Oklahoma County Hazard Mitigation Plan 2013 Update

February 2014

Prepared By:
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SECTION 1: INTRODUCTION

BACKGROUND

In response to the requirements of the Disaster Mitigation Act of 2000 (DMA 2000), Oklahoma County, Oklahoma has developed this Hazard Mitigation Plan (HMP or Plan). DMA 2000 amends the Stafford Act and is designed to improve planning for, response to, and recovery from, disasters by requiring state and local entities to implement pre-disaster mitigation planning and develop HMPs. The Federal Emergency Management Agency (FEMA) has issued guidelines for HMPs. The Oklahoma Department of Emergency Management (OEM) also supports plan development for jurisdictions in the State of Oklahoma.

Specifically, DMA 2000 requires that states with support from local governmental agencies develop HMPs to prepare for and reduce the potential impacts of natural hazards. DMA 2000 is intended to facilitate cooperation between state and local authorities, prompting them to work together. This enhanced planning will better enable local and state governments to articulate accurate needs for mitigation, resulting in faster allocation of funding and more effective risk reduction projects.

Hazard Mitigation is any sustained action taken to reduce or eliminate the long term risk and effects that can result from specific hazards.

FEMA defines a ***Hazard Mitigation Plan*** as the documentation of a state or local government evaluation of natural hazards and the strategies to mitigate such hazards.

DMA 2000 Origins -The Robert T. Stafford Disaster Relief and Emergency Assistance Act

In the early 1990s, a new federal policy regarding disasters began to evolve. Rather than simply reacting whenever disasters strike communities, the federal government encouraged communities to first assess their vulnerability to various disasters and then take actions to reduce or eliminate potential risks. The logic is simply that a disaster-resistant community can rebound from a natural disaster with less loss of property or human injury at much lower cost, and, consequently, more quickly. Moreover, other costs associated with disasters, such as the time lost from productive activity by business and industries, are minimized.

The ***Federal Emergency Management Agency*** (FEMA) estimates that for every dollar spent on damage prevention (mitigation), twice that amount is saved through avoided post-disaster damage repair.

DMA 2000 provides an opportunity for States, tribes and local governments to take a new and revitalized approach to mitigation planning. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous mitigation planning provisions (Section 409) and replacing them with a new set of requirements (Section 322). This section sets forth the requirements that communities evaluate natural hazards within their respective jurisdictions and develop an appropriate plan of action to mitigate those hazards, while emphasizing the need for State, tribal and local governments to closely coordinate mitigation planning and implementation efforts.

The amended Stafford Act requires that each local jurisdiction identify potential natural hazards to the health, safety and well being of its residents and identify and prioritize actions that can be taken by the community to mitigate those hazards—before disaster strikes. For communities to remain eligible for hazard mitigation assistance from the federal government, they must first prepare a HMP (this plan). By

regulation, this plan must be formally updated, approved by FEMA, and adopted by all participating jurisdictions every five years.

Responsibility for fulfilling the requirements of Section 322 of the Stafford Act and administering the FEMA Hazard Mitigation Program has been delegated to the State of Oklahoma, specifically to OEM. FEMA also provides support through guidance, resources, and plan reviews.

Organizations Involved in the Mitigation Planning Effort

In addition to Oklahoma County, the following jurisdictions within the County have participated in the planning process:

Table 1-1. Participating Jurisdictions

Participating Jurisdictions		
Oklahoma County	City of Edmond	City of Nichols Hills
Town of Arcadia	Town of Forest Park	City of Nicoma Park
City of Bethany	City of Harrah	City of Spencer
City of Choctaw	Town of Luther	City of The Village
City of Del City	City of Midwest City	City of Warr Acres

Oklahoma County intends to implement this plan with the participation of its various departments, organizations, and governing body, as well as by coordinating with relevant State, and federal entities. Coordination helps to ensure that stakeholders have established communication channels and relationships necessary to support mitigation planning and implement the mitigation strategy identified in Section 6.

Multiple Agency Support for Hazard Mitigation

Primary responsibility for the development and implementation of mitigation strategies and policies lies with local governments. However, local governments are not alone; various partners and resources at the regional, state, and federal levels are available to assist communities in the development and implementation of mitigation strategies. Within the State of Oklahoma, OEM is the lead agency providing hazard mitigation planning assistance to local jurisdictions. OEM provides guidance to support mitigation planning. In addition, FEMA provides grants, tools, and training to support mitigation planning.

Additional input and support for this planning effort was obtained from a range of agencies and through public involvement (as discussed in Section 3). Oversight for the preparation of this plan was provided by the Oklahoma County Hazard Mitigation Planning Committee (Planning Committee) identified in Section 3.

IMPLEMENTATION OF THE PLANNING PROCESS

This HMP was prepared in accordance with the following regulations and guidance:

- DMA 2000 (Public Law 106-390, October 30, 2000).
- 44 Code of Federal Regulations (CFR) Parts 201 and 206 (including: Feb. 26, 2002, Oct. 1, 2002, Oct. 28, 2003, and Sept. 13, 2004 Interim Final Rules).

- FEMA. 2004. "How-To Guide for Using HAZUS-MH for Risk Assessment." FEMA Document No. 433. February.
- FEMA Mitigation Planning How-to Series (FEMA 386-1 through 4, 2002), available at: http://www.fema.gov/fima/planhowto.shtm.

Table 1-2 summarizes the requirements outlined in the DMA 2000 Interim Final Rule and where each of these requirements is addressed in this Plan.

Table 1-2. FEMA Local Mitigation Plan Review Crosswalk

FEMA Local Mitigation Plan Review Crosswalk	
Plan Criteria	**Primary Location in Plan**
Prerequisites	
Adoption by the Local Governing Body: §201.6(c)(5)	Section 2.0; Appendix B
Planning Process	
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Section 3.0
Risk Assessment	
Identifying Hazards: §201.6(c)(2)(i)	Sections 5.2 and 5.3
Profiling Hazards: §201.6(c)(2)(i)	Section 5.4
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)	Section 5.4
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)	Sections 4.0
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)	Section 5.3
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)	Section 4.0 and 5.3
Mitigation Strategy	
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Sections 6.0 and 9
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)	Sections 6.0 and 9
Implementation of Mitigation Actions: §201.6(c)(3)(iii)	Sections 6.0 and 9
Plan Maintenance Process	
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)	Section 7.0
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Section 7.0
Continued Public Involvement: §201.6(c)(4)(iii)	Section 7.0

The planning process and findings are to be documented in local HMPs. To support the planning process to develop this HMP, Oklahoma County has accomplished the following:

- Developed a Hazard Mitigation Planning Committee (planning committee)
- Identified the hazards of concern that pose the greatest risk to the planning area
- Profiled these hazards
- Estimated the inventory at risk and potential losses associated with these hazards
- Developed mitigation goals, objectives and actions that address the identified risks
- Developed mitigation plan maintenance procedures to be executed after obtaining approval of the plan from OEM and FEMA

To address the requirements of DMA 2000 and better understand their potential vulnerability to and losses associated with hazards of concern, Oklahoma County used the Hazards U.S. – Multi-Hazard (HAZUS-MH) software package (discussed in greater detail later in this Plan) supplemented by local data, as feasible, to support the risk assessment and vulnerability evaluation. HAZUS-MH assesses risk and estimates potential losses for natural hazards. It produces outputs that will assist state and local governments, communities, and the private sector in implementing emergency response, recovery, and mitigation programs, including the development of HMPs.

As required by DMA 2000, the planning process has informed the public and provided opportunities for public comment and input. In addition, local and regional stakeholders have participated in the planning process, providing input and expertise throughout the planning process, and helping to identify appropriate mitigation actions.

This plan documents the process and outcomes of the County's efforts. Additional information on the planning process is included in Section 3, Planning Process. Documentation that the prerequisites for plan approval have been met is included in Section 2, Plan Adoption.

Benefits of Mitigation Planning

The planning process will help prepare citizens and government agencies to better respond when disasters occur. Also, mitigation planning allows Oklahoma County to become eligible for mitigation grant funding for mitigation projects that will reduce the impact of future disaster events. The long-term benefits of mitigation planning include:

- An increased understanding of hazards faced by Oklahoma County
- A more sustainable and disaster-resistant community
- Financial savings through partnerships that support planning and mitigation efforts
- Focused use of limited resources on hazards that have the biggest impact on the community
- Reduced long-term impacts and damages to human health and structures and reduced repair costs

Organization of this Mitigation Plan

This Plan was organized in accordance with FEMA and OEM guidance, and its structure follows the four-phase planning process recommended by FEMA and summarized in Figure 1-2.

Section 1, Introduction: An overview of the history, process, and components of the Plan.

Section 2, Plan Adoption: Information regarding the adoption of the Plan by Oklahoma County.

Section 3, Planning Process: A description of the Plan methodology and development process, Planning Committee and stakeholder involvement efforts, and a description of how this Plan will be incorporated into existing programs.

Section 4, Town Profile: An overview of Oklahoma County, including: (1) general information, (2) population and demographics, (3) general building stock inventory, (4) land use trends, (5) future growth and development, and (6) critical facilities.

Section 5, Risk Assessment: Documentation of the hazard identification and ranking process, hazard profiles, and findings of the vulnerability assessment (estimates of the impact of hazard events on life, safety and health, general building stock, critical facilities, the economy and future growth and development). Description of the status of local data and planned steps to improve local data to support mitigation planning.

Section 6, Mitigation Strategy: Information regarding the mitigation goals, objectives, capability assessment, and mitigation action items identified by the Town in response to priority hazards of concern.

Section 7, Plan Maintenance Procedures: The system established by Oklahoma County to monitor, evaluate, maintain, and update the Plan.

Section 8: Planning Partnership: Description of the planning partnership, jurisdictional annexes and benefit /cost review process.

Section 9: Jurisdictional Annexes: A jurisdiction-specific annex for each participating jurisdiction and the County containing their hazards of concern, risk ranking, capability assessments, mitigation actions and action prioritization specific only to the County or that jurisdiction.

Acronyms: Abbreviations used throughout this Plan.

Glossary: Glossary of terms found throughout the Plan.

References: Sources of data and information used throughout this plan.

Appendices –

Appendix A: Sample Resolution of Plan Adoption: Documentation that supports the Plan approval signatures included in Section 2 of this Plan.

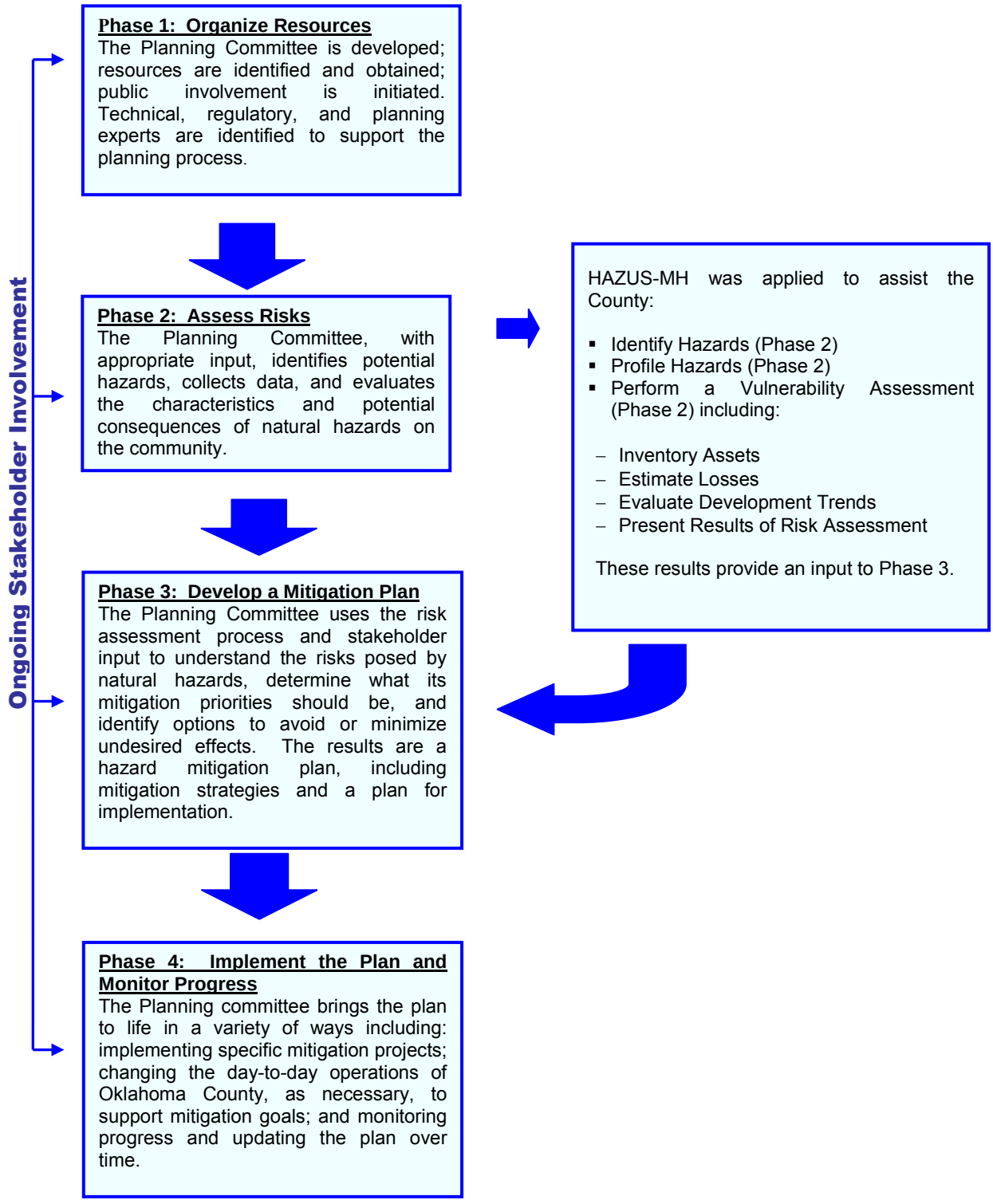
Appendix B: Meeting Documentation: Agendas, attendance sheets, minutes, and other documentation (as available and applicable) of planning meetings convened during the development of the plan.

Appendix C: Public and Stakeholder Outreach Documentation: Documentation of the public and stakeholder outreach effort including webpages, informational materials, public and stakeholder meetings and presentations, surveys, and other methods used to receive and incorporate public and stakeholder comment and input to the plan update process.

Appendix D, Federal Mitigation Programs, Activities, and Initiatives: Summary of federal funding options that could be used to fund mitigation activities.

Appendix E, Dam Failure Mapping

Figure 1-1. Oklahoma County Hazard Mitigation Planning Process



SECTION 2: PLAN ADOPTION

OVERVIEW

This section contains information regarding adoption of the Plan by Oklahoma County and each participating jurisdiction.

Plan Adoption by Local Governing Bodies

Adoption by the local governing bodies demonstrates the commitment of Oklahoma County and each participating jurisdiction to fulfill the mitigation goals and objectives outlined in the Plan. Adoption legitimizes the Plan and authorizes responsible agencies to execute their responsibilities. In order for the multi-jurisdictional plan to be approved, each jurisdiction included in the Plan must have its governing body adopt the Plan, even when a cross-jurisdiction agency has the authority to prepare such plans in the name of the respective jurisdictions.

Each participating jurisdiction will proceed with formal adoption proceedings when FEMA provides conditional approval of this Plan. Each participating jurisdiction understands that a conditional approval of the Plan will be provided for those municipalities that meet the planning requirements with the exception of the adoption requirement as stated above. Following adoption or formal action on the Plan, each participating jurisdiction must submit a copy of the resolution or other legal instrument showing formal adoption (acceptance) of the Plan to Oklahoma Department of Emergency Management (OEM). Each participating jurisdiction understands that FEMA will transmit acknowledgement of verification of formal plan adoption and the official approval of the Plan to the mitigation plan coordinator.

The resolutions issued to support adoption of the Plan by each jurisdiction are included below.

In addition to being required by DMA 2000, adoption of the plan is necessary because:

- It lends authority to the plan to serve as a guiding document for all local and state government officials;
- It gives legal status to the plan in the event it is challenged in court;
- It certifies the program and grant administrators that the plan's recommendations have been properly considered and approved by the governing authority and jurisdictions' citizens; and
- It helps to ensure the continuity of mitigation programs and policies over time because elected officials, staff, and other community decision-makers can refer to the official document when making decisions about the community's future.

Source: FEMA. 2003. "How to Series"-*Bringing the Plan to Life* (FEMA 386-4). August.

RESOLUTION NO. 1206-13
A RESOLUTION OF THE BOARD OF TRUSTEES OF THE TOWN OF ARCADIA AUTHORIZING THE ADOPTION OF THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN – 2013 UPDATE

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **TOWN OF ARCADIA**:

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

PASSED AND ADOPTED on this 19th day of December, 2013, by the following vote:

AYES:	**3**	**ABSENT:**	**0**
ABSTAIN:	**0**	**NOES:**	**0**

Marilyn Murrell

Marilyn Murrell, Mayor

ATTEST:

Sharree L. Butler

Sharree L. Butler, Town Clerk

RESOLUTION NO. 1378

A RESOLUTION OF THE OF THE CITY OF BETHANYAUTHORIZING THE ADOPTION OF THE 2013 UPDATE TO THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **CITY OF BETHANY**:

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

END

The undersigned hereby certify that the foregoing Resolution was duly adopted and approved by the Mayor and City Council of the City of Bethany on the 21st day of January, 2014.

MAYOR

Attest:

CITY CLERK

Approved as to form and legality on February 4th, 2014.

CITY ATTORNEY

RESOLUTION NO. 13-22
A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF CHOCTAW AUTHORIZING THE ADOPTION OF THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN – 2013 UPDATE

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **CITY OF CHOCTAW**:

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

PASSED AND ADOPTED on this 17th day of December, 2013, by the following vote:

AYES: Jerry Bower; Jeannie Abts; Larry Goeller; Randy Ross
NAYS: None
ABSENT: Ron Bradshaw; Roger Malone; Steve Krieske
ABSTAIN: None

Mayor, City of Choctaw

ATTEST:
Clerk, City of Choctaw

RESOLUTION NO. 01-06-14A

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF DEL CITY AUTHORIZING THE ADOPTION OF THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN – 2013 UPDATE

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and

WHEREAS, pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, the Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS, a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **CITY OF DEL CITY**:

1. Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.

2. Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.

3. Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.

4. Will continue its support of the Mitigation Planning Committee as described within the Plan.

5. Will help to promote and support the mitigation successes of all participants in this Plan.

6. Will incorporate mitigation planning as an integral component of government and partner operations.

7. Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

PASSED and ADOPTED on this 16th day of January, 2014.

Brian E. Linley, Mayor

ATTEST:

By: Carol Noble
Carol Noble, City Clerk

Reviewed this 6 day of January, 2014, by:

Jack Fried, City Attorney

RESOLUTION NO. 01-14

A RESOLUTION TO ADOPT THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN (2014 UPDATE) AS THE HAZARD MITIGATION PLAN FOR THE CITY OF EDMOND

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and
WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and
WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and
WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and
WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **CITY OF EDMOND**:

1) Adopts in its entirety, the 2014 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

APPROVED by the Mayor and City Council on this the 13th day of January, 2014.

MAYOR

ATTEST:

CITY OF EDMOND SEAL EDMOND, OKLAHOMA

City Clerk

APPROVED as to form and legality this 13th day of January, 2014.

City Attorney

RESOLUTION NO. 2013-113

A RESOLUTION OF THE BOARD OF TRUSTEES OF THE TOWN OF FOREST PARK AUTHORIZING THE ADOPTION OF THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN – 2013 UPDATE

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **TOWN OF FOREST PARK**:

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

PASSED AND ADOPTED on this **19th day of December, 2013,** by the following vote:

AYES: 5
NOES: Ø
ABSENT: Ø
ABSTAIN: Ø

ATTEST: _____
Clerk, Town of Forest Park

_____
Mayor, Town of Forest Park

RESOLUTION NO. 121913CC

A RESOLUTION OF THE CITY OF THE CITY COUNCIL OF THE CITY OF HARRAH AUTHORIZING THE ADOPTION OF THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN – 2013 UPDATE

WHEREAS; Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk of life, property, environment and the economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS; The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within County; and

WHEREAS; the coalition has completed a planning process that engages the public, assesses the rick and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **CITY OF HARRAH:**

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the planning partnership no less that every five years.

PASSED AND ADOPTED on this 19th day of December, 2013, by the following vote:

AYES: Patterson, Barron, Bishop, Fryar

NAYS: None

ABSENT: Smith

ABSTAIN:

ATTEST:

Cindy Pollard

CITY CLERK CITY OF HARRAH

MAYOR CITY OF HARRAH

RESOLUTION NO.
A RESOLUTION OF THE BOARD OF TRUSTEES OF THE TOWN OF LUTHER AUTHORIZING THE ADOPTION OF THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN – 2013 UPDATE

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **TOWN OF LUTHER**:

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

PASSED AND ADOPTED on this 17TH day of December, 2013, by the following vote:

AYES: 4
NOES: 0
ABSENT: 0
ABSTAIN: 0

Cecilia Taft
Mayor, Town of Luther

ATTEST: Linda Burk
Clerk, Town of Luther
Acting Town Clerk

TOWN OF LUTHER OFFICIAL SEAL OKLAHOMA COUNTY

Vault Copy
01-14-14
C-9

RESOLUTION NO. 14-01

A RESOLUTION OF THE COUNCIL OF THE CITY OF MIDWEST CITY, OKLAHOMA ADOPTING THE 2013 UPDATE OF THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN.

WHEREAS, unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the City of Midwest City in the State of Oklahoma hereby:

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.

2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.

3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.

4) Will continue its support of the Mitigation Planning Committee as described within the Plan.

5) Will help to promote and support the mitigation successes of all participants in this Plan.

6) Will incorporate mitigation planning as an integral component of government and partner operations.

7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

PASSED, APPROVED AND ADOPTED this 14th day of January, 2014, by the City Council of the City of Midwest City in the State of Oklahoma.

Lynn Jack Fry, Jr., Mayor

ATTEST:

Rhonda Atkins, City Clerk

APPROVED as to form and legality this 14th day of January, 2014.

Katherine Bolles, City Attorney

RESOLUTION NO. 1207
A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF NICHOLS HILLS AUTHORIZING THE ADOPTION OF THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN – 2013 UPDATE

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **CITY OF NICHOLS HILLS**:

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

PASSED AND ADOPTED on this 14th day of January, 2014 by the following vote:

AYES: Goetzinger, Clements, Hoffman
NOES: None
ABSENT: None
ABSTAIN: None

Mayor, City of Nichols Hills

ATTEST: _____
Clerk, City of Nichols Hills

CITY OF NICHOLS HILLS OFFICIAL SEAL

RESOLUTION NO. 2014-01
A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF NICOMA PARK AUTHORIZING THE ADOPTION OF THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN – 2013 UPDATE

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **CITY OF NICOMA PARK**:

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

PASSED AND ADOPTED on this 7th day of January, 2014, by the following vote:

AYES: Loudermilk, Wiegert, Kolar, Trowell, Cochell, Foughty, Pittman.
NOES: None.
ABSENT: None.
ABSTAIN: None.

Mayor, City of Nicoma Park

ATTEST:
Clerk, City of Nicoma Park

OKLAHOMA COUNTY BOARD OF COUNTY COMMISSIONERS
RESOLUTION No. 2660-13

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and,

WHEREAS, the Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post-disaster hazard mitigation programs and the Federal Emergency Management Agency (FEMA) requires local governments to have an "All-Hazards" Hazard Mitigation Plan, approved by FEMA and adopted by each participating jurisdiction, to remain eligible for funding from the Hazard Mitigation Grant Program and Pre-Disaster Mitigation Program; and,

WHEREAS, the participating governments in the Oklahoma County Hazard Mitigation Plan have completed all steps in the development of an appropriate Plan; and,

WHEREAS, the Oklahoma County Board of County Commissioners has provided oversight in the development, revision and completion of the Oklahoma County Hazard Mitigation Plan through the Oklahoma County Office of Emergency Management as recent as December 9, 2013;

NOW, THEREFORE, BE IT RESOLVED, WE, the Board of County Commissioners of Oklahoma County, by virtue of the authority vested in us by the Laws of Oklahoma County, do hereby adopt in its entirety the 2013 Update of the Oklahoma County Hazard Mitigation Plan, as tentatively approved by FEMA (pending local adoption) on November 25, 2013.

Approved this 18th day of Dec, 2013.

Board of County Commissioners
of Oklahoma County, Oklahoma

Raymond L Vaughn Jr
Ray Vaughn, Chairman

Willa Johnson, Vice Chairperson

Brian Maughan
Brian Maughan, Member

ATTEST:

Carolyn Caudill
Carolynn Caudill, County Clerk

SEAL OF OKLAHOMA COUNTY 1890

RESOLUTION NO. 32-12-13

A RESOLUTION OF THE SPENCER CITY COUNCIL OF THE CITY OF SPENCER AUTHORIZING THE ADOPTION OF THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN – 2013 UPDATE

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **CITY OF SPENCER**:

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

PASSED AND ADOPTED on this 21st day of December , 2013, by the following vote:

AYES: 4
NOES: 0
ABSENT: 1
ABSTAIN: 0

ATTEST: _____
Clerk, City of Spencer

_____
Mayor, City of Spencer

RESOLUTION
12-17-2013 (C)

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF THE VILLAGE AUTHORIZING THE ADOPTION OF THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN – 2013 UPDATE

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **CITY OF THE VILLAGE**:

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.

2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.

3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.

4) Will continue its support of the Mitigation Planning Committee as described within the Plan.

5) Will help to promote and support the mitigation successes of all participants in this Plan.

6) Will incorporate mitigation planning as an integral component of government and partner operations.

RESOLUTION
12-17-2013 (C)

7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

APPROVED AND ADOPTED by the governing body of the City of The Village this 17th day of December, 2013 by the following vote:

AYES: Hibbard, Symes, Bennett, Broughton and Bernardy
NOES: None
ABSENT: None
ABSTAIN: None

Mayor Chris Bernardy

ATTEST:

Bruce K. Stone,
City Clerk

RESOLUTION NO. 489
A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF WARR ACRES AUTHORIZING THE ADOPTION OF THE OKLAHOMA COUNTY HAZARD MITIGATION PLAN – 2013 UPDATE

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the **CITY OF WARR ACRES**:

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

PASSED AND ADOPTED on this 21st day of January, 2014 by the following vote:

AYES: Shapiro, Ryan, McClure, Godwin, Maxey, Mickley, Fuhrman, and Woolley.
NOES:
ABSENT:
ABSTAIN:

CITY OF WARR ACRES CORPORATE SEAL OKLAHOMA

ATTEST: _____
Clerk, City of Warr Acres

_____
Mayor, City of Warr Acres

SECTION 3: PLANNING PROCESS

INTRODUCTION

This section includes a description of the planning process used to develop the Plan Update, including how it was prepared, who was involved in the process, and how the public was involved.

To ensure that the Plan met the requirements of the DMA 2000, an approach to the planning process and plan documentation was developed to achieve the following goals:

- The Plan was multi-jurisdictional and considers all natural hazards facing the planning area, thereby satisfying the natural hazards mitigation planning requirements specified in DMA 2000. In addition to Unincorporated Oklahoma County, fourteen (14) of the incorporated jurisdictions in the County elected to participate in the planning process.

Table 3-1. Participating Jurisdictions

Participating Jurisdictions		
Oklahoma County	City of Edmond	City of Nichols Hills
Town of Arcadia	Town of Forest Park	City of Nicoma Park
City of Bethany	City of Harrah	City of Spencer
City of Choctaw	Town of Luther	City of The Village
City of Del City	City of Midwest City	City of Warr Acres

- The Plan was developed following the process outlined by DMA 2000, FEMA regulations, and FEMA and Oklahoma Emergency Management (OEM) guidance. Following this process will ensure all the requirements are met and support Plan review.

This update to the Oklahoma County HMP was written using the best available information obtained from a wide variety of sources. Throughout plan development, a concerted effort was made to gather information from participating municipal agencies and staff as well as stakeholders, federal and state agencies, and the residents within the planning area. The Planning Committee solicited information from local agencies and individuals with specific knowledge of certain natural hazards and past historical events, as well as considering planning and zoning codes, ordinances, and other recent planning decisions. The natural hazard mitigation strategies identified in this plan have been developed through an extensive planning process involving county and local agencies, municipal officials and staff, and planning area residents.

This section of the Plan describes the mitigation planning process, including (1) Planning Partnership – Organization and Activity; (3) Stakeholder and Public Outreach and Involvement; (4) Coordination with Existing Mitigation Efforts and Programs; (5) Integration/Coordination with Existing Plans and Programs; and (5) Continued Public and Stakeholder Involvement.

PLANNING PARTNERSHIP - ORGANIZATION AND ACTIVITY

This section of the Plan identifies how the planning process was organized with the many "planning partners" involved, and outlines the major activities that were conducted in the development of this Plan.

Organization of Planning Partnership

The 2006 planning process was led by the Oklahoma County Planning Department and Oklahoma County Emergency Management, which has remained the County hazard mitigation "management team" for overseeing plan implementation, review and updating.

In 2009, Oklahoma County applied for a grant to update the 2006 HMP under HMGP 1735-DR-OK, which was subsequently awarded in 2010.

During June-July 2010, the Oklahoma County Planning Department invited the incorporated municipalities within the County to participate in the plan update process, and conducted administrative meetings with the municipalities to discuss the process in July and September, 2010.

A Planning Committee was assembled consisting of representatives from the various Unincorporated County departments and agencies, and representatives from each of the participating municipalities. The Planning Committee was charged with the following:

- Represent their jurisdiction throughout the planning process;
- Establish Plan development goals;
- Establish a timeline for completion of the Plan;
- Ensure that the Plan meets the requirements of DMA 2000 and FEMA and OEM guidance;
- Solicit and encourage the participation of regional agencies, a range of stakeholders, and citizens in the Plan development process;
- Assist in gathering information for inclusion in the Plan, including the use of previously developed reports and data;
- Organize and oversee the public involvement process;
- Assist with identification of "Hazards of Concern"
- Assist with the update of the hazard mitigation planning Goals and Objectives
- Assist with the review of a broad range of potential mitigation initiatives
- Identify, develop and prioritize appropriate mitigation initiatives.
- Develop and author the jurisdictional annex for their jurisdiction;
- Review, amend and approve all sections of the Plan;
- Develop, revise, adopt, and maintain the Plan.

Table 3-2 identifies the Planning Committee and other county and municipal representatives that provided input to the Plan Update process.

Table 3-2. County and Municipal Planning Partnership

Jurisdiction or Agency	Name, Title, Department
Unincorporated Oklahoma County	Ruth Walters, County Planner, Oklahoma County Department of Planning David Barnes, Emergency Management Director, Oklahoma County Emergency Management David Burright, Oklahoma County Emergency Management Greg Whitworth, Oklahoma County Emergency Management Stacy Trumbo, County Engineer, Oklahoma County Engineering Department (incl. oversight of Flood Plain Management Board)

Jurisdiction or Agency	Name, Title, Department
Town of Arcadia	Marilyn Murrell, Mayor Gerald McCauley, Chief of Police, Arcadia Police Department James Woodard, Arcadia Fire Department
City of Bethany	Scott Schroeder, Fire Chief/Emergency Manager, Bethany Fire Department
City of Choctaw	Loren Bumgarner, Fire Chief Robert Floyd, City Manager Durland Lewis Bernie Nauheimer, Asst. City Manager
City of Del City	Jim Hock, Fire Chief, Del City Fire Department Bill Graham, Director, Public Works Tom Leatherbee, Community Services Director Monica Kynaston, Community Services, City Planner
City of Edmond	Matt Stillwell, Director Mike Magee, Emergency Management Coordinator Jeff Byram, Hydrologist, Edmond Drainage Utility Nancy Kennedy, NFIP Floodplain Administrator/Stormwater Manager, Edmond Drainage Utility Steve Manek Brook Pintens, Emergency Management Dean Sherrick, Edmond Electric Glenn Fisher, Edmond Electric Brett Griffin, Edmond Electric Herb Mason, Public Works and Streets Department
Town of Forest Park	Chuck Blair, Fire Chief Wesley Blair
City of Harrah	Michelle Cogdill, Finance/HR Murrel Coleman, Fire Chief Chris Bain, Code Enforcement/Building Inspector, NFIP Floodplain Admin.
Town of Luther	Jason Miller, Fire Chief Kim Bournes, Emergency Manager Kevin Dixon, Luther Fire Department Chris Carpenter, Water Operator Richard Smith Chris Bridges, Town Engineer and NFIP Floodplain Administrator
City of Midwest City	Patrick Meneffee, City Engineer, NFIP Floodplain Administrator Mike Bower, Emergency Manager Kevin Burns, Engineering Department
City of Nichols Hills	Terry Hamilton, Deputy Fire Chief Keith Bryan, Fire Chief David Poole, City Manager Randy Smith, Director of Public Works Kelly Hurley, Code Enforcement/Building Inspector Lindy Stormont, Risk Manager

Jurisdiction or Agency	Name, Title, Department
City of Nicoma Park	Jim Shonts, Emergency Manager James King, Fire Chief Robert Pittmann, Mayor James Pumphrey, Mayor (former) Eric Crews, Police Department
City of Spencer	Dale Griffith, Captain, Spencer Fire Department Robert Taylor, Fire Chief, Spencer Fire Department Tim Jones, Public Works Director Dwight W. Peoples, Code Enforcement Officer Nicole Mukes, City Manager Jeff Hale
City of The Village	Wes Tollison, Fire Chief Randy Neal, Fire Department Larry Walton, Public Works Bruce Stone, City Manager Eric Knight, Chief Inspector, Building and Code Enforcement
City of Warr Acres	Kenny Koger, Fire Chief Steven Coy, Warr Acres Fire Department Michael Turman, Public Works Director, NFIP Floodplain Administrator Rob Carter, Emergency Manager

Note: Various other regional, county and local agencies, departments, stakeholders and the public have participated in and contributed to the development of this Plan, as identified later in this Section.
* Indicates NFIP Floodplain Administrator for this community

To help facilitate the plan update process, Oklahoma County contracted with a planning consultant (Tetra Tech, Inc. – Tulsa and Oklahoma City, OK) to support the plan update process. The contract consultant was tasked with:

- Developing a plan update strategy and schedule
- Assisting with the development and implementation of a public and stakeholder outreach program
- Data collection
- Facilitation and attendance at meetings (planning committee, stakeholder, public and other)
- Updating the hazards of concern, hazard profiling and risk assessment
- Reviewing and updating the mitigation planning goals and objectives
- Assistance with the screening of mitigation actions and the identification of appropriate actions
- Assistance with the prioritization of mitigation actions
- Authoring of the Plan update documents

Planning Partnership Activities:

Municipal participation in the plan update process included the following activities:

At the August 2011 planning committee meeting, all municipalities were provided with electronic copies of the 2006 Plan, the 2011 Oklahoma State Hazard Mitigation Plan, and the 2006 FEMA Plan Review Crosswalk and encouraged to review these materials to identify areas that they believed required specific attention in the update process. Also at this time, all municipalities were provided with survey

worksheets to facilitate municipal input on hazard events and losses since the 2006 Plan, review of the 2006 plan goals and objectives, local capability assessment, review and update their local critical facility inventory, identify hazard areas and specific vulnerabilities in their community, and identify past, ongoing and potential mitigation activities (see sample municipal survey forms and worksheets in Appendix F).

In January 2012, the planning committee met to review plan progress, and conduct a Strengths, Weaknesses, Obstacles and Opportunities (SWOO) exercise to screen a broad range of mitigation alternatives for use by planning partnership as they developed their county and local mitigation strategies. Following the January meeting, all municipalities were invited to host local plan support meetings with the OKC management team and contract planning consultant to support their municipal participation in the plan update process, and specifically to work on updating their local mitigation strategy.

In a March 2012, the planning committee met for a Jurisdictional Annex Workshop, at which time the communities were provided with their draft municipal annex (chapter to the plan), the updated hazard profiles and risk assessment, and other resources to assist the community in completing their municipal annexes. Following this meeting, all municipalities were again invited to host local plan support meetings with the OKC management team and contract planning consultant to provide direct support with updating their local mitigation strategy and completion of their jurisdictional annexes.

A summary of the activities and milestones achieved by the planning partnership during the development of this Plan is included in Table 3-3. It must be recognized that this summary table identifies only the formal meetings held during plan development, and does not reflect the larger universe of planning activities conducted by individuals and groups throughout the planning process. In addition to these meetings there was a great deal of communication between Planning Committee members through electronic mail (email), by phone, and via a secure collaborative web site. The consultant established the secure, collaborative website for the sharing of information and data amongst the Planning Committee. All planning partners and interested stakeholders were provided with access. This site was designed to facilitate the sharing of data and information, post notices, and helped maintain communication between all plan participants.

After completion of the Plan, implementation and ongoing maintenance will become a function of the Planning Committee. The Planning Committee will review the Plan and accept public comment as part of an annual review and as part of the five year mitigation plan update.

Table 3-3 presents a summary of the planning partnership efforts implemented during the development process for this Plan, as well as key milestones in the Plan's development.

Table 3-3. Summary of Planning Partnership Activities and Project Milestones

Date	Description of Activity	Participants
2009	Oklahoma County submits for a grant to update the 2006 HMP under HMGP 1735-DR-OK	Oklahoma County; Oklahoma Emergency Management; FEMA Region VI
June-July, 2010	County invites municipalities to participate in the plan update process	OK Planning Department; al incorporated municipalities
July 15, 2010	Planning Committee Meeting – Administrative meeting to discuss upcoming plan update project.	Planning committee members (see Appendix C); David Barnes – OK Emergency Management, Ruth Walters – OK Planning Department
September 23, 2010	Planning Committee Meeting – Discussion of project organization, planning process and data and information needs.	Planning committee members (see Appendix C); David Barnes – OK Emergency Management, Ruth Walters – OK Planning Department
August 17, 2011	Plan Update Kick-Off Meeting – Provided partnership with an overview of the plan update process; provided copy of original plan, plan review crosswalk and latest	Planning committee members (see Appendix C); David Barnes – OK Emergency Management, Ruth Walters – OK Planning Department ;

Date	Description of Activity	Participants
	State Plan, discussed review process; reviewed original hazards of concern; reviewed county and local data collection process; provided local worksheets for updating hazard events and losses, local capability assessment, and goals and objectives; reviewed public and stakeholder outreach strategy; discussed mitigation grant opportunities.	Jonathan Raser - Tetra Tech
August – December, 2011	County and participating municipalities provide data and information for hazard profile and risk assessment; complete capability assessments; conduct public and stakeholder outreach.	County and municipal planning partnership with support from contract consultant; public and stakeholders.
December, 2011	Oklahoma County develops and launches project Hazard Mitigation Planning website, including Citizens Hazard Preparedness / Public Awareness questionnaire.	Oklahoma County, public
January, 2012	County announces project on County homepage, and encourages participating municipalities to provide links to project website and survey.	Oklahoma County, participating municipalities, public
January 17, 2012	Planning Committee Meeting – Review plan update process and progress; discuss municipal participation; review plan update timeline; review mitigation grant funding opportunities; conduct a Strengths, Weaknesses, Obstacles and Opportunities (SWOO) exercise to screen a broad range of mitigation alternatives for use by planning partnership.	Planning committee members (see Appendix C); Mary Jane Coffman, American Red Cross; Greg Whitworth, Oklahoma State Emergency Management; Tetra Tech
January 17-18, 2012	Local Project Support Meetings - County representatives and contract consultant meet with municipalities to assist with data collection, reviewing goals and objectives, identifying local capabilities, and identifying local vulnerabilities and potential mitigation projects (specific meetings identified below).	County Project Management; Participating municipalities (see following); contract consultant.
January 17, 2012	Local project support meeting – City of the Village	Wes Tollison, Randy Neal, Larry Walton, Bruce Stone – City of The Village; Ruth Walters – OKC Planning; David Cross, Ryan Smith, Jonathan Raser – Tetra Tech
January 18, 2012	Local project support meeting – Town of Luther	Kim Bournes, Chris Carpenter, Jason Miller, Kevin Dixon – Town of Luther; Ruth Walters – OKC Planning; David Barnes – OKC EM; Jonathan Raser – Tetra Tech
January 18, 2012	Local project support meeting – City of Del City	Bill Graham, Mike Davis, Monica Kynaston, Cike Cantrell, Jim Hock – City of Del City; Ruth Walters – OKC Planning; David Barnes – OKC EM; Jonathan Raser – Tetra Tech
January 18, 2012	Local project support meeting – City of Nicoma Park	Jim Shonts, Eric Crews, James King – City of Nicoma Park; Ruth Walters – OKC Planning; David Barnes – OKC EM; Jonathan Raser – Tetra Tech
March 20, 2012	Planning Committee Meeting - Jurisdictional Annex Workshop to provide participating jurisdictions with the templates, tools and resources to develop their chapter (jurisdictional annex) to the Plan.	Planning committee members (see Appendix C); Mary Jane Coffman, American Red Cross; Tetra Tech
March 20-22, 2012	Local Project Support Meetings - County and contract consultant meet with municipalities to assist with complete their jurisdictional annexes, including the identification and prioritization of mitigation initiatives and projects (see following).	County Project Management; Participating municipalities (see following); contract consultant.
March 20, 2012	Local project support meeting – City of Edmond	Mike Magee, Herb Mason, Dean Shrrick, Clenn Fisher, Brook Pintens, Brett Griffin, Jeff Byram – City of Edmond; Ruth Walters – OKC Planning; David Cross, Jonathan Raser – Tetra Tech

Date	Description of Activity	Participants
March 21, 2012	Local project support meeting – City of Warr Acres	Kenny Koger, Stephen Coy – City of Warr Acres; Ruth Walters – OKC Planning; Jonathan Raser – Tetra Tech
March 21, 2012	Local project support meeting – City of Del City	Jim Hock, Bill Graham, Tom Leatherbee, Monica Kynaston – City of Del City; Ruth Walters – OKC Planning; Jonathan Raser – Tetra Tech
March 21, 2012	Local project support meeting – City of Spencer	Tim Jones, Dwight W. Peoples, Robert Taylor – City of Spencer; Ruth Walters – OKC Planning; Jonathan Raser – Tetra Tech
March 22, 2012	Local project support meeting – City of Midwest City	Mike Bower, Patrick Menefee, Guy Henson – City of Midwest City; Ruth Walters – OKC Planning; Jonathan Raser – Tetra Tech
March 22, 2012	Local project support meeting – Town of Arcadia	Gerald McCauley, Marilyn Murrel – Town of Arcadia; Ruth Walters – OKC Planning; Jonathan Raser – Tetra Tech
March 22, 2012	Local project support meeting – Town of Luther	Kim Bournes, Chris Carpenter, Richard Smith, Chris Bridges, Kevin Dixon, Jason Miller – Town of Luther; Ruth Walters – OKC Planning; Jonathan Raser – Tetra Tech
March 22, 2012	Local project support meeting – City of Nichols Hills	Randy Smith, Terry Hamilton, Randy Smith, David Poole, Lindy Stormont – City of Nichols Hills; Ruth Walters – OKC Planning; Jonathan Raser – Tetra Tech
April – October 2012		
September – October 2012	Project hazard mitigation planning website updated to include interim draft sections of the plan for public review and comment.	Oklahoma County, public
October 2012	Participating villages update their homepage advertisement/links to the HMP public website, post announcement/update of the planning process through their public email distribution lists (“email blasts”), and are requested to announce/update the HMP program in local newsletters. Updated tri-fold brochures provided for local public distribution.	Oklahoma County and municipalities, public
October 2012	Draft plan submitted to OEM for courtesy review.	OEM
October 2012	Complete draft plan posted to project HMP website, and hard-copies of the Introduction and municipal annexes are posted in the municipal buildings. County and municipalities inform the public of the availability of the draft for review by email blasts, notices in local newsletters, “news” announcements on municipal website homepages, at announcements at local civic meetings.	Oklahoma County and all participating municipalities, public
May 2013	Plan submitted to OEM/FEMA for review and approval.	OEM and FEMA Region VI
June 2013	Local project support meeting - Edmond	Oklahoma County, OEM, and FEMA Region VI
July 2013	County	Oklahoma County
July 2013	Local project support meeting – Midwest City	Oklahoma County and Midwest City
July 2013	Local project support meeting – Warr Acres	Oklahoma County and Warr Acres
July 2013	Local project support meeting – Edmond, Harrah, Nicoma Park, Spencer, The Village	Oklahoma County, Edmond, Harrah, Nicoma Park, Spencer, and The Village
July 2013	Local project support meeting – Del City	Oklahoma County and Del City
July 2013	Local project support meeting – Choctaw, Luther	Oklahoma County, Choctaw, and Luther
July 2013	Local project support meeting – Nichols Hills	Oklahoma County and Nichols Hills
July 2013	Local project support meeting – Forest Park	Oklahoma County and Forest Park
August 2013	Local project support meeting – Bethany	Oklahoma County and Bethany

Date	Description of Activity	Participants
August 2013	Local project support meeting – The Village	Oklahoma County and The Village
August 2013	Local project support meeting – Arcadia	Oklahoma County and Arcadia

STAKEHOLDER OUTREACH AND INVOLVEMENT

Efforts were made throughout the plan update process to assure broad regional, county and local representation and participation. Stakeholder outreach was performed early on, and continually throughout, the planning process. In addition to "mass media" notification efforts, stakeholders were invited to attend planning committee meetings, or were engaged through existing meetings and forums of stakeholder groups.

The following is list of the various stakeholders that were invited to participate in the development of this Plan, along with a summary of how these stakeholders participated and contributed to the Plan. It should be noted that this summary listing cannot possibly represent the universe of stakeholders that were aware of and/or contributed to this Plan, as outreach efforts were being made, both formally and informally, throughout the process by the many planning partners involved in the effort, and documentation of all such efforts is impossible. Rather, this summary is intended to demonstrate the scope and breadth of the stakeholder outreach efforts made during the development of this Plan.

Information and input provided by these stakeholders has been included variously throughout this Plan where appropriate, as identified in the references.

FEMA Region VI: Provided grant funding to perform the update; provided plan update guidance; provided local NFIP data; provided regulatory review and ultimately approval of the plan update documents.

Oklahoma State Emergency Management: Assisted with securing grant funding to perform the plan update; provided plan update guidance; attended planning committee meeting(s); provided review and comment on the draft plan documents. Bill Penka, State Hazard Mitigation Officer, provided technical assistance along with his planning team of Charlie Balthrop, Mike Bradford, and Jeanne Patrigo.

Oklahoma State Department of Environmental Quality: Website reviewed for relevant plans and data. Stormwater and MS4 information has been incorporated through consideration of local stormwater management projects that intersect with flood mitigation.

Oklahoma County Department of Planning: Shared project management team responsibilities with the OKC Emergency Management, facilitated the entire plan update process, provided county and local data and information, provided direct municipal support throughout the process, , assisted with the update of county-level mitigation strategies, reviewed and edited draft and final plan sections. Former County Planner Ruth Walters and current Planner Eric Brandt provided input, along with Tyler Gammon, Director of Planning. Also assisting was Gordon Murray, GIS coordinator.

Oklahoma County Emergency Management: Shared project management team responsibilities with the OKC Planning Department, facilitated the entire plan update process, provided county and local data and information, assisted with the update of county-level mitigation strategies, provided direct municipal support throughout the process, reviewed and edited draft and final plan sections. Emergency Management Director David Barnes, along with Operations Officer David Burright, Communications Specialist John Comstock and Resource Specialist Greg Whitworth were heavily involved with this process.

Oklahoma County Engineering: Through Planning Department, shared project management team responsibilities with the OKC Emergency Management, facilitated the entire plan update process, provided county and local data and information, provided direct municipal support throughout the

process, Stacy Trumbo, County Engineer, assisted with the update of county-level mitigation strategies, reviewed and edited draft and final plan sections.

County Highway Districts (three): Provided input to the plan update process via meetings held with Emergency Management, including information on vulnerable infrastructure and potential mitigation projects. Former Superintendent Craig Wallace from District 1; Brian Jasper, Interim Superintendent District 1; Kevin Hopkins, District 2 Superintendent; and Gerald Wright, District 3 Superintendent assisted with this process.

Oklahoma County Board of County Commissioners: The three County commissioners were invited to participate in the planning process, and have been notified of all formal meetings conducted as part of the plan update process. The county commissioners have been variously involved in the process through outreach by the Planning Department, with respect to specific vulnerable areas and potential mitigation projects considered during this plan update process. Our County Commissioners include Willa Johnson (District 1), Brian Maughan (District 2), and Ray Vaughn (District 3).

Association of Central Oklahoma Governments (ACOG): Emergency Management has been coordinating with Steve Willoughby, Director of 911 at ACOG on mitigation projects and the possible leveraging of non-FEMA grant funding sources to support mitigation in the region.

American Red Cross – Oklahoma County Chapter: James Tittle, Regional Director, attended planning committee meeting(s). Provided inventory data on ARC facilities, identified potential mitigation initiatives.

Eastern Oklahoma Fire Chiefs: Project presented at regular meetings of this group by OK Emergency Management, encouraging local participation and input to the plan update process. Most of the participating municipalities have had direct input from their local fire departments and fire chiefs. This group covers a wide geographic base, well outside of the County limits. Many of the Chiefs are contact points for the plan and are listed in the annexes contained herein.

Oklahoma City Metro Fire Chiefs (Metro Chiefs): Project presented at regular meetings of this group by OK Emergency Management, encouraging local participation and input to the plan update process. It is noted that Oklahoma City was not a formal participant in this planning process, but has been included in public and stakeholder outreach efforts.

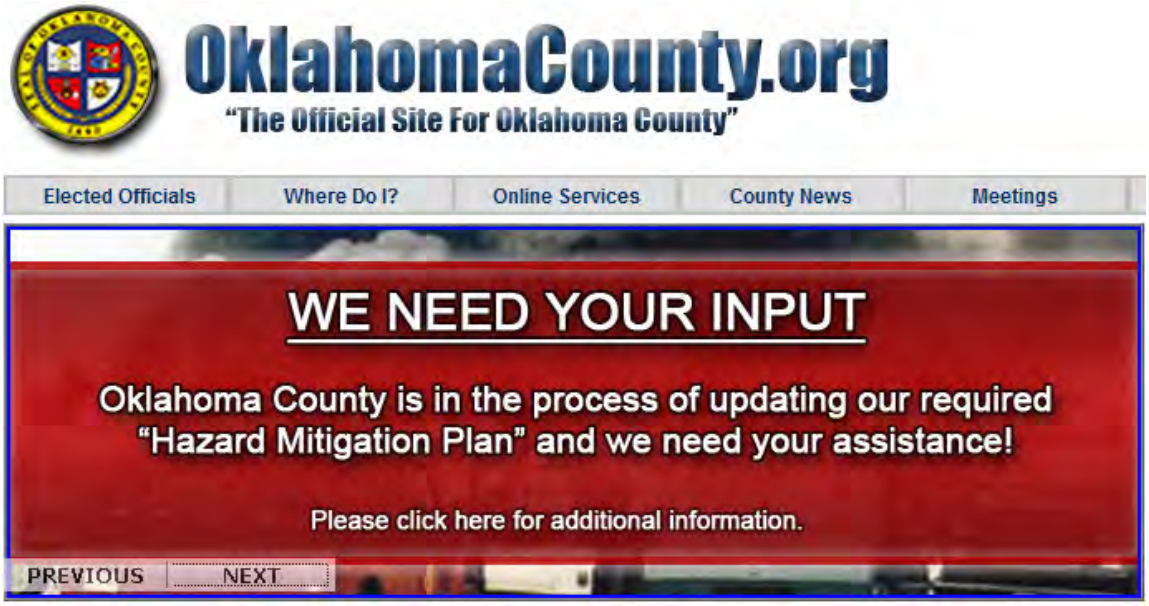
United States Army Corps of Engineers: Provided information during original floodplain management planning effort. Provided input on current and planned Corps studies and projects. Mark Locke and Lloyd Lewis at the Southwestern Division in Tulsa were contacted regarding the dam inundation maps included herein.

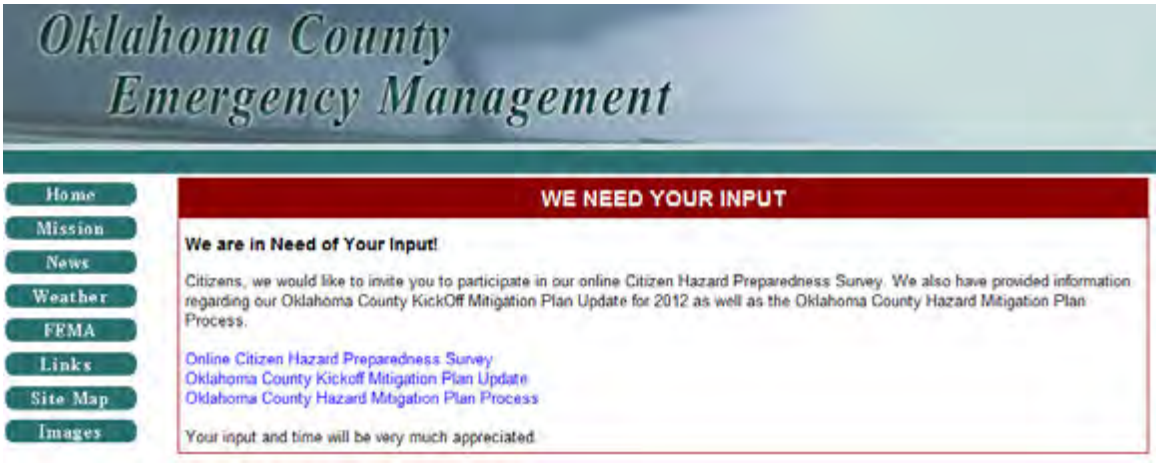
PUBLIC OUTREACH AND PARTICIPATION

In order to facilitate coordination and communication between the Planning Committee and citizens, various methods of public outreach were conducted to inform the public of the Plan and encourage participation in the planning process. The following public outreach efforts were made during this plan update process:

- The plan update project was presented to various regional, county and local boards and commissions at during regularly scheduled meetings throughout this planning process, as identified in Table 3-3.

- Oklahoma County developed a public Hazard Mitigation Planning webpage (http://www.oklahomacounty.org/emergencymanagement/documents/hmp.pdf) to explain the project and elicit public participation in the process and input to the plan. The webpage was launched in September 2011 and has been supported by an announcement on the County homepage since January, 2012.





- An on-line natural hazards preparedness citizen survey was developed to gauge household preparedness that may impact the Planning Area and to assess the level of knowledge of tools and techniques to assist in reducing risk and loss of those hazards (http://www.surveymonkey.com/s/LRLMPTC). The questionnaire asked 24 quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs. The questionnaire also asked several demographic questions to help analyze trends.

The questionnaire has been available on the public website since September, 2011, through email distribution lists, and local newsletters. Response rates to date are considered good. Appendix D summarizes public input received through the website, the online survey and other sources, and identifies how this input was integrated into the Plan update as appropriate.

Responses from the Oklahoma County Survey conducted via the public information website and input from the public HMP meetings were collected and presented to the Steering Committee. The Steering Committee reviewed and utilized this input during the development of the Mitigation Strategy to ensure that the concerns of the public were addressed.

- Draft and ultimately final versions of the Plan have been posted to the public website (http://www.oklahomacounty.org/emergencymanagement/documents/hmp.pdf) for public review and comment.

- Unincorporated Oklahoma County and all participating jurisdictions have identified continued public outreach as a high priority mitigation initiative (see Section 9.1). Under these initiatives, the County will implement a program of media releases and other public notifications regarding where the public can review the Plan and provide ongoing input, and may include additional public meetings to further promote awareness of the Plan.

INTEGRATION/COORDINATION WITH EXISTING PLANS AND PROGRAMS

While hazard mitigation plans are developed in response to certain Federal requirements and mandates (see Appendix A), they are most effective when they become part of an integrated suite of hazard risk management tools available to the communities. This Plan has been developed in consideration of other related planning efforts, and as such, should complement and support the mission, findings, recommendations, initiatives, actions and mandates of those plans and programs, as applicable and appropriate.

Examples of other natural hazard risk management and related programs in Unincorporated Oklahoma County and the participating municipalities include Comprehensive Emergency Management Plans (CEMP), the National Flood Insurance Program (NFIP), floodplain management plans and other flood risk reduction studies and programs, and master plan/comprehensive planning efforts. This hazard mitigation planning process has carefully reviewed these related programs, and incorporated their data, findings and recommendations into this Plan. Further, as feasible, those departments, agencies and representatives involved in the development and implementation of those plans and programs have been encouraged to participate in this planning process.

Section 6 "Mitigation Strategy" includes a Capability Assessment subsection which provides a summary and description of the existing plans, programs and regulatory mechanisms in Oklahoma County that support hazard mitigation. This section documents how these existing plans and programs have been integrated into this updated plan, and how this plan will continue to promote and effect that coordination.

The integration of existing data, plans and programs is further documented in the comprehensive "References" section of this plan update, as well as in the "Data and Methodology" sections of the hazard profiles (Section 5).

Comprehensive Emergency Management Planning

While this planning process is focused on the mitigation phase of the emergency management planning cycle, preparedness, response and recovery procedures and activities are defined within comprehensive emergency management plans (CEMPs). To assure that these plans complement and support each other, OKEM has continued to provide mitigation project management support along with OK Planning Department, and have involved many local emergency managers throughout the update process.

This plan update project has been managed through OKEM, allowing broad integration of relevant emergency management data, information and programs to this update. Further, county and municipal participation in this process has included emergency managers, police, fire and other first responders and local emergency management support groups.

Data and information used included disaster claims data (including public and individual assistance) and other loss information to support the updated vulnerability assessments and assist with the identification of appropriate, cost-effective mitigation projects. Specifics about response and recovery programs and efforts in the County, including the management and administration of mitigation and emergency preparedness grant programs, have led to specific county and local-level mitigation actions to improve regional emergency management coordination and build related risk management capabilities.

The county and municipalities recognize that the findings and recommendations of this plan update need to be incorporated into their emergency planning, preparedness, response and recovery programs and operations. Public education and outreach to improve personal preparedness, and promote an awareness

of mitigation opportunities and personal protection through risk insurance, have been incorporated in specific county and local initiatives.

National Flood Insurance Program

Established in 1968, the NFIP provides federally-backed flood insurance to residents of communities that enact and enforce regulations that more carefully regulate development within floodplain areas. For individual property owners to be eligible to buy the federally-backed flood insurance, their property must be located within a community that participates in NFIP.

For a community to be eligible in NFIP, it must adopt and enforce a floodplain management ordinance to regulate proposed development in floodplains and officially designate a local floodplain coordinator/administrator. The intent of the program is to ensure that new construction does not exacerbate existing flood hazards and is designed to better withstand flooding. All municipalities participating in this plan update participate in the NFIP, and have enacted and enforced floodplain management ordinances as required.

Table 3-4 identifies the local NFIP Floodplain Administrators for the participating municipalities during this plan update process. The floodplain administrators in each municipality have been involved in this planning process, at minimum providing specific flood-related information and mitigation initiatives, as well as providing review and input on the planning documents.

Data from FEMA Region VI regarding NFIP Insurance Reports was used in the risk assessment for the flood hazard included in Section 5. Mitigation activities related to this program are included in the jurisdictional annexes provided in Section 9.

All municipalities were encouraged to include mitigation initiatives that specify continued and enhanced participation in the NFIP, and address their flood vulnerable structures and infrastructure, including Repetitive Loss (RL) and Severe Repetitive Loss (SRL) properties. The county and all municipalities have identified public outreach initiatives that include increasing public awareness of and participation in the NFIP.

Community Rating System (CRS)

The NFIP has been successful in protecting property owners who acquire flood insurance through the program from catastrophic financial losses due to flooding, and in requiring that new buildings constructed within 100-year flood plains are better protected from flood damage.

In the 1990s, the Flood Insurance Administration (FIA) established the CRS to encourage local governments to increase their standards for floodplain development. The goal of this program is to encourage communities, through flood insurance rate adjustments, to implement standards above and beyond the minimum required in order to:

- Reduce losses from floods
- Facilitate accurate insurance ratings
- Promote public awareness of the availability of flood insurance

CRS is a voluntary program designed to reward participating jurisdictions for their efforts to create more disaster-resistant communities using the principles of sustainable development and management. Of the communities participating in this Plan, currently only the City of Edmond (CRS Class 7) participates in

CRS, however some of the municipalities have included a high priority mitigation initiative to join the CRS program.

Table 3-4. Municipal Floodplain Administrators (2011-2012)

Jurisdiction	Name	Title
Town of Arcadia	Chris Bridges	Town Engineer (Contracted)
City of Bethany		Appointed by City Council
City of Choctaw		City Building Official by Code
City of Del City	Thomas Leatherbee	Designated by City Manager (currently Community Services/Del City/Director and City Planner)
City of Edmond	Nancy Kennedy	Stormwater Manager, Edmond Drainage Utility; City Manager or Designee per City Code
Town of Forest Park	TBD	TBD
City of Harrah	Chris Bain	Code Enforcement / Building Inspector
Town of Luther	Chris Bridges	Town Engineer (Contracted)
City of Midwest City	Patrick Meneffee	City Engineer
City of Nichols Hills	Kelly Hurley	Code Enforcement Officer
City of Nicoma Park		City Building Official per city code
City of Spencer		TBD
City of The Village		Emergency Management, per Flood Damage Prevention Ordinance
City of Warr Acres	Michael Turman	Public Works Director

Source: As identified by municipalities, or within their municipal code

Floodplain Management Plans and Other Flood Studies

Flood studies and other floodplain management planning efforts have been ongoing in the planning area. In August 2011, the City of Del City hosted a Discovery Meeting for the Lower North Canadian watershed RiskMAP program. The December 30, 2011 FEMA Discovery Report was reviewed and incorporated into this plan update process as appropriate.

FEMA Hazard Mitigation Assistance (HMA) Grant Programs

By maintaining a FEMA-approved HMP (this plan), the county and all participating communities are eligible to apply for and receive mitigation grant funding for eligible, cost-effective mitigation projects under the FEMA Unified Hazard Mitigation Assistance (Unified HMA) grant programs, including:

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- Repetitive Flood Claims (RFC)
- Severe Repetitive Loss (SRL)

Participation in FEMA 404 HMGP may cover mitigation activities including raising, removing, relocating or replacing structures within flood hazard areas. Unincorporated Oklahoma County and the participating municipalities have applied for assistance through FEMA 404 HMGP for various projects, including stormwater infrastructure improvements, property acquisitions and structural retrofits.

