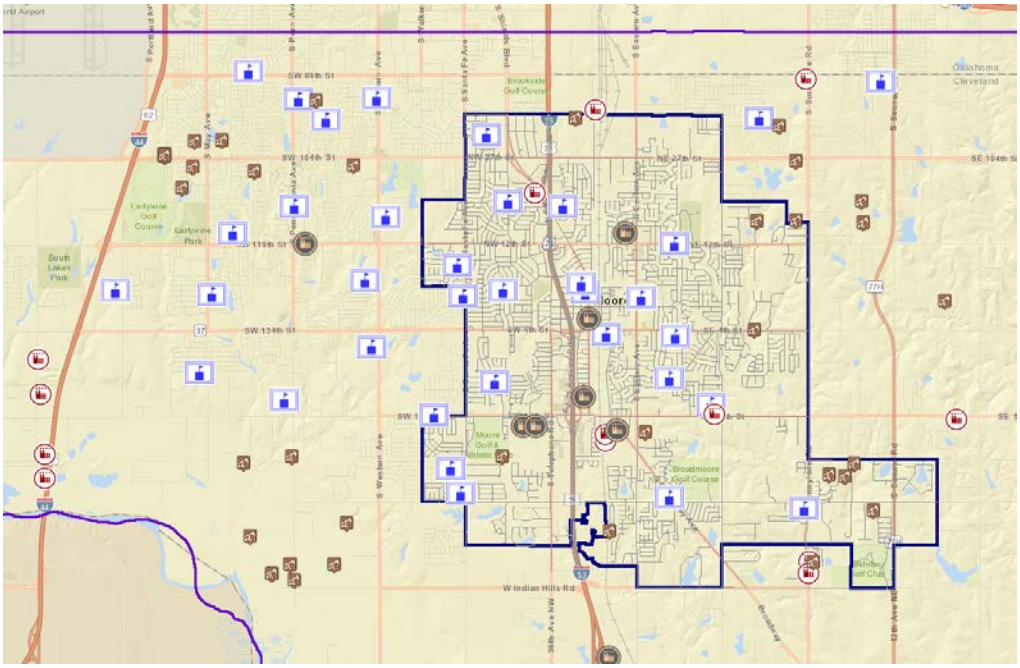
Hazardous materials are substances that pose a potential risk to life or health due to their chemical or toxic nature.

Location

The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 was created to help communities plan for chemical emergencies. It also requires industry to report on the storage, use and releases of hazardous substances to federal, state and local governments. EPCRA requires state and local governments to use this information to prepare for and protect their communities from potential risks.

The "Community Right-to-Know" portion of this legislation requires facilities that have quantities of extremely hazardous substances (as set forth by regulation) present on-site at or above the reporting threshold to report to their Local Emergency Planning Committee (LEPC) and local fire department. This information is received annually by the Moore and Oklahoma City Fire Departments, as well as the respective Emergency Management Departments, for use in planning and training.

There are multiple sites in the planning area that utilize and store hazardous materials in the course of their business operations or manufacturing. There are 8 sites that have quantities of extremely hazardous substances (EHS) that are above mandated reporting thresholds; 12 non-EHS sites, and 42 sites of oil and gas production and/or storage. Location and chemical inventories of the EHS and non-EHS facilities may be found in *Appendix J*.



(no additional sites are within MPS boundaries in areas not displayed)

Oil and gas production facilities are assumed to have various produced hydrocarbons on site. There may also be other chemicals on site during times of drilling and or maintenance.

Extent

The extent of a fixed facility hazardous material release can be measured in terms of the:

- Nature of the release (size of release point, rate of release, indoors/outside, etc);
- Amount of product released and total quantity of product that could be released;
- Flammability, explosiveness, oxidation, toxicity, infectiousness, radioactivity, and/or corrosiveness of the material released;

- Physical state of the material (solid, gas, liquid), both during storage and after release;
- Pressure of the material while being stored;
- Weather conditions.

The extent of fixed facility hazardous material release varies by occurrence. The City of Moore/MPS planning team considers the extent of a fixed facility hazardous material release to be:

- *Minor*, when an event occurs that does not result in injuries or major property damage, or evacuation of more than the immediate area of the release,;
- *Major*, when an event occurs that results in death, injuries, or major property damage, and/or requires evacuations of more than the immediate area of the release.

Previous Occurrences

The Moore Fire Department responded to 668 hazardous material related calls in the past 5 years. The majority of these calls are believed to be very minor in nature; however, their current reporting software does not allow for greater breakout of details.

Probability of Future Events: HIGHLY LIKELY

Vulnerability and Impacts

People and property are vulnerable to the effects of a fixed facility hazardous materials release.

Death or serious illness may be caused from physical contact or the inhalation of hazardous materials and/or their by-products. People located within the immediate evacuation distance of the eight EHS facilities are most vulnerable to a release, both due to the increased dangerousness of the materials being released and also due to shorter notification/protection times due to the proximity.

Transportation routes may be impacted by a fixed facility hazardous materials release. By the nature of their business, facilities with hazardous materials are typically located on major roadway arteries. These would likely be closed during a hazardous materials release. These transportation vulnerabilities can impede the normal flow of vehicular traffic, cause financial loss to drivers due to increased travel times and fuel usage, financial and time-critical losses to shippers and receivers,

Of the eight facilities that store EHS substances, only one is within 1,500’ of a MPS facility. This facility – SW Bell “Moore Swift” located at 300 S. Broadway in Moore – has reported to store:

- 11,572 pounds (app. 1,600 gal.) of #2 diesel fuel inside a tank inside of their building;
- 3,935 pounds (app. 250 gal.) of sulfuric acid in batteries inside of their building;
- 38,034 pounds of lead in batteries inside of their building.

Their building is approximately 1,300’ to the northwest of the MPS VISTA Academy. Given the nature and storage location of the chemicals, it is unlikely that a release would affect the school.

Both the Moore and Oklahoma City Departments are trained and equipped for response to hazardous materials events.

Exercises involving hazardous materials releases are conducted annually by the Cleveland County LEPC; the City of Moore is an active member of this group. The local (Moore/Cleveland County) component of an annual statewide emergency management exercise in 2017 involved a large fire/explosion hazard event from a train derailment, as well as a release of anhydrous ammonia from a large fixed facility in Moore. Several MPS facilities were “impacted” as result of these events.

Another local exercise in 2014 involved the release of a large amount of chlorine, also as part of a train derailment just to the south of Moore. This event "impacted" the Cleveland County Jail, an animal rescue facility, and transportation along Interstate Highway 35.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
HazMat-Fixed	Highly Likely	Limited	< 6 hours	< 6 hours	3.1

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3.6.7 Hazardous Materials - Transportation

Description

Hazardous materials are substances that, because of their chemical or toxic nature, pose a potential risk to life or health.

Location

Hazardous materials are transported daily through the planning area via:

- Interstate Highway 35, bisecting the planning area north/south;
- BNSF Railway, bisecting the planning area north/south;
- State Highway 37, bisecting the planning area east/west;
- Interstate Highways 44 and 240, near the west (I-44) and north (I-240) boundaries of the planning area;
- Numerous gathering, transmission and distribution pipelines, throughout the planning area.

Hazardous materials may also be transported on any street or road in the planning area; typically these shipments will not be as frequent as on highways nor will the quantities of product be typically as large.

In addition, hazardous materials may be temporarily stored in rail cars parked on a siding of the BNSF Railway; the siding is located from just south of NE 12th Street to just north of SE 19th Street.

Extent

The extent of a transportation-based hazardous material release can be measured in terms of the:

- Nature of the release (size of release point, rate of release, indoors/outside, etc);
- Amount of product released and total quantity of product that could be released;
- Flammability, explosiveness, oxidation, toxicity, infectiousness, radioactivity, and/or corrosiveness of the material released;
- Physical state of the material (solid, gas, liquid), both during storage and after release;
- Pressure of the material while being stored;
- Weather conditions.

No commodity flow studies have been conducted on the highways to determine the volume of shipments of hazardous materials. A 2019 commodity flow study on the BNSF Railway indicates that there were more than 125,000 rail cars or intermodal containers with hazardous materials that passed through the planning area in the previous year. *(More detailed information is available to public safety personnel, but is not printed here due to security and business confidential concerns.)*

The extent of transportation-based hazardous material release varies by occurrence. The City of Moore/MPS planning team considers the extent of a fixed facility hazardous material release to be:

- *Minor*, when an event occurs that does not result in injuries or major property damage, or evacuation of more than the immediate area of the release,;
- *Major*, when an event occurs that results in death, injuries, or major property damage, and/or requires evacuations of more than the immediate area of the release.

While the extent of hazardous materials event may appear the same for both fixed-facility events and transportation-based events, there are differences:

- Fixed-facility events occur at locations know prior to the event, with the types, amounts, and properties of materials known and planned for in advance;

- Transportation-based events may occur anywhere along roadways, rail lines, and pipelines. While hazardous materials are not allowed to be carried via air travel, aircraft themselves typically carry large amounts of fuel. The types, amounts, and properties of the materials typically need to be discovered after an event occurs.

Previous Occurrences

The Moore Fire Department responded to 668 hazardous material related calls in the past 5 years. The majority of these calls are believed to be very minor in nature; however, their current reporting software does not allow for greater breakout of details.

According to the Federal Railroad Administration Office of Safety Analysis, no hazardous materials releases on a railroad occurred near Moore between 2008 and 2018.

On June 12, 1974, a Santa Fe Railroad train derailed at Indian Hills Rd. due to physical damage to the rails. Thirty-six cars derailed, including one carrying 70,000 lbs. of phosphorus trichloride. Over 1,000 persons were evacuated in north Norman and south Moore; numerous responders were hospitalized after breathing fumes from the chemical. Several responders were forced to retire after this event due to medical issues caused by exposure to the event.

Probability of Future Events: UNLIKELY

Vulnerability and Impacts

People and property are vulnerable to the effects of a transportation-based hazardous materials release.

Death or serious illness may be caused from physical contact or the inhalation of hazardous materials and/or their by-products.

Transportation routes will obviously be impacted by a transportation-based hazardous materials release. These transportation vulnerabilities can impede the normal flow of vehicular traffic, cause financial loss to drivers due to increased travel times and fuel usage, financial and time-critical losses to shippers and receivers,

Both the Moore and Oklahoma City Departments are trained and equipped for response to hazardous materials events.

Exercises involving hazardous materials releases are conducted annually by the Cleveland County LEPC; the City of Moore is an active member of this group. The local (Moore/Cleveland County) component of an annual statewide emergency management exercise in 2017 involved a large fire/explosion hazard event from a train derailment, as well as a release of anhydrous ammonia from a large fixed facility in Moore. Several MPS facilities were “impacted” as result of these events.

Another local exercise in 2014 involved the release of a large amount of chlorine, also as part of a train derailment just to the south of Moore. This event “impacted” the Cleveland County Jail, an animal rescue facility, and transportation along Interstate Highway 35.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
HazMat- Transportation	Unlikely	Limited	< 6 hours	6-12 hours	1.85

3.6.8 Epidemic/Pandemic

Description

An epidemic is a widespread occurrence of an infectious disease in a community at a particular time. A pandemic is the spread of a new disease over a large region, perhaps over multiple continents or even worldwide.

Bioterrorism incidents can also be included in this identified hazard area.

Location

The entire planning area is susceptible to an epidemic/pandemic event. Note that outbreaks will occur simultaneously throughout the nation and the world.

Extent

Epidemics/pandemics are monitored by the Centers for Disease Control. Area conditions are monitored by the Oklahoma State Department of Health, with local monitoring at the Cleveland County Health Department.

The planning team considers the extent of epidemic events in the planning area to be:

- *Minor*, when an event occurs which does not cause significant numbers of people to become ill, and/or be absent from school or employment;
- *Major*, when an event occurs that causes significant numbers of illness or fatalities within the planning area, and/or when schools and businesses are forced to close.

Typically the extent of an epidemic event is classified by the Oklahoma State Department of Health, rather than officials of the City of Moore or the Moore Public Schools.

Previous Occurrences

There has been one incident of pandemic influenza in the past 10 years. Between April 2009 and April 2010, an Influenza A (H1N1) virus emerged. There were an estimated 60.8 million cases, 274,304 hospitalizations, and 12,469 deaths in the United States; 22 deaths in Oklahoma; 3 deaths in Cleveland County.

Probability of Future Events: UNLIKELY

Pandemics (especially influenza) are expected, but unpredictable and arrive with very little warning. However, it is highly unlikely that a novel strain of influenza would appear in Cleveland County first.[44]

Vulnerability and Impacts

All people in the planning area are vulnerable to epidemics. Those who have a greater vulnerability include people with chronic health conditions, the young, elderly, and those who are pregnant.

Impacts obviously include serious illness and/or death. Numbers of persons affected may be significant because communicable diseases may be highly infectious and could result in high levels of morbidity and mortality. People may be asymptomatic while infectious.

Effects of influenza on the individual communities may be relatively prolonged (several waves of weeks to months at a time) as compared to other types of disasters.

[44] Cleveland County Pandemic Response Annex 2019, p. 1.

Numbers of ill people requiring outpatient medical care and hospitalization may overwhelm the local healthcare systems.

Risks of exposure and illness in healthcare workers and other first responders may be higher than the general population, therefore, creating more strain on the already overwhelmed healthcare system.

Lost feeling of personal security, and other perception/mental health issues are also likely with an epidemic.

Disruptions of national and community infrastructures including commerce, utilities, and public safety as the spread of infection may be worldwide. Any major event that might occur would likely cause disruptions to normal activities at workplaces and MPS and other schools, with locations likely closed for several days or perhaps weeks. Even minor events may cause disruption of production and/or business, resulting in financial loss.

Shortages (from mild to severe) of personnel in sectors that provide critical public safety services will result from widespread illness in the community.

Strategies for stopping the spread of disease (once a pandemic strain has been identified) include personal protection, isolation, antiviral medications, and vaccination.

Rigorous planning for response to epidemics occurs at the National, state and local levels. Plans exist and are regularly updated and exercised for the mass inoculation and prophylaxis of the general population should it become necessary. The City of Moore is an active participant in the local plan.

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Pandemic	Unlikely	Critical	> 24 hours	> 24 hours	1.3

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3.6.9 Transportation Accident

Description

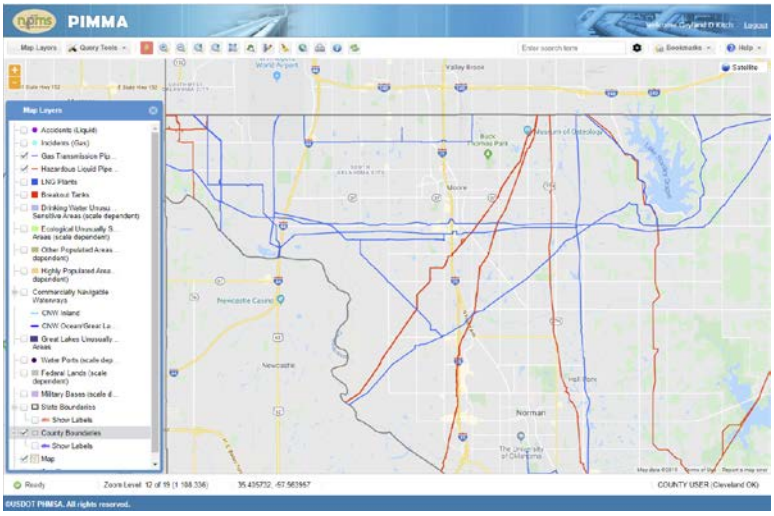
Transportation accidents may involve collisions of automobiles and trucks, rail accidents and derailments, aircraft accidents, and pipeline ruptures.

Location

Transportation accidents may occur anywhere in the planning area.

Major transportation facilities include:

- Interstate Highway 35, bisecting the planning area north/south;
- BNSF Railway, bisecting the planning area north/south;
- State Highway 37, bisecting the planning area east/west;
- Interstate Highways 44 and 240, near the west (I-44) and north (I-240) boundaries of the planning area;
- Numerous gathering, transmission and distribution pipelines, throughout the planning area;
- Will Rogers World Airport, just north of the western portion of the planning area;
- Tinker Air Force Base, just north and east of the planning area
- Max Westheimer Airport (general aviation), just south of the planning area.



Transmission pipelines in the City of Moore

Maps of the transportation facilities may be found in *Appendix K*.

Extent

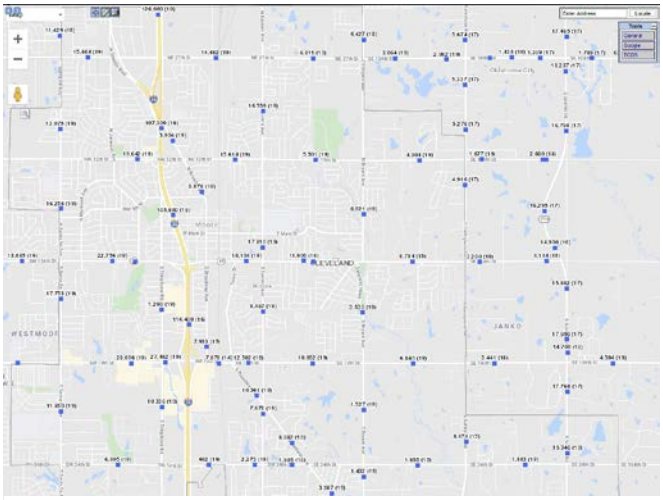
Approximate volumes of movements on transportation facilities per day in the planning area include:

- 105,800-114,400 vehicles on I-35[45];
- 16,104-22,756 vehicles on SH-37[46];
- 36 trains on the BNSF Railway (14 northbound and 22 southbound)[47], inclusive of two passenger trains which have an average daily ridership of 63 each[48];
- 274 flights arriving/departing Will Rogers World Airport[49];
- 200 flights arriving/departing Tinker Air Force Base[50];
- 134 flights arriving/departing Max Westheimer Airport[51].

[45] Association of Central Oklahoma Governments, Transportation Data Management System
[46] Ibid
[47] BNSF Railway, November 2019
[48] Rail Passengers Association, Amtrak fact sheet: Heartland Flyer service (data 2016)
[49] Will Rogers World Airport, Aviation Activity Report, November 2019
[50] AirportIQ5010, Airport Master Records and Reports, TIK Operations 12 months
[51] AirportIQ5010, Airport Master Records and Reports, OUN Operations 12 months ending 1/1/2018

The planning team considers the extent of a transportation accident event in the planning area to be:

- *Minor*, when an event occurs that results in few serious injuries or fatalities, and can be handled by normal public safety response;
- *Major*, when multiple serious injuries or fatalities occur, likely requiring additional mutual aid public safety resources.



Average Daily Traffic Counts. See Appendix K.

Previous Occurrences

There are vehicle accidents in the planning area on a daily basis. Most of these accidents are categorized as "minor" based on above definition; very few require more than a "normal" response of 1-3 police officers, 0-2 ambulances, and 0-2 fire companies.

On February 3, 2020 a pickup struck a group of high school cross-country runners while they were leaving their school to begin a practice run. Two students were killed and four more injured (two critically) in this event, which is under investigation at the time of this writing. Response to this event included 4 fire companies and approximately 20 personnel, 6 ambulances and medical command staff, approximately 25 law enforcement personnel. Responders were on-scene for approximately 10 hours (not including follow up investigations).

There have been 6 train derailments in the past 10 years close to or in the planning area. None of these are classified as "major".[52]

On June 12, 1974, a Santa Fe Railroad train derailed at Indian Hills Rd. due to physical damage to the rails. Thirty-six cars derailed, including one carrying 70,000 lbs. of phosphorus trichloride. Over 1,000 persons were evacuated in north Norman and south Moore; numerous responders were hospitalized after breathing fumes from the chemical. Several responders were forced to retire after this event due to medical issues caused by exposure to the event.

Pipeline accidents occur in the planning area on occasion; there have been none that involved injury or fatality. There have been limited evacuations with a few of these. Due to a data loss when changing records systems at the Moore Fire Department, detailed information concerning these is unavailable. It is estimated by the Fire Chief and Emergency Manager that there are 2-3 pipeline-related events per year in the planning area.

There have been no aircraft accidents within the planning area within the past 10 years.

Probability of Future Events: LIKELY

Vulnerability and Impacts

All roads in the planning area are vulnerable to a potential accident; all persons in the planning area are vulnerable. Anyone driving or traveling in a motor vehicle, or any pedestrian walking close to a roadway are vulnerable. The impacts of a major motor vehicle accident could include:

[52] https://acog.ms2soft.com/tcds/tsearch.asp?loc=Acog&mod=

- Death and/or serious injury to 1-125 persons in vehicles (high number scenario would involve two motor coaches or school buses), plus additional pedestrians or persons in buildings if struck;
- Major damage to vehicles and/or property;
- Prolonged disruption of traffic;
- Potential for an associated hazardous materials event, which would introduce additional impacts related to toxicity, health, and evacuation/sheltering issues;
- Relatively short-term mental health issues in the community, particularly increasing with the number of casualties and/or if the casualties included children.

There are three scenarios for a rail accident:

- Derailment of a train;
- Collision between a train and a vehicle;
- Collision between two trains.

Any location close to the railroad could be affected by a derailment. Buildings and infrastructure could be damaged by derailed cars or flying debris. The City's Public Safety Center, The Station/Central Park, MPS VISTA Academy and a City of Moore water tower are among critical facilities/infrastructure that are near the railroad and therefore more vulnerable to a derailment event.

Impacts of a major railway derailment event could include:

- Death and/or serious injury to 1-65 persons (high number scenario would involve a passenger train event);
- Major damage to vehicles and/or property;
- Prolonged disruption of road traffic if the event impacted a grade crossing;
- Potential for an associated hazardous materials event, which would introduce additional impacts related to toxicity, health, and evacuation/sheltering issues;
- Financial loss to the railroad company and its shippers due to potential longer-term disruption of normal rail service.

There are five at-grade rail-street crossings in the planning area, all of which are equipped with active warning gates, flashing lights, and audible bells:

- NE 12th Street;
- Main Street;
- SE 4th Street;
- SW 34th Street;
- Indian Hills Road.

The at-grade crossing at Indian Hills Road is a designated "quiet zone" crossing (train engineer is not required to sound horn in advance of the crossing) and has supplementary safety measures (SSMs). The crossing at SW 34th Street had additional SSMs installed as part of a street/bridge project in 2019 and is being considered for a quiet zone designation.

There are two other below-grade crossings in the planning area, on NE 27th Street and on SE 19th Street. It should be noted that the City of Moore is currently (2020) working on plans to construct a below-grade crossing at SE 4th Street; this is a multi-year project and actual construction costs are not yet funded.

Impacts of a major railway/vehicle collision event could include:

- Death and/or serious injury to 1-130 persons (high number scenario would involve a passenger train vs. motor coach/school bus collision event);
- Major damage to vehicles and/or property;

- Prolonged disruption of road traffic at both the grade crossing involved and possibly other nearby grade crossings blocked by the train;
- Potential for an associated hazardous materials event, which would introduce additional impacts related to toxicity, health, and evacuation/sheltering issues;
- Financial loss to the railroad company and its shippers due to potential longer-term disruption of normal rail service.