Throughout this plan update process, participating municipalities were provided information, including FEMA brochures and publications, to inform them of these grant programs. The county and all municipalities were asked to identify any projects that were funded under these programs, as identified in their jurisdictional annexes (Section 9).

As the county and municipalities updated their mitigation strategies, potential mitigation grant eligible projects have been indicated as such when identifying the potential funding source. OKEM will continue to inform the municipalities as mitigation grant opportunities are announced by OEM, and provide assistance as feasible and appropriate with the grant application process.

Comprehensive / Master Planning

Careful local comprehensive or master planning can greatly facilitate and support natural hazard mitigation efforts. These plans establish a long range land-use strategy directing and affecting both new development and re-development activities in the community. Through mechanisms and programs such as zoning, ordinances, natural resources management and capital funding, preventative mitigation activities and initiatives can effect longterm and cost-effective mitigation and promote sustainable growth and development.

Information from the County Comprehensive Plan and available local comprehensive plans were incorporated into the regional profile (Section 4), hazard profiles (Section 5), and into the asset inventory (population/demographics, general building stock, critical facilities) used to develop the updated vulnerability assessments (Section 5).

Recommendations within these plans have been considered in developing and updating the county and municipal-level mitigation strategies. The availability of model ordinances to address the specific risks and regulatory frameworks of the County was presented to the planning partnership during the planning process, discussed at the Jurisdictional Annex Workshops, and included in mitigation strategy identification/development resources provided to the plan participants.

It was the intention that through this planning process, municipalities shall incorporate the findings and recommendations of this plan update into future local planning efforts, and into the overall execution of their land-use planning process (e.g. site plan review, permitting, code enforcement). Known or anticipated future development in the County was identified at the local level, including the identification of known hazard risks and risk zones, within the jurisdictional annexes (Section 9).

INTEGRATION OF EXISTING DATA AND PLANS INTO MITIGATION PLAN

The mitigation plan integrates local and federal data as discussed below.

Local Data

The Planning Committee reviewed and incorporated existing data and plans to support the mitigation plan. A number of electronic and hard copy documents were made available to support the planning process. These documents are too numerous to list below; therefore, a summary is provided. A complete listing is included in the references section of this document.

- Oklahoma County Geographic Information System (GIS) data
- Documentation of past mitigation actions and grant applications
- Historic maps
- Oklahoma County Comprehensive, and Emergency Management Plans

Cross-referencing this Plan when such documents are updated will need to occur and has been included as mitigation activities in the jurisdictional annexes in Volume II, Section 9.

Federal and State Data

Federal and State data was collected and used throughout the mitigation process including:

- US Census data
- HAZUS-MH provided data
- FEMA "How To" Series (386-1 to 386-4, and 386-7)
- Data from the National Oceanic and Atmospheric Administration (NOAA)
- Data from the National Weather Service
- Data from FEMA including FEMA NFIP Studies
- Public laws and other programs such as the NFIP were examined to complete this Plan.

A complete list of the existing data and plans used to support this HMP is included in the references section of this document.

CONTINUED PUBLIC AND STAKEHOLDER INVOLVEMENT

Oklahoma County and the mitigation planning partnership are committed to the continued involvement of the public, as detailed in Section 7, "Plan Implementation, Maintenance and Update Procedures". This detailed public involvement plan includes the following elements:

The Oklahoma County mitigation planning partnership has identified continued public outreach as a high priority mitigation initiative (see Section 9.1). Under this initiative, the partnership will implement a program of media releases and other public notifications regarding where the public can review the Plan and provide ongoing input, and may include public meetings to further promote awareness of the Plan. Additional outreach will be through utility bill notices, public access TV channels, local newspapers, the County website and jurisdictional websites.

The plan will continue to be posted on County website (http://www.oklahomacounty.org/emergencymanagement/documents/hmp.pdf). Full copies of the Plan shall continue to be made available in hard-copy for review during normal business hours at the following locations:

Oklahoma County Emergency Management – and –
Oklahoma County Planning Commission
Oklahoma County Annex Building
320 Robert S. Kerr Avenue, Oklahoma City, OK 73102

Municipal supervisors/mayors or clerks and the Oklahoma County HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. Contact information for the County and all participating municipalities is included in the Point of Contact information in the jurisdictional annexes in Section 9 of this Plan.

The Oklahoma County Hazard Mitigation Planning Coordinator is responsible for collecting and maintaining public comment and input, as provided through the municipal mitigation planning representatives.

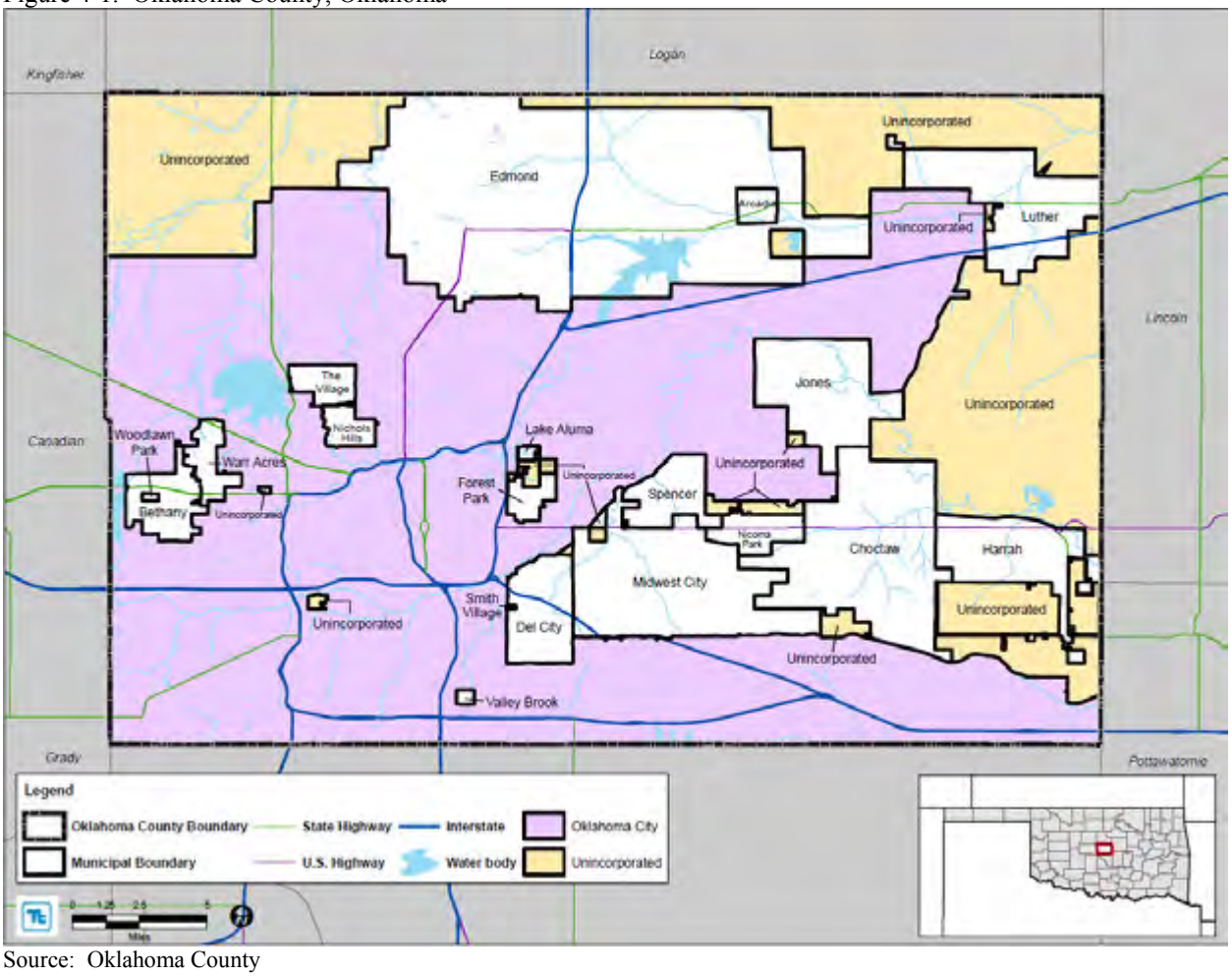
SECTION 4: REGIONAL PROFILE

This section provides profile information which is presented and analyzed to develop an understanding of a study area, including the economic, structural, and population assets at risk and the particular concerns that may be present related to hazards analyzed later in this plan (e.g., low lying areas prone to flooding or a high percentage of vulnerable persons in an area). The profile describes the general information of the Planning Area (physical setting, population and demographics, general building stock, and land use and population trends) and critical facilities located within the Oklahoma County Planning Area.

Location

Oklahoma County is located in the center of the State, encompassing about 720 square miles. Oklahoma City is the county seat, as well as the state capital (Figure 4-1).

Figure 4-1. Oklahoma County, Oklahoma



Source: Oklahoma County

History

Since before statehood, the State of Oklahoma has had a very colorful history. Prior to Statehood in 1907, the passage of the Organic Act of May 2, 1890, created Oklahoma Territory and allowed the Organization of Government in the central areas. Almost three million acres were opened to settlement by homestead

and seven counties formed from the Unassigned Lands and the Panhandle. The governor was authorized to apportion the members of the Legislature among the counties and was also empowered to appoint county officers. Oklahoma County was one of the first seven counties in Oklahoma organized under the Organic Act. It was designated County Number 2 until voters renamed it Oklahoma County.

In June of 1890, Governor George W. Steele, the first territorial governor of Oklahoma, ordered that a census be taken of the territory. At that time, the counties of Oklahoma Territory were; Logan, Oklahoma, Cleveland, Canadian, Kingfisher, Payne, and Beaver (the Panhandle region). The 1890 Census index contains 18,753 records for heads-of-household in these seven counties. Oklahoma is now comprised of 77 counties. (OK County CP, 2007)

Government and Political Subdivisions

There are 20 cities and towns located in Oklahoma County, as well as unincorporated Oklahoma County. Oklahoma County has a constitutional form of government composed of eight elected officials. There are three County Commissioners forming the Board of County Commissioners. Other officials are the County Assessor, County Clerk, Court Clerk, Sheriff, and County Treasurer.

Oklahoma County is divided into three districts: District 1, District 2, and District 3. Of the 720 total square miles in Oklahoma County, 578 square miles are located within incorporated cities and 142 square miles are unincorporated. There are scattered unincorporated areas within the three County Districts, that is, relatively small parcels surrounded by incorporated lands.

Geographically speaking, the unincorporated areas of Oklahoma County can be separated into three areas that will be used throughout this document: 1) Northeast Oklahoma County is primarily composed of District 1, 2) Southeast Oklahoma County area is primarily composed of District 2, and 3) Northwest Oklahoma County is primarily composed of District 3.

Physical Setting

This section presents the physical setting of the Oklahoma County Planning Area, including: hydrography and hydrology, topography and geology, climate, and land use/land cover.

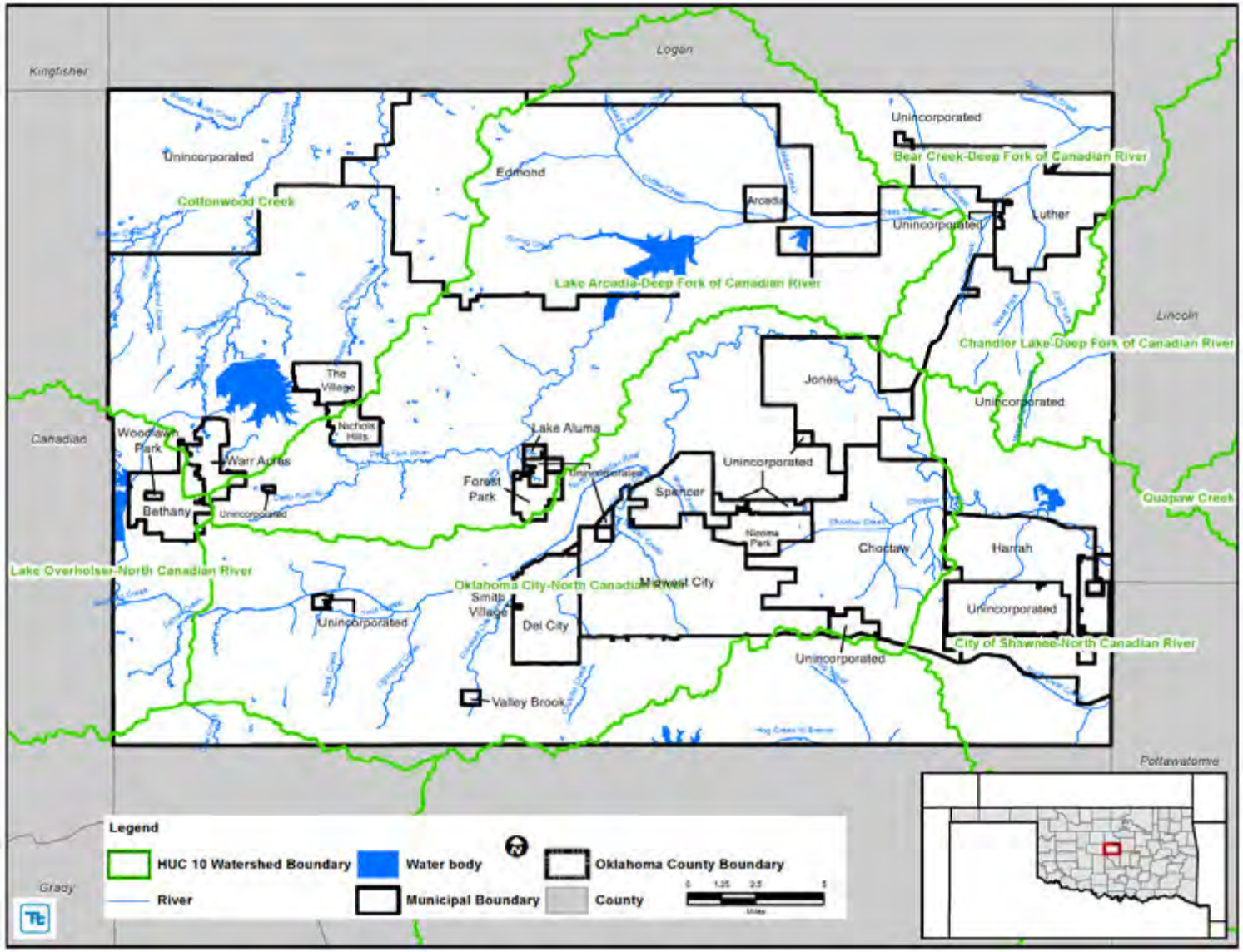
Hydrography and Hydrology

Creeks, rivers, riparian and floodplain areas are prevalent throughout the unincorporated areas of Oklahoma County (see Figure 4-2) (OK COUNTY CP, 2007). The major stream systems include Deer Creek, Deep Fork, Coffee Creek, Crutcho Creek, Cherry Creek, and Soldier Creek, which are all small tributaries to the Canadian and Cimarron Rivers (OK COUNTY HMP, 2006).

There are three major lakes: Overholser, Hefner, and Arcadia. Lake Overholser is located in Central Oklahoma along the Canadian County/Oklahoma County line. Arcadia Lake is located on the Deep Fork River in the eastern city limits of the City of Edmond with Highway 66 on the north, Post Road on the east, I-35 on the west and Memorial Road on the south. Lake Hefner is located in northwest Oklahoma City with Hefner Parkway (Hwy 74) on the east, Wilshire Blvd. on the south, MacArthur Blvd. on the west and Hefner Road (108th St) on the north.

Further information on hydrography and hydrology within the County may be found in the Flood Hazard Profile later in this Plan.

Figure 4-2. Oklahoma County Waterbodies and Hydrologic Unit Code (HUC) 10 Watershed Boundaries



Source: Oklahoma County

Topography

The topography of Oklahoma County is a mixture of low rolling hills and level plains. Elevations range from approximately 1,100 to 1,300 feet above the National Geodetic Vertical Datum of 1929 (NGVD). Slopes range from 1 percent on the uplands to 12 percent near streams.

The topography of the county is generally divided by I-35 running North and South through the center of the county. West of I-35, the topography is basically flat with trees, and mostly urban. East of I-35, the topography consists of rolling hills, wooded areas and pasture lands (OK COUNTY HMP, 2006).

Geology

Oklahoma County has predominately clay and sandy loam soils (Soil Survey of OK County, Date Unknown). The presence of clay in these soils results in expansive soil conditions being common throughout the County.

Climate

Oklahoma County's climate is generally dry and breezy, with little humidity. Winter months (December through March) bring temperatures between 25 and 50 degrees F, while summer months (May through September) can be quite warm with temperatures ranging from 80 - 100 degrees F. Snowfall is typically light in winter months.

The climate of the area is variable with pronounced, but gradual, seasonal changes. Spring and fall seasons are mild with warm, humid days and cool nights, but summers are long and hot, and winters are usually mild and short. The average length of the growing season is 215 days.

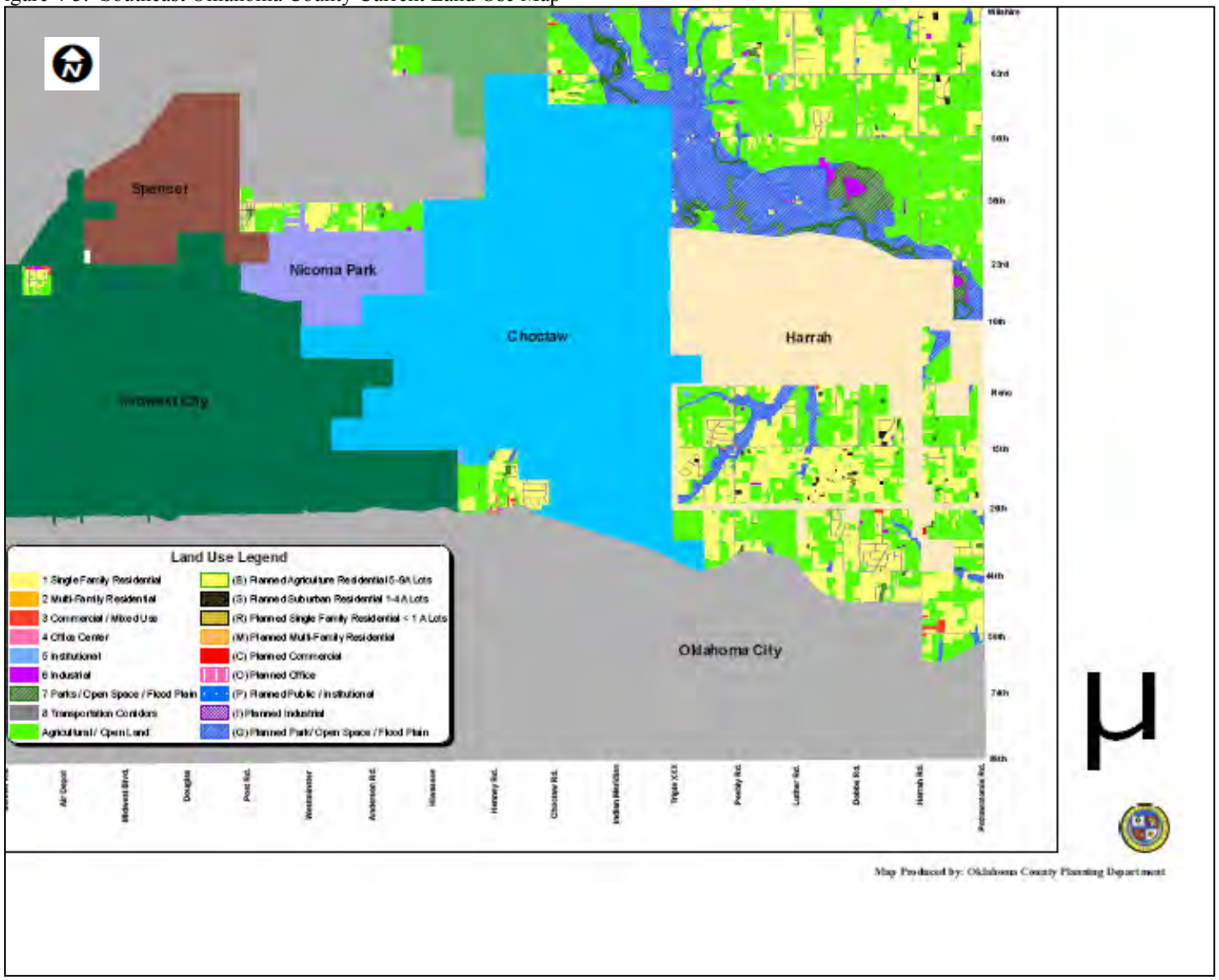
Temperatures range from below freezing in winter to more than 100 degrees Fahrenheit in the summer. Average daily maximum temperatures vary from 48 degrees Fahrenheit in January to 95 degrees Fahrenheit in July and August, while daily minimum temperatures average 28 degrees Fahrenheit in January and 70 degrees Fahrenheit in July and August. In some years, more than 15 consecutive days of temperatures higher than 100 degrees Fahrenheit have been recorded in July and August. Winter temperatures below freezing occur an average of 80 days, with the temperature dropping below 0 degree Fahrenheit an average of only one day per winter.

The average annual precipitation is 32 inches with accumulations varying throughout the year. Fall and winter are the driest seasons, receiving 14 to 24 percent of the total annual precipitation, with an average of 6 inches of snow in January and February. The spring season is the wettest month, receiving 33 percent of the annual precipitation. Locally intense and scattered thunderstorms are the source of precipitation in the spring, summer and fall, which sometimes results in extensive flooding [OK COUNTY HMP, 2006].

Land Use and Land Cover

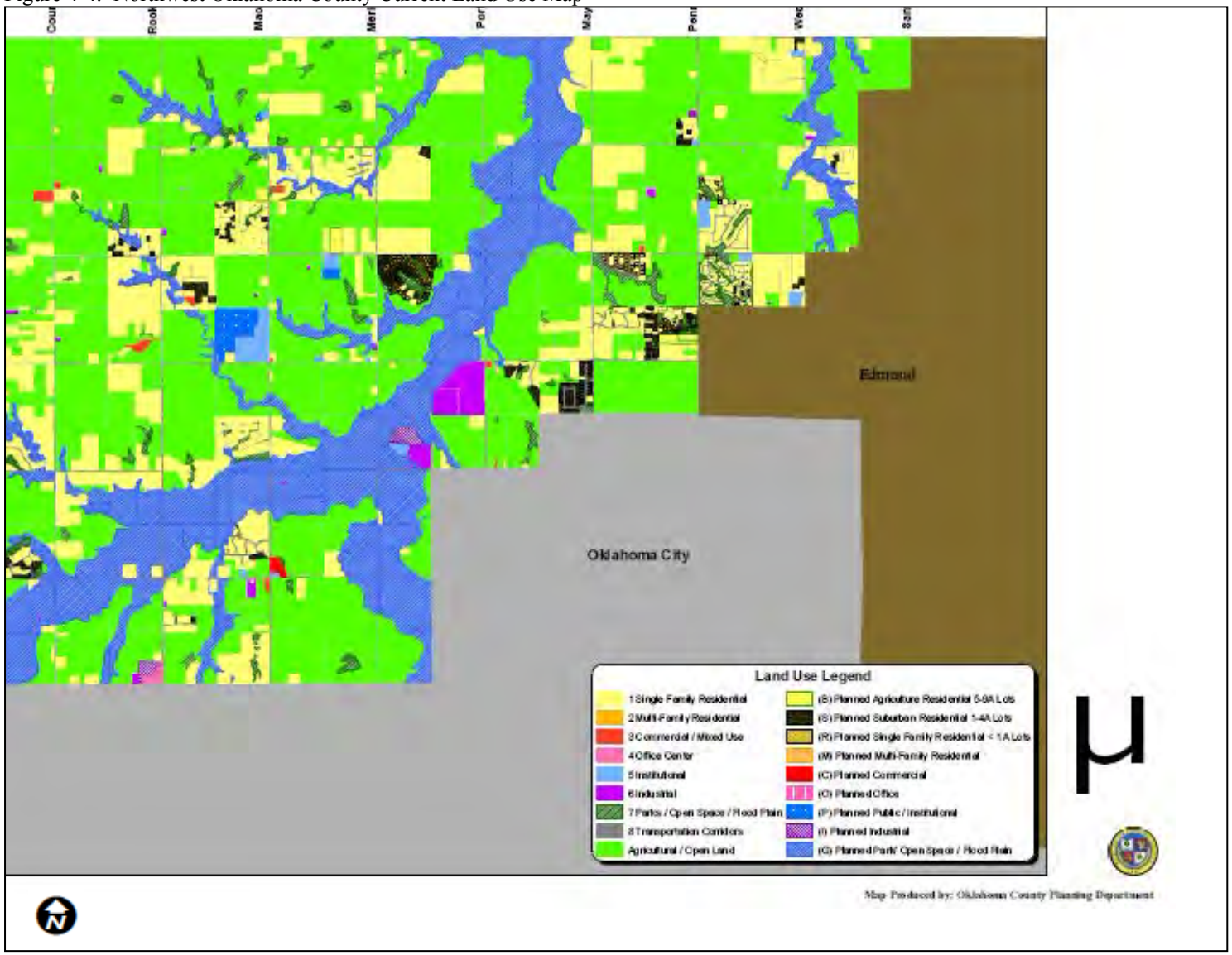
Oklahoma County currently has a land area of approximately 720 square miles, with approximately 142 square miles located in the unincorporated area. Historically, the land use in the majority of the unincorporated areas of Oklahoma County has been agricultural. Although the trend in recent years has been toward residential development, currently over 131 square miles remain zoned for agricultural uses (OK COUNTY CP, 2007). Refer to Figures 4-3 and 4-4 for 2007 land use in the unincorporated areas of Oklahoma County and Figure 4-5 for urbanized areas in the County.

igure 4-3. Southeast Oklahoma County Current Land Use Map



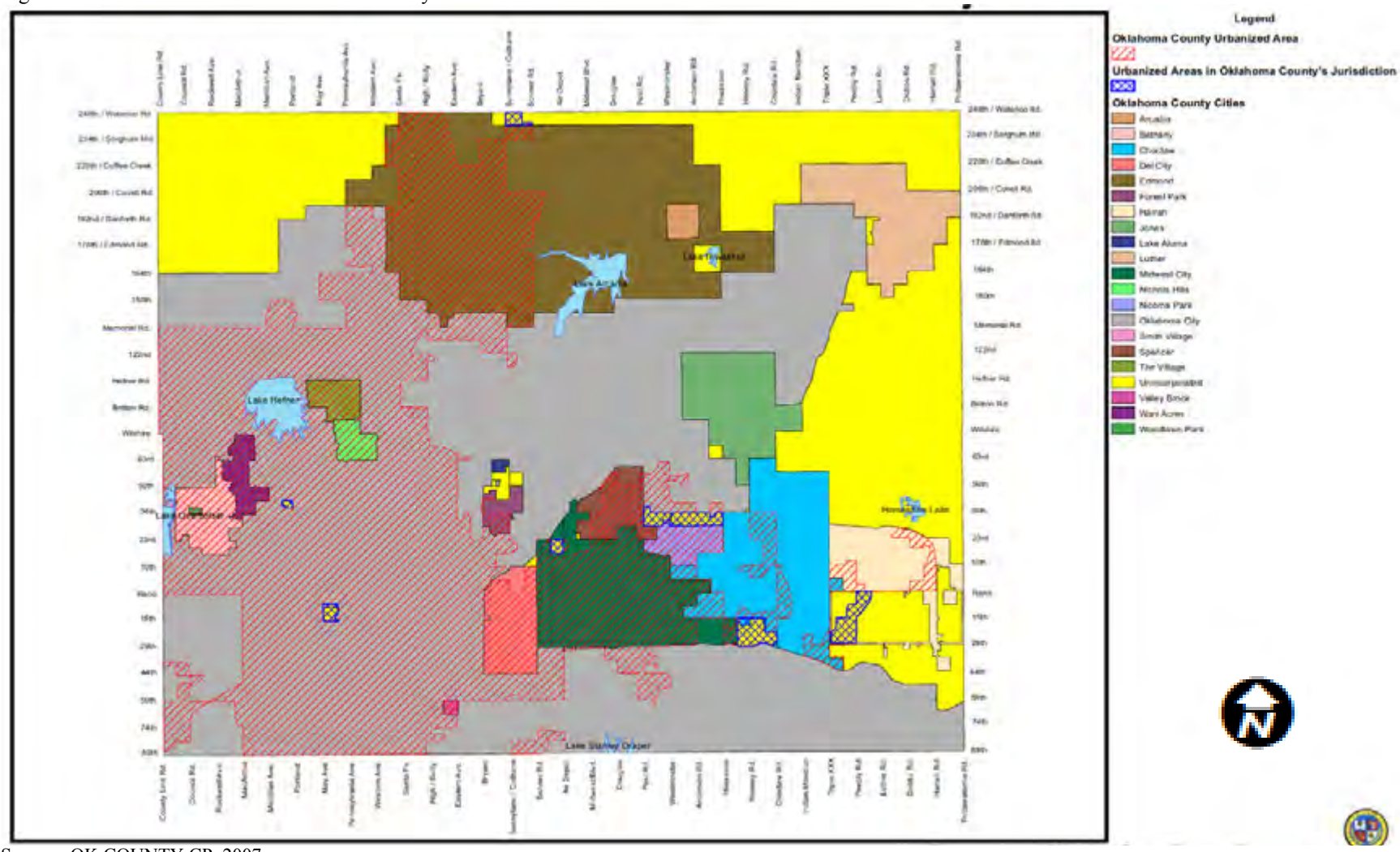
Source: OK COUNTY CP, 2007

Figure 4-4. Northwest Oklahoma County Current Land Use Map



Source: OK COUNTY CP, 2007

Figure 4-5. Urbanized Area in Oklahoma County.



Source: OK COUNTY CP, 2007

POPULATION AND DEMOGRAPHICS

According to 2010 U.S. Census figures, the Oklahoma County Planning Area had a population of 246,655. DMA 2000 requires that HMPs consider socially vulnerable populations. These populations can be more susceptible to hazard events, based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. For the purposes of this study, vulnerable populations shall include (1) the elderly (persons aged 65 and over) and (2) those living in low-income households. Further, non-English speaking populations are important to consider as communication issues are important when addressing emergency preparedness, response and mitigation.

For the purposes of this plan update effort, the HAZUS-MH (v2.0) and associated population and demographics has been used to conduct vulnerability assessments. The population and demographic data currently available for direct processing in HAZUS-MH is based on the 2000 U.S. Census. According to 2000 and 2010 U.S. Census figures, Oklahoma County experienced approximately an eight (8) percent increase in population, from 228,699 in 2000 to 246,655 in 2010. The change in population and demographics since 2000 has not been consistent across the planning area. Table 4-1 presents these general and socially-vulnerable population statistics for the Oklahoma County Planning Area based on the 2000 and 2010 U.S. Census.

Table 4-1. Oklahoma County Plan Participants Population Statistics (2010 and 2000 U.S. Census)

Municipality	Census 2010 Pop.	HAZUS-HM 2000 Pop.	HAZUS-MH Pop. Over 65*	Percent of HAZUS-MH Pop. Over 65*	HAZUS-MH Low-Income Pop. **	Percent of HAZUS-MH Low-Income Pop. **
Arcadia (T)	247	279	18	6.5	30	10.8
Bethany (C)	19,051	20,199	1,350	6.7	1,872	9.3
Choctaw (C)	11,146	9,412	434	4.6	450	4.8
Del City (C)	21,332	22,128	1,338	6.0	2,507	11.3
Edmond (C)	81,405	68,312	2,354	3.4	3,908	5.7
Forest Park (T)	998	888	78	8.8	30	3.4
Harrah (C)	5,095	4,641	223	4.8	327	7.0
Luther (T)	1,221	958	49	5.1	59	6.2
Midwest City (C)	54,371	54,010	2,856	5.3	5,608	10.4
Nichols Hills (C)	3,710	4,056	347	8.6	137	3.4
Nicoma Park (C)	2,393	2,415	161	6.7	238	9.9
Spencer (C)	3,912	3,749	223	5.9	410	10.9
The Village (C)	8,929	10,157	653	6.4	869	8.6
Unincorporated County	19,345	13,151	607	4.6	649	4.9
Warr Acres (C)	10,043	10,997	595	5.4	1,096	10.0

Source: Census 2010 (U.S. Census Bureau); HAZUS-MH 2.0
Note: Pop. = population
* Individuals over the age of 65. Percentage is calculated out of total population of municipality. Please note the population over the age of 65 appears to be underestimated (statistics from the flood model).
** Households with an income of less than $20,000. Percentage is calculated out of total population of municipality.

When possible, 2010 Census data was used to estimate exposure and these results are reported in the vulnerability assessment subsections in Section 5.4 of this plan. When specified, loss estimates were based on the 2000 Census data and have been appropriately documented as such.

It is noted that the census data for household income provided in HAZUS-MH includes two ranges ($0-10,000 and $10,000-$20,000/year) that were totaled to provide the "low-income" data used in this study. This does not correspond exactly with the "poverty" thresholds established by the U.S. Census Bureau, which identifies households with an annual household income below $15,000 per year as "low income" for this region. This difference is not believed to be significant for the purposes of this planning effort.

Population and Demographic Trends

This section discusses population trends to use as a basis for estimating future changes that could significantly change the character of the area. Population trends can provide a basis for making decisions on the type of mitigation approaches to consider and the locations in which these approaches should be applied. This information can also be used to support planning decisions regarding future development in vulnerable areas.

The 2007 Oklahoma County Master Plan indicates that population of the unincorporated areas of Oklahoma County increased significantly from 1890 to 1950, however the region experienced a sharp decline from 1950 to 1970, most probably attributable to annexation of the property by abutting municipalities. The unincorporated areas of Oklahoma County saw considerable growth from 1980, however in 2008 growth in the unincorporated areas decreased significantly and has remained sluggish. (source: Oklahoma County Planning Department, 2012).

Population projections indicate a projected change in population of about +16% for both the County and the unincorporated parts of the County from 2000 to 2030 (Oklahoma Department of Commerce).

GENERAL BUILDING STOCK

According to 2010 U.S. Census figures, Oklahoma County (in its entirety) had a total 319,828 housing units. Further, Oklahoma County had a total of 279,434 households.

The U.S. Census defines household as all the persons who occupy a housing unit, and a housing unit as a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. Therefore, you may have more than one household per housing unit. 2010 U.S. Census figures identify an average of 2.48 persons per household in the County (in its entirety).

The data in HAZUS-MH 2.0 estimates a total building replacement value (structure and content) of nearly $27 billion for Plan participants in Oklahoma County. Approximately 80% of the building stock structural value is associated with residential structures (HAZUS-MH 2.0). Table 4-2 presents Building Stock Statistics by Occupancy Class for Plan participants Oklahoma County, based on HAZUS-MH provided data.

Table 4-2. Building Stock Replacement Value by Occupancy Class of Plan Participants

Municipality	Total	Residential	Commercial	Industrial
Arcadia (T)	$43,250,000	$29,723,000	$6,278,000	$2,169,000
Bethany (C)	$2,293,487,000	$1,775,151,000	$336,854,000	$48,498,000
Choctaw (C)	$1,003,396,000	$840,765,000	$68,725,000	$19,124,000
Del City (C)	$2,338,495,000	$1,844,493,000	$257,195,000	$152,458,000
Edmond (C)	$9,285,130,000	$7,309,353,000	$1,434,364,000	$238,844,000
Forest Park (T)	$123,259,000	$100,163,000	$16,486,000	$466,000
Harrah (C)	$448,684,000	$356,144,000	$48,314,000	$13,505,000
Luther (T)	$91,547,000	$67,474,000	$7,546,000	$4,765,000
Midwest City (C)	$5,522,362,000	$4,567,274,000	$684,256,000	$66,520,000
Nichols Hills (C)	$768,937,000	$634,569,000	$114,252,000	$5,790,000
Nicoma Park (C)	$298,215,000	$223,568,000	$39,534,000	$11,873,000
Spencer (C)	$388,547,000	$314,070,000	$41,842,000	$11,271,000
The Village (C)	$1,316,825,000	$1,065,061,000	$149,877,000	$14,737,000
Unincorporated County	$1,316,912,000	$1,044,639,000	$162,463,000	$56,756,000
Warr Acres (C)	$1,321,272,000	$994,186,000	$245,370,000	$17,454,000
Total	**$26,877,425,000**	**$21,412,091,000**	**$3,660,342,000**	**$671,262,000**

Municipality	Agriculture	Religious	Government	Education
Arcadia (T)	$0	$1,448,000	$1,206,000	$2,426,000
Bethany (C)	$2,922,000	$55,626,000	$8,640,000	$65,796,000
Choctaw (C)	$3,218,000	$31,160,000	$1,600,000	$38,804,000
Del City (C)	$1,564,000	$51,328,000	$12,843,000	$18,614,000
Edmond (C)	$28,064,000	$135,128,000	$23,351,000	$116,026,000
Forest Park (T)	$0	$3,544,000	$0	$2,600,000
Harrah (C)	$1,684,000	$14,598,000	$3,083,000	$11,356,000
Luther (T)	$622,000	$6,268,000	$578,000	$4,294,000
Midwest City (C)	$5,876,000	$97,560,000	$38,256,000	$62,620,000
Nichols Hills (C)	$620,000	$11,332,000	$0	$2,374,000
Nicoma Park (C)	$262,000	$13,416,000	$200,000	$9,362,000
Spencer (C)	$356,000	$10,808,000	$732,000	$9,468,000
The Village (C)	$1,922,000	$20,214,000	$11,930,000	$53,084,000
Unincorporated County	$14,488,000	$18,502,000	$9,178,000	$10,886,000
Warr Acres (C)	$3,060,000	$28,952,000	$3,780,000	$28,470,000
Total	**$65,712,000**	**$506,990,000**	**$117,576,000**	**$443,452,000**

Source: HAZUS-MH 2.0

Note (1): The valuation of general building stock and the loss estimates determined in Oklahoma County were based on the default general building stock database provided in HAZUS-MH MR4. The general building stock valuations provided in HAZUS-MH MR4 are Replacement Cost Value from R.S. Means as of 2006.

Note (2): Value reflects the replacement cost for building structure and contents. Generally, contents for residential structures are valued at about 50 percent of the building's value. For commercial facilities, the value of the content is generally about equal to the building's structural value. Building stock is generated by using 2000 U.S. Census data. Total is total of all building classes (Residential, Commercial, Industrial, Agricultural, Religious, Government and Education).

Development Trends and New Development

The unincorporated area of Oklahoma County currently has a land area of approximately 142 square miles. Historically, the land use in the majority of the unincorporated areas of Oklahoma County has been agricultural. Although the trend in recent years has been toward residential development, currently over 131 square miles remain zoned for agricultural uses.

A steady rise in residential development has occurred primarily in the northwest corner of the County. The availability of public water (Deer Creek Rural Water District) has played a primary role in this trend. Public sanitary sewer from Oklahoma City is also available in limited locations in the northwest area of the County (County District 3).

The presence of agricultural uses helps preserve open spaces, scenic quality, and natural wildlife habitat. Agricultural markets are increasingly competitive and across the United States, agricultural land is becoming an increasingly diminished resource. The 1997 National Resource Inventory (NRI) indicates that from 1992 to 1997, just over 11.2 million acres of land were converted to urban uses nationwide. There are many trends prompting agricultural land conversion, including rising land values, the estate tax, and encroaching urban influences. Regardless of the reasons, Oklahoma County may continue to lose significant amounts of agricultural land in the coming years (OK COUNTY CP, 2007).

Known and anticipated development, along with their proximity to hazard risk zones, is identified for each municipality in their municipal annexes (Section 9) of this Plan Update.

CRITICAL FACILITIES

An inventory of critical facilities for the participating jurisdictions in Oklahoma County was developed from various sources including HAZUS-MH provided data and input from the county and planning Committees. The inventory of critical facilities presented in this section represents the current state of this effort at the time of publication of the HMP and used for the risk assessment in Section 5. While the County believes this to have been the best available data for the plan update process, it is recognized that it is not complete. The county and jurisdictions have included a mitigation initiative(s) to work to improve the completeness, accuracy and attribution of the countywide critical facility database to support future plan update efforts as well as to support other planning and emergency management programs.

Critical Facilities are those facilities considered critical to the health and welfare of the population and that are especially important following a hazard. As defined for this HMP, critical facilities include essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities, and hazardous material facilities.

Essential facilities are a subset of critical facilities that include those facilities that are important to ensure a full recovery following the occurrence of a hazard event. For the County risk assessment, this category was defined to include police, fire, EMS, schools/colleges, shelters, senior facilities, and medical facilities.

Essential Facilities

This section provides information on emergency facilities, hospital and medical facilities, shelters, schools, and senior care and living facilities.

Emergency Facilities

For the purposes of this Plan, emergency facilities include Emergency Operation Centers (EOC), police, fire and emergency medical services (EMS). Tables 4-3 through 4-5 provide an inventory of EOC, police stations, fire stations and EMS facilities in the planning area. Figure 4-6 illustrates the locations of these emergency facilities.

Table 4-3. Emergency Operation Centers in the Planning Area

Name	Address	Municipality	Replacement Cost (Structural Value)	Building Type
Edmond Civil Defense	101 E 1st St	Edmond (C)	$890,000	Concrete
EOC At Public Works	8730 Se 15th St	Midwest City (C)	TBD	Concrete

Source: Oklahoma County Planning Committee; OKEM, 2006; HAZUS-MH MR5
Note: The structural value includes the building structure, but not the building content.
C = City
TBD = To be determined

Table 4-4. Police Stations in the Planning Area

Name	Address	Municipality	Replacement Cost (Structural Value)*	Building Type
Choctaw Police Dept	2437 N Main St	Choctaw (C)	$1,246,000	Concrete
Choctaw Police Dept	16401 NE 23rd St	Choctaw (C)	$1,246,000	Concrete
Police	23 E 1st St	Edmond (C)	$2,500,000	Masonry
Forest Park Police Dept	4203 N Coltrane Rd	Forest Park (T)	$325,000	Concrete
Police Station	1900 Church Ave	Harrah (C)	$1,246,000	Concrete

Name	Address	Municipality	Replacement Cost (Structural Value)*	Building Type
Luther City Hall/Police Station	110 S Main St	Luther (C)	$50,000	Concrete
Nicoma Park Police Dept	2301 Nichols Dr	Nicoma Park (C)	$300,000	Concrete
Spencer Police Dept	8300 NE 36th St	Spencer (C)	$1,246,000	Concrete
Village Police Dept	2304 Manchester Dr	The Village (C)	$1,200,000	Concrete
Warr Acres Police Dept	5930 NW 49th St	Warr Acres (C)	$1,246,000	Concrete

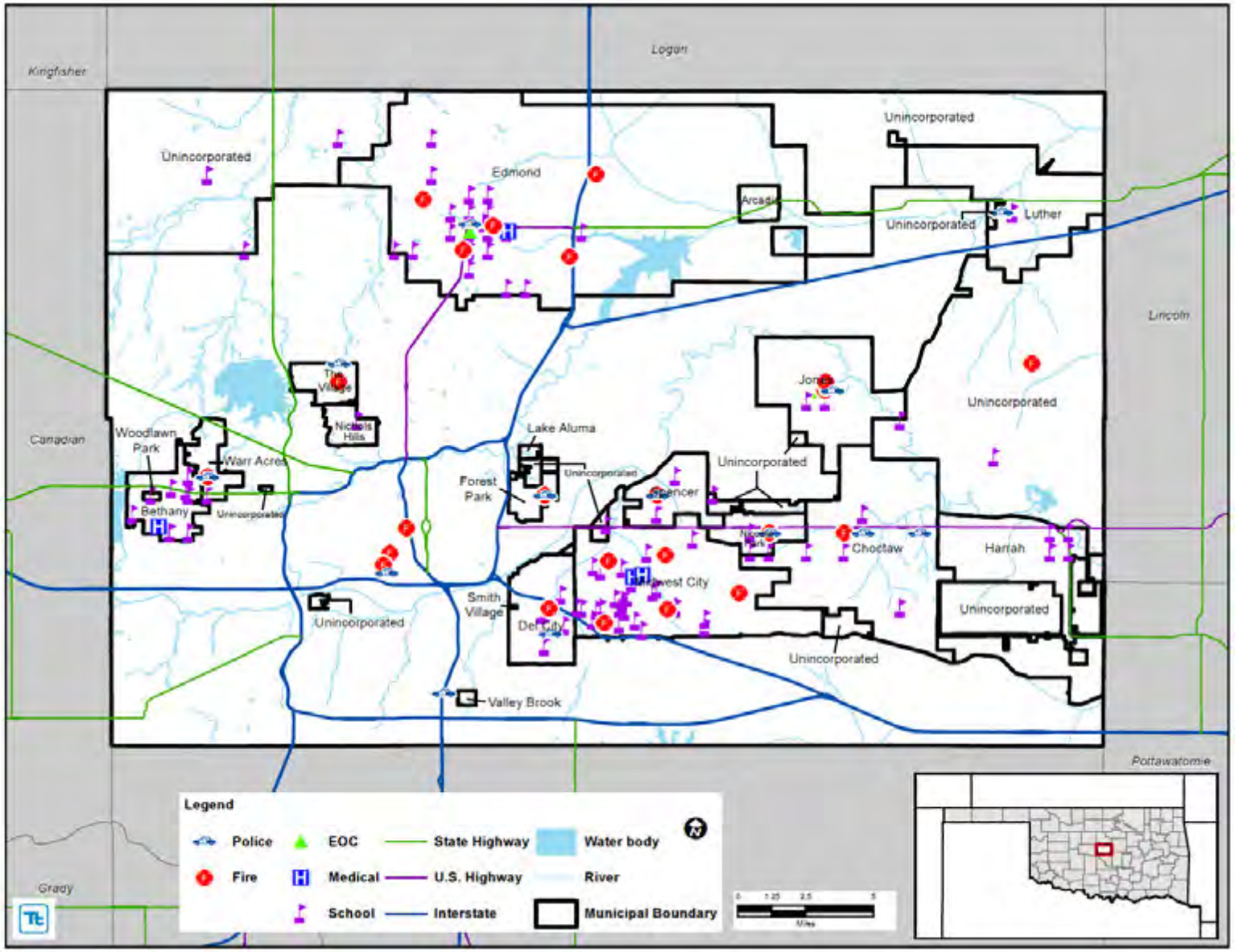
Source: Oklahoma County Planning Committee; OKEM, 2006; HAZUS-MH MR5
Note: The structural value includes the building structure, but not the building content.
* = HAZUS-MH default data unless otherwise provided
C = City Dept = Department
T = Town TBD = To be determined

Table 4-5. Fire/EMS in the Planning Area

Name	Address	Municipality	Replacement Cost (Structural Value)	Building ype*
Choctaw Fire Department	14181 NE 23rd ST	Choctaw (C)	$550,000	Concrete
Fire Station #1	925 E 2nd St	Edmond (C)	TBD	Concrete
Fire Station #4	1701 West I-35 Frontage Rd	Edmond (C)	TBD	Concrete
Fire Station #2	1315 S Broadway	Edmond (C)	TBD	Concrete
Fire Station #3	1540 W Danforth Rd	Edmond (C)	TBD	Concrete
Fire Station #5	5300 E Covell Rd	Edmond (C)	TBD	Steel
Fire Dept Apparatus Storage Bdg	5320 E Covell Rd	Edmond (C)	TBD	Steel
Town of Forest Park Fire Dept.	4203 N Coltrane	Forest Park (T)	TBD	Concrete
Fire Station #1		Harrah (C)	$82,000	Concrete
Fire Station #2		Harrah (C)	$140,000	Concrete
Hickory Hills Volunteer Fire Department	19750 NE 108TH	Luther (T)	$84,000	Concrete
Fire Station 4	8712 NE 10th St	Midwest City (C)	TBD	Concrete
Fire Station 3	808 N Air Depot Blvd	Midwest City (C)	$235,000	Concrete
Fire Station 2	550 Adair Blvd	Midwest City (C)	TBD	Concrete
Fire Station 1	8750 SE 15th St	Midwest City (C)	TBD	Concrete
Fire Station 5	801 S Westminster Rd	Midwest City (C)	$456,940	Concrete
Nicoma Park Fire Department	11600 NE 23rd	Nicoma Park (C)	$270,000	Concrete
Arcadia Fire Department		Arcadia (T)	$50,000	Concrete
Spencer Fire Department	8310 NE 36th ST	Spencer (C)	$170,000	Concrete
The Village Fire Department	2201 W Britton RD	The Village (C)	$1,400,000	Concrete
Warr Acres Fire Department	5930 NW 49th ST	Warr Acres (C)	TBD	Concrete

Source: Oklahoma County Planning Committee; OKEM, 2006; HAZUS-MH MR5
Note: The structural value includes the building structure, but not the building content.
* = HAZUS-MH default data unless otherwise provided.
C = City
T = Town

Figure 4-6. Emergency Facilities and Schools in the Planning Area



Source: Oklahoma County Planning Committee; OKEM, 2006; HAZUS-MH MR5

Hospitals and Medical Centers

Table 4-6 provides an inventory of hospitals and major medical facilities in the Planning area.

Table 4-6. Medical Facilities in Planning Area

Name	Address	Municipality	Replacement Cost (Structural Value)	Building Type
Edmond Medical Center	1 South Bryant Street	Edmond (C)	$6,230,000	Concrete
Family Care Center	20826 Main St	Harrah (C)	TBD	TBD
Renaissance Women's Medical Center		Midwest City (C)	$3,219,330	TBD
Midwest Regional Medical Center	2825 Parklawn Drive	Midwest City (C)	$39,971,570	TBD

Source: Oklahoma County Planning Committee; OKEM, 2006; HAZUS-MH MR5
Notes: C = City

Schools

Within Oklahoma County, there are 20 municipal jurisdictions and 19 separate School Districts. Eight of the 19 School Districts overlap within the borders of the unincorporated areas of Oklahoma County. The overlapping districts include Oklahoma City School District, Choctaw/Nicoma Park School District, Deer Creek School District, Edmond School District, Harrah School District, Jones School District, Luther School District, and the McLoud School District.

With only one exception, school buildings within the various school districts are located in an incorporated municipality. A very small area of Unincorporated Oklahoma County falls in the Oklahoma City School District or the Edmond School District. Conversely, the majority of the Deer Creek School District serves Unincorporated Oklahoma County. Most of Deer Creek's school buildings, including the school administration building, are also located in the unincorporated area of the County.

Because the majority of attendance for Deer Creek Schools is from Unincorporated Oklahoma County, this District has an enormous impact on residential growth in the northwest area, and vice versa. Currently, the Deer Creek District has three elementary schools, one middle school, and one high school. Deer Creek's total enrollment for May 2007 was 2,909 students, up from 2,809 in August 2006 (source: http://www.deercreekschools.org/studentpopulation). Two new schools in northwestern Oklahoma County have been constructed in the past five years; Rose Union and Grove Valley.

Table 4-9 lists public and private schools and universities in the Planning Area. Refer to Figure 4-6 for the location of these schools.

Shelters

The two shelter facilities identified by the Planning Committee are identified below in Table 4-7. In the event of an emergency, it is best to consult your municipality to find out where to seek shelter.

Table 4-7. Shelter Facilities in the Planning Area

Name	Address	Municipality	Replacement Cost (Structural Value)	Building Type
MAC - Senior Center	2733 Marilyn Williams Dr	Edmond (C)	TBD	Masonry
First Baptist Ch/Public Shelter	2185 Church St	Harrah (C)	TBD	TBD

Source: Oklahoma County Planning Committee

Senior Care and Senior Living Facilities

Table 4-8 provides an inventory of senior facilities in Oklahoma County.

Table 4-8. Senior Facilities in the Planning Area

Name	Address	Municipality	Replacement Cost (Structural Value)*	Building Type**
Harrah Senior Housing	2696 Summers Ave	Harrah (C)	TBD	TBD
Harrah Senior Citizen's Center	19791 Summers Ave	Harrah (C)	TBD	TBD
Harrah Nursing Center and Apt.	2400 Whites Meadow Dr	Harrah (C)	TBD	TBD
Summit Ridge Retirement	18501 NE 63rd	Unincorporated	TBD	TBD

Source: Oklahoma County Planning Committee; OKEM, 2006

Table 4-9. Schools in the Planning Area

Name	Address	Municipality	Designated Shelter	Replacement Cost (Structural Value)*	Building Type*
EARL HARRIS ES	3911 N. ASBURY	Bethany (C)	TBD	$9,623,360	Masonry
APOLLO ES	1901 N. PENIEL	Bethany (C)	TBD	$4,996,330	Masonry
WESTERN OAKS ES	7210 NW 23RD STREET	Bethany (C)	TBD	$8,795,900	Masonry
SW College Of Christian Min.	7210 NW 39TH EXPRESSWAY	Bethany (C)	TBD	TBD	Masonry
Southern Nazarene University	6729 NW 39TH EXPRESSWAY	Bethany (C)	TBD	TBD	Masonry
BETHANY MONTESSORI	2201 N ROCKWELL AVE	Bethany (C)	TBD	$324,750	Masonry
CHILDREN'S CTR	6800 NW 39TH EXPRESSWAY	Bethany (C)	TBD	$630,940	Masonry
BETHANY MS	4312 NORTH MUELLER	Bethany (C)	TBD	$3,852,460	Masonry
BETHANY HS	4500 NORTH MUELLER	Bethany (C)	TBD	$4,871,250	Masonry
LAKE PARK ES	8221 NW 30	Bethany (C)	TBD	$4,810,570	Masonry
OVERHOLSER ES	7900 NW 36TH BETHANY OK 73008	Bethany (C)	TBD	$5,823,790	Masonry
BETHANY CHRISTIAN ACADEMY	6719-NW 23RD STREET	Bethany (C)	TBD	$402,690	Masonry
WESTERN OAKS MS	7200 NW 23RD ST	Bethany (C)	TBD	$9,434,450	Masonry
SNU SCHOOL FOR CHILDREN	6729 NW 39TH EXPRESSWAY	Bethany (C)	TBD	$1,085,590	Masonry
CHOCTAW JHS	14667 NORTHEAST 3RD STREET	Choctaw (C)	TBD	$8,230,090	Masonry
CHOCTAW HS	14300 N. E. TENTH STREET	Choctaw (C)	TBD	$19,415,410	Masonry
L. W. WESTFALL ES	13239 NE 10TH. ST.	Choctaw (C)	TBD	$5,182,080	Masonry
JAMES GRIFFITH IES	1861 S. INDIAN MERIDIAN	Choctaw (C)	TBD	$5,106,930	Masonry
NICOMA PARK JHS	1321 NORTH HICKMAN	Choctaw (C)	TBD	$6,780,780	Masonry
NICOMA PARK IES	1318 N. HICKMAN AVENUE	Choctaw (C)	TBD	$5,013,210	Masonry
CHOCTAW ES	14663 NE 3RD STREET	Choctaw (C)	TBD	$4,354,620	Masonry
INDIAN MERIDIAN ES	1865 S. INDIAN MERIDIAN	Choctaw (C)	TBD	$8,542,600	Masonry
Kerr Jr. High School	2300 Linda Lane	Del City (C)	TBD	TBD	Masonry
TOWNSEND ES	SE 40TH & EPPERLY	Del City (C)	TBD	$6,296,620	Masonry
CHRISTIAN HERITAGE ACADEMY	4400 SE 27TH ST	Del City (C)	TBD	$7,417,290	Masonry
Del City High School	1900 S. Sunnydale Rd.	Del City (C)	TBD	TBD	Masonry
Del Crest Jr. High	4731 Judy Dr.	Del City (C)	TBD	TBD	Masonry
DEER CREEK HS	6101 N. W. 206TH ST.	Edmond (C)	TBD	$9,788,890	Masonry
DEER CREEK MS	21175 N. MACARTHUR	Edmond (C)	TBD	$8,801,650	Masonry

Name	Address	Municipality	Designated Shelter	Replacement Cost (Structural Value)*	Building Type*
ST ELIZABETH ANN SETON CATHOLI	925 SO BOULEVARD	Edmond (C)	TBD	$5,127,340	Masonry
OKLAHOMA CHRISTIAN SCHOOL	4680 E. 2nd	Edmond (C)	TBD	$13,709,090	Masonry
ST MARYS EPISCOPAL SCHOOL	325 E 1ST ST	Edmond (C)	TBD	$1,317,560	Masonry
HOLY TRINITY LUTH PRE-SCHOOL	308 NW 164TH ST	Edmond (C)	TBD	$55,670	Masonry
OKLAHOMA CHRISTIAN ACADEMY	1101 E 9TH STREET	Edmond (C)	TBD	$4,585,470	Masonry
FIRST PRESBYTERIAN ECP	1001 S RANKIN ST	Edmond (C)	TBD	$139,180	Masonry
CLEGERN ES	601 S.JACKSON	Edmond (C)	TBD	$4,101,310	Masonry
WILL ROGERS ES	1215 E. 9TH STREET	Edmond (C)	TBD	$9,150,530	Masonry
DEER CREEK ES	4704 NW 164	Edmond (C)	TBD	$8,491,930	Masonry
CHISHOLM ES	2300 SE 33RD ST.	Edmond (C)	TBD	$9,302,510	Masonry
ORVIS RISNER ES	2801 S. RANKIN	Edmond (C)	TBD	$9,842,890	Masonry
MEMORIAL HS	1000 E. 15TH	Edmond (C)	TBD	$39,712,290	Masonry
CIMARRON MS	3701 S. BRYANT	Edmond (C)	TBD	$11,251,200	Masonry
SANTA FE HS	1901 SW 15TH STREET	Edmond (C)	TBD	$38,158,130	Masonry
CHEYENNE MS	1271 W. COVELL ROAD	Edmond (C)	TBD	$13,557,850	Masonry
CROSS TIMBERS ES	4800 N. KELLY	Edmond (C)	TBD	$12,713,680	Masonry
PRAIRIE VALE ES	22522 N. PENNSYLVANIA	Edmond (C)	TBD	$9,302,510	Masonry
NORTH HS	215 W. DANFORTH	Edmond (C)	TBD	$44,212,390	Masonry
JOHN ROSS ES	1901' NORTH THOMAS DRIVE	Edmond (C)	TBD	$16,158,630	Masonry
NORTHERN HILLS ES	901 EAST WAYNE	Edmond (C)	TBD	$10,906,780	Masonry
RUSSELL DOUGHERTY ES	19 N. BOULEVARD	Edmond (C)	TBD	$2,665,920	Masonry
SUNSET ES	400 W. 8TH STREET	Edmond (C)	TBD	$9,859,780	Masonry
CENTRAL MS	500 E. 9TH STREET	Edmond (C)	TBD	$14,415,190	Masonry
SEQUOYAH MS	1125 EAST DANFORTH ROAD	Edmond (C)	TBD	$16,272,760	Masonry
University of Central Oklahoma	100 N UNIVERSITY DR	Edmond (C)	TBD	TBD	Masonry
IDA FREEMAN ES	501 W. HURD	Edmond (C)	TBD	$6,347,290	Masonry
HARRAH JHS	1480 N. DOBBS ROAD	Harrah (C)	TBD	$5,079,090	Masonry
Virginia Smith Elementary School	100 N UNIVERSITY DR	Harrah (C)	TBD	TBD	Masonry
Russell Babb Elementary/Public School	2091 NE 10th STREET	Harrah (C)	TBD	TBD	Masonry
Clara Reynolds Elementary School	55 HARRISON STREET	Harrah (C)	TBD	TBD	Masonry
Harrah Middle School/Admin Office	20665 WALKER STREET	Harrah (C)	TBD	TBD	Masonry

Name	Address	Municipality	Designated Shelter	Replacement Cost (Structural Value)*	Building Type*
Harrah Jr. High	1480 N DOBBS STREET	Harrah (C)	TBD	TBD	Masonry
OKLAHOMA ACADEMY	6100 ACADEMY LN	Harrah (C)	TBD	$610,530	Masonry
CLARA REYNOLDS ES	755 HARRISON STREET	Harrah (C)	TBD	$3,983,110	Masonry
VIRGINIA SMITH ES	20227 N.E. 10TH	Harrah (C)	TBD	$5,317,180	Masonry
HARRAH MS	20665 WALKER STREET	Harrah (C)	TBD	$3,908,130	Masonry
HARRAH HS	20370 ELM STREET	Harrah (C)	TBD	$6,533,970	Masonry
RUSSELL BABB ES	20901 N.E. 10TH ST.	Harrah (C)	TBD	$3,440,490	Masonry
Harrah High School	20370 ELM STREET	Harrah (C)	TBD	TBD	Masonry
LUTHER MS	800 S. DOGWOOD	Luther (T)	TBD	$2,315,930	Masonry
LUTHER HS	320 S.E. 2ND ST.	Luther (T)	TBD	$3,169,560	Masonry
LUTHER ES	900 S. DOGWOOD	Luther (T)	TBD	$4,624,810	Masonry
FAITH ACADEMY CHRISTIAN SCHOOL	504 ASKEW DRIVE	Midwest City (C)	TBD	$350,730	Masonry
SOONER-ROSE ES	5601 S.E. 15TH	Midwest City (C)	TBD	$7,124,090	Masonry
STEED ES	2118 FLANNERY DR	Midwest City (C)	TBD	$8,491,930	Masonry
SOLDIER CREEK ES	9201S.E.15TH	Midwest City (C)	TBD	$10,045,540	Masonry
GOOD SHEPHERD LUTHERAN SCHOOL	700 NORTH AIR DEPOT BLVD	Midwest City (C)	TBD	$1,169,100	Masonry
ST PHILIP NERI	1121 FELIX PLACE	Midwest City (C)	TBD	$2,249,130	Masonry
Soldier Creek Elementary School	9021 S.E. 15TH	Midwest City (C)	TBD	TBD	Masonry
Midwest City High School	213 ELM DRIVE	Midwest City (C)	TBD	TBD	Masonry
Ridgecrest Elementary School	137 W. RIDGEWOOD DR	Midwest City (C)	TBD	TBD	Masonry
Telstar Elementary School	9521 NE 16TH ST	Midwest City (C)	TBD	TBD	Masonry
Cleveland Elementary School	3301 SUNVALLEY DR	Midwest City (C)	TBD	TBD	Masonry
Sooner Rose Elementary School	5601 S.E. 15TH	Midwest City (C)	TBD	TBD	Masonry
TRAUB ES	6500 SE 15TH	Midwest City (C)	TBD	$4,962,550	Masonry
Mid-Del School District Enroll Ctr	7217 S.E. 15TH	Midwest City (C)	TBD	TBD	Masonry
Crutcho Elementary School	2401 N. AIR DEPOT BLVD	Midwest City (C)	TBD	TBD	Masonry
Monroney Middle School	7400 E RENO AVE	Midwest City (C)	TBD	TBD	Masonry
Traub Elementary School	6500 S.E. 15TH	Midwest City (C)	TBD	TBD	Masonry
Mid-Del Schools Administration	7217 S.E. 15TH	Midwest City (C)	TBD	TBD	Masonry
Willow Brook Elementary	8105 N.E. 10TH		TBD	TBD	Masonry
J.E. Sutton Field House	6400 SOUTH SOONER RD		TBD	TBD	Masonry

Name	Address	Municipality	Designated Shelter	Replacement Cost (Structural Value)*	Building Type*
Rose State College	6420 SE 15TH ST	Oklahoma City (C)	TBD	TBD	Masonry
Carl Albert Middle School	2515 S POST RD	Oklahoma City (C)	TBD	TBD	Masonry
Country Estates Elementary School	1609 FELIX PL	Oklahoma City (C)	TBD	TBD	Masonry
Jarman Middle School	Oklahoma City (C)	Oklahoma City (C)	TBD	TBD	Masonry
Steed Elementary School	2118 FLANNERY DR	Midwest City (C)	TBD	TBD	Masonry
Eastside Elementary School	600 N KEY BLVD	Oklahoma City (C)	TBD	TBD	Masonry
Carl Albert High School	2009 S POST RD	Midwest City (C)	TBD	TBD	Masonry
Mid-Del Technology Center	1621 MAPLE DR	Oklahoma City (C)	TBD	TBD	Masonry
St Philip Neri Catholic School	1121 FELIX PL	Oklahoma City (C)	TBD	TBD	Masonry
NICHOLS HILLS ES	1306 W. WILSHIRE BLVD.	Nichols Hills (C)	TBD	$5,097,650	Masonry
NICOMA PARK ES	11601 JEFFORDS AVENUE	Nicoma Park (C)	TBD	$4,168,860	Masonry
SPENCER ES	8900 NE 50TH	Spencer (C)	TBD	$2,096,960	Masonry
STAR SPENCER HS	3001 NORTH SPENCER ROAD	Spencer (C)	TBD	$7,469,250	Masonry
GREEN PASTURES ES	4300 NORTH POST ROAD	Spencer (C)	TBD	$742,290	Masonry
SPENCER ROAD CHRISTIAN SCHOOL	8515 NE 25TH ST	Spencer (C)	TBD	$727,440	Masonry
ROGERS MS	4000 N. SPENCER ROAD	Spencer (C)	TBD	$6,556,240	Masonry
CENTRAL ES	5728 N.W. 40TH	Warr Acres (C)	TBD	$8,762,130	Masonry
Deer Creek Elementary	4704 NW 164th St	Unincorporated	TBD	TBD	Masonry
Prairie Vale Elementary	22522 N. Penn	Unincorporated	TBD	TBD	Masonry
Rose Union Elementary	5100 NW 220th	Unincorporated	TBD	TBD	Masonry
Grove Valley Elementary	3500 NW 192nd	Unincorporated	TBD	TBD	Masonry
Deer Creek Middle School	21175 N. MacArthur	Unincorporated	TBD	TBD	Masonry
Deer Creek High School	6101 NW 206th	Unincorporated	TBD	TBD	Masonry

Source: Oklahoma County Planning Committee; OKEM, 2006; HAZUS-MH MR5
Notes: The structural value includes the building structure, but not the building content.
* = HAZUS-MH default data
C = City

TBD = To be determined

Transportation Systems

This section presents available inventory data for roadways, airports, railways and other transportation systems for Oklahoma County.

The whole of Oklahoma County is served by an extensive transportation system of federal and state highways, major County arterials, buses, regional airfields, and an international airport. In addition, a growing trail and bikeway system serves recreational bicycle travel in several area cities. This transportation system accommodates over a million trips daily, mostly by single occupancy vehicles. Increasing congestion on freeways and arterials, combined with regional low ridership on buses, drives the need to develop an increasingly more extensive and higher capacity roadway and transit support network within Oklahoma County and the central Oklahoma area in general.

Accompanying the increasing demand for transportation service and more arterial capacity in Oklahoma County are the variety of jurisdictional and political boundaries overlapping within the Oklahoma City Metropolitan Area. Planning, funding, and implementation of transportation improvements within Oklahoma County are complicated by these overlapping jurisdictions. Major jurisdictions include: Oklahoma County, the City of Oklahoma City, the City of Edmond, the City of Midwest City, Luther, the Town of Arcadia, the Oklahoma Department of Transportation (ODOT), ACOG, and the Oklahoma Turnpike Authority (OTA). The metropolitan planning boundary, the Oklahoma City Area Regional Transportation Study area (OCARTS), is administered by the Association of Central Oklahoma Governments (ACOG). The OCARTS area includes approximately 2,085 square miles, which encompasses all of Oklahoma and Cleveland Counties and portions of Canadian, Grady, Logan, and McClain Counties. The OCARTS area is also designated as the Transportation Management Area (TMA) for the Oklahoma City metropolitan region (OK COUNTY CP, 2007).

Highway, Roadways and Associated Systems

Oklahoma County has 3,924 miles of roads and streets, including 94 miles of interstate highways and 94 miles of other state highways. The highways include Interstate Highways 35, 40, and 44; the Kilpatrick Turnpike and the Turner Turnpike (also Interstate Highway 44); U.S. Highways 62, 77, and 270; and Oklahoma State Highways 3, 4, 66, 74, 152, and 270 (USDA NRCS Soil Survey of Oklahoma County, 2003).

Currently, unincorporated Oklahoma County maintains approximately 598 road miles. This includes assisting smaller municipalities with road repair and construction. There are currently 166 bridges included in unincorporated Oklahoma County's bridge inventory.

District One Roads:

Oklahoma County District 1 is responsible for maintaining approximately 238.43 road miles within eastern Oklahoma County. This total includes roads in the unincorporated areas of District 1, and many interior roads in Arcadia, Luther, Spencer, Nicoma Park, Forest Park, and the City of Jones. Together, this accounts for approximately 40% of the total road miles in Oklahoma County.

There are over 160 bridges listed on Oklahoma County's bridge inventory. District 1 has 56 of those bridges within the district's boundaries. To date, District 1 has replaced/constructed eight (8) new bridges. Funding for bridge projects come from a variety of sources, including county, state, and federal funds (source: http://www.oklahomacounty.org/district1, Oklahoma County District 1 website) (OK COUNTY CP, 2007).

District Two Roads:

Oklahoma County District 2 is responsible for maintaining approximately 178.74 road miles in Oklahoma County. Primarily, District 2 is located in the southern part of Oklahoma County; a portion extends into northeastern Oklahoma County. All District 2 county roadways are hard surfaced. This includes public roadways in the unincorporated areas, as well as many interior roads which District 2 works in conjunction with the cities of Oklahoma City, Midwest City, Del City, Harrah, Choctaw and Bethany.

District 2 contains 58 bridge structures; 51 of them are currently ranked above the state sufficiency rating, four are currently being replaced and 3 are programmed to be reconstructed in the near future. (Source: http://www.oklahomacounty.org/district2/, Oklahoma County District 2 website.) (OK COUNTY CP, 2007).

District Three Roads:

Oklahoma County District 3 is responsible for maintaining approximately 178.84 road miles within western and northwestern Oklahoma County. This total includes roads in the unincorporated areas of District 3 and many interior roads in the cities of Edmond, Oklahoma City, Arcadia, Nichols Hills, Warr Acres, and The Village.

District 3 has over 105 road miles that will be improved in 2007 and 2008; another 108 road miles are scheduled for improvement in 2009, 2010, and 2011. District 3 has 50 bridges within the district's boundaries (source http:/www.oklahomacounty.org/district3, Oklahoma County District 3 website). (OK COUNTY CP, 2007).

Railways:

There are three railroad lines in the county—the Atchison, Topeka, and Santa Fe Railway; the St. Louis-San Francisco Railway; and the Chicago, Rock Island, and Pacific Railway (USDA NRCS Soil Survey of Oklahoma County, 2003).

Airports and Heliports

Table 4-10. Airports in the Planning Area

Name	Municipality
Wiley Post Airport - OKC	Bethany (C)

Source: OKEM, 2006

Lifeline Utility Systems

This section presents potable water, wastewater, and energy resource utility system data. Due to heightened security concerns, local utility lifeline data sufficient to complete the analysis have only partially been obtained. Utility data are included in HAZUS-MH but are not sufficient to support detailed analyses for Oklahoma County.

Potable Water Supply

Unincorporated Oklahoma County currently does not have a water or sanitary sewer utility infrastructure to support major economic development or urban residential development throughout the unincorporated areas of the County. This is a hindrance to development in some areas of Unincorporated Oklahoma County. Public water services are available from the Deer Creek Rural Water District in northwest Oklahoma County; some areas of the northwest portion of Unincorporated Oklahoma County are served by Oklahoma City public water and some areas may be served if utility lines are extended. Oklahoma City also has public sanitary sewer services that can be extended to certain portions of the northwest corner of the County.

The majority of Unincorporated Oklahoma County utilizes water wells and septic systems for both residential development and for small business or commercial uses. Oklahoma County does not maintain a centralized public water distribution system in its unincorporated areas. Outside the areas that have access to public water facilities described above, residents and businesses rely on individual wells to provide water. Although ground water is generally available throughout Oklahoma County, its depth, production sustainability, and susceptibility to surface contaminants varies (OK COUNTY CP, 2007).

The City of Edmond identified 59 wells servicing their jurisdiction.

Table 4-11. Potable Water Facilities in the Planning Area

Name	Municipality	Replacement Value
Bethany Water Plant	Bethany (C)	TBD
NW Water Complex Na Hypochlorite Bdg	Edmond (C)	TBD
Breakpoint Chlorination Facility	Edmond (C)	TBD
Water Treatment Plant	Edmond (C)	TBD
MIDWEST CITY CITY OF (WATER T	Midwest City (C)	TBD

Source: Oklahoma County Planning Committee; OKEM, 2006; HAZUS-MH MR5
C = City TBD = To be determined

Table 4-12. Potable Pump Stations in the Planning Area

Name	Municipality	Replacement Value
I-35 Pump Station	Edmond (C)	TBD
2nd Street Booster Station	Edmond (C)	TBD
NW Pump Station	Edmond (C)	TBD
College Pump Station and Clearwell	Edmond (C)	TBD
South 33rd Pump Station and Clearwell	Edmond (C)	TBD
Danforth Pump Station and Clearwell	Edmond (C)	TBD
College PS Sodium Hypochlorite Bldg	Edmond (C)	TBD
Fire Station #4 Lift Station	Edmond	TBD

Source: Oklahoma County Steering Committee
C = City TBD = To be determined

Table 4-13. Water Towers in the Planning Area

Name	Municipality	Replacement Value
Danforth Water Tower	Edmond (C)	TBD
33rd Street Water Tower	Edmond (C)	TBD
College Water Tower	Edmond (C)	TBD
Post Road Water Tower	Edmond (C)	TBD
I-35 Short Water Tower	Edmond (C)	TBD
I-35 Tall Water Tower	Edmond (C)	TBD
Nichols Hills Water Tower	Nichols Hills (C)	TBD

Source: OKEM, 2006; Oklahoma County Steering Committee
Note: In Edmond, each water tower holds 500,000 gallons.
C = City
TBD = To be determined

Wastewater Facilities

The County also does not have a centralized waste water collection, treatment, and disposal system in its unincorporated areas. On-site waste water disposal systems such as septic tanks or aeration systems are used to service development in the unincorporated areas. Some areas in the northwest portion of Unincorporated Oklahoma County may be served by municipal sanitary sewer treatment facilities (OK COUNTY CP, 2007).

Table 4-14. Wastewater Treatment Facilities in the Planning Area

Facility Name	Municipality	Cost
Water Treatment Facility	Del City (C)	$6,112,000
Wastewater Treatment Complex	Del City (C)	$11,869,000
Coffee Creek Wastewater Treatment Plant	Edmond (C)	$59,274,000
Wastewater Treatment Plant	Harrah (C)	$270,000
Water Treatment Facility	Midwest City (C)	TBD
Wastewater Treatment Plant	Midwest City (C)	TBD
Water Treatment Facility	Del City (C)	$6,112,000

Source: Oklahoma County Steering Committee; OKDEM, 2006
C = City
TBD = To be determined

Energy Resources

All of Oklahoma County is serviced by the following energy providers: Oklahoma Natural Gas (ONG), Oklahoma Gas & Electric (OG&E), Canadian Valley Electric, Central Rural Electric Cooperative (CREC), and Oklahoma Electric Cooperative (OEC).

HAZUS-MH and the Planning Committee provided the location of three (3) electric facilities and nine (9) electric substations within the Planning Area. All electric facilities and substations identified are inventoried below in Tables 4-15 and 4-16.

Table 4-15. Electric Facilities in the Planning Area

Name	Municipality	Type of Facility	Cost
OG & E ELECTRIC SRVCS	Harrah (C)		$97,900,000
OG&E HORSESHOE LAKE	Harrah (C)		$97,900,000
Redbud Energy LP	Oklahoma County		$97,900,000

Source: Oklahoma County Planning Committee; OKEM, 2006; HAZUS-MH MR5
C = City

Table 4-16. Electric Substations in the Planning Area

Name	Municipality	Type of Facility	Cost
SBC Central Office/Switching Sta.	Del City (C)	Substation	$15,943,000
Ketch Substation	Edmond (C)	Substation	TBD
Mitch Substation	Edmond (C)	Substation	TBD
Eastern Substation	Edmond (C)	Substation	TBD
Hafer Substation	Edmond (C)	Substation	TBD
Danforth Substation	Edmond (C)	Substation	TBD
White Substation	Edmond (C)	Substation	TBD
Fairfield Substation	Edmond (C)	Substation	TBD

Source: Oklahoma County Planning Committee; OKEM, 2006
C = City
TBD = To be determined

Communication Resources

Telephone service in the County is provided by AT&T, Cox Communications and various cellular telephone companies. Cable service is provided by Cox Communications.

Each municipality has either a joint or separate radio station to alert the communities of important announcements during an emergency. HAZUS-MH and the Planning Committee identified the communications facilities/equipment inventoried in Table 4-17 below.

Table 4-17. Communication Facilities/Equipment within Oklahoma County

Name	Address	Municipality	Cost
Communications Hut	5306 E Covell Rd	Edmond (C)	TBD
EOC-UCO Radio Tower	517 Chowning Ave	Edmond (C)	TBD
EOC-Mid Van Radio Tower	1500 N Midwest Blvd	Edmond (C)	TBD
Radio Tower (Primary)		Oklahoma County	TBD

Source: Oklahoma County Planning Committee; OKEM, 2006
TBD = To be determined

High-Potential Loss Facilities

High-potential loss facilities include dams, levees, nuclear power plants, military installations and hazardous materials (HAZMAT) facilities. No levees or nuclear power plants were identified in the Planning Area. Dams are discussed below.

Dams

The 2006 County HMP identified the following dams located in Oklahoma County:

- Lake Hefner is located in the NW part of Oklahoma City/Oklahoma County. Hefner dam located on the North side of the impoundment.
- Arcadia Lake is located in the NE part of Oklahoma County near the community of Arcadia. The dam is located on the east side of the lake.
- Lake Overholser is located in Central Oklahoma County along the Canadian County/Oklahoma County line. The dam is located on the east side of the lake on the North Canadian River.

There are other small impoundments, ranging from farm ponds to small lakes such as Lake Aluma and Horseshoe Lake.

While Canton Lake Dam is not located in Oklahoma County, it is noted that according to USACE, the inundation zone in the event of a failure of the Canton Lake Dam includes portions of Oklahoma County.

A dam is included in the National Inventory of Dams if: 1) it is a "high" or "significant" hazard potential class dam or, 2) it is a "low" hazard potential class dam that exceeds 25 feet in height and 15 acre-feet storage or, 3) it is a "low" hazard potential class dam that exceeds 50 acre-feet storage and 6 feet height. Table 4-18 defines the hazard potential classification, as accepted by the NID Interagency Committee on Dam Safety. Table 4-19 lists the dams in all of Oklahoma County as provided by the County.

Table 4-18. Dam Hazard Potential Classifications

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, and Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

Source: NID, 2007

Table 4-19. Dams in Oklahoma County

Name	Water Body	Nearest City	Year Complete	Owner	Hazard*	EAP	NID
Brown Lake	WALNUT CREEK	GUTHRIE	1965	DONALD I. & DONETTA BROWN TRUST	L	NR	OK12199
BELLE ISLE STATION POND	TRIB DEEP FORK CREEK	OKLAHOMA CITY	2001	SAPPHIRE PROPERTIES	L	NR	OK83013
Brixton Heights Addition	Tributary to Spring Creek	OKLAHOMA CITY	1985	New Church Ministries, Inc	H	N	OK02543
Blue Stem	SPRING CREEK	OKLAHOMA CITY	1925	Bluestem Lake HOA Inc.	S	NR	OK02412
ARCADIA LAKE	DEEP FORK RIVER		1978	City of Edmond	L	NR	OK22178
BOMER	EAST FORK WILDHORSE CREEK	LUTHER	1956	ALLEN K BOOHER	L	NR	OK02544
DEER CREEK FARMS	TR-DEER CREEK	GUTHRIE	1965	BILL SWISHER	L	NR	OK20724
DOLESE YOUTH PARK	TR-BLUFF CR		1960		L	NR	OK22001
Dry Creek Detention Pond	Dry Creek	Oklahoma City	1978	City of Oklahoma City - Utilities Department	H	Y	OK11061
HARRIS ROY C. & JAMES C.	TR-DEER CREEK	GUTHRIE	1955	ROY C. & JAMES C. HARRIS	L	NR	OK02408
Hefner	Bluff Creek	OKLAHOMA CITY	1943	City of Oklahoma City - Utilities Department	H	Y	OK02535
FOX LAKE	TR-SPRING CR		1963	GENE PHILLIPS	L	NR	OK00051
KERR BREENE M.	TR-DEER CR	GUTHRIE	1965	BREENE M KERR	L	NR	OK20725
KERR BREENE M.	TR-DEER CREEK	GUTHRIE	1965	Rees Source Ventures Inc	L	NR	OK12195
Knight	TR-SPRING CR	OKLAHOMA CITY	1962	Leo Fry	H	N	OK11001
J-M Ranch	Tributary of Chishom Creek	OKLAHOMA CITY	1970	Valhalla LLC	L	NR	OK12194
NOFTSGER M. LAWRENCE & G	TR-SOLDIER CR	GUTHRIE	1968	Nancy Arnold Noftsger Trust	L	NR	OK02427
Northeast Lake	TR-DEEP FORK RIV	OKLAHOMA CITY	1908	City of Oklahoma	H	Y	OK02424
Lansbrook	SPRING CREEK	OKLAHOMA CITY	1931	Lansbrook HOA	S	NR	OK02410
Leven	Spring Creek	OKLAHOMA CITY	1920	Oklahoma Department of Transportation	L	NR	OK02420
LOGSDON FELIX D.	TR-DEEP FORK RIV	LUTHER	1965	Linda and Webster L. Benham III Co Trust	L	NR	OK12204
LOPEZ MARTIN J.	TR-NORTH CANADIAN RIV	OKLAHOMA CITY	1965	MARTIN J LOPEZ	L	NR	OK12232
LOWRY DAVID C.	TR-NORTH CANADIAN RIVER	HARRAH	1965	LLTJ, LLC c/o JULIE HAYDEN LOWRY TAYLOR	L	NR	OK12207
MASSEYS	TR-DEEP FORK RIV	ARCADIA	1970	OAKDALE VALLEY HOA	L	NR	OK12201
May Avenue Dam	NORTH CANADIAN RIVER	Oklahoma City	2003	City of Oklahoma City	L	NR	OK30061
NW Oklahoma City Sludge Lagoon No. 1	TR-Bluff Creek	OKLAHOMA CITY	1954	City of Oklahoma City - Utilities Department	H	Y	OK11051
Frances Oakes Dam	Tributary of Chisholm Creek	EDMOND	1965	unknown	L	NR	OK12193

Name	Water Body	Nearest City	Year Complete	Owner	Hazard*	EAP	NID
OKLAHOMA SPORTING CLAYS	DEEP FORK	EDMOND	1994	OKLAHOMA SPORTING CLAYS	L	NR	OK22242
OKNONAME 109024	TR-DEEP FORK RIV	OKLAHOMA CITY	1965	E.K. GAYLORD	L	NR	OK02422
OKNONAME 109002	TR-NORTH CANADIAN RIVER	HARRAH	1970	OMMIE OLETA WHITE REV TRUST	L	NR	OK12212
OKNONAME 109013	TR-DEER CREEK	GUTHRIE	1957	COBBLESTONE DEVELOPERS LLC	L	NR	OK02407
OKNONAME 109018	BLOODY RUSH CREEK	GUTHRIE	1965	BAPTIST GEN CONV OF OKLA	L	NR	OK12192
OKNONAME 109019	TR-BLOODY RUSH CREEK	GUTHRIE	1965	BREENE M KERR	L	NR	OK20653
Regal Lake	TR-SPRING CREEK	OKLAHOMA CITY	1920	Regal Lake, HOA	H	Y	OK02418
Overholser	N. Canadian River	OKLAHOMA CITY	1919	City of Oklahoma City - Utilities Department	H	Y	OK02537
OKNONAME 30211	TINKER CREEK	EDMOND		GARY SPENCER	L	NR	OK30211
PATE	TR-TINKER CR	ARCADIA	1950	BILL PATE	L	NR	OK13184
Pines West	Tributary to Spring Creek	OKLAHOMA CITY	1925	Pines Homeowners Association	H	Y	OK11006
QUILLIAN J.W. NO.209	TR-CHISOLM CR	EDMOND	1960	J.W. QUILLIAN	L	NR	OK02421
Silver Lake	Spring Creek	Oklahoma City	1932	Silver Lake Inc.	L	NR	OK02416
SCS-BEAR-FALL & COON CREEK SITE-032	TR-COON CREEK	LUTHER	1960	OKLAHOMA CO CONS DIST	L	NR	OK02411
Ten Acre	TR-CHOCTAW CREEK	CHOCTAW	1965	City of Choctaw	L	NR	OK12205
Esperanza Dam	Tributary to Bluff Creek	Oklahoma City	1965	Esperanza Owners Association Inc.	L	NR	OK02409
HIWASSEE	TR-DEEP FORK RIV	LUTHER	1950	LAKE HIWASSEE IMP. CO.	L	NR	OK02432
South Lake Dam	DEER CREEK	Oklahoma City	2005	Summit Lake L.L.C.	S	NR	OK30164
WHITE PINE TRAIL	DEER CREEK	OKLAHOMA CITY	2005	SUMMIT LAKE L.L.C.	L	NR	OK30163
Sportsmans Club	TRI-DEEP FORK CREEK	OKLAHOMA CITY	1948	Sportsmans Country Club, Inc.	H	N	OK02426
Will Rogers Park Holding Pond	TR-Deep Fork	OKLAHOMA CITY	1967	City of Oklahoma City - Utilities Department	H	Y	OK11069
Eastern Avenue	North Canadian River	OKLAHOMA CITY	2002	City of Oklahoma City	L	NR	OK22289
Lightning Creek Holding Pond B	Lightning Creek	OKLAHOMA CITY	1977	City of Oklahoma City - Utilities Department	L	Y	OK12209
TWIN BRIDGES	TR-COFFEE CREEK	EDMOND	1970	4 STRONG WINDS LLC. & MOREY FAMILY INVESTMENT LLC.	S	NR	OK11068
TY HARTWIG	WALNUT CREEK	OKLAHOMA CITY	2004	TY HARTWIG	L	NR	OK30104

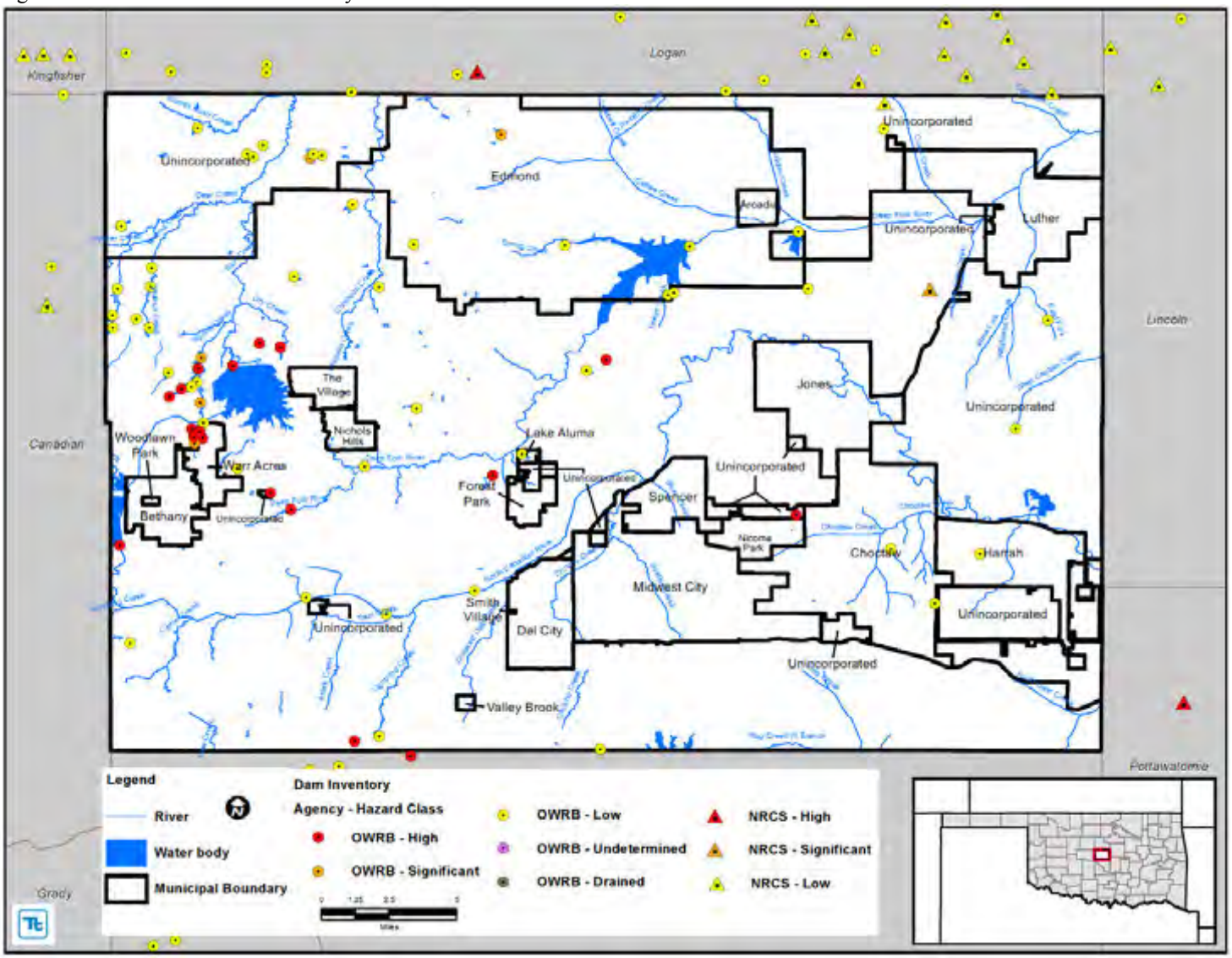
Name	Water Body	Nearest City	Year Complete	Owner	Hazard*	EAP	NID
WILLOW	TR-SPRING CREEK	OKLAHOMA CITY	1920	Willow Lake Preservation Society Inc	L	NR	OK11018
Western Avenue Dam	North Canadian River	Oklahoma City	2000	City of Oklahoma City	L	NR	OK30264
WOLF RIDGE	TR-WEST CAPTAIN CREEK	WELLSTON	1973	LOIS HENRY	L	NR	OK12231
Twin Lakes East	TR-SPRING CR	OKLAHOMA CITY	1930	Twin Lakes Homeowners Association	H	N	OK11000
Ski Island Lake	SPRING CREEK	OKLAHOMA CITY	1957	Ski Island Lake Club	H	Y	OK02406
Isola Bella Apartments	TR-SPRING CREEK	OKLAHOMA CITY	1960	Woodlake Apartments	S	NR	OK11004
Mary Mahoney				Community Health Centers, Inc.	H	N	OK30376
ALUMA	TR-DEEP FORK	OKLAHOMA CITY	1921	LAKE ALUMA CLUB	L	NR	OK02425
SCS-KICKAPOO NATIONS SITE-04	TR-SMITH CR	LUTHER	1986	OKLAHOMA CO CONS DIST	S	NR	OK22070
Lakeside Dam	TRIB TO DEEP FORK CREEK	OKLAHOMA CITY	2005	Lakeside of Oakdale Home Owners Assoc	H	Y	OK30068
BROWN MART D.	WALNUT CREEK	GUTHRIE	1965	Robert L. & Janelle Brown	L	NR	OK12198
OKNONAME 109010	TR-DEER CREEK	GUTHRIE	1955	E.L. KLOSS	L	NR	OK12200
Lightning Creek Holding Pond C	Tributary to Lightning Creek	Oklahoma City	1977	City of Oklahoma City - Utilities Department	H	Y	OK11071
COBBLESTONE	UN TRIB WALNUT CR	OKLAHOMA CITY	1924	COBBLESTONE Inc C/O Neighborhood Services Corp.	L	NR	OK30112
Twin Lakes West	Tributary to Spring Creek	OKLAHOMA CITY	1930	Twin Lakes Homeowners Association	H	N	OK11005
ABBOTT W. ROGERS	TR-WEST ELM CREEK	FRANKLIN	1965	DOMINUS, LLC	L	NR	OK12208
Pines East	Tributary to Spring Creek	OKLAHOMA CITY	1925	Pines Homeowners Association	H	Y	OK11007
EAGLE	TR-SPRING CREEK	OKLAHOMA CITY	1965	EAGLE LAKE ESTATES HOA	L	NR	OK12197

Source: Oklahoma County

Notes:

L	=	Low	NR	=	Not Required
S	=	Significant	L	=	Local
H	=	High			
EAP	=	Emergency Action Plan			

Figure 4-7. Dams in Oklahoma County



Source: Oklahoma County Planning Department
Notes: OKWB = Oklahoma Water Board; NRCS = Natural Resources Conservation Service

Military Installations

Tinker Air Force Base, the largest enterprise in the county, is located within Midwest City.

Other Facilities

The user-defined facilities category includes all assets that the Planning Area and participating municipalities deemed critical to include in the inventory and that do not fit within a pre-defined HAZUS-MH facility category. These facilities include municipal halls and County-owned buildings, etc. Table 4-20 below lists all user-defined facilities for Planning Area and Figure 4-8 displays their locations throughout the Planning Area.

Table 4-20. Other Facilities in the Planning Area

Name	Municipality	Replacement Value	Building Type
Arcadia City Hall	Arcadia (C)	$300,000	TBD
Overholser Elementary School	Bethany (C)	TBD	TBD
Bethany Fire/Police Dispatch	Bethany (C)	TBD	TBD
Lake Park Elementary School	Bethany (C)	TBD	TBD
Bethany Public Schools Complex	Bethany (C)	TBD	TBD
Bethany City Hall	Bethany (C)	TBD	TBD
Choctaw City Hall	Choctaw (C)	TBD	TBD
City Hall	Del City (C)	$699,600	TBD
Public Works/Fleet Maintenance	Del City (C)	$323,000	TBD
Del City City Hall	Del City (C)	TBD	TBD
Municipal Court Building	Edmond (C)	TBD	Masonry
MAC - Senior Center	Edmond (C)	TBD	Masonry
Vehicle Maintenance Facility	Edmond (C)	$712,000	Concrete
Downtown City Campus Area	Edmond (C)	$9,020,000	TBD
Edmond City Hall & Administration	Edmond (C)	$18,000,000	TBD
Public Works Authority	Edmond (C)	TBD	TBD
Vacant Animal Control 3rd St	Edmond (C)	TBD	Steel
Administration Building	Edmond (C)	TBD	Concrete
City First	Edmond (C)	TBD	TBD
XTimbers Animal Welfare	Edmond (C)	TBD	TBD
PSC OPs Yard	Edmond (C)	TBD	TBD
PSC OPs Building	Edmond (C)	TBD	Masonry
PSC Admin Building	Edmond (C)	TBD	TBD
Council Chambers	Edmond (C)	TBD	TBD
Forest Park City Hall	Forest Park (C)	TBD	TBD
Oklahoma Liquefied Gas (Olg)	Harrah (C)	TBD	TBD
Harrah Public Works Maintenance	Harrah (C)	$18,000	TBD
Charlie Brown Friends Daycare Ctr.	Harrah (C)	TBD	TBD
Harrah Best Yet Groc. Store	Harrah (C)	TBD	TBD
Harrah Towne Plaza Strip Mall	Harrah (C)	TBD	TBD

Name	Municipality	Replacement Value	Building Type
Harrah West Shopping Center	Harrah (C)	TBD	TBD
Lake Pointe Shopping Center	Harrah (C)	TBD	TBD
First Baptist Ch/Public Shelter	Harrah (C)	TBD	TBD
Harrah Senior Citizen's Center	Harrah (C)	TBD	TBD
Play-N-Station	Harrah (C)	TBD	TBD
Harrah Nursing Center and Apt.	Harrah (C)	TBD	TBD
Oklahoma Liquefied Gas - Storage	Harrah (C)	TBD	TBD
St. Teresa 's Catholic Church	Harrah (C)	TBD	TBD
Harrah Senior Housing	Harrah (C)	TBD	TBD
Apple Valley Apartments	Harrah (C)	TBD	TBD
United States Post Office	Harrah (C)	TBD	TBD
Harrah City Hall	Harrah (C)	$180,000	TBD
City Hall	Harrah (C)	TBD	TBD
Choctaw Propane	Harrah (C)	TBD	TBD
Country Boy Grocery Store	Harrah (C)	TBD	TBD
Luther City Hall	Luther (C)	$50,000	TBD
Luther Mill And Farm Supply	Luther (C)	$2,000,000	TBD
City Hall	Midwest City (C)	TBD	TBD
Reed Center	Midwest City (C)	TBD	TBD
Oklahoma County Sheriff Department	Midwest City (C)	TBD	TBD
Oklahoma County Training Facility	Midwest City (C)	TBD	TBD
MWC Fire Administration	Midwest City (C)	TBD	TBD
Tinker Air Force Base	Midwest City (C)	TBD	TBD
YMCA	Midwest City (C)	TBD	TBD
All American Fitness Center	Midwest City (C)	TBD	TBD
Shell	Midwest City (C)	TBD	TBD
Valero	Midwest City (C)	TBD	TBD
St Matthew's Methodist Church	Midwest City (C)	TBD	TBD
AM-PM	Midwest City (C)	TBD	TBD
Cornerstone Family Church	Midwest City (C)	TBD	TBD
Free Methodist Church of Midwest City	Midwest City (C)	TBD	TBD
Meadowood Baptist Church	Midwest City (C)	TBD	TBD
Good Shepherd Lutheran Church	Midwest City (C)	TBD	TBD
Ridgecrest Church of Christ	Midwest City (C)	TBD	TBD
Eastside Church of Christ	Midwest City (C)	TBD	TBD
Douglas Boulevard United Methodist Church	Midwest City (C)	TBD	TBD
Neighborhood Missionary Baptist Church	Midwest City (C)	TBD	TBD
Church of Jesus Christ of LDS	Midwest City (C)	TBD	TBD
Gas Station- name unknown	Midwest City (C)	TBD	TBD
Midwest Regional Medical Center	Midwest City (C)	TBD	TBD
St Mark Lutheran Church	Midwest City (C)	TBD	TBD
Walgreens	Midwest City (C)	TBD	TBD
Best Western	Midwest City (C)	TBD	TBD
Motel 6	Midwest City (C)	TBD	TBD

Name	Municipality	Replacement Value	Building Type
Super 8	Midwest City (C)	TBD	TBD
Studio 6	Midwest City (C)	TBD	TBD
Hampton Inn	Midwest City (C)	TBD	TBD
Comfort Inn & Suites East	Midwest City (C)	TBD	TBD
Coachlight Apartments	Midwest City (C)	TBD	TBD
Rose State College	Midwest City (C)	TBD	TBD
La Petite	Midwest City (C)	TBD	TBD
Mid-Del Technology Center	Midwest City (C)	TBD	TBD
Integris Prohealth Physicians	Midwest City (C)	TBD	TBD
Gas Station- name unknown	Midwest City (C)	TBD	TBD
Parklawn Plaza	Midwest City (C)	TBD	TBD
Regional Medical Office Complex	Midwest City (C)	TBD	TBD
Crest Food Store	Midwest City (C)	TBD	TBD
Buy For Less	Midwest City (C)	TBD	TBD
Aldi	Midwest City (C)	TBD	TBD
Crest Foods	Midwest City (C)	TBD	TBD
Future Walmart Market	Midwest City (C)	TBD	TBD
Shell	Midwest City (C)	TBD	TBD
Gas Station- name unknown	Midwest City (C)	TBD	TBD
Midwest City Medical Group	Midwest City (C)	TBD	TBD
Spring Tree Apartments	Midwest City (C)	TBD	TBD
Parkview Apartments	Midwest City (C)	TBD	TBD
Woodside Village Apartments	Midwest City (C)	TBD	TBD
Century Martial Arts	Midwest City (C)	TBD	TBD
Midwest City Depot Apartments	Midwest City (C)	TBD	TBD
Legacy Corner Apartments	Midwest City (C)	TBD	TBD
Rolling Oaks Apartments	Midwest City (C)	TBD	TBD
Willow Creek Apartments	Midwest City (C)	TBD	TBD
Planet Plaza Apartments	Midwest City (C)	TBD	TBD
Raintree Meadow Apartments	Midwest City (C)	TBD	TBD
Orchard Springs Apartments	Midwest City (C)	TBD	TBD
East Oaks Village Senior Apartments	Midwest City (C)	TBD	TBD
East Oaks Village Senior Apartments	Midwest City (C)	TBD	TBD
Yorkshire Apartments	Midwest City (C)	TBD	TBD
Calico Corners Apartments	Midwest City (C)	TBD	TBD
Villa Gardens Apartments	Midwest City (C)	TBD	TBD
Midwest Manor Apartments	Midwest City (C)	TBD	TBD
Huntington Place Apartments	Midwest City (C)	TBD	TBD
Midwest Territory Apartments	Midwest City (C)	TBD	TBD
Fairfax Apartments	Midwest City (C)	TBD	TBD
Silverwood Apartments	Midwest City (C)	TBD	TBD
Meadow Glen Apartments	Midwest City (C)	TBD	TBD
Chestnut Square Apartments	Midwest City (C)	TBD	TBD
Eden Cove Apartments	Midwest City (C)	TBD	TBD
David Stanley Dodge	Midwest City (C)	TBD	TBD

Name	Municipality	Replacement Value	Building Type
Joe Cooper Ford	Midwest City (C)	TBD	TBD
Hudiburg Toyota/Chevrolet/Pontiac/GMC	Midwest City (C)	TBD	TBD
IBC Bank	Midwest City (C)	TBD	TBD
First Fidelity Bank	Midwest City (C)	TBD	TBD
Arvest	Midwest City (C)	TBD	TBD
First National Bank of Midwest City	Midwest City (C)	TBD	TBD
Foam Brite Car Wash	Midwest City (C)	TBD	TBD
Vacant	Midwest City (C)	TBD	TBD
Holiday Inn Express	Midwest City (C)	TBD	TBD
Becker's	Midwest City (C)	TBD	TBD
La Petite Child Care	Midwest City (C)	TBD	TBD
Center Place Apartments	Midwest City (C)	TBD	TBD
Center Place Apartments	Midwest City (C)	TBD	TBD
Center Place Apartments	Midwest City (C)	TBD	TBD
Center Place Apartments	Midwest City (C)	TBD	TBD
Center Place Apartments	Midwest City (C)	TBD	TBD
Center Place Apartments	Midwest City (C)	TBD	TBD
Meadowood Village Apartments	Midwest City (C)	TBD	TBD
Concord Apartments	Midwest City (C)	TBD	TBD
Meadow Ridge Apartments	Midwest City (C)	TBD	TBD
Firestone	Midwest City (C)	TBD	TBD
Uptown Center	Midwest City (C)	TBD	TBD
Poblano's	Midwest City (C)	TBD	TBD
Village Oaks Plaza	Midwest City (C)	TBD	TBD
Andrew Plaza	Midwest City (C)	TBD	TBD
23 Post Plaza	Midwest City (C)	TBD	TBD
Eastgate Shopping Center	Midwest City (C)	TBD	TBD
Boulevard Market Place	Midwest City (C)	TBD	TBD
Midwest Crossing	Midwest City (C)	TBD	TBD
Town Center Shops	Midwest City (C)	TBD	TBD
Kenwood Plaza	Midwest City (C)	TBD	TBD
Sooner Tank LLC	Midwest City (C)	TBD	TBD
Orchard Plaza Shopping Center	Midwest City (C)	TBD	TBD
Sheraton Midwest City Hotel	Midwest City (C)	TBD	TBD
Lowe's	Midwest City (C)	TBD	TBD
Gateway Plaza Shopping Center	Midwest City (C)	TBD	TBD
Decker Center	Midwest City (C)	TBD	TBD
Holiday Square Shopping Center	Midwest City (C)	TBD	TBD
Town and Country Shopping Center	Midwest City (C)	TBD	TBD
Heritage Plaza Shopping Center	Midwest City (C)	TBD	TBD
Unnamed Shopping Center	Midwest City (C)	TBD	TBD
Caspian Plaza	Midwest City (C)	TBD	TBD
Campus Corner Shopping Center	Midwest City (C)	TBD	TBD
Chick-Fil-A	Midwest City (C)	TBD	TBD
Rib Crib	Midwest City (C)	TBD	TBD

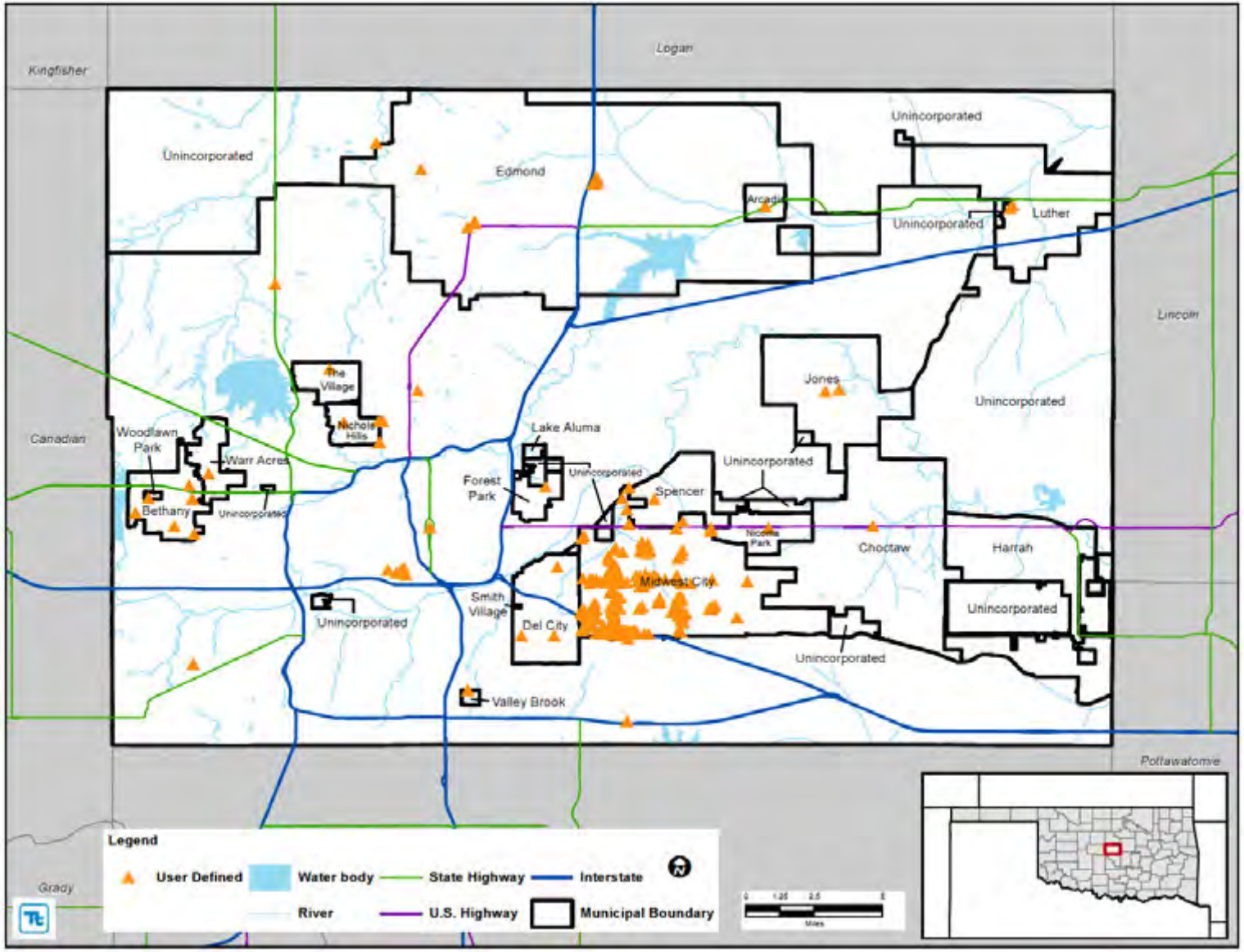
Name	Municipality	Replacement Value	Building Type
Henry Hudson's	Midwest City (C)	TBD	TBD
Shopping Center (unnamed)	Midwest City (C)	TBD	TBD
Ulta	Midwest City (C)	TBD	TBD
Autumn House bldg 1	Midwest City (C)	$8,846,850	TBD
Reed Conference Center	Midwest City (C)	TBD	TBD
Emergency Ops Ctr - City Hall	Midwest City (C)	$6,500,000	TBD
Tinker Air Force Base	Midwest City (C)	TBD	TBD
Midwest City City Hall	Midwest City (C)	TBD	TBD
Chromalloy Oklahoma	Midwest City (C)	$12,075,000	TBD
Shopping Center (unnamed)	Midwest City (C)	TBD	TBD
Home Depot	Midwest City (C)	TBD	TBD
Sonic	Midwest City (C)	TBD	TBD
Panda Express	Midwest City (C)	TBD	TBD
Regional Square Shopping Center	Midwest City (C)	TBD	TBD
Cheddar's	Midwest City (C)	TBD	TBD
Lockheed Shopping Center	Midwest City (C)	TBD	TBD
Catherine's	Midwest City (C)	TBD	TBD
Rue 21	Midwest City (C)	TBD	TBD
Petsmart	Midwest City (C)	TBD	TBD
Hibbet	Midwest City (C)	TBD	TBD
Town Center Shops	Midwest City (C)	TBD	TBD
Lane Bryant	Midwest City (C)	TBD	TBD
Marshall's	Midwest City (C)	TBD	TBD
Kohl's	Midwest City (C)	TBD	TBD
Target	Midwest City (C)	TBD	TBD
JC Penney	Midwest City (C)	TBD	TBD
Best Buy	Midwest City (C)	TBD	TBD
Jack in the Box	Midwest City (C)	TBD	TBD
Santa Fe Steak House	Midwest City (C)	TBD	TBD
Midwest Square Office Park	Midwest City (C)	TBD	TBD
Sienna Extended Care and Rehab	Midwest City (C)	TBD	TBD
Buena Vista Care and Rehabilitation	Midwest City (C)	TBD	TBD
Midwest City Nursing Center	Midwest City (C)	TBD	TBD
Arbor House Assisted Living	Midwest City (C)	TBD	TBD
Alterra Sterling House of Midwest City	Midwest City (C)	TBD	TBD
Autumn House Retirement Home	Midwest City (C)	TBD	TBD
Welcome Center	Midwest City (C)	TBD	TBD
MWC Water Treatment Plant	Midwest City (C)	TBD	TBD
MWC Public Works	Midwest City (C)	TBD	TBD
Continental Square	Midwest City (C)	TBD	TBD
MWC Animal Shelter	Midwest City (C)	TBD	TBD
MWC Police Firing Range	Midwest City (C)	TBD	TBD
MWC Community Center	Midwest City (C)	TBD	TBD
Shopping Center (unnamed)	Midwest City (C)	TBD	TBD
MWC Senior Center	Midwest City (C)	TBD	TBD

Name	Municipality	Replacement Value	Building Type
MWC Metropolitan Library	Midwest City (C)	TBD	TBD
Chromalloy Gas Turbine Corporation	Midwest City (C)	TBD	TBD
Plasma Pheresis Center	Midwest City (C)	TBD	TBD
Legacy Corner Apartments	Midwest City (C)	TBD	TBD
Bags, Inc.	Midwest City (C)	TBD	TBD
United Technologies Corp	Midwest City (C)	TBD	TBD
Boeing Aero Space	Midwest City (C)	TBD	TBD
Hawthorn Suites	Midwest City (C)	TBD	TBD
MWC Northside Treatment Plant	Midwest City (C)	TBD	TBD
Logan's Roadhouse	Midwest City (C)	TBD	TBD
Oklahoma Journal Building	Midwest City (C)	TBD	TBD
Auto Zone	Midwest City (C)	TBD	TBD
Furniture Gallery	Midwest City (C)	TBD	TBD
Chilli's	Midwest City (C)	TBD	TBD
Steak 'n Shake	Midwest City (C)	TBD	TBD
Walmart	Midwest City (C)	TBD	TBD
Golden Palace	Midwest City (C)	TBD	TBD
Old Chicago	Midwest City (C)	TBD	TBD
Applebee's	Midwest City (C)	TBD	TBD
Napa Auto Parts	Midwest City (C)	TBD	TBD
Golden Corral	Midwest City (C)	TBD	TBD
Middle Pointe	Midwest City (C)	TBD	TBD
Woodlands Office Park	Midwest City (C)	TBD	TBD
Cherry Center	Midwest City (C)	TBD	TBD
McDonald's	Midwest City (C)	TBD	TBD
Rose Rock Center	Midwest City (C)	TBD	TBD
Anthony's TV & Appliance, Inc.	Midwest City (C)	TBD	TBD
Griffin Plaza	Midwest City (C)	TBD	TBD
U.S. Post Office	Midwest City (C)	TBD	TBD
Heritage Park Mall	Midwest City (C)	TBD	TBD
Sam's Wholesale Club	Midwest City (C)	TBD	TBD
MRMC Accessory Building	Midwest City (C)	TBD	TBD
Vacant	Midwest City (C)	TBD	TBD
Golden Goose Flea Market	Midwest City (C)	TBD	TBD
Nichols Hills City Hall	Nichols Hills (C)	TBD	TBD
Nichols Hills Public Works	Nichols Hills (C)	$4,998,000	TBD
City Hall Complex	Nichols Hills (C)	$2,250,000	TBD
Plaza North	Nicols Hills (C)	TBD	TBD
Plaza South	Nicols Hills (C)	TBD	TBD
Western Business District	Nicols Hills (C)	TBD	TBD
Oklahoma City Golf & Country Club	Nicols Hills (C)	$5,452,990	TBD
Nicoma Park City Hall	Nicoma Park (C)	$600,000	TBD
The Village City Hall	Oklahoma County	$1,200,000	TBD

Name	Municipality	Replacement Value	Building Type
Oklahoma City Stockyards	Oklahoma County	TBD	TBD
Oklahoma Supreme Court	Oklahoma County	TBD	TBD
Warr Acres City Hall	Oklahoma County	TBD	TBD
City Hall	Oklahoma County	TBD	TBD
Oklahoma Publishing Company	Oklahoma County	TBD	TBD
General Motors Plant	Oklahoma County	TBD	TBD
Spencer City Hall	Oklahoma County	TBD	TBD
Valley Brook City Hall	Oklahoma County	TBD	TBD
Federal Reserve Bank	Oklahoma County	TBD	TBD
State Capital	Oklahoma County	TBD	TBD
Oklahoma Co. Detention Center	Oklahoma County	TBD	TBD
Oklahoma Co. Courthouse & Annex	Oklahoma County	TBD	TBD
Oklahoma City City Hall	Oklahoma County	TBD	TBD
U.S. Filter--Deer Creek Wwtp	Oklahoma County	TBD	TBD
FAA Mike Monroney Center	Oklahoma County	TBD	TBD
U.S. Filter--Chisholm Creek Wwtp	Oklahoma County	TBD	TBD
United Methodist Church	The Village (C)	$700,000	TBD

Source: Oklahoma County Steering Committee
C = City
T = Town
TBD = To be determined

Figure 4-8. Other Facilities in the Planning Area



Source: Oklahoma County Planning Committee, OKEM, 2006

Economic Profile

Agriculture is a leading industry in Oklahoma County. Approximately one-third of the acreage in the county is cropland or rangeland. The county has many agribusiness enterprises. Wheat, corn, alfalfa, and beef and dairy cattle are the main agricultural commodities produced in the county. Wheat is the most commonly grown crop on the cultivated land. It used for both grain and forage production. Cattle production is divided among cow-calf, stocker cattle, and dairy cattle enterprises. Most of the native range and improved pasture in the county is used by cowcalf operations. Stocker cattle graze winter pastures of wheat and other small grains. A fair amount of the acreage of these pastures is being grazed out and not harvested for grain. Several producers operate dairy farms for milk production.

Other enterprises in the county include Tinker Air Force Base (the largest enterprise in the county); the Oklahoma City Air Logistics Center; the Oklahoma State Capitol Complex; city and county governments; health care services; educational facilities, including grade schools, four vocational schools, and nine colleges and universities; Federal regulatory agencies; automobile assembly plants; tire manufacturers; television stations; telecommunication companies; the Will Rogers World Airport; and oil and gas production facilities (USDA NRCS Soil Survey of Oklahoma County, 2003).

5.1 METHODOLOGY AND TOOLS

This section describes the methodology and tools used to support the risk assessment process.

Methodology

The risk assessment process used for this Plan is consistent with the process and steps presented in FEMA 386-2, State and Local Mitigation Planning How-to-Guide, Understanding Your Risks – Identifying Hazards and Estimating Losses (FEMA, 2001). This process identifies and profiles the hazards of concern and assesses the vulnerability of assets (population, structures, critical facilities and the economy) at risk in the community. A risk assessment provides a foundation for the community's decision makers to evaluate mitigation measures that can help reduce the impacts of a hazard when one occurs (Section 6 and Section 9 of this plan).

Step 1: The first step of the risk assessment process is to identify the hazards of concern. FEMA's current regulations only require an evaluation of natural hazards. Natural hazards are natural events that threaten lives, property, and many other assets. Often, natural hazards can be predicted, where they tend to occur repeatedly in the same geographical locations because they are related to weather patterns or physical characteristics of an area.

Step 2: The next step of the risk assessment is to prepare a profile for each hazard of concern. These profiles assist communities in evaluating and comparing the hazards that can impact their area. Each type of hazard has unique characteristics that vary from event to event. That is, the impacts associated with a specific hazard can vary depending on the magnitude and location of each event (a hazard event is a specific, uninterrupted occurrence of a particular type of hazard). Further, the probability of occurrence of a hazard in a given location impacts the priority assigned to that hazard. Finally, each hazard will impact different communities in different ways, based on geography, local development, population distribution, age of buildings, and mitigation measures already implemented.

Steps 3 and 4: To understand risk, a community must evaluate what assets it possesses and which assets are exposed or vulnerable to the identified hazards of concern. Hazard profile information combined with data regarding population, demographics, general building stock, and critical facilities at risk, located in Section 4, prepares the community to develop risk scenarios and estimate potential damages and losses for each hazard.

Tools

To address the requirements of DMA 2000 and better understand potential vulnerability and losses associated with hazards of concern, Oklahoma County used standardized tools, combined with local, state, and federal data and expertise to conduct the risk assessment. Our standardized tools used to support the risk assessment are described below.

Hazards U.S. – Multi-Hazard (HAZUS-MH)

In 1997, FEMA developed a standardized model for estimating losses caused by earthquakes, known as Hazards U.S. or HAZUS. HAZUS was developed in response to the need for more effective national-, state-, and community-level planning and the need to identify areas that face the highest risk and potential for loss. HAZUS was expanded into a multi-hazard methodology, HAZUS-MH with new models for estimating potential losses from wind (hurricanes) and flood (riverine and coastal) hazards. HAZUS-MH is a Geographic Information System (GIS)-based software tool that applies engineering and scientific risk calculations that have been developed by hazard and information technology experts to provide defensible

damage and loss estimates. These methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards. The GIS framework also supports the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

HAZUS-MH uses GIS technology to produce detailed maps and analytical reports that estimate a community's direct physical damage to building stock, critical facilities, transportation systems and utility systems. To generate this information, HAZUS-MH uses default HAZUS-MH provided data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. Damage reports can include induced damage (inundation, fire, threats posed by hazardous materials and debris) and direct economic and social losses (casualties, shelter requirements, and economic impact) depending on the hazard and available local data. HAZUS-MH's open data architecture can be used to manage community GIS data in a central location. The use of this software also promotes consistency of data output now and in the future and standardization of data collection and storage. The guidance Using HAZUS-MH for Risk Assessment: How-to Guide (FEMA 433) was used to support the application of HAZUS-MH for this risk assessment and plan. More information on HAZUS-MH is available at http://www.fema.gov/plan/prevent/hazus/index.shtm.

In general, probabilistic analyses were performed to develop estimates of long-term average losses (annualized losses) for the earthquake hazard, as well as an expected/estimated distribution of losses (mean return period losses) for the earthquake and flood hazards. The probabilistic hazard generates estimates of damage and loss for specified return periods (e.g., 100- and 500-year or 1% and 0.2% annual chance flood events). For annualized losses, HAZUS-MH 2.0 calculates the maximum potential annual dollar loss resulting from various return periods averaged on a "per year" basis. It is the summation of all HAZUS-supplied return periods (e.g., 10, 50, 100, 200, and 500) multiplied by the return period probability (as a weighted calculation). In summary, the estimated cost of a hazard each year is calculated.

Custom methodologies in HAZUS-MH were used to assess potential exposure and losses associated with hazards of concern for Oklahoma County:

- Inventory: The default demographic data in HAZUS-MH 2.0, based on the 2000 U.S. Census, was used for analysis. However, the 2010 U.S. Census data was used to estimate hazard exposure at the municipal level.

  The valuation of general building stock and the loss estimates determined in the Planning Area were based on the default general building stock database provided in HAZUS-MH 2.0. The general building stock valuations are Replacement Cost Value from RSMeans as of 2006. The occupancy classes available in HAZUS-MH 2.0 were condensed into the following categories (residential, commercial, industrial, agricultural, religious, government, and educational) to facilitate the analysis and the presentation of results. Residential loss estimates address both multi-family and single family dwellings.

  The critical facility inventory (essential facilities, utilities, transportation features and user-defined facilities) was updated for the earthquake, flood and wind hazard models. This comprehensive inventory was developed by gathering input from numerous sources including the original 2006 HMP critical facility inventory, default data in the previous version of HAZUS-MH (MR5), GIS, provided by Oklahoma County Planning Department, participating municipalities and input from the Planning Committee.

The 'user-defined facilities' category includes all assets that the County deemed critical to include in the inventory and that do not fit within a pre-defined HAZUS-MH facility category. These facilities include shelters, senior care facilities and municipal-owned buildings.

- Earthquake: A probabilistic assessment was conducted for Oklahoma County for the 100-, 500- and 2,500-year MRPs through a modified Level 1 analysis in HAZUS-MH 2.0 to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information from historic earthquakes and inferred faults, locations and magnitudes, and computes the probable ground shaking levels that may be experienced during a recurrence period by Census tract. Probabilistic estimates are best for urban planning, land use, zoning and seismic building code regulations (NYCEM, 2003). The default assumption is a magnitude 7 earthquake for all return periods. Default demographic and general building stock data in HAZUS-MH 2.0 were used for the earthquake analysis. However, as described above, updated critical facility inventories were used.

  In addition, the April 9, 1952 El Reno earthquake was run as an historic earthquake to quantify estimated potential losses with today's current built environment. The historic scenario was run with the following parameters: magnitude 5.1, fault depth 10 kilometers, epicenter location of 35.52° N, 97.85° W, and the central and eastern U.S. attenuation function.

- Flood: The HAZUS-MH 2.0 riverine model; the Oklahoma FEMA 2009 Digital Flood Insurance Rate Maps (DFIRMs); and USGS one-third ArcSecond Digital Elevation Models (DEM) (10 meter resolution) were used to estimate exposure and potential losses associated with the flood hazard.

  HAZUS-MH 2.0 was used to run the hydrology and hydraulics for the selected river reaches, using the DFIRMs as a guide. HAZUS-MH 2.0 generated the flood-depth grid and flood boundary for the specified return periods (100- and 500-year MRPs) and calculated the estimated damages to the general building stock and critical facilities based on this depth grid. Default damage functions and first-floor elevations were used. The Flood Annualized Loss Analysis option in HAZUS-MH 2.0 is deactivated pending forthcoming methodology adjustments. Therefore, annualized flood losses were not calculated for Oklahoma County.

- Wind: HAZUS-MH 2.0 does not have the capabilities to model the wind hazard for Oklahoma County in the wind model. To analyze the wind hazard, the wind damage function curves for various building types in the HAZUS-MH 2.0 wind model were examined to discuss their vulnerability.

- Other Hazards: HAZUS-MH support was used to evaluate other hazards (dam failure, drought, expansive soils, extreme temperature, hail, lightning, winter storm, wildfire), as feasible. For many of the hazards evaluated in this risk assessment, historic data are not adequate to model future losses at this time. However, HAZUS-MH can map hazard areas and calculate exposures if geographic information on the locations of the hazards and inventory data are available. For some of the other hazards of concern, areas and inventory susceptible to specific hazards were mapped and exposure was evaluated to help guide mitigation efforts discussed in Section 6 and Section 9. For other hazards, a qualitative analysis was conducted using the best available data and professional judgment.

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

1) Approximations and simplifications necessary to conduct such a study
2) Incomplete or dated inventory, demographic, or economic parameter data
3) The unique nature, geographic extent, and severity of each hazard
4) Mitigation measures already employed by the participating municipalities and the amount of advance notice residents have to prepare for a specific hazard event

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, Oklahoma County will collect additional data to assist in developing refined estimates of vulnerabilities to natural and non-natural hazards.

5.2 IDENTIFICATION OF NATURAL HAZARDS OF CONCERN

Hazards of Concern is defined as those hazards that are considered most likely to impact a community. These are identified using available data and local knowledge.