It is unlikely but possible for two trains to collide within the planning area. While this could occur at any location on the railway, three ingress/egress to siding locations have additional vulnerability:

- Just north of NE 12th Street;
- Just south of NE 12th Street;
- Just north of SE 19th Street.

In addition to the normal vulnerability, it could be possible for trains on the siding to fail to completely clear the mainline and therefore be an obstruction to a train traveling on the main.

Impacts of a major train vs. train collision event could include:

- Death and/or serious injury to 1-10 persons (train crew members);
- Major damage to vehicles and/or property;
- Prolonged disruption of road traffic if the event impacted a grade crossing;
- Potential for an associated hazardous materials event, which would introduce additional impacts related to toxicity, health, and evacuation/sheltering issues;
- Financial loss to the railroad company and its shippers due to potential longer-term disruption of normal rail service.

All locations within the planning area are vulnerable to an aircraft accident. These could vary in extent from a single engine general aviation aircraft with only a single person on board, to a commercial airliner with several hundred aircraft on board, to a wide variety of military aircraft. Impacts of a major aircraft accident event could include:

- Death and/or serious injury to 1-160 persons in the aircraft, plus additional persons on the ground as a direct result of a crash and/or the immediate after-effects such as fire;
- Destruction/major damage to multiple structures, vehicles and/or property as a direct result of a crash and/or the immediate after-effects such as fire;
- Prolonged disruption of road traffic if the event impacted highways and/or arterial streets;
- Potential for an associated hazardous materials event due to fuel on board the aircraft (as example, a USAF E-3 Sentry such as is based at Tinker AFB may have a fuel capacity of 21,000 gallons[53]).

Any location close to a pipeline could be affected by a rupture. Impacts of a major railway event could include:

- Death and/or serious injury to persons near the rupture, due to explosion, fire, and/or an associated hazardous materials event;
- Major damage to property;
- Prolonged disruption of road traffic if the event impacted a highway or arterial street;

Priority Risk Index

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	PRI
Transportation Accident	Likely	Limited	< 6 hours	< 6 hours	2.65

[53] U.S. Air Force fact sheet, E-3 Sentry (AWACS)

3.7 Repetitive and Severe Repetitive Loss Structures in Planning Area

There are currently no repetitive loss properties in the City of Moore.

A property located at SW 34th Street at the East Service Road previously had three repetitive losses. However, this property has been purchased by the City of Moore; all structures have been removed and the property is now the site of ramps serving a highway overpass.

3.8 Critical Infrastructure

Information on 26 City of Moore, 41 Moore Public Schools, and 6 additional facilities in the planning area is available to public safety personnel, but is not printed here due to security concerns.

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CHAPTER FOUR: CAPABILITIES ASSESSMENT

4.1 Existing Institutions, Plans, and Ordinances

The City of Moore Emergency Operations Plan is a guide to how the City conducts all-hazards emergency response. It describes specific authorities and best practices for managing incidents that range from the serious but purely local, to large scale terrorist attacks or catastrophic natural disasters. Elements of the Plan are reviewed by the City's Emergency Planning Group each quarter, and comprehensive updates are made on an annual basis. It should be noted that reviews of the Hazard Mitigation Plan are conducted by the same group at the same meetings, providing opportunity for the cross-expansion and improvement of both plans.

Each Moore Public Schools facility has a Crisis Management Plan specific to their campus. The plans prepare for crisis situations at MPS facilities, and create an organizational structure that provides for efficient and functional decision making. These plans serve as a framework for crisis intervention, as the facility crisis management teams realize that many situations are unique and require specific actions that cannot be anticipated. Each Crisis Management Plan is updated annually, approved, and a copy placed on file with the appropriate assistant superintendent. Copies of each Plan are also shared with the appropriate law enforcement, fire and emergency management agency serving the facility. As these plans have matured, they have expanded to include additional potential hazards and efforts to mitigate hazards and their effects.

The Envision Moore Plan 2040 (Comprehensive Plan) provides guidance to government staff, elected and appointed officials, businesses, civic organizations and Moore citizens on how to address existing development and land use issues and position the city for future success. The Plan includes an assessment of current conditions and trends, and recommendations for achieving community goals. Requests for amendments to specific portions of Envision Moore 2040 are made on a regular basis as the City continues to develop and mature. Exceptions to the plan should be consistent with the Future Land Use Plan portion, and require application, review and approval by both the City Council and Planning Commission.

The City of Moore has adopted the following building codes for construction:

- 2015 International Residential Code
- 2015 International Building Code
- 2015 International Mechanical Code
- 2015 International Plumbing Code
- 2015 International Fuel Gas Code
- 2014 National Electric Code
- 2015 International Fire Code
- 2015 NFPA Life Safety Code

The City has adopted an amendment to the 2015 IRC, "Modular construction, manufactured housing and any other prefabricated construction is not permitted in any zoning district within the city limits"[54].

In 2014 the City adopted code requiring new residential construction to withstand 135 mph winds, improving the City's mitigation stance by potentially reducing failures of pieces of homes during wind storms and therefore also causing a reduction in the amount of flying debris impacting and potentially failing other structures.

[54] Moore City Ordinance Sec. 5-204 (b) 109.5

4.2 Administrative and Technical Capability

Both the City of Moore and Moore Public Schools have full-time professional Finance Departments.

The two primary goals of the MPS Financial Services Department are to:

- protect and enhance the financial well-being of the district
- maintain compliance with state law and Board of Education policy in the handling of all financial activity of Moore Public Schools

Other objectives include:

- install and preserve proper internal controls for the purpose of safeguarding property
- contribute counsel to the Board of Education and district administration on financial matters
- conduct strategic planning for the purchase and utilization of district resources
- supply payroll and employee benefits services to employees
- administer treasury activities to include the investing of idle funds in a manner that returns the greatest benefit to the district and provide accounting and timely reporting of relevant financial information

The goals of the City of Moore's Finance Department are:

- Accountability of public funds;
- Preparation of accurate, timely financial reports for the public, bondholders, auditors, City Council, management, and city departments;
- Legal compliance and best practice methods regarding cash and investment funds management;
- Excellent customer service;
- Compliance with federal and state statutes regarding grant management.

Objectives of the Department are:

- Improved customer service with training and equipment;
- Continual improvement of cost management;
- Increased use of e-bills and electronic payments;
- Accurate conversion of financial software to new vendor.

MPS employs a full-time Director of Safety and Security. The District also employs School Resource Officers at all secondary educational venues, and employs off-duty law enforcement officers as floating courtesy offices specifically for the elementary schools. Elementary venues are also frequented by on-duty law enforcement officers. An explosives and firearms detecting canine and full-time handler will be at the various MPS facilities each day. The District has also employed eleven Licensed Professional Counselors (LPCs) to provide mental health and wellness services.

Both the City of Moore and the Moore Public Schools have full-time Information Technology departments. The City's includes a specialist in Geographic Information Systems, and several other city employees are fluent in GIS.

The City's Community Development Director or designee serves as the floodplain administrator for the city, to administer and implement the provision of Chapter 8 (Floods and Drainage) of the City's Land Development Code and other appropriate sections of 44 CFR (National Flood Insurance Program Regulations) pertaining to floodplain management.

Both the City of Moore and Moore Public Schools welcome opportunities to expand and improve emphasis on hazard mitigation capabilities through additional personnel training, exercising, and implementation of advanced technical capabilities.

4.3 Financial Capabilities

The City may levy taxes for specific issues, and collects fees for water and sewer services as well as new development. The City can incur debt through general obligation funds and/or special tax bonds. The City is a Community Development Block Grant recipient, and also receives other federal and state funding. The City's Emergency Management Department is a sub-grantee of FEMA's Emergency Management Performance Grant (EMPG) via the Oklahoma Department of Emergency Management.

The City's overall budget for FY 2019-2020 is $115,467,913. This results in a projected expenditure of $1,904 per capita based on an estimated population of 60,636.

The Moore Public School District is funded through Ad Valorem taxes and bonds. The District's estimated General Fund Budget is $151,735,524. Additionally, the MPS Building Fund is $9,055,860 and the Child Nutrition Fund is $9,785,000. MPS' budgeted per pupil expenditure is $6,252.

4.4 Education and Outreach Capabilities

The City of Moore's public safety departments all participate in frequent public information programs and provide timely safety information via social media. The Emergency Management Department sponsors "Community Emergency Response Training" on a bi-annual basis (generally prior to "storm season" in the spring and during National Preparedness Month in the fall); this course is a 20 hour course that provides basic emergency skills training to the general public

Moore High School sponsors a safety and preparedness rally annually, inviting national speakers and local responders to provide information to students. The MPS Junior High Schools typically have career days at which members of the fire, police, and emergency management departments speak on public safety topics.

4.5 NFIP Participation

The City of Moore has participated in the National Flood Insurance Program since 1974, and employs a full-time planner who is also the City's designated floodplain manager. Two additional City employees are certified floodplain managers.

The City's Flood Insurance Rate Maps (FIRMs) have a current effective date of February 20, 2013. FIRMs are digital in nature. The City's Floodplain Ordinance (#625(08)), was last updated and approved on July 21, 2008.

The City continues to participate in the NFIP in the following ways:

- Requiring minimum finished floor elevations of 1 foot above base flood elevation for new construction;
- Attending annual training through Oklahoma Water Resources Board;
- Educating citizens and enforcing flood management requirements.

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CHAPTER FIVE: MITIGATION STRATEGY

5.1 Mitigation Goals

Mitigation goals for the City of Moore/MPS planning area are as follows:

1. To take proactive steps to eliminate or reduce loss of life and injury as result of emergencies and disasters.
2. To protect public health, safety and well-being during emergencies and disasters.
3. To take proactive steps to minimize damage to property from emergencies and disasters, including damage to city facilities, MPS venues, and critical infrastructure in the planning area.
4. To conserve and safeguard the natural environment.
5. Increase overall community preparedness and disaster resistance.

5.2 Action Items

The following action items have been reviewed, and updated as necessary for the 2019 Hazard Mitigation Plan Update. The table below illustrates which mitigation actions address which hazards. Completion of these mitigation actions is dependent upon securing funding to complete each one.

Action Item #1	**Alerting/Warning Systems**
Description	Install devices as needed to provide alerting/ warning information to planning area prior to/ during a hazardous event. Maintain system by updating components as needed. Replace existing older units according to 10 year plan.
Hazards Addressed	Dam Failure *(City of Moore only)*, High Winds, Lightning, Tornadoes, HazMat fixed, HazMat transportation
Jurisdictions	City of Moore, Moore Public Schools
Responsible Party	City of Moore Emergency Management Department Moore Public Schools Safety & Security
Mitigation Action Type	5% Projects
Cost	$25,000/OWS unit. OWS controllers $12,000/unit. MPS units to be determined
Potential Funding Sources	HMGP, PDM, CDBG, Local funds
Potential Implementation Timeline	Ongoing
Current Action Status	In progress according to Moore 10-year siren plan. Under review at MPS.

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Action Item #2	Generators for Critical Facilities
Description	Install backup power generators at critical infrastructure locations to mitigate effects of commercial power outages due to natural or manmade hazard events.
Hazards Addressed	Earthquake, Extreme Heat, High Winds, Lightning, Tornadoes, Wildfire, Winter Storm, Cyber
Jurisdictions	City of Moore, Moore Public Schools
Responsible Party	City of Moore, Moore Public Schools
Mitigation Action Type	5% Projects
Cost	Variable dependent upon size of facility
Potential Funding Sources	HMGP, PDM, CDBG, Local funds
Potential Implementation Timeline	Dependent upon available funding
Current Action Status	In progress; units have been installed at some city and MPS facilities during previous HMP period.

Action Item #3	StormReady Business Program
Description	Develop and implement a program to assist businesses in preparing for the effects of severe weather, similar to the "StormReady Community" program for local governments.
Hazards Addressed	High Winds, Lightning, Tornadoes, Winter Storm
Jurisdictions	City of Moore
Responsible Party	City of Moore Emergency Management Dept.
Mitigation Action Type	Education and Awareness Programs
Cost	Minimal
Potential Funding Sources	HMGP, local public and/or private funds
Potential Implementation Timeline	2020
Current Action Status	Pending available staff time

Action Item #4	Impact Resistant Window Film
Description	Install impact resistant film at critical facilities to minimize the effects of air-borne debris.
Hazards Addressed	Hail, High Wind, Tornadoes, School Violence, Terrorism
Jurisdictions	City of Moore, Moore Public Schools
Responsible Party	City of Moore, Moore Public Schools
Mitigation Action Type	Structure and Infrastructure
Cost	Dependent on facility, approx. $12-13/sq ft.
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	Under review for both jurisdictions
Current Action Status	Carryover from previous HMP. MPS has installed tinted, non-impact resistive film at all locations. Additional locations pending funding. Project modified to meet the needs of participating jurisdictions.

Action Item #5	Bury Electrical Distribution Lines
Description	Collaborate with local power utilities to move power lines underground where possible. Enact requirements for underground power lines for any future construction.
Hazards Addressed	Dam Failure, Earthquake, Extreme Heat, High Wind, Lightning, Tornado, Wildfire, Winter Storm
Jurisdictions	City of Moore, Moore Public Schools
Responsible Party	City of Moore, local power utilities
Mitigation Action Type	Structure and Infrastructure, Local Plans and Regulations
Cost	Approximately $435,000/mile to bury existing lines. Minimal cost for regulation requiring underground lines for new construction.
Potential Funding Sources	HMGP (utility coops only), utility provider funds
Potential Implementation Timeline	Deferred pending funding
Current Action Status	Carryover from previous HMP; no current activity

Action Item #6	Portable Dynamic Message Signs
Description	Acquire portable dynamic message signs with wireless programming capability to provide warning information at specific locations prior to events *(locations vary by hazard, i.e. high traffic areas on tornado forecast days, flood areas on high precipitation forecast days, greater WUI-Risk areas on wildfire potential days, etc.)*; safety and mitigation information during incidents; education and awareness.
Hazards Addressed	Dam Failure *(City of Moore only)*, Drought, Earthquake, Extreme Heat, Flood, Tornado, Wildfire, Winter Storm
Jurisdictions	City of Moore, Moore Public Schools
Responsible Party	City of Moore, Moore Public Schools
Mitigation Action Type	5% Projects, Education and Awareness Programs
Cost	Approximately $20,000 per unit
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	Pending funding
Current Action Status	Carryover from previous HMP; pending funding.

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Action Item #7	Master Uninterruptable Power Supplies for Critical Facilities
Description	Install Master Uninterruptible Power Systems for critical facilities. These provide critical power filtering to lessen effects of power spikes and other varying voltage/amperage situations, and also continuous uninterrupted power to computers/ servers/ networks between the onset of commercial power outages and provision of emergency generator power.
Hazards Addressed	Earthquake, Extreme Heat, High Wind, Lightning, Tornado, Wildfire, Winter Storm, Cyber, Terrorism
Jurisdictions	City of Moore, Moore Public Schools
Responsible Party	City of Moore, Moore Public Schools
Mitigation Action Type	5% Projects
Cost	Dependent upon size of facility
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	Pending funding
Current Action Status	Carryover from previous HMP; pending funding.

Action Item #8	Convert Outdoor Warning System to Solar Power
Description	Convert the City's outdoor warning devices to solar power
Hazards Addressed	Dam Failure, High Winds, Lightning, Tornadoes, HazMat fixed, HazMat transportation
Jurisdictions	City of Moore
Responsible Party	City of Moore, Emergency Management Dept.
Mitigation Action Type	5% Projects
Cost	$4,000/unit, 29 eligible units
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	Pending funding
Current Action Status	Carryover from previous HMP; pending funding.

Action Item #9	Shelter for City & MPS Vehicles
Description	Install overhead covers for vehicle parking at critical facilities to protect City and MPS vehicle by lessening the impact of hail and other airborne weather hazards.
Hazards Addressed	Extreme Heat, Hail, High Wind, Tornado, Winter Storm
Jurisdictions	City of Moore, Moore Public Schools
Responsible Party	City of Moore, Moore Public Schools
Mitigation Action Type	Structure and Infrastructure Projects
Cost	Approx. $72,000/4 vehicles
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	Pending funding
Current Action Status	Carryover from previous HMP; pending funding.

Action Item #10	Oakridge Drainage Project
Description	Install approximately 360' of new 36" RCP; re-grade detention facility and add a new spillway.
Hazards Addressed	Flood
Jurisdictions	City of Moore
Responsible Party	City of Moore
Mitigation Action Type	Structure and Infrastructure Projects
Cost	$650,000
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	2020
Current Action Status	New action item, pending funding.

Action Item #11	Implement Recommendations of Master Drainage Plan
Description	Implement recommendations outlined in the City's Master Drainage Plan.
Hazards Addressed	Dam Failure, Flood
Jurisdictions	City of Moore
Responsible Party	City of Moore
Mitigation Action Type	Structure and Infrastructure Projects
Cost	Dependent upon each recommendation
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	2020-2024
Current Action Status	New action item, pending funding

Action Item #12	Produce and Air Visual Media for Mitigation Education
Description	Contract for professional production of visual media to be aired on video boards (such as at Moore Stadium and Buck Thomas Park) during large events, with education information for awareness and mitigation of hazards on an individual level.
Hazards Addressed	All hazards *(City of Moore only for hazard "Dam Failure")*
Jurisdictions	City of Moore, Moore Public Schools
Responsible Party	City of Moore, Moore Public Schools
Mitigation Action Type	Education and Awareness Programs
Cost	$5-10,000 per (professional) production; $4,000 for air time at MPS Stadium; less expensive for homemade production; negligible for posting on websites/social media
Potential Funding Sources	HMGP, local funds, educational grants
Potential Implementation Timeline	2020, ongoing
Current Action Status	New action item, in perpetual progress

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Action Item #13	Develop Hazard Mitigation, Education, Information and Awareness Programs
Description	Continue to create and present comprehensive awareness and mitigation education programs for all hazards
Hazards Addressed	All hazards *(City of Moore only for hazard "Dam Failure")*
Jurisdictions	City of Moore, Moore Public Schools
Responsible Party	City of Moore, Moore Public Schools
Mitigation Action Type	Education and Awareness Programs
Cost	Minimal
Potential Funding Sources	HMGP, local funds, educational grants
Potential Implementation Timeline	2020, ongoing
Current Action Status	Combination of several previous items, in perpetual progress

Action Item #14	Install Storm Shelters in City Facilities
Description	Install engineered storm shelters at all City of Moore facilities
Hazards Addressed	High Wind, Tornado
Jurisdictions	City of Moore
Responsible Party	City of Moore
Mitigation Action Type	Structure and Infrastructure Projects
Cost	$250,000 for City Hall; others dependent upon facility
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	Pending funding
Current Action Status	New action item, pending funding

Action Item #15	Individual Storm Shelter Program
Description	Implement program to provide financial incentives for the installation of engineered storm shelters at residences in the City of Moore
Hazards Addressed	High Wind, Tornado
Jurisdictions	City of Moore
Responsible Party	City of Moore, Emergency Management Dept.
Mitigation Action Type	Structure and Infrastructure Projects
Cost	$2,500/unit
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	Pending funding
Current Action Status	New action item, pending funding

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Action Item #16	Study Drainage Improvements for SE Basin
Description	Commission a study of the SE Drainage Basin of the North Fork River to determine needed improvements to reduce downstream flooding
Hazards Addressed	Flood
Jurisdictions	City of Moore
Responsible Party	City of Moore
Mitigation Action Type	5% projects
Cost	Approximately $75,000
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	Pending funding
Current Action Status	New action item, pending funding

Action Item #17	Implement Drainage Improvements for SE Basin
Description	Implement improvements recommended by Action Item #16 to the SE Drainage Basin
Hazards Addressed	Flood
Jurisdictions	City of Moore
Responsible Party	City of Moore
Mitigation Action Type	Structure and Infrastructure Projects
Cost	Dependent upon scope of project
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	Pending funding
Current Action Status	New action item, pending funding

Action Item #18	Implement drought-tolerant landscaping (xeriscaping)
Description	Incorporate drought tolerant or xeriscape practices for all facilities.
Hazards Addressed	Drought
Jurisdictions	City of Moore, Moore Public Schools
Responsible Party	City of Moore, Moore Public Schools
Mitigation Action Type	Natural Systems Protection
Cost	Minimal
Potential Funding Sources	Local funds
Potential Implementation Timeline	2020-2024
Current Action Status	New action item, pending funding

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Action Item #19	Improvements to Water System
Description	Make improvements to the City of Moore water system to increase production and delivery capacity
Hazards Addressed	Drought
Jurisdictions	City of Moore
Responsible Party	City of Moore
Mitigation Action Type	Structure and Infrastructure Systems
Cost	Dependent upon scope of individual improvements
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	Ongoing
Current Action Status	New action item, pending funding

Action Item #20	Protective Crosswalks at MPS Facilities
Description	Install protective crosswalks on arterial streets at Moore Public School facilities
Hazards Addressed	Winter Storm, Transportation Accidents
Jurisdictions	City of Moore, Moore Public Schools
Responsible Party	City of Moore, Moore Public Schools
Mitigation Action Type	Structure and Infrastructure Systems
Cost	Approximately $110,000 per location
Potential Funding Sources	HMGP, local funds
Potential Implementation Timeline	Ongoing
Current Action Status	Completed at Highland East JHS; pending funding for other locations

Action Item #21	Wildland Personal Protective Equipment
Description	Acquire and/or replace Moore Fire Dept. personal protective equipment used for wildland firefighting
Hazards Addressed	Extreme Heat, Wildfire
Jurisdictions	City of Moore
Responsible Party	City of Moore
Mitigation Action Type	
Cost	Approximately $75,000
Potential Funding Sources	Local funds
Potential Implementation Timeline	Ongoing
Current Action Status	New action item

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Action Item #22	Huddleston Dam Information
Description	Acquire detailed information and mapping for a potential dam breach at Huddleston Dam
Hazards Addressed	Dam Failure
Jurisdictions	City of Moore
Responsible Party	Dam owner, City of Moore
Mitigation Action Type	Structure and Infrastructure Projects
Cost	Approximately $10,000
Potential Funding Sources	HMGP, Private funds
Potential Implementation Timeline	Ongoing
Current Action Status	New action item