To provide a strong foundation for mitigation strategies considered in Sections 6 and 9, Oklahoma County considered a full range of natural hazards that could impact the area, and then identified and ranked those hazards that presented the greatest concern. The natural hazard of concern identification and update process incorporated input from the County and participating jurisdictions; review of the 2006 Oklahoma County HMP and 2011 State of Oklahoma Hazard Mitigation Plan (OK HMP) and previous hazard identification efforts; research and local, state, and federal information on the frequency, magnitude, and costs associated with the various hazards that have previously, or could feasibly, impact the region; and qualitative or anecdotal information regarding natural hazards and the perceived vulnerability of the study area's assets to them. Table 5.2-1 documents the process of identifying and updating the natural hazards of concern for further profiling and evaluation.

For the purposes of this planning effort, the Planning Committee chose to group some natural hazards together, based on the similarity of hazard events, their typical concurrence or their impacts, consideration of how hazards have been grouped in Federal Emergency Management Agency (FEMA) guidance documents (FEMA 386-1, "Understanding Your Risks, Identifying Hazards and Estimating Losses; FEMA's "Multi-Hazard Identification and Risk Assessment – The Cornerstone of the National Mitigation Strategy"), and consideration of hazard grouping in the 2006 Oklahoma County and 2011 Oklahoma State HMPs.

The "Flood" hazard includes riverine, flash and urban flooding. Other types of flooding such as coastal do not generally occur within the County; therefore, they were not further considered for inclusion within this HMP. Inclusion of the various forms of flooding under a general "Flood" hazard is consistent with that used in FEMA's "Multi-Hazard Identification and Risk Assessment" guidance.

"High Winds" and "Tornados" have been presented together in the "High Winds and Tornado" profile.

The "Severe Winter Storm" hazard includes heavy snowfall, blizzards, freezing rain/sleet, and ice storms. This grouping is consistent with that used in the OK State HMP, as well as the "Severe Winter Storm" hazard used in FEMA's "Multi-Hazard Identification and Risk Assessment" guidance.

These groupings do not change the definition of the included specific events/hazards, as defined within FEMA guidance and other risk assessment documents, and does not affect the hazard analysis conducted through the use of HAZUS-MH, either directly or as a risk assessment support tool.

Please note that technological (for example, hazardous material incidents) and man-made hazards (for example, terrorism) are not being addressed in this planning process. The DMA 2000 regulations do not require consideration of such hazards, and the Planning Committee has elected to focus full attention on the natural hazards, particularly flooding, that clearly pose the greatest risk to the County. Further, the risks of man-made and technological hazards are generally mitigated and/or managed through other regulatory programs and plans.

Table 5.2-1. Identification of Natural Hazards of Concern for Oklahoma County, Oklahoma

Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in Oklahoma County?	If yes, does this hazard pose a significant threat to Oklahoma County?	Why was this determination made?	Source(s)
Avalanche	No	No	• The OK HMP does not identify avalanche as a hazard of concern for the State of Oklahoma. • The topography and climate of Oklahoma County does not readily support the occurrence of an avalanche event. • Oklahoma, in general, has a very low occurrence of avalanche events based on statistics provided by National Avalanche Center – American Avalanche Association (NAC-AAA) between 1950 and 2006. • Due to the fact that this hazard has no known historical occurrences, the County decided not to analyze the avalanche hazard for the purpose of this Plan.	• OK HMP • Review of NAC-AAA database between 1950 and 2006
Coastal Erosion / Coastal Storm	No	No	• The OK HMP does not identify coastal erosion or coastal storm as a hazard of concern for the State of Oklahoma. • Oklahoma County is not bounded by coastal waters; therefore, not directly impacted by coastal storms that result in coastal erosion. • Due to the fact that this hazard has no known historical occurrences, the County decided not to analyze the coastal erosion/coastal storm hazard for the purpose of this Plan.	• OK HMP
Dam Failure	Yes	Yes	• The OK HMP identifies this as a hazard of concern for the State of Oklahoma • The Planning Committee considers it as a risk for the planning area.	• OK HMP
Drought	Yes	Yes	• The OK HMP identifies drought as a hazard of concern for the State of Oklahoma. • Various sources indicated that many drought events or periods impacted large regions of the State, including Oklahoma County. Such events include: o 2000-2001 o August 2000 o 2005 – 2007 – Many counties in the State were affected, including Oklahoma County. Drought levels ranged from severe to exceptional. Wildfires became a serious problem during this time. o 2011	• OK HMP • NOAA-NCDC • Drought Impact Reporter • SHELDUS

Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in Oklahoma County?	If yes, does this hazard pose a significant threat to Oklahoma County?	Why was this determination made?	Source(s)
Earthquake	Yes	Yes	• The OK HMP indicates earthquake as a hazard of concern for the State of Oklahoma. • According to the USGS online seismic hazard maps, the peak ground acceleration with a 10% probability of exceedance over 50 years for Oklahoma County is between 3 and 5% g. FEMA guidance recommends earthquakes are evaluated further if an area has a 3% g peak acceleration or more. • According to the OK HMP, the following earthquake events affected Oklahoma County: o April 9, 1952 – the largest earthquake to ever strike Oklahoma; magnitude of 5.7; caused by slippage along the Nemaha fault line; damage was moderate in Oklahoma County. Damage included toppled chimneys and smokestacks, cracked and loosened bricks on buildings, and broken windows and dishes. o October 13, 2010 – the third strongest earthquake in the history of Oklahoma; it struck approximately eight miles southeast of Norman; USGS received reports of the earthquake being felt over the eastern two-thirds of the State; Oklahoma County reported having felt this earthquake. o November 6, 2011 – the largest earthquake in the State in recent times, and possibly stronger than the 1952 quake, rattled Prague, OK and was felt from southwest Illinois to the Big Country area of West Texas. Walls cracked and plates fell. At St. Gregory's University in Shawnee, a spire on a building fell and three others were damaged.	• OK HMP • USGS
Expansive Soils	Yes	Yes	• The OK HMP identifies expansive soils as a hazard of concern for the State of Oklahoma. • USGS indicated that Oklahoma County's soils consists of clay having slight to moderate swelling potential • The planning committee has indicated that expansive soils continue to be a hazard, particularly to subsurface infrastructure, throughout the County.	• OK HMP • USGS
Extreme Temperature	Yes	Yes	• The OK HMP identifies extreme heat as a hazard of a concern for the State of Oklahoma. However, for the purpose of this Plan, extreme temperatures will include both heat and cold events for Oklahoma County. • NOAA's NCDC storm events database indicates that Oklahoma County was impacted by approximately 26 extreme temperature events between 1950	• OK HMP • NOAA-NCDC • National Atlas

Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in Oklahoma County?	If yes, does this hazard pose a significant threat to Oklahoma County?	Why was this determination made?	Source(s)
			and 2011. However, most events are of a regional extent rather than localized to just one county or community.	
Flood (Riverine, Flash and Urban Flooding)	Yes	Yes	• The OK HMP identifies flooding as the main hazard of concern for the State of Oklahoma. • Oklahoma County has been issued 45 FEMA Disaster Declarations for flood-related events, each event resulting in extensive damages. • NOAA's NCDC storm events database indicates that Oklahoma County was impacted by approximately 58 flood events between 1950 and 2011. This includes flash flooding. • NFIP identifies that Oklahoma County has made over 1,400 flood claims as of August 2011, totaling over $14 million in payments.	• OK HMP • OEM • FEMA • SHELDUS • NOAA-NCDC • NFIP
Hailstorm	Yes	Yes	• The OK HMP identifies hailstorms as a hazard of concern for the State of Oklahoma. • Oklahoma County has experienced numerous hailstorm events that have resulted in significant damage throughout the County.	• OK HMP • SHELDUS • NOAA-NCDC
Hurricane (and other Tropical Cyclones)	No	No	• The OK HMP does not identify hurricanes and other tropical cyclones as a hazard of concern for the State of Oklahoma. • Due to the fact that this hazard has no known historical occurrences, the County decided not to analyze the hurricanes and other tropical cyclone hazard for the purpose of this Plan.	• OK HMP
Ice Jams	No	No	• The OK HMP does not identify ice jams as a hazard of concern for the State of Oklahoma. • The USACE CRREL Ice Jam Database did not indicate any ice jam events within Oklahoma County between 1857 and 2011.	• OK HMP • Review of USACE CRREL Ice Jam Database
Ice Storm	Yes	Yes	Please see Severe Winter Storm	
Infestation	Yes	No	• The OK HMP does not identify infestation as a hazard of concern for the State of Oklahoma. • The Planning Committee does not consider infestation to be a significant risk for the planning area.	• OK HMP
Land Subsidence /	Yes	No	• The OK State HMP indicates that counties on the eastern side of the state are susceptible to sinkholes as a result of historic mining operations.	• OK HMP

Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in Oklahoma County?	If yes, does this hazard pose a significant threat to Oklahoma County?	Why was this determination made?	Source(s)
Sinkholes			Oklahoma County was not identified as a county particularly vulnerable to sinkhole hazards • The Planning Committee does not consider land subsidence/sinkholes to be a significant risk for the planning area.	
Landslide	No	No	• The OK State HMP indicates "landslides may occur anywhere in Oklahoma but generally east of I-35. Most of the area west of I-35 is flat land where landslides are not an issue. Few counties in Oklahoma will consider that landslides are a hazard". • The Planning Committee does not consider landslide to be a significant risk for the planning area.	• OK HMP
Lightning	Yes	Yes	• The OK HMP identifies this as a hazard of concern for the State of Oklahoma • The Planning Committee considers it as a risk for the planning area.	• OK HMP
Nor'Easters	No	No	• Nor'Easter is not identified as a hazard of concern in the OK HMP • Oklahoma County is not bounded by coastal waters; therefore, the County will not be impacted by Nor'Easters. • Due to the fact that this hazard has no known historical occurrences, the County decided not to analyze the Nor'Easter hazard for the purpose of this Plan.	• OK HMP
Severe Winter Storm (Heavy Snow, Blizzards, Freezing Rain/Sleet, and Ice Storms)	Yes	Yes	• The OK HMP identifies all types of severe winter storms as hazards of concern for the State of Oklahoma. • The FEMA, OK HMP and OEM indicate that Oklahoma County has been issued seven FEMA Disaster Declarations for winter storm events (some also identified as flooding events). o FEMA-DR-1355 – Severe Winter Storm o FEMA-DR-1735 – Severe Winter Storms o FEMA-EM-3158 – Snow Storm o FEMA-EM-3272 – Severe Winter Storms and Flooding o FEMA-EM-3280 – Severe Winter Storms o FEMA-EM-3308 – Severe Winter Storm o FEMA-EM-3316 – Severe Winter Storm • NOAA's NCDC storm events database indicates that Oklahoma County was impacted by approximately 18 winter storms between 1993 and 2012. However, most events are of a regional extent rather then localized to just one county or community.	• OK HMP • OEM • FEMA • NOAA-NCDC • SHELDUS

Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in Oklahoma County?	If yes, does this hazard pose a significant threat to Oklahoma County?	Why was this determination made?	Source(s)
Tornado	Yes	Yes	• The OK State HMP indicates that the entire State is vulnerable to the tornado hazard. • Oklahoma County has a history of tornado events that have resulted in significant property damage and loss of life. • The Planning Committee considers tornados to be a significant risk for the planning area.	• OK HMP
Tsunami	No	No	• Tsunami is not identified as a hazard of concern in the OK HMP • Oklahoma County is not bounded by coastal waters; therefore, the County will not be impacted by tsunamis. • Due to the fact that this hazard has no known historical occurrences, the County decided not to analyze the tsunami hazard for the purpose of this Plan.	• OK HMP
Volcano	No	No	• Volcanoes are not identified as a hazard of concern in the OK HMP • There are no known volcanoes located in the State or County	• OK HMP
Wildfire	Yes	Yes	• The OK State HMP indicates that most of the counties in the State are vulnerable to the wildfire hazard. • Oklahoma County has a history of wildfire events that have resulted in significant damages. • The Planning Committee considers wildfire to be a significant risk for the planning area.	• OK HMP
Windstorm	Yes	Yes	See “Tornado” hazard.	

CRREL	Cold Regions Research and Engineering Laboratory
DPC	Disaster Preparedness Commission
DR	Presidential Disaster Declaration Number
EM	Presidential Emergency Declaration
FEMA	Federal Emergency Management Agency
HMP	Hazard Mitigation Plan
NCDC	National Climatic Data Center
NOAA	National Oceanic and Atmospheric Administration
OK	Oklahoma
SHELDUS	Spatial Hazard Events and Losses Database for the United States
USACE	U.S. Army Corp of Engineers
USGS	U.S. Geologic Survey

According to input from Oklahoma County, and review of all available resources, a total of eleven (11) natural hazards of concern were identified as significant hazards affecting the County, to be addressed within this plan:

- Dam Failure
- Drought
- Earthquake
- Expansive Soils
- Extreme Heat
- Flooding (riverine, flash and urban)
- Hail
- Lightning
- Wildfire
- Wind (including tornado)
- Severe Winter Storms

Other natural hazards of concern have occurred within the County, but typically have a low potential to result in significant impacts. The County deemed other natural hazards as minor in comparison to those bulleted above; therefore, additional natural hazards will not be further addressed within this version of the Plan. However, if deemed necessary by the County, these hazards may be considered in future versions of the Plan.

5.3.1 DAM FAILURE

This section provides a profile and vulnerability assessment for the dam failure hazard.

HAZARD PROFILE

This section provides profile information including description, location, extent, previous occurrences and losses and the probability of future occurrences.

Description

A dam is an artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material for the purpose of storage or control of water (FEMA, 2010). Dams are man-made structures built across a stream or river that impound water and reduce the flow downstream (FEMA, 2003). They are built for the purpose of power production, agriculture, water supply, recreation, and flood protection. Dam failure is any malfunction or abnormality outside of the design that adversely affect a dam's primary function of impounding water (FEMA, 2010).

A dam that impounds water in the upstream area is referred to as a reservoir. The amount of water impounded is measured in acre-feet. An acre-foot is the volume of water that covers an acre of land to a depth of one foot. As a function of upstream topography, even a very small dam may impound or detain acre-feet of water. 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 (OK State HMP, 2011).

Dam failures are generally catastrophic if the structure is breached or significantly damaged. There are about 84,000 dams in the United States, according to the 2009 update to the U.S. Army Corps of Engineers' (USACE) National Inventory of Dams. Approximately one third of these pose a "high" or "significant" hazard to life and property if failure occurs (OK State HMP, 2011).

Dam failure or levee breeches can occur with little warning. Intense storms may produce a flood in a few hours or even minutes for upstream locations. Flash floods occur within six hours of the beginning of heavy rainfall, and dam failure may occur within hours of the first signs of breaching. Other failures and breeches can take much longer to occur, from days to weeks, as a result of debris jams or the accumulation of melting snow (OK State HMP, 2011).

Dam failures are of particular concern because the failure of a large dam has the potential to cause more death and destruction than the failure of any other man-made structure. This is because of the destructive power of the flood wave that would be released by the sudden collapse of a large dam. (OK State HMP, 2011). Dam failures typically occur when spillway capacity is inadequate and excess flow overtops the dam, or when internal erosion (piping) through the dam or foundation occurs. Dams can fail for one or a combination of the following reasons:

- Overtopping caused by floods that exceed the capacity of the dam (inadequate spillway capacity);
- Prolonged periods of rainfall and flooding;
- Deliberate acts of sabotage (terrorism);
- Structural failure of materials used in dam construction;
- Movement and/or failure of the foundation supporting the dam;
- Settlement and cracking of concrete or embankment dams;

- Piping and internal erosion of soil in embankment dams;
- Inadequate or negligent operation, maintenance and upkeep;
- Failure of upstream dams on the same waterway; or
- Earthquake (liquefaction / landslides) (FEMA, 2011).

Each dam in the USACE inventory is assigned a downstream hazard classification based on the potential loss of life and damage to property should the dam fail. The three classifications are high, significant and low. With changing demographics and land development in downstream areas, hazard classifications are updated continually. The hazard classification is not an indicator of the adequacy of a dam or its physical integrity.

According to 2012 USACE statistics, Oklahoma has 364 high hazard dams and 136 significant hazard dams. Although dams are not a natural hazard, the flooding that could occur from a dam could be. Even a small earthquake in the right location could cause a dam to begin leaking and eventually break. These initial hazard classifications are based upon current conditions, including population and land-use patterns below the dams. Such conditions can shift over time, such that a structure that is not considered high hazard may receive such designation in the future, should, for example, dwellings are built within the floodplain below the dam. Other high hazard dams may have such designation lowered should land use patterns change, reducing the threat of loss to life or property. Mitigation aspects, such as relocations of vulnerable properties, can reduce the number and magnitude of high hazard dams.

The Oklahoma Water Resources Board (OWRB) coordinates the Oklahoma Dam Safety Program to ensure the safety of more than 4,758 dams in the state that falls within its jurisdiction, especially those that could impact downstream life and property. Dams falling within the OWRB's jurisdiction are non-Federally constructed and maintained dams which are: 1) greater than 6 feet in height with storage capacities of 50 acre-feet or more; and/or 25 feet or greater in height with storage capacities of 15 acre-feet or more. The program requires inspections every five and three years for low and significant hazard structures, respectively. It requires annual inspection of the State's high hazard dams, so designated due to the presence of one or more habitable structures downstream with loss of life likely to occur if a dam were to fail. The 364 high hazard dams in Oklahoma include federally constructed and maintained dams that are not regulated by the OWRB (OK State HMP, 2011).

Extent

Dams are innately hazardous structures. Failure or misoperation can result in the release of the reservoir contents--this includes water, mine wastes or agricultural refuse--causing negative impacts upstream or downstream or at locations remote from the dam. Negative impacts of primary concern are loss of human life, economic loss including property damage, lifeline disruption and environmental damage. (OK State HMP, 2011)

Some dams are considered to have a greater hazard potential than others. "High hazard" is a term used to determine how hazardous a dam's failure might be to the downstream area. While the definition varies from place to place, it generally means if failure of a high hazard dam occurs, there probably will be loss of life. It must be emphasized that this determination does not mean that these dams are in need of repair – these dams could be in excellent condition or they could be in poor condition. High hazard potential dams exist in every state and affect the lives of thousands downstream. The low, intermediate, and high hazard classifications are identified and described below:

- *Low Hazard* is a dam located in an area where failure will damage nothing more than isolated buildings, undeveloped lands, or township or county roads and/or will cause no significant economic loss or serious environmental damage. Failure or misoperation would result in no probable loss of human life. Losses are principally limited to the owner's property.
- *Intermediate Hazard* is a dam located in an area where failure may damage isolated homes, main highways, minor railroads, interrupt the use of relatively important public utilities, and/or will cause significant economic loss or serious environmental damage. Failure or misoperation would result in no probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- *High Hazard* is a dam located in an area where failure may cause loss of human life, serious damage to homes, industrial or commercial buildings, important public utilities, main highways or railroads and/or will cause extensive economic loss. This is a downstream hazard classification for dams in which more than 6 lives would be in jeopardy and excessive economic loss (urban area including extensive community, industry, agriculture, or outstanding natural resources) would occur as a direct result of dam failure (NYSDEC, Date Unknown).

Flood severity from a dam failure can be measured with a low, medium or high severity, which are further defined as follows:

- Low severity - No buildings are washed off their foundations; structures are exposed to depths of less than 10 feet.
- Medium severity - Homes are destroyed but trees or mangled homes remain for people to seek refuge in or on; structures are exposed to depths of more than 10 feet.
- High severity - Floodwaters sweep the area clean and nothing remains. Locations are flooded by the near instantaneous failure of a concrete dam, or an earthfill dam that turns into "jello" and washes out in seconds rather than minutes or hours. In addition, the flooding caused by the dam failure sweeps the area clean and little or no evidence of the prior human habitation remains after the floodwater recedes (Graham, 1999).

Two factors which influence the potential severity of a full or partial dam failure include (1) The amount of water impounded; and (2) The density, type, and value of development and infrastructure located downstream (City of Sacramento Development Service Department, 2005). The above definition for dam failure induced flood severity is accepted as a standard measure for Oklahoma County and the County's hazard prone jurisdictions. Flood inundation depths (extents) for each jurisdiction are show as elevation above sea level on the maps found in an Appendix E (restricted from public view).

Location

The Dam Incident Notification (DIN) system maintained by the National Performance of Dam Program (NPDP) maps the location of state and federally monitored dams throughout the state. The database shows 65 dams appearing to be located within Oklahoma County; 14 of those are categorized as high hazard, four (4) of those are categorized as intermediate hazard dams, and the remaining 47 as low hazard. Table 5.3.1-1 lists the high hazard dams located in Oklahoma County (NCDP, 2012).

Table 5.3.1-1: High Hazard Dams in Oklahoma County

Name	National / State ID #	Owner Type	Water Course	Year Built	Dam Type	Crest Length (ft)	Height (ft)	Storage Capacity (acre-ft)	Drainage Area (sq. mi.)	Affect Jurisdictions in Plan? (Y/N)*	Comments
Lake Arcadia	OK00035 / 75012	Federal	Deep Fork River	1986	Earth	5250	102	190700	105	Yes	
Ski Island Lake	OK02406	Private	Spring Creek	1957	Earth	2000	27	386	6.3	Yes	Unincorporated Oklahoma County bridges and roads along Deer Creek between Meridian Ave and May Ave., north of 164th St. The area is largely undeveloped.
Regal	OK02418	Private	Tr – Spring Creek	1920	Earth	424	16	81	1.2	No	
Northeast (Zoo Lake)	OK02424	Local Gvt.	Tr – Deep Fork River	1908	Earth	890	43	800	2.92	No	
Hefner	OK02535	Local Gvt.	Bluff Creek	1943	Earth	1	112	107400	9.69	Yes	Unincorporated Oklahoma County bridges and roads along Deer Creek between Meridian Ave and May Ave., north of 164th St. Significant damage to bridges and roads around the area.
Overholser	OK02537	Local Gvt.	N. Canadian River	1919	Earth	1	61	31100	738	Yes	Inundation along North Canadian River. At risk: Choctaw, Del City, Harrah, Midwest City, Spencer, Unincorporated County. See North Canadian River floodplain area in annex maps.
Brixton Heights Addition (St. Francis West Lake)	OK02543	Private	Tr – Spring Creek	1957	Earth	860	20	90	0.79	No	
Twin Lakes East	OK11000	Private	Tr – Spring Creek	1930	Earth	500	23	65	0.34	Yes	Dam failure could flood homes north of NW 67th near and west of MacArthur Blvd. in Warr Acres
Knight (Lyrewood Lake)	OK11001	Private	Tr – Spring Creek	1962	Earth	300	15	75	0.51	No	
Twin Lakes West	OK11005	Private	Tr – Spring Creek	1930	Earth	345	20	60	1.54	Yes	Dam failure could flood homes north of NW 67th near and west of MacArthur Blvd in Warr Acres.
NW Oklahoma City Sludge Lagoon No 1	OK11051	Local Gvt.	Bluff Creek	1954	Earth	1265	30	403	0.15	No	
Dry Creek Detention	OK11061	Local Gvt.	Dry Creek	1978	Earth	1290	25	281	10.97	No	
Will Rogers Park Holding Pond	OK11069	Local Gvt.	Tr – Deep Fork	1967	Earth	1230	24	323	3.8	No	
Lightning Creek Holding Pond C	OK11071	Local Gvt.	Tr – Lightning Creek	1977	Earth	4000	16	187	0.63	No	

Source: NPDP, 2012

* Potential jurisdiction dam failures specified in Table 5.3.1-2 Note: TR = Tributary BR = Branch

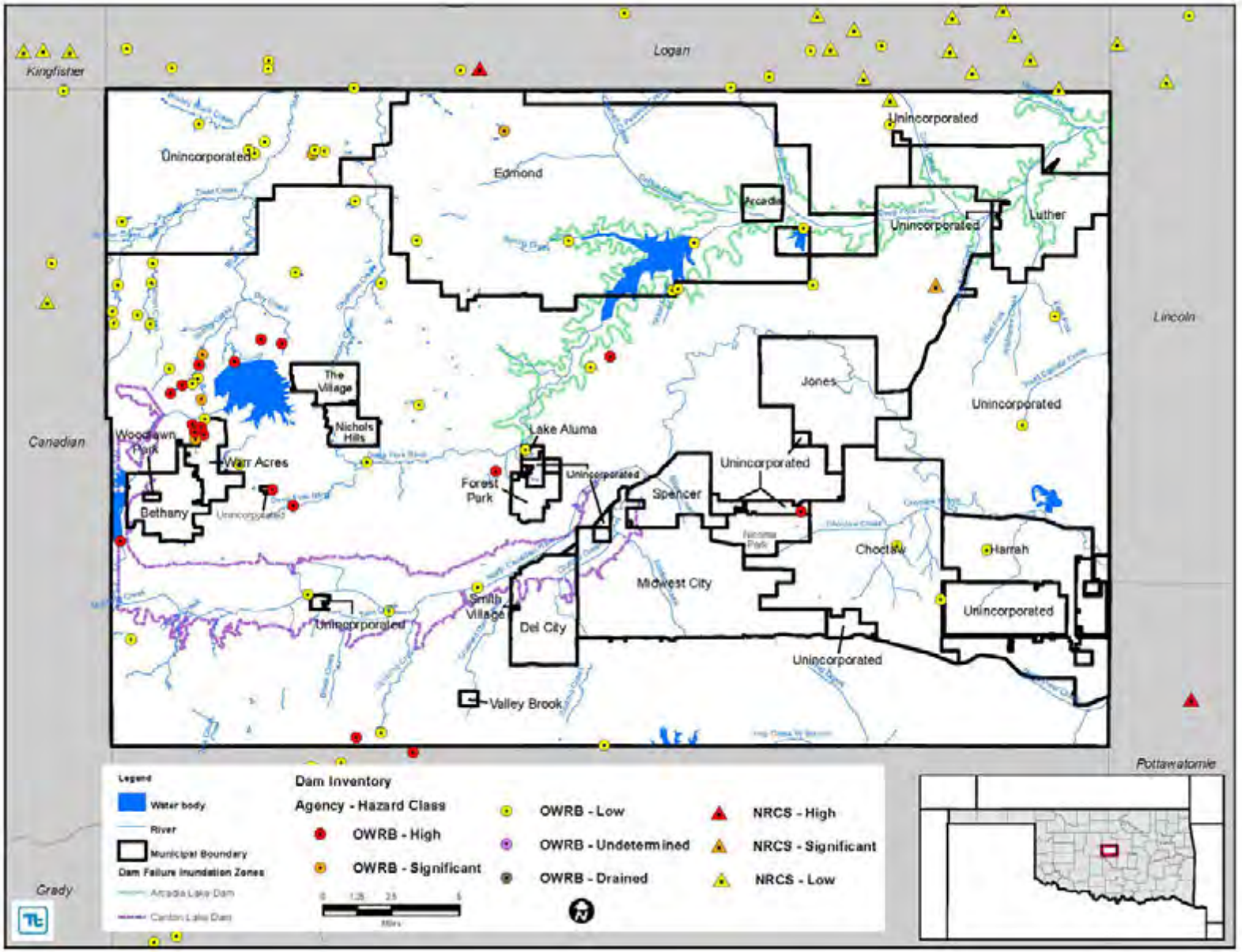

Kingfisher
Logan
Lincoln
Canadian
Grady
Pottawatomie
Unincorporated
Edmond
Arcadia
Luther
Jones
The Village
Nichols Hills
Lake Aluma
Woodlawn Park
Warr Acres
Bethany
Forest Park
Spencer
Choctaw
Harrah
Midwest City
Smith Village
Del City
Valley Brook
Legend
Water body
River
Municipal Boundary
Dam Failure Inundation Zones
Arcadia Lake Dam
Canton Lake Dam
Dam Inventory
Agency - Hazard Class
OWRB - High
OWRB - Significant
OWRB - Low
OWRB - Undetermined
OWRB - Drained
NRCS - High
NRCS - Significant
NRCS - Low

Figure 5.3.1-1 above shows Warr Acres is the only jurisdiction in the plan to contain high hazard dams (two) within its municipal boundary. Of the 14 high hazard dams in the planning area, four are significant in size, purpose, and hazard potential in Oklahoma County. Digitized inundations are available for Arcadia and Canton Lake, but are not available for all at-risk jurisdictions or high hazard dams. Most high hazard dams in Oklahoma County are privately owned. As a result, inundation information is not available or deficient.

Arcadia Lake Dam

Arcadia Lake is located in northeast Oklahoma County, approximately 1.5 miles southwest of the town of Arcadia, in the metropolitan areas of Oklahoma City and Edmond. Arcadia Lake was formed in 1986 by impounding the Deep Fork arm of the Canadian River below its convergence with Spring Creek. Water released from Arcadia Lake flows east into the Deep Fork of the Canadian River until it reaches Lake Eufaula (OCWP, 2000 : http://www.owrb.ok.gov/studies/reports/arcadia/arcadia_e.php).

Arcadia Lake is a source of recreation for the Oklahoma City metropolitan area. The dam is federally owned and maintained, and located on the east side of the lake, which contains 1,820 acres of water. Should the lake experience a breach in its dam, the water release would affect the Deep Fork Creek upstream to Okmulgee, Oklahoma. The towns of Arcadia and Luther in Oklahoma County would be the primary areas affected, (Oklahoma County HMP, 2006) along with rural east Edmond.

Appendix E (restricted from public view) illustrates the inundation of a potential dam failure of Arcadia Lake Dam for Arcadia and Luther, respectively. Just downstream of the dam, a water treatment plant exists in Edmond City Limits. A convenience store and tourist stop in Arcadia is also in the direct path, and would be affected approximately 2 hours after a major failure according to the EOP. The main flow would travel south of Arcadia, however much of the southern half of Arcadia could receive some inundation should a total failure of the dam occur. The Soldier Creek bridge east of Arcadia in Edmond near Danforth and Anderson Rd would be inundated. Many miles of Historic Route 66 would be underwater through east Edmond and Unincorporated Oklahoma County. High tension electric lines east of Danforth and Hiwassee could be taken down if a highline stand is destroyed. The inundation area in unincorporated Oklahoma County is almost entirely regulatory floodplain with very few structures. A few homes and oil wells exist northeast Covel Rd. and Dobbs Rd. along Hogback Rd. along with a high tension line that crosses east to west. The Stillwater Central Railroad line travels along Hogback Rd. and would be inundated for several miles as the tracks follow the Deep Fork Creek to Wellston in Lincoln County just east of Oklahoma County.

Canton Lake Dam

Canton Lake Dam is located in Blaine County, approximately two miles north of the town of Canton. The dam is a 15,140-foot-long structure with a 640-foot gated, concrete spillway, which rises to a maximum height of 68 feet above the streambed. Completed in 1948, the Canton Lake stores 114,370 acre-feet of water and drains a total area of 12,483 square miles (including upstream projects). The dam provides flood control protection as well as water storage on the Canadian River in Oklahoma. State Highway 58-A extends across the dam embankment and spillway. Oklahoma City obtained water rights to Canton Lake so water from Canton flows to Oklahoma City's Lake Hefner and Lake Overholser (OK State HMP, 2011).

The stability of the Canton Dam spillway and the amount of floodwater the dam could safely hold was the subject of concern and discussion for over 30 years. Restrictions on the amount of water the dam could safely hold affected the dam's ability to provide flood protection to the level for which it was designed. Due to these restrictions, downstream flooding could occur. This potential flooding could impact areas in Oklahoma County including, but not limited to, downtown Oklahoma City (OK State HMP, 2011).

Canton Lake Dam is undergoing construction of an auxiliary spillway to reduce seepage under the existing embankment and ensure the dam can pass the probable maximum flood requirements and to meet seismic requirements. This construction is expected to be complete around 2016. As of 2013, work is well underway, with the construction of the auxiliary spillway 820 feet long and 670 feet wide. This includes a 670 foot long cut off wall to reduce upstream erosion (www.nicholsonconstruction.com and www.swd.usace.army.mil).

Bethany would be inundated in a small area near the corner of NW 23rd and Eagle Ln. In addition, most of two mile sections north of NW 36th St. Expressway and west of Council would be inundated. This includes a heavily residential area south of NW 39th St. and two city Parks north of NW 39th St., a mobile home park, residences, and the city water treatment plant.

The inundation of a potential dam failure of Canton Lake Dam for northwest parts of Del City is mostly undeveloped or abutting an industrial area. A few homes may be at risk east of Burk Way and south of Reno Ave along with an industrial park near Bryant Pl. In addition a few buildings on Tinker Diagonal north of Delmar Rd. may be at risk. A tank battery farm in the industrial area may be at risk in a complete failure.

In Midwest City, a train depot for loading of new automobiles may be at risk if a full failure occurs. A mobile home park northeast of the depot is at risk, along with homes in a small unincorporated area near Northeast 23rd and Air Depot. Oklahoma County is in the process of a multi-grant mitigation project to remove homes in this area that flood when Crutcho Creek overtops its bank. Floodwaters could back into Soldier Creek all the way to NE 10th and Midwest Blvd. In Spencer, a few homes near NE 46th and Spencer Rd. could be inundated in a worst case scenario. In Jones, the area affected is neast of NW 4th and primarily north of Main St and contains businesses and homes. In Harrah, NE 23rd could be inundated west of Peebly Rd and east of Luther Rd. Much of the inundation area is open floodplain in the rural unincorporated parts of eastern Oklahoma County.

Detailed inundation maps (with flood depths) are located in Appendix E (restricted from public view). The FEMA floodways in the North Canadian River cover much of the same area as the dam failure risk.

Hefner Dam

Lake Hefner Dam, owned and operated by Oklahoma City, was built in 1943 on Bluff Creek in northwest Oklahoma County for the purposes of water supply and recreation. The lake serves as terminal storage for diversions from the North Canadian River and releases from Canton Lake. Built on the highest point of land in Oklahoma City, it is only 5 miles north of downtown and contains 2,580 surface acres of water. The dam is located on the North side of the impoundment.

Since it was impounded in 1947, there has not been a breach of the Lake Hefner Dam. However, in recent years, there have been extensive construction projects occurring below the dam in Oklahoma City from NW 108th Street to NW 164th, including housing developments, a major hospital complex (Mercy Hospital) and several shopping centers. Should there be a breach of the Lake Hefner dam, the water from the lake would travel through these areas to the Deer Creek Watershed and spread northeast to the Cimarron River on the north side of Guthrie, OK (OK County HMP, 2006). See the information above in Table 5.3.1-1.

Overholser Dam

Lake Overholser is located in Central Oklahoma County along the Canadian County/Oklahoma County line. The Overholser Dam was built in 1917 and 1918 to impound water from the North Canadian River to satisfy the needs of future growth in Oklahoma City. The dam, located on the east side of the lake on the North Canadian River, is 62 feet high and 1,258 feet long. Today, Lake Overholser is a 'backup' reservoir, tapped during the summer to meet the increased seasonal demand. The dam was added to the National Register of Historic Places in 2007. The lake is owned by Oklahoma City and covers 1700 surface acres (OK County HMP, 2006).

Floods resulting from a breach in the Overholser Dam would affect the downtown Oklahoma City area, as well as all throughout the county along the North Canadian River (OK County HMP, 2006).

Lake Overholser is downstream of the Canton Lake Dam and would receive much of the water should a dam failure of Canton Lake Dam occur. Water from this dam can be channeled into Lake Hefner mentioned above. Otherwise, a failure of Overholser Dam would follow the same path as a Canton Lake Dam failure through Oklahoma City and into the jurisdictions in this plan east of Bethany as noted in the table below (Bethany would not be impacted as it is upstream of the Overholser dam).

Small lakes and dams

There are other small impoundments throughout the County, ranging from farm ponds to small lakes such as Lake Aluma and Horseshoe Lake.

Lake Aluma, a private community, would have no impact. A failure would only affect Oklahoma City. Horseshoe Lake would affect rural areas inside of Harrah city limits; north of 23rd St. Streets may be damaged and a bridge at Luther Rd N of 23rd and another on Whites Meadow Dr. In addition, a hydroelectric plant is present on the island in Horseshoe Lake and the loss of the lake may cause an electrical outage to the area which it supplies.

Jurisdictions potentially impacted by dam failure are found in Table 5.3.1-2 below:

Table 5.3.1-2: Potential Jurisdiction Dam Failures

Jurisdiction	Potential Dam Hazard
Arcadia	McCarley/Arcadia Lake
Bethany	Canton Lake, Overholser
Choctaw	Canton Lake, Overholser
Del City	Canton Lake, Overholser
Edmond	Arcadia Lake
Forest Park	None
Harrah	Canton Lake, Overholser
Luther	Arcadia Lake
Midwest City	Canton Lake, Overholser
Nichols Hill	None
Nicoma Park	None
Spencer	Canton Lake, Overholser
The Village	None
Warr Acres	Twin Lakes East and West
Unincorporated	Hefner, Ski Island Lake, Arcadia Lake, Canton Lake, Overholser

Range of Magnitude

Two main factors which influence the potential severity of a full or partial dam failure include (1) The amount of water impounded; and (2) The density, type, and value of development and infrastructure located downstream (City of Sacramento Development Service Department, 2005). Failures of small dams, such as those created to form a pond or other small water body, may result in a flood of only a few hundred gallons of water, and may not impact any structures or other property. Failures of large dams, such as those created to form large water supply reservoirs or recreational lakes, may result in millions of gallons of water destroying hundreds of structures and potentially killing large numbers of people.

The environmental effects of dam failure can also be significant. Reservoirs held behind dams affect many ecological aspects of a river, and water releases from dams usually contain very little suspended sediment; this can lead to scouring of river beds and banks. The environment would be exposed to a number of risks in the event of dam failure. The inundation could introduce many foreign elements into local waterways, resulting in potential destruction of downstream habitat and detrimental effects on many species of animals, especially endangered species-listed aquatic species (Contra Costa County, 2011).

Previous Occurrences and Losses

The Oklahoma Water Resources Board reports there have been two high hazard dams break in Oklahoma since 1950, although neither of those have occurred within Oklahoma County. While flood events frequently cause small earth dams on farm or ranch ponds to break, usually due to erosion caused by the heavy rains, these events are inconsistently recorded and most often do not have a significant impact.

A significant dam failure was recorded in Oklahoma City in 1923, when heavy rains caused Lake Overholser dam to fail resulting in the displacement of approximately 15,000 residents. Estimated damages, recovery costs, fatalities, and injuries are unknown. This historical failure of Lake Overholser is highly unlikely to occur with present day mitigation measures, spillway construction, and siting of structures. In the event that Lake Overholser was to fail in present day the impact would be minimal and at most a handful of homes would be impacted (OK City HMP, 2011).

In August 2007, water once again flowed over the Overholser Dam again due to Tropical Storm Erin. Overtopping occurred even though the flood gates were fully opened (OK State HMP, 2011).

A potential dam failure occurred at the Dry Creek Detention Pond Dam on April 10, 2008. Heavy rains had occurred in the days prior to April 10, 2008. The Overflow Pipe that runs from the pond, under the dam, and into Dry Creek had failed and the leaking water had eroded the earthen dam above it causing two large holes, one on the back of the dam and one front of the dam. There was a potential for the remaining portions of the earthen dam to collapse and cause a sudden release of water from the pond resulting in a flash flood along Dry Creek north of the dam. Public Works took immediate mitigation actions and prevented any failure. Public safety personnel notified residents in the potential inundation zone of the hazard and provide information on protective actions they should take (OK City HMP, 2011).

No other dam failure events have been recorded in Oklahoma County.

Probability of Future Events

The likelihood of a dam failure in Oklahoma County is extremely difficult to predict. Nonetheless, the risk of such an event increases for each dam as the dam's age increases and/or frequency of maintenance decreases. Given the variety and multitude of impoundment structures throughout Oklahoma County, it is likely that multiple jurisdictions will be at risk from the dam failure hazard in the future. However, provided that the recommended repairs, regular maintenance, and routine inspections of the dams in in Oklahoma County are performed in the future, dam failures are considered unlikely.

In Section 5.3, the identified hazards of concern for Oklahoma County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, and the limited amount of recorded dam failures in the past 100 years in Oklahoma County, the probability of occurrence for dam failure affecting any of the jurisdictions participating in the Oklahoma County HMP that have a dam failure risk (Table 5.3.1-2) is considered '1 – Unlikely.' A dam failure event is possible within the next ten years. Event has a 1 in 10 chance of occurring.

Though an unlikely event, it is estimated that a dam and impoundment failure event may cause direct and indirect impacts in Oklahoma County. Some of the events may induce secondary hazards such as flooding and water quality and supply concerns. Residents may also experience evacuations, transportation delays/accidents/inconveniences and public health concerns.

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For dam failure events, the dam inundation zones are identified as the hazard areas. Therefore, all assets in the dam inundation zones (population, structures, critical facilities and lifelines), are exposed and considered vulnerable when there is a dam failure event. The following text evaluates and estimates the potential impact of dam failure on Oklahoma County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health of residents, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

The dam failure hazard is a significant concern to Oklahoma County due to potential failure of 65 dams reported dams in the County, 14 of which are classified as high hazard. The direct and indirect losses associated with these events include injury and loss of life, damage to structures and infrastructure, agricultural losses, utility failure (power outages), and stress on community resources.

Data and Methodology

The Oklahoma Water Resources Board (OWRB) coordinates the Oklahoma Dam Safety Program to ensure the safety of greater than 4,600 dams in the State. The program requires inspections every five years for "low" hazard dams, three years for "significant" hazard dams, and annual for "high" hazard dams. In addition, owners of "high hazard" dams are required to have an OWRB-approved emergency action plan (EAP) (OWRB, 2012).

An EAP is a formal document to identify potential emergency conditions at a dam and specify actions to be followed to minimize property damage and loss of life. In general, EAPs contain six basic elements: 1) Notification Flowchart; 2) Emergency Detection, Evaluation, and Classification; 3) Responsibilities; 4) Preparedness; 5) Inundation Maps; and 6) Appendices. Refer to the Table in Section 4 for a complete list of dams in Oklahoma County and their associated hazard. The inundation maps that are part of the EAP show emergency management authorities the critical areas for action in case of an emergency. As specified by OWRB, inundation mapping should include:

- North arrow and a bar scale
- Clearly delineated and labeled inundation areas. This is especially important if there are "sunny day" failure and PMF plus breach inundation limits shown on the inundation maps?
- A qualification statement that the inundation limits for an actual dam failure may vary from what is shown
- Clearly labeled local roads, drainages, and other landmarks
- Downstream limit of the inundation mapping
- Channel cross sections taken at critical downstream locations, such as at major road crossings, schools, major population centers, etc.
- Information at important downstream cross sections:

- Peak flood stage
- Flood wave arrival time
- Maximum water surface elevation
- Peak discharge (OWRB, 2012).

While Canton Lake Dam is not located in Oklahoma County, it is noted that according to USACE, the inundation zone in the event of a failure of the Canton Lake Dam includes portions of Oklahoma County.

Arcadia Lake is located in the northeastern part of Oklahoma County near the community of Arcadia. The dam is located on the east side of the lake, which contains 1,820 acres of water. Should the lake experience a breach in its dam, the water release would affect the Deep Fork Creek upstream to Okmulgee, Oklahoma. The Towns of Arcadia and Luther in Oklahoma County would be the primary areas affected, although Jones could also see some flooding (OKEM, 2006).

Lake Overholser is located in Central Oklahoma County along the Canadian County/Oklahoma County line. The lake contains 1,700 surface acres of water. The dam is located on the east side of the lake on the North Canadian River. Floods resulting from a breach in that dam would affect the downtown area, as well as all throughout the county along the North Canadian River (OKEM, 2006).

There are other small impoundments, ranging from farm ponds to small lakes such as Lake Aluma and Horseshoe Lake, which would have less impact on the county in the event of a dam failure (OKEM, 2006).

There have been no recorded complete dam failures in the past 100 years in Oklahoma County. For dam failures of high hazard dams, inundation areas are likely to be similar to the 1% and 0.2% annual chance flood events downstream of each dam. Refer to Section 5.3.6 (Flood) for exposure and potential loss estimates associated with these flood events. A qualitative assessment of the dam failure hazard is provided below.

Impact on Life, Health and Safety

All population in a dam failure inundation zone is considered exposed and vulnerable. Of the population exposed, the most vulnerable include the economically disadvantaged and the population over the age of 65. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on the net economic impact to their family. The population over the age of 65 is also highly vulnerable because they are more likely to seek or need medical attention which may not be available to due isolation during a flood event and they may have more difficulty evacuating.

There is often limited warning time for dam failure. These events are frequently associated with other natural hazard events such as earthquakes, landslides or severe weather, which limits their predictability and compounds the hazard. Populations without adequate warning of the event are highly vulnerable to this hazard.

Impact on General Building Stock, Critical Facilities and the Economy

All buildings and infrastructure located in the dam failure inundation zone are considered exposed and vulnerable. Property located closest to the dam inundation area has the greatest potential to experience the largest, most destructive surge of water. All transportation infrastructure in the dam failure inundation zone are vulnerable to damage and potentially cutting off evacuation routes, limiting emergency access

and creating isolation issues. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the dam failure hazard if located within the dam failure inundation zones.

Effect of Climate Change on Vulnerability

The potential effects of climate change on Oklahoma County's vulnerability to dam failure shall need to be considered as a greater understanding of regional climate change impacts develop.

Additional Data and Next Steps

For future plan updates, if digitized boundaries of dam inundation zones (extent/location) and water surface elevations are available, depth grids can be developed using LiDAR terrain data. If only the dam inundation extent and location is available, approximate depth grids can be developed in modeling tools such as FEMA's HAZUS-MH. The HAZUS-MH riverine flood model can then be run using the available depth grids to estimate potential losses to population, buildings, utilities, infrastructure and shelter estimates generated. Similar to the flood hazard, using accurate building and infrastructure inventories will create more accurate exposure and loss estimates.

Overall Vulnerability Assessment

According to the Oklahoma State HMP, a breach in the Overholser Dam would cause flooding in part of downtown Oklahoma City, Spencer, part of Harrah, and unincorporated parts of the County. Flooding could continue as far as Mcloud and Shawnee. The effects of a dam failure would be catastrophic to the area around Oklahoma City, whether it was from Canton Lake Dam or from Lake Overholser Dam (OK State HMP, 2011).

If a breach occurred in the Canton Lake Dam, several communities downstream would be affected and some possibly destroyed. Much of the area between Canton and Oklahoma City is agricultural and several highways and two railroads would be unusable so the economic loss would be huge. The Town of Canton is located only two miles below the Canton Dam and would likely be nearly totally inundated with floodwaters. Other towns that would be affected would include Greenfield, Watonga, parts of El Reno, parts of Yukon and parts of downtown Oklahoma City (OK State HMP, 2011).

Several unincorporated areas are threatened by a dam failure event. High hazards dams that pose such a threat to the unincorporated areas include Hefner, Ski Island Lake, Arcadia Lake, Canton Lake, and Overholser. Damages caused by a dam failure around these areas would largely be to bridges, roads, and undeveloped lands.

Existing and future mitigation efforts including personal and structural dam safety should continue to be developed and employed that will enable the study area to be prepared for these events when they occur and lower their risk.

5.3.2 DROUGHT

This section provides a profile and vulnerability assessment for the drought hazard.

HAZARD PROFILE

This section provides profile information including: description, location and extent, previous occurrences and losses, and the probability of future occurrences.

Description

The Climate Prediction Center (CPC) of the National Weather Service (NWS) defines drought as a deficiency of moisture that results in adverse impacts on people, animals, or vegetation over a sizeable area (CPC, 2004). Drought should be considered relative to some longterm average condition of balance between precipitation and evapotranspiration (evaporation plus transpiration) in a particular area. It is also related to the timing (principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (rainfall intensity, number of rainfall events) of the rains. It is important to note; however, that a period of below-normal rainfall does not necessarily result in drought conditions (OKS HMP, 2011). Some areas in the United States are more susceptible to drought than other areas. Climactic and geographic variables will influence the susceptibility and severity of drought in an area. High temperature, high wind, and low relative humidity are often associated with drought in many regions of the world and can significantly aggravate its severity (OK City HMP, 2011). These conditions are caused by anomalous weather patterns when shifts in the jet stream block storm systems from reaching an area. As a result, large high-pressure cells may dominate a region for a prolonged period, thus reducing precipitation.

According to the Federal Emergency Management Agency (FEMA) and the NWS, there are four different ways that drought can be defined or grouped:

- Meteorological drought is a measure of departure of precipitation from normal. It is defined solely on the degree of dryness. Due to climatic differences, what might be considered a drought in one location of the country may not be a drought in another location.
- Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced ground water or reservoir levels, etc. It occurs when there is not enough water available for a particular crop to grow at a particular time. Agricultural drought is defined in terms of soil moisture deficiencies relative to water demands of plant life, primarily crops.
- Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply and occurs when these water supplies are below normal. It is related to the effects of precipitation shortfalls on stream flows and reservoir, lake and groundwater levels.
- Socioeconomic drought is associated with the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought. This differs from the aforementioned types of drought because its occurrence depends on the time and space processes of supply and demand to identify or classify droughts. The supply of many economic goods depends on weather (e.g., water, forage, food grains, fish, and hydroelectric power). Socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply.

The effects of drought conditions have socio-economic consequences on local and regional communities. While drought impacts in Oklahoma are numerous and far-reaching, the greatest impacts of drought are generally experienced in the agricultural community. The agriculture industry is heavily dependent upon stored soil water, which can be rapidly depleted during dry periods. These effects contribute to reduced income for farmers and agribusiness, increased prices for food and timber, unemployment, reduced tax revenues due to reduced expenditures, and migration. The most direct impact of drought is economic rather than loss of life or immediate destruction of property. Drought affects water levels for use by industry, agriculture, and individual consumers. The Dust Bowl of the 1930's, the greatest natural disaster in Oklahoma history, drove over 800,000 people off the land due to extreme drought conditions (OK City HMP, 2011).

Drought is a normal part of virtually all climates. However, an ample water supply is critical to the economic well-being of the U.S. and of Oklahoma. During droughts, crops do not mature, wildlife and livestock are undernourished, land values decrease, and unemployment increases. Therefore, drought affects Oklahoma in a number of ways, spanning all regions of the state and many sectors of its society, economy, and environment. In general, drought impacts include the following:

Table 5.3.2-1. Economical, Environmental and Social Impacts of Drought in Oklahoma

Economical	Environmental	Social
• Reduced crop, rangeland, and forest productivity • Reduced income for farmers and agribusiness • Increased consumer prices for food and timber • Increased importation of food (higher costs) • Insect infestation and plant disease • Unavailability of water and feed for livestock and irrigate croplands • Loss of hydroelectric power generation • Disruption of reproduction cycles (breeding delays or unfilled pregnancies) • Income loss • Unemployment • Reduced tax revenue because of reduced expenditures • Loss of navigability of rivers and canals	• Increased desertification - Damage to animal species • Reduction and degradation of fish and wildlife habitat • Lack of feed and drinking water • Disease • Increased livestock and wildlife mortality rates • Damage to plant species, loss of biodiversity • Increased number and severity of fires • Wind and water erosion of soils • Increased groundwater depletion • Water quality effects • Increased number and severity of fires • Air quality effects	• Food shortages • Loss of human life from food shortages, heat, suicides, violence • Reduced water supplies for municipal/industrial, agricultural and power uses • Political conflicts • Public dissatisfaction with government regarding drought response • Inequity in the distribution of drought relief • Reduced quality of life which leads to changes in lifestyle • Increased poverty • Population migrations

Source(s): OK City HMP, 2011 and Edwards et al.

Extent

The extent (e.g., magnitude or severity) of drought can depend on the duration, intensity, geographic extent, and the regional water supply demands made by human activities and vegetation. The intensity of the impact from drought could be minor to total damage in a localized area or regional damage affecting human health and the economy. Generally, impacts of drought evolve gradually and regions of maximum intensity change with time. The severity of a drought is determined by areal extent as well as intensity and duration. The frequency of a drought is determined by analyzing the intensity for a given duration,

which allows determination of the probability or percent chance of a more severe event occurring in a given mean return period. All of Oklahoma County in the past has experienced exceptional droughts as defined in table 5.3.2-4 below. All Oklahoma County jurisdictions participating in this plan are expected to experience exceptional drought in the future.

A variety of measures is used to predict the severity and impact of droughts including the Palmer Drought Severity Index (PDSI), Crop Moisture Index (CMI), and the Standardized Precipitation Index (SPI). Other indices include accumulated departure from normal stream flows, low-flow frequency estimates, groundwater levels, and lake levels.

Palmer Drought Severity Index

The Palmer Drought Severity Index, developed by Wayne Palmer in 1965, is the index typically used to report drought conditions. The PDSI uses temperature and rainfall information in a formula to determine dryness and is most effective when determining long-term drought. The PDSI varies from values of +6.0 to -6.0 with a classification scale indicating relative meteorological and hydrological development cycles (Table 5.3.2-2). Palmer also developed a formula for standardizing drought calculations for each individual location based on the variability of precipitation and temperature at that location. The advantage of the Palmer Index is that it is standardized to local climate, so it can be applied to any site for which sufficient precipitation and temperature data is available (NOAA, 2009).

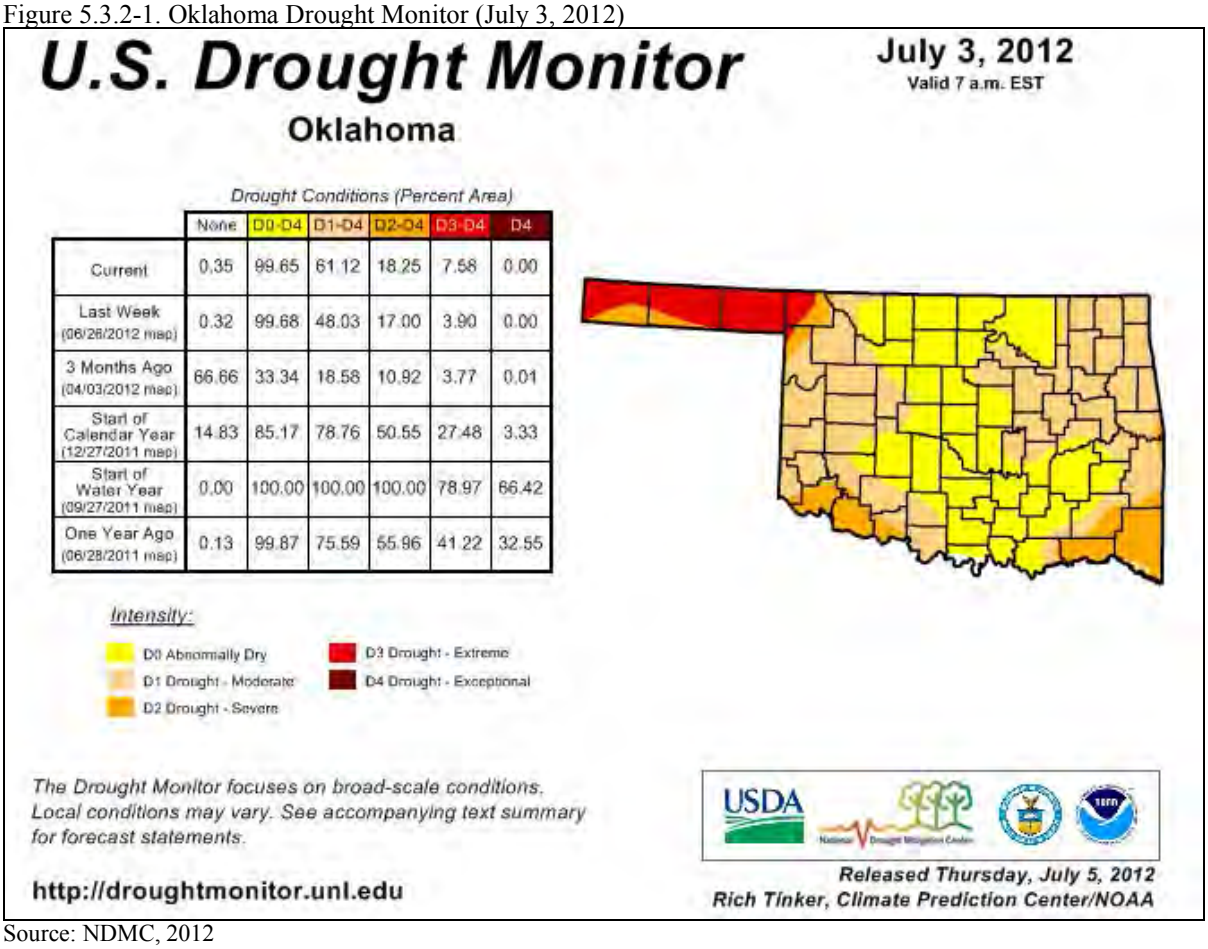
Table 5.3.2-2. Palmer Drought Severity Index (PDSI) Classifications

Palmer Classifications	
4.0 or more	Extremely Wet
3.0 to 3.99	Very Wet
2.0 to 2.99	Moderately Wet
1.0 to 1.99	Slightly Wet
0.5 to 0.99	Incipient Wet Spell
0.49 to -0.49	Near Normal
-0.5 to -0.99	Incipient Dry Spell
-1.0 to -1.99	Mild Drought
-2.0 to -2.99	Moderate Drought
-3.0 to -3.99	Severe Drought
-4.0 or less	Extreme Drought

Source: Hayes, 2006

The National Weather Service (NWS) provides a map, released weekly, that shows the various intensities of drought throughout the U.S. (Figure 5.3.2-1). At the time of this map, Oklahoma County was experiencing abnormally dry conditions, indicated by the yellow color.

Figure 5.3.2-1. Oklahoma Drought Monitor (July 3, 2012)



Source: NDMC, 2012

Crop Moisture Index

Subsequent to the development of the PDSI, Wayne Palmer developed the Crop Moisture Index formula. Measured values are reported synonymous with the PDSI, as illustrated in Table 5.3.2-3. The CMI is more effective in calculating short-term abnormal dryness or wetness affecting agriculture and produces results that fluctuate considerably from week to week. Interpretation of the results indicates the status of dryness or wetness affecting warm season crops and field activities (NOAA, 2009).

Standardized Precipitation Index

The Standardized Precipitation Index was designed to enhance the detection of onset and monitoring of drought. The SPI is a simpler measure of drought than the PDSI and is based solely on the probability of precipitation for a given time period. A key feature of the SPI is the flexibility to measure drought at different time scales. Values of SPI are derived by comparing the total cumulative precipitation for a particular station or region over a specific time interval (the last month, the last 3 months, the last 6 months) with the average cumulative precipitation for that same time interval over the entire length of the record. The severity of a drought can be compared to the average condition for a particular station or region. Values range from 2.00 and above to -2.00 with near normal conditions ranging from 0.99 to -0.99 (NCDC, Date Unknown) (Figure 5.3.2-2).

Figure 5.3.2-3. Standardized Precipitation Index (SPI) Classification

Standardized Precipitation Index Classifications	
SPI Value	**Drought Category**
2.00 and above	Extremely Wet
1.50 to 1.99	Very Wet
1.00 to 1.49	Moderately Wet
-0.99 to 0.99	Near Normal
-1.00 to -1.49	Moderately Dry
-1.50 to -1.99	Severely Dry
-2.00 and less	Extremely Dry

Source: NCDC, Date Unknown

The National Drought Mitigation Center (NDMC) helps develop and implement measures to reduce societal vulnerability to drought, stressing preparedness and risk management rather than crisis management. Most of the NDMC's services are directed to state, federal, regional, and tribal governments that are involved in drought and water supply planning. The NDMC produces a daily drought monitor map that identifies drought areas and ranks droughts by intensity. U.S. Drought Monitor summary maps are available from May 1999 through the present and identify general drought areas and classification droughts by intensity ranging from D1 (moderate drought) to D4 (exceptional drought). D0, drought watch areas, are drying out and possibly heading for drought, or are recovering from drought but not yet back to normal and suffering long-term impacts such as low reservoir levels (Table 5.3.2-4).

Table 5.3.2-4. NDMC Drought Severity Classification Table

Category	Description	Possible Impacts	Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (%)	USGS Weekly Streamflow (%)	Standardized Precipitation Index (SPI)	Satellite Vegetation Health Index
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	36-45
D1	Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	26-35
D2	Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	16-25

Category	Description	Possible Impacts	Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (%)	USGS Weekly Streamflow (%)	Standardized Precipitation Index (SPI)	Satellite Vegetation Health Index
D3	Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	6-15
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies	-5.0 or less	0-2	0-2	-2.0 or less	1-5

Source: NDMC, 2003
Note: Additional indices used, mainly during the growing season, include the USDA/NASS Topsoil Moisture, Crop Moisture Index (CMI), and Keetch Byram Drought Index (KBDI). Indices used primarily during the snow season and in the West include the River Basin Snow Water Content, River Basin Average Precipitation, and the Surface Water Supply Index (SWSI).

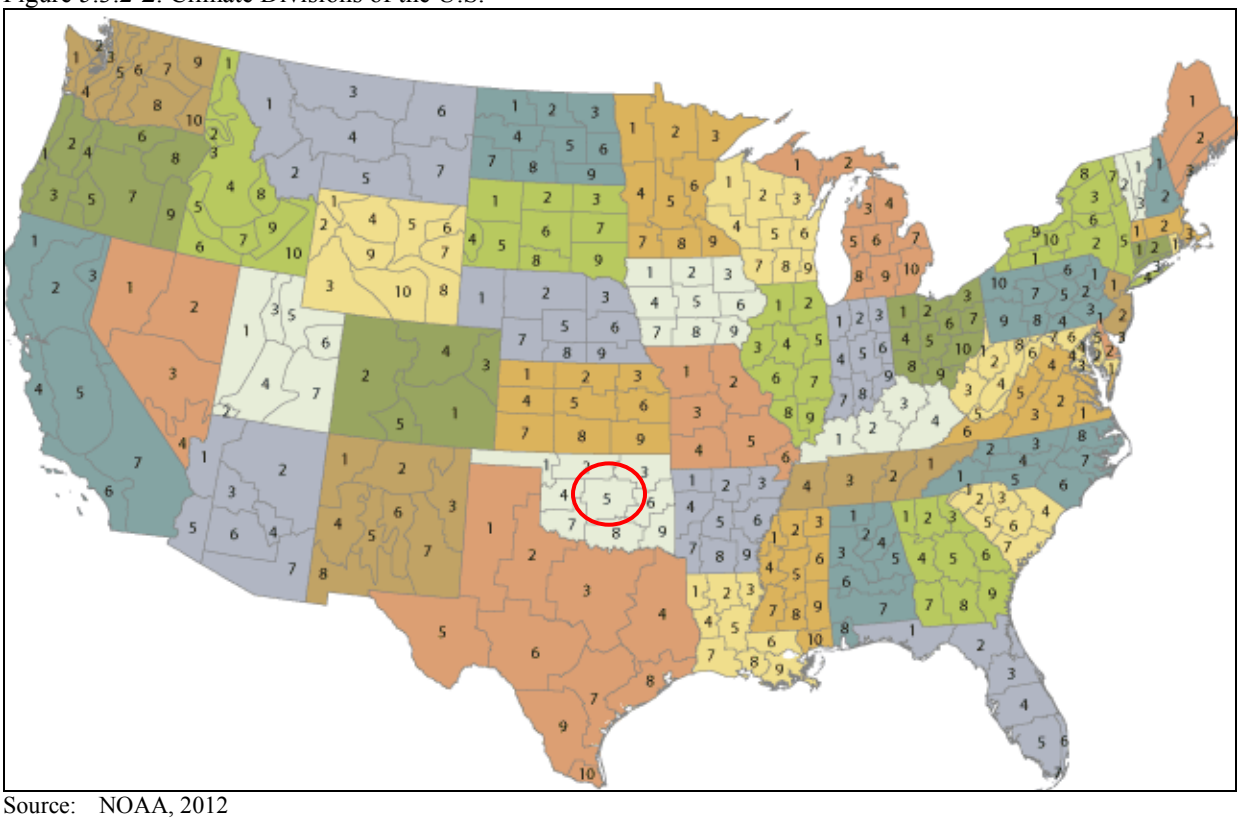
The NDMC launched the Drought Impact Reporter (DIR), an interactive web-based mapping tool designed to compile and display impact information across the United States, is the first comprehensive database of drought impacts in the United States (NDMC, 2012). A review of the DIR database was completed to identify historical drought events in Oklahoma County (Table 5.3.2-4).