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Hazard	Jurisdiction	Item	Mitigation Action Items	Category
Dam Failure	Moore	1	Alerting/warning devices	5%
	Moore	5	Bury electrical lines	Structure & Infrastructure
	Moore	6	Portable motorist information signs	5%
	Moore	8	Convert warning devices to solar power	5%
	Moore	11	Master drainage plan	Structure & Infrastructure
	Moore	12	Visual media	Education & Awareness
	Moore	13	Education programs	Education & Awareness
	Moore	22	Huddleston Dam Information	Structure & Infrastructure
	MPS		N/A *(dam failure is not a MPS hazard)*	
Drought	Moore & MPS	6	Portable motorist information signs	5%
	Moore & MPS	12	Visual media	Education & Awareness
	Moore & MPS	13	Education programs	Education & Awareness
	Moore & MPS	18	Drought-tolerant landscaping	Natural Systems Protection
	Moore	19	Upgrade water supply systems	Structure & Infrastructure
Earthquake	Moore & MPS	2	Generators for critical facilities	5%
	Moore & MPS	5	Bury electrical lines	Structure & Infrastructure
	Moore & MPS	6	Portable motorist information signs	5%
	Moore & MPS	7	Master UPS for critical facilities	5%
	Moore & MPS	12	Visual media	Education & Awareness
	Moore & MPS	13	Education program	Education & Awareness
Extreme Heat	Moore & MPS	2	Generators for critical facilities	5%
	Moore & MPS	5	Bury electrical lines	Structure & Infrastructure
	Moore & MPS	6	Portable motorist information signs	5%
	Moore & MPS	7	Master UPS for critical facilities	5%
	Moore & MPS	9	Shelter for city/school vehicles	Structure & Infrastructure
	Moore & MPS	12	Visual media	Education & Awareness
	Moore & MPS	13	Education program	Education & Awareness
Flood	Moore & MPS	6	Portable motorist information signs	5%
	Moore	10	Oak Ridge Drainage project	Structure & Infrastructure
	Moore	11	Master Drainage Plan projects	Structure & Infrastructure
	Moore & MPS	12	Visual media	Education & Awareness
	Moore & MPS	13	Education program	Education & Awareness
	Moore	16	SE Drainage Basin study	5%
	Moore	17	SE Drainage Basin implementation	Structure & Infrastructure
Hail	Moore & MPS	4	Window film	Structure & Infrastructure
	Moore & MPS	9	Shelter for city/school vehicles	Structure & Infrastructure
	Moore & MPS	12	Visual media	Education & Awareness
	Moore & MPS	13	Education program	Education & Awareness

High Wind	Moore & MPS	1	Alerting/warning devices	5%
	Moore & MPS	2	Generators for critical facilities	5%
	Moore	3	StormReady Business program	Education & Awareness
	Moore & MPS	4	Window film	Structure & Infrastructure
	Moore & MPS	5	Bury electrical lines	Structure & Infrastructure
	Moore & MPS	7	Master UPS for critical facilities	5%
	Moore	8	Convert warning devices to solar power	5%
	Moore & MPS	9	Shelter for city/school vehicles	Structure & Infrastructure
	Moore & MPS	12	Visual media	Education & Awareness
	Moore & MPS	13	Education program	Education & Awareness
	Moore	14	Safe rooms in city facilities	Structure & Infrastructure
	Moore	15	Individual safe room program	Structure & Infrastructure
Lightning	Moore & MPS	1	Alerting/warning devices	5%
	Moore & MPS	2	Generators for critical facilities	5%
	Moore	3	StormReady Business program	Education & Awareness
	Moore & MPS	5	Bury electrical lines	Structure & Infrastructure
	Moore & MPS	7	Master UPS for critical facilities	5%
	Moore	8	Convert warning devices to solar power	5%
	Moore & MPS	12	Visual media	Education & Awareness
	Moore & MPS	13	Education program	Education & Awareness
Tornado	Moore & MPS	1	Alerting/warning devices	5%
	Moore & MPS	2	Generators for critical facilities	5%
	Moore	3	StormReady Business program	Education & Awareness
	Moore & MPS	4	Window film	Structure & Infrastructure
	Moore & MPS	5	Bury electrical lines	Structure & Infrastructure
	Moore & MPS	6	Portable Dynamic Message Signs	5%
	Moore & MPS	7	Master UPS for critical facilities	5%
	Moore	8	Convert warning devices to solar power	5%
	Moore & MPS	9	Shelter for city/school vehicles	Structure & Infrastructure
	Moore & MPS	12	Visual media	Education & Awareness
	Moore & MPS	13	Education program	Education & Awareness
	Moore	14	Safe rooms in city facilities	Structure & Infrastructure
	Moore	15	Individual safe room program	Structure & Infrastructure
Wildfire	Moore & MPS	2	Generators for critical facilities	5%
	Moore & MPS	5	Bury electrical lines	Structure & Infrastructure
	Moore & MPS	6	Portable motorist information signs	5%
	Moore & MPS	7	Master UPS for critical facilities	5%
	Moore & MPS	12	Visual media	Education & Awareness
	Moore & MPS	13	Education program	Education & Awareness

Winter Weather	Moore & MPS	2	Generators for critical facilities	5%
	Moore	3	StormReady Business program	Education & Awareness
	Moore & MPS	5	Bury electrical lines	Structure & Infrastructure
	Moore & MPS	6	Portable motorist information signs	5%
	Moore & MPS	7	Master UPS for critical facilities	5%
	Moore & MPS	9	Shelter for city/school vehicles	Structure & Infrastructure
	Moore & MPS	12	Visual media	Education & Awareness
	Moore & MPS	13	Education program	Education & Awareness
	Moore & MPS	20	Protective crosswalks	Education & Awareness

5.3 Action Item Prioritization

Numerous factors were considered when the Planning Team prioritized the various action items. Some of these factors included:

Social: The Planning Team consisted of a diverse membership including representatives of local, county and state governments, school district leadership, local business owners, and community members at large. This Team made the final prioritizations.

The public was invited to participate in the planning process via surveys and public meetings. Survey results were included into the final prioritizations.

Technical: Numerous business and technical experts were consulted concerning technical components of the various projects; their comments and suggestions received were incorporated into the prioritization.

Administrative: Proper implementation of the projects will rely on existing City and MPS staff. Staff availability and departmental priorities, along with existing plans and actions were considered in the final prioritization.

Political: The Planning Team included appointed and elected officials from the participating jurisdictions, who provided input on the prioritization.

Legal: The City's Attorney was part of the Planning Team; attorneys from both jurisdictions have reviewed the Plan.

Economic: Each of the action items were reviewed for their benefit to the communities, versus their cost. The resultant benefit versus cost was a factor in the final prioritization. Additionally, the City's Economic Development Director was a part of the Planning Team and provided input on the prioritization of items based upon their economic impact to the planning area.

Environmental: The City's Community Development, Public Works, and Parks and Recreation departments have various responsibilities for environmental, natural and cultural resources within Moore; each was represented on the Planning Team.

5.4 Integration of Data, Goals, and Action Items

The City of Moore and Moore Public Schools maintains and regularly updates numerous planning documents.

The *City of Moore Emergency Operations Plan* describes specific authorities and best practices for managing emergency incidents. The Emergency Operations Plan incorporates hazard and vulnerability information from this Hazard Mitigation Plan as a basis for planning response and management activities. The EOP is reviewed and updated on an annual basis, with the City's Emergency Management Department facilitating the update.

Envision Moore 2040, the City of Moore's Comprehensive Plan, highlights current conditions and trends within Moore, guiding development along with providing recommendations for achieving community goals. Much of the community profile information for this Plan comes from Envision 2040; action items from this Plan will be considered for inclusion in revisions and updates to the Comp Plan. The Comprehensive Plan is updated and amended as necessary, with the City's Community Development Department facilitating updates.

The *City of Moore Comprehensive Stormwater Management and Master Drainage Plan* is a technical document that provides much of the information for the Dam Failure and Flooding hazard sections of this plan, along with action items to address specific vulnerabilities. This plan is updated as necessary, with the City's Community Development Department facilitating updates.

The City's *Debris Management Plan* is incorporated into the Emergency Operations Plan; any pertinent information from this Plan will be integrated during the annual EOP review and update.

The *City Charter*, *Municipal Codes and Ordinances*, and *Land Development Code* provide the legal basis and set forth the laws within the City of Moore, and act as a guide for the information and action items in this Hazard Mitigation Plan. The City's Codes are updated as necessary; the City department facilitating is dependent upon the nature of the update.

Moore Public Schools Crisis Management Plans are reviewed annually at each of the MPS venues. Much of the vulnerability and action item information for this Plan was taken from these plans. Each building principal is responsible for the annual update, with oversight from the district's Safety and Security Department.

High School Sports Emergency Action Plans provide mitigation information for hazards to high school athletes and procedures for when emergencies occur. Much of the hazard and vulnerability information is shared between the Sport EAPs and this Plan. The District's Athletic Director is responsible for any updates.

Each of the above listed plans are either maintained or reviewed when updated by the City's Emergency Management Department. Part of this review is to bring new information and/or updates to the Emergency Planning Group at their quarterly meetings, along with suggestions on whether updates might need integration into this Hazard Mitigation Plan in the form of updates, new material, action items, or even new goals. The other part of the review is to for the parties responsible for the other documents - all members of the Emergency Planning Group - to integrate information and actions from this Hazard Mitigation Plan into their respective documents.

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CHAPTER SIX PLAN UPDATE PRIORITIZATION AND REVIEW

6.1 Plan Update Review, Evaluation, and Implementation

The City of Moore Emergency Management Department is responsible for the monitoring and evaluation of this Plan. The Department continuously works to:

- Identify new hazards that may develop in the planning area;
- Monitor development and changes to the planning area;
- Monitor hazard sites for new, changed, or deleted locations;
- Record any actual occurrences for inclusion in updates to the Plan;
- Monitor the vulnerabilities and impacts for potential changes;
- Provide liaison with City and MPS departments concerning advocacy for the implementation of action items;
- Maintain a relationship with the Moore Public Schools concerning their hazards and action items.
- Maintain liaison with the general public concerning the Plan;
- Convene and facilitate quarterly Emergency Planning Group meetings for evaluation and potential Plan updates.
- Facilitate activities for the 5-year update to the Plan.

The City's Emergency Planning Group (which includes City personnel, community stakeholders, and MPS) will evaluate and update this plan. This group meets quarterly to review the community's various emergency plans and operational response posture. Review of the Hazard Mitigation Plan is on each quarterly agenda, and associated activities at the meetings may include:

- Review updated information provided by the Emergency Management Department's continuous monitoring activities as outlined above;
- Review each hazard's Priority Risk Index for currency and potential updates, to include changes in hazard impacts or changes in the planning area's vulnerabilities;
- Review the status of action items; evaluate if completed items accomplished the intended goals; review priorities and opportunities for grants and funding;
- Discuss any changing political, social, legal, economic, environmental or other situations that could affect the Plan.
- Evaluate if the goals of the Plan are being effectively met through implementation of the Plan.

The citizens of Moore and patrons of MPS will continue to be invited to participate in plan reviews and updates. The planning team will continue to utilize multiple methods to inform the public about opportunities to review and comment on the plan. These methods include social media, newsletters, and websites. Proposed revisions will be posted for public comment during the review process; public comments will be addressed and any necessary changes made.

In summary, the methodology for monitoring and evaluating this Hazard Mitigation Plan is:

1. The Emergency Management Department will conduct the activities listed in the first set of bullets as part of their normal, regular daily routines;
2. Items noted in the EM activity surveillance will be brought to the next regularly scheduled (quarterly) Emergency Planning Group meeting. The Emergency Planning Group will then conduct each of the items listed in the second set of bullets (inclusive of reviewing the status of action items, discussing things that could affect the Plan and evaluating whether the goals of the Plan are being met). If deemed appropriate, changes, additions, or updates to the Hazard Mitigation Plan will be recommended, with the EM Department then responsible for actions necessary for formal updates; and

3. The public will continue to be invited to participate in reviews and updates.

Approved hazard mitigation plans are valid for five years. At least 18 months before the expiration of the current plan, the Emergency Planning Group will begin a comprehensive review and formal process to update and revise the plan for resubmission. The City of Moore Emergency Management Department is responsible for facilitating these reviews and incorporating updates into the plan document.

A draft plan will be submitted to the Oklahoma Department of Emergency Management for review prior to plan expiration. Revisions will be incorporated into the document as necessary before submission to FEMA for approval. Any revisions from FEMA will be incorporated into the Plan before it is submitted to the Moore City Council and MPS Board for adoption.

The approved plan will be posted on the city's website.

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6.1 Changes in Jurisdictional Development

The City of Moore continues to grow rapidly. Population rose from 55,081 in 2010 to 61, 523 in 2017. The population is expected to exceed 80,000 by 2040. Little has changed in terms of development during the previous Plan period however, as our only significant geographic hazards are floodplains and floodways. We continue to enforce FEMA regulations for development within a floodplain. There were no major changes in land use over the past 5 years.

In May of 2013 an EF5 tornado impacted the City of Moore and destroyed 808 single family homes, 33 mobile homes, 55 apartments, 36 non-residential buildings and 2 schools. Rebuilding is mostly complete; a major change is that there are now no mobile homes in the city, which decreases vulnerability during severe weather.

MPS was also severely impacted by the 2013 tornado, with the destruction of two elementary schools and damage to a junior high school, information technology center, and the District's administrative service center. Each of these facilities have been rebuilt.

The City of Moore and MPS continues to improve critical infrastructure. MPS has constructed engineered storm shelters at all District venues. The City opened a new Public Safety Center in 2014, housing the Police and Emergency Management Departments, Information Technology, and Municipal Court. This 52,000 sq. ft. facility includes an 8,500 sq. ft. engineered storm shelter for the City's 9-1-1 and Emergency Operations Centers.

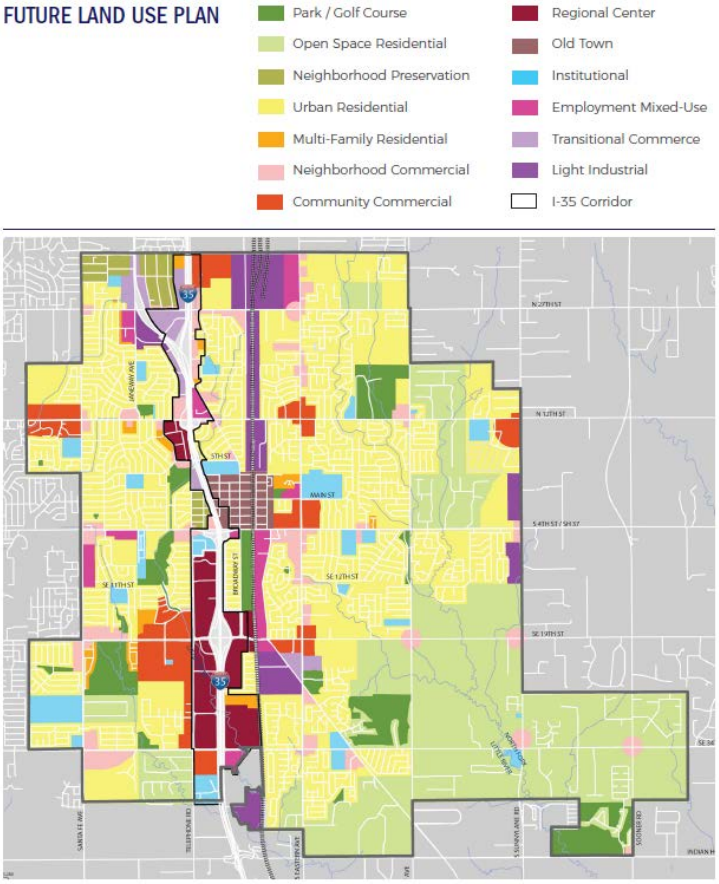

FIGURE 3.1: FUTURE LAND USE MAP

44

The Emergency Management Department continues to add and renovate the City's outdoor warning system, which currently consists of 42 units to cover approximately 25 sq. miles.

The City also opened a new recreation and aquatics center in 2016. New animal shelter and public works facilities are being planned.

The Envision Moore 2040 plan also includes action items to revise and enforce codes and regulations to reduce the risk of flood damage, and to encourage new development to utilize floodplains as open space. The plan also includes implementing low impact development techniques.

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6.3 Status of Previous Mitigation Action Items

The table below lists the status of mitigation items for Moore and MPS listed in the Cleveland County 2013-2018 plan, which included the City of Moore and Moore Public Schools.

Action Items Accomplished – Previous Hazard Mitigation Plan			
Action Project #	**Action Item**	**Hazard Mitigated**	**Status**
1	Individual Safe Room Program	High winds, Tornadoes	Established and administered an individual safe room rebate program using funds from an American Red Cross grant. Provided rebates for 1,600 households in Moore. This phase is complete, however we would certainly offer it again should additional funding become available.
2	Outdoor Warning Devices	High winds, Tornadoes	Ongoing. The City currently has 42 units; maintenance and planned replacement of existing units is ongoing.
4	Community/School Safe Rooms	High Winds, Tornadoes	Complete. Engineered storm shelters have been constructed at all MPS venues.
5	Protective Crosswalks for several schools	Hail, High Winds, Tornadoes, Winter Weather	Ongoing. A crosswalk has been installed at Highland East Jr High; crosswalks continue to be needed at other locations.
6	Weather Monitoring Equipment	All	Complete. The City has a weather monitoring equipment in the Emergency Operations Center Warning Area.
9	Fire Awareness Program	Wildfire	Ongoing. The Fire and Emergency Management departments provide fire awareness education for all types of fires at schools and through CERT classes.
11B	Mass Communication System	All	Complete. Both the City and MPS utilize mass communication systems.
11D	Mass Communication System (Schools)	All	Complete. Both the City and MPS utilize mass communication systems.
12	Wildfire Awareness/Prevention	Wildfire	Ongoing. The Emergency Management Department notifies citizens of high fire danger days and advises of burning restrictions through social media. Burn permits are also required within the city.
13B	Public Awareness/Education	All	Ongoing. The Emergency Management Dept. sponsors CERT classes bi-annually, and regularly distributes hazard information via social media and other public outreach activities.
13D	Public Awareness/Education (Schools)	All	Ongoing. Moore Public Schools regularly conducts drills and exercises and distributes related handouts to students.
16A	Drainage Improvements	Flood	Ongoing. The City has completed drainage projects on SW 34th, Nail Parkway, and Markwell. A new project is set to begin shortly in the Southgate addition. A new Stormwater/Drainage Plan now has identified and prioritized other projects.
22 A & B	Portable Motorist Information Signs	All	The City of Moore has an agreement with ODOT to use their signs whenever needed.
27	Drainage Project (Little River 12th-19th Streets)	Flood	This is a CDBG/Recovery project in progress.

29	Pedestrian Bridge Project	Flood	Completed 2017
30	Drainage Bridge Structure on 34th Street	Flood	Completed November 2019.
32	Citywide Drainage Study	Flood	Completed 2016
33B	Public Education Equipment	Fire	Ongoing. Both the Fire and Emergency Management Depts. have received grants and acquired fire extinguisher simulators. Additional equipment is acquired as needed and funding is available.
33D	Public Education Equipment (Schools)	All	In process/ongoing. The school district acquires education equipment as needed.
34	Public Information/Education on Hail	Hail	Ongoing. The Emergency Management Dept. provides hail safety information via social media, CERT classes and public outreach.
36	Stream Monitoring on the Little River	Flood	Complete. Project is no longer necessary with the November 2019 completion of the 34th St bridge.
37	Cooling Stations/Facilities	Extreme Heat	Ongoing. The city has several cooling stations located at strategic public facilities, and has several methods by which to distribute cooling station locations and details.
39	Extreme Heat Education	Extreme Heat	Ongoing. The Emergency Management Dept distributes information regarding extreme heat mitigation measures via social media.
41	Drainage Project at 1400 Nail Parkway	Flood	Completed 2017
43	Drainage Project at Markwell	Flood	Completed 2017
44A	Repetitive Loss Property Acquisition in Flood Plain	Flood	Complete. The City purchased the only RPL property as part of the 34th St. bridge project.
46B	Web/Apps for Community Outreach	All	Ongoing. The City of Moore utilizes social media and the city website to communicate to the community at large; an app has not yet been developed.
46D	Web/Apps for Community Outreach	All	Ongoing. Moore Public Schools utilizes social media , their website and an alert system to communicate with students and parents.
49	Earthquake Preparedness	Earthquake	Ongoing. The Emergency Management Dept. incorporates earthquake preparedness into public outreach and school education programs; and participates in ShakeOut exercises.
52	Box Structure Fairmoore Park	Flood	Completed 2016
53A	Maintain Floodplain Advisor	Flood	Ongoing. The City of Moore maintains a full-time Floodplain Advisor in the Community Development Department.

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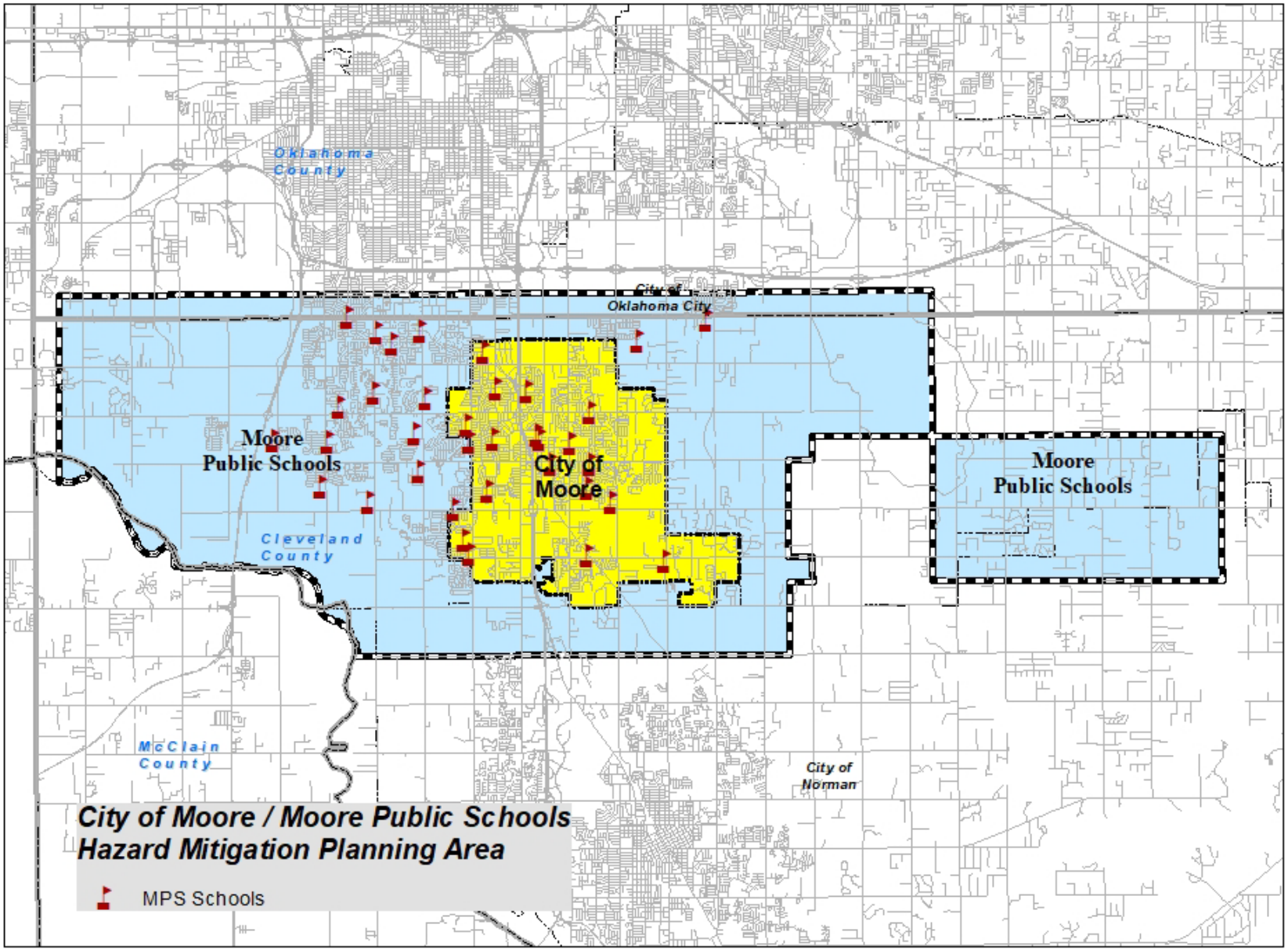
Action Items Not Accomplished – Previous Hazard Mitigation Plan					
Action Item #	**Action Item**	**Hazard Mitigated**	**Jurisdiction Impacted**	**Reason Not Accomplished**	**Item Still Relevant?**
3	Emergency Generator for Critical Facilities	High Winds, Lightning, Tornadoes, Winter Weather	City of Moore, MPS	Have been installed at some City and MPS facilities; pending funding at others	Y
10A	Storm Ready Business	All	City of Moore	Pending	Y
15	Window film on critical facilities	Hail, High Winds, Tornadoes	City of Moore, MPS	Currently in progress at MPS	Y
19	Bury Electrical Distribution Lines	High Winds, Lightning, Tornadoes, Winter Weather	City of Moore	Lack of Funding	Y
22A	Portable Motorist Information Signs	All	City of Moore	Lack of Funding	Y
22B	Portable Motorist Information Signs (Schools)	All	MPS	Lack of Funding	Y
25	Convert Outdoor Warning System to Solar Power	High winds, Tornadoes	City of Moore	Lack of Funding	Y
26	Master UPS for Critical Facilities	All	City of Moore	Lack of Funding	Y
28	Drainage Project with Norman	Flood	City of Moore	Moore portion is complete; however main portion of this project is within City of Norman.	N
31	Shelter for City Vehicles	High Winds, Hail, Lightning, Tornadoes, Winter Weather	City of Moore	Lack of Funding	Y
46B	Web/Apps for Community Outreach	All	City of Moore	Lack of funding, development time, use of other media	N
46D	Web/Apps for Community Outreach (Schools)	All	Moore Public Schools	Lack of funding, development time, use of other media	N
47	Vegetation Management	Flood, Wildfire	City of Moore	Vegetation management is not problematic in Moore	N
51	Snow Fencing	Winter Weather	City of Moore	Project declined	N
55	Safe Room at Brand Senior Center	High winds, Tornadoes	City of Moore	City policy changed; Center closed during weather	N

6.5 Changes in Jurisdictional Priorities

The only change in priorities of note is the updated framing code that requires all new construction to meet wind resistance up to an EF2.

Appendix A: City of Moore & Moore Public Schools Planning Area



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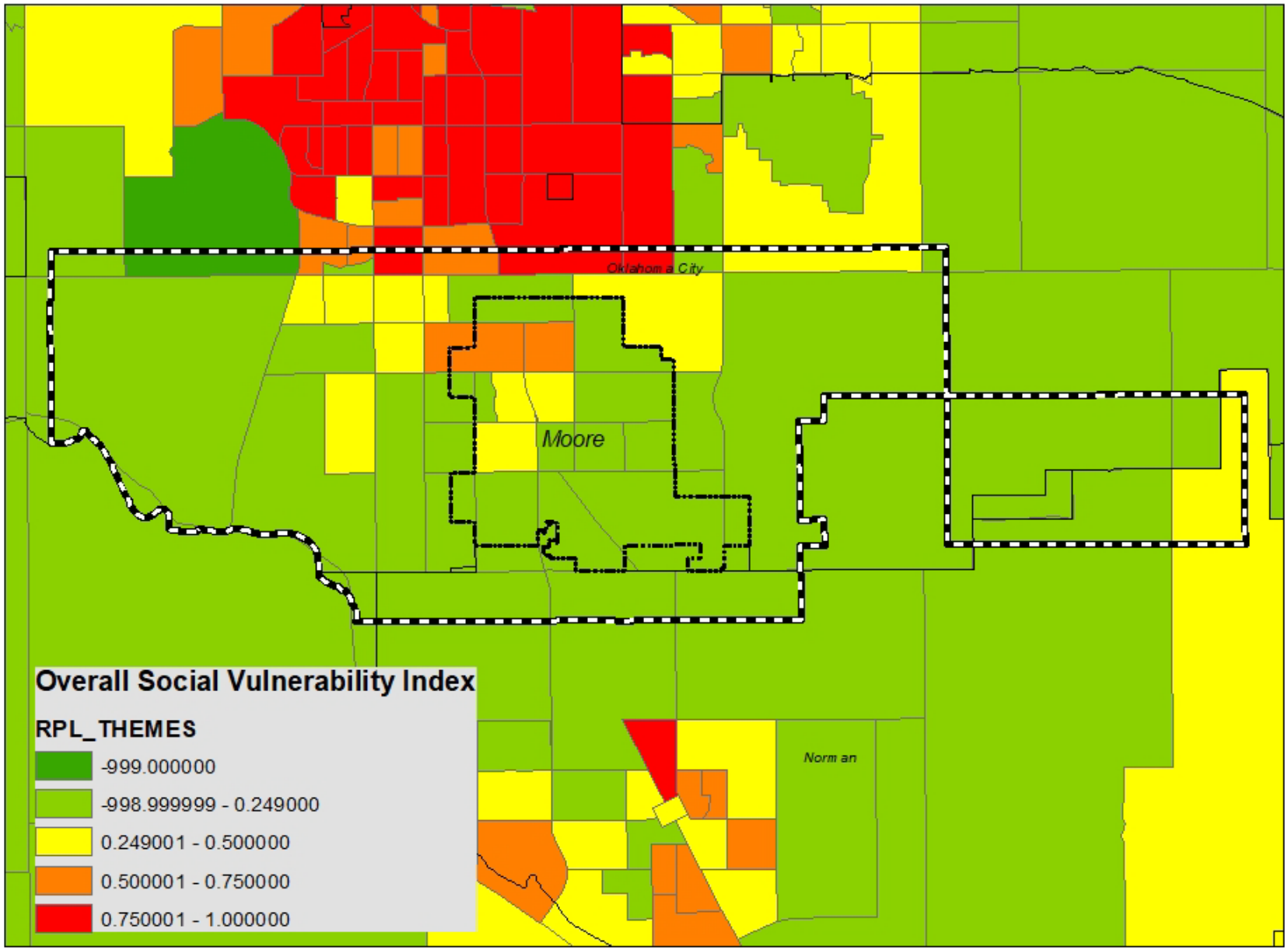
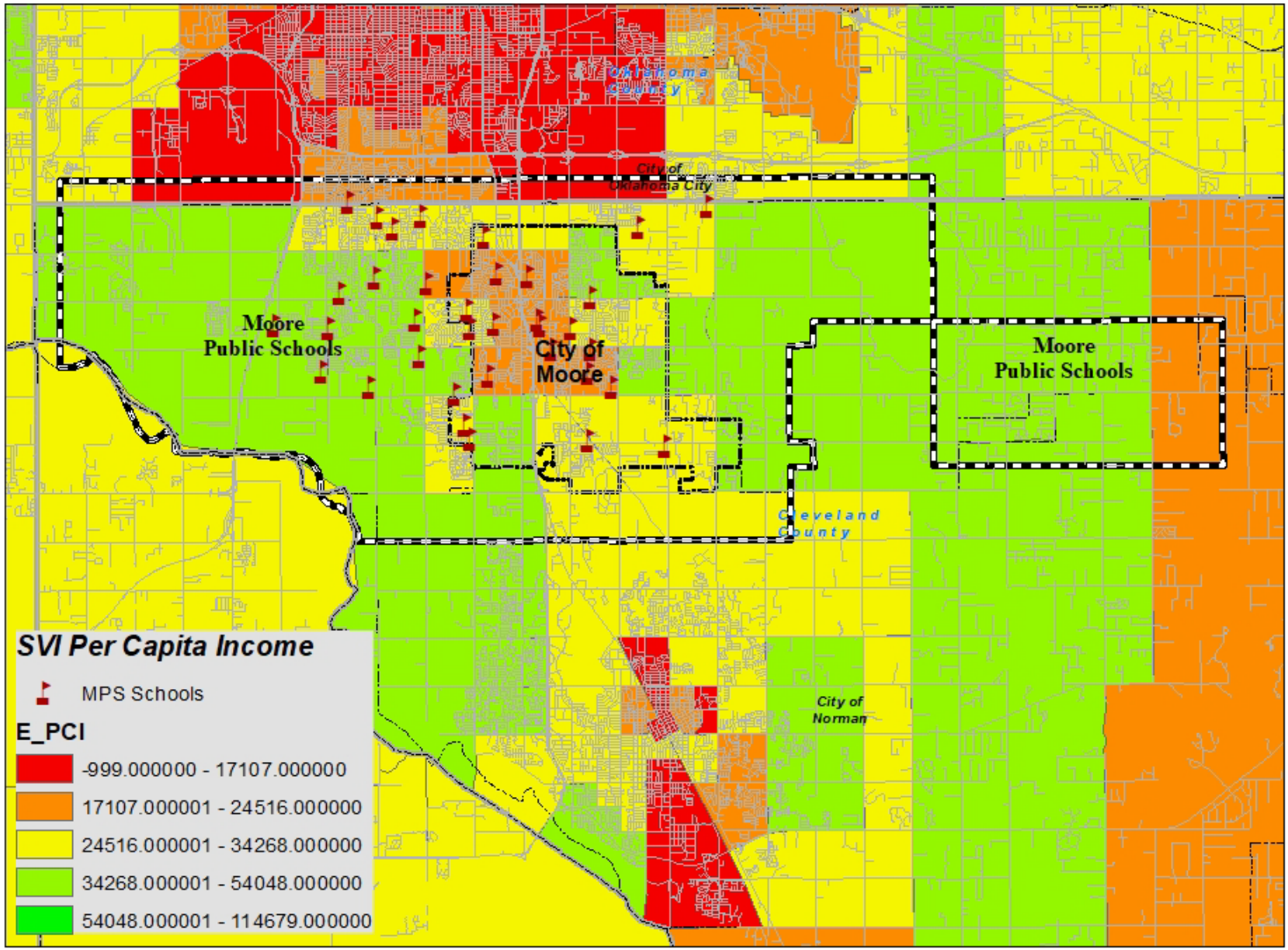
Appendix B: Social Vulnerability Index




Oklahoma County
City of Oklahoma City
Moore Public Schools
City of Moore
Moore Public Schools
Cleveland County
City of Norman
SVI Per Capita Income
MPS Schools
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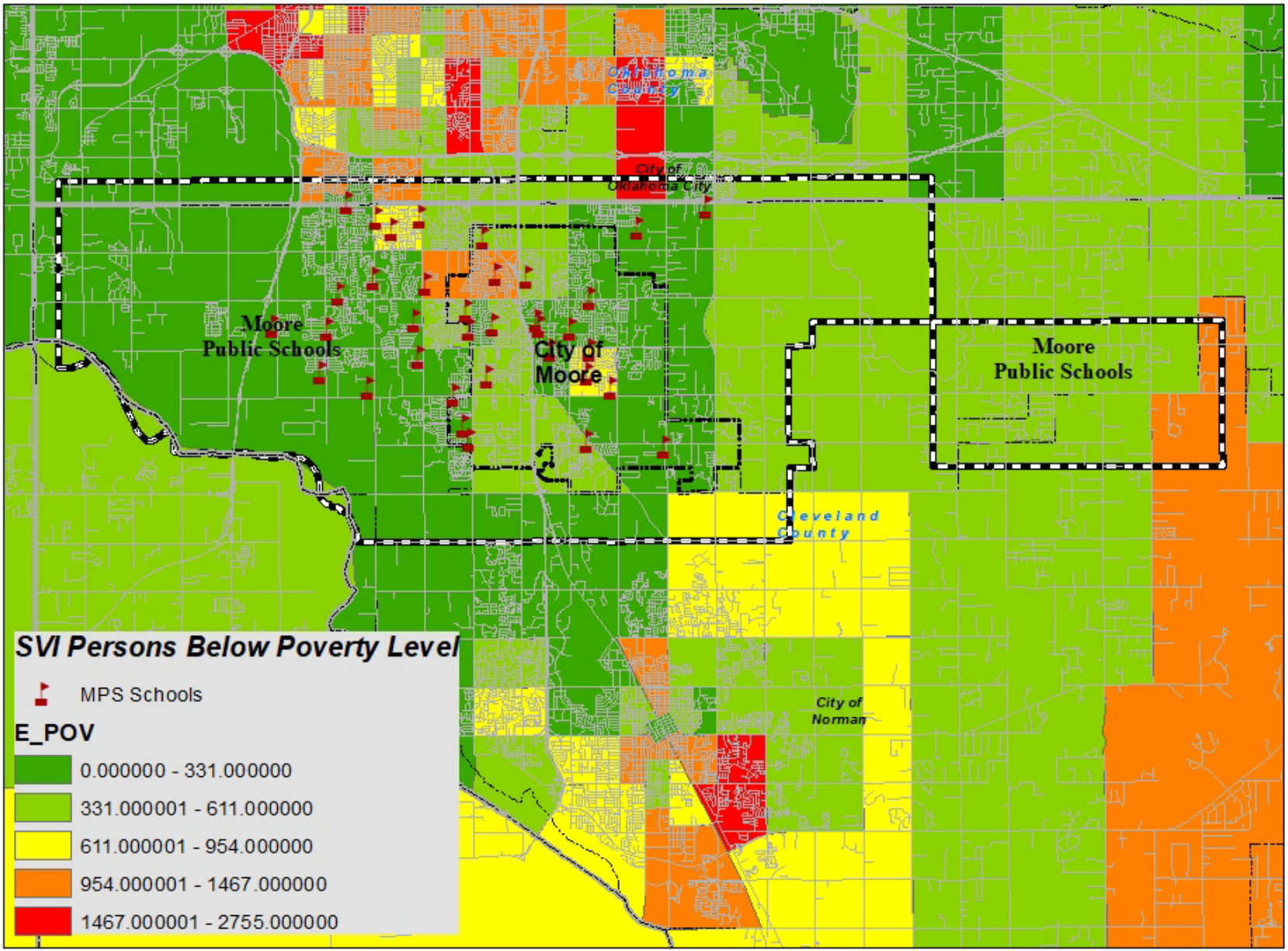
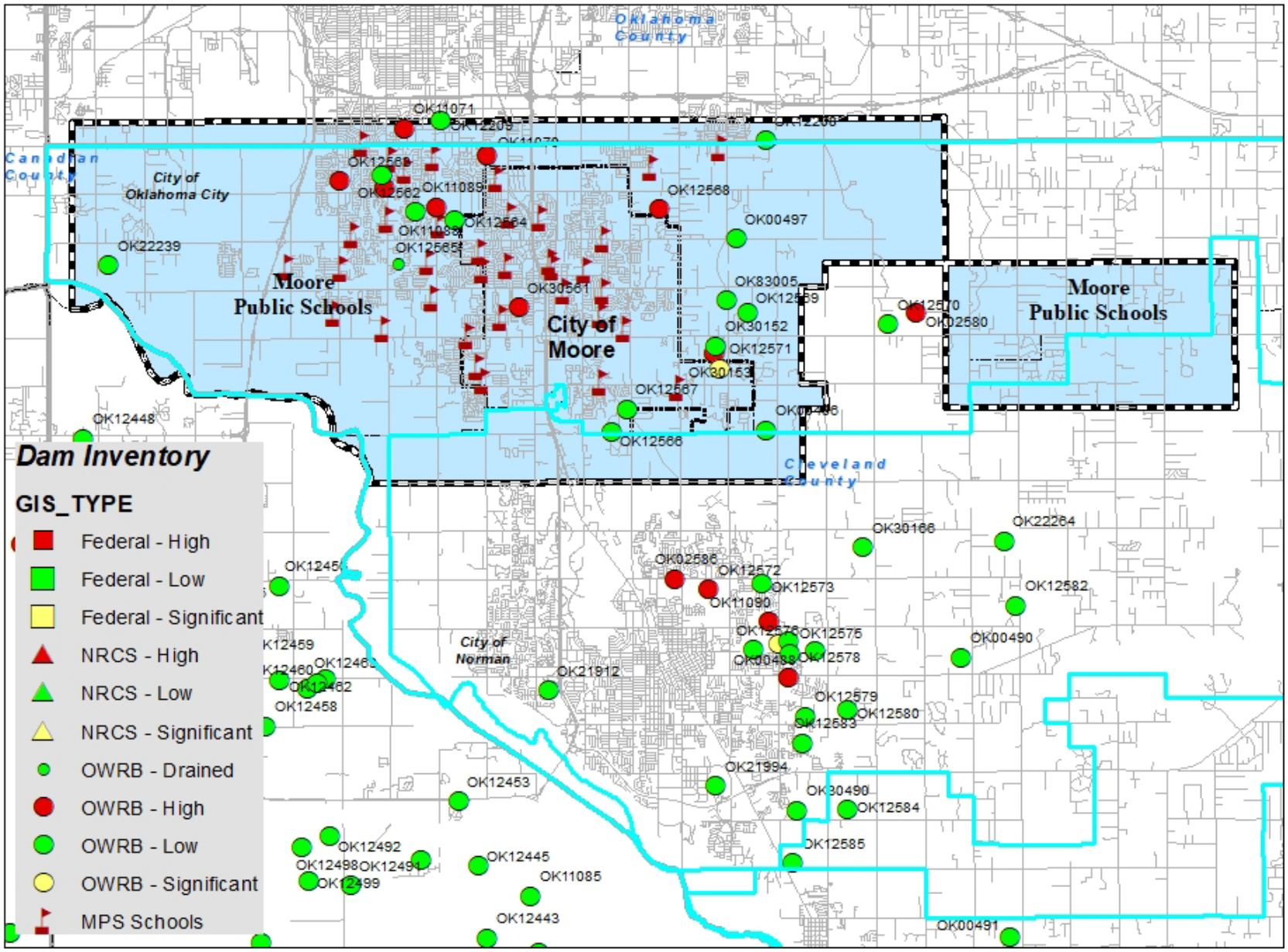
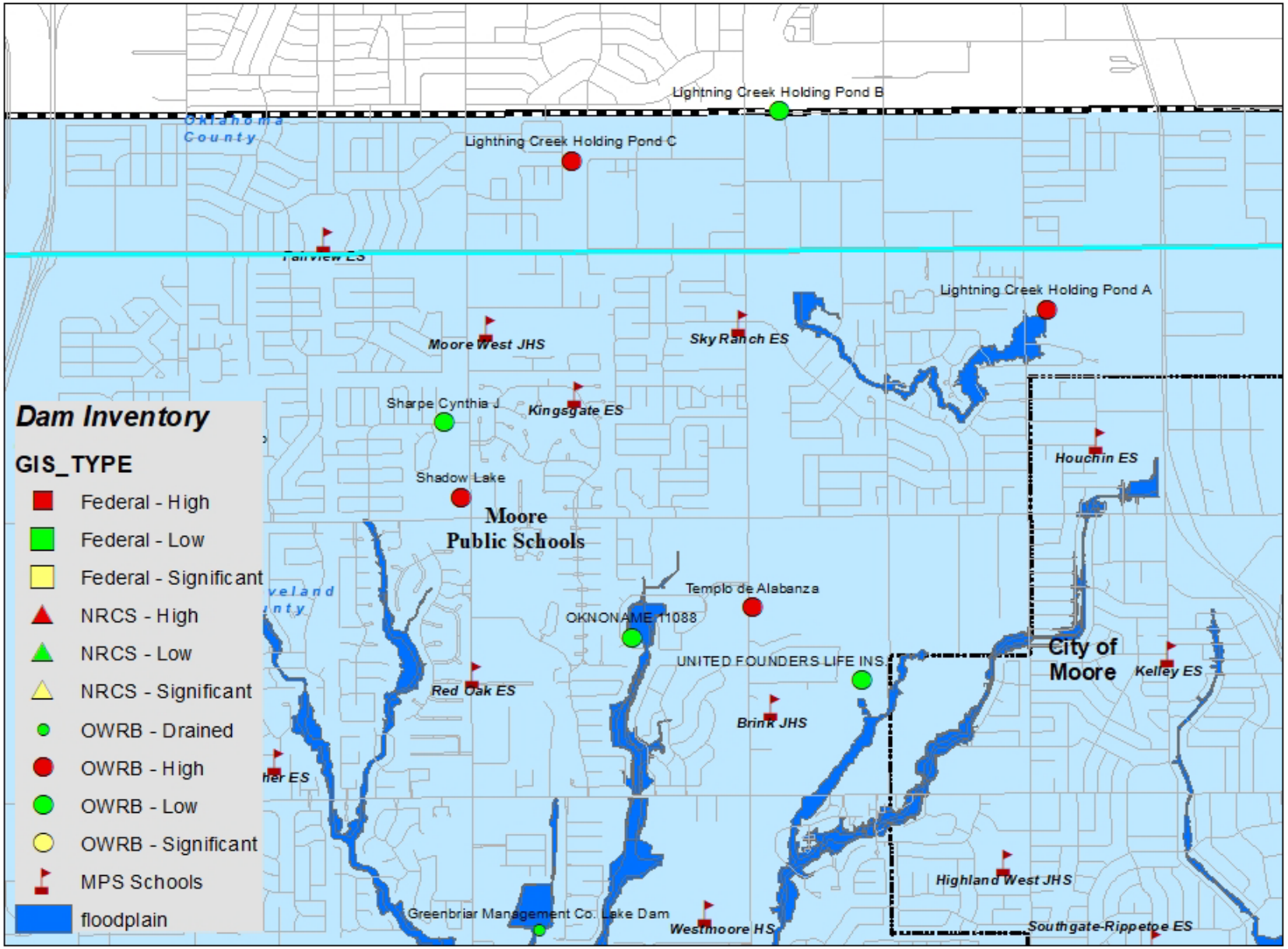
34268.000001 - 54048.000000
54048.000001 - 114679.000000


Oklahoma County
City of Oklahoma City
Moore Public Schools
City of Moore
Moore Public Schools
Cleveland County
City of Norman
SVI Persons Below Poverty Level
MPS Schools
E_POV
0.000000 - 331.000000
331.000001 - 611.000000
611.000001 - 954.000000
954.000001 - 1467.000000
1467.000001 - 2755.000000