The North America Drought Monitor (NA-DM) is a cooperative effort between drought experts in Canada, Mexico and the U.S. to monitor drought across the continent on an ongoing basis. The Drought Monitor concept was developed as a process that synthesizes multiple indices, outlooks and local impacts, into an assessment that best represents current drought conditions. The final outcome of each Drought Monitor is a consensus of federal, state and academic scientists. Maps of U.S. droughts are available from this source from 2003 to the present (NCDC, 2006).

Location

Climate divisions are regions within a state that are climatically homogenous as possible. The National Oceanic and Atmospheric Administration (NOAA) has divided the U.S. into 359 climate divisions (Figure 5.3.2-2). The boundaries of these divisions typically coincide with the county boundaries, except in the western U.S., where they are based largely on drainage basins (U.S. Energy Information Administration, Date Unknown).

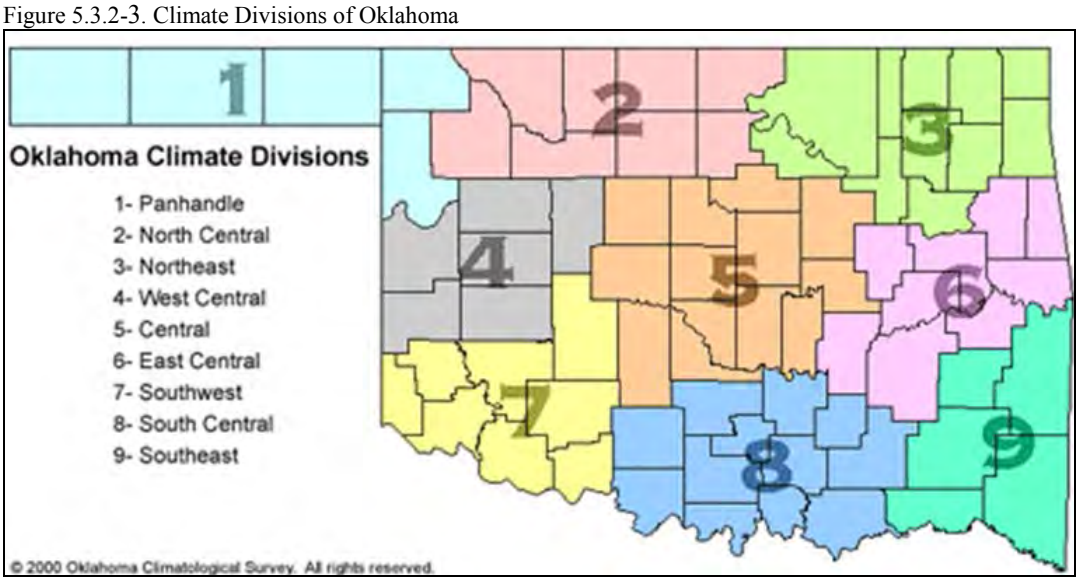
Figure 5.3.2-2. Climate Divisions of the U.S.



Source: NOAA, 2012
Note (1): The red circle indicates the approximate location of Oklahoma County (Central Climate Division)
Note (2): 1 = Panhandle; 2 = North Central; 3 = Northeast; 4 = West Central; 5 = Central; 6 = East Central; 7 = Southwest; 8 = South Central; 9 = Southeast

The State of Oklahoma is made up of nine climate divisions which are sequentially numbered from 1 to 9 (Figure 5.3.2-3). Oklahoma County is located within the Division 5: Central (NOAA, 2012).

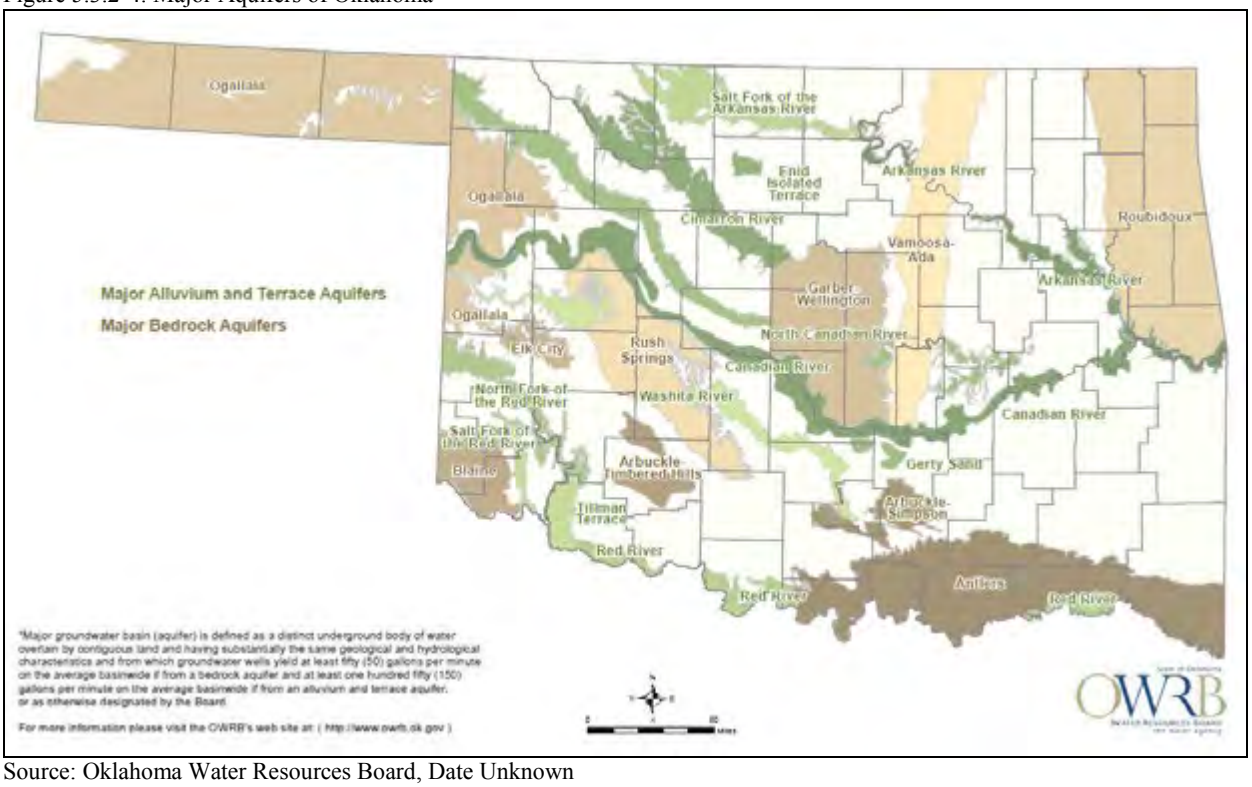
Figure 5.3.2-3. Climate Divisions of Oklahoma



Source: Oklahoma Climatological Survey, 2000
Note: Oklahoma County is located in the Central Climate Division (Division 5).

Drought is a recurring part of Oklahoma's climate cycle, as it is in all the Plains states. Land use largely affects the availability of surface and soil water necessary to sustain non-drought conditions. According to the U.S. Department of Agriculture (USDA) National Agricultural Statistics Service (NASS), there are 1,289 farms in Oklahoma County, occupying 159,823 acres of land in the Oklahoma County. Land is used to raise livestock and grow crops including cattle and calves, nursery and greenhouses, and other crops and hay (USDA NASS, 2007). Agricultural resources account for 73 percent of useable groundwater for irrigation; relying on natural precipitation and the supply and demand of groundwater resources, which become limited or compromised during times of drought. Oklahoma is underlain by 23 major groundwater basins containing 320 million acre-feet of water in storage; however, only half of that amount may be recoverable (Figure 5.3.2-4). Almost all of Oklahoma's usable surface water comes from precipitation that falls within the state's borders. Therefore, drought in Oklahoma is linked to local rainfall patterns and Oklahoma County is susceptible to recurring drought events.

Figure 5.3.2-4. Major Aquifers of Oklahoma



Source: Oklahoma Water Resources Board, Date Unknown

Impacts from drought are largely based on the type of land use associated with a particular location. Urban communities are affected by drought differently from mixed and rural jurisdictions.

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with drought events throughout the State of Oklahoma and Oklahoma County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

According to NOAA's NCDC storm events database, Oklahoma County experienced 27 drought events between 1950 and 2012. Property damages and crop loss, including costs incurred from other counties, was estimated at $32.5 million and $561.6 million, respectively. According to the Hazard Research Lab at the University of South Carolina's Spatial Hazard Events and Losses Database for the U.S. (SHELDUS), between 1960 and 2010, 17 drought events occurred within the County. The database indicated that drought events and losses specifically associated with Oklahoma County and its municipalities totaled over $3.9 million in property damage and over $11 million in crop damages. However, these numbers may vary due to the database identifying the location of the hazard event in various forms or throughout multiple counties or regions. Between 1950 and 2011, FEMA indicated that the State of Oklahoma did not experience any drought-related FEMA disasters (DR) or emergencies (EM) (FEMA, 2012).

Based on all sources researched, known drought events that have affected Oklahoma County and its municipalities are identified in Table 5.3.2-6. Not all sources have been identified or researched; therefore, Table 5.3.2-6 may not include all events that have occurred throughout the County and region.

Table 5.3.2-6. Drought Events Between 1909 and 2012.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
1909 – 1918	Drought	N/A	N/A	Drought consisted of two severe multi-year episodes, interrupted by 1915, one of the wettest years of the 20th Century. This event comprises the lowest ten-year statewide rainfall on record. 1910 was the smallest annual rainfall Statewide and for four of Oklahoma's nine climate divisions.	OKS HMP
1930 – 1940	Drought	N/A	N/A	Statistically, the climate's contribution to the Dust Bowl was not as severe as during the 1910's or 1950's, but it left the deepest scar on Oklahoma's economy and psyche. The Dust Bowl was at its worst in during the mid-1930's, when severe drought, intense heat, immature and/or inappropriate agricultural practices and overall economic conditions combined to cause the greatest exodus of citizens in State history. Reaction to the event revolutionized farm and conservation practices in much of the U. S.	OKS HMP
1952 – 1958	Drought	N/A	N/A	Drought was accompanied by intense summer heat, insect invasions, and crop failures, specifically in the "Wheat Belt" of central and north-central Oklahoma.	OKS HMP
July 1998	Drought	N/A	N/A	A devastating drought and heat wave affected southeastern Oklahoma farmers. This event was recorded as the fourth driest. The southeast Oklahoma climate division (which includes Choctaw, Pushmataha, Latimer and Le Flore Counties) received 50 percent of normal rainfall from May 1 through July 31. The southeastern portion of the state was classified by the Palmer Drought Index as being in the midst of a "severe drought" while the east-central portion was experiencing "moderate drought". Oklahoma Agriculture Secretary estimated crop damage throughout the state at $2 billion, of which $500 million might have taken place in the southeast and east-central portion of the state. The President declared the area a drought disaster.	OKS HMP
August 2000	Drought	N/A	N/A	An extended period of unusually dry weather affected the state, including Oklahoma County. Many parts of the state did not receive rainfall for 30 to 90 days. Total crop losses of wheat, cotton, and peanuts, were estimated between $60 million and $1 billion dollars statewide ($399.8 million in Oklahoma County). Seven counties near the Texas border, including Carter, Comanche, Cotton, Jefferson, Love, Marshall, and Tillman, were declared federal disaster areas. Reservoir levels 50 percent below normal across the southwestern and south central portion of the state.	OKS HMP; OKC HMP; NOAA

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
July 4, 2001	Drought	N/A	N/A	An extended period of excessive heat affected all of western and central portions of the state, including Oklahoma County. Daily mean temperatures were five degrees above normal with most areas regularly experienced high temperatures at or above 100 degrees Eight fatalities resulted from the heat. In addition to the excessive heat, rainfall averaged about one-third of normal, resulting in a drought.	OKS HMP; OKC HMP
2001 – 2002	Drought	N/A	N/A	The period during this drought event produced the latest and longest of a series of dry episodes dating to the winter of 1995 – 1996. The timing, location, and duration of the event made it most damaging to the state's agricultural industry. The largest sectors to be adversely affected were winter wheat producers and those livestock operations that rely on wheat for winter forage. Row crops were injured by the lack of rainfall and associated heat wave during summer 2001. Hay operations also suffered greatly from the event. Crop loss exceeded $1 billion.	OKS HMP
December 1, 2005	Drought	N/A	N/A	Approximately $10 million in property damage and $500,000 in crop loss was incurred during this drought event.	NOAA-NCDC
January 1, 2006	Drought	N/A	N/A	More than $15 million in property damage and an estimated $750,000 in crop loss was incurred during this drought event. Drought levels ranged from severe to exceptional with the driest conditions in the southeastern portion of the state. Some precipitation did fall during the month, mainly in the form of snow, which did not do much to alleviate the dry conditions over the area. Wildfires caused by the severe dry conditions, created major problems throughout the state.	OKS HMP; NOAA-NCDC
April 1, 2006	Drought	N/A	N/A	More than $1.5 million in property damage and over $750,000 in crop loss was incurred during this drought event. Strong winds, warm temperatures, and dry conditions caused wildfires and blowing dust that reduced visibilities across western and central Oklahoma. Farm ponds dried up and available food for livestock decreased. Programs were developed to assist farmers and ranchers in building new wells. Some ranchers were forced to sell off livestock herds. Farmers and agriculture professionals predicted the worst wheat crop since 1957; many fields of crops were declared disasters in spring. Towns instituted volunteer water rationing programs.	OKS HMP

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
August 1, 2006	Drought	N/A	N/A	Oklahoma State was declared a disaster area allowing federal assistance. Approximately $100,000 in property damages were incurred during this event. Drought conditions ranged from extreme to exceptional, with the worst conditions in the southern portion of the state. Dry conditions maintained an increase in wildfire potential across the region with burn bans being issued by the state. Communities instituted water-rationing programs. Recreation was limited as some lakes were closed to boating, swimming, and fishing. Fish kills were reported due to increased temperatures. Crop damage was in excess of $2 million. Ranchers and farmers sold off their livestock herds due to dried up farm ponds, lack of pastureland, and the lack of hay. Cotton crops and those crops that rely on irrigation suffered from the dry and hot conditions.	OKS HMP
2005 – 2007	Drought	N/A	N/A	49 counties, including Oklahoma County, experienced drought from 2005 – 2007. Drought levels ranged from severe to exceptional, with the driest conditions in the southeastern portion of the state. Dry conditions maintained an increase in wildfire potential throughout the state. Costs associated with property damage and crop failure are unknown. No fatalities or injuries were reported.	OKS HMP
June 2008	Drought	N/A	N/A	D2 drought set in over a small area of Harper and Ellis Counties. Approximately $100,000 in property damages incurred from the event. No fatalities or injuries were reported.	OKS HMP
2011	Drought	N/A	N/A	2011 was one of the hottest and driest years in the history for the Southern Plains. It was the driest period in the state since the 1920s and 1930s. Extremely hot and dry conditions and record drought conditions struck much of the region. The hot and dry condition caused crop and livestock losses, water restrictions, brush fires, losses in recreation due to low lake levels, and many heat-related deaths and illnesses. In the State of Oklahoma, a majority of range and grazing pastures were classified as being in 'very poor' condition for much of the 2011 growing season. Summer and fall crops, hay forages, and alfalfa were hit hard due to lack of precipitation. Many crops were declared a total loss. Farm ponds dried up, affecting the livestock as well. Many of the lakes (Grand Lake, Keystone Lake, Fort Gibson Lake, Lake Tenkiller, Skiatook Lake, and Lake Eufaula) in the state were closed or under an advisory due to the development of a toxic algae.	Drought Impact Reporter, NWS

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
January 2012	Drought	N/A	N/A	0.04 inches of precipitation since 12/20/11. Starting to worry La Nina might be beginning to take hold again. We saw a wet fall (little more than normal) and most ponds are back to normal. But one month with almost no measureable precipitation is not good and hoping it is not a sign of things to come.	Drought Impact Reporter
March 2012	Drought	N/A	N/A	Extreme to exceptional drought conditions across southwest Oklahoma and northwestern Texas. Warm, dry and windy conditions led to many wildfires in Oklahoma.	Drought Impact Reporter

OKS HMP Oklahoma State Hazard Mitigation Plan
OKC HMP Oklahoma County Hazard Mitigation Plan
NOAA National Oceanic and Atmospheric Administration
FEMA Federal Emergency Management Agency
N/A Not Applicable
NWS National Weather Service

Probability of Future Events

It is estimated that Oklahoma County will continue to experience direct and indirect impacts of drought and its impacts on occasion, with the secondary effects causing potential disruption or damage to agricultural activities and creating shortages in water supply within communities.

In Section 5.3, the identified hazards of concern for Oklahoma County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for drought in all the jurisdictions participating in Oklahoma County HMP is considered "4 – Highly Likely" (Event is probable within the calendar year. Event has a 1 in 1 year chance of occurring).

Climate Change

Agriculturally dependent communities and regions are often viewed as being particularly susceptible to the impacts of climate change, which is understandable given the important role that climatic conditions play in agricultural production (McLeman et al., 2008). Considerations of the potential impacts of climate change on drought should take into account the probability, frequency, and severity of possible extreme events. Temporal and spatial variance of meteorological conditions and storms can affect soil conditions, water availability, agricultural yields, and susceptibility to pest and pathogen infestations (Rosenzweig et al. 2001). The relationship among extreme events is important to understand. Droughts, followed by intense rains, for example, can reduce soil water absorption and increase the potential for flooding. Developing adaptive strategies as a response mechanism will provide a platform for successful management and recovery during drought events that may ultimately minimize socio-economic impacts.

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the drought hazard, all of Oklahoma County has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities and lifelines), as described in the County Profile (Section 4), are vulnerable to a drought. Assets at particular risk would include any open land or structures at located along the wildland/urban interface (WUI) that could become vulnerable to the wildfire hazard due to extended periods of low rain and high heat, usually associated with a drought. Assets outside of the WUI may also be at risk due to the secondary hazard of expansive soil. In addition, water supply resources could be impacted by extended periods of low rain. Finally, vulnerable populations could be particularly susceptible to the drought hazard and cascading impacts due to age, health conditions, and limited ability to mobilize to shelter, cooling and medical resources. The following text evaluates and estimates the potential impact of the drought hazard on Oklahoma County plan participants including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact, including: (1) impact on life, safety and health of county residents, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

All of Oklahoma County is vulnerable to drought. However, areas at particular risk are: areas used for agricultural purposes (farms and cropland), open/forested land vulnerable to the wildfire hazard, areas where communities rely on private water supply, and certain areas where elderly, impoverished or otherwise vulnerable populations are located.

Data and Methodology

Data was collected from Oklahoma State, the County, and Planning Committee sources. At the time of this HMP, insufficient data are available to model the long-term potential impacts of a drought on the County. Over time, additional data will be collected to allow better analysis for this hazard. Available information and a preliminary assessment are provided below.

Impact on Life, Health and Safety

Droughts conditions can cause a shortage of water for human consumption and reduce local fire-fighting capabilities. The drought hazard is a concern because private water supply sources are used in Oklahoma County.

Social impacts of a drought include mental and physical stress, public safety (increased threat from forest/grass fires), health, conflicts between water users, reduced quality of life, and inequities in the distribution of impacts and disaster relief. The infirm, young, and elderly are particularly susceptible to drought and extreme temperatures, sometimes associated with drought conditions, due to their age, health conditions and limited ability to mobilize to shelters, cooling and medical resources. Impacts on the economy and environment may have social implications as well (OKDEM, 2011). For the purposes of this HMP, the entire population in the County is vulnerable to drought events.

Impact on General Building Stock and Critical Facilities

No structures are anticipated to be directly affected by a drought and are expected to be operational during a drought event. However, droughts contribute to conditions conducive to wildfires. Risk to life and property is greatest in those areas where forested areas adjoin urbanized areas (high density residential, commercial and industrial) or WUI. Therefore, all assets in and adjacent to, the WUI zone, including population, structures, critical facilities, lifelines, and businesses are considered vulnerable to wildfire. Please refer to Section 5.3.9 regarding the wildfire hazard in Oklahoma County.

Impact on Economy

It is difficult to estimate financial damages as a result of a drought because droughts produce a complex web of impacts. A prolonged drought can have serious environmental and direct and indirect economic impacts on a community. General economic effects from a drought include the following:

- Decreased land prices
- Loss to industries directly dependent on agricultural production (e.g., machinery and fertilizer manufacturers, food processors, dairies, etc.)
- Unemployment from drought-related declines in production
- Strain on financial institutions (foreclosures, more credit risk, capital shortfalls)
- Revenue losses to Federal, State, and Local governments (from reduced tax base)
- Reduction of economic development
- Fewer agricultural producers (due to bankruptcies, new occupations)
- Rural population loss (NYSOEM, 2011).

Environmental losses include damages to the following:

- Plant and animal species
- Wildlife habitat
- Air and water quality
- Forest and range fires
- Decay of landscape quality
- Soil erosion (OKDEM, 2011)

Droughts can directly impact municipal and private water supply sources (i.e., declining aquifers, reduced stream flows, etc). As noted, agricultural resources need ample water supplies for successful production, relying on natural precipitation and the supply and demand of groundwater resources, both of which become limited or compromised during times of drought. According to the U.S. Department of Agriculture (USDA) National Agricultural Statistics Service (NASS), there are 1,289 farms in Oklahoma County, occupying 159,823 acres of land in the County. Land is used to grow agricultural products as well as to raise livestock (USDA NASS, 2007).

The entire agricultural industry in Oklahoma County is vulnerable to the drought hazard. The historic record may assist Oklahoma County in estimating potential future losses as a result of this hazard of concern.

According to the State HMP, much of the State's power comes from hydroelectric plants. Therefore, power supplies can potentially be affected by low water levels having social, environmental and economic implications as well (OKDEM, 2011).

A summary of the direct and indirect losses as a result of a drought is presented in Figure 5.3.2-7 (OKDEM, 2011).

Figure 5.3.2-7. Timescale of Drought Vulnerability

Timescale of Drought Vulnerability					
Drought Issue or Vulnerable Community	**Approx. Time Scale of Onset**	**Some Prominent Impacts**	**Approx. Avg. Time Between Significant Events on This Time Scale**	**Contributing Factors and Circumstances**	**Related Notes**
Drought-enhanced Wildfire Danger	1-2 months	Dried organic soil material can act as additional fuel to wildfire; more frequent wildfires; more intense wildfires	Fairly common. Tends to occur at least somewhere in the State during most years.	Time since last burn; density of undergrowth (often enhanced by preceding prolonged wetness); severity of drought.	Somewhat seasonal.
Horticulture / Urban, Suburban Lawns	1-2 months	Increased municipal water use; horticultural failure; lawn damage; increased pest damage	Somewhat common. Most growing seasons will undergo one or two fairly dry months. Consecutive dry months are slightly rarer.	Effectiveness of conservation and mitigation practices; severity of drought; severity of heat.	Highly Seasonal.
Municipal Water Distribution	1-2 months	Short-term water rationing (on the order of weeks); loss of revenue for water-use-dependent municipalities	Somewhat common.	Capacity and quality of distribution system; quality of conservation and mitigation practices; severity of drought; severity of heat.	Highly seasonal.
Agriculture	2-6 months	Crop failure; poor crop yield; depressed livestock prices due to sell-offs.	Severe drought-related losses struck 6-8 times since 1980 (note: highly variable by crop). Catastrophic failures occur 1-2 times per decade *on average*.	Timing of event versus crop cycle; availability and cost of irrigation water; agricultural techniques; conservation practices; crop selection; drought-tolerant varieties.	Highly tied to crop cycle; example: very dry Apr-May can help wheat harvest while destroying row crops.
Reservoir depletion	1+ years	Severe, prolonged rationing; widespread water shortages;		Effectiveness of conservation and mitigation practices; demand; size and engineering of reservoir.	Smaller reservoirs are more sensitive at shorter timescales.

		irrigation denied			
Aquifer depletion	10+ years	Widespread farm & ranch failure;	Many aquifer levels are dropping in recent decades.	Financial / physical ability to drill deeper; demand.	Still little known about aquifer depletion

Source: OKDEM, 2011

Effect of Climate Change on Vulnerability

The potential effects of climate change on Oklahoma County's vulnerability to drought events shall need to be considered as a greater understanding of regional climate change impacts develop.

Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the drought hazard because the entire County is exposed and vulnerable.

Additional Data and Next Steps

For the revised plan, any additional information regarding localized concerns and past impacts will be collected and analyzed. This data will be developed to support future revisions to the plan. Mitigation efforts could include building on existing Oklahoma State, Oklahoma County, and local efforts.

Overall Vulnerability Assessment

Historic data available indicate that droughts can impact Oklahoma County. Drought events can cause significant impacts and losses to the County's water supply and economy. The cascade effects of drought include increased susceptibility to the wildfire hazard, increased and thus shortages on local resources (i.e., water supply, electricity). Losses associated with the wildfire hazard are discussed earlier in this section.

5.3.3 EARTHQUAKE

This section provides a profile and vulnerability assessment for the earthquake hazard.

HAZARD PROFILE

This section provides profile information including description, extent, location, previous occurrences and losses and the probability of future occurrences.

Description

An earthquake is the sudden movement of the Earth's surface caused by the release of stress accumulated within or along the edge of the Earth's tectonic plates, a volcanic eruption, or by a manmade explosion (Federal Emergency Management Agency [FEMA], 2010; Shedlock and Pakiser, 1997). Most earthquakes occur at the boundaries where the Earth's tectonic plates meet (faults); however, less than 10 percent of earthquakes occur within plate interiors. Oklahoma State is in an area where plate interior-related earthquakes occur. As plates continue to move and plate boundaries change over geologic time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust (Shedlock and Pakiser, 1997).

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter (Shedlock and Pakiser, 1997). Earthquakes usually occur without warning and their effects can impact areas of great distance from the epicenter (FEMA, 2001).

According to the U.S. Geological Society (USGS) Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect resident's normal activities. This includes surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, tsunamis, and seiches. A description of each of these is provided below.

- Surface faulting: Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.
- Ground motion (shaking): The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
- Landslide: A movement of surface material down a slope.
- Liquefaction: A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.
- Tectonic Deformation: A change in the original shape of a material due to stress and strain.
- Tsunami: A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands.

- Seiche: The sloshing of a closed body of water from earthquake shaking (USGS, 2009).

Extent

Seismic waves are the vibrations from earthquakes that travel through the Earth and are recorded on instruments called seismographs. The magnitude or extent of an earthquake is a measured value of the earthquake size, or amplitude of the seismic waves, using a seismograph. The Richter magnitude scale (Richter Scale) was developed in 1932 as a mathematical device to compare the sizes of earthquakes (USGS, 1989). The Richter Scale is the most widely-known scale that measures the magnitude of earthquakes (Shedlock and Pakiser, 1997; USGS, 2004).

The magnitude of an earthquake measured using the Richter Scale ranges from 0 to 9; and although there is no upper limit, the largest shocks recorded by the USGS have been between 8.8 to 8.9 (USGS 2004). The magnitude of an earthquake does not illustrate the severity of damage to an area but measures the magnitude of the waves. Therefore, an earthquake in a densely populated area, which results in many deaths and considerable damage, may have the same magnitude and shock in a remote area that did not cause any damage (USGS, 1989). The State of Oklahoma considers a reading of 5.4 and below on the Richter scale a minor severity and 5.5 and above to be a major severity (OK State HMP, 2011). Table 5.3.3-1 presents the Richter Scale magnitudes and corresponding earthquake effects.

Table 5.3.3-1. Richter Scale

Richter Magnitude	Earthquake Effects
2.5 or less	Usually not felt, but can be recorded by seismograph
2.5 to 5.4	Often felt, but only causes minor damage
5.5 to 6.0	Slight damage to buildings and other structures
6.1 to 6.9	May cause a lot of damage in very populated areas
7.0 to 7.9	Major earthquake; serious damage
8.0 or greater	Great earthquake; can totally destroy communities near the epicenter

Source: USGS, 2006

The intensity of an earthquake is based on the observed effects of ground shaking on people, buildings, and natural features, and varies with location. Intensity is expressed by the Modified Mercalli Scale; a subjective measure that describes how strong a shock was felt at a particular location (Shedlock and Pakiser, 1997; USGS, 2004). The Modified Mercalli Scale expresses the intensity of an earthquake's effects in a given locality in values ranging from I to XII. Table 5.3.3-2 summarizes earthquake intensity as expressed by the Modified Mercalli Scale. Table 5.3.3-3 displays the Modified Mercalli Scale and peak ground acceleration equivalent.

Table 5.3.3-2. Modified Mercalli Intensity Scale

Mercalli Intensity	Description
I	Felt by very few people; barely noticeable.
II	Felt by few people, especially on upper floors.
III	Noticeable indoors, especially on upper floors, but may not be recognized as an earthquake.
IV	Felt by many indoors, few outdoors. May feel like passing truck.
V	Felt by almost everyone, some people awakened. Small objects moves, trees and poles may shake.

Mercalli Intensity	Description
VI	Felt by everyone; people have trouble standing. Heavy furniture can move, plaster can fall off walls. Chimneys may be slightly damaged.
VII	People have difficulty standing. Drivers feel their cars shaking. Some furniture breaks. Loose bricks fall from buildings. Damage is slight to moderate in well-built buildings; considerable in poorly built buildings.
VIII	Well-built buildings suffer slight damage. Poorly built structures suffer severe damage. Some walls collapse.
IX	Considerable damage to specially built structures; buildings shift off their foundations. The ground cracks. Landslides may occur.
X	Most buildings and their foundations are destroyed. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, lakes. The ground cracks in large areas.
XI	Most buildings collapse. Some bridges are destroyed. Large cracks appear in the ground. Underground pipelines are destroyed.
XII	Almost everything is destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move.

Source(s): Michigan Tech University, 2007; Nevada Seismological Laboratory, 1996

Table 5.3.3-3. Modified Mercalli Intensity (MMI) and PGA Equivalents

MMI	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	< .17	Not Felt	None
II	.17 – 1.4	Weak	None
III	.17 – 1.4	Weak	None
IV	1.4 – 3.9	Light	None
V	3.9 – 9.2	Moderate	Very Light
VI	9.2 – 18	Strong	Light
VII	18 – 34	Very Strong	Moderate
VIII	34 – 65	Severe	Moderate to Heavy

Source: FEMA, 2001

Seismic hazards are often expressed in terms of Peak Ground Acceleration (PGA) and Spectral Acceleration (SA). PGA is the maximum acceleration experienced by a particle on the ground and SA is approximately what is experienced by a building, as modeled by a particle mass on a massless vertical rod having the same natural period of vibration as the building. Both PGA and SA can be measured in *g* (the acceleration due to gravity) or expressed as a percent acceleration force of gravity (%g) (USGS, 2012). In summary, PGA expresses the severity of an earthquake and is a measure of how hard the earth shakes (or accelerates) in a given geographic area.

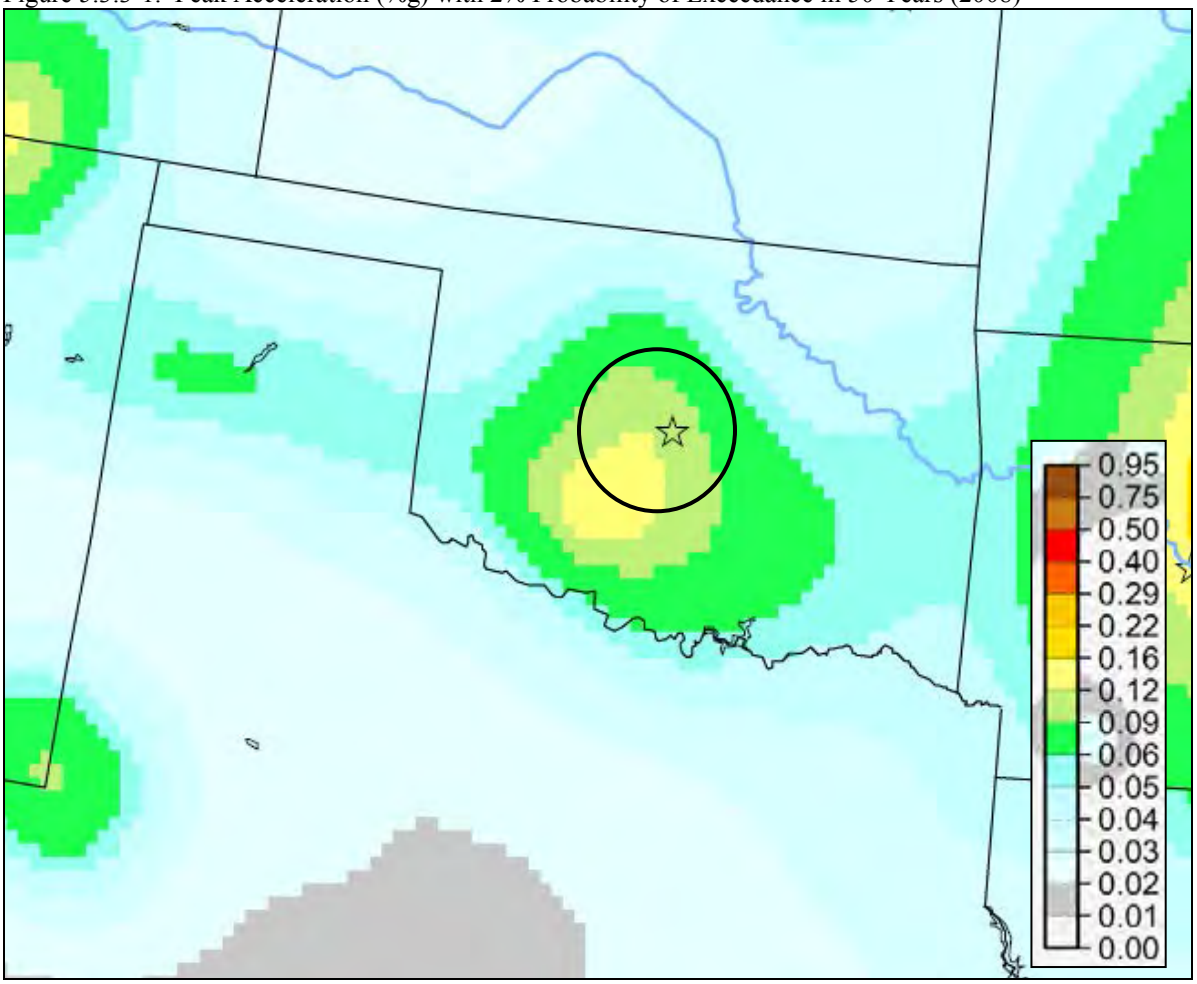
PGA is a common earthquake measurement that shows three things: the geographic area affected, the probability of an earthquake of each given level of severity, and the strength of ground movement (severity) expressed in terms of percent of acceleration force of gravity (%g). In other words, PGA expresses the severity of an earthquake and is a measure of how hard the earth shakes (or accelerates) in a given geographic area (Organization of American States, 1991).

ShakeMaps, national maps illustrating earthquake-shaking hazards, represent ground shaking produced by an earthquake rather than the parameters describing the earthquake source. While an earthquake has one magnitude and one epicenter, it produces a range of ground shaking levels at sites throughout the region based on variables including distance from the earthquake, rock and soil conditions, and variations of seismic waves from the earthquake due to complexities in the structure of the Earth's crust (USGS, 2011). ShakeMaps are instrumental information resources essential to creating and updating the seismic design

requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities and land use planning used in the U.S. Scientists frequently revise these maps to reflect new information and knowledge. Buildings, bridges, highways, and utilities built to meet modern seismic design requirements are typically able to withstand earthquakes better, with less damages and disruption. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown et al., 2001).

The USGS recently updated the National Seismic Maps in 2008 which superced the 2002 maps. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps. The 2008 map represents the best available data as determined by the USGS (USGS, 2009).

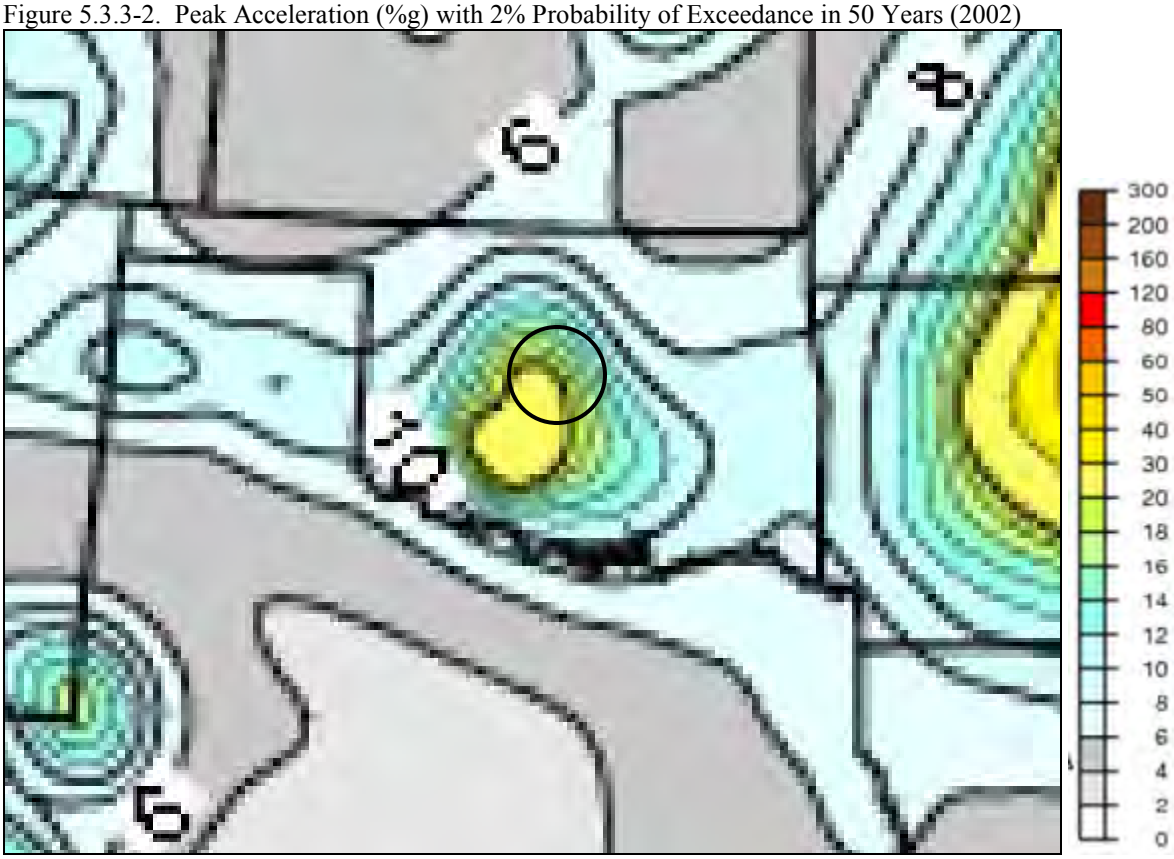
Figure 5.3.3-1. Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years (2008)



Source: USGS, 2012
Note: The black circle indicates the approximate location of Oklahoma County. The PGA for the County ranged from 0.06 to 0.12.

The 2002 seismic hazard map shows that Oklahoma County has a PGA between 16 and 30% (Figure 5.3.3-2). The 2008 map shows that the County has a PGA between 6 and 12% (Figure 5.3.3-1). These maps are based on peak ground acceleration (%g) with 2% probability of exceedance in 50 years.

Figure 5.3.3-2. Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years (2002)



Source: USGS, 2012
Note: The black circle indicates the approximate location of Oklahoma County. The PGA for the County ranged from 16 to 30.

The above figures indicate the PGA which is primarily the area of increased activity within Oklahoma County over the last few years. A quake event on December 16, 2007 (a 2.5 magnitude) in eastern Oklahoma was outside the major activity area. In the State of Oklahoma, only a few earthquakes per year are large enough to be felt, while the rest are not felt nor do any visible damage (Oklahoma State HMP, 2011).

The National Earthquake Hazard Reduction Program (NEHRP) developed and defined five soil classifications that impact the severity of an earthquake. The soil classification system ranges from A to E, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. NEHRP soil classifications are not available for Oklahoma County.

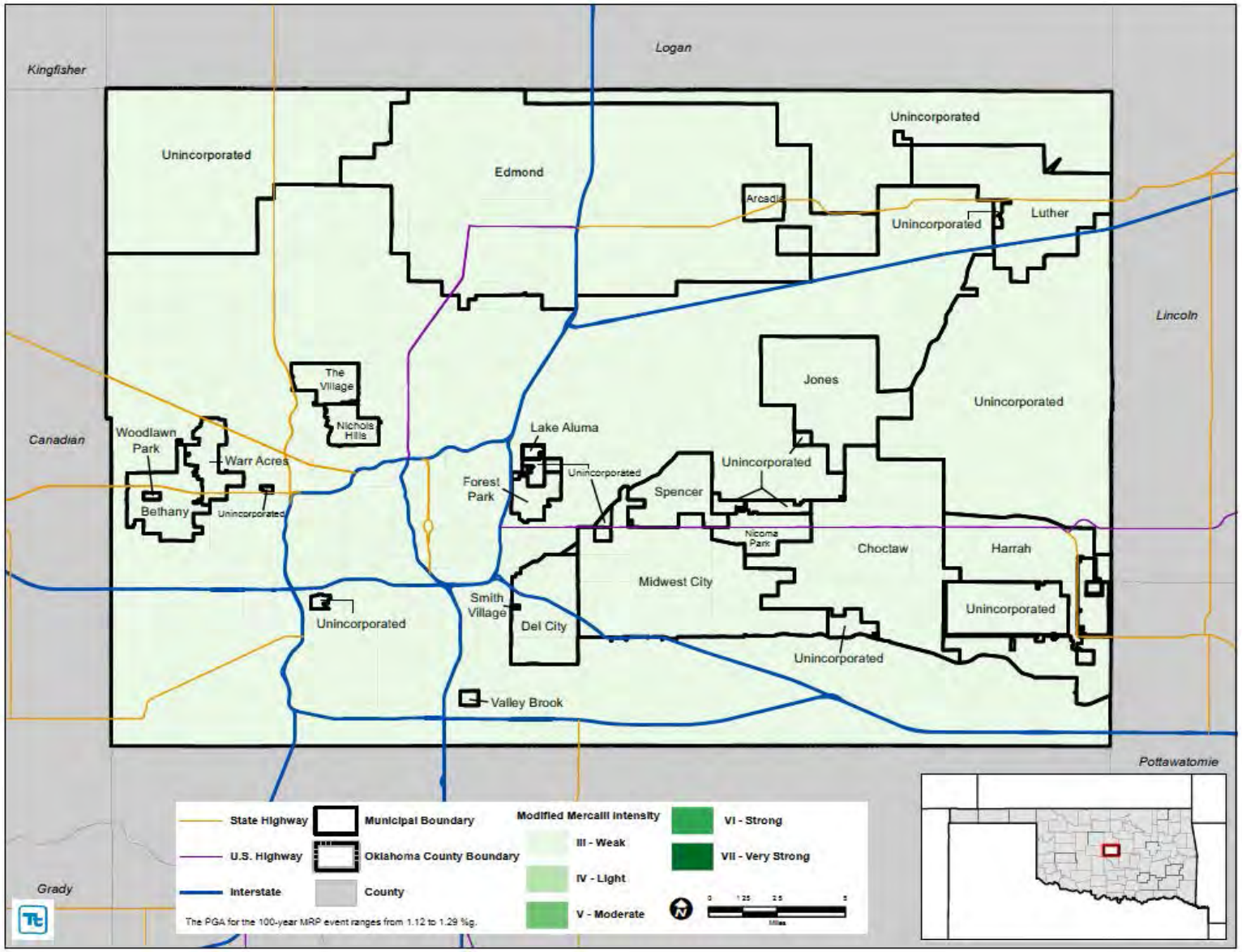
Table 5.3.3-4. NEHRP Soil Classifications

Soil Classification	Description
A	Very hard rock (e.g., granite, gneisses)
B	Sedimentary rock or firm ground
C	Stiff clay
D	Soft to medium clays or sands
E	Soft soil including fill, loose sand, waterfront, lake bed clays

Source: University of Utah Seismograph Stations, Date Unknown

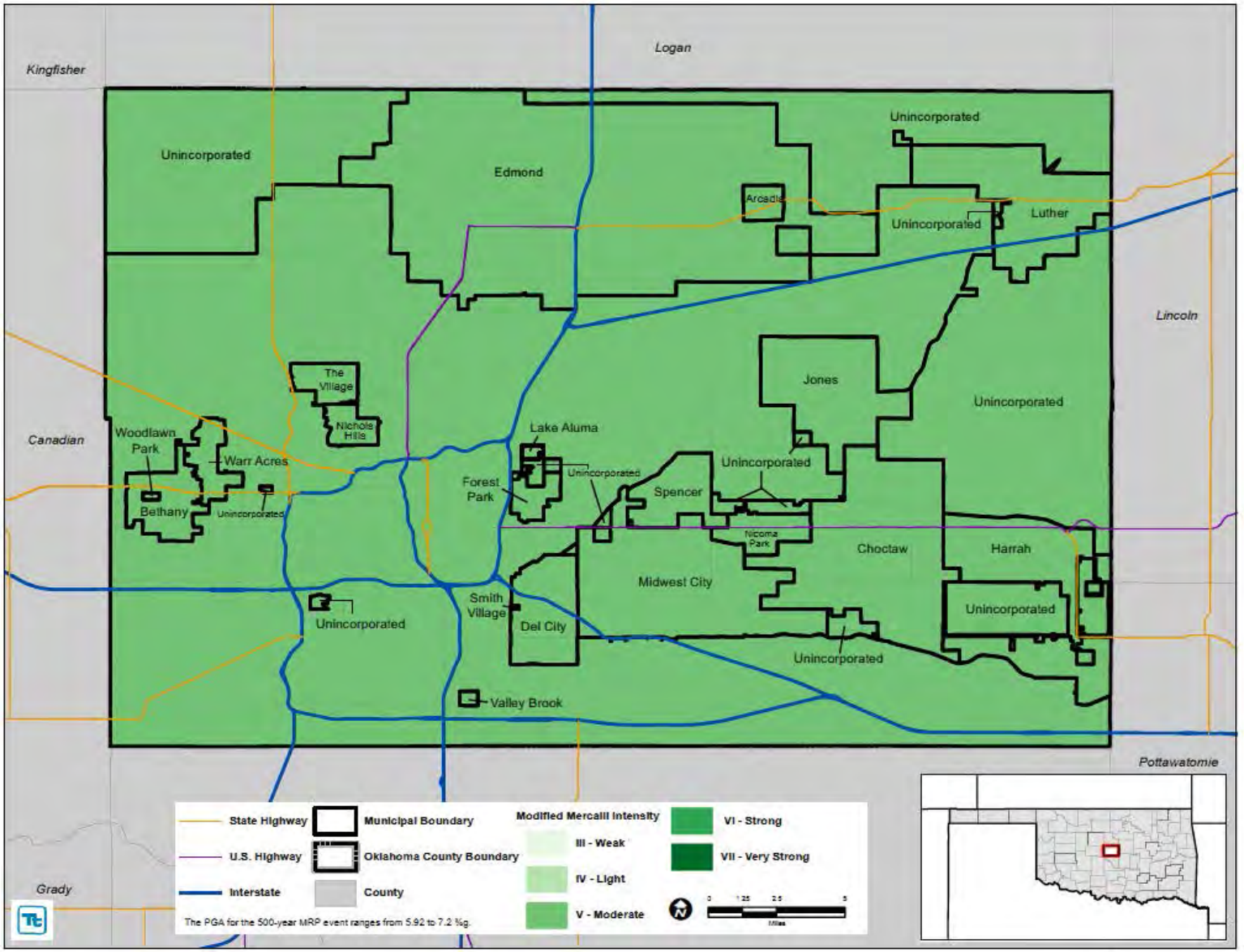
A probabilistic assessment was conducted for the 100-, 500- and 2,500-year mean return periods (MRP) through a Level 1 analysis in HAZUS-MH 2.0 to analyze the earthquake hazard for Oklahoma County. The HAZUS analysis evaluates the statistical likelihood that a specific event will occur and what consequences will occur. A 100-year MRP event is an earthquake with a 1% chance that the mapped ground motion levels (PGA) will be exceeded in any given year. For a 500-year MRP, there is a 0.2% chance the mapped PGA will be exceeded in any given year. For a 2,500-year MRP, there is a 0.04% chance the mapped PGA will be exceeded in any given year. Figures 5.3.3-3 through 5.3.3-5 illustrates the geographic distribution of PGA (%*g*) across Oklahoma County or 100-, 500- and 2,500-year MRP events at the Census-Tract level.

Figure 5.3.3-3. Peak Ground Acceleration in Oklahoma County for a 100-Year MRP Earthquake Event



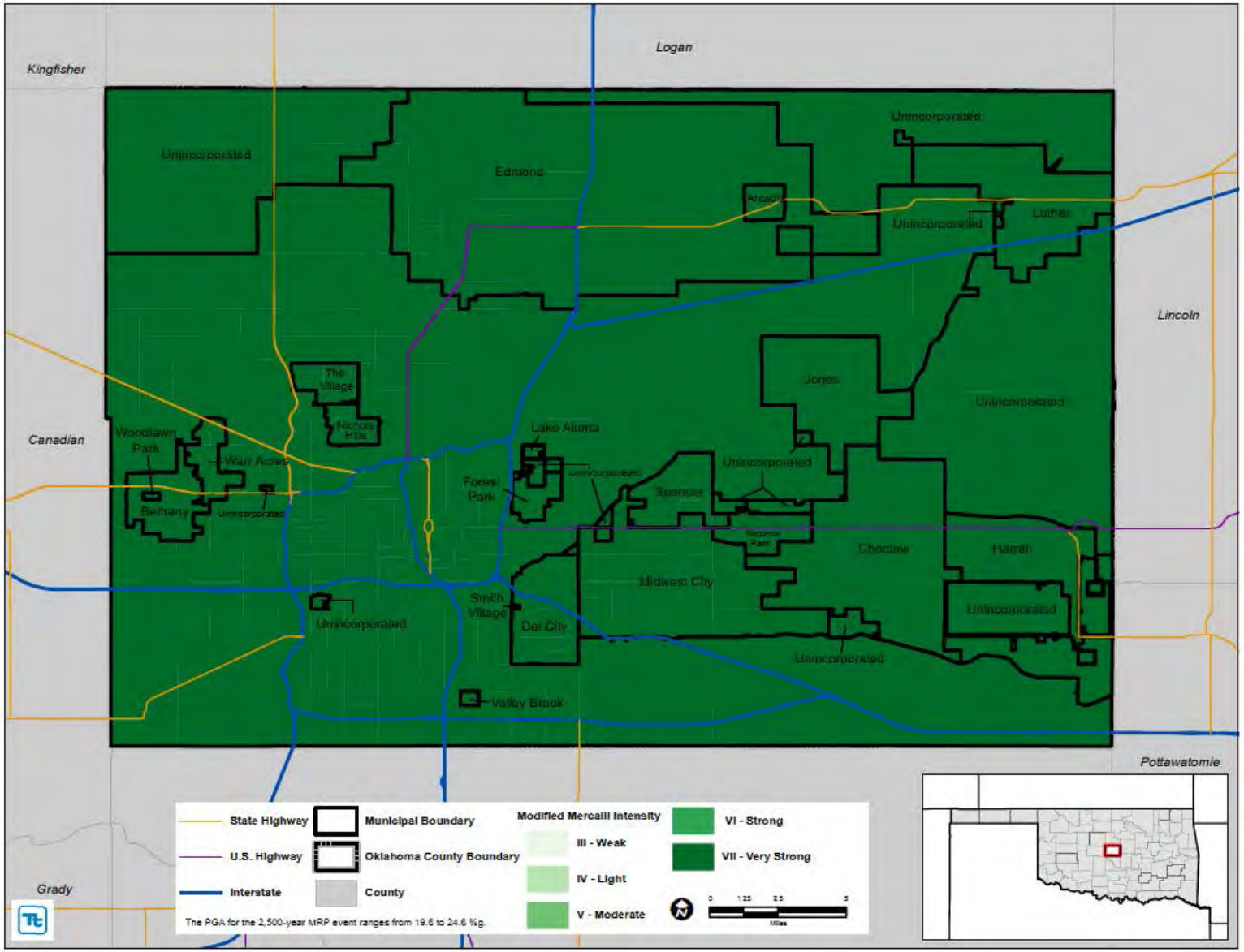
Source: HAZUS 2.0

Figure 5.3.3-4. Peak Ground Acceleration in Oklahoma County for a 500-Year MRP Earthquake Event by Census Tract



Source: HAZUS 2.0

Figure 5.3.3-5. Peak Ground Acceleration in Oklahoma County for a 2,500-Year MRP Earthquake Event by Census Tract



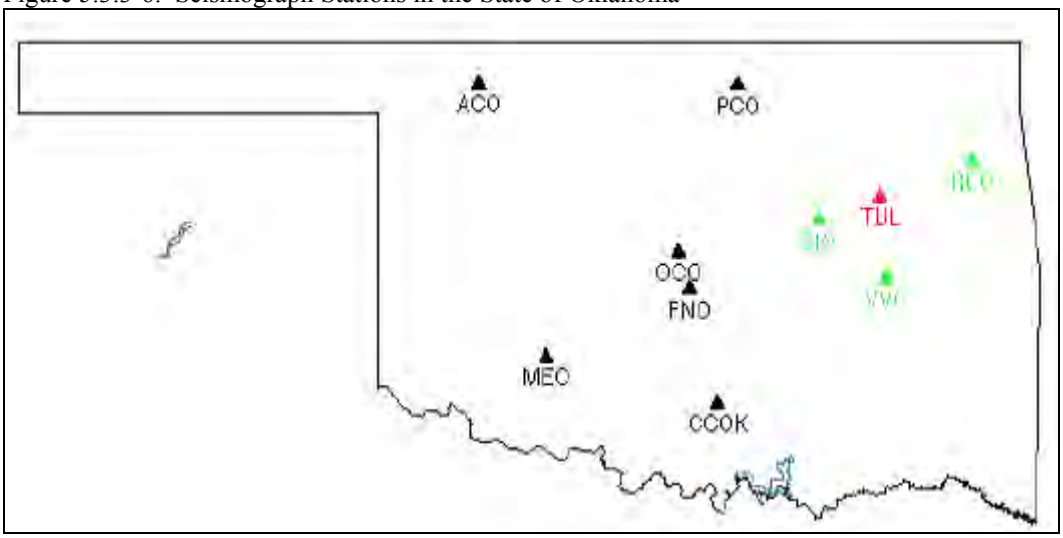
Source: HAZUS 2.0

Location

The largest earthquakes felt in the United States were along the New Madrid fault in Missouri, where a three-month long series of quakes from 1811 to 1812 included three quakes larger than a magnitude of 8 on the Richter Scale (Oklahoma County Hazard Mitigation Plan, 2007). During 2011, a magnitude 5.6 earthquake, the largest event to hit Oklahoma in modern times, was recorded during this period of increased seismic activitiy. The State of Oklahoma averages about 50 to 100 recorded earthquakes annually. Most of these earthquakes occur on deep faults that are not visible at the Earth's surface and residents report only one or two earthquakes as being felt each year.

The Oklahoma Geological Survey Observatory (OGS) is located in rural Tulsa County and is a comprehensive geophysical observatory which records, identifies, and locates 30 to 67 earthquakes in the State each year. It also records about five worldwide earthquakes each day. The OGS operates a statewide network of earthquake detecting equipment. The OGS operates eight satellite seismograph stations and records data. In the State, earthquake data has been recorded since January 1, 1962; however, the statewide network did not become operational until 1977 (OK State HMP, 2011). Figure 5.3.3-6 shows the locations of the seismograph stations in Oklahoma.

Figure 5.3.3-6. Seismograph Stations in the State of Oklahoma



Source: OK State HMP, 2011

Table 5.3.3-5. Seismograph Station Locations

Station	Location	Equipment Utilized
TUL	Near Leonard, OK (Tulsa County)	Oklahoma Geological Survey Observatory
RLO	Rose Lookout (Mayes Co.)	Telemeter remote location – (sends to Leonard)
SLO	Slick (Creek Co.)	Telemeter remote location – (sends to Leonard)
VVO	Vivian (McIntosh Co.)	Telemeter location – (sends to Leonard)
CCOK	No information	No information
MEO	Lawton, OK (Comanche Co.)	Out of service – equipment waiting replacement Fall 2013
FNO	Norman, OK (Cleveland Co.)	No information
ACO	Alabaster Caverns (Woods Co.)	Seismometer - volunteer operated
PCO	Ponca City (Kay Co.)	Digitizers communicating with SCREAM software running on PCs. SCREAM send packets over the internet to Leonard.
OCO	Oklahoma City (Oklahoma Co.)	Seismometer - volunteer operated

Source: OK State HMP, 2011

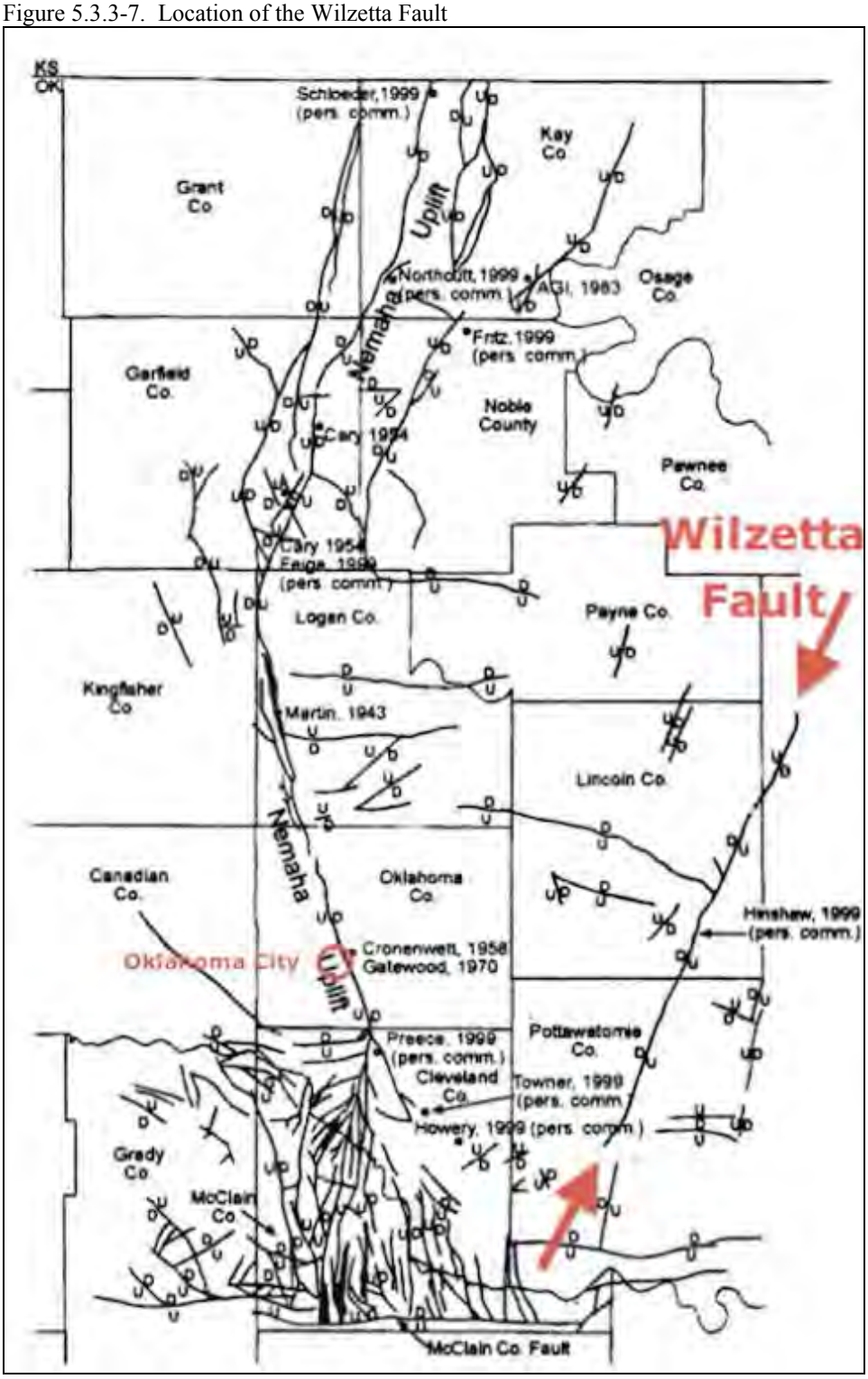
The State of Oklahoma has a great number of faults of different sizes, but very large earthquakes are not expected to occur in the State. The State is at moderate risk for an earthquake due to its close proximity to the New Madrid Seismic Zone. Seven main regions of earthquake activity exist in Oklahoma and include:

- The El Reno-Mustang area in central Oklahoma;
- Love and Carter counties;
- An area in southeastern Oklahoma north of the Ouachita Mountains in the Arkoma Basin;
- The Meers fault, located near Meers on the eastern edge of the Anadarko Basin;
- The area around Lindsay in Garvin County;
- An area near Ada in Pontotoc County; and
- In eastern Oklahoma County near Jones (Memorial Rd. / Indian Meridian Rd.) (Oklahoma State HMP, 2011).