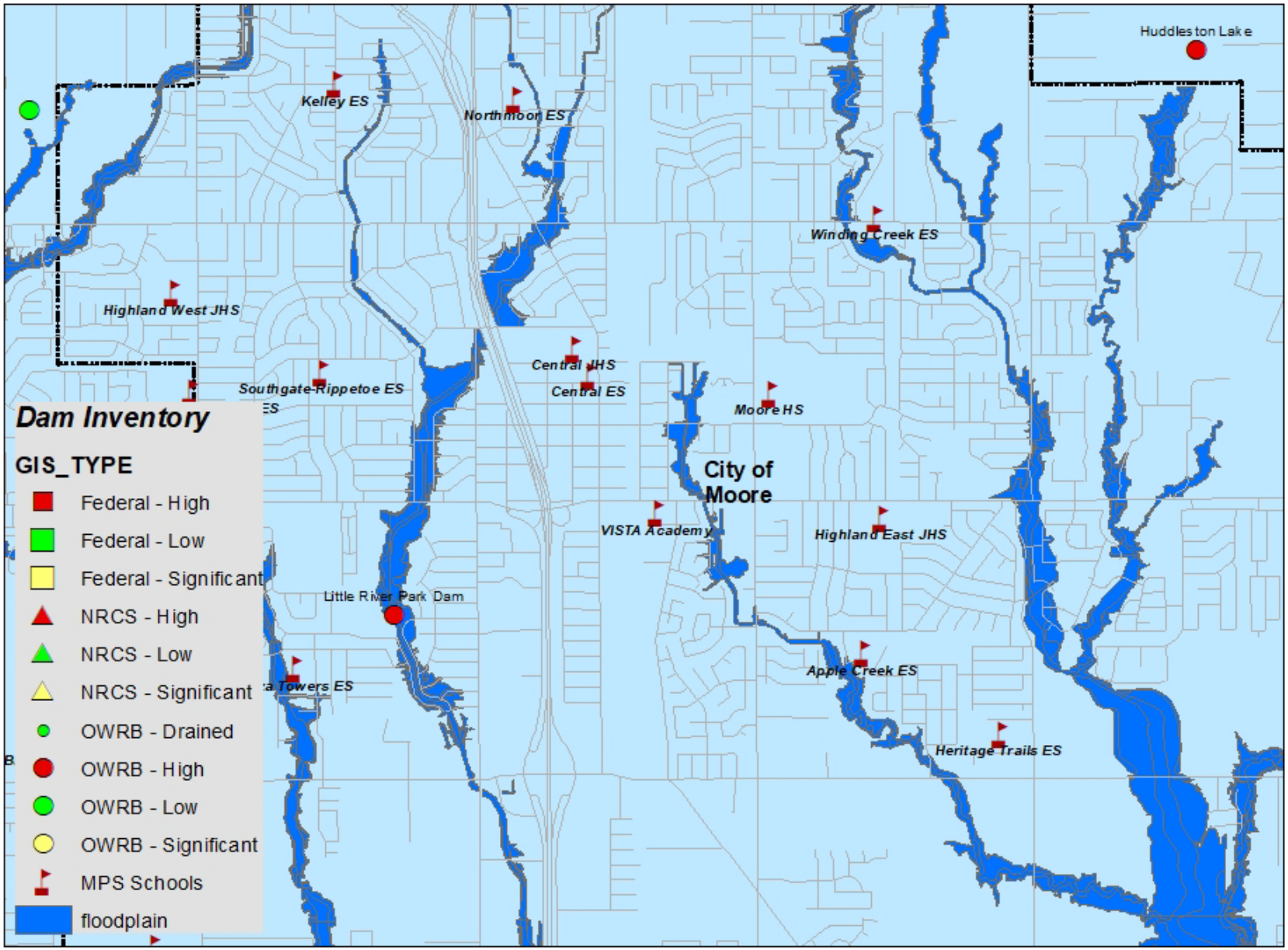
Page intentionally blank

Appendix C: Dams in the City of Moore/MPS Planning Area





Northwest section of Planning Area



Central section of Planning Area

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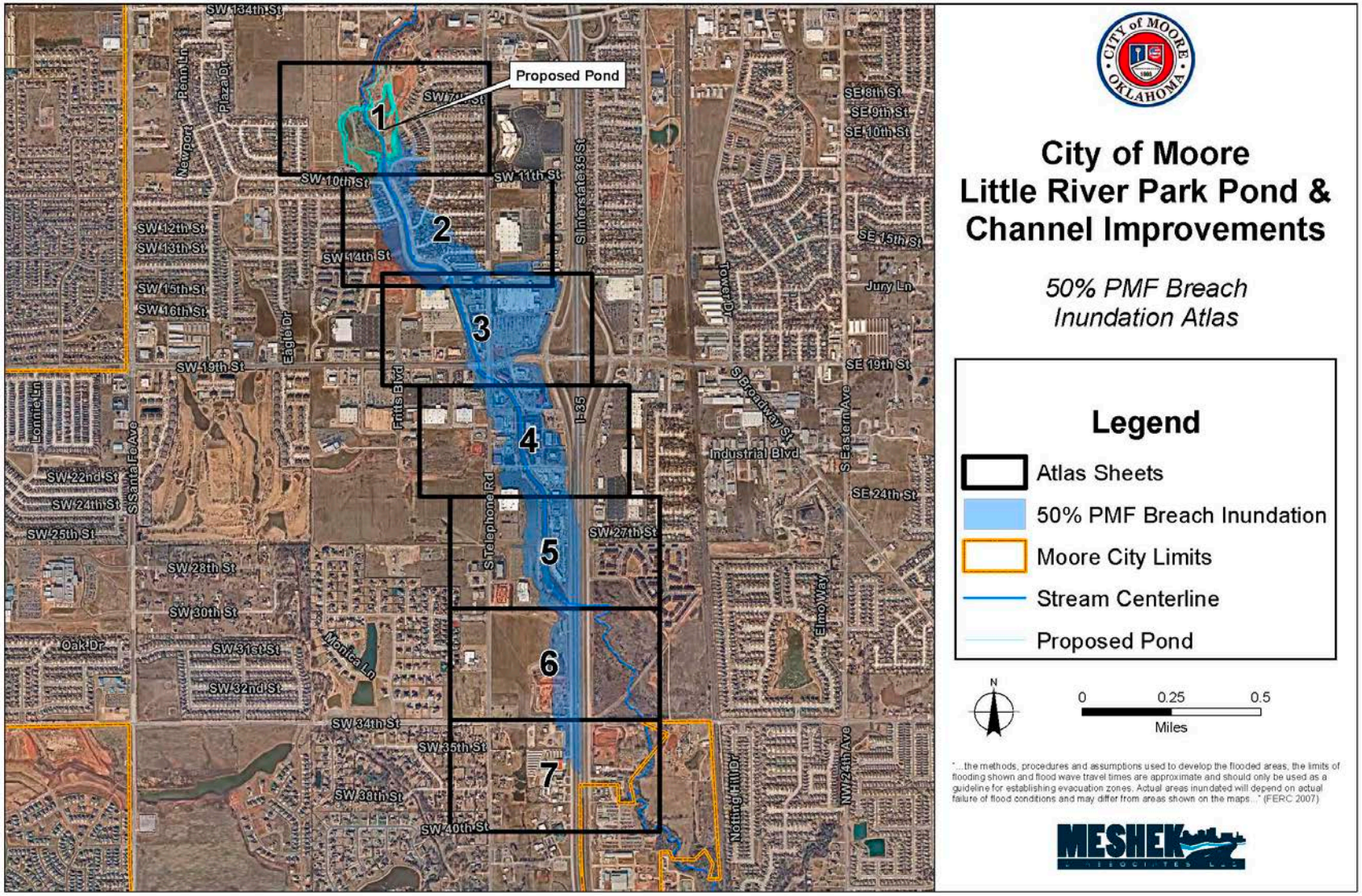
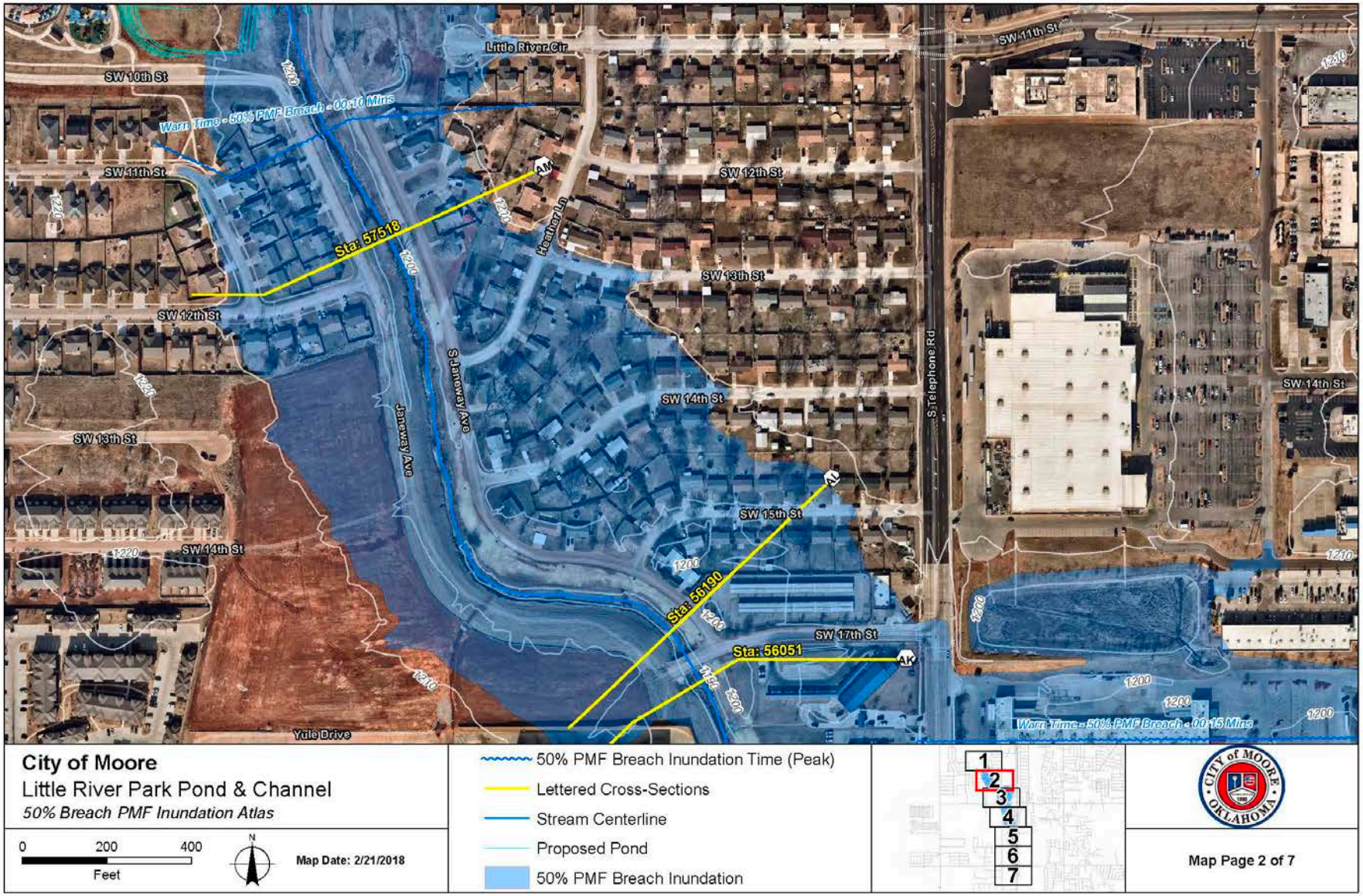
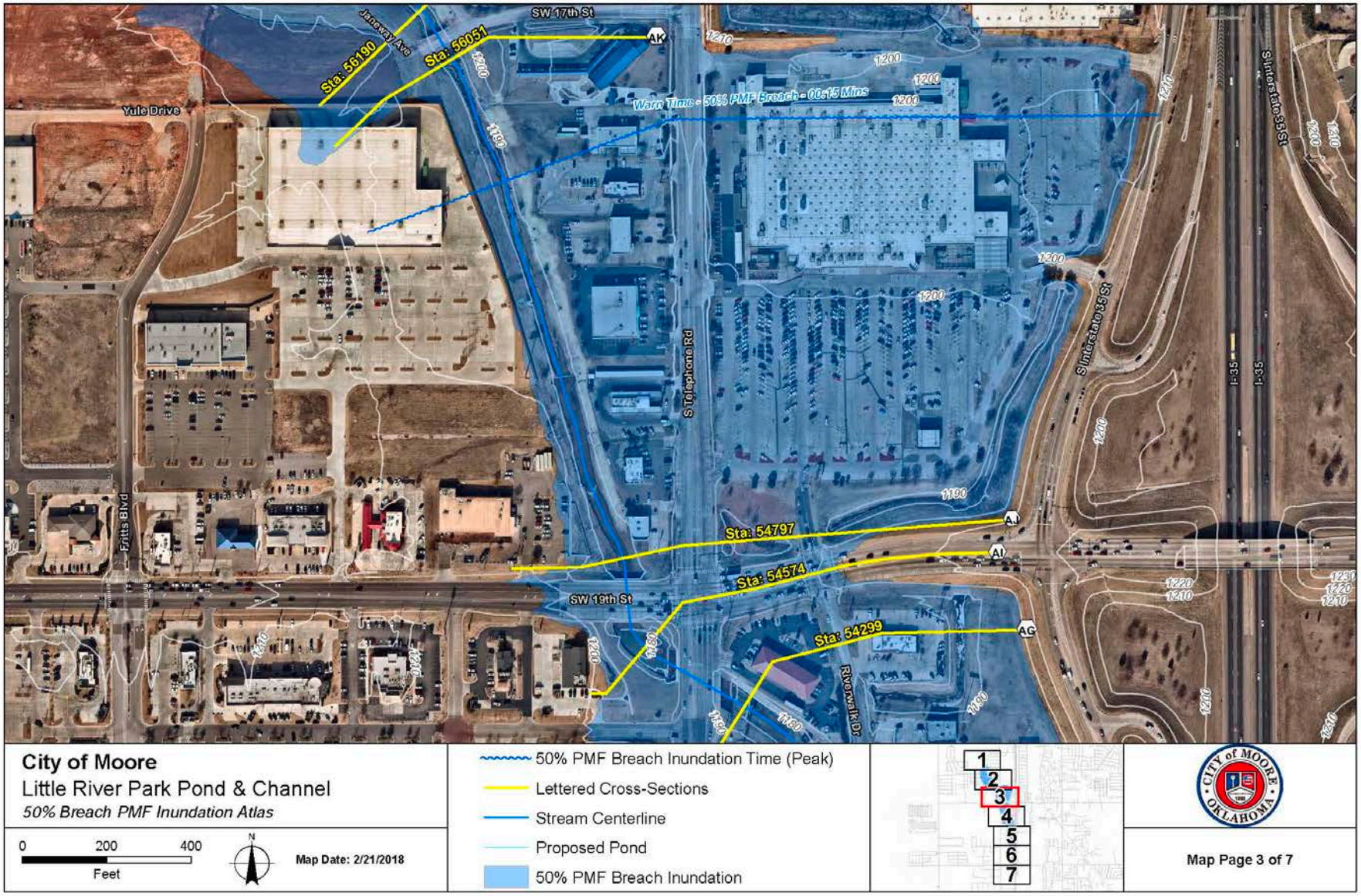
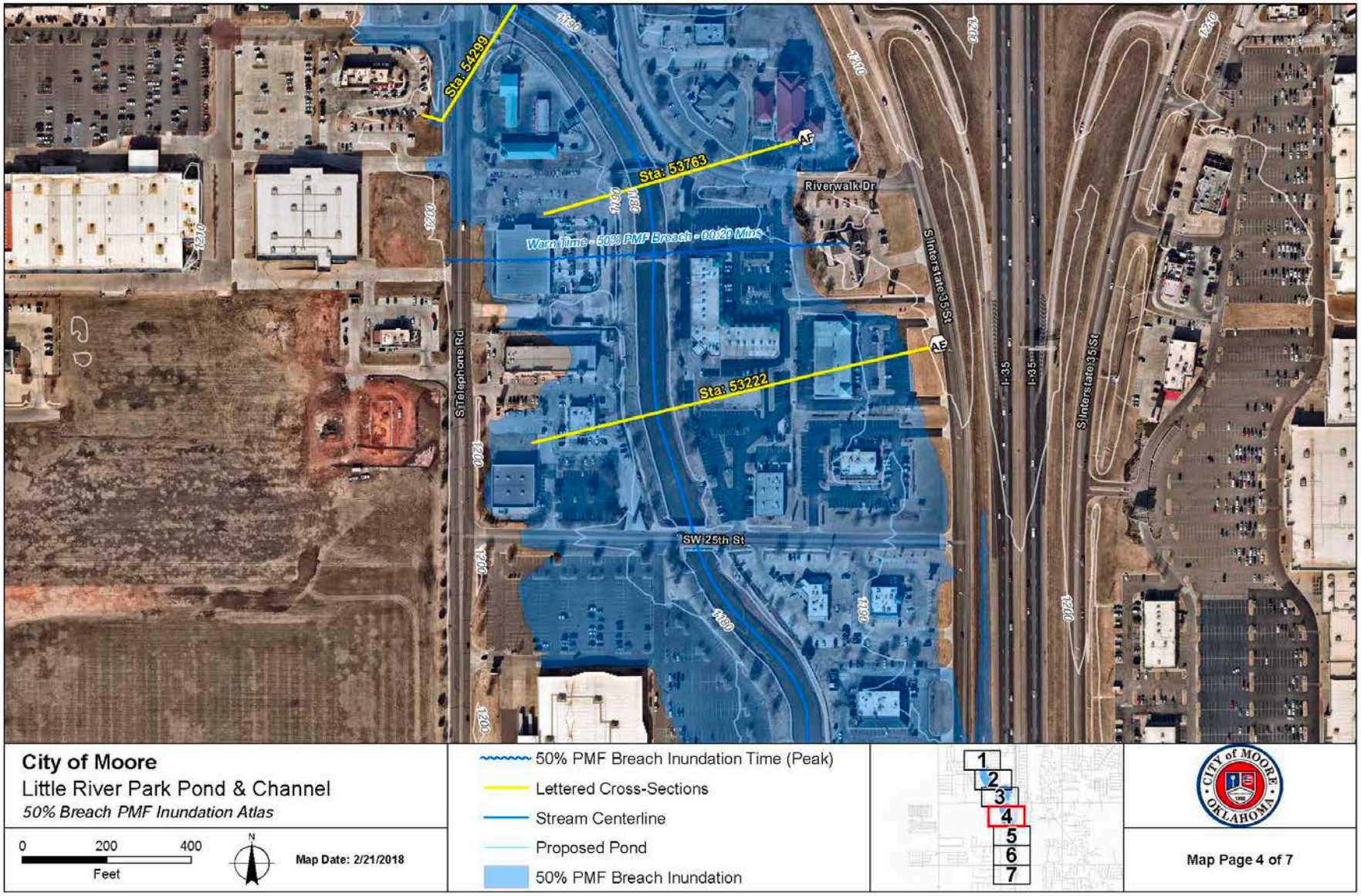
Appendix D: Little River Dam Inundation Maps and Information




City of Moore
Little River Park Pond & Channel
50% Breach PMF Inundation Atlas
0 200 400
Feet
N
Map Date: 2/21/2018
50% PMF Breach Inundation Time (Peak)
Lettered Cross-Sections
Stream Centerline
Proposed Pond
50% PMF Breach Inundation
1 2 3 4 5 6 7
Map Page 1 of 7
Warn Time - 50% PMF Breach - 00:09 Mins
SW 6th St
Heather Ln
Kings Manor
S Telephone Rd
SW 7th St
SW 8th St
SW 9th St
SW 10th St
Cardan Pl
Ridgeway Dr
Saint Cecil
S Janeway Ave
1220
1210
1200


Little River Cir
SW 10th St
SW 11th St
SW 12th St
SW 13th St
SW 14th St
SW 15th St
SW 17th St
Heather Ln
S Janeway Ave
Janeway Ave
S Telephone Rd
Warn Time - 50% PMF Breach - 00:10 Mins
Sta: 57518
Sta: 56190
Sta: 56051
Warn Time - 50% PMF Breach - 00:15 Mins
Yule Drive
City of Moore
Little River Park Pond & Channel
50% Breach PMF Inundation Atlas
0 200 400
Feet
N
Map Date: 2/21/2018
50% PMF Breach Inundation Time (Peak)
Lettered Cross-Sections
Stream Centerline
Proposed Pond
50% PMF Breach Inundation
1 2 3 4 5 6 7
CITY of MOORE OKLAHOMA
Map Page 2 of 7

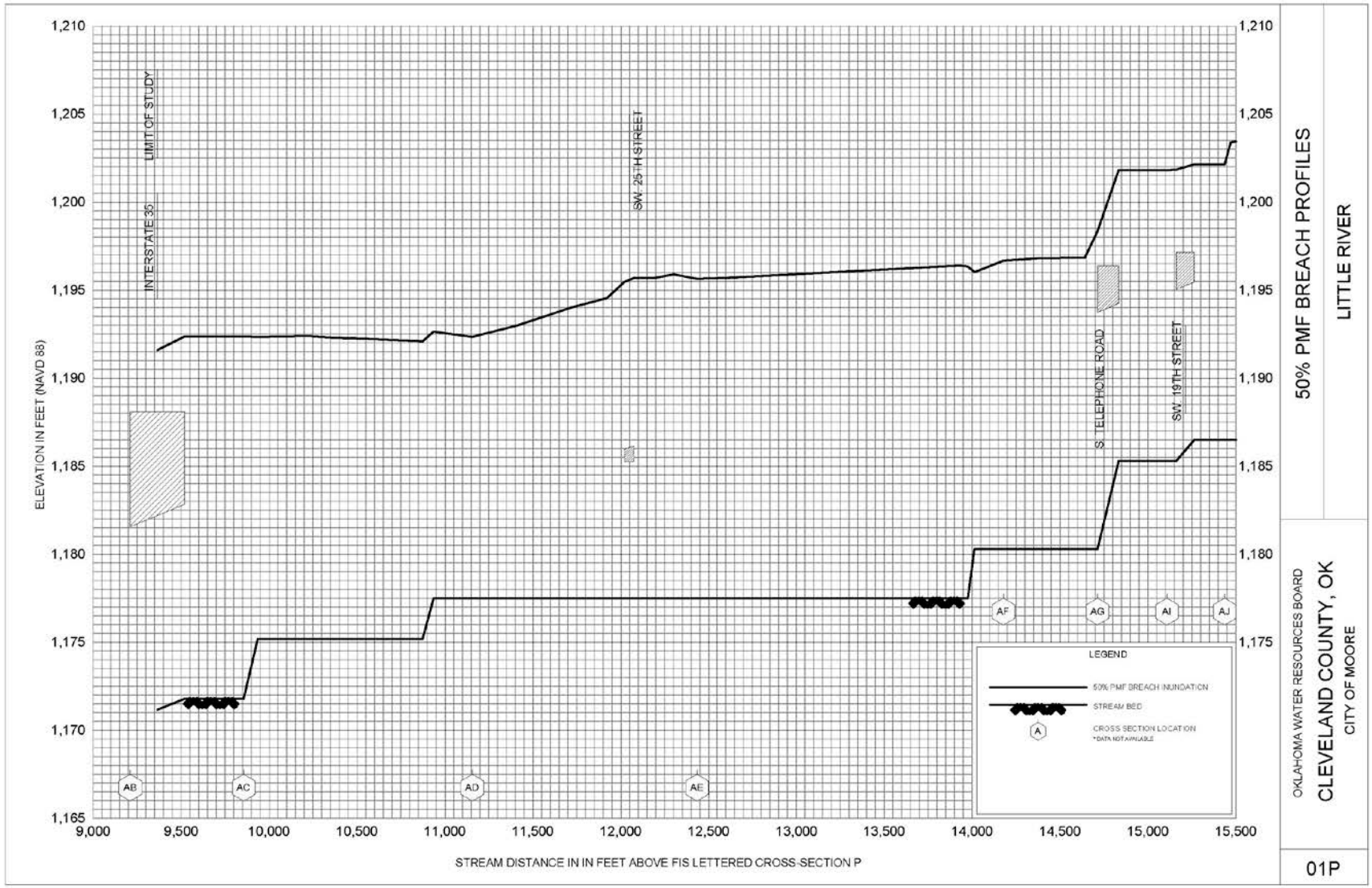

SW 17th St
Janeway Ave
Sta: 56190
Sta: 56051
AK
Yule Drive
Warn Time = 50% PMF Breach = 00:15 Mins
S Interstate 35 St
I-35
S Telephone Rd
Fritts Blvd
Sta: 54797
AJ
AI
Sta: 54574
SW 19th St
Sta: 54299
AG
Riverwalk Dr
City of Moore
Little River Park Pond & Channel
50% Breach PMF Inundation Atlas
0 200 400
Feet
N
Map Date: 2/21/2018
50% PMF Breach Inundation Time (Peak)
Lettered Cross-Sections
Stream Centerline
Proposed Pond
50% PMF Breach Inundation
1 2 3 4 5 6 7
CITY of MOORE OKLAHOMA
Map Page 3 of 7

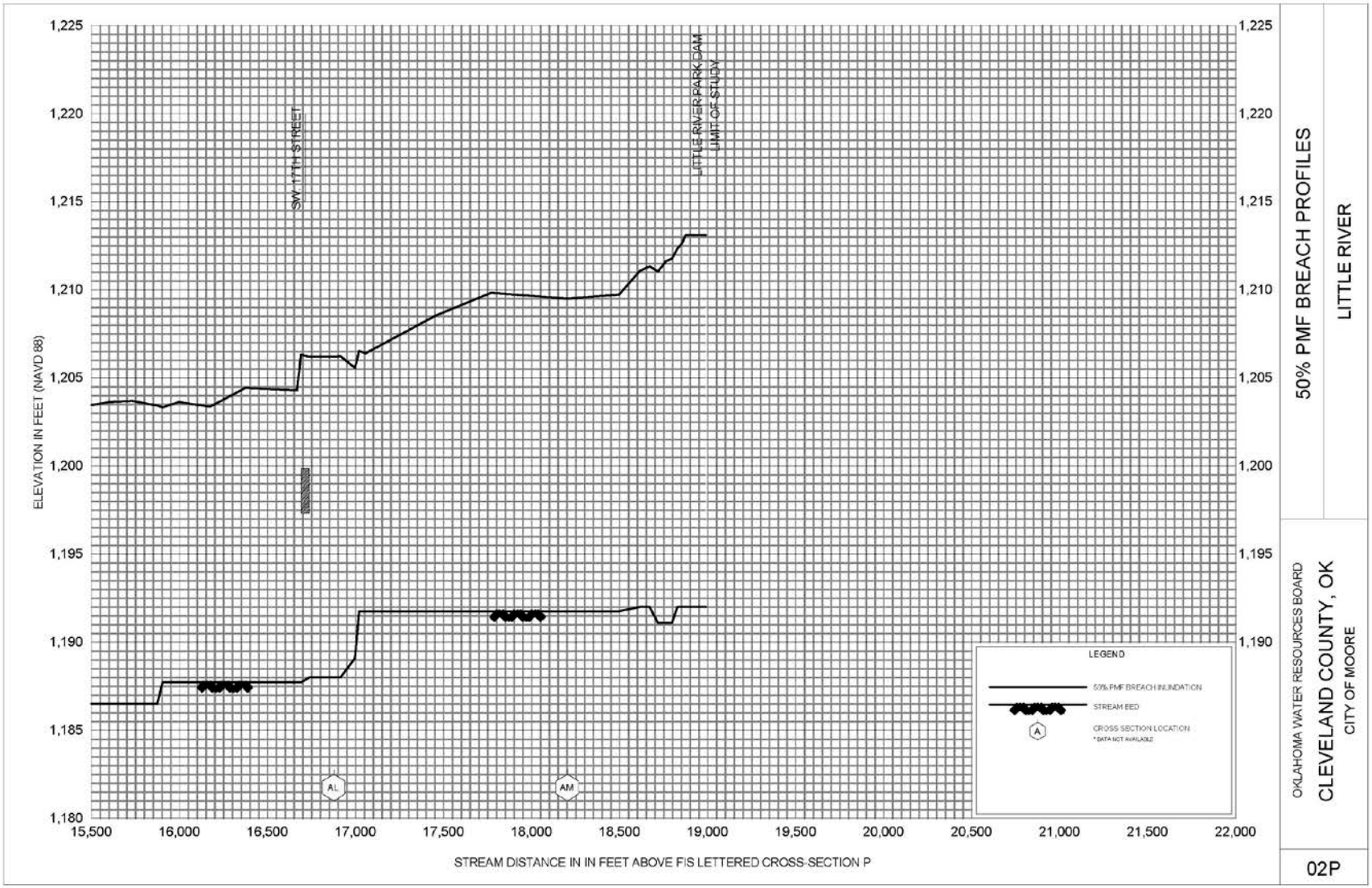

Sta: 54299
Sta: 53763
Sta: 53222
AF
AE
Riverwalk Dr
Warm Time - 50% PMF Breach - 00:20 Mins
S Telephone Rd
S Interstate 35 St
I-35
SW 25th St
City of Moore
Little River Park Pond & Channel
50% Breach PMF Inundation Atlas
0 200 400
Feet
N
Map Date: 2/21/2018
50% PMF Breach Inundation Time (Peak)
Lettered Cross-Sections
Stream Centerline
Proposed Pond
50% PMF Breach Inundation
1 2 3 4 5 6 7
CITY of MOORE OKLAHOMA
Map Page 4 of 7


Sta: 51999
Sta: 50697
Sta: 50363
S Interstate 35 St
I-35
S Telephone Rd
Magnolia Ct
Sycamore Ct
SW 27th St
26th St
Crystal Dr
City of Moore
Little River Park Pond & Channel
50% Breach PMF Inundation Atlas
0 200 400
Feet
N
Map Date: 2/21/2018
50% PMF Breach Inundation Time (Peak)
Lettered Cross-Sections
Stream Centerline
Proposed Pond
50% PMF Breach Inundation
1 2 3 4 5 6 7
CITY of MOORE OKLAHOMA
Map Page 5 of 7

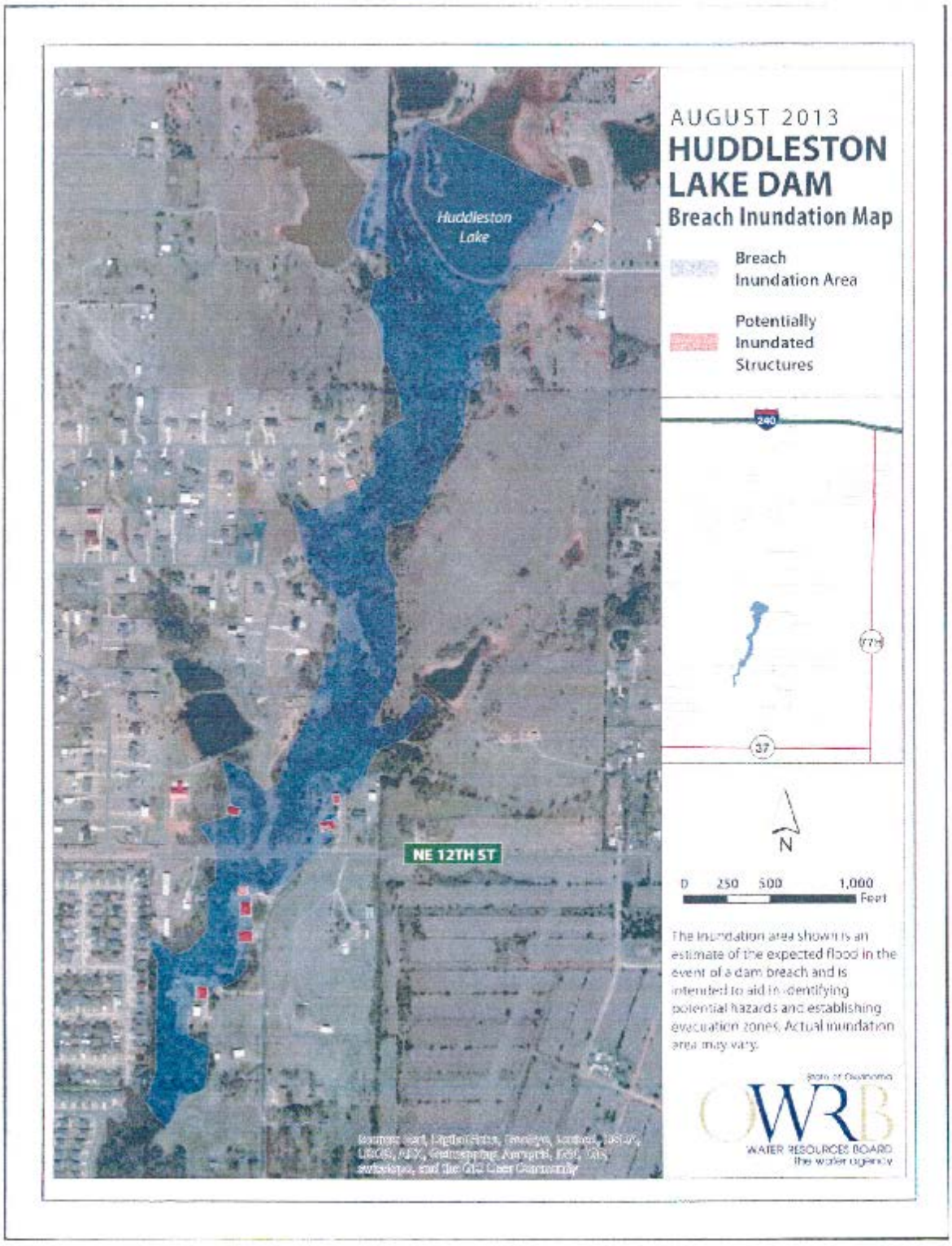

Willow Bend Blvd
Sycamore Ct
Sycamore Dr
S Telephone Rd
Sta: 50697
S Interstate 35 St
Sta: 50363
I-35
SW 34th St
W Bethel Rd
1190
1180
1170
1160
City of Moore
Little River Park Pond & Channel
50% Breach PMF Inundation Atlas
0 200 400
Feet
N
Map Date: 2/21/2018
50% PMF Breach Inundation Time (Peak)
Lettered Cross-Sections
Stream Centerline
Proposed Pond
50% PMF Breach Inundation
1
2
3
4
5
6
7
CITY of MOORE OKLAHOMA
Map Page 6 of 7


SW 34th St
W Bethel Rd
SW 35th St
SW 38th St
SW 40th St
S Telephone Rd
36th Ave NW
S Interstate 35 St
I-35
N Interstate Dr
Sta: 50363
1190
1180
1170
1160
City of Moore
Little River Park Pond & Channel
50% Breach PMF Inundation Atlas
0 200 400
Feet
N
Map Date: 2/21/2018
50% PMF Breach Inundation Time (Peak)
Lettered Cross-Sections
Stream Centerline
Proposed Pond
50% PMF Breach Inundation
1
2
3
4
5
6
7
Map Page 7 of 7


50% PMF BREACH PROFILES
LITTLE RIVER
OKLAHOMA WATER RESOURCES BOARD
CLEVELAND COUNTY, OK
CITY OF MOORE
01P
ELEVATION IN FEET (NAVD 88)
STREAM DISTANCE IN IN FEET ABOVE FIS LETTERED CROSS-SECTION P
1,210
1,205
1,200
1,195
1,190
1,185
1,180
1,175
1,170
1,165
9,000
9,500
10,000
10,500
11,000
11,500
12,000
12,500
13,000
13,500
14,000
14,500
15,000
15,500
LIMIT OF STUDY
INTERSTATE 35
SW 25TH STREET
S TELEPHONE ROAD
SW 19TH STREET
AB
AC
AD
AE
AF
AG
AI
AJ
LEGEND
50% PMF BREACH INUNDATION
STREAM BED
A
CROSS SECTION LOCATION
*DATA NOT AVAILABLE


50% PMF BREACH PROFILES
LITTLE RIVER
OKLAHOMA WATER RESOURCES BOARD
CLEVELAND COUNTY, OK
CITY OF MOORE
02P
ELEVATION IN FEET (NAVD 88)
STREAM DISTANCE IN IN FEET ABOVE FIS LETTERED CROSS-SECTION P
SW 17TH STREET
LITTLE RIVER PARK DAM
LIMIT OF STUDY
AL
AM
LEGEND
50% PMF BREACH INUNDATION
STREAM BED
CROSS-SECTION LOCATION
* DATA NOT AVAILABLE
1,225
1,220
1,215
1,210
1,205
1,200
1,195
1,190
1,185
1,180
15,500
16,000
16,500
17,000
17,500
18,000
18,500
19,000
19,500
20,000
20,500
21,000
21,500
22,000

Appendix E: Huddleston Dam Failure Inundation Area



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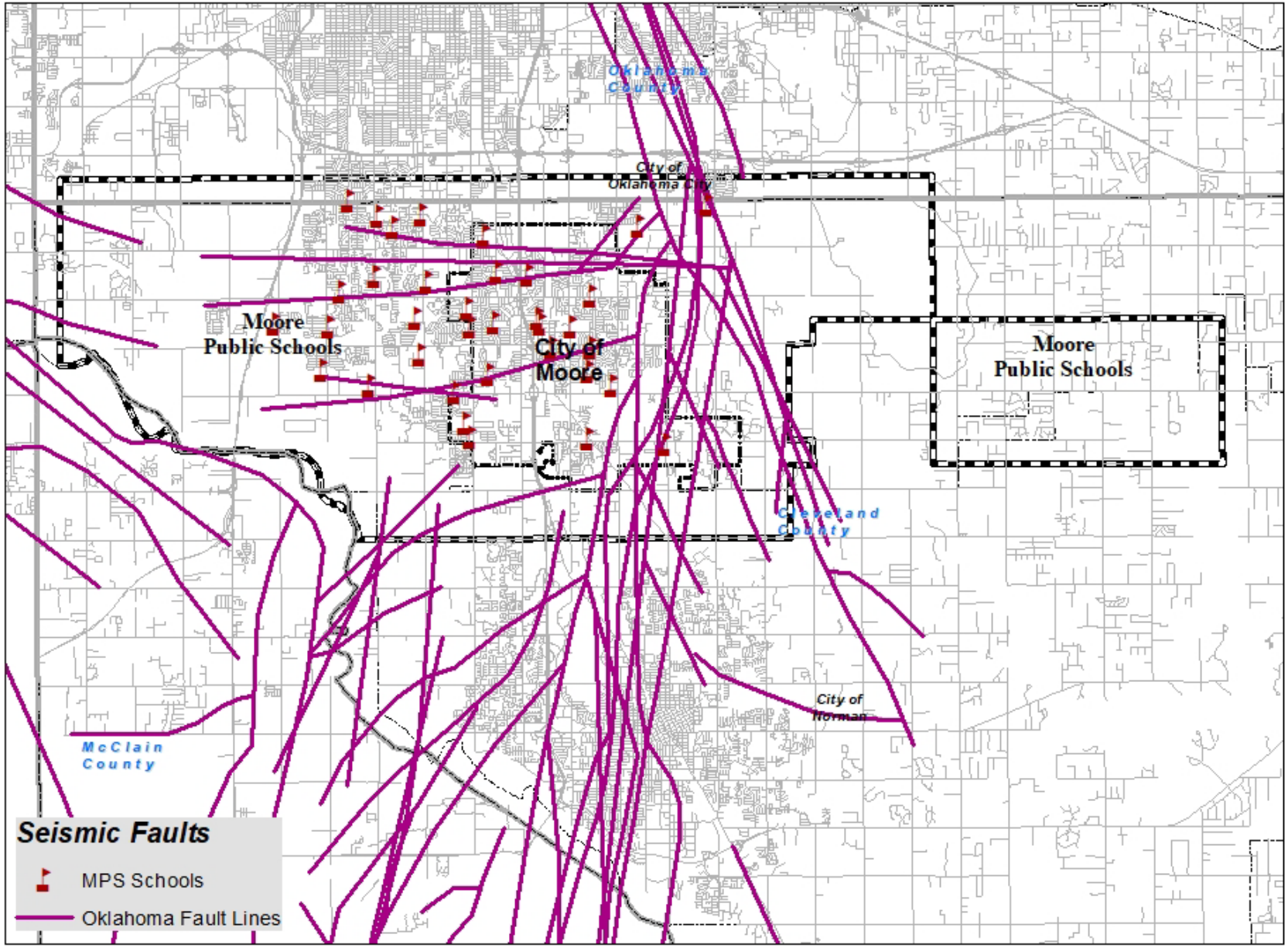
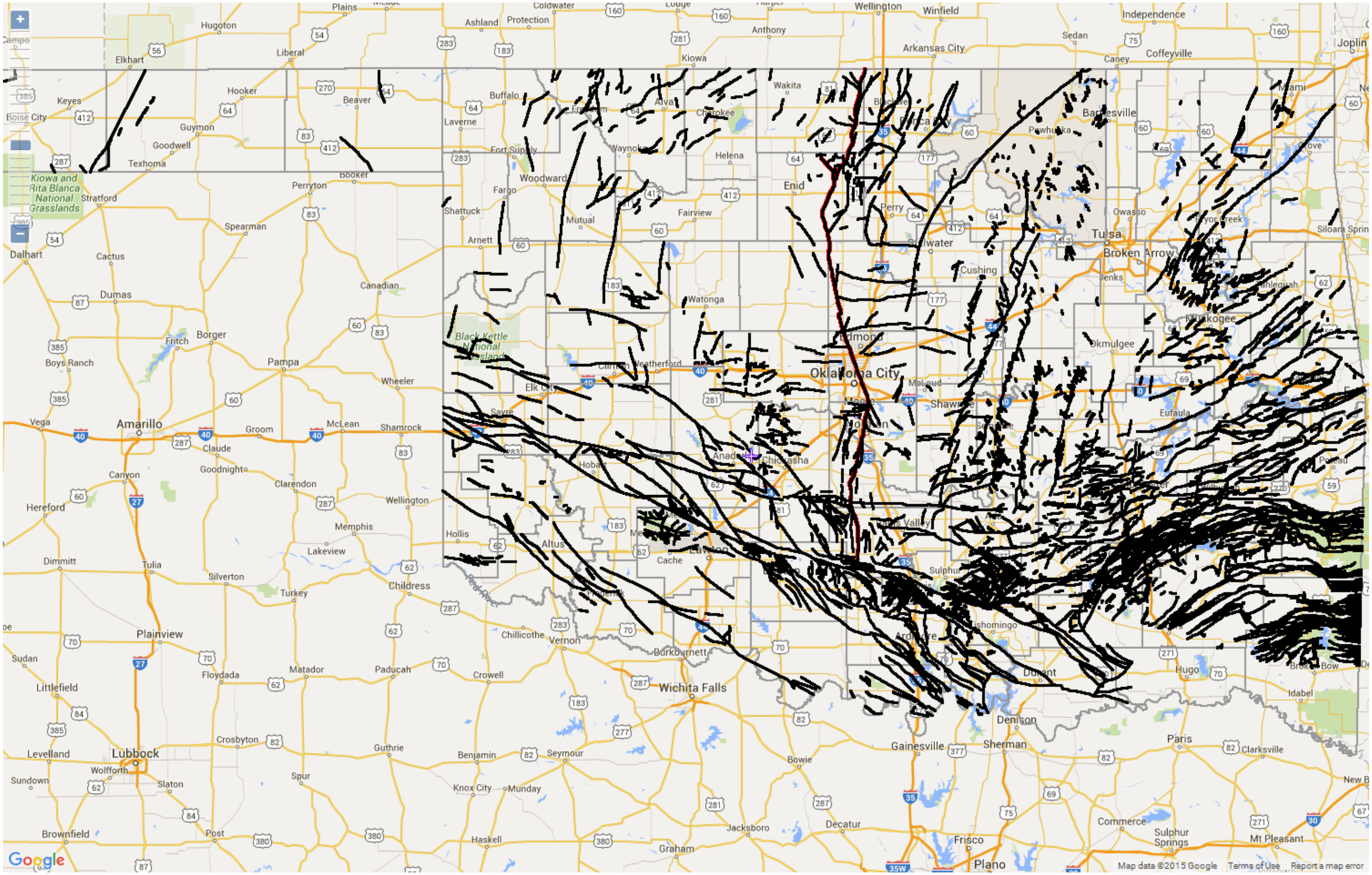
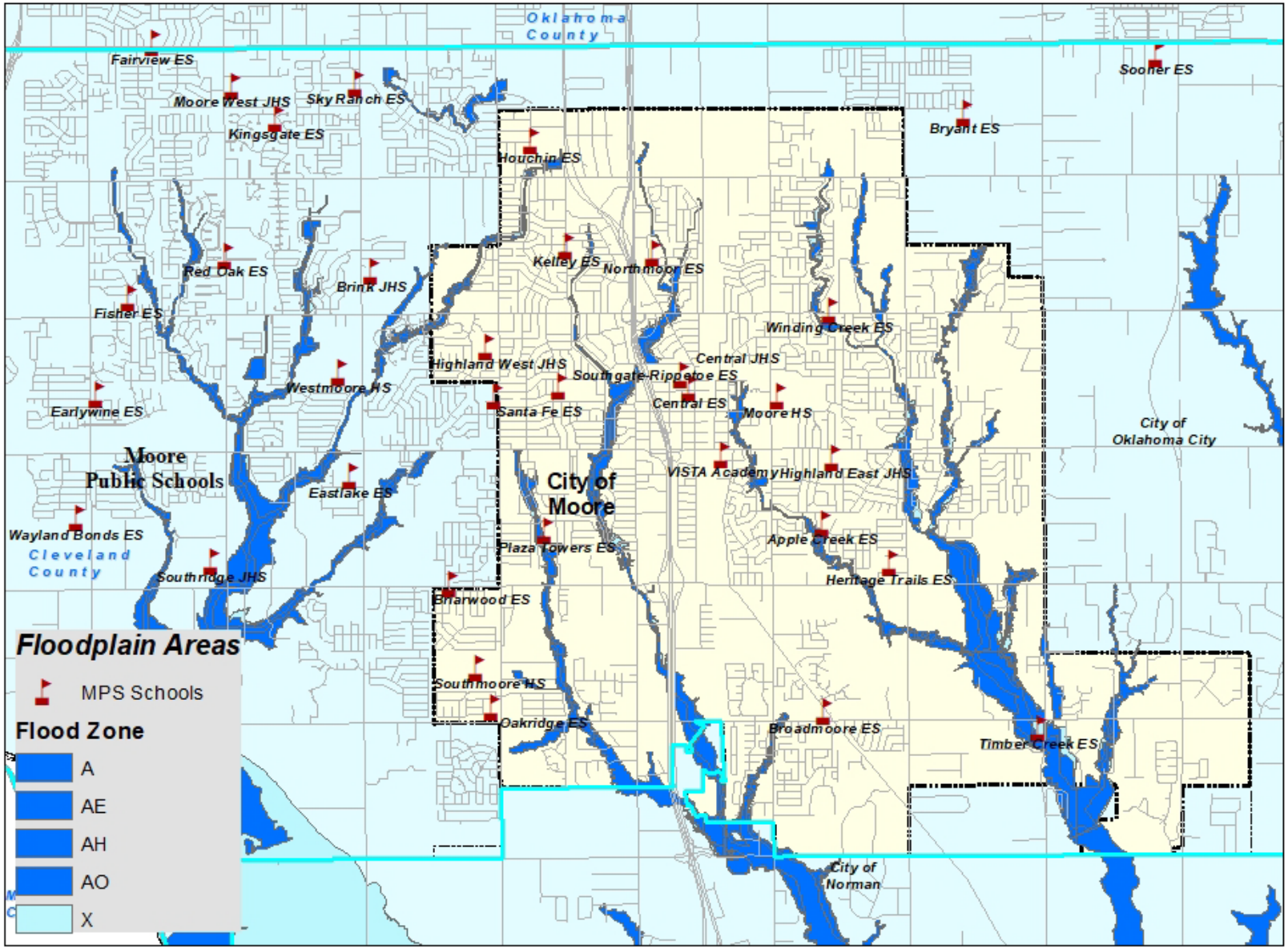
Appendix F: Seismic Faults in the Planning Area, Oklahoma