The Wilzetta Fault and the Meers Fault are found in the State. The Wilzetta fault intersects Creek, Lincoln, and Pottawatomie Counties. Meers fault is located in the southwestern portion of the State in Comanche and Kiowa Counties. A description of each fault is provided below. The Wilzetta fault is one of a series of small faults formed in the Pennsylvanian Epoch (approximately 300 million year ago) during the intraplate deformation known as the Ancestral Rocky Mountains mountain-building episode (orogeny). The relationship between the recent earthquakes and this older structure is still unknown and requires further investigation (Oklahoma Geological Survey, 2011). Figure 5.3.3-7 illustrates the location of the Wilzetta Fault.

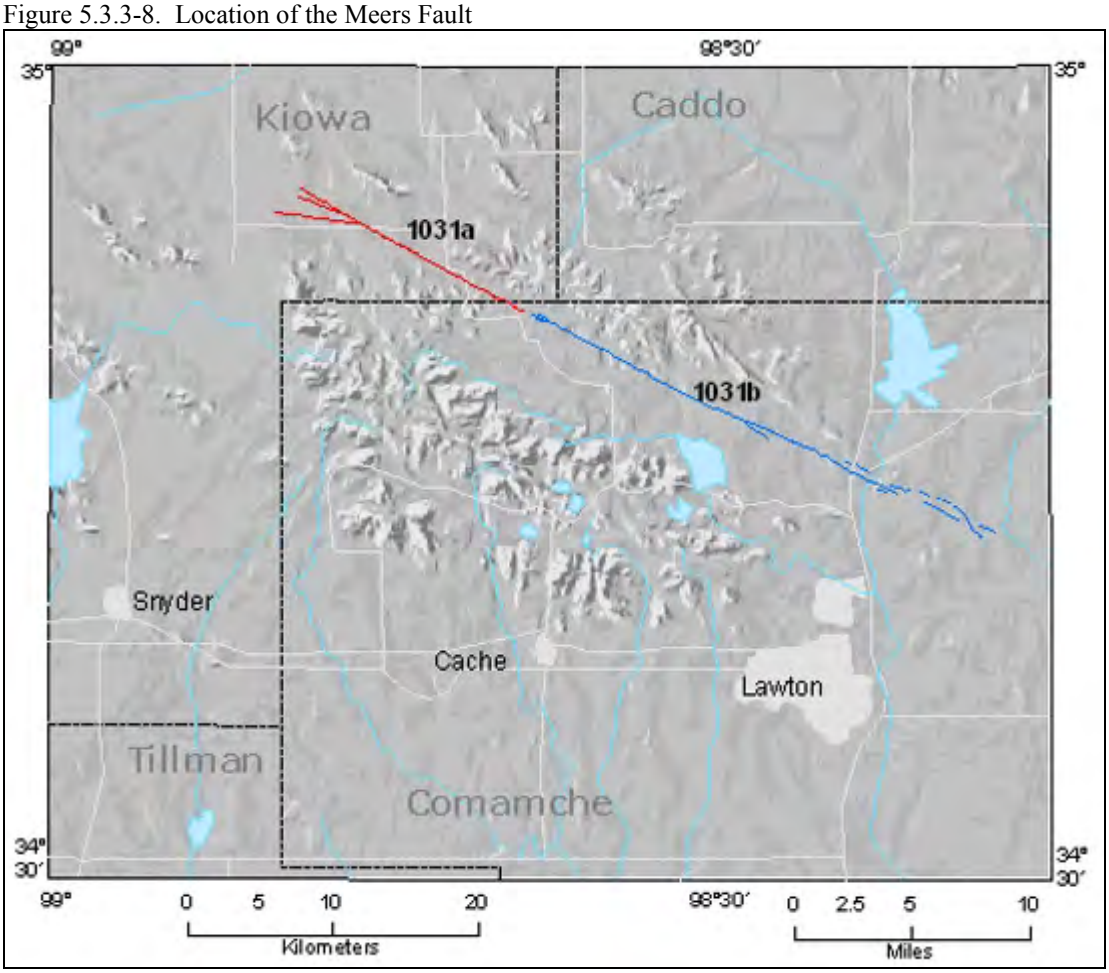
The Meers fault is the first documented movement of a fault in the last 10,000 years in the Central Mid-Continent region of the U.S. - Oklahoma, Kansas, Nebraska, South Dakota, and North Dakota (OK State HMP, 2011). Located in south-central Oklahoma, the Meers fault is the only fault identified east of the Rocky Mountain Region with evidence of surface-rupturing (Figure 5.3.3-8). A distinct fault trace is visible for 15 miles from near Saddle Mountain to Cache Creek. Paleoseismology studies have identified a temporal clustering of at least three earthquakes on this fault and an earthquake of magnitude 5.6 are considered to be capable of striking at irregular intervals anywhere in eastern North America (Oklahoma Geological Survey, 2011).

Figure 5.3.3-7. Location of the Wilzetta Fault



Source: Countywide & Sun, Date Unknown

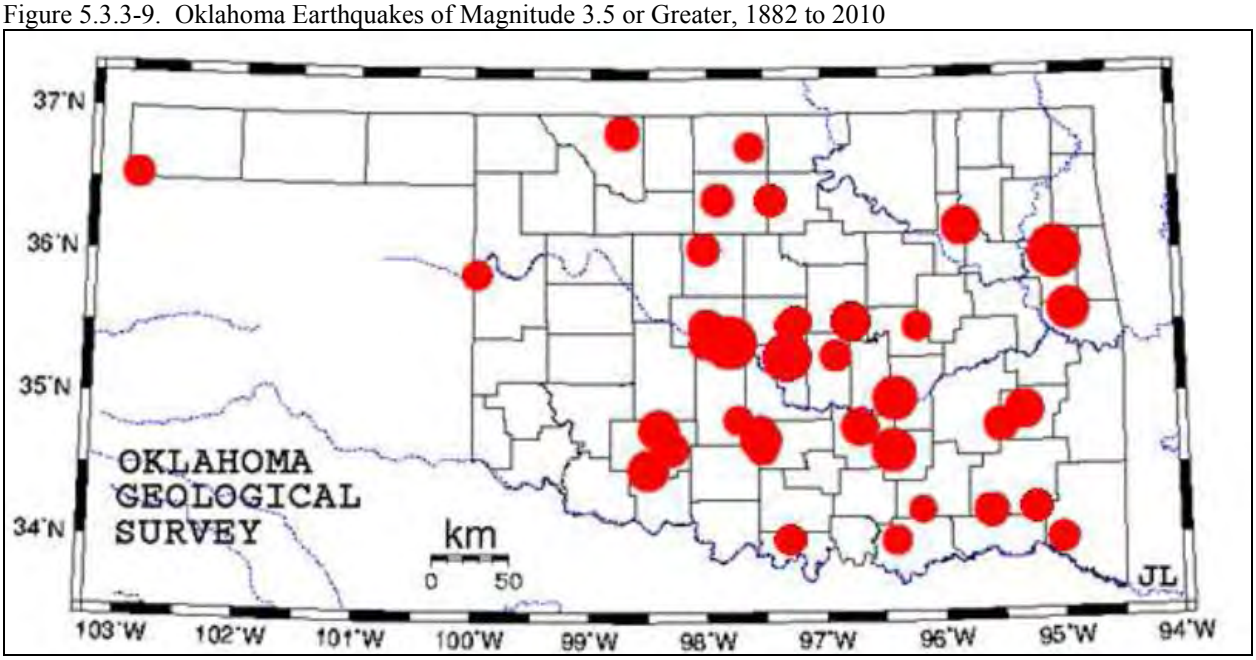
Figure 5.3.3-8. Location of the Meers Fault



Source: USGS, 2010

Earthquakes that have been felt in the State tend to concern people the most. Figure 5.3.3-9 plots the locations of earthquakes, with a magnitude greater than 3.5, from 1882 to 2010. There have been significant events within the vicinity of the Meers Fault; however, there has also been activity in other areas. Since 2008, eastern Oklahoma County, near the Town of Jones, has seen an increase in activity. Between 2009 and 2010, at least nine earthquakes of magnitude 3.5 have occurred in this area. A magnitude 4.1 quake happened in southeast Lincoln County near Sparks on February 27, 2010. This was topped by a 4.7 earthquake, rated the second strongest in the history of Oklahoma, on October 13, 2010. This earthquake occurred just south of the aforementioned active area and was felt widely across much of the eastern two thirds of the State and into the Dallas-Fort Worth area (OK State HMP, 2011).

Figure 5.3.3-9. Oklahoma Earthquakes of Magnitude 3.5 or Greater, 1882 to 2010

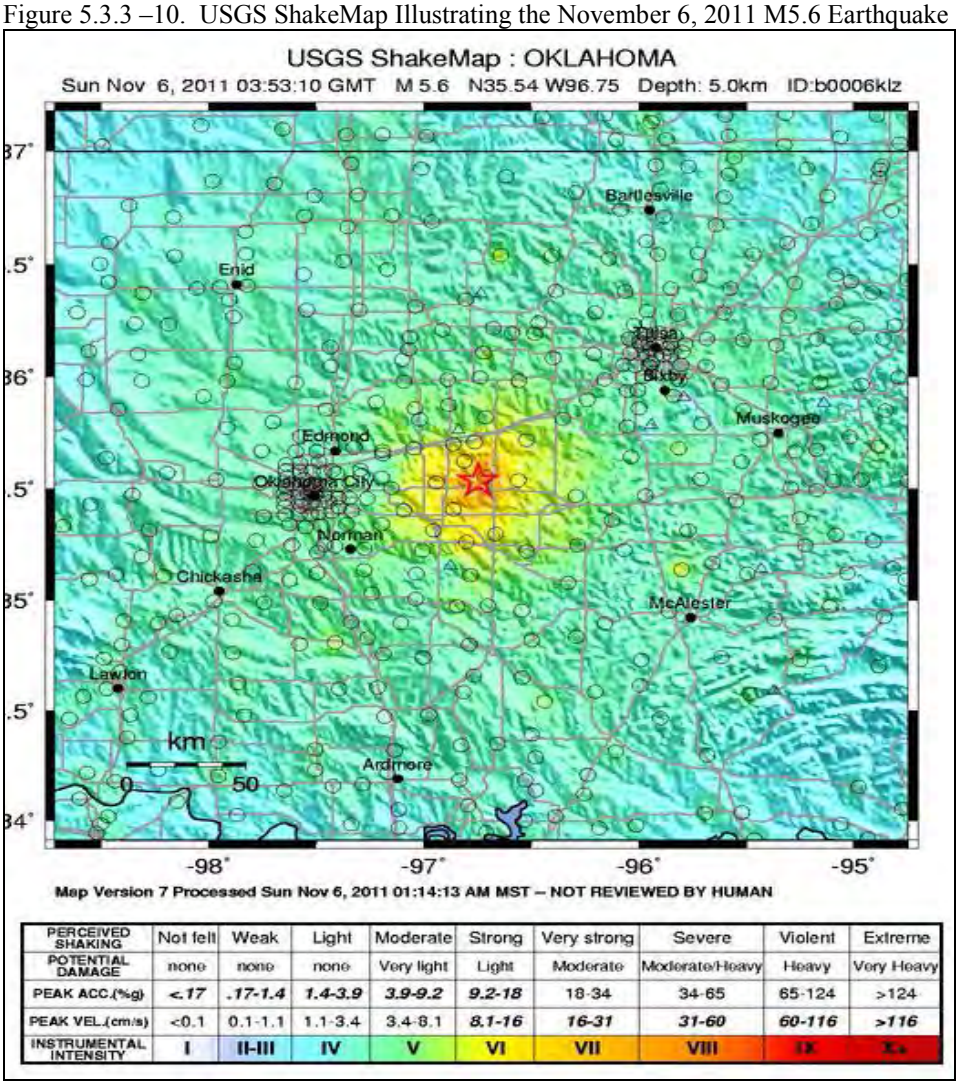


Source: OK State HMP, 2011

Previous Occurrences and Losses

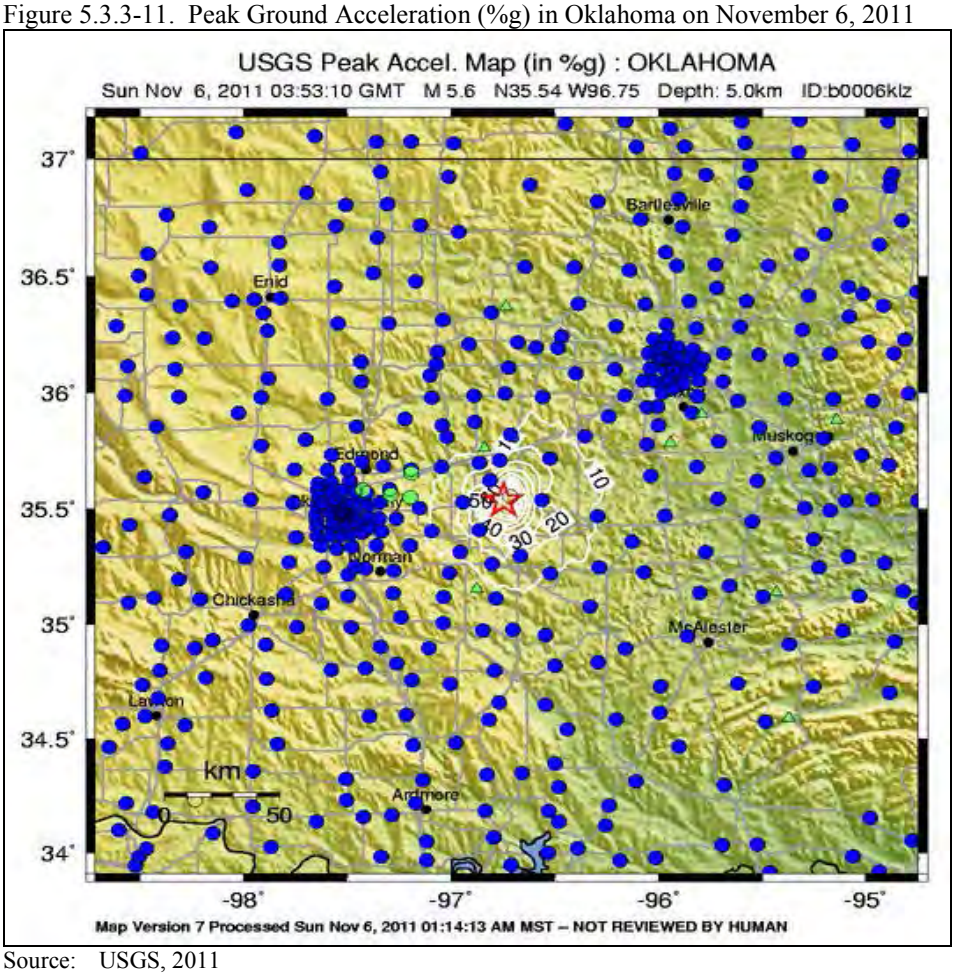
Currently, there are about 50 measurable earthquakes each year in Oklahoma with only a few of these having shaking strong enough to be felt. A total of 43 felt earthquakes in 2009 made this an exceptional year for seismic activity in Oklahoma. Twenty-seven of the felt earthquakes occurred in Oklahoma County, and another 7 were located in Lincoln County (OK State HMP, 2011). The shallow magnitude 4.7 and 5.6 earthquakes of November 5 and 6, 2011, are the largest events recorded during this period of increased seismicity (Figure 5.3.3-10). Additionally, the M5.6 quake is the largest quake to hit Oklahoma in modern times (Oklahoma Geological Survey, 2011).

Figure 5.3.3 –10. USGS ShakeMap Illustrating the November 6, 2011 M5.6 Earthquake



Source: USGS, 2011

Figure 5.3.3-11. Peak Ground Acceleration (%g) in Oklahoma on November 6, 2011



Source: USGS, 2011

According to the USGS and OGS, over 30 earthquakes have affected the State of Oklahoma between 1952 and 2012. Additional sources have noted other earthquake events in the State as well. Table 5.3.3-6 depicts these earthquake evets, with several of these events located in the vicinity of Oklahoma County.

Many sources provided historical information regarding previous occurrences and losses associated with earthquakes throughout the State of Oklahoma. Therefore, with so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the sources. Not all earthquake occurrences have been documented in this table.

Table 5.3.3-6. Earthquake History in Oklahoma between 1950 and 2012

Event Date / Name	County	Town	Size / General Magnitude	Losses / Impacts	Source(s)
April 9, 1952	Canadian	Concho	Approximately 5.7	Largest quake reported during the time. Caused slippage along the Nemaha fault. Moderate damage in Canadian, Oklahoma, and Kay Counties including toppled chimneys and smokestacks, cracked and loosened bricks on buildings, and broken windows and dishes. Slight damage reoprted from other towns in Oklahoma, kansas, Arkansas, Iowa, Missouri, Nebraska, and Texas.	OK HMP; Oklahoma Geological Survey; USGS
October 7, 1952	Hughes	Holdenville	N/A	Homes and buildings shook. Tremors were felt in Kingfisher, Oklahoma, and Tulsa Counties.	Oklahoma Geological Survey
March 17, 1953	Oklahoma	Edmond	N/A	Two earthquakes about an hour apart caused minor damage to a building foundation and plaster. Tremors were felt in Canadian, Oklahoma, and Grady Counties.	Oklahoma Geological Survey
February 16, 1956	Pushmataha	Antlers	N/A	No reference and/or no damage reported.	Oklahoma Geological Survey
April 2, 1956	Rogers	Catoosa	N/A	Buidings shook and objects fell. Minor effects were reported from other nearby towns.	Oklahoma Geological Survey
October 30, 1956	Pontotoc	Ada	4.1	Maximum intensity of VII was reported west of the Town of Catoosa (Rogers County), where a slippage of the formation caused an oil well to be shut down.	OK HMP; Oklahoma Geological Survey
June 15, 1959	Comanche	NE Faxon	4.0	No reference and/or no damage reported.	OK HMP
June 17, 1959	Latimer	Wilburton	4.2	Slight damage consisting of cracks in plaster, pavement, and a house foundation.	OK HMP; Oklahoma Geological Survey
April 27, 1961	N/A	N/A	4.1	No reference and/or no damage reported.	OK HMP
October 14, 1968	N/A	N/A	N/A	Minor damage at Durant (Bryon County) consisted of cracked walls and glass. Slight foreshocks were felt at Durant and October 10 and 11, 1968.	Oklahoma Geological Survey
May 2, 1969	Cimarron	N/A	4.5	The only reported damage consisted of cracked plaster in the Town of Wewoka (Seminole County). The quake was felt primarily in the eastern portion of the state.	Oklahoma Geological Survey
March 30, 1976	Kingfisher	N/A	2.7	No reference and/or no damage reported.	Oklahoma Geological Survey
December 8, 1987	Garvin	Lindsay	3.7	No reference and/or no damage reported.	Oklahoma Geological Survey
November 15, 1990	Garvin	Antioch	3.9	Largest earthquake in the state since 1987 that rattled windows. No death or injuries were reported.	SHMP; Oklahoma Geological Survey
January 18, 1995	Coal	Stonewall	4.2	No reference and/or no damage reported.	OK HMP

Event Date / Name	County	Town	Size / General Magnitude	Losses / Impacts	Source(s)
September 6, 1997	Comanche	NW Richards Spur	4.4	No reference and/or no damage reported.	OK HMP
April 28, 1998	Cimarron	Felt	4.2	No reference and/or no damage reported.	OK HMP
June 19, 2002	Atoka	Darwin	3.6	The first earthquake in the county in 26 years; felt in bordering towns of Texas and New Mexico.	Oklahoma Geological Survey
October 19, 2002	Garvin	Purdy	3.4	No reported damage or fatalities; only slight shaking of and rattling of dishes and windows. The earthuake was felt widely in Bryan and Atoka Counties.	Oklahoma Geological Survey; USGS
April 22, 2005	Choctaw	Hugo	3.0	No reference and/or no damage reported.	USGS
May 4, 2006	Carter	Ardmore	3.0	No reference and/or no damage reported.	USGS
May 27, 2007	Pittsburg	McAlester	3.6	No reference and/or no damage reported.	USGS
January 7, 2008	N/A	N/A	2.0	No reported damage or fatalities. One person felt the quake making it the smallest felt by humans. Garvein is the most active in the state when it comes to earthquakes, registering 319 tremblors since 1997.	Oklahoma Geological Survey
August 3, 2009	Oklahoma	Oklahoma City	3.4	No reference and/or no damage reported.	USGS
December 30, 2009	Lincoln	Sparks	2.4	No reference and/or no damage reported.	USGS
February 27, 2010	Cleveland	Norman	4.1	No reference and/or no damage reported.	OK HMP
October 13, 2010	Oklahoma	Oklahoma City	4.7	Minor damage, primarily to windows due to items falling from shelves. No fatalities were reported; however, EMSA reported two people required medical attention after suffering a fall. The quake was reportedly felt over the eastern 2/3rds of the state, mainly east of highway U.S. 281 and west of U.S. 269.	OK HMP
November 6, 2011	Lincoln	Prague	5.6	Largest earthquake to hit the state in modern times. Knocked pictures off walls and woke people and pets as it shook an area that stretched into Arkansas, Kansas, Missouri and Texas.	USGS; Huffington Post
March 16, 2012	Oklahoma	N/A	1.9	No reference and/or no damage reported.	Oklahoma Geological Survey
April 12, 2012	Oklahoma	Choctaw	1.7	No reference and/or no damage reported.	Oklahoma Geological Survey
April 23, 2012	Oklahoma	Harrah	1.8 – 2.2	No reference and/or no damage reported.	Oklahoma Geological Survey
April 26, 2012	Oklahoma	Choctaw	1.7 – 2.2	No reference and/or no damage reported.	Oklahoma Geological Survey
April 30, 2012	Oklahoma	Jones	1.9	No reference and/or no damage reported.	Oklahoma Geological Survey

Source(s): USGS 2012; Oklahoma Geological Survey 2012; Oklahoma State Hazard Mitigation Plan 2011; Huffington Post 2011.

N/A	Not Applicable/Not Available
OK HMP	Oklahoma State Hazard Mitigation Plan
USGS	U.S. Geological Survey

Historically, Oklahoma County has not experienced significant earthquakes. For this reason, buildings in the Oklahoma County area are not designed for major earthquakes and a major earthquake would result in heavy damage and casualties and would be devastating to the economy of the County and the State of Oklahoma. Increased seismic activity has broadened interest in researching the probability and severity of furture events in the local area; however, there is currently not a sufficient amount of data to presume the probability of future earthquakes and the monetary damages produced by such an event.

Probability of Future Events

Earthquake hazard maps illustrate the distribution of earthquake shaking levels that have a certain probability of occurring over a given time period. According to the USGS, in 2008, Oklahoma County had a PGA of 6-12% for earthquakes with a two-percent probability of occurring within 50 years.

According to the State of Oklahoma HMP, the State averages about 50 to 100 recorded earthquakes per year but only about one or two, on average, are felt and no damage estimates are available by facility. The probability of a future event of any significance along the Meers fault is still being debated by scientists (OK State HMP, 2011).

The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for earthquakes in the Planning Area is considered "1 - Unlikely" (Event is possible within the next ten years. Event has a 1 in 10 year's chance of occurring). It is anticipated that Oklahoma County will continue to experience impacts from earthquakes that may affect the general building stock, local economy, and may induce secondary hazards such as fire ignition and utility failure.

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the earthquake hazard, the entire County has been identified as the exposed hazard area. Therefore, all assets in Oklahoma County (population, structures, critical facilities and lifelines), as described in the Regional Profile (Section 4), are vulnerable. The following section includes an evaluation and estimation of the potential impact of the earthquake hazard on the Oklahoma County including the following:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health of residents, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

Earthquakes usually occur without warning and can impact areas a great distance from their point of origin. The extent of damage depends on the density of population and building and infrastructure construction in the area shaken by the quake. Some areas may be more vulnerable than others based on soil type, the age of the buildings and building codes in place.

In summary, the entire population and general building stock inventory of Oklahoma County is at risk of being damaged or experiencing losses due to impacts of an earthquake. The impacts on population, existing structures, critical facilities and the economy within the County and participating municipalites are presented below for three probabilistic earthquake events, the 100-year, 500- and 2,500-year mean return periods (MRP), in addition to annualized losses; following a summary of the data and methodology used.

Data and Methodology

A probabilistic assessment was conducted for Oklahoma County for the 100-, 500- and 2,500-year MRPs through a modified Level 1 analysis in HAZUS-MH 2.0 to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information from historic earthquakes and inferred faults, locations and magnitudes, and computes the probable ground shaking levels that may be experienced during a recurrence period by Census tract. Probabilistic estimates are best for urban planning, land use, zoning and seismic building code regulations (NYCEM, 2003). The default assumption is a magnitude 7 earthquake for all return periods.

In addition, the April 9, 1952 El Reno earthquake was run as an historic earthquake to quantify estimated potential losses with today's current built environment. The historic scenario was run with the following parameters: magnitude 5.1, fault depth 10 kilometers, epicenter location of 35.52° N, 97.85° W, and the central and eastern U.S. attenuation function.

Please note that the output from the HAZUS 2.0 earthquake model is by Census tract. Census tracts do not exactly follow municipal boundaries. In some cases, there is more than one municipality per Census tract. Therefore, estimated potential losses are provided by grouping municipalities together based on how the Census tracts are delineated. Although this HMP does not include Oklahoma City, select Census tracts overlap both HMP participants and the City and results are reported accordingly.

National Earthquake Hazard Reduction Potential (NEHRP) soil classifications were not available for Oklahoma County. Therefore, the default soil type D was used across Oklahoma County in the HAZUS-MH model.

In addition to the probabilistic and historic scenarios mentioned, an annualized loss run was conducted in HAZUS 2.0 to estimate the annualized general building stock dollar losses for Oklahoma County. The annualized loss methodology combines the estimated losses associated with ground shaking for eight return periods: 100, 250, 500, 750, 1,000, 1,500, 2,000, 2,500-year, which are based on values from the USGS seismic probabilistic curves. The aggregation of these losses and exceedance probabilities are then annualized, providing, in essence, the estimated cost of earthquakes to the study region (2011 Draft NYS HMP).

As noted in the HAZUS-MH Earthquake User Manual 'Uncertainties are inherent in any loss estimation methodology. They arise in part from incomplete scientific knowledge concerning earthquakes and their effects upon buildings and facilities. They also result form the approximations and simplifications that are necessary for comprehensive analyses. Incomplete or inaccurate inventories of the built environment, demographics and economic parameters add to the uncertainty. These factors can result in a range of uncertainly in loss estimates produced by the HAZUS Earthquake Model, possibly at best a factor of two or more.' However, HAZUS's potential loss estimates are acceptable for the purposes of this HMP.

Impact on Life, Health and Safety

The entire population of Oklahoma County is potentially exposed to direct and indirect impacts from earthquakes. The degree of exposure is dependent on many factors, including the age and construction type of buildings and the soil type buildings are constructed on. The impact of earthquakes on life, health and safety is dependent upon the severity of the event. Risk to public safety and loss of life from an earthquake in the County is minimal with higher risk occurring in buildings as a result of damage to the structure, or people walking below building ornamentation and chimneys that may be shaken loose and fall as a result of the quake. Business interruption may prevent people from working, road closures could isolate populations and loss of functions of utilities could impact populations that may not have suffered direct damage from the event itself.

Populations considered most vulnerable include the elderly (persons over the age of 65) and individuals living below the Census poverty threshold. These socially vulnerable populations are most susceptible, based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing.

Residents may be displaced or require temporary to long-term sheltering due to the event. The number of people requiring shelter is generally less than the number displaced as some displaced persons use hotels or stay with family or friends following a disaster event. Table 5.3.3-7 summarizes the population HAZUS-MH 2.0 estimates will be displaced or will require short-term sheltering as a result of the 100-, 500- and 2,500-year MRP and historic 1952 earthquake events.

Table 5.3.3-7. Estimated Sheltering Needs for Oklahoma County

Scenario	Displaced Households	People Requiring Short-Term Shelter
100-Year Earthquake	0	0
500-Year Earthquake	57	37

Scenario	Displaced Households	People Requiring Short-Term Shelter
2,500-Year Earthquake	919	597
El Reno 1952 Earthquake	48	31

Source: HAZUS-MH 2.0
Please note these results include portions of Oklahoma City.

According to the 1999-2003 New York City Area Consortium for Earthquake Loss Mitigation (NYCEM) Summary Report (*Earthquake Risks and Mitigation in the New York / New Jersey / Connecticut Region*), there is a strong correlation between structural building damage and the number of injuries and casualties from an earthquake event. HAZUS-MH 2.0 estimates the number of people that may potentially be injured and/or killed by an earthquake depending upon the time of day the event occurs. These estimates are provided for three times of day (2:00am, 2:00pm and 5:00pm), representing the periods of the day that different sectors of the community are at their peak. The 2:00am estimate considers the residential occupancy at its maximum, the 2:00pm estimate considers the educational, commercial and industrial sector at their maximum and the 5:00pm estimate represents peak commuter time.

No injuries or casualties are estimated for the 100-year event. Tables 5.3.3-8 and 5.3.3-9 summarize the injuries and casualties estimated for the 500-year and 2,500-year MRP and historic 1952 earthquake events (Table 5.3.3-10).

Table 5.3.3-8. Estimated Number of Injuries and Casualties from the 500-Year MRP Earthquake Event

Level of Severity	Time of Day		
	2:00 AM	2:00 PM	5:00 PM
Injuries	90	88	77
Hospitalization	14	13	12
Casualties	2	2	2

Source: HAZUS-MH 2.0
Please note these results include portions of Oklahoma City.

Table 5.3.3-9. Estimated Number of Injuries and Casualties from the 2,500-Year MRP Earthquake Event

Level of Severity	Time of Day		
	2:00 AM	2:00 PM	5:00 PM
Injuries	1,040	1,189	994
Hospitalization	236	269	233
Casualties	51	56	48

Source: HAZUS-MH 2.0
Please note these results include portions of Oklahoma City.

Table 5.3.3-10. Estimated Number of Injuries and Casualties from the Historic El Reno 1952 Earthquake Event

Level of Severity	Time of Day		
	2:00 AM	2:00 PM	5:00 PM
Injuries	71	65	58
Hospitalization	11	10	9
Casualties	2	2	1

Source: HAZUS-MH 2.0
Please note these results include portions of Oklahoma City.

Earthquakes can cause secondary hazard events such as fires. No fires are anticipated as a result of the 100-, 500- and 2,500-year and historic 1952 events.

Impact on General Building Stock

After considering the population exposed to the earthquake hazard, the value of general building stock exposed to and damaged by 100-, 500- and 2,500-year MRP earthquake events was evaluated. In addition, annualized losses were calculated using HAZUS 2.0. Annualized losses are useful for mitigation planning because they provide a baseline upon which to 1) compare the risk of one hazard across multiple jurisdictions and 2) compare the degree of risk of all hazards for each participating jurisdiction. Please note that annualized loss does not predict what losses will occur in any particular year.

The entire County's general building stock is considered at risk and exposed to this hazard. Refer to Table 4-X in the County Profile (Section 4) for general building stock data replacement value statistics (structure and contents). According to the State of Oklahoma HMP, buildings with foundations resting on unconsolidated landfill and other unstable soil, and mobile homes and trailers that are not tied to their foundations are at a higher risk because they can be shaken off their mountings during an earthquake. In addition, bridges and highway overpasses which are currently undergoing upgrades or replacement are also highly vulnearable (OK DEM, 2011).

The HAZUS-MH 2.0 model is based on the best available earthquake science. HAZUS-MH 2.0 methodology and model were used to analyze the earthquake hazard for the general building stock for Oklahoma County. See Figures 5.3.3-3 through 5.3.3-5 earlier in this profile that illustrate the geographic distribution of PGA (g) across Oklahoma County for 100-, 500- and 2,500-year MRP events at the Census-tract level.

A building's construction determines how well it can withstand the force of an earthquake. According to NYCEM, un-reinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward, whereas steel and wood buildings absorb more of the earthquake's energy. Additional attributes that contribute to a building's capability to withstand an earthquake's force include its age, number of stories and quality of construction. HAZUS-MH considers building construction and the age of buildings as part of the analysis. Because the default general building stock was used for this HAZUS-MH analysis, the default building ages and building types already incorporated into the inventory were used.

The HAZUS 2.0 model estimates the value of the exposed building stock and the loss (in terms of damage to the exposed stock). Please note that the output from the HAZUS 2.0 earthquake model is by Census tract. Census tracts do not exactly follow municipal boundaries. In some cases, there is more than one municipality per Census Tract. Therefore, estimated potential losses are provided by grouping municipalities together based on how the Census tracts are delineated. Although this HMP does not include Oklahoma City, select Census tracts overlap both HMP participants and the City and results are reported accordingly.

Using HAZUS 2.0, probabilistic models were run for 100-, 500- and 2,500-year MRP earthquake events. In addition, a probabilistic model was run to estimate annualized dollar losses for Oklahoma County, and a historic scenario was run for the 1952 El Reno earthquake (magnitude 5.1, fault depth 10, 35.52° N, 97.85° W, central and eastern U.S. attenuation function). The estimated annualized losses are approximately $970,642 per year. Table 5.3.3-11 summarizes the damage estimated for these probabilistic earthquake events. Damage loss estimates include structural and non-structural damage to the building and loss of contents.

Table 5.3.3-11. Summary of Estimated Earthquake General Building Stock Losses for Oklahoma County

Scenario	Total * (Buildings + Contents)	Residential (Buildings + Contents)	Commercial (Buildings + Contents)
100-Year MRP Probabilistic	$0	$0	$0
500-Year MRP Probabilistic	$63,632,940	$48,122,068	$1,203,479
2,500-Year MRP Probabilistic	$883,830,446	$649,498,205	$161,529,453
El Reno 1952 **	$119,659,391	$60,780,710	$13,168,224
Annualized Loss	$970,642	$689,043	$194,507

Source: HAZUS-MH 2.0
Notes: The HAZUS-MH earthquake model results are reported by Census Tract. In some cases, there is more than one municipality per Census Tract and thefefore results include portions of Oklahoma City.
*Total is sum of damages for all occupancy classes (residential, commercial, industrial, agricultural, educational, religious and government).
**According to the HAZUS manual, there is considerable uncertainty related to the characteristics of ground motion in the Eastern U.S. The embedded attenuation relations in the Earthquake Model, which are those commonly recommended for design, tend to be conservative. Hence use of these relations may lead to overestimation of losses in this region, both for scenario events and when using probabilistic ground motion.

Potential building damage was evaluated by HAZUS-MH 2.0 across the following damage categories (none, slight, moderate, extensive and complete). Table 5.3.3-12 provides definitions of these five categories of damage for a light wood-framed building; definitions for other building types are included in HAZUS-MH technical manual documentation.

Table 5.3.3-12. Example of Structural Damage State Definitions for a Light Wood-Framed Building

Damage Category	Description
Slight	Small plaster or gypsum-board cracks at corners of door and window openings and wall-ceiling intersections; small cracks in masonry chimneys and masonry veneer.
Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.
Extensive	Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates and/or slippage of structure over foundations; partial collapse of room-over-garage or other soft-story configurations.
Complete	Structure may have large permanent lateral displacement, may collapse, or be in imminent danger of collapse due to cripple wall failure or the failure of the lateral load resisting system; some structures may slip and fall off the foundations; large foundation cracks.

Source: HAZUS-MH Technical Manual

For the 500-year MRP event, HAZUS-MH estimates that approximately two-percent of the buildings in the region will be at least moderately damaged. HAZUS-MH also estimates 59 buildings that will be damaged beyond repair. A majoriy of these buildings are residential structures constructed of unreinforced masonry.

For the 2,500-year MRP event, HAZUS-MH estimates greater than 1,500 buildings will be damaged beyond repair, and of these buildings 85% are residential building. A majoriy of these buildings (approximately 84%) are constructed of unreinforced masonry. HAZUS-MH estimates greater than 14-percent of the buildings will at least be moderately damaged.

As noted throughout this vulnerability assessment, these values include portions of Oklahoma County due to the manner in which the Census tracts are delineated.

Residential and commercial buildings account for most of the damage for earthquake events. This is likely because they comprise the majority of the building inventory.

Impact on Critical Facilities

After considering the general building stock exposed to, and damaged by, 100-, 500- and 2,500-year MRP earthquake events, critical facilities were evaluated. The estimated damages as a result of the historic 1952 earthquake event are similar to that of the 500-year MRP event and are therefore not discussed further. All critical facilities (essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities and user-defined facilities) in Oklahoma County are considered exposed and vulnerable to the earthquake hazard. Refer to subsection "Critical Facilities" in Section 4 (County Profile) of this Plan for a complete inventory of critical facilities.

HAZUS-MH 2.0 estimates the probability that critical facilities may sustain damage as a result of 100-, 500- and 2,500-year MRP earthquake events. Additionally, HAZUS-MH estimates percent functionality for each facility days after the event. For the 100-Year MRP event, HAZUS-MH 2.0 estimates it is 100% probable that emergency facilities (police, fire, EMS and medical facilities), schools and specific facilities identified by the County as critical (i.e., user-defined facilities such shelters, municipal buildings, etc) will not experience any structural damage. These facilities are estimated to be 100% functional on day one of the 100-year MRP earthquake event. Therefore, the impact to critical facilities is not significant for the 100-year event.

Tables 5.3.3-13 and 5.3.3-14 list the probability of critical facilities sustaining the damage category as defined by the column heading and percent functionality after the event for the 500-year and 2,500-year MRP earthquake events.

Table 5.3.3-13. Estimated Damage and Loss of Functionality for Critical Facilities in Oklahoma County for the 500-Year MRP Earthquake Event

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Arcadia City Hall	Arcadia (C)	User Defined	92.7	5.2	1.8	0.2	0	92.7	97.8
APOLLO ES	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
BETHANY HS	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
BETHANY MS	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
EARL HARRIS ES	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
CHILDREN'S CTR	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
SNU SCHOOL FOR CHILDREN	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
BETHANY MONTESSORI	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
Southern Nazarene University	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
SW College Of Christian Min.	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
LAKE PARK ES	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
OVERHOLSER ES	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
BETHANY CHRISTIAN ACADEMY	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
WESTERN OAKS MS	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
WESTERN OAKS ES	Bethany (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3
Bethany Fire/Police Dispatch	Bethany (C)	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
Bethany Public Schools Complex	Bethany (C)	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
Bethany City Hall	Bethany (C)	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
Western Oaks School Complex	Bethany (C)	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
Choctaw Police Dept	Choctaw (C)	Police	92.3	5.5	2	0.3	0	92.2	97.6
Choctaw Police Dept	Choctaw (C)	Police	92.3	5.5	2	0.3	0	92.2	97.6
Choctaw Fire Department	Choctaw (C)	Fire	92.3	5.5	2	0.3	0	92.2	97.6
JAMES GRIFFITH IES	Choctaw (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
NICOMA PARK IES	Choctaw (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
NICOMA PARK JHS	Choctaw (C)	School	92.1	5.6	2	0.3	0	92	97.5
CHOCTAW ES	Choctaw (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
CHOCTAW HS	Choctaw (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
CHOCTAW JHS	Choctaw (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
L. W. WESTFALL ES	Choctaw (C)	School	92.3	5.5	2	0.3	0	92.2	97.6

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
INDIAN MERIDIAN ES	Choctaw (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
Choctaw City Hall	Choctaw (C)	User Defined	92.3	5.5	2	0.3	0	92.2	97.7
Del City Police Department	Del City (C)	Police	91.9	5.7	2.1	0.3	0	91.8	97.4
Del City Fire Department	Del City (C)	Fire	91.9	5.7	2.1	0.3	0	91.8	97.4
TOWNSEND ES	Del City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
CHRISTIAN HERITAGE ACADEMY	Del City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Del City High School	Del City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Del Crest Jr. High	Del City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Kerr Jr. High School	Del City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Del City City Hall	Del City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Public Works/Fleet Maintenance	Del City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
City Hall	Del City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Edmond Medical Center	Edmond (C)	Medical	97.9	1.7	0.4	0	0	97.9	99.5
Police	Edmond (C)	Police	92.3	5.5	2	0.3	0	92.2	97.6
Fire Station #1	Edmond (C)	Fire	92.5	5.3	1.9	0.2	0	92.4	97.6
Fire Station #4	Edmond (C)	Fire	92.5	5.3	1.9	0.2	0	92.4	97.6
Fire Station #2	Edmond (C)	Fire	92.3	5.5	2	0.3	0	92.2	97.6
Fire Station #3	Edmond (C)	Fire	92.3	5.5	2	0.3	0	92.2	97.6
Fire Station #5	Edmond (C)	Fire	92.7	5.2	1.8	0.2	0	92.7	97.7
Fire Dept Apparatus Storage Bdg	Edmond (C)	Fire	92.7	5.2	1.8	0.2	0	92.7	97.7
Edmond Civil Defense	Edmond (C)	EOC	92.3	5.5	2	0.3	0	92.2	97.6
SUNSET ES	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
SEQUOYAH MS	Edmond (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
RUSSELL DOUGHERTY ES	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
NORTHERN HILLS ES	Edmond (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
JOHN ROSS ES	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
NORTH HS	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
PRAIRIE VALE ES	Edmond (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
CROSS TIMBERS ES	Edmond (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
CHEYENNE MS	Edmond (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
SANTA FE HS	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
CIMARRON MS	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
MEMORIAL HS	Edmond (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
ORVIS RISNER ES	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
DEER CREEK ES	Edmond (C)	School	92.1	5.6	2	0.3	0	92	97.5
DEER CREEK HS	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
DEER CREEK MS	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
ST ELIZABETH ANN SETON CATHOLI	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
OKLAHOMA CHRISTIAN SCHOOL	Edmond (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
ST MARYS EPISCOPAL SCHOOL	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
HOLY TRINITY LUTH PRE-SCHOOL	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
OKLAHOMA CHRISTIAN ACADEMY	Edmond (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
FIRST PRESBYTERIAN ECP	Edmond (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
CHISHOLM ES	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
CLEGERN ES	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
WILL ROGERS ES	Edmond (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
CENTRAL MS	Edmond (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
IDA FREEMAN ES	Edmond (C)	School	92.3	5.5	2	0.3	0	92.2	97.6
University of Central Oklahoma	Edmond (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
MAC - Senior Center	Edmond (C)	User Defined	92.5	5.3	1.9	0.2	0	92.4	97.7
PSC Admin Building	Edmond (C)	User Defined	92.7	5.2	1.8	0.2	0	92.7	97.8
PSC OPs Building	Edmond (C)	User Defined	92.7	5.2	1.8	0.2	0	92.7	97.8
PSC OPs Yard	Edmond (C)	User Defined	92.7	5.2	1.8	0.2	0	92.7	97.8
XTimbers Animal Welfare	Edmond (C)	User Defined	92.7	5.2	1.8	0.2	0	92.7	97.8
City First	Edmond (C)	User Defined	92.3	5.5	2	0.3	0	92.2	97.7
Administration Building	Edmond (C)	User Defined	92.3	5.5	2	0.3	0	92.2	97.7
Municipal Court Building	Edmond (C)	User Defined	92.3	5.5	2	0.3	0	92.2	97.7
Council Chambers	Edmond (C)	User Defined	92.3	5.5	2	0.3	0	92.2	97.7
Public Works Authority	Edmond (C)	User Defined	92.3	5.5	2	0.3	0	92.2	97.7
Vacant Animal Control 3rd St	Edmond (C)	User Defined	92.3	5.5	2	0.3	0	92.2	97.7

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Edmond City Hall & Administration	Edmond (C)	User Defined	92.3	5.5	2	0.3	0	92.2	97.7
Forest Park City Hall	Forest Park (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Forest Park Police Dept	Forest Park (T)	Police	91.9	5.7	2.1	0.3	0	91.8	97.4
Town of Forest Park Fire Dept.	Forest Park (T)	Fire	91.9	5.7	2.1	0.3	0	91.8	97.4
RUSSELL BABB ES	Harrah (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
HARRAH HS	Harrah (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
HARRAH MS	Harrah (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
VIRGINIA SMITH ES	Harrah (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
CLARA REYNOLDS ES	Harrah (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
HARRAH JHS	Harrah (C)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
OKLAHOMA ACADEMY	Harrah (C)	School	92.7	5.2	1.8	0.2	0	92.7	97.7
Jones Police Dept	Jones (C)	Police	92.3	5.5	2	0.3	0	92.2	97.6
Jones Fire Dept	Jones (C)	Fire	92.3	5.5	2	0.3	0	92.2	97.6
Emergency Operations Center	Jones (C)	EOC	92.3	5.5	2	0.3	0	92.2	97.6
Town Hall/Police Dept.	Jones (C)	User Defined	92.3	5.5	2	0.3	0	92.2	97.7
Jones City Hall	Jones (C)	User Defined	92.3	5.5	2	0.3	0	92.2	97.7
Public Works Building	Jones (C)	User Defined	92.3	5.5	2	0.3	0	92.2	97.7
Jones Fire Department	Jones (T)	Fire	92.3	5.5	2	0.3	0	92.2	97.6
JONES HS	Jones (T)	School	92.3	5.5	2	0.3	0	92.2	97.6
JONES ES	Jones (T)	School	92.3	5.5	2	0.3	0	92.2	97.6
JONES MS	Jones (T)	School	92.5	5.3	1.9	0.2	0	92.4	97.6
Luther City Hall/Police Station	Luther (C)	Police	92.9	5.1	1.8	0.2	0	92.9	97.8
Luther City Hall	Luther (C)	User Defined	92.9	5.1	1.8	0.2	0	92.9	97.9
Luther Mill And Farm Supply	Luther (C)	User Defined	92.9	5.1	1.8	0.2	0	92.9	97.9
Hickory Hills Volunteer Fire Department	Luther (T)	Fire	92.7	5.2	1.8	0.2	0	92.7	97.7
LUTHER ES	Luther (T)	School	92.9	5.1	1.8	0.2	0	92.9	97.8
LUTHER HS	Luther (T)	School	92.9	5.1	1.8	0.2	0	92.9	97.8
LUTHER MS	Luther (T)	School	92.9	5.1	1.8	0.2	0	92.9	97.8
Midwest Regional Medical Center	Midwest City (C)	Medical	97.6	1.9	0.5	0	0	97.5	99.4
Renaissance Medical Center	Midwest City (C)	Medical	97.6	1.9	0.5	0	0	97.5	99.4

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Fire Station 3	Midwest City (C)	Fire	92.1	5.6	2	0.3	0	92	97.5
Fire Station 2	Midwest City (C)	Fire	91.9	5.7	2.1	0.3	0	91.8	97.4
Fire Station 1	Midwest City (C)	Fire	92.1	5.6	2	0.3	0	92	97.5
Fire Station 5	Midwest City (C)	Fire	92.1	5.6	2	0.3	0	92	97.5
Fire Station 4	Midwest City (C)	Fire	92.1	5.6	2	0.3	0	92	97.5
EOC At Public Works	Midwest City (C)	EOC	92.1	5.6	2	0.3	0	92	97.5
Mid-Del Technology Center	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Rose State College	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
St Philip Neri Catholic School	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Crutcho Elementary School	Midwest City (C)	School	92.1	5.6	2	0.3	0	92	97.5
Telstar Elementary School	Midwest City (C)	School	92.1	5.6	2	0.3	0	92	97.5
Cleveland Elementary School	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Ridgecrest Elementary School	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Monroney Middle School	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Steed Elementary School	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Country Estates Elementary School	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Midwest City High School	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Soldier Creek Elementary School	Midwest City (C)	School	92.1	5.6	2	0.3	0	92	97.5
Mid-Del Schools Administration	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Carl Albert High School	Midwest City (C)	School	92.1	5.6	2	0.3	0	92	97.5
Eastside Elementary School	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Jarman Middle School	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Carl Albert Middle School	Midwest City (C)	School	92.1	5.6	2	0.3	0	92	97.5
J.E. Sutton Field House	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Willow Brook Elementary	Midwest City (C)	School	92.1	5.6	2	0.3	0	92	97.5
Mid-Del School District Enroll Ctr	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Traub Elementary School	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Sooner Rose Elementary School	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
TRAUB ES	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
SOLDIER CREEK ES	Midwest City (C)	School	92.1	5.6	2	0.3	0	92	97.5

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
STEED ES	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
SOONER-ROSE ES	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
FAITH ACADEMY CHRISTIAN SCHOOL	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
GOOD SHEPHERD LUTHERAN SCHOOL	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
ST PHILIP NERI	Midwest City (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Legacy Corner Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Meadow Glen Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Silverwood Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Fairfax Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Midwest Territory Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Huntington Place Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Midwest Manor Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Villa Gardens Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Calico Corners Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Yorkshire Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Spring Tree Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
East Oaks Village Senior Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Chestnut Square Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Raintree Meadow Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Planet Plaza Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Willow Creek Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Rolling Oaks Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Legacy Corner Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Midwest City Depot Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Coachlight Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Woodside Village Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Parkview Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Orchard Springs Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
East Oaks Village Senior Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Meadow Ridge Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Concord Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Meadowood Village Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Center Place Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Center Place Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Center Place Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Center Place Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Center Place Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Center Place Apartments	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Eden Cove Apartments	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Becker's	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Firestone	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Vacant	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Foam Brite Car Wash	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
First National Bank of Midwest City	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Arvest	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
First Fidelity Bank	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
IBC Bank	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Hudiburg Toyota/Chevrolet/Pontiac/GMC	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Joe Cooper Ford	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
David Stanley Dodge	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
La Petite Child Care	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
La Petite	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Eastside Church of Christ	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Douglas Boulevard United Methodist Churc	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Neighborhood Missionary Baptist Church	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
St Mark Lutheran Church	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Church of Jesus Christ of LDS	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
St Matthew's Methodist Church	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Ridgecrest Church of Christ	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Good Shepherd Lutheran Church	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Meadowood Baptist Church	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Free Methodist Church of Midwest City	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Cornerstone Family Church	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
City Hall	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Reed Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Oklahoma County Sheriff Department	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Oklahoma County Training Facility	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
MWC Fire Administration	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
YMCA	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
All American Fitness Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Shell	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
AM-PM	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Valero	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Gas Station- name unknown	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Gas Station- name unknown	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Gas Station- name unknown	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Shell	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Future Walmart Market	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Crest Foods	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Aldi	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Buy For Less	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Crest Food Store	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Regional Medical Office Complex	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Parklawn Plaza	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Walgreens	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Integris Prohealth Physicians	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Midwest City Medical Group	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Comfort Inn & Suites East	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Hampton Inn	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Studio 6	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Super 8	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Motel 6	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Best Western	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Holiday Inn Express	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Sheraton Midwest City Hotel	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Hawthorn Suites	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Boeing Aero Space	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
United Technologies Corp	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Bags, Inc.	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Sooner Tank LLC	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Plasma Pheresis Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Century Martial Arts	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Chromalloy Gas Turbine Corporation	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
MWC Metropolitan Library	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
MWC Senior Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
MWC Community Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
MWC Police Firing Range	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
MWC Animal Shelter	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
MWC Public Works	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Welcome Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Autumn House Retirement Home	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Alterra Sterling House of Midwest City	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Arbor House Assisted Living	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Midwest City Nursing Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Buena Vista Care and Rehabilitation	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Sienna Extended Care and Rehab	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Midwest Square Office Park	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Continental Square	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Oklahoma Journal Building	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Woodlands Office Park	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Cherry Center	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Rose Rock Center	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Middle Pointe	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Griffin Plaza	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
U.S. Post Office	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Heritage Park Mall	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Sam's Wholesale Club	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
MRMC Accessory Building	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Vacant	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Golden Goose Flea Market	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Anthony's TV & Appliance, Inc.	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Golden Corral	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Napa Auto Parts	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Applebee's	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Auto Zone	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Furniture Gallery	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Chilli's	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Steak 'n Shake	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Walmart	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Golden Palace	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
McDonald's	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Old Chicago	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Logan's Roadhouse	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Santa Fe Steak House	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Poblano's	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Henry Hudson's	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Rib Crib	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Chick-Fil-A	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Campus Corner Shopping Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Caspian Plaza	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Unnamed Shopping Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Heritage Plaza Shopping Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Town and Country Shopping Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Holiday Square Shopping Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Decker Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Gateway Plaza Shopping Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Uptown Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Lockheed Shopping Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Shopping Center (unnamed)	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Shopping Center (unnamed)	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Kenwood Plaza	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Town Center Shops	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Midwest Crossing	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Boulevard Market Place	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Eastgate Shopping Center	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
23 Post Plaza	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Andrew Plaza	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Village Oaks Plaza	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Regional Square Shopping Center	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Orchard Plaza Shopping Center	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Lowe's	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Best Buy	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
JC Penney	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Target	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Kohl's	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Marshall's	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Lane Bryant	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Town Center Shops	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Hibbet	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Petsmart	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Rue 21	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Catherine's	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Ulta	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Cheddar's	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Jack in the Box	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Panda Express	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Sonic	Midwest City (C)	User Defined	92.1	5.6	2	0.3	0	92	97.6
Home Depot	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Shopping Center (unnamed)	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Chromalloy Oklahoma	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Midwest City City Hall	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Tinker Air Force Base	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Emergency Ops Ctr - City Hall	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Reed Conference Center	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Autumn House bldg 1	Midwest City (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
NICHOLS HILLS ES	Nichols Hills (C)	School	91.9	5.7	2.1	0.3	0	91.8	97.4
Nichols Hills City Hall	Nichols Hills (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Nichols Hills Public Works	Nichols Hills (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
City Hall Complex	Nichols Hills (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Nicoma Park City Hall	Nicoma Park C)	User Defined	92.3	5.5	2	0.3	0	92.2	97.7
Plaza North	Nichols Hills (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Plaza South	Nichols Hills (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Western Business District	Nichols Hills (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Oklahoma City Golf & Country Club	Nichols Hills (C)	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Nicoma Park Police Dept	Nicoma Park (C)	Police	92.3	5.5	2	0.3	0	92.2	97.6
Nicoma Park Fire Department	Nicoma Park (C)	Fire	92.3	5.5	2	0.3	0	92.2	97.6
NICOMA PARK ES	Nicoma Park (C)	School	92.1	5.6	2	0.3	0	92	97.5
Deaconess At Bethany Hospital	Oklahoma County	Medical	97.4	2	0.5	0	0	97.4	99.3
OKC Police Headquarters	Oklahoma County	Police	91.7	5.9	2.2	0.3	0	91.6	97.3
Emsa Ambulance Headquarters	Oklahoma County	Fire	91.9	5.7	2.1	0.3	0	91.8	97.4

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Oklahoma City Fire Station 5	Oklahoma County	Fire	91.9	5.7	2.1	0.3	0	91.8	97.4
OKC Fire Headquarters	Oklahoma County	Fire	91.7	5.9	2.2	0.3	0	91.6	97.3
Federal Reserve Bank	Oklahoma County	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
FAA Mike Monroney Center	Oklahoma County	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
U.S. Filter--Deer Creek Wwtp	Oklahoma County	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
Oklahoma City City Hall	Oklahoma County	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
Oklahoma Co. Courthouse & Annex	Oklahoma County	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
Oklahoma Co. Detention Center	Oklahoma County	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
Spencer City Hall	Oklahoma County	User Defined	92.1	5.6	2	0.3	0	92	97.6
State Capital	Oklahoma County	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
The Village City Hall	Oklahoma County	User Defined	92.1	5.6	2	0.3	0	92	97.6
Tinker Air Force Base	Oklahoma County	User Defined	91.5	6	2.2	0.3	0	91.4	97.4
Valley Brook City Hall	Oklahoma County	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
U.S. Filter--Chisholm Creek Wwtp	Oklahoma County	User Defined	92.5	5.3	1.9	0.2	0	92.4	97.7
General Motors Plant	Oklahoma County	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
Oklahoma Publishing Company	Oklahoma County	User Defined	91.9	5.7	2.1	0.3	0	91.8	97.5
City Hall	Oklahoma County	User Defined	92.7	5.2	1.8	0.2	0	92.7	97.8
Warr Acres City Hall	Oklahoma County	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
Spencer Police Dept	Spencer (C)	Police	92.1	5.6	2	0.3	0	92	97.5
Spencer Fire Department	Spencer (C)	Fire	92.1	5.6	2	0.3	0	92	97.5
ROGERS MS	Spencer (C)	School	92.1	5.6	2	0.3	0	92	97.5
SPENCER ES	Spencer (C)	School	92.1	5.6	2	0.3	0	92	97.5
STAR SPENCER HS	Spencer (C)	School	92.1	5.6	2	0.3	0	92	97.5
GREEN PASTURES ES	Spencer (C)	School	92.1	5.6	2	0.3	0	92	97.5
SPENCER ROAD CHRISTIAN SCHOOL	Spencer (C)	School	92.1	5.6	2	0.3	0	92	97.5
Village Police Dept	The Village (C)	Police	92.1	5.6	2	0.3	0	92	97.5
The Village Fire Department	The Village (C)	Fire	91.9	5.7	2.1	0.3	0	91.8	97.4
Valley Brook Police Department	Valley Brook (T)	Police	91.7	5.9	2.2	0.3	0	91.6	97.3
Valley Brook City Hall	Valley Brook (T)	User Defined	91.7	5.9	2.2	0.3	0	91.6	97.4
Warr Acres Police Dept	Warr Acres (C)	Police	91.7	5.9	2.2	0.3	0	91.6	97.3

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Warr Acres Fire Department	Warr Acres (C)	Fire	91.7	5.9	2.2	0.3	0	91.6	97.3
CENTRAL ES	Warr Acres (C)	School	91.7	5.9	2.2	0.3	0	91.6	97.3

Source: HAZUS-MH 2.0

Table 5.3.3-14. Estimated Damage and Loss of Functionality for Critical Facilities in Oklahoma County for the 2,500-Year MRP Earthquake Event

2,500-Year MRP Event											
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Arcadia City Hall	Arcadia (C)	User Defined	63.3	20.1	12.8	3.3	0.5	63.3	83.4	96.2
APOLLO ES	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
BETHANY HS	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
BETHANY MS	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
EARL HARRIS ES	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
CHILDREN'S CTR	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
SNU SCHOOL FOR CHILDREN	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
BETHANY MONTESSORI	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
Southern Nazarene University	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
SW College Of Christian Min.	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
LAKE PARK ES	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
OVERHOLSER ES	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
BETHANY CHRISTIAN ACADEMY	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
WESTERN OAKS MS	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
WESTERN OAKS ES	Bethany (C)	School	54.3	23.1	16.7	4.9	0.9	54.3	77.4	94.1
Bethany Fire/Police Dispatch	Bethany (C)	User Defined	54.3	23.1	16.7	4.9	0.9	54.3	77.3	94.1
Bethany Public Schools Complex	Bethany (C)	User Defined	54.3	23.1	16.7	4.9	0.9	54.3	77.3	94.1
Bethany City Hall	Bethany (C)	User Defined	54.3	23.1	16.7	4.9	0.9	54.3	77.3	94.1
Western Oaks School Complex	Bethany (C)	User Defined	54.3	23.1	16.7	4.9	0.9	54.3	77.3	94.1
Choctaw Police Dept	Choctaw (C)	Police	62.2	20.5	13.3	3.4	0.5	62.2	82.7	95.9
Choctaw Police Dept	Choctaw (C)	Police	62.2	20.5	13.3	3.4	0.5	62.2	82.7	95.9
Choctaw Fire Department	Choctaw (C)	Fire	60.9	21	13.8	3.7	0.6	60.9	81.9	95.7
JAMES GRIFFITH IES	Choctaw (C)	School	61.4	20.8	13.6	3.6	0.6	61.4	82.2	95.8
NICOMA PARK IES	Choctaw (C)	School	60.9	21	13.8	3.7	0.6	60.9	81.9	95.7
NICOMA PARK JHS	Choctaw (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
CHOCTAW ES	Choctaw (C)	School	62.2	20.5	13.3	3.4	0.5	62.2	82.7	95.9
CHOCTAW HS	Choctaw (C)	School	60.9	21	13.8	3.7	0.6	60.9	81.9	95.7
CHOCTAW JHS	Choctaw (C)	School	62.2	20.5	13.3	3.4	0.5	62.2	82.7	95.9
L. W. WESTFALL ES	Choctaw (C)	School	60.9	21	13.8	3.7	0.6	60.9	81.9	95.7

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
INDIAN MERIDIAN ES	Choctaw (C)	School	61.4	20.8	13.6	3.6	0.6	61.4	82.2	95.8
Choctaw City Hall	Choctaw (C)	User Defined	62.2	20.5	13.3	3.4	0.5	62.2	82.7	95.9
Del City Police Department	Del City (C)	Police	56.7	22.4	15.7	4.5	0.8	56.7	79.1	94.7
Del City Fire Department	Del City (C)	Fire	56.7	22.4	15.7	4.5	0.8	56.7	79.1	94.7
TOWNSEND ES	Del City (C)	School	56.7	22.4	15.7	4.5	0.8	56.7	79.1	94.7
CHRISTIAN HERITAGE ACADEMY	Del City (C)	School	56.7	22.4	15.7	4.5	0.8	56.7	79.1	94.7
Del City High School	Del City (C)	School	56.7	22.4	15.7	4.5	0.8	56.7	79.1	94.7
Del Crest Jr. High	Del City (C)	School	56.7	22.4	15.7	4.5	0.8	56.7	79.1	94.7
Kerr Jr. High School	Del City (C)	School	56.7	22.4	15.7	4.5	0.8	56.7	79.1	94.7
Del City City Hall	Del City (C)	User Defined	56.7	22.4	15.7	4.5	0.8	56.7	79	94.7
Public Works/Fleet Maintenance	Del City (C)	User Defined	56.7	22.4	15.7	4.5	0.8	56.7	79	94.7
City Hall	Del City (C)	User Defined	56.7	22.4	15.7	4.5	0.8	56.7	79	94.7
Edmond Medical Center	Edmond (C)	Medical	68.4	17.5	12	1.6	0.5	68.3	85.8	97.8
Police	Edmond (C)	Police	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Fire Station #1	Edmond (C)	Fire	60.7	21.1	13.9	3.7	0.6	60.7	81.8	95.6
Fire Station #4	Edmond (C)	Fire	60.7	21.1	13.9	3.7	0.6	60.7	81.8	95.6
Fire Station #2	Edmond (C)	Fire	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Fire Station #3	Edmond (C)	Fire	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Fire Station #5	Edmond (C)	Fire	63.3	20.1	12.8	3.3	0.5	63.3	83.4	96.2
Fire Dept Apparatus Storage Bdg	Edmond (C)	Fire	63.3	20.1	12.8	3.3	0.5	63.3	83.4	96.2
Edmond Civil Defense	Edmond (C)	EOC	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
SUNSET ES	Edmond (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
SEQUOYAH MS	Edmond (C)	School	60.7	21.1	13.9	3.7	0.6	60.7	81.8	95.6
RUSSELL DOUGHERTY ES	Edmond (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
NORTHERN HILLS ES	Edmond (C)	School	60.7	21.1	13.9	3.7	0.6	60.7	81.8	95.6
JOHN ROSS ES	Edmond (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
NORTH HS	Edmond (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
PRAIRIE VALE ES	Edmond (C)	School	60.1	21.3	14.2	3.8	0.6	60	81.3	95.5
CROSS TIMBERS ES	Edmond (C)	School	60.9	21	13.8	3.7	0.6	60.9	81.9	95.7
CHEYENNE MS	Edmond (C)	School	60.9	21	13.8	3.7	0.6	60.9	81.9	95.7

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
SANTA FE HS	Edmond (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
CIMARRON MS	Edmond (C)	School	59.4	21.5	14.5	3.9	0.7	59.3	80.9	95.3
MEMORIAL HS	Edmond (C)	School	60.7	21.1	13.9	3.7	0.6	60.7	81.8	95.6
ORVIS RISNER ES	Edmond (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
DEER CREEK ES	Edmond (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
DEER CREEK HS	Edmond (C)	School	59.1	21.6	14.6	4	0.7	59.1	80.7	95.3
DEER CREEK MS	Edmond (C)	School	59.1	21.6	14.6	4	0.7	59.1	80.7	95.3
ST ELIZABETH ANN SETON CATHOLI	Edmond (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
OKLAHOMA CHRISTIAN SCHOOL	Edmond (C)	School	62	20.6	13.3	3.5	0.6	62	82.6	95.9
ST MARYS EPISCOPAL SCHOOL	Edmond (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
HOLY TRINITY LUTH PRE-SCHOOL	Edmond (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
OKLAHOMA CHRISTIAN ACADEMY	Edmond (C)	School	60.7	21.1	13.9	3.7	0.6	60.7	81.8	95.6
FIRST PRESBYTERIAN ECP	Edmond (C)	School	60.7	21.1	13.9	3.7	0.6	60.7	81.8	95.6
CHISHOLM ES	Edmond (C)	School	59.4	21.5	14.5	3.9	0.7	59.3	80.9	95.3
CLEGERN ES	Edmond (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
WILL ROGERS ES	Edmond (C)	School	60.7	21.1	13.9	3.7	0.6	60.7	81.8	95.6
CENTRAL MS	Edmond (C)	School	60.7	21.1	13.9	3.7	0.6	60.7	81.8	95.6
IDA FREEMAN ES	Edmond (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
University of Central Oklahoma	Edmond (C)	School	60.7	21.1	13.9	3.7	0.6	60.7	81.8	95.6
MAC - Senior Center	Edmond (C)	User Defined	60.9	21	13.8	3.7	0.6	60.9	81.9	95.7
PSC Admin Building	Edmond (C)	User Defined	63.3	20.1	12.8	3.3	0.5	63.3	83.4	96.2
PSC OPs Building	Edmond (C)	User Defined	63.3	20.1	12.8	3.3	0.5	63.3	83.4	96.2
PSC OPs Yard	Edmond (C)	User Defined	63.3	20.1	12.8	3.3	0.5	63.3	83.4	96.2
XTimbers Animal Welfare	Edmond (C)	User Defined	63.3	20.1	12.8	3.3	0.5	63.3	83.4	96.2
City First	Edmond (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Administration Building	Edmond (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Municipal Court Building	Edmond (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Council Chambers	Edmond (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Public Works Authority	Edmond (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Vacant Animal Control 3rd St	Edmond (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Edmond City Hall & Administration	Edmond (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Forest Park City Hall	Forest Park (C)	User Defined	57.4	22.2	15.4	4.3	0.8	57.3	79.5	94.9
Forest Park Police Dept	Forest Park (T)	Police	57.4	22.2	15.4	4.3	0.8	57.3	79.5	94.9
Town of Forest Park Fire Dept.	Forest Park (T)	Fire	57.4	22.2	15.4	4.3	0.8	57.3	79.5	94.9
RUSSELL BABB ES	Harrah (C)	School	63.8	19.9	12.6	3.2	0.5	63.8	83.7	96.3
HARRAH HS	Harrah (C)	School	63.8	19.9	12.6	3.2	0.5	63.8	83.7	96.3
HARRAH MS	Harrah (C)	School	63.8	19.9	12.6	3.2	0.5	63.8	83.7	96.3
VIRGINIA SMITH ES	Harrah (C)	School	63.8	19.9	12.6	3.2	0.5	63.8	83.7	96.3
CLARA REYNOLDS ES	Harrah (C)	School	63.8	19.9	12.6	3.2	0.5	63.8	83.7	96.3
HARRAH JHS	Harrah (C)	School	63.8	19.9	12.6	3.2	0.5	63.8	83.7	96.3
OKLAHOMA ACADEMY	Harrah (C)	School	64.8	19.6	12.1	3	0.5	64.8	84.4	96.5
Jones Police Dept	Jones (C)	Police	62	20.6	13.3	3.5	0.6	62	82.6	95.9
Jones Fire Dept	Jones (C)	Fire	62	20.6	13.3	3.5	0.6	62	82.6	95.9
Emergency Operations Center	Jones (C)	EOC	62	20.6	13.3	3.5	0.6	62	82.6	95.9
Town Hall/Police Dept.	Jones (C)	User Defined	62	20.6	13.3	3.5	0.6	62	82.6	95.9
Jones City Hall	Jones (C)	User Defined	62	20.6	13.3	3.5	0.6	62	82.6	95.9
Public Works Building	Jones (C)	User Defined	62	20.6	13.3	3.5	0.6	62	82.6	95.9
Jones Fire Department	Jones (T)	Fire	62	20.6	13.3	3.5	0.6	62	82.6	95.9
JONES HS	Jones (T)	School	62	20.6	13.3	3.5	0.6	62	82.6	95.9
JONES ES	Jones (T)	School	62	20.6	13.3	3.5	0.6	62	82.6	95.9
JONES MS	Jones (T)	School	63.5	20.1	12.7	3.2	0.5	63.5	83.5	96.2
Luther City Hall/Police Station	Luther (C)	Police	66.6	18.9	11.4	2.7	0.4	66.5	85.4	96.8
Luther City Hall	Luther (C)	User Defined	66.6	18.9	11.4	2.7	0.4	66.5	85.4	96.8
Luther Mill And Farm Supply	Luther (C)	User Defined	66.6	18.9	11.4	2.7	0.4	66.5	85.4	96.8
Hickory Hills Volunteer Fire Department	Luther (T)	Fire	65.9	19.1	11.7	2.8	0.4	65.9	85	96.7
LUTHER ES	Luther (T)	School	66.6	18.9	11.4	2.7	0.4	66.5	85.4	96.8
LUTHER HS	Luther (T)	School	66.6	18.9	11.4	2.7	0.4	66.5	85.4	96.8
LUTHER MS	Luther (T)	School	66.6	18.9	11.4	2.7	0.4	66.5	85.4	96.8
Midwest Regional Medical Center	Midwest City (C)	Medical	65.8	18.4	13.3	1.9	0.6	65.8	84.2	97.5
Renaissance Medical Center	Midwest City (C)	Medical	65.8	18.4	13.3	1.9	0.6	65.8	84.2	97.5

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Fire Station 3	Midwest City (C)	Fire	58.5	21.8	14.9	4.1	0.7	58.4	80.3	95.1
Fire Station 2	Midwest City (C)	Fire	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Fire Station 1	Midwest City (C)	Fire	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Fire Station 5	Midwest City (C)	Fire	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Fire Station 4	Midwest City (C)	Fire	58.5	21.8	14.9	4.1	0.7	58.4	80.3	95.1
EOC At Public Works	Midwest City (C)	EOC	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Mid-Del Technology Center	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Rose State College	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
St Philip Neri Catholic School	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Crutcho Elementary School	Midwest City (C)	School	58.5	21.8	14.9	4.1	0.7	58.4	80.3	95.1
Telstar Elementary School	Midwest City (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Cleveland Elementary School	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Ridgecrest Elementary School	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Monroney Middle School	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Steed Elementary School	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Country Estates Elementary School	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Midwest City High School	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Soldier Creek Elementary School	Midwest City (C)	School	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Mid-Del Schools Administration	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Carl Albert High School	Midwest City (C)	School	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Eastside Elementary School	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Jarman Middle School	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Carl Albert Middle School	Midwest City (C)	School	59	21.7	14.7	4	0.7	58.9	80.6	95.2
J.E. Sutton Field House	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Willow Brook Elementary	Midwest City (C)	School	58.5	21.8	14.9	4.1	0.7	58.4	80.3	95.1
Mid-Del School District Enroll Ctr	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Traub Elementary School	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Sooner Rose Elementary School	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
TRAUB ES	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
SOLDIER CREEK ES	Midwest City (C)	School	59	21.7	14.7	4	0.7	58.9	80.6	95.2

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
STEED ES	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
SOONER-ROSE ES	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
FAITH ACADEMY CHRISTIAN SCHOOL	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
GOOD SHEPHERD LUTHERAN SCHOOL	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
ST PHILIP NERI	Midwest City (C)	School	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Legacy Corner Apartments	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Meadow Glen Apartments	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Silverwood Apartments	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Fairfax Apartments	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Midwest Territory Apartments	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Huntington Place Apartments	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Midwest Manor Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Villa Gardens Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Calico Corners Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Yorkshire Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Spring Tree Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
East Oaks Village Senior Apartments	Midwest City (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Chestnut Square Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Raintree Meadow Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Planet Plaza Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Willow Creek Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Rolling Oaks Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Legacy Corner Apartments	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Midwest City Depot Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Coachlight Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Woodside Village Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Parkview Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Orchard Springs Apartments	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
East Oaks Village Senior Apartments	Midwest City (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Meadow Ridge Apartments	Midwest City (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Concord Apartments	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Meadowood Village Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Center Place Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Center Place Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Center Place Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Center Place Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Center Place Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Center Place Apartments	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Eden Cove Apartments	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Becker's	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Firestone	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Vacant	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Foam Brite Car Wash	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
First National Bank of Midwest City	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Arvest	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
First Fidelity Bank	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
IBC Bank	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Hudiburg Toyota/Chevrolet/Pontiac/GMC	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Joe Cooper Ford	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
David Stanley Dodge	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
La Petite Child Care	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
La Petite	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Eastside Church of Christ	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Douglas Boulevard United Methodist Churc	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Neighborhood Missionary Baptist Church	Midwest City (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
St Mark Lutheran Church	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Church of Jesus Christ of LDS	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
St Matthew's Methodist Church	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Ridgecrest Church of Christ	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Good Shepherd Lutheran Church	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Meadowood Baptist Church	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Free Methodist Church of Midwest City	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Cornerstone Family Church	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
City Hall	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Reed Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Oklahoma County Sheriff Department	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Oklahoma County Training Facility	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
MWC Fire Administration	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
YMCA	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
All American Fitness Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Shell	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
AM-PM	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Valero	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Gas Station- name unknown	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Gas Station- name unknown	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Gas Station- name unknown	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Shell	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Future Walmart Market	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Crest Foods	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Aldi	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Buy For Less	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Crest Food Store	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Regional Medical Office Complex	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Parklawn Plaza	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Walgreens	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Integris Prohealth Physicians	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Midwest City Medical Group	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Comfort Inn & Suites East	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Hampton Inn	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Studio 6	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Super 8	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Motel 6	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Best Western	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Holiday Inn Express	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Sheraton Midwest City Hotel	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Hawthorn Suites	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Boeing Aero Space	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
United Technologies Corp	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Bags, Inc.	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Sooner Tank LLC	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Plasma Pheresis Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Century Martial Arts	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Chromalloy Gas Turbine Corporation	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
MWC Metropolitan Library	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
MWC Senior Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
MWC Community Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
MWC Police Firing Range	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
MWC Animal Shelter	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
MWC Public Works	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Welcome Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Autumn House Retirement Home	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Alterra Sterling House of Midwest City	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Arbor House Assisted Living	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Midwest City Nursing Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Buena Vista Care and Rehabilitation	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Sienna Extended Care and Rehab	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Midwest Square Office Park	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
Continental Square	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Oklahoma Journal Building	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Woodlands Office Park	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Cherry Center	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Rose Rock Center	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Middle Pointe	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Griffin Plaza	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
U.S. Post Office	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Heritage Park Mall	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Sam's Wholesale Club	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
MRMC Accessory Building	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Vacant	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Golden Goose Flea Market	Midwest City (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Anthony's TV & Appliance, Inc.	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Golden Corral	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Napa Auto Parts	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Applebee's	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Auto Zone	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Furniture Gallery	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Chilli's	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Steak 'n Shake	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Walmart	Midwest City (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Golden Palace	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
McDonald's	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Old Chicago	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Logan's Roadhouse	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Santa Fe Steak House	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Poblano's	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Henry Hudson's	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Rib Crib	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Chick-Fil-A	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Campus Corner Shopping Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Caspian Plaza	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Unnamed Shopping Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Heritage Plaza Shopping Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Town and Country Shopping Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Holiday Square Shopping Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Decker Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Gateway Plaza Shopping Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Uptown Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Lockheed Shopping Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Shopping Center (unnamed)	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Shopping Center (unnamed)	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Kenwood Plaza	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Town Center Shops	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Midwest Crossing	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Boulevard Market Place	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Eastgate Shopping Center	Midwest City (C)	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
23 Post Plaza	Midwest City (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Andrew Plaza	Midwest City (C)	User Defined	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Village Oaks Plaza	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Regional Square Shopping Center	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Orchard Plaza Shopping Center	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Lowe's	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Best Buy	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
JC Penney	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Target	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Kohl's	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Marshall's	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Lane Bryant	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Town Center Shops	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Hibbet	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Petsmart	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Rue 21	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Catherine's	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Ulta	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Cheddar's	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Jack in the Box	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Panda Express	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Sonic	Midwest City (C)	User Defined	59	21.7	14.7	4	0.7	58.9	80.6	95.2
Home Depot	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Shopping Center (unnamed)	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Chromalloy Oklahoma	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Midwest City City Hall	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Tinker Air Force Base	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Emergency Ops Ctr - City Hall	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Reed Conference Center	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
Autumn House bldg 1	Midwest City (C)	User Defined	57.8	22	15.2	4.2	0.7	57.8	79.8	95
NICHOLS HILLS ES	Nichols Hills (C)	School	56.6	22.4	15.7	4.5	0.8	56.5	78.9	94.7
Nichols Hills City Hall	Nichols Hills (C)	User Defined	56.6	22.4	15.7	4.5	0.8	56.5	78.9	94.7
Nichols Hills Public Works	Nichols Hills (C)	User Defined	56.6	22.4	15.7	4.5	0.8	56.5	78.9	94.7
City Hall Complex	Nichols Hills (C)	User Defined	56.6	22.4	15.7	4.5	0.8	56.5	78.9	94.7
Nicoma Park City Hall	Nichoma Park C)	User Defined	60.9	21	13.8	3.7	0.6	60.9	81.9	95.7
Plaza North	Nicols Hills (C)	User Defined	56.6	22.4	15.7	4.5	0.8	56.5	78.9	94.7
Plaza South	Nicols Hills (C)	User Defined	56.6	22.4	15.7	4.5	0.8	56.5	78.9	94.7
Western Business District	Nicols Hills (C)	User Defined	56.6	22.4	15.7	4.5	0.8	56.5	78.9	94.7
Oklahoma City Golf & Country Club	Nicols Hills (C)	User Defined	56.6	22.4	15.7	4.5	0.8	56.5	78.9	94.7
Nicoma Park Police Dept	Nicoma Park (C)	Police	60.9	21	13.8	3.7	0.6	60.9	81.9	95.7
Nicoma Park Fire Department	Nicoma Park (C)	Fire	60.9	21	13.8	3.7	0.6	60.9	81.9	95.7
NICOMA PARK ES	Nicoma Park (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
Deaconess At Bethany Hospital	Oklahoma County	Medical	64.9	18.7	13.8	2	0.6	64.8	83.6	97.3
OKC Police Headquarters	Oklahoma County	Police	55.7	22.7	16.1	4.7	0.8	55.7	78.4	94.5
Emsa Ambulance Headquarters	Oklahoma County	Fire	56.6	22.4	15.7	4.5	0.8	56.5	78.9	94.7

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Oklahoma City Fire Station 5	Oklahoma County	Fire	56.6	22.4	15.7	4.5	0.8	56.5	78.9	94.7
OKC Fire Headquarters	Oklahoma County	Fire	55	22.9	16.4	4.8	0.9	54.9	77.8	94.2
Federal Reserve Bank	Oklahoma County	User Defined	55.7	22.7	16.1	4.7	0.8	55.7	78.3	94.5
FAA Mike Monroney Center	Oklahoma County	User Defined	55.7	22.7	16.1	4.7	0.8	55.7	78.3	94.5
U.S. Filter--Deer Creek Wwtp	Oklahoma County	User Defined	56.7	22.4	15.7	4.5	0.8	56.7	79	94.7
Oklahoma City City Hall	Oklahoma County	User Defined	55.7	22.7	16.1	4.7	0.8	55.7	78.3	94.5
Oklahoma Co. Courthouse & Annex	Oklahoma County	User Defined	55.7	22.7	16.1	4.7	0.8	55.7	78.3	94.5
Oklahoma Co. Detention Center	Oklahoma County	User Defined	55	22.9	16.4	4.8	0.9	54.9	77.8	94.2
Spencer City Hall	Oklahoma County	User Defined	58.5	21.8	14.9	4.1	0.7	58.4	80.2	95.1
State Capital	Oklahoma County	User Defined	56.6	22.4	15.7	4.5	0.8	56.5	78.9	94.7
The Village City Hall	Oklahoma County	User Defined	57.6	22.1	15.3	4.3	0.7	57.6	79.7	94.9
Tinker Air Force Base	Oklahoma County	User Defined	52.9	23.4	17.4	5.3	1	52.9	76.3	93.7
Valley Brook City Hall	Oklahoma County	User Defined	55.2	22.8	16.4	4.8	0.9	55.1	77.9	94.3
U.S. Filter--Chisholm Creek Wwtp	Oklahoma County	User Defined	60.1	21.3	14.2	3.8	0.6	60	81.3	95.5
General Motors Plant	Oklahoma County	User Defined	57.1	22.3	15.5	4.4	0.8	57	79.3	94.8
Oklahoma Publishing Company	Oklahoma County	User Defined	57.4	22.2	15.4	4.3	0.8	57.3	79.5	94.9
City Hall	Oklahoma County	User Defined	63.3	20.1	12.8	3.3	0.5	63.3	83.4	96.2
Warr Acres City Hall	Oklahoma County	User Defined	55	22.9	16.4	4.8	0.9	54.9	77.8	94.2
Spencer Police Dept	Spencer (C)	Police	58.5	21.8	14.9	4.1	0.7	58.4	80.3	95.1
Spencer Fire Department	Spencer (C)	Fire	58.5	21.8	14.9	4.1	0.7	58.4	80.3	95.1
ROGERS MS	Spencer (C)	School	58.5	21.8	14.9	4.1	0.7	58.4	80.3	95.1
SPENCER ES	Spencer (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
STAR SPENCER HS	Spencer (C)	School	58.5	21.8	14.9	4.1	0.7	58.4	80.3	95.1
GREEN PASTURES ES	Spencer (C)	School	59.6	21.5	14.4	3.9	0.7	59.5	81	95.4
SPENCER ROAD CHRISTIAN SCHOOL	Spencer (C)	School	58.5	21.8	14.9	4.1	0.7	58.4	80.3	95.1
Village Police Dept	The Village (C)	Police	57.6	22.1	15.3	4.3	0.7	57.6	79.7	94.9
The Village Fire Department	The Village (C)	Fire	56.6	22.4	15.7	4.5	0.8	56.5	78.9	94.7
Valley Brook Police Department	Valley Brook (T)	Police	55.2	22.8	16.4	4.8	0.9	55.1	78	94.3
Valley Brook City Hall	Valley Brook (T)	User Defined	55.2	22.8	16.4	4.8	0.9	55.1	77.9	94.3
Warr Acres Police Dept	Warr Acres (C)	Police	55	22.9	16.4	4.8	0.9	54.9	77.8	94.2

2,500-Year MRP Event										
			Percent Probability of Sustaining Damage					Percent Functionality		
Name	Municipality	Type	None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Warr Acres Fire Department	Warr Acres (C)	Fire	55	22.9	16.4	4.8	0.9	54.9	77.8	94.2
CENTRAL ES	Warr Acres (C)	School	55	22.9	16.4	4.8	0.9	54.9	77.8	94.2

Source: HAZUS-MH 2.0

Impact on Economy

Earthquakes also have impacts on the economy, including: loss of business function, damage to inventory, relocation costs, wage loss and rental loss due to the repair/replacement of buildings. As noted in the State of Oklahoma HMP Update, the disruption of traffic flow will likely be impacted for residents as well as for critical services such as emergency police, fire and ambulance. Power and water outages and damages to buildings may cause critical and essential facilities to be closed for extended periods of time (OK DEM, 2011).

HAZUS-MH estimates the total economic loss associated with each earthquake scenario, which includes building- and lifeline-related losses (transportation and utility losses) based on the available inventory (facility [or GIS point] data only). Direct building losses are the estimated costs to repair or replace the damage caused to the building. This is reported in the "Impact on General Building Stock" section discussed earlier. Lifeline-related losses include the direct repair cost to transportation and utility systems and are reported in terms of the probability of reaching or exceeding a specified level of damage when subjected to a given level of ground motion. Additionally, economic loss includes business interruption losses associated with the inability to operate a business due to the damage sustained during the earthquake as well as temporary living expenses for those displaced. These losses are discussed below.

HAZUS-MH estimates long-term economic impacts to the region for 15 years after the earthquake. For the 500-year event, HAZUS-MH estimates the total economic loss of approximately $90 Million. For the 2,500-year event, HAZUS-MH estimates approximately $1.1 Billion. For the historic 1952 El Reno event, HAZUS-MH estimates $57.5 Million. These totals include the capital stock losses (building structure, content and inventory), and income losses. Again, please note that HAZUS-MH 2.0 earthquake loss estimates are on the Census-tract level and this total includes some portions of Oklahoma City. For further details, refer to the 'Data and Methodology' subsection above.

For the 100-year MRP, in terms of utilities, HAZUS-MH estimates 100% functionality on day 1 of the event. No damages are estimated and are not discussed further in this assessment for this HMP. Tables 5.3.3-15 and 5.3.3-16 summarize the HAZUS-MH 2.0 estimated probability of damage that each utility may sustain (as defined by the column heading) and estimated loss of use in days a result of a 500-year and 2,500-year MRP earthquake event, respectively. Damage categories are related to the damage ratio (defined as ratio of repair to replacement cost) for evaluation of direct economic loss. Refer to the HAZUS-MH Earthquake Technical Manual for a description of the damage categories for each utility feature.

In terms of transportation, roadway segments and railroad tracks may experience damage due to ground failure. Damage estimates to these components were not calculated by HAZUS. It is assumed that regional transportation and distribution of materials may be interrupted as a result of an earthquake event. Losses to the community that result from damages to lifelines can be much greater than the cost of repair.

HAZUS 2.0 estimates the airports in the County will be nearly 100% functional day one of a 500-year MRP event and approximately 87% functional day one of a 2,500-year event. For the 100-year MRP event, HAZUS-MH 2.0 estimates all highway bridges will be fully functional day one of the event. For the 500-year MRP event, HAZUS-MH estimates highway bridges will be 100% functional day one of the event. For the 2,500- year MRP event, HAZUS-MH estimates highway bridges will approximately 80 to 100% functional day one of the event.

Table 5.3.3-15. Estimated Utility Impacts in Oklahoma County from the 500-year MRP Earthquake Event

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
WWLS-FM CH 285	Bethany (C)	Communication	89.6	9.6	0.8	0	0	99.5	99.9
Bethany Water Plant	Bethany (C)	Potable Water	97.2	2.2	0.5	0	0	98.7	99.9
Wastewater Treatment Complex	Del City (C)	WWTF	97.3	2.2	0.5	0	0	98	99.9
Water Treatment Facility	Del City (C)	WWTF	97.2	2.2	0.5	0	0	97.9	99.9
SBC Central Office/Switching Sta.	Del City (C)	Electric Power	97.3	2.2	0.5	0	0	98.4	99.9
Fire Station #4 Lift Station	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
KKWD CH 250	Edmond (C)	Communication	91	8.4	0.6	0	0	99.6	99.9
KOKF CH 215	Edmond (C)	Communication	91.6	7.8	0.6	0	0	99.6	99.9
KCSC CH 211	Edmond (C)	Communication	91	8.4	0.6	0	0	99.6	99.9
LAWTON CITY OF-WATER PLANT	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Water Treatment Plant	Edmond (C)	Potable Water	97.7	1.9	0.4	0	0	98.9	99.9
Breakpoint Chlorination Facility	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
NW Water Complex Na Hypochlorite Bdg	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
NW Pump Station	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
College Pump Station and Clearwell	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
South 33rd Pump Station and Clearwell	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Danforth Pump Station and Clearwell	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
College PS Sodium Hypochlorite Bldg	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
I-35 Pump Station	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
2nd Street Booster Station	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #33	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #32	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #18	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #14	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #35	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #62	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #64	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #65	Edmond (C)	Potable Water	97.7	1.9	0.4	0	0	98.9	99.9
Well #66	Edmond (C)	Potable Water	97.7	1.9	0.4	0	0	98.9	99.9

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Well #67	Edmond (C)	Potable Water	97.7	1.9	0.4	0	0	98.9	99.9
Well #68	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #34	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #61	Edmond (C)	Potable Water	97.7	1.9	0.4	0	0	98.9	99.9
Well #60	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #29	Edmond (C)	Potable Water	97.7	1.9	0.4	0	0	98.9	99.9
Well #28	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #49	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #53	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #16	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #17	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #46	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #10	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #27	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #09	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #08	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #48	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #19	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #22	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #31	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #36	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #43	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #47	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #30	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #15	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #51	Edmond (C)	Potable Water	97.4	2.1	0.5	0	0	98.8	99.9
Well #55	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #42	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #54	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #23	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Well #56	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #26	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #58	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #59	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #39	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #57	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #38	Edmond (C)	Potable Water	97.4	2.1	0.5	0	0	98.8	99.9
Well #37	Edmond (C)	Potable Water	97.4	2.1	0.5	0	0	98.8	99.9
Well #21	Edmond (C)	Potable Water	97.4	2.1	0.5	0	0	98.8	99.9
Well #25	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #24	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #11	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #41	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #44	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #63	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Well #50	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #20	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #45	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Well #52	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
I-35 Tall Water Tower	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
I-35 Short Water Tower	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
Post Road Water Tower	Edmond (C)	Potable Water	97.7	1.9	0.4	0	0	98.9	99.9
College Water Tower	Edmond (C)	Potable Water	97.6	2	0.4	0	0	98.9	99.9
33rd Street Water Tower	Edmond (C)	Potable Water	97.4	2.1	0.5	0	0	98.8	99.9
Danforth Water Tower	Edmond (C)	Potable Water	97.5	2	0.5	0	0	98.8	99.9
Coffee Creek Wastewater Treatment Plant	Edmond (C)	WWTF	97.6	2	0.4	0	0	98.2	99.9
33rd Street Lift Station	Edmond (C)	WWTF	97.5	2	0.5	0	0	98.1	99.9
Memorial Road Lift Station	Edmond (C)	WWTF	97.5	2	0.5	0	0	98.1	99.9
40th Street Lift Station	Edmond (C)	WWTF	97.5	2	0.5	0	0	98.1	99.9
Coffee Creek Plant Lift Station	Edmond (C)	WWTF	97.6	2	0.4	0	0	98.2	99.9

500-Year MRP Event									
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Oak Tree Lift Station	Edmond (C)	WWTF	97.6	2	0.4	0	0	98.2	99.9
Oak Tree Reserve Lift Station	Edmond (C)	WWTF	97.6	2	0.4	0	0	98.2	99.9
Chisholm Creek Lift Station	Edmond (C)	WWTF	97.6	2	0.4	0	0	98.2	99.9
Spring Creek Lift Station	Edmond (C)	WWTF	97.6	2	0.4	0	0	98.2	99.9
WILLIAMS GAS PIPELI/EDMOND COMPRESSOR ST	Edmond (C)	Natural Gas	97.7	1.9	0.4	0	0	98.9	99.9
Garber Substation	Edmond (C)	Electric Power	97.7	1.9	0.4	0	0	98.6	99.9
Fairfield Substation	Edmond (C)	Electric Power	97.5	2	0.5	0	0	98.5	99.9
White Substation	Edmond (C)	Electric Power	97.7	1.9	0.4	0	0	98.6	99.9
Danforth Substation	Edmond (C)	Electric Power	97.6	2	0.4	0	0	98.5	99.9
Hafer Substation	Edmond (C)	Electric Power	97.6	2	0.4	0	0	98.5	99.9
Eastern Substation	Edmond (C)	Electric Power	97.5	2	0.5	0	0	98.5	99.9
Mitch Substation	Edmond (C)	Electric Power	97.6	2	0.4	0	0	98.5	99.9
Ketch Substation	Edmond (C)	Electric Power	97.5	2	0.5	0	0	98.5	99.9
EOC-Mid Van Radio Tower	Edmond (C)	Communication	97.6	2	0.4	0	0	99.7	99.9
EOC-UCO Radio Tower	Edmond (C)	Communication	97.6	2	0.4	0	0	99.7	99.9
Communications Hut	Edmond (C)	Communication	97.7	1.9	0.4	0	0	99.7	99.9
OG & E ELECTRIC SRVCS	Harrah (C)	Electric Power	97.6	2	0.4	0	0	99.6	99.8
OG&E HORSESHOE LAKE	Harrah (C)	Electric Power	97.6	2	0.4	0	0	99.6	99.8
OCTAGON RESOURCES I/DYNAMIC BOOSTER STA	Luther (T)	Natural Gas	97.7	1.8	0.4	0	0	98.9	99.9
MWC Water Treatment Plant	Midwest City (C)	Potable Water	97.4	2.1	0.5	0	0	98.8	99.9
MWC Northside Treatment Plant	Midwest City (C)	Potable Water	97.4	2.1	0.5	0	0	98.8	99.9
KTLV 1220	Midwest City (C)	Communication	90.3	9	0.7	0	0	99.5	99.9
Wastewater Treatment Plant	Midwest City (C)	WWTF	97.4	2.1	0.5	0	0	98	99.9
Water Treatment Facility	Midwest City (C)	WWTF	97.4	2.1	0.5	0	0	98	99.9
Nichols Hills Water Tower	Nichols Hills (C)	Potable Water	97.3	2.2	0.5	0	0	98.7	99.9
Redbud Energy LP	Oklahoma County	Electric Power	97.7	1.8	0.4	0	0	99.6	99.9
Radio Tower (Primary)	Oklahoma County	Communication	97.5	2	0.5	0	0	99.7	99.9
KROU CH 289	Spencer	Communication	91.6	7.8	0.6	0	0	99.6	99.9

Source: HAZUS-MH 2.0

Table 5.3.3-16. Estimated Utility Impacts in Oklahoma County from the 2,500-year MRP Earthquake Event

2,500-Year MRP Event											
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
WWLS-FM CH 285	Bethany (C)	Communication	20.3	42.4	30.4	6.3	0.6	78.9	98.5	99.5
Bethany Water Plant	Bethany (C)	Potable Water	62.7	18	16.9	2	0.4	78.1	98.1	98.5
Wastewater Treatment Complex	Del City (C)	WWTF	63.5	17.8	16.4	1.9	0.4	71.4	97.7	97.9
Water Treatment Facility	Del City (C)	WWTF	62.7	18	16.9	2	0.4	70.7	97.6	97.8
SBC Central Office/Switching Sta.	Del City (C)	Electric	63.5	17.8	16.4	1.9	0.4	73.9	99.5	99.7
Fire Station #4 Lift Station	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
KKWD CH 250	Edmond (C)	Communication	23.3	43.2	27.8	5.2	0.5	81.2	98.8	99.6
KOKF CH 215	Edmond (C)	Communication	24.7	43.4	26.7	4.8	0.4	82.1	98.9	99.7
KCSC CH 211	Edmond (C)	Communication	23.3	43.2	27.8	5.2	0.5	81.2	98.8	99.6
LAWTON CITY OF-WATER PLANT	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Water Treatment Plant	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
Breakpoint Chlorination Facility	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
NW Water Complex Na Hypochlorite Bdg	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
NW Pump Station	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
College Pump Station and Clearwell	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
South 33rd Pump Station and Clearwell	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Danforth Pump Station and Clearwell	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
College PS Sodium Hypochlorite Bldg	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
I-35 Pump Station	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
2nd Street Booster Station	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #33	Edmond (C)	Potable Water	65.2	17.3	15.4	1.7	0.4	79.9	98.4	98.8
Well #32	Edmond (C)	Potable Water	65.2	17.3	15.4	1.7	0.4	79.9	98.4	98.8
Well #18	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #14	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #35	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #62	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #64	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #65	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
Well #66	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9

2,500-Year MRP Event											
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Well #67	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
Well #68	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #34	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #61	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
Well #60	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
Well #29	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
Well #28	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #49	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #53	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #16	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #17	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #46	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #10	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #27	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #09	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #08	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #48	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #19	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #22	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #31	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #36	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #43	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #47	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #30	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #15	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #51	Edmond (C)	Potable Water	64.4	17.5	15.9	1.8	0.4	79.3	98.3	98.7
Well #55	Edmond (C)	Potable Water	65.2	17.3	15.4	1.7	0.4	79.9	98.4	98.8
Well #42	Edmond (C)	Potable Water	65.2	17.3	15.4	1.7	0.4	79.9	98.4	98.8
Well #54	Edmond (C)	Potable Water	65.2	17.3	15.4	1.7	0.4	79.9	98.4	98.8
Well #23	Edmond (C)	Potable Water	65.2	17.3	15.4	1.7	0.4	79.9	98.4	98.8

2,500-Year MRP Event										
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Well #56	Edmond (C)	Potable Water	65.2	17.3	15.4	1.7	0.4	79.9	98.4	98.8
Well #26	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
Well #58	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
Well #59	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
Well #39	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #57	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #38	Edmond (C)	Potable Water	64.4	17.5	15.9	1.8	0.4	79.3	98.3	98.7
Well #37	Edmond (C)	Potable Water	64.4	17.5	15.9	1.8	0.4	79.3	98.3	98.7
Well #21	Edmond (C)	Potable Water	64.4	17.5	15.9	1.8	0.4	79.3	98.3	98.7
Well #25	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #24	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #11	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #41	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #44	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #63	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #50	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #20	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #45	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Well #52	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
I-35 Tall Water Tower	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
I-35 Short Water Tower	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Post Road Water Tower	Edmond (C)	Potable Water	66.6	16.9	14.6	1.5	0.3	80.8	98.5	98.9
College Water Tower	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
33rd Street Water Tower	Edmond (C)	Potable Water	64.4	17.5	15.9	1.8	0.4	79.3	98.3	98.7
Danforth Water Tower	Edmond (C)	Potable Water	66	17.1	15	1.6	0.3	80.4	98.5	98.8
Coffee Creek Wastewater Treatment Plant	Edmond (C)	WWTF	66	17.1	15	1.6	0.3	73.5	98.1	98.3
33rd Street Lift Station	Edmond (C)	WWTF	65.2	17.3	15.4	1.7	0.4	72.4	98.4	99.2
Memorial Road Lift Station	Edmond (C)	WWTF	65.2	17.3	15.4	1.7	0.4	72.4	98.4	99.2
40th Street Lift Station	Edmond (C)	WWTF	65.2	17.3	15.4	1.7	0.4	72.4	98.4	99.2
Coffee Creek Plant Lift Station	Edmond (C)	WWTF	66	17.1	15	1.6	0.3	73.1	98.4	99.3

2,500-Year MRP Event										
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Oak Tree Lift Station	Edmond (C)	WWTF	66.6	16.9	14.6	1.5	0.3	73.6	98.5	99.3
Oak Tree Reserve Lift Station	Edmond (C)	WWTF	66.6	16.9	14.6	1.5	0.3	73.6	98.5	99.3
Chisholm Creek Lift Station	Edmond (C)	WWTF	66	17.1	15	1.6	0.3	73.1	98.4	99.3
Spring Creek Lift Station	Edmond (C)	WWTF	66	17.1	15	1.6	0.3	73.1	98.4	99.3
WILLIAMS GAS PIPELI/EDMOND COMPRESSOR ST	Edmond (C)	Natural Gas	67.5	16.7	14.1	1.4	0.3	81.2	99	99.7
Garber Substation	Edmond (C)	Electric	66.6	16.9	14.6	1.5	0.3	76.4	99.6	99.8
Fairfield Substation	Edmond (C)	Electric	66	17.1	15	1.6	0.3	75.9	99.6	99.8
White Substation	Edmond (C)	Electric	66.6	16.9	14.6	1.5	0.3	76.4	99.6	99.8
Danforth Substation	Edmond (C)	Electric	66	17.1	15	1.6	0.3	75.9	99.6	99.8
Hafer Substation	Edmond (C)	Electric	66	17.1	15	1.6	0.3	75.9	99.6	99.8
Eastern Substation	Edmond (C)	Electric	66	17.1	15	1.6	0.3	75.9	99.6	99.8
Mitch Substation	Edmond (C)	Electric	66.6	16.9	14.6	1.5	0.3	76.4	99.6	99.8
Ketch Substation	Edmond (C)	Electric	66	17.1	15	1.6	0.3	75.9	99.6	99.8
EOC-Mid Van Radio Tower	Edmond (C)	Communication	66	17.1	15	1.6	0.3	90.8	99.4	99.7
EOC-UCO Radio Tower	Edmond (C)	Communication	66	17.1	15	1.6	0.3	90.8	99.4	99.7
Communications Hut	Edmond (C)	Communication	67.5	16.7	14.1	1.4	0.3	91.4	99.5	99.7
OG & E ELECTRIC SRVCS	Harrah (C)	Electric	66	17.1	15	1.6	0.3	86.8	98.5	99.1
OG&E HORSESHOE LAKE	Harrah (C)	Electric	66	17.1	15	1.6	0.3	86.8	98.5	99.1
OCTAGON RESOURCES I/DYNAMIC BOOSTER STA	Luther (T)	Natural Gas	68.3	16.5	13.6	1.4	0.3	81.7	99	99.7
MWC Water Treatment Plant	Midwest City (C)	Potable Water	64.4	17.5	15.9	1.8	0.4	79.3	98.3	98.7
MWC Northside Treatment Plant	Midwest City (C)	Potable Water	64.4	17.5	15.9	1.8	0.4	79.3	98.3	98.7
KTLV 1220	Midwest City (C)	Communication	21.9	42.9	29	5.7	0.6	80.1	98.6	99.6
Wastewater Treatment Plant	Midwest City (C)	WWTF	64.4	17.5	15.9	1.8	0.4	72.1	97.8	98
Water Treatment Facility	Midwest City (C)	WWTF	64.4	17.5	15.9	1.8	0.4	72.1	97.8	98
Nichols Hills Water Tower	Nichols Hills (C)	Potable Water	63.5	17.8	16.4	1.9	0.4	78.7	98.2	98.6
Redbud Energy LP	Oklahoma County	Electric	67.5	16.7	14.1	1.4	0.3	87.6	98.7	99.2
Radio Tower (Primary)	Oklahoma County	Communication	65.2	17.3	15.4	1.7	0.4	90.5	99.4	99.7
KROU CH 289	Spencer	Communication	24.4	43.4	26.9	4.9	0.4	81.9	98.8	99.7

Source: HAZUS-MH 2.0

Table 5.3.3-17. Estimated Impacts to Transportation Features in the Oklahoma County from the 500-year MRP Earthquake Event

Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Wiley Post Airport - OKC	Bethany (C)	Airport	97.2	2.2	0.5	0	0	99.6	99.9
Downtown Airpark	Oklahoma County	Airport	97.2	2.2	0.5	0	0	99.6	99.9
Wiley Post Airpark	Oklahoma County	Airport	97.3	2.2	0.5	0	0	99.6	99.9
Will Rogers World Airport	Oklahoma County	Airport	97.1	2.3	0.6	0	0	99.6	99.9

Source: HAZUS-MH 2.0

Table 5.3.3-18. Estimated Impacts to Transportation Features in the Oklahoma County from the 2,500-year MRP Earthquake Event

Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality	
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 7
Wiley Post Airport - OKC	Bethany (C)	Airport	62.7	18	16.9	2	0.4	87.2	97.9
Downtown Airpark	Oklahoma County	Airport	62.7	18	16.9	2	0.4	87.2	97.9
Wiley Post Airpark	Oklahoma County	Airport	63.5	17.8	16.4	1.9	0.4	87.6	98
Will Rogers World Airport	Oklahoma County	Airport	62.1	18.1	17.3	2.1	0.4	86.9	97.8

Source: HAZUS-MH 2.0

HAZUS-MH also estimates the volume of debris that may be generated as a result of an earthquake event to enable the study region to prepare and rapidly and efficiently manage debris removal and disposal. Debris estimates are divided into two categories: (1) reinforced concrete and steel that require special equipment to break it up before it can be transported, and (2) brick, wood and other debris that can be loaded directly onto trucks with bulldozers (HAZUS-MH Earthquake User's Manual).

For the 100-year MRP event, HAZUS-MH 2.0 estimates approximately no debris will be generated. Table 5.3.3-19 summarizes the estimated debris generated by the 500-, 2,500-year MRP and historical 1952 earthquake events.

Table 5.3.3-19. Estimated Debris Generated by the 500- and 2,500-year MRP Earthquake Events

County	500-Year		2,500-Year		1952 El Reno	
	Brick/Wood (tons)	Concrete/Steel (tons)	Brick/Wood (tons)	Concrete/Steel (tons)	Brick/Wood (tons)	Concrete/Steel (tons)
Oklahoma	49,146	14,484	335,984	207,858	33,096	8,968

Source: HAZUS-MH 2.0

Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across Oklahoma County. It is anticipated that the human exposure and vulnerability to earthquake impacts in newly developed areas will be similar to those that currently exist within the Planning Area. The State of Oklahoma has adopted the 2009 International Residential Code (IRC), with modifications effective July 2011. The 2009 IRC is the minimum building code for one- and two-family and townhouse residential construction. The County may require additional modifications to the building code to further decrease the built environment's vulnerability to the hazard.

New development located in areas with softer NEHRP soil classes (D and E) may be more vulnerable to the earthquake hazard. As noted earlier, NEHRP soil data was not available for Oklahoma County. However, it is known that softer soils can amplify ground shaking to damaging levels even in a moderate earthquake (NYCEM, 2003). Softer soils are generally located along riverine reaches. Therefore, these areas are more vulnerable to the earthquake hazard.

Additional Data and Next Steps

A HAZUS-MH earthquake analysis was conducted for Oklahoma County using the default model data, with the exception of the updated critical facility inventory which included user-defined data. Additional data needed to further refine the County's vulnerability assessment include: (1) updated demographic and building stock data to update the default data in HAZUS-MH; and (2) NEHRP soil classifications and soil liquefaction data.

In terms of general building stock data, updated building age, construction type and current replacement value would further support the refined analysis. Additionally, un-reinforced masonry critical facilities and privately-owned buildings (i.e., residences) can be identified using local knowledge and/or pictometry/orthophotos. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response/recovery efforts for these properties can be set in place.

5.3.4 EXPANSIVE SOILS

This section provides a profile and vulnerability assessment for the expansive soils hazard.

HAZARD PROFILE

This section provides profile information including description, extent, location, previous occurrences and losses and the probability of future occurrences.

Description

Soils and soft rock that tend to swell or shrink due to changes in moisture content are known as expansive soils. Expansive soils are often referred to as swelling clays because clay materials are most susceptible to swelling and shrinking. Changes in soil volume present a hazard primarily to structures built on expansive soils. The most extensive damage occurs to highways and streets (FEMA, 1997).

In the U.S., two major groups of rocks serve as parent materials of expansive soils and more common in the western portion of the country. The first group consists of ash, glass, and rocks of volcanic origin. The aluminum silicate minterals in these volcanic materials often decompose to form expansive clay minerals, known as montmorillonite. The second group consists of sedimentary rocks containing clay minerals, for example the shales of the semiarid west-central states (FEMA, 1997).

Expansive soils are clay-rich shales, or soils from the weathering of shales, that may contain smectic clay minerals, that swell up to 1.5 to two times their original dry volume after adding water. Soil saturation from rainfall, lawn watering, or sewer leakage may cause major damage by soils expanding under sidewalks, highways, utility lines, and foundations. If construction takes place on wet expanded soils, then shrinkage may occur after drying, resulting in severe cracking in structures (Luza and Johnson, 2009).

When water is added to these expansive clays, the water molecules are pulled into gaps between the clay plates. As more is absorbed, the plates are forced further apart, leading to an increase in soil pressure or an expansion of the soil's volume. Soils that contain expansive clays become very stickey when wet and usually are characterized by surface cracks or a "popcorn" texture when dry. Therefore, the presence of surface cracks is usually an indication of an expansive soil (Oklahoma State HMP, 2011).

The affects of expansive soils are most prevalent in regions of moderate to high precipitation, where prolonged periods of drought are followed by long periods of rainfall. Expansive soils can be recognized either by visual inspection in the field or by conducting laboratory analysis (Oklahoma County HMP, 2006).

Extent

The effects of expansive soils are typically experienced in regions of moderate to high precipitation, where periods of drought are followed by periods of rainfall. Damages from expansive soils also result from increases in moisture volume from broken or leaking water and sewer lines (Oklahoma County HMP, 2006).

Dry clays are capable of absorbing water and will increase in volume in an amount proportional to the amount of water absorbed. This soaking and subsequent swelling of dry clay is the Coefficient of Linear Extensibility (COLE). COLE correlates with the volume change of a soil upon wetting and drying.

Areas capable of these changes in soil volume present a hazard to buildings, slabs, concrete, asphalt, and other structures built over the soils and to pipelines buried in them. The greatest damage occurs when structures are constructed when clays are dry and then subsequent soaking rains swell the clay. Damage can be so severe that the cost of repair can exceed the value of the building (Oklahoma County HMP, 2006).

Volume expansion measures the free swelling of a disturbed soil on wetting from air dry to saturated. A volume expansion of 20-40% indicated a large potential expansion on wetting and subsequent shrinkage on drying.

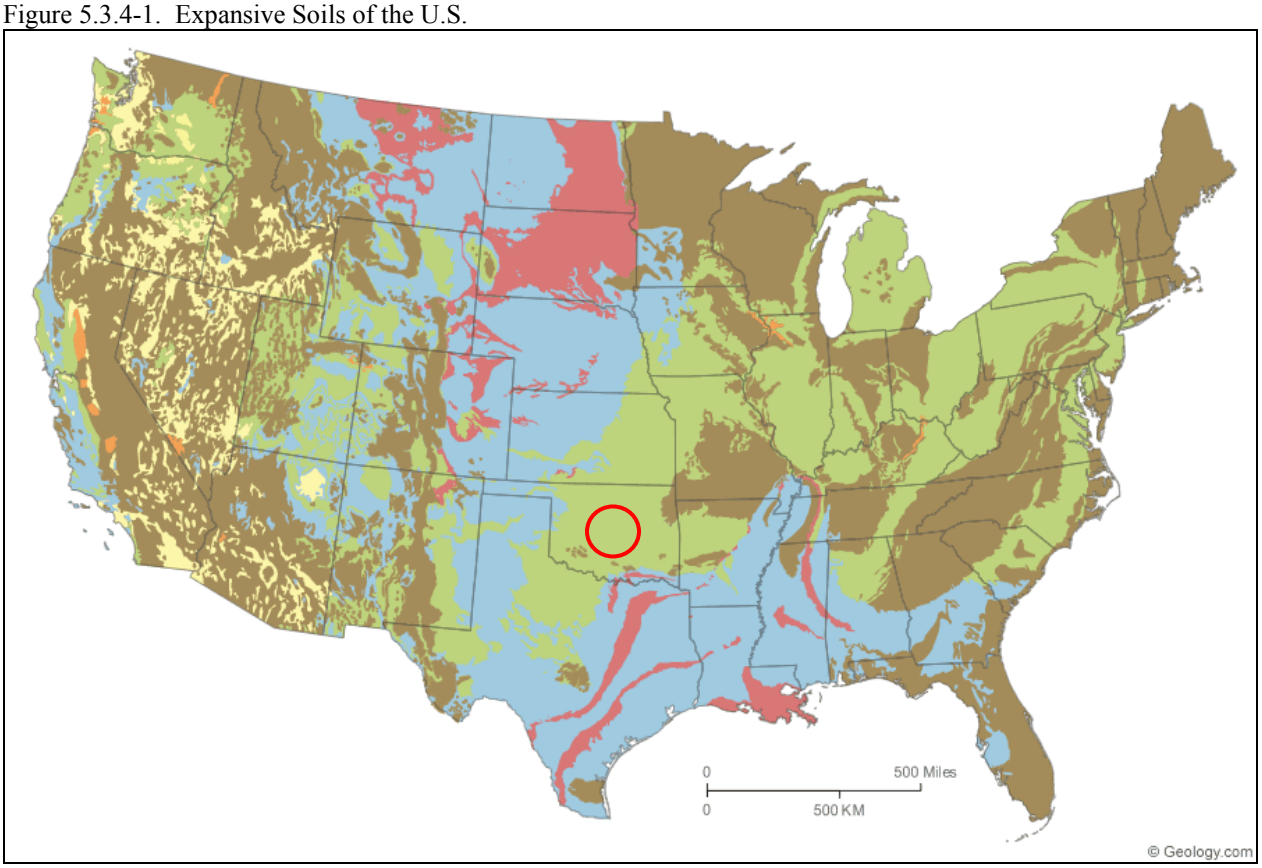
The following tables illustrate the potential volume change of expansive soils. Please note that Oklahoma County and its municipalities would be considered within the "Arid to semi-arid climate." All jurisdictions within Oklahoma County may experience High Potential Volume Change during periods of extremely dry weather.

Potential Volume Change	Arid to semi-arid climate		Humid climate	
	Plasticity Index (%)	Linear Shrinkage (%)	Plasticity Index (%)	Linear shrinkage
Low	0-15	0-5	0-30	0-12
Medium	15-30	5-12	30-50	12-18
High	>30	>12	>50	>18

Location

The effects of expansive soils are most prevalent in regions of moderate to high precipitation, where prolonged periods of drought are followed by long periods of rainfall. The expansive soil hazard occurs mainly in the southern, central and western parts of the U.S. (FEMA, 1997). Figure 5.3.4-1 shows the geographic distribution of expansive soils in the U.S. The figure also includes soils that have a clay mineral composition which can potentially cause damage.

Figure 5.3.4-1. Expansive Soils of the U.S.



Source: Geology.com, Date Unknown

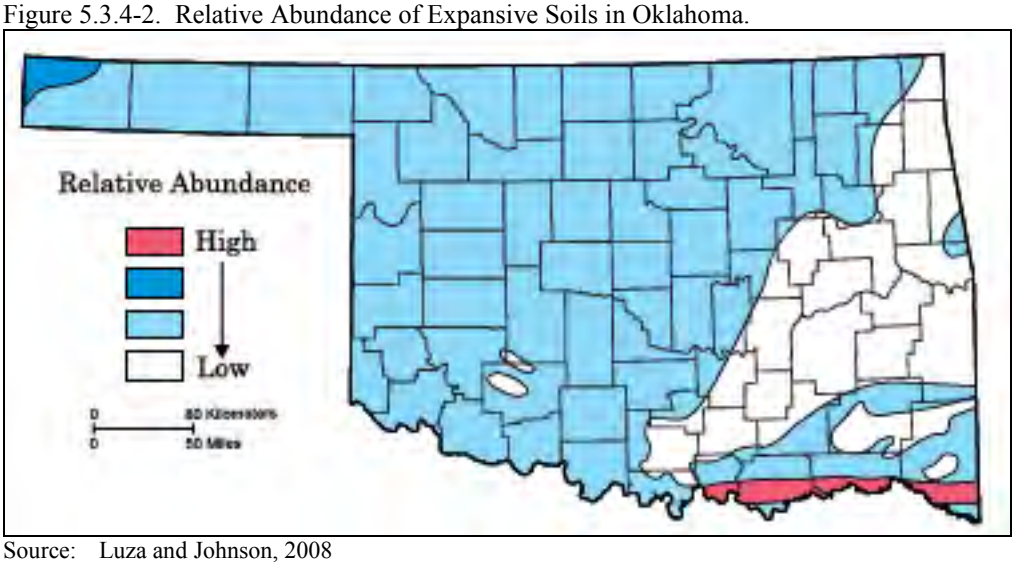
Notes: The red circle indicates the approximate location of Oklahoma County. Less than 50% of Oklahoma County is underlain by soils with abundant clays of slight to moderate swelling potential.

- Over 50 percent of these areas are underlain by soils with abundant clays of high swelling potential.
- Less than 50 percent of these areas are underlain by soils with clays of high swelling potential.
- Over 50 percent of these areas are underlain by soils with abundant clays of slight to moderate swelling potential.
- Less than 50 percent of these areas are underlain by soils with abundant clays of slight to moderate swelling potential.
- These areas are underlain by soils with little to no clays with swelling potential.
- Data insufficient to indicate the clay content or the swelling potential of soils.

Expansive soils can occur anywhere in the State of Oklahoma. Over 75% of the state's bedrock units are possible sources for expansive soils (Figure 5.3.4-2). Prinicpal geologic units in Oklahoma having high shrink-swell potential are Cretaceous shales that crop out in souther Oklahoma. Other shales that locally have moderately high shrink-swell potential are several Pennsylvanian units in the eastern part of the State and several Permian units in central Oklahoma (Luza and Johnson, 2009). Areas of expansive soils within Oklahoma County have not been identified. There are no specific problem areas of expansive soils in Oklahoma County (Oklahoma County HMP, 2006).

Based on the

Figure 5.3.4-2. Relative Abundance of Expansive Soils in Oklahoma.



Source: Luza and Johnson, 2008
Note: Oklahoma County is shown as having a lower abudance of expansive soils.

Previous Occurrences and Losses

There have been no reported problems with expansive soils in Oklahoma County. However, with bodies of water and watersheds present, there is a risk and possibility of occurrence (Oklahoma County HMP, 2006).

Probability of Future Events

The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for expansive soils in the Planning Area is considered "1 - Unlikely" (Event is possible within the next ten years. Event has a 1 in 10 year's chance of occurring). Although no reported incidences have occurred within the Planning Area, it is anticipated that Oklahoma County will continue to experience indirect impacts from expansive soils that may affect the general building stock, local economy and may induce secondary hazards such ignite fires and cause utility failure.

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following text evaluates and estimates the potential impact of expansive soils on Oklahoma County Plan participants including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact, including: (1) impact on life, safety and health of County residents, (2) general building stock, (3) critical facilities, and (4) economy
- Further data collections that will assist understanding of this hazard over time

Overview of Vulnerability

Expansive soil hazards are slow to develop but can cause a range of structural impacts to the built environment. Damage to residential homes, commercial buildings, highways and streets can cause a financial drain on the local and regional economy.

Data and Methodology

At the time of this HMP, insufficient data is available to model the long-term potential impacts of expansive soils on Oklahoma County. Over time, additional data will be collected to allow better analysis for this hazard. Available information and a preliminary assessment are provided below. Available information and a preliminary assessment are provided below.

Impact on Life, Health and Safety

Expansive soil hazards are slow and do not pose a risk to life, health and safety.

Impact on General Building Stock and Critical Facilities

Because of differences in building construction, residential structures and one-story commercial structures are more susceptible to damage by expansive soils compared to multi-story buildings. Multi-story buildings are heavier and can generally counter the swelling pressures. The exception is when multi-story buildings are built on wet clay, and may experience damage by shrinkage of the clay if moisture levels are substantially reduced (be evapotranspiration or by evaporation from under heated buildings) (FEMA, 1997).

Various types of structural damage to buildings include sticking doors; uneven flooring; and cracked foundations, floors, walls, ceilings and windows. Damage to small buildings is greatest when the structure is built on dry clay, such as during drought conditions, followed by rain which swells the soil. Human activities can also influence the moisture of the soils including an increase in moisture from broken or leaking water and sewer lines, watering the landscaping, and surface ponding (FEMA, 1997).

According to FEMA's *Multi Hazard Identification and Risk Assessment*, the best way to mitigate structural damage from expansive soils is to avoid building on them. However, when this is not possible, engineering practices can be applied including removal of the soil; application of heavy loads to offset the swelling pressure; preventing access to water; presetting and chemical stabilization (FEMA, 1997).

Property maintenance to prevent excessive moisture from entering the soil near foundations should be implemented for owners of buildings in areas of expansive soils. This would include proper grading and

keeping gutters/downspouts clear of debris and not discharging adjacent to the foundation. In addition, inspection of the property after heavy rainfall to address drainage issues should also be put into practice.

Impact on Economy

As summarized by FEMA, the greatest damage from expansive soils is to highways and roads. Damages result from differential vertical movement that occurs as clay moisture content adjusts to the changed environment. For pavement, differential movement of 0.4 inches (or 1 centimeter) with a horizontal distance of 20 feet (6 meters) can pose an engineering problem for fast travel (FEMA, 1997). Infrastructure damage is costly and can impact the local and regional economy.

Impact on Future Development

As discussed and illustrated in Section 4, areas targeted for future growth and development have been identified across the County. Any new development in terms of structures and infrastructure (i.e., highways and streets) on known expansive soils could be potentially impacted. Proper grading and building regulations/code including proper slab design and emplacement procedures can mitigate structural damage to new development in areas where expansive soils exist. In most cases, structural damage due to expansive soils is not covered by insurance (FEMA, 1997).

Effect of Climate Change on Vulnerability

The potential effects of climate change on Oklahoma County's vulnerability to expansive soils events shall need to be considered as a greater understanding of regional climate change impacts develop.

Additional Data and Next Steps

For future plan updates, Oklahoma County can further identify and map expansive soil extent in the County and document damages to buildings and infrastructure. This will help refine the hazard area so that future new development can be avoided and for which mitigation measures should be developed or refined for the built environmental already present on these soils.

5.3.5 EXTREME TEMPERATURES

This section provides a profile and vulnerability assessment for the extreme temperature hazard.

HAZARD PROFILE

This section provides profile information including description, location and extent, previous occurrences and losses and the probability of future occurrences.

Description

As part of the Southern Great Plains, the State of Oklahoma is prone to wide swings of temperature. Summer temperatures typically climb above the 100 degree mark and during the winter, temperatures drop below zero (OK State HMP, 2011).

Extreme temperatures include both cold and hot events, which can have a significant impact to human health, commercial/agricultural businesses and primary and secondary effects on infrastructure (e.g., burst pipes and power failure). What constitutes "extreme cold" or "extreme heat" can vary across different areas of the country, based on what the population is accustomed to.

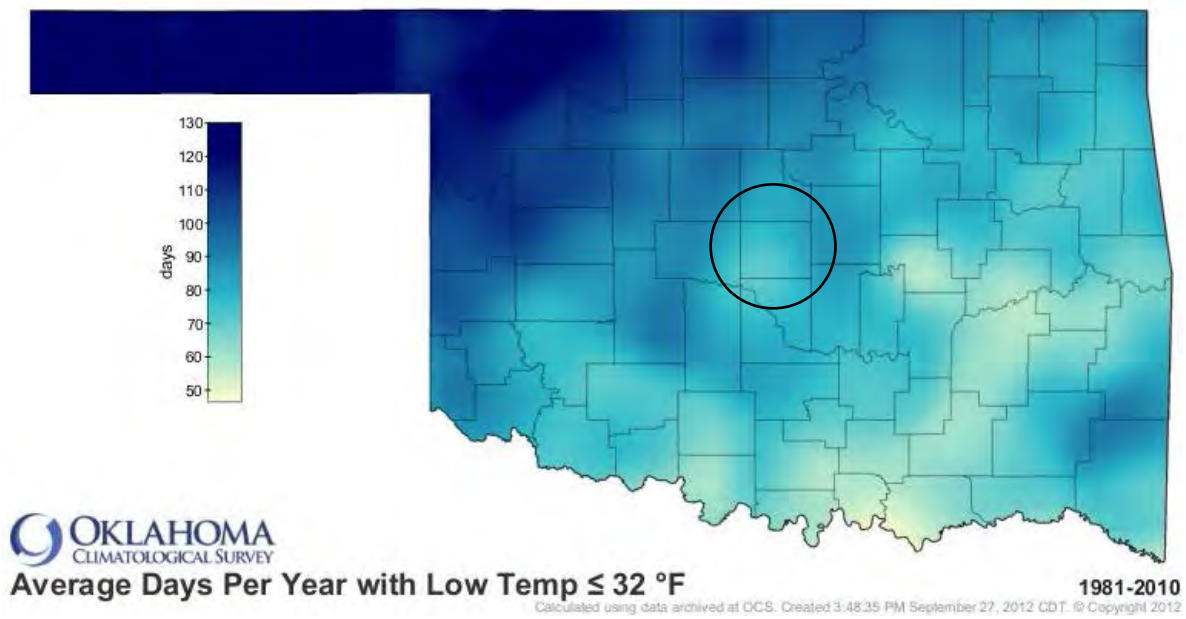
Extreme Cold

Extreme cold and its effects can vary across different areas of the country. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." Exposure to cold temperatures, whether indoors or outside, can lead to serious or life-threatening health problems such as hypothermia, cold stress, frostbite or freezing of the exposed extremities such as fingers, toes, nose and ear lobes [Centers for Disease Control and Prevention (CDC), 2005].

Extreme cold often accompanies a winter storm. What constitutes as extreme cold and its effects varies across different areas of the U.S. In areas unaccustomed to winter weather, near freezing temperatures are considered extreme cold. Freezing temperatures can cause severe damage to crops. Pipes may freeze and burst in homes that are poorly insulated (NWS, 1991).