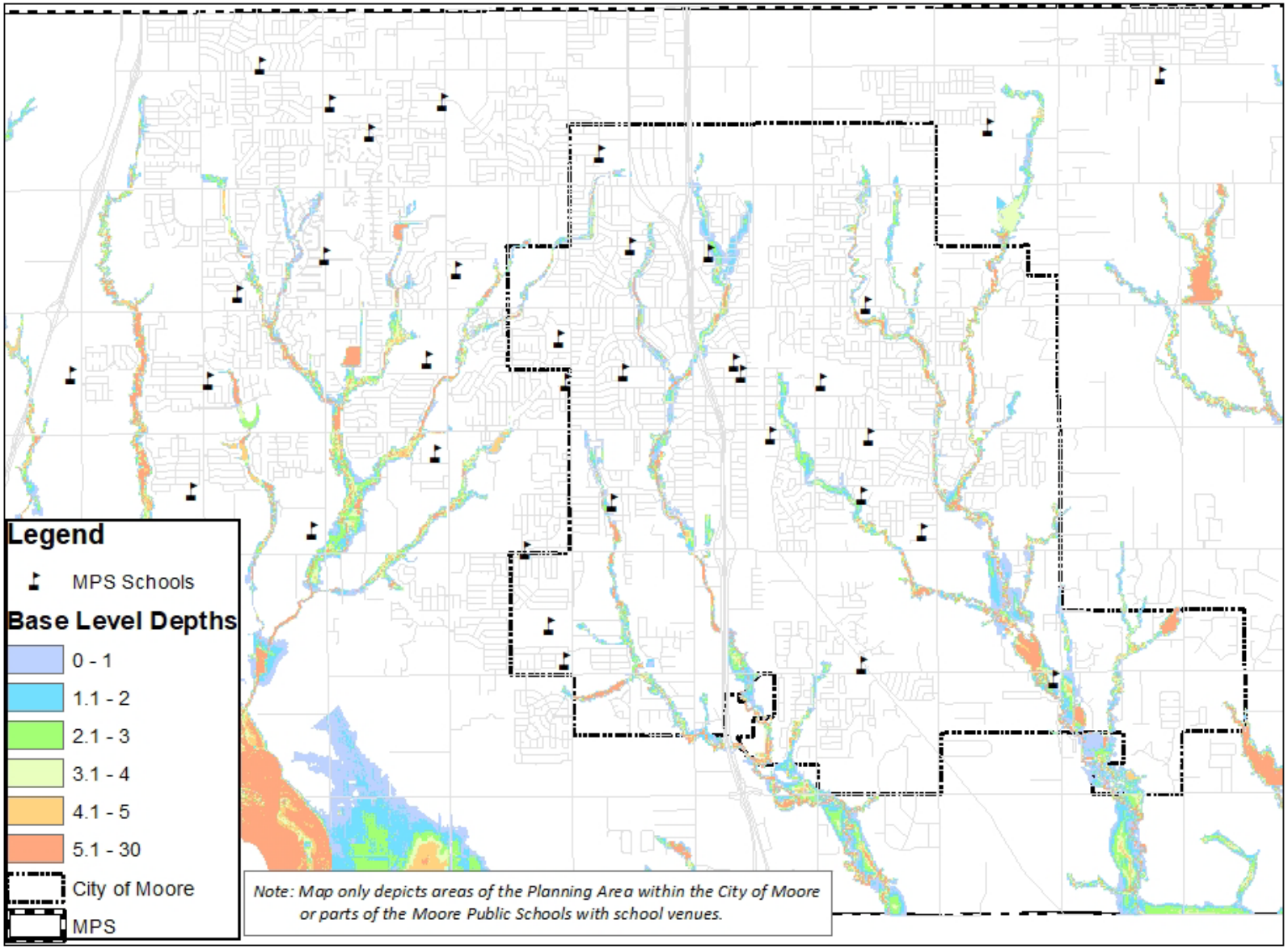

Hugoton
Liberal
Elkhart
Hooker
Guymon
Goodwell
Texhoma
Beaver
Booker
Perryton
Stratford
Kiowa and Rita Blanca National Grasslands
Spearman
Dalhart
Cactus
Dumas
Canadian
Borger
Fritch
Pampa
Wheeler
Boys Ranch
Vega
Amarillo
Groom
McLean
Shamrock
Claude
Canyon
Clarendon
Wellington
Hereford
Memphis
Lakeview
Dimmitt
Tulia
Silverton
Turkey
Childress
Plainview
Sudan
Floydada
Matador
Paducah
Crowell
Littlefield
Levelland
Lubbock
Crosbyton
Guthrie
Benjamin
Seymour
Sundown
Wolfforth
Slaton
Spur
Knox City
Munday
Brownfield
Post
Haskell
Graham
Jacksboro
Decatur
Bowie
Wichita Falls
Burkburnett
Vernon
Chillicothe
Altus
Hollis
Cache
Lawton
Woodward
Shattuck
Arnett
Buffalo
Laverne
Alva
Cherokee
Helena
Enid
Fairview
Watonga
Weatherford
Clinton
Elk City
Sayre
Oklahoma City
Edmond
Norman
Chickasha
Shawnee
Stillwater
Perry
Cushing
Tulsa
Broken Arrow
Owasso
Bartlesville
Pawhuska
Okmulgee
Muskogee
Eufaula
Tahlequah
Sulphur
Tishomingo
Ardmore
Durant
Denison
Sherman
Gainesville
Hugo
Idabel
Paris
Clarksville
Frisco
Plano
Commerce
Sulphur Springs
Mt Pleasant
Wellington
Winfield
Arkansas City
Independence
Coffeyville
Sedan
Caney
Joplin
Miami
Siloam Springs
Ashland
Protection
Coldwater
Kiowa
Anthony
Wakita
Mutual
Enid
Map data ©2015 Google
Terms of Use
Report a map error
Google

Appendix G: Flood Hazard Maps

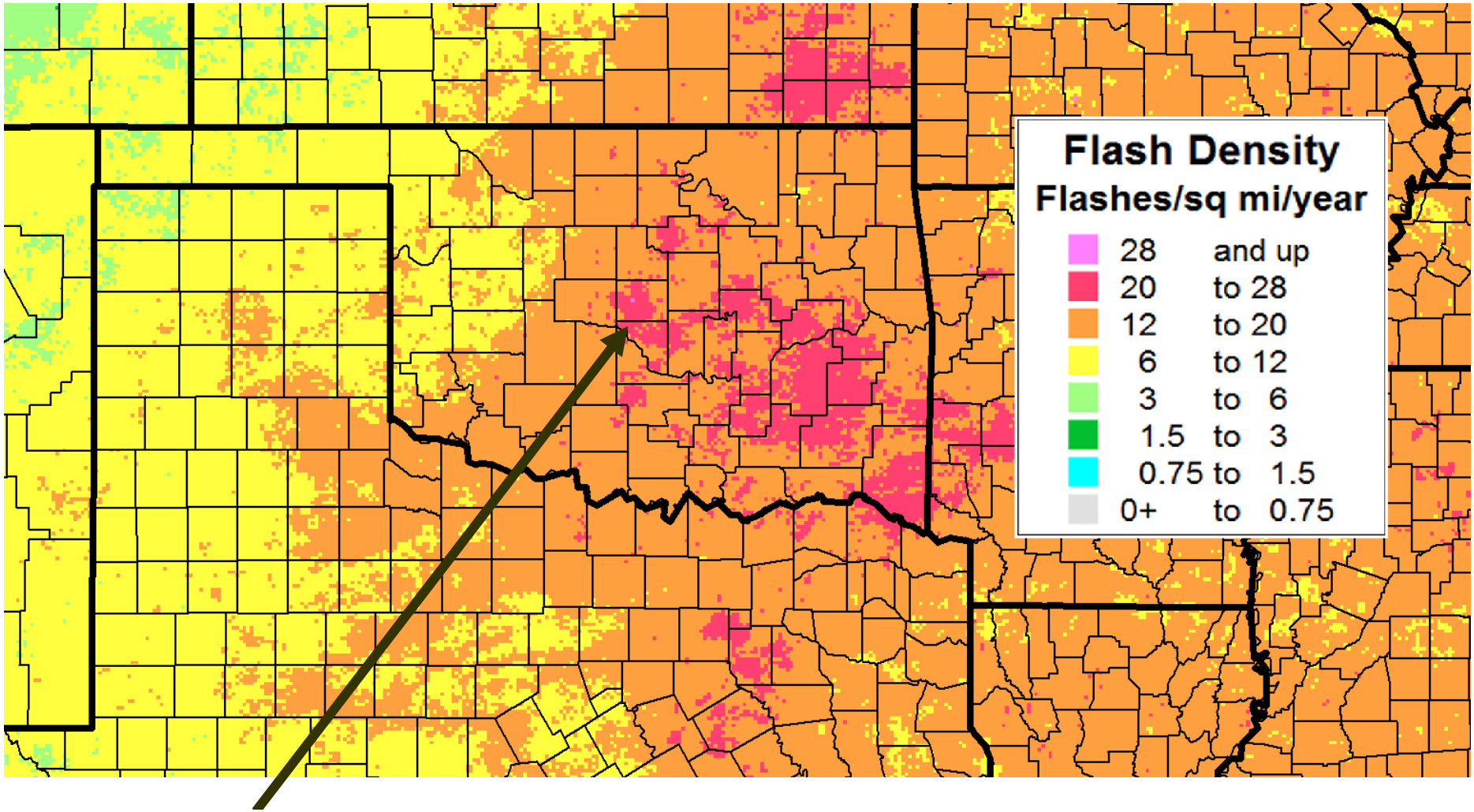


Estimated Base Flood Elevation

Depicts estimated water depths above land surface during a 1% annual chance storm event.



Appendix H: Lightning Flash Density



City of Moore / Moore Public Schools Planning Area

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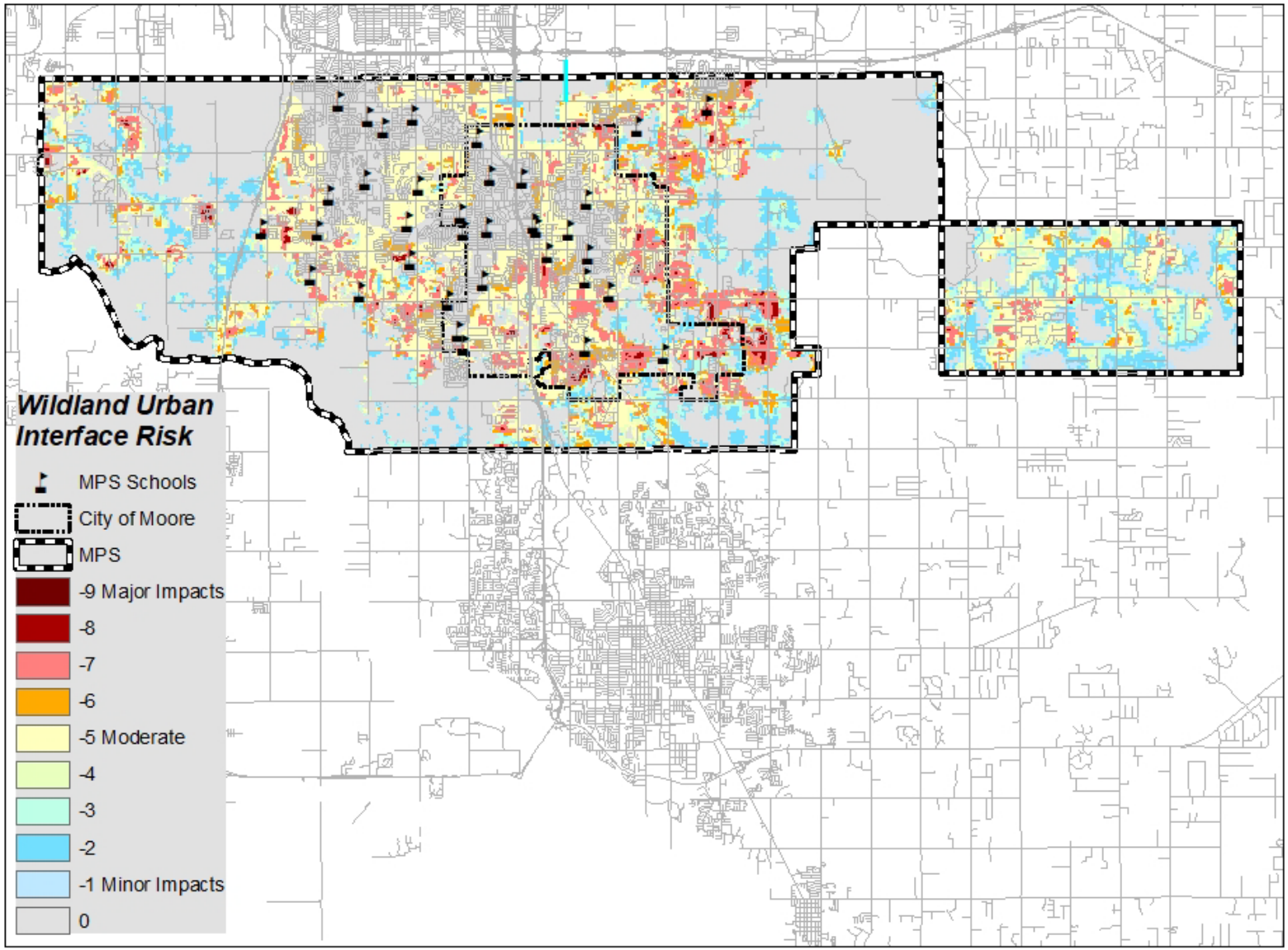
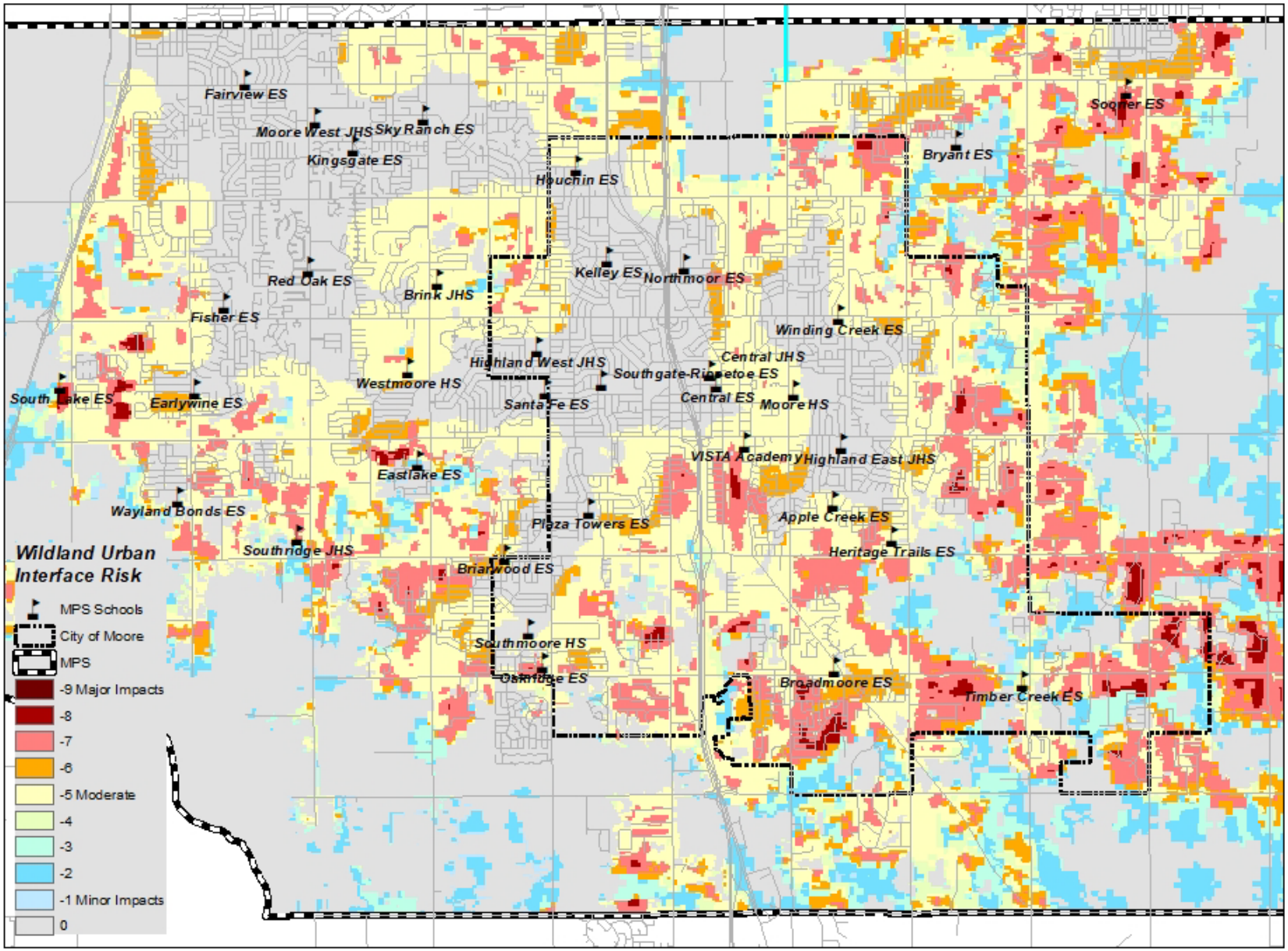
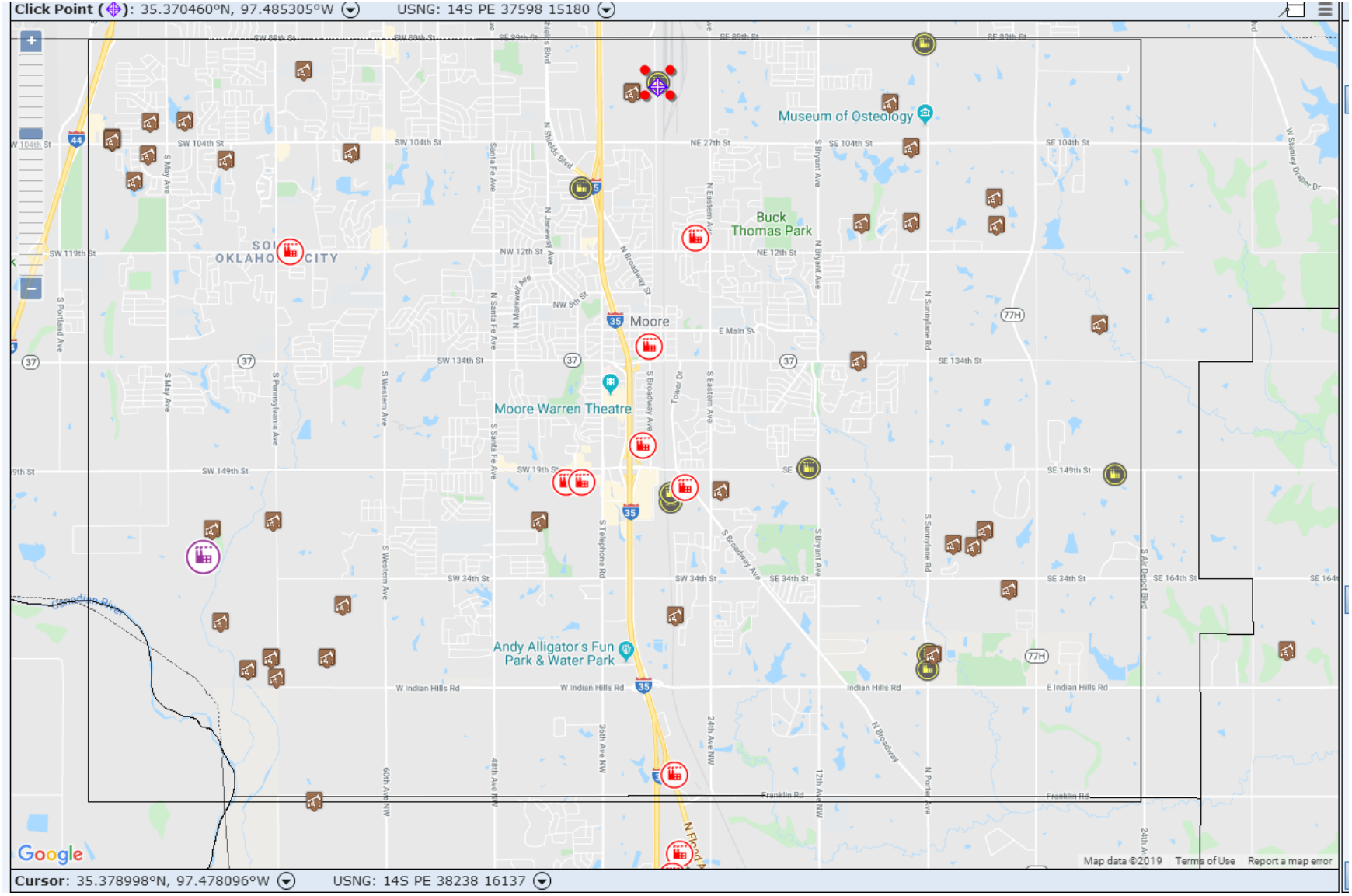
Appendix I: Wildland Urban Interface Risk