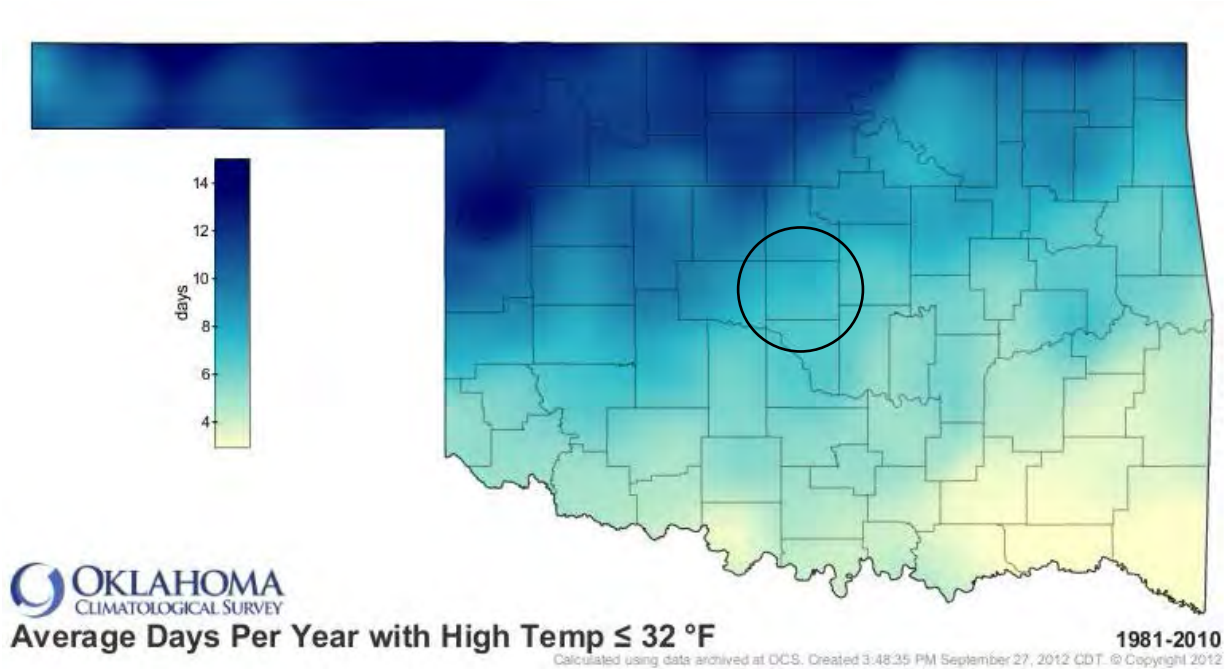
Figure 5.3.5-1 illustrates the number of days per year with an average low below 32°F. Figure 5.3.5-2 illustrates the number of days per year with an average high below 32°F.

Figure 5.3.5-1. Annual Number of Days with a Low below 32°F



Source: Oklahoma Climatological Survey
Note: Average based on 1981 – 2010 data. The black circle indicates the location of Oklahoma County. The County experiences between 60 to 80 days, each year, with a low below 32 degrees.

Figure 5.3.5-2. Annual Number of Days with a High below 32°F



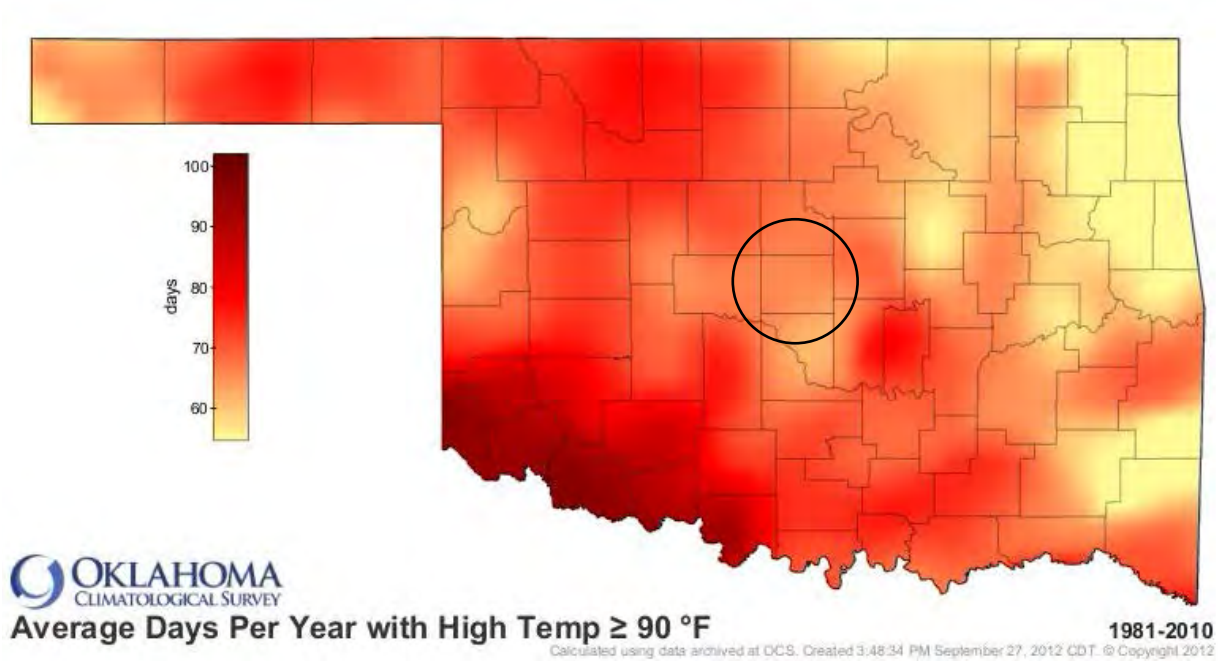
Source: Oklahoma Climatological Survey
Note: Average based on 1981 – 2010 data. The black circle indicates the location of Oklahoma County. The County experiences between 6-10 days, each year, with a high below 32 degrees.

Extreme Heat

Temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks are defined as extreme heat. Given Oklahoma's disposition towards high average temperatures, extreme heat may also constitute any temperature over 100 degrees. Humid or muggy conditions occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground. Excessively dry and hot conditions can provoke dust storms and low visibility. Droughts occur when a long period passes without substantial rainfall and a heat wave combined with a drought is a very dangerous situation. An extreme heat event or heat wave is a period of excessive daytime and nighttime heat in association with high humidity relative to geographic location and time of year (Oklahoma City HMP, 2011).

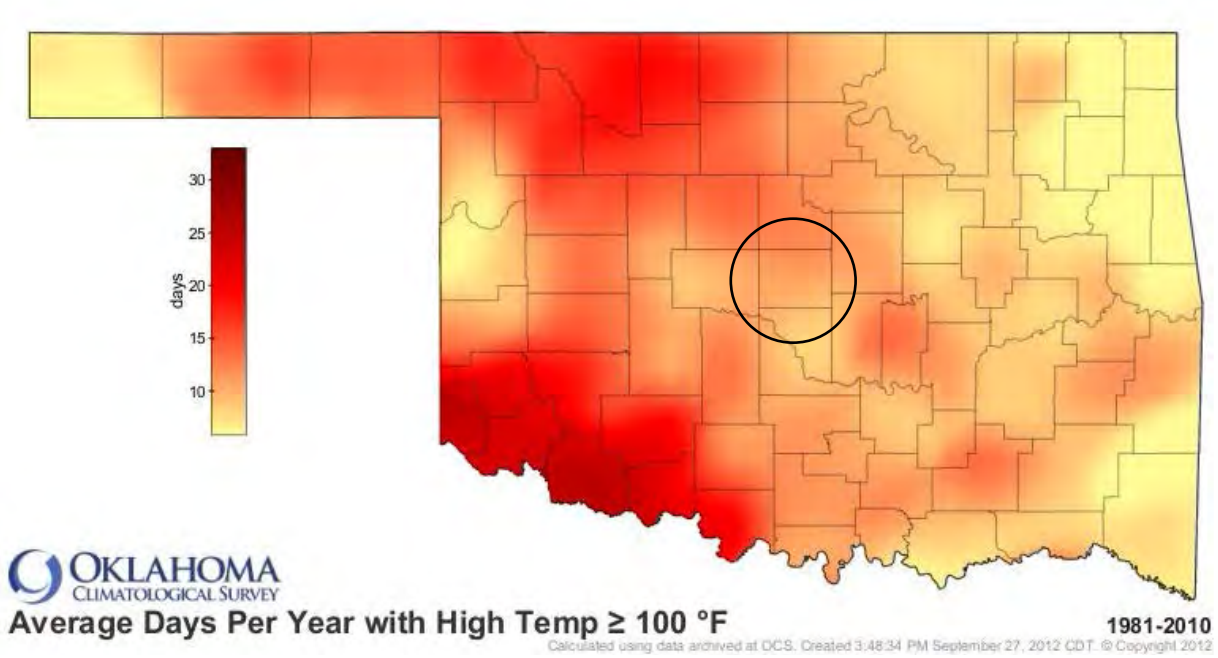
In Oklahoma, the warmest period of summer extends from mid-July through mid-August. The gradually shortening days and the occasional arrival of cooler temperatures from the north bring some relief by late August. August is the State's second hottest, fifth driest and least windy month, with an average temperature between the low and high of 82.4°F (OK State HMP, 2011). Figure 5.3.5-3 illustrates the number of days per year with a daily temperature exceeding 90°F. Figure 5.3.5-4 illustrates the number of days per year with a daily temperature exceeding 100°F.

Figure 5.3.5-3. Annual Number of Days Exceeding 90°F



Source: Oklahoma Climatological Survey
Note: Average based on 1981 – 2010 data. The black circle indicates the location of Oklahoma County. The County experiences between 60 to 80 days, each year, with temperatures over 90 degrees.

Figure 5.3.5-4. Annual Number of Days Exceeding 100°F



Source: Oklahoma Climatological Survey
Note: Average based on 1981 – 2010 data. The black circle indicates the location of Oklahoma County. The County experiences between 10 to 20 days, each year, with temperatures over 100 degrees.

Extreme heat is hazardous to livestock and agricultural crops. It can result in water shortages, exacerbate fire hazards, and prompt demands for energy. Roads, bridges and railroad tracks are susceptible to damages from extreme heat. Between 1970 and 1999, excessive heat exposure resulted in 8,015 deaths in the U.S. During this period, more people died from extreme heat than from hurricanes, lightning, tornadoes, floods, and earthquakes combined (OK State HMP, 2011).

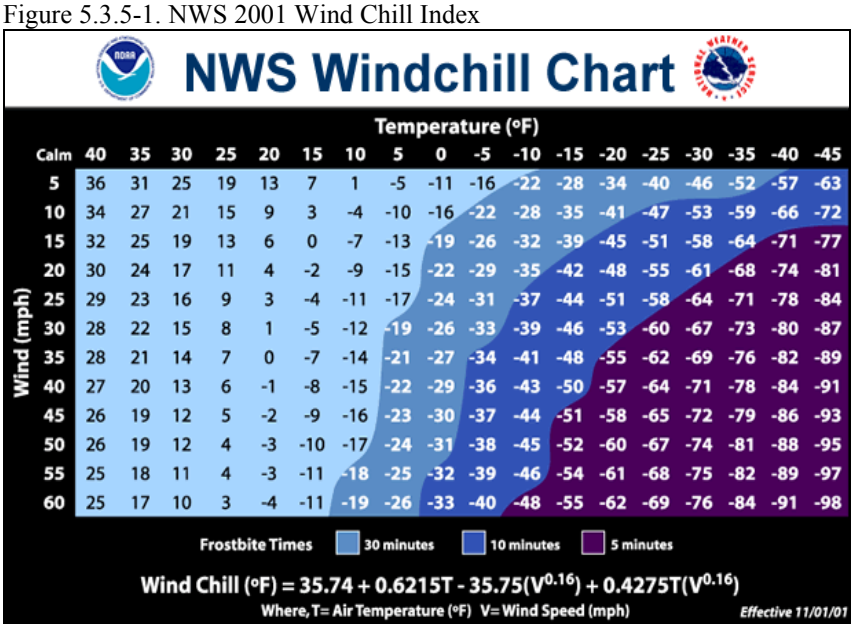
Extent

The extent (severity or magnitude) of extreme temperatures are generally measured through the Wind Chill Temperature (WCT) Index for cold extremes, and the Heat Index (HI) for heat extremes.

Wind Chill Temperature Index

Whenever temperatures drop well below normal and wind speed increases, heat can leave a person's body more rapidly (known by the National Weather Service (NWS) as the Wind Chill Temperature Index). The Wind Chill Temperature (WCT) Index is the temperature your body feels when the air temperature is combined with the wind speed. It is based on the rate of heat loss from exposed skin caused by the effects of wind and cold. As the speed of the wind increases, it can carry heat away from your body much more quickly, causing skin temperature to drop. When there are high winds, serious weather-related health problems are more likely, even when temperatures are only cool. The importance of the wind chill index is as an indicator of how to dress properly for winter weather to avoid extreme cold affects to human health. The Wind Chill Chart (Figure 5.3.5-3), which was improved from its original 1945 version, by NWS in November 2001, shows the difference between actual air temperature and perceived temperature, and amount of time until frostbite occurs.

Figure 5.3.5-1. NWS 2001 Wind Chill Index



Source: NWS, 2006

The Heat Index

As identified by the NWS and the National Oceanic and Atmospheric Administration (NOAA), the Heat Index is the temperature the body feels when heat and humidity are combined. Higher humidity plus higher temperatures often combine to make us feel a perceived temperature that is higher than the actual air temperature. As presented by the NWS, Figure 5.3.5-X shows the Heat Index that corresponds to the actual air temperature and relative humidity.

Figure 5.3.5-2. Heat Index Chart

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

Heat Index	Notes
80-90	Caution - fatigue is possible with prolonged exposure and activity
90-105	Extreme caution - sunstroke, heat cramps, and heat exhaustion are possible

105-130	Danger - sunstroke, heat cramps, and heat exhaustion are likely; heat stroke is possible
over 130	Extreme danger - heat stroke or sunstroke are likely with continued exposure

Source: NWS, 2012

Location

According to the Oklahoma Climatological Survey, the County can expect to experience an around 6-10 days a year in which expected temperature highs are below 32 degrees. In addition, the County averages 20 to 25 days each year of daytime high temperatures greater than 100°F. Therefore, extreme heat and cold is likely to occur within and affect all of Oklahoma County (OKC HMP, 2006).

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with extreme temperature events throughout the State of Oklahoma and Oklahoma County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

Based on information provided by the Oklahoma Climatological Survey, Oklahoma County experienced a record high on July 8, 1970. On this day, the temperature reached 117 degrees Fahrenheit at Lake Overholser. The record low for Oklahoma County was experienced on February 12, 1899. On this day, temperatures in Edmond were recorded at -17 degrees Fahrenheit.

According to NOAA's NCDC storm events database, Oklahoma County experienced 29 extreme temperature events between April 30, 1950 and December 31, 2012. These events include excessive heat, heat, cold/wind chill, and extreme cold. These events may also include other counties. According to the Hazard Research Lab at the University of South Carolina's Spatial Hazard Events and Losses Database for the U.S. (SHELDUS), between 1960 and 2010, 50 extreme temperature events occurred within the County.

Between 1954 and 2012, FEMA declared that the State of Oklahoma experienced no extreme temperature-related disasters (DR) or emergencies (EM). Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties (FEMA, 2012).

Based on all sources researched, known extreme temperature events that have affected Oklahoma County and its municipalities are identified in Table 5.3.5-1. With temperature documentation for the State of Oklahoma being so extensive, not all sources have been identified or researched. Therefore, Table 5.3.5-1 may not include all events that have occurred throughout the County and region.

Table 5.3.5-1. Extreme Temperature Events between 1950 and 2012

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
July 1980	Extreme Heat	N/A	N/A	An extreme heat event caused over $2.5 M in crop damages.	SHELDUS
June 27, 1994	Extreme Heat	N/A	N/A	Temperatures reached the 110 degree mark in southwest Oklahoma and exceeded the 100 degree mark in the northwest and central portions of the state.	NOAA-NCDC
January 18-20, 1996	Extreme Cold	N/A	N/A	A strong arctic air mass settled across Oklahoma and resulted in two deaths. Low temperatures fell into the single digits and high temperatures rose only to around 20°F. Wind chill values fell as low as 35 to 40° below zero.	NOAA-NCDC
February 1-5, 1996	Extreme Cold	N/A	N/A	A cold front moved across the State, bringing single digit temperatures and wind chills of 30 to 40 degrees below zero. Temperatures did not go above freezing for a week.	NOAA-NCDC
May 25, 1996	Extreme Cold	N/A	N/A	A transient took shelter from the cold weather in a parked pickup truck near the intersection of North Santa Fe and NE 50th. He died of hypothermia and was found the next day.	NOAA-NCDC
July 1-7, 1996	Extreme Heat	N/A	N/A	High temperatures exceeded 100°F in central Oklahoma. Highs in Oklahoma City ranged from 102°F to 110°F during this time. There were seven deaths attributed to this heat event.	OK State HMP, NOAA-NCDC
May – October 1998	Extreme Heat	N/A	N/A	Excessive heat and drought conditions affected western and central Oklahoma, with the most intense heat and severe drought conditions occurring from mid-June through early September across central and southern Oklahoma. There were 19 fatalities and three injuries related to this heat wave. Agriculture losses were estimated at $2 billion.	Oklahoma City HMP
July 26-31, 1999	Extreme Heat	N/A	N/A	A period of temperatures ranging from the upper 90s to near 105°F affected portions of central and southwest Oklahoma. Eight people died and one serious injury resulted from this event.	NOAA-NCDC
July 31, 2001	Extreme Heat	N/A	N/A	An extended period of excessive heat affected all of western and central Oklahoma. Daily mean temperatures ranged from the mid-80s to near 90°F. Most areas experienced temperatures at or above 100°F. In addition to the heat, rainfall averaged about one-third of normal, resulting in a drought.	OK State HMP
July 2006	Extreme Heat	N/A	N/A	Temperatures reached triple digits across Oklahoma during the month of July. Many locations reached 105°F. The heat caused 10 fatalities across the area during this time period. The heat caused a portion of I-44 in Oklahoma City to buckle. Many power outages occurred as a result of this event.	OK State HMP

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
August 2006	Extreme Heat	N/A	N/A	During the first half of August, triple digit heat struck across central and eastern Oklahoma. The heat caused eight fatalities. Many streets buckled from the heat.	OK State HMP
January 12-18, 2007	Cold/Wind Chill	N/A	N/A	A strong arctic cold front moved through the State, bringing several rounds of wintery precipitation and cold temperatures. Two people died of hypothermia due this event.	NOAA-NCDC
July – August 2008	Excessive Heat	N/A	N/A	A period of excessive heat occurred across much of central and eastern Oklahoma. High temperatures reached the 100 to 105 degree range, with maximum heat index values that reached the 105 to 115 degree range. Three deaths and 47 injuries were a result from this event.	OK State HMP

Source: OK State HMP, 2011; NOAA-NCDC Storm Query; Oklahoma City HMP; Oklahoma County HMP, 2006; SHELDUS

Probability of Future Events

Extreme heat events occur each year throughout the State of Oklahoma and the County. It is estimated that Oklahoma County and all of its jurisdictions, will continue to experience extreme heat events annually that may induce secondary hazards such as thunderstorms, drought, human health impacts, and utility failure, as well as many other anticipated impacts.

In Section 5.3, the identified hazards of concern for Oklahoma County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for extreme heat events in the County is considered 'Highly Likely' (Event is probable within the calendar year. Event has a 1 in 1 year chance of occurring).

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. Most extreme temperature events involve a large region; therefore, the entire County has been identified as the hazard area. The following text evaluates and estimates the potential impact of extreme temperatures on Oklahoma County Plan participants including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact, including: (1) impact on life, safety and health of County residents, (2) general building stock, (3) critical facilities, and (4) economy
- Further data collections that will assist understanding of this hazard over time

Overview of Vulnerability

Extreme temperatures generally occur for a short period of time but can cause a range of impacts, particularly to vulnerable populations that may not have access to adequate cooling or heating. This natural hazard can also cause impacts to agriculture (crops and animals), infrastructure (e.g., through pipe bursts associated with freezing, power failure) and the economy.

Data and Methodology

At the time of this HMP, insufficient data is available to model the long-term potential impacts of extreme temperature on Oklahoma County. Over time, additional data will be collected to allow better analysis for this hazard. Available information and a preliminary assessment are provided below. Available information and a preliminary assessment are provided below.

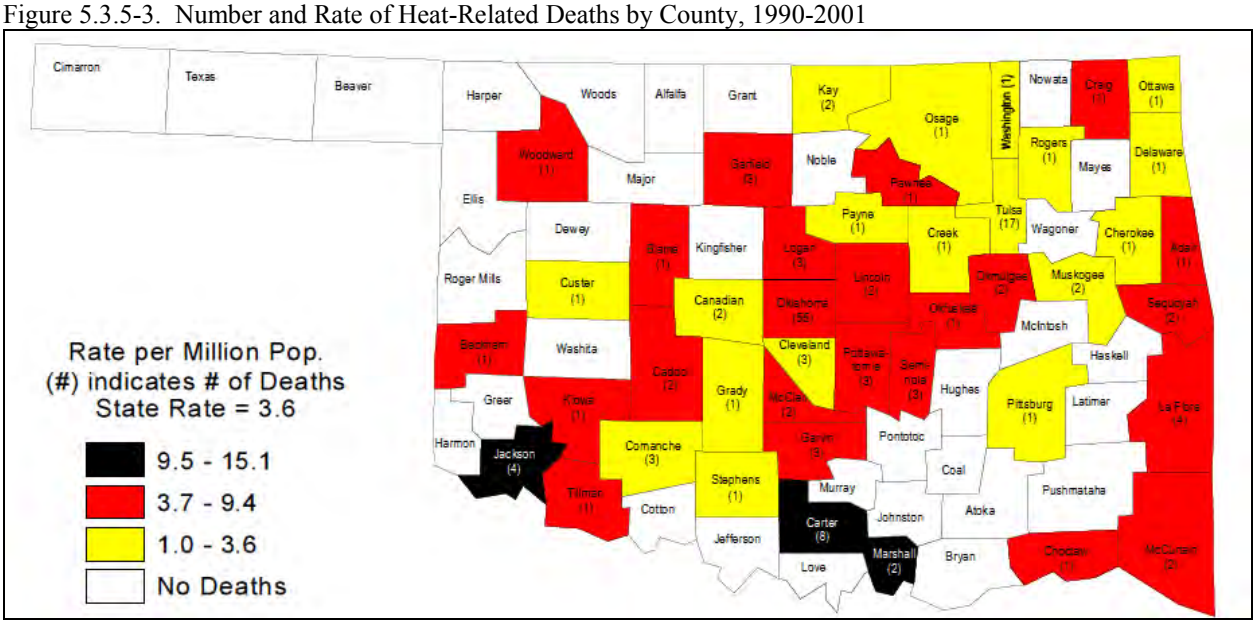
Impact on Life, Health and Safety

For the purposes of this HMP, the entire population in Oklahoma County is vulnerable to extreme temperature events. Extreme temperature events have potential health impacts including injury and death. The County Profile summarizes population of Plan participants in Oklahoma County over the age of 65, and population with an annual income below the poverty threshold.

According to the CDC, populations most at risk to extreme cold and heat events include the following: 1) the elderly, who are less able to withstand temperatures extremes due to their age, health conditions and limited mobility to access shelters; 2) infants and children up to four years of age; 3) individuals who are physically ill (e.g., heart disease or high blood pressure), 4) low-income persons that cannot afford proper heating and cooling; and 5) the general public who may overexert during work or exercise during extreme heat events or experience hypothermia during extreme cold events.

Between 1990 and 2001, Oklahoma County recorded the most heat-related deaths in the State (total of 55). Figure 5.3.5-5 shows the number of heat-related deaths for the State of Oklahoma.

Figure 5.3.5-3. Number and Rate of Heat-Related Deaths by County, 1990-2001



Source: Oklahoma State Health Department, 2002

Meteorologists can accurately forecast extreme heat event development and the severity of the associated conditions with several days of lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations, implement short-term emergency response actions and focus on surveillance and relief efforts on those at greatest risk. Adhering to extreme temperature warnings can significantly reduce the risk of temperature-related deaths.

Impact on General Building Stock

All of the building stock in Oklahoma County is exposed to the extreme temperature hazard. Table 4-X (County Profile) summarizes the general building stock. Extreme heat generally does not impact buildings. Losses may be associates with the overheating of HVAC systems. Extreme cold temperature events can damage buildings through freezing/bursting pipes and freeze/thaw cycles. Additionally, manufactured homes (mobile homes) and antiquated or poorly constructed facilities may have inadequate capabilities to withstand extreme temperatures.

Impact on Critical Facilities

All critical facilities in Oklahoma County are exposed to the extreme temperature hazard. Impacts to critical facilities are the same as described for general building stock (above). Additionally, it is essential that critical facilities remain operational during natural hazard events. Extreme heat events can sometimes cause short periods of utility failure, commonly referred to as "brown-outs", due to increased usage from air conditioners, appliances, etc. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can cause power interruption as well. Backup power is recommended for critical facilities and infrastructure.

Impact on Economy

Extreme temperature events also have impacts on the economy, including loss of business function and damage/loss of inventory. Business-owners may be faced with increased financial burdens due to unexpected repairs caused to the building (e.g., pipes bursting), higher than normal utility bills or business interruption due to power failure (i.e., loss of electricity, telecommunications).

The agricultural industry is most at risk in terms of economic impact and damage due to extreme temperature events. Extreme heat events can result in drought and dry conditions and directly impact livestock, livestock products and crop production.

Impact on Future Development

Although the trend in recent years has been toward residential development, currently over 131 square miles remain zoned for agricultural uses in the County. With the loss of farmland, the overall impacts of extreme temperature on agriculture will likely decrease due to the decrease of the industry.

Effect of Climate Change on Vulnerability

The potential effects of climate change on Oklahoma County's vulnerability to extreme temperature events shall need to be considered as a greater understanding of regional climate change impacts develop.

Additional Data and Next Steps

For future plan updates, Oklahoma County can track data on extreme temperature events, obtain additional County- and jurisdiction-specific information on past and future events, particularly in terms of any injuries, deaths, shelter needs, pipe freeze, agricultural losses and other impacts. This will help to identify any concerns or trends for which mitigation measures should be developed or refined. In time, quantitative modeling of estimated extreme heath/cold events may be feasible as data is gathered and improved.

5.3.6 FLOOD

This section provides a profile and vulnerability assessment for the flood hazard.

HAZARD PROFILE

This section provides profile information including description, location, extent, previous occurrences and losses and the probability of future occurrences.

Description

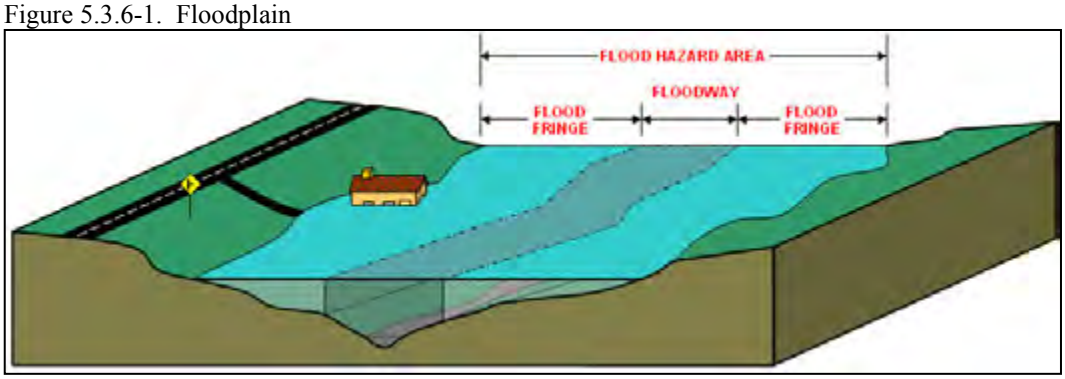
Floods are one of the most common natural hazards in the U.S. They can develop slowly over a period of days or develop quickly, with disastrous effects that can be local (impacting a neighborhood or community) or regional (affecting entire river basins, coastlines and multiple counties or states) (Federal Emergency Management Agency [FEMA], 2008). Most communities in the U.S. have experienced some kind of flooding, after spring rains, heavy thunderstorms, coastal storms, or winter snow thaws (George Washington University, 2001). Floods are one of the most common hazards in Oklahoma. As defined by the National Flood Insurance Program (NFIP), flooding is a general and temporary condition of partial or complete inundation on normally dry land from the following:

- Overflow of inland or tidal waters;
- Unusual and rapid accumulation or runoff of surface waters from any source;
- Mudflows; or
- The collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood (FloodSmart.gov, 2012)

A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. Most often floodplains are referred to as 100-year floodplains. A 100-year floodplain is not the flood that will occur once every 100 years, rather it is the flood that has a one-percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. With this term being misleading, FEMA has properly defined it as the one-percent annual chance flood. This one percent annual chance flood is now the standard used by most Federal and State agencies and by the NFIP (FEMA, 2002).

Figure 5.3.6-1 depicts the flood hazard area, the flood fringe, and the floodway areas of a floodplain.

Figure 5.3.6-1. Floodplain



Source: NJDEP, Date Unknown

Many floods fall into three categories: riverine, coastal and shallow (FEMA, 2005). Other types of floods may include ice-jam floods, alluvial fan floods, dam failure floods, and floods associated with local drainage or high groundwater (as indicated in the previous flood definition). For the purpose of this HMP and as deemed appropriate by the County, riverine/flash and dam failure flooding are the main flood types of concern for the County. These types of flood or further discussed below.

Riverine/Flash Floods – Riverine floods are the most common flood type and occur along a channel, and include overbank and flash flooding. Channels are defined, ground features that carry water through and out of a watershed. They may be called rivers, creeks, streams or ditches. When a channel receives too much water, the excess water flows over its banks and inundates low-lying areas (FEMA, Date Unknown; The Illinois Association for Floodplain and Stormwater Management, 2006).

Flash floods are "a rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, beginning within six hours of the causative event (e.g., intense rainfall, dam failure). However, the actual time threshold may vary in different parts of the country. Ongoing flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters" (NWS, 2005).

Extent

In the case of riverine or flash flooding, once a river reaches flood stage, the flood extent or severity categories used by the NWS include minor flooding, moderate flooding, and major flooding. Each category has a definition based on property damage and public threat:

- Minor Flooding - minimal or no property damage, but possibly some public threat or inconvenience.
- Moderate Flooding - some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- Major Flooding - extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations (NWS, 2008).

The severity of a flood depends not only on the amount of water that accumulates in a period of time, but also on the land's ability to manage this water. One element is the size of rivers and streams in an area; but an equally important factor is the land's absorbency. When it rains, soil acts as a sponge. When the land is saturated or frozen, infiltration into the ground slows and any more water that accumulates must flow as runoff (Harris, 2001). The State of Oklahoma (and Oklahoma County jurisdictions) considers a rainfall of one inch per hour or a river rise that stays within the river's banks to be a minor severity. A major severity to the State (and the County jurisdictions) is identified as a rainfall of three inches or more an hour, or more than one inch in three hours on saturated ground, or a river that overflows its bank (OK HMP, 2010).

Creeks, rivers, riparian and floodplain areas are common throughout the County (Oklahoma County Master Plan, 2007). Flooding can occur anywhere in the State of Oklahoma. Riverine flooding may occur anywhere near a river, creek or stream. Those communities that are located downstream from flood control dams are at risk from riverine flooding (Oklahoma HMP). New development, roads, and agriculture uses all contribute to the loss of riparian and floodplain areas; increasing the chances of downstream flooding (Oklahoma County Master Plan, 2007).

The State of Oklahoma is divided into eight water planning areas. Oklahoma County is located within the Central Planning Area. This Planning Region is primarily located in the North Canadian and Canadian River Basins. It is the smallest of the eight planning regions, comprising of only 3,544 square miles. Oklahoma County accounts for more than 17-percent of the total projected municipal and industrial water demand for the entire State (Oklahoma Water Resources Board, 1997).

Of the four major rivers in the Central Planning Area, the Deep Fork River and the North Canadian River are located within the County. The Deep Fork River is of fair quality with moderate mineral content. At certain times of the year, the chloride content approaches the maximum allowed under Safe Drinking Water Act standards. The North Canadian River has relatively high levels of Total Dissolved Solvents (TDS) and chloride. Oklahoma City wastewater return flows constitute a large percentage of the River's total flow (Oklahoma Water Resources Board, 1997).

Arcadia Lake is one of the major reservoirs of the Central Planning Area. This lake provides water supply, flood control and recreation opportunities along the Deep Fork River in Oklahoma County. The Lake provides 12,100 acre-feet per year of water supply. The entire available yield is allocated to the Edmund Public Works Authority (Oklahoma Water Resources Board, 1997).

There are five major municipal lakes within the Central Planning, three of which are owned and operated by Oklahoma City. The largest municipal lake is Lake Stanley Draper, on East Elm Creek in Cleveland County. It was built in 1962 by the Oklahoma City and it utilized primarily as terminal storage for water pumped from Atoka and McGee Creek Reservoirs in the Southeast Planning Region. Lake Hefner is also owned and operated by Oklahoma City and was built on Bluff Creek in 1943 for water supply and recreation in northwest Oklahoma County. It serves as terminal storage for diversions from the North Canadian River and releases from Canton Lake. Lake Overholser is the Oklahoma City reservoir. It is located on the North Canadian River in eastern Canadian County. It was built in 1919 for water supply and recreational purposes (Oklahoma Water Resources Board, 1997).

Within the County, there are several waterways that cause major flooding. These include the North Canadian River, Deep Fork Creek and Deer Creek. The North Canadian River has its headwaters in New Mexico and flows in a southeasterly direction through western Oklahoma to Oklahoma City and then to Eufaula Reservoir in eastern Oklahoma. The reach of the River that flows through the County is controlled at the very end of the Canton Reservoir which is approximately 75 miles upstream and the rest is affected by Lake Overholser. Major flooding has occurred within the County along the River. Oklahoma City and the City of Del City have experienced major flooding associated with this River (FEMA, 2009).

The Deep Fork basin headwaters are located within Oklahoma City and drain the areas immediately north of the City's business district. The Deep Fork flows northeasterly out of the County (FEMA, 2009).

The Deer Creek basin is located in the northwest part of the County and flows in a northeasterly direction out of the County. Most of the basin in located within a rural setting, except for one major tributary, Bluff Creek. Bluff Creek drains an extensive urban area, including several urban lakes (Lake Hefner), which is a major water supply lake for Oklahoma City (FEMA, 2009).

FEMA Flood Hazard Areas

According to FEMA, flood hazard areas are defined as areas that are shown to be inundated by a flood of a given magnitude on a map. These areas are determined using statistical analyses of records of riverflow, storm tides, and rainfall; information obtained through consultation with the community;

floodplain topographic surveys; and hydrologic and hydraulic analyses. Flood hazard areas are delineated on FEMA's Flood Insurance Rate Maps (FIRM), which are official maps of a community on which the Federal Insurance and Mitigation Administration has indicated both the Special Flood Hazard Areas (SFHA) and the risk premium zones applicable to the community. These maps identify the SFHAs; the location of a specific property in relation to the SFHA; the base (100-year) flood elevation (BFE) at a specific site; the magnitude of a flood hazard in a specific area; the undeveloped coastal barriers where flood insurance is not available and locates regulatory floodways and floodplain boundaries (100-year and 500-year floodplain boundaries) (FEMA, 2003; FEMA, 2004; FEMA, 2006; FEMA, 2008).

The land area covered by the floodwaters of the base flood is the SFHA on a FIRM. It is the area where the National Flood Insurance Programs (NFIP) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. The SFHA includes Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, V1-30, VE, and V. (FEMA, 2007). This regulatory boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities since many communities have maps showing the extent of the base flood and likely depths that will be experienced. The base flood is often referred to as the "100-year" flood designation. The BFE on a FIRM is the elevation of a base flood event, or a flood which has a 1-percent chance of occurring in any given year as defined by the NFIP. The BFE describes the exact elevation of the water that will result from a given discharge level, which is one of the most important factors used in estimating the potential damage to occur in a given area. A structure located within a 100-year floodplain has a 26-percent chance of suffering flood damage during the term of a 30-year mortgage. The 100-year flood is a regulatory standard used by Federal agencies and most states, to administer floodplain management programs. The 100-year flood is used by the NFIP as the basis for insurance requirements nationwide. FIRMs also depict 500-year flood designations, which is a boundary of the flood that has a 0.2-percent chance of being equaled or exceeded in any given year (FEMA, 2003; FEMA, 2006).

In addition to FIRM and DFIRMs, FEMA also provides Flood Insurance Studies (FISs) for entire counties and individual jurisdictions. These studies aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. They are narrative reports of countywide flood hazards, including descriptions of the flood areas studied and the engineered methods used, principal flood problems, flood protection measures and graphic profiles of the flood sources (FEMA, Date Unknown). A countywide FIS for Oklahoma has been completed (December 2009). The 2009 FIS indicated the following principal flood problems:

- City of Choctaw – The City has low-lying areas that are subject to periodic flooding caused by overflow of the Choctaw Creek and its tributaries, along with the North Canadian River. The most severe flooding occurs upstream from roadways that restrict the flow. Flooding along the Creek has not caused extensive property damage; however, future development could increase the threat of flood problems.
- City of Del City – Flooding in the City is mainly caused by the Crutcho and Cherry Creeks. Areas where natural and man-made obstructions in the floodplains have an increased severity of flooding.
- City of Edmond – Flooding in the City typically results from intense thunderstorms associated with squall line activity. The greatest potential for flood damage in the City exists along the upper portion of Spring Creek, west of Bryant Avenue. The main reasons why this area floods is due to increased urbanization, residential development along the floodplain, and inadequate bridge and culvert openings.
- City of Midwest City – Low-lying areas in the City are subject to periodic flooding caused by overflow of Crutcho, Soldier and Silver Creeks. Most flooding occurs upstream from roadways

that restrict the flow. Urban expansion and future development in floodplains could increase the severity of flooding in the City.

- Town of Nicoma Park – Low-lying areas in the Town are subject to periodic flooding caused by overflow of Choctaw Creek and its tributaries. The most severe flooding occurs as a result of thunderstorms and intense rainfall. Most flooding occurs upstream from roadways that restrict the flow.
- City of Spencer – Low-lying areas in the City are subject to periodic flooding caused by overflow from the North Canadian River, Crutcho Creek, Silver Creek and Tributary 9. The most severe flooding typically occurs after thunderstorms with intense rainfall. Most flooding occurs upstream from roadways that restrict the flow.
- City of The Village – Potential for flood damage exists within the City along the Chisholm Creek channel from Barclay Road downstream to Hefner Road. The potential for the greatest flood damage exists for the homes bordering Village Drive from Goldstone Terrace to Finley Drive and within the apartment complex along the floodplains from Finley Drive to Cavanaugh.
- City of Warr Acres – Low-lying areas in the City are subject to periodic flooding caused by overflow of Spring Creek. The most severe flooding occurs as a result of thunderstorms and intense rainfall. Most flooding occurs upstream from roadway and ponds that restrict the flow (FEMA, 2009).

Previous Occurrences and Losses

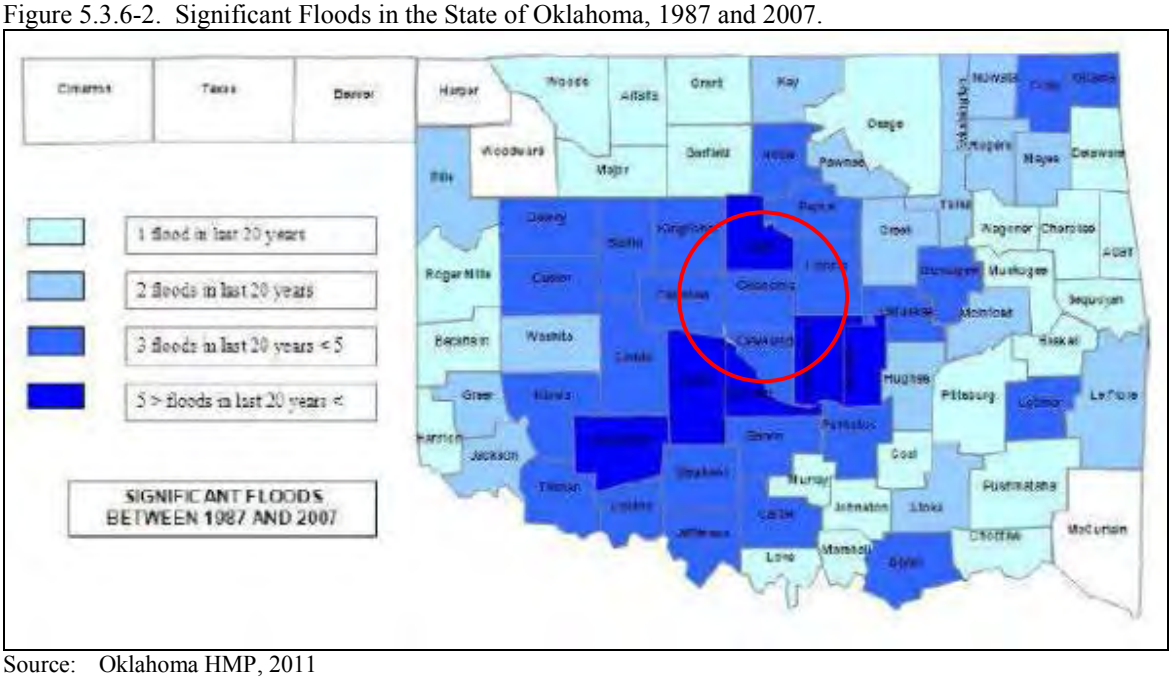
Major flooding is not a significant concern to Oklahoma County; however, moderate flooding is considered a concern to County, as this could affect isolated areas and communities within the County. Many sources provided historical information regarding previous occurrences and losses associated with flooding events throughout the State of Oklahoma and Oklahoma County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

According to NOAA's NCDC storm events database, Oklahoma County experienced 58 flood events between April 30, 1950 and November 31, 2011. Total property damages, as a result of these flood events, were estimated at $13.2 million. This total may include damages to other counties. According to the Hazard Research Lab at the University of South Carolina's Spatial Hazard Events and Losses Database for the U.S. (SHELDUS), between 1960 and 2010, 41 flood events occurred within the County. The database indicated that flood events and losses specifically associated with Oklahoma County and its municipalities totaled over $13.5 million in property damage and over $3.1 million in crop damage. However, these numbers may vary due to the database identifying the location of the hazard event in various forms or throughout multiple counties or regions.

Between 1954 and 2011, FEMA declared that the State of Oklahoma experienced 46 flood-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: severe storms, tornado, heavy rains, hail, and straight-line winds. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations. Of those events, the Oklahoma Emergency Management Office (OEM), FEMA, and other sources indicate that Oklahoma County has been declared as a disaster area as a result of 13 flood events (FEMA, 2012; OEM, 2012).

Figure 5.3.6-2 shows past significant flooding that has occurred in the State of Oklahoma between 1987 and 2007. The counties in dark blue are the most vulnerable to flooding and have experienced more than five significant floods in the last 20 years. According to this figure, Oklahoma County has experienced between three and five significant floods in the last 20 years.

Figure 5.3.6-2. Significant Floods in the State of Oklahoma, 1987 and 2007.



Source: Oklahoma HMP, 2011

Note: The red circle indicates the approximate location of Oklahoma County. The County has experienced between three and five significant floods in last 20 years.

Based on all sources researched, known flooding events that have affected Oklahoma County and its municipalities are identified in Table 5.3.6-1. With flood documentation for the State being so extensive, not all sources have been identified or researched. Therefore, Table 5.3.6-1 may not include all events that have occurred throughout the County and region.

Table 5.3.6-1. Flooding Events Between 1950 and 2012

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
June 8-10, 1974	Flooding	DR-441	Yes	The County had approximately $620 K in property damage and 14 injuries.	FEMA, SHELDUS
November 26, 1974	Flooding	DR-453	Yes		FEMA
October 17-19, 1983	Flooding	DR-693	Yes	The County had approximately $656 K in property damage and $2.1 M in crop damage.	FEMA, SHELDUS
September 29 – October 1, 1986	Flooding	DR-778	Yes	The County had approximately $2 M in property damage and $892 K in crop damage.	FEMA
May 2, 1990	Flooding, Tornado	DR-866	Yes	The County had approximately $500 K in property damage and one fatality.	FEMA, SHELDUS
May 8, 1993	Tornadoes	DR-991	Yes	Four fatalities; $50 M in property damage	FEMA, NOAA-NCDC
June 9, 1993	Flash Flooding	N/A	N/A	Severe TSTMs moved across northern Oklahoma, causing lightning, large hail, damaging winds, flash flooding and three tornadoes. The three tornadoes were not in Oklahoma County. Oklahoma County had approximately $50 K in property damage.	NOAA-NCDC
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	The County had approximately $268 K in property damage.	FEMA, SHELDUS
April 24-26, 1999	Flooding	N/A	N/A	Between five and seven inches of rain across portions of the State. Some areas had over 10 inches of rain. In Oklahoma County, the Town of Choctaw NE 23rd was closed due to flooding. Oklahoma County had approximately $932 K in property damage.	NOAA-NCDC
May 3-4, 1999	Tornadoes, Flooding	DR-1272	Yes	The County had over $450 M in property damage, 234 injuries and 12 fatalities.	FEMA, SHELDUS
June 23, 1999	Flash Flooding	N/A	N/A	TSTMs formed across portions of central Oklahoma, causing widespread street flooding. In Oklahoma County, on West Reno in Oklahoma City was flooded. A pick-up truck was almost submerged. Water had to bed removed by pumps at NW 6th and Penn, which sections of SE 74th near Hiawassee Road caved in. Oklahoma County had approximately $50 K in property.	NOAA-NCDC

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
October 21-29, 2000	Flooding	DR-1349	Yes	The County had approximately $670 K in property damage.	FEMA, SHELDUS
May 30, 2001	Flooding	N/A	N/A	Severe TSTMs formed over portions of northern and western Oklahoma. Strong winds and hail accompanied the TSTMs and flooding occurred in many areas. In Oklahoma County, portions of Interstate 35 were inundated with one foot of water in Oklahoma City. Cars were stalled in high water on the Interstate, near SW 89th. The North Deer Creek at SE 59th and Dobbs Road overflowed its banks. Oklahoma County had approximately $30 K in property damage.	NOAA-NCDC
September 7, 2001	Urban Flooding	N/A	N/A	In Oklahoma City, a car stalled in high water at the intersection of NE 18th and Walnut, and four vehicles stalled in high water at NW 79th and Broadway Ave. The County had approximately $25 K in property damage.	NOAA-NCDC
August 11-12, 2004	Flash Flood	N/A	N/A	Strong TSTMs brought heavy rainfall and flooding to the north central portion of Oklahoma, affecting Garfield, Logan, Oklahoma, and Pottawatomie Counties. Rainfall totals ranged between 2.5 inches and five inches. The heavy rain caused flash and riverine flooding in the affected counties. In Oklahoma County, there was minor flooding along the North Canadian River, which crested at 19.1 feet. Deer Creek overflowed its banks and flooded Meridian Avenue. Flash flooding was reported in Oklahoma City, which closed the underpass on NE 23rd Avenue at the junction of Interstate 235. Flood depths were up to six feet in some locations. In the City of Bethany, Eldon Lynn Park was inundated by flash flooding. Water had to be pumped out of the park. In the City of Edmund, flash flooding inundated the intersection of Western Avenue and NE 234th Street. In Midwest City, Soldier Creek overflowed its banks and flooded the intersection of NE 10th Street and Midwest Boulevard, and Woodside Drive and E. Reno Avenue. The flooding caused the City to close the NE 10th Street/Midwest Boulevard intersection. Approximately 50 apartment units were flooded in this area. Many residents were evacuated. Crutcho Creek overflowed its banks near the intersection of NE 23rd Street and Air Depot Boulevard. Interstate 40 was closed due to flooding. The County had approximately $500 K in property damage.	NOAA-NCDC

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
January 12-26, 2007	Severe Winter Storms and Flooding	EM-3272	Yes		FEMA
May 4-11, 2007	Tornadoes, Flooding	DR-1707	No	TSTMs brought large hail, high winds, tornadoes and heavy rain to the area. The heavy rains caused flooding in Oklahoma County. In Oklahoma City, there were reports of widespread flash flooding. One to two feet of water was on Morgan Road. Two feet of water was reported on Interstate 40. Ramps to the Interstate were closed. High water rescues were performed. Two vehicles were swept into the North Canadian River near Sooner Road. In the City of Harrah, NE 50th and Harrah Road were closed due to flooding. The County had over $45,000 in road and bridge repairs.	NOAA-NCDC, Planning Committee Input
June 10 – July 25, 2007	Flooding, Tornadoes	DR-1712	Yes	June 14th – Showers and TSTMs developed over the State, bringing heavy rains, hail and wind. The heavy rains caused flooding in many locations. In the City of Harrah, two of water was reported on the roadway at NE 50th and Harrah Road. June 26th – Intense showers and TSTMs moved through the eastern two-thirds of the State, bringing heavy rainfall and flash flooding. In the City of Bethany, high water covered the road at Ski Island. Water rescues were performed. The County had approximately $5 K in property damage. June 29th – Slow moving showers and TSTMs developed and moved northeast into the State. Flash flooding resulted over parts of southwest and central Oklahoma. In Oklahoma City, numerous roads were closed in the northern portion of the City due to flooding. July 10th – TSTMs brought hail, high winds and flash flooding to the area. In Oklahoma City, a bridge north of Danforth Road on Western Avenue was closed due to a creek overflowing its banks.	FEMA
August 19, 2007	Tornadoes, Flooding (Remnants of Tropical Storm Erin)	DR-1718	Yes	Remnants of Tropical Storm Erin brought heavy rainfall to the area. Sustained wind speeds of 35 to 45 mph struck the area. The heavy rain caused flooding and rivers and creeks to overflow their banks. In Oklahoma City, several feet of water inundated the intersection of NW 36th and Broadway. Numerous City streets were closed due to flooding. The County had approximately $15 K in property damage.	FEMA, NOAA-NCDC

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
April 10, 2008	Flash Flooding	N/A	N/A	A coldfront moved through the State, bringing strong TSTMs, heavy rain and hail. Numerous locations had up to several inches of rain, causing flash flooding. In Oklahoma City, several streets were closed due to flooded roadways. The County had approximately $5 K in property damage.	NOAA-NCDC
June 13-15, 2010	Tornadoes, Straight-Line Winds, and Flooding	DR-1926	Yes	Significant flooding occurred over parts of central Oklahoma. Many homes and cars were flooded. One person died, 136 injured. At the end of the storm, widespread rainfall totals ranged between five and nine inches. At Will Rogers Airport in Oklahoma City, the largest daily precipitation was reported, with 7.61 inches. In Oklahoma City, the heavy rain led to flash flooding. Several roadways were flooded and closed. In the City of Choctaw, roads were barricaded due to flooding in the City; bridges and culverts had to be repaired as a result of this event. In the City of Del City, roads and intersections were closed due to flooding; residential and commercial properties had damage due to flooding; debris removal from roadways and culverts; City had over $27,000 in expenses. In the City of Nichols Hills, three streets were damaged from this storm – Trenton Road, Huntington Ave., and Dorchester Drive, causing the City over $55,000 in expenses. The County had received almost a foot of rain after this event. This storm affected 122 homes – 52 with minor damage, 11 with major damage and one completely destroyed. Damages to Oklahoma County included a two-lane roadway and culvert washed out by floodwaters. In the City of Forest Park, floodwaters washed out a roadway and two culverts. Roadways throughout the County were flooded and damaged. The County had over $340,000 in expenses. The County had approximately $5.5 M in property damage.	FEMA, NOAA-NCDC, Input from Planning Committee

Note (1): Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of increased U.S. Inflation Rates.

FEMA	Federal Emergency Management Agency	NCDC	National Climate Data Center
K	Thousand ($)	NOAA	National Oceanic Atmospheric Administration
M	Million ($)	NWS	National Weather Service
Mph	Miles Per Hour	SHELDUS	Spatial Hazard Events and Losses Database for the U.S.
N/A	Not applicable	TSTM	Thunderstorm

Probability of Future Events

Given the history of flood events that have impacted Oklahoma County, it is apparent that future flooding of varying degrees will occur. The fact that the elements required for flooding exist and that major flooding has occurred throughout the county in the past suggests that many people and properties are at risk from the flood hazard in the future.

It is estimated that Oklahoma County will continue to experience direct and indirect impacts of floods annually. Table 5.3.6-2 summarizes the occurrences of flood events and their annual occurrence (on average).

Table 5.3.6-2. Occurrences of Flood Events in Oklahoma County, 1950 - 2011

Event Type	Total Number of Occurrences	Annual Number of Events (average)
Flash Flood	47	1.3
Urban / Small Stream Flood	4	0.1
Flood	7	0.1
Total:	**58**	**1.1**

Source: NOAA-NCDC, 2011

In Section 5.3, the identified hazards of concern for Oklahoma County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for flood in the County and all participating jurisdictions in this HMP is considered 'Highly Likely' (Event is probable within the calendar year. Event has a 1 in 1 year chance of occurring.).Although Forest Park, Nichols Hills, and Valley Brook do not currently have population in the 100 year or 500 year flood zone (see below), they are considered equally at risk of flooding of streets and culverts as Oklahoma County jurisdictions have experienced heavy rain events where cells stall or repeatedly train across the same area causing rainfall amounts sufficient enough to cause flash flooding of varying depths over widespread areas. Given recent occurrences over the past 10 years, this is expected to continue to be a problem in the future.

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the flood hazard, areas identified as hazard areas include the 100- and 500-year floodplains. The following text evaluates and estimates the potential impact of flooding in Oklahoma County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact, including: (1) impact on life, safety and health, (2) general building stock, (3) critical facilities and infrastructure, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

All types of flooding can cause widespread damage throughout rural and urban areas, including but not limited to: water-related damage to the interior and exterior of buildings; destruction of electrical and other expensive and difficult-to-replace equipment; injury and loss of life; proliferation of disease vectors; disruption of utilities, including water, sewer, electricity, communications networks and facilities; loss of agricultural crops and livestock; placement of stress on emergency response and healthcare facilities and personnel; loss of productivity; and displacement of persons from homes and places of employment (Foster, Date Unknown).

The flood hazard is a concern for Oklahoma County. To assess vulnerability, potential losses were calculated for the County for riverine flooding for 100-year and 500-year MRP flood events. The flood hazard exposure and loss estimate analysis is presented below.

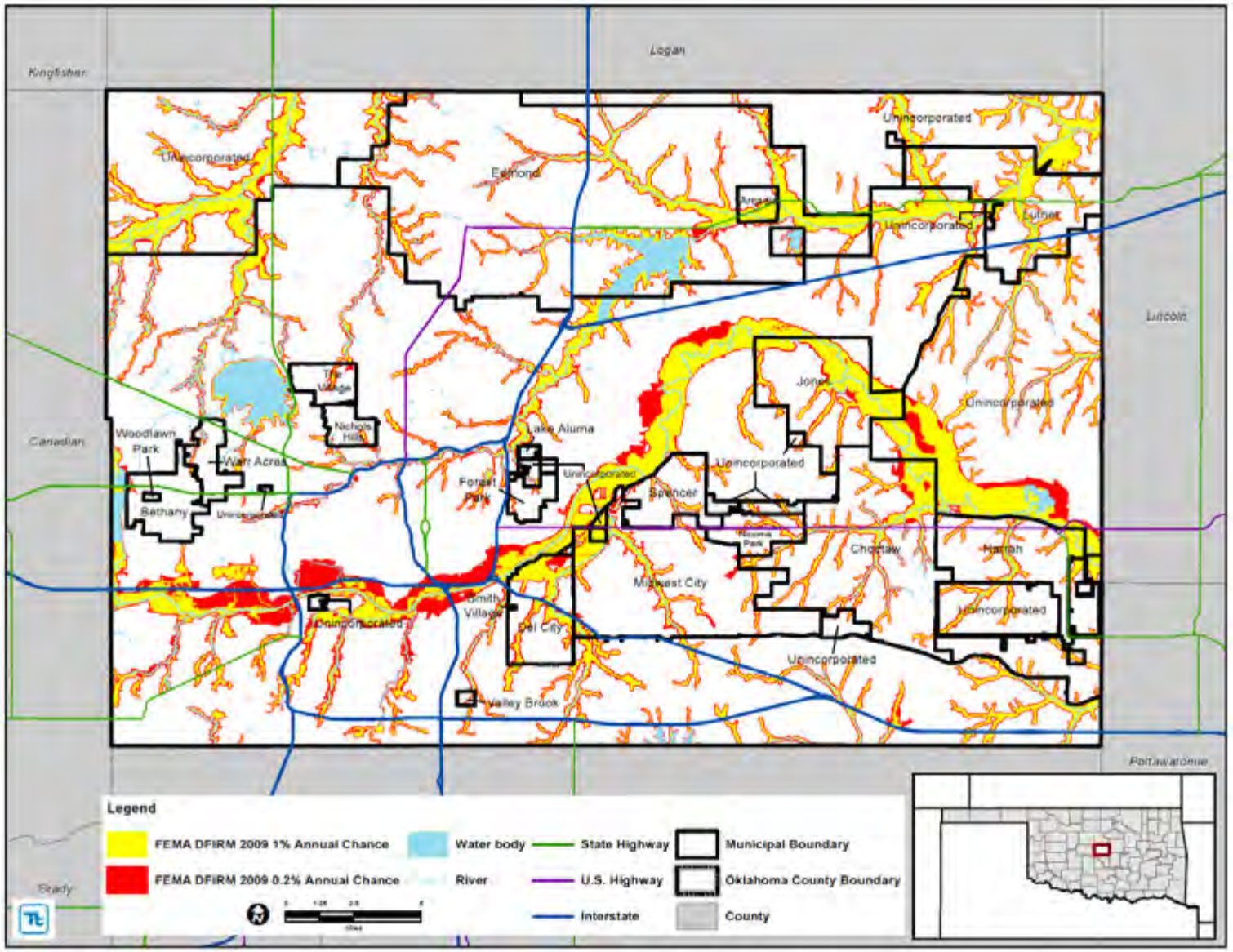
Data and Methodology

The 100- and 500-year MRP flood events were examined to evaluate Oklahoma County's risk and vulnerability to the flood hazard. These MRP flood events are generally those considered by planners and evaluated under federal programs such as the NFIP.

A modified Level 1 HAZUS-MH analysis was performed to analyze the risk and vulnerability to Oklahoma County. The model uses 2000 U.S. Census data at the block level and default general building stock data (RSMeans 2006), which has a level of accuracy acceptable for planning purposes. Where possible, the HAZUS-MH default data was enhanced using local GIS data from the county, state and federal sources and updated 2010 U.S. Census data was used for the exposure analysis.

The hydrology and hydraulics for the selected river reaches in the County was run in HAZUS and the flood-depth grid and flood boundary for the specified return periods (100- and 500-year mean return period [MRP]) were generated. To estimate exposure, the 2009 FEMA DFIRM flood boundaries were used. HAZUS-MH 2.0 calculated the estimated damages to the general building stock and critical facilities based on the depth grid generated and the default HAZUS damage functions in the flood model. Figure 5.3.6-3 illustrates the flood boundaries used for this vulnerability assessment.

Figure 5.3.6-3. Floodplains in Oklahoma County



Source: FEMA, 2009

Impact on Life, Health and Safety

The impact of flooding on life, health and safety is dependent upon several factors including the severity of the event and whether or not adequate warning time is provided to residents. Exposure represents the population living in or near floodplain areas that could be impacted should a flood event occur. Additionally, exposure should not be limited to only those who reside in a defined hazard zone, but everyone who may be affected by the effects of a hazard event (e.g., people are at risk while traveling in flooded areas, or their access to emergency services is compromised during an event). The degree of that impact will vary and is not measurable.

To estimate the population exposed to the 100- and 500-year flood events, the FEMA DFIRM floodplain boundaries were overlaid upon the 2010 Census population data in GIS (U.S. Census 2010). Census blocks do not follow the boundaries of the floodplain. The Census blocks with their centroid in the flood boundaries were used to calculate the estimated population exposed to this hazard. Using this approach, it is estimated that 10,354 people are within the 100-year floodplain or 4.2% of the total County population (population total 246,682 which represents the municipalities in the table below), and 12,071 people are within the 500-year floodplain (4.9% of the total population of 246,682 people). Table 5.3.6-3 lists the estimated population located within the 100- and 500-year flood zones by participant.

Table 5.3.6-3. Estimated Oklahoma County Population Vulnerable to the 100-Year and 500-Year MRP Flood Hazard

Municipality	Population in 100-Year Flood Boundary	Population in 500-Year Flood Boundary
Arcadia (T)	7	20
Bethany (C)	142	142
Choctaw (C)	984	993
Del City (C)	2,167	3,135
Edmond (C)	2,687	2,866
Forest Park (T)	0	0
Harrah (C)	329	331
Luther (T)	125	129
Midwest City (C)	1,844	2,209
Nichols Hills (C)	0	0
Nicoma Park (C)	148	231
Spencer (C)	77	88
The Village	89	165
Unincorporated County	1,419	1,426
Valley Brook (T)	0	0
Warr Acres (C)	16	16
Total	**10,034**	**11,751**

Source: Census, 2010; FEMA, 2009

Note: The method used to estimate exposure indicates there is no population in Forest Park, Nichols Hills and Valley Brook located in the 100- and 500-year flood zones. Please note that there are flood zones present in these municipalities and this methodology may be underestimating the population exposed.

Of the population exposed, the most vulnerable include the economically disadvantaged and the population over the age of 65. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on the net economic impact to

their family. The population over the age of 65 is also more vulnerable because they are more likely to seek or need medical attention which may not be available to due isolation during a flood event and they may have more difficulty evacuating.

HAZUS-MH 2.0 estimates the potential sheltering needs as a result of a 100- and 500-year MRP flood events. For the 100-year event, HAZUS-MH 2.0 estimates nearly 12,500 people will be displaced and 9,417 people will seek short-term sheltering. For the 500-year event, HAZUS-MH 2.0 estimates 14,533 people will be displaced and 11,315 people will seek short-term sheltering. Refer to Table 5.3.6-4. These population statistics are higher than the estimated population vulnerable to the 100- and 500-year flood events using the Census-block centroid in the floodplain method described above. This indicates the estimated vulnerable population may be underestimated.

The total number of injuries and casualties resulting from flooding is generally limited based on advance weather forecasting, blockades and warnings. Therefore, injuries and deaths generally are not anticipated if proper warning and precautions are in place. Ongoing mitigation efforts should help to avoid the most likely cause of injury, which results from persons trying to cross flooded roadways or channels during a flood.

Table 5.3.6-4. Estimated Oklahoma County Population Displaced or Seeking Short-Term Shelter from the 100-Year and 500-Year MRP Events

Municipality	100 Year				500 Year			
	Displaced Persons	Percent Displaced	Persons Seeking Short-Term Sheltering	Percent Seeking Shelter	Displaced Persons	Percent Displaced	Persons Seeking Short-Term Sheltering	Percent Seeking Shelter
Arcadia (T)	23	8.2	5	1.8	33	11.8	8	2.9
Bethany (C)	1,384	6.