Fairview ES
Moore West JHS
Sky Ranch ES
Kingsgate ES
Houchin ES
Soonер ES
Bryant ES
Red Oak ES
Brink JHS
Kelley ES
Northmoor ES
Fisher ES
Winding Creek ES
Central JHS
Highland West JHS
Southgate-Rippetoe ES
Westmoore HS
South Lake ES
Earlywine ES
Santa Fe ES
Central ES
Moore HS
VISTA Academy
Highland East JHS
Eastlake ES
Wayland Bonds ES
Plaza Towers ES
Apple Creek ES
Southridge JHS
Heritage Trails ES
Briarwood ES
Southmoore HS
Oakridge ES
Broadmoore ES
Timber Creek ES
Wildland Urban Interface Risk
MPS Schools
City of Moore
MPS
-9 Major Impacts
-8
-7
-6
-5 Moderate
-4
-3
-2
-1 Minor Impacts
0

Appendix J: 2019 Tier II Facilities Map and Table

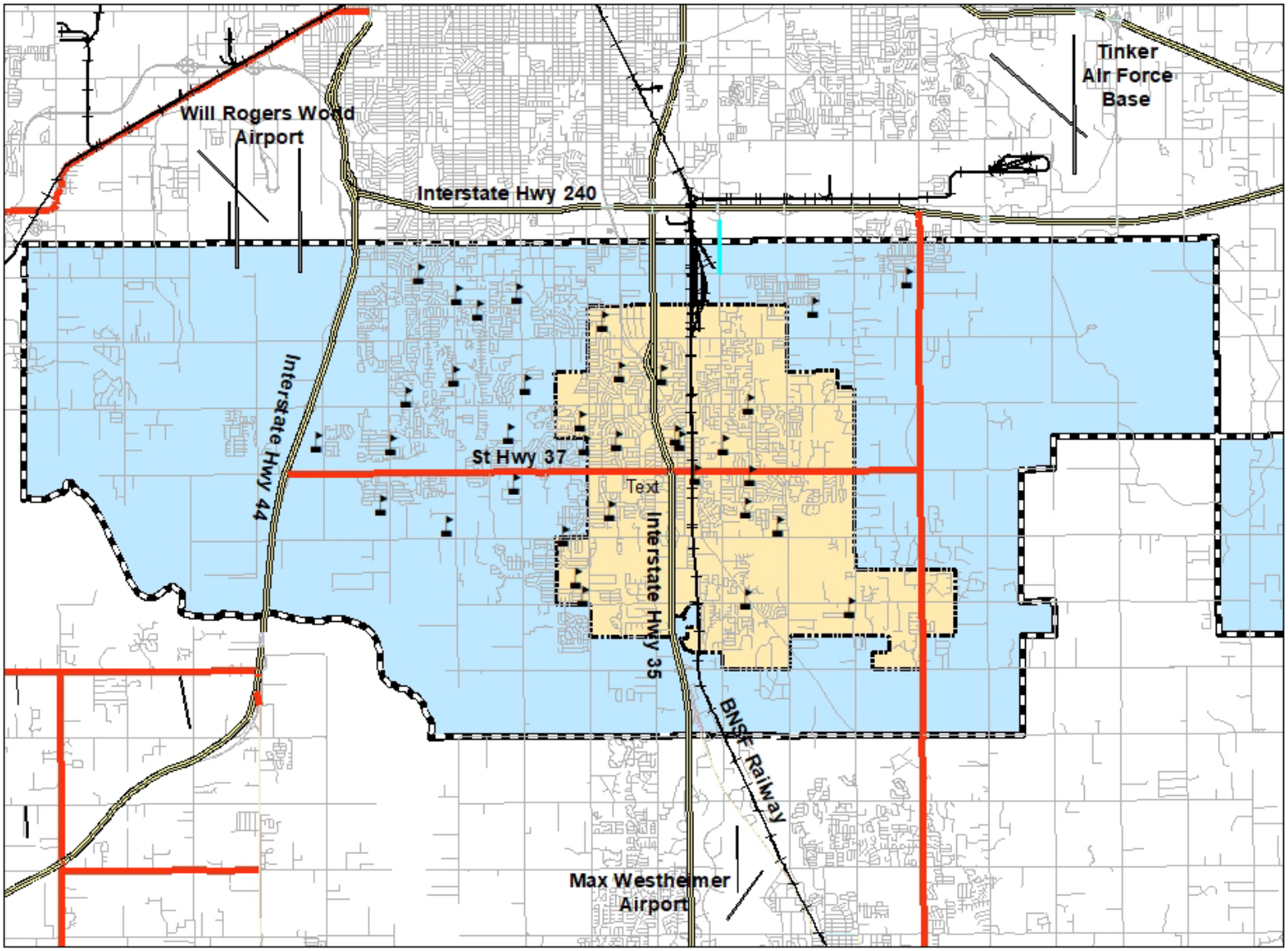


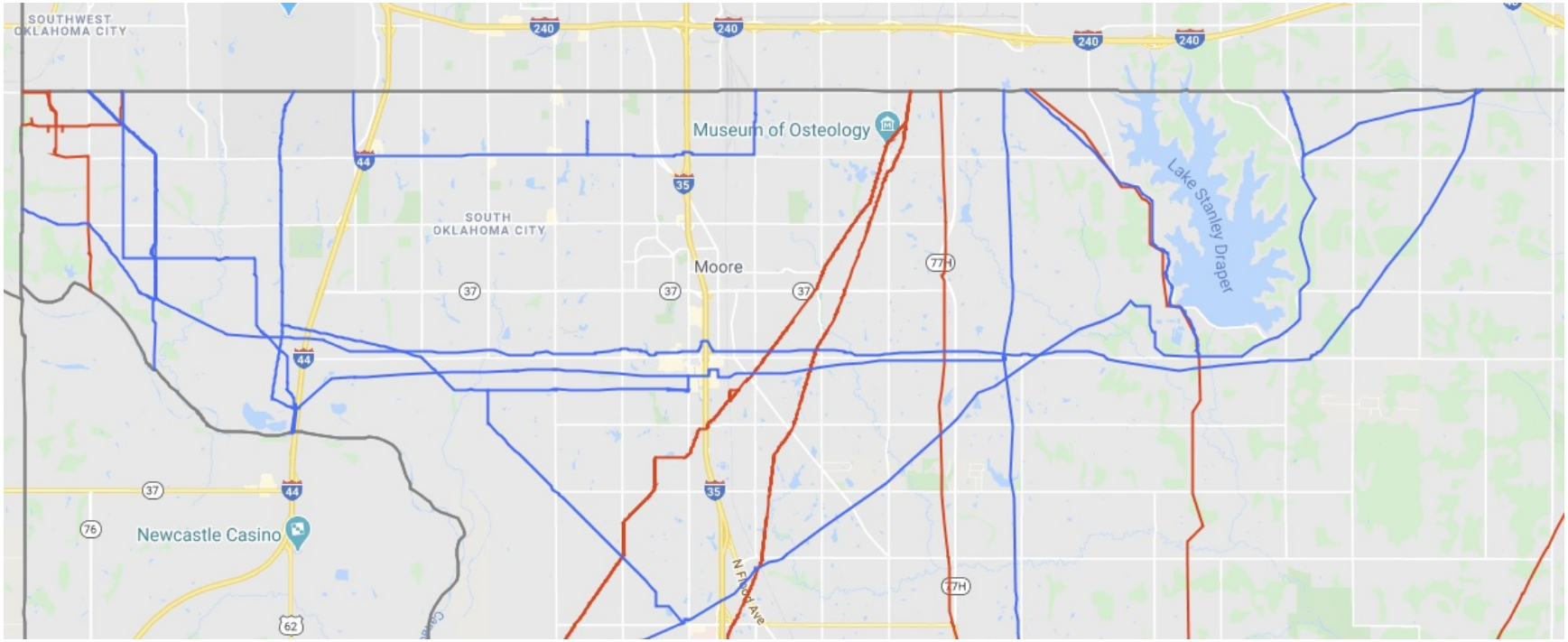
Graphic	Label	Layer
	ALVARADO 2014, LLC - DANIELS 1-19	2019 OIL & GAS TIER 2
	Antioch Energy, LLC - Mills 2-8	2019 OIL & GAS TIER 2
	Antioch Energy, LLC - Mills 8-1	2019 OIL & GAS TIER 2
	Antioch Energy, LLC - South Moore 1-35	2019 OIL & GAS TIER 2
	Azure Energy--Helen #32-A	2019 OIL & GAS TIER 2
	Azure Energy--Helen #32-B	2019 OIL & GAS TIER 2
	Azure Energy--Stotts #4	2019 OIL & GAS TIER 2
	Azure Energy--Ward #31-A	2019 OIL & GAS TIER 2
	Azure Energy--Ward #31-B	2019 OIL & GAS TIER 2
	Azure Energy--Ward #31-C	2019 OIL & GAS TIER 2
	Azure Energy--Ward #31-D	2019 OIL & GAS TIER 2
	Cameron/ Schlumberger DPS - Moore	2019 TIER 2 EHS
	Chaparral--Boomer #1-31	2019 OIL & GAS TIER 2
	Cox Communications-Moore Hub	2019 TIER 2 EHS
	Dolese Bros. Co.--Moore Batch Plant	2019 TIER 2 NON EHS
	E & S EQUIPMENT, LLC	2019 TIER 2 NON EHS
	EEC--Kinkaid Well	2019 OIL & GAS TIER 2
	EnerVest Operating LLC- GOLDMAN 1-6	2019 OIL & GAS TIER 2
	EnerVest Operating LLC- SLOAT 1	2019 OIL & GAS TIER 2
	EnerVest Operating LLC- TRUST 2	2019 OIL & GAS TIER 2

	EnerVest Operating LLC- WHEATLAND UNIT 1-3	2019 OIL & GAS TIER 2
	EnerVest Operating LLC- WHEATLAND UNIT 1-4	2019 OIL & GAS TIER 2
	EnerVest Operating LLC- WHEATLAND UNIT 2-3	2019 OIL & GAS TIER 2
	EnerVest Operating LLC- WHEATLAND UNIT 2-4 (P&A)	2019 OIL & GAS TIER 2
	EnerVest Operating LLC- WHEATLAND UNIT 3-3	2019 OIL & GAS TIER 2
	EnerVest Operating LLC- WHEATLAND UNIT 3-4	2019 OIL & GAS TIER 2
	Ferrellgas-Norman	2019 TIER 2 NON EHS
	Grand Resources--Howell	2019 OIL & GAS TIER 2
	Grand Resources--Mosier	2019 OIL & GAS TIER 2
	Grand Resources--Seiter	2019 OIL & GAS TIER 2
	Grand Resources--Young	2019 OIL & GAS TIER 2
	Inframark--South Canadian	2019 TIER 2 RMP
	January Investments LLC - Dorothy #1	2019 OIL & GAS TIER 2
	January Investments LLC - Kelly #1-6	2019 OIL & GAS TIER 2
	KEPCO Operating, Inc. - Blessington #1-7	2019 OIL & GAS TIER 2
	Meadowbrook Oil--Goldman	2019 OIL & GAS TIER 2
	Mid-Con Energy Operating, LLC--Kings Park	2019 OIL & GAS TIER 2
	Mid-Con Energy Operating, LLC--South Moore Unit 12-1	2019 OIL & GAS TIER 2
	Pheldon Oil--Hamond	2019 OIL & GAS TIER 2
	Phillips 66--PARKS TRUCK STATION	2019 TIER 2 NON EHS
	Prime Operating--TULLIUS, ROSE #1	2019 OIL & GAS TIER 2

	r.c. Taylor Operating Co., LLC - Boulevard	2019 OIL & GAS TIER 2
	r.c. Taylor Operating Co., LLC - Interstate # 1 & Boulevard # 12	2019 OIL & GAS TIER 2
	Red Baker Propane, Inc.	2019 TIER 2 NON EHS
	RIVIERA OPERATING, LLC - STATE 16 1	2019 OIL & GAS TIER 2
	Sam’s Club #6779	2019 TIER 2 EHS
	Schwan's Home Service, Inc. - 107490	2019 TIER 2 NON EHS
	Silver Star Construction- PMI Moore	2019 TIER 2 NON EHS
	Southern Star Central Pipeline - Cement Checks	2019 TIER 2 NON EHS
	STEPHENS & JOHNSON-- GUTHRIE	2019 OIL & GAS TIER 2
	STEPHENS & JOHNSON-- NELMS	2019 OIL & GAS TIER 2
	STEPHENS & JOHNSON-- TODD	2019 OIL & GAS TIER 2
	Summit Oil Co., Inc. - Stotts 1-3	2019 OIL & GAS TIER 2
	Sunstate Equipment Co-OKLAHOMA CITY	2019 TIER 2 NON EHS
	SW BELL--MOORE SWIFT CO - R62134	2019 TIER 2 EHS
	SW BELL--MOORE WEST CO - R62116	2019 TIER 2 EHS
	Target Store T-2727	2019 TIER 2 EHS
	THE HOME DEPOT STORE #3917	2019 TIER 2 EHS
	York International Corporation	2019 TIER 2 EHS

Appendix K: Transportation Infrastructure

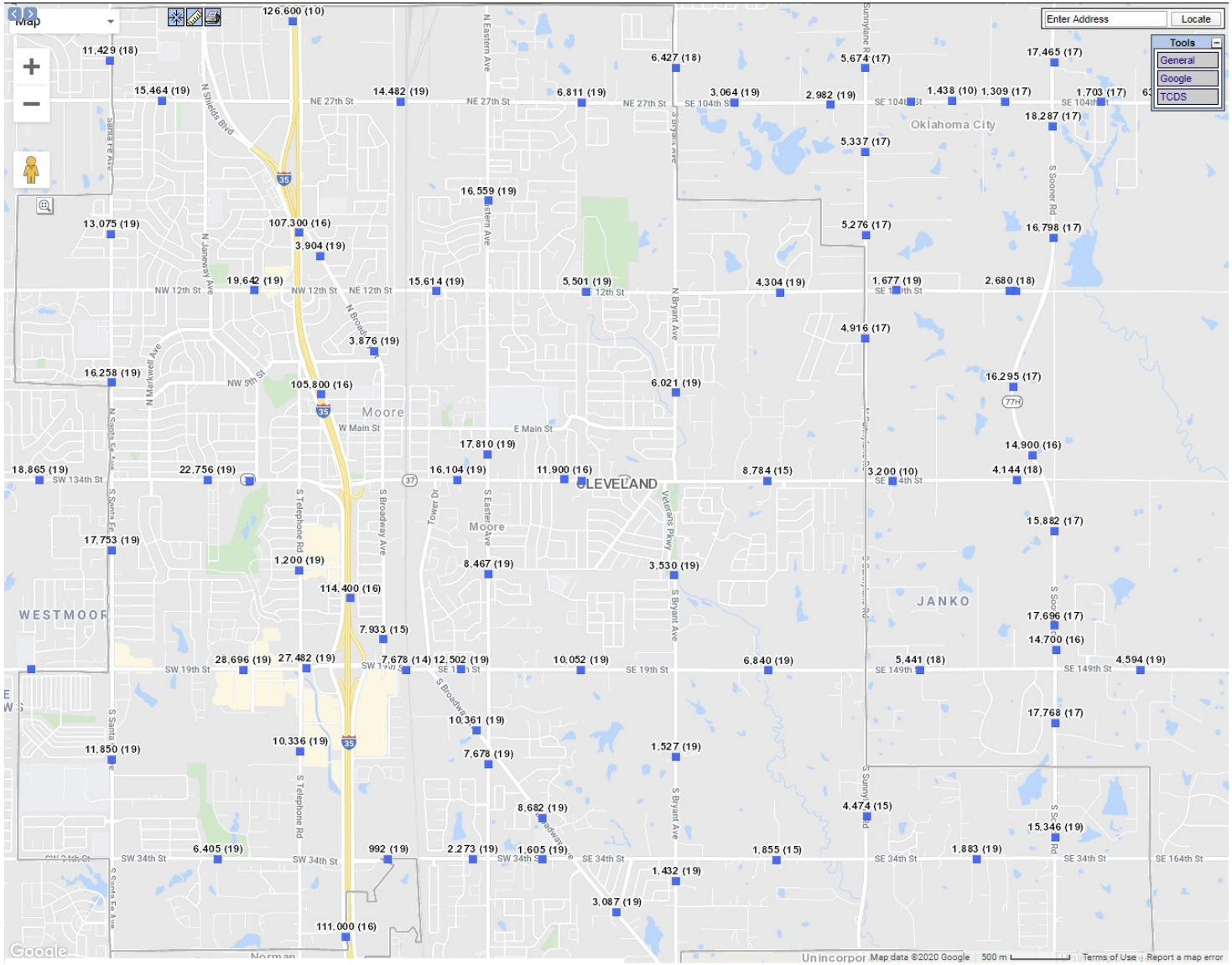




Pipeline Locations in the Planning Area

Blue - Gas Transmission pipelines
Red - Hazardous Liquid pipelines

(note: does not include gathering or distribution lines)



Average Daily Traffic Counts

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Appendix L: Public Survey Questions and Results

Moore, Oklahoma
Hazard Mitigation Survey
We want to hear from you!

This survey is for people who live or work in the City of Moore, or whose children attend Moore Public Schools to tell us what your biggest concerns are regarding disasters in the city. We'd also like to know your thoughts on what we can do to protect our city from potential hazards. Please complete all 10 questions; the survey shouldn't take more than 20 minutes. Thank you!

1. What is your affiliation with Moore? (Check all that apply)
- ☐ I live in Moore
- ☐ I work in Moore
- ☐ My children attend Moore Public Schools
- ☐ Other (please specify)_____

2. In the past five years, have you or someone in your household directly experienced any of these natural disasters? (Please check all that apply.)

- ☐ Lightning
- ☐ High Winds
- ☐ Flood
- ☐ Earthquake
- ☐ Hail
- ☐ Drought
- ☐ Wildfire
- ☐ Tornado
- ☐ Winter Storm
- ☐ Extreme Heat
- ☐ None of These

3. How concerned are you about any of these disasters affecting the city/school district in the future?

Hazard	Very Concerned	Concerned	Neutral	Not Very Concerned	Not Concerned
Drought					
Earthquake					
Extreme Heat					
Flood					
Hail					
High Winds					
Lightning					
Tornado					
Wildfire					
Winter Storm					

Please list any other hazards that concern you, and tell us your level of concern:

_____

4. A number of activities can reduce our community's risk from natural hazards. These can be regulatory or non-regulatory. Please check the box that best represents your opinion of the following strategies to reduce the risk and loss associated with natural disasters.

Strategy	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

I support policies to restrict or prohibit development in areas subject to natural hazards.					
I support using local tax dollars to reduce risks and losses from natural hazards.					
I support protecting historical and cultural structures.					
I am willing to make my home more disaster-resilient.					
I support steps to safeguard the local economy following a disaster event.					
I support improving the disaster preparedness of local schools (in addition to building safe rooms).					

For the hazards that concern you most, what actions, or projects do you suggest to lessen their effects? (You may list more than one)

_____
_____

5. Which of the following do you consider most reliable to provide you with information about how to make your household and home safer from natural disasters? Please check up to three.

- ☐ News Media
- ☐ Police/Fire/Emergency Management Personnel
- ☐ City Elected Officials or Management
- ☐ Insurance Agency/Company
- ☐ Utility Company
- ☐ University or Research Institution
- ☐ Neighbor/ Friend/ Family Member
- ☐ Non-Profit Organization (Red Cross, Salvation Army, etc.)
- ☐ Social Media
- ☐ State or Federal Agency
- ☐ Not Sure
- ☐ Other (please specify) _____

6. What are the most effective ways for you to receive information about how to make your household and home safer from disasters? (Please check up to three)

- ☐ Newspaper Story
- ☐ Newspaper Ad
- ☐ TV News
- ☐ TV Ad
- ☐ Radio News
- ☐ Radio Ad
- ☐ Email Newsletters
- ☐ Online News Outlet
- ☐ Schools
- ☐ Outdoor Ads (Billboards)
- ☐ Books
- ☐ Mail
- ☐ First Responders- Fire/Police/Emergency Medical Services
- ☐ Fact Sheet/Brochure
- ☐ Chamber of Commerce
- ☐ Public Workshops
- ☐ Social Media
- ☐ University or Research Institution
- ☐ Other (please specify) _____

7. Next, we would like to know what specific types of community assets are most important to you. (Please check the corresponding box for each asset)

Asset	Very Important	Important	Neutral	Not Very Important	Not Important
Elder-Care Facilities					
Schools (K-12)					

Hospital					
Major Bridges					
Fire/Police/Ambulance Stations					
Museums/Historic Buildings					
Major Employers					
Small Businesses					
Colleges/Universities					
City Hall/Courthouse					
Parks					

Other (please specify)

_____

8. Planning for natural hazards can help lessen their impact. The following statements will help determine our citizens' priorities regarding planning for natural hazards in our community. Please select the appropriate rating next to each item with regard to potential mitigation actions.

Planning Item	Very Important	Important	Neutral	Not Very Important	Not Important
Protecting Private Property					
Protecting Critical Facilities (e.g., roads/highways, hospitals, fire/police stations, schools, etc.)					
Preventing injury or loss of life					
Preventing Development in Hazard Prone Areas					
Protecting Cultural and Historic Landmarks					
Protecting and Reducing Damage to Utilities					
Strengthening Emergency Services (Fire, Police, Ambulance)					
Promoting Cooperation among Public Agencies, Citizens, Non-Profit Organizations, and Businesses					

9. The precautions your household takes and training you receive can make a big difference in your ability to recover from a natural disaster or emergency. In the following list, please indicate which actions you have done, which you plan to do, which you have not done, and which you are unable to do. Please check one answer for each.

Precaution	Have Done	Plan to Do	Have Not Done	Don't Deem Necessary	Unable to Do
Attended meetings or received written information on natural disasters or emergency preparedness					
Talked with members of your household about what to do in case of natural disasters or emergencies					
Developed a Household/Family Emergency Plan in order to decide what everyone would do in a disaster					
Practiced your emergency plan by having a drill where you carry out the actions you would take in an emergency					
Stored disaster supplies such as drinking water and non-perishable food					
At least one member of your household is First Aid/CPR certified					

Protected your home by having smoke detectors on each level					

10. Please provide any additional comments below. We are especially interested in your suggestions for mitigation projects. If you'd like someone to follow up with you regarding anything in this survey, please give us your contact information.

_____

_____

_____

THANK YOU FOR COMPLETING THIS SURVEY!

Please return completed survey to: City of Moore Emergency Management
109 E. Main Street, Moore, OK 73160
Phone: 405-793-5062 Fax: 405-793-4425
Email: emermgt@cityofmoore.com

You may also take this survey online at **https://www.surveymonkey.com/r/8JJR7ZM** or by this code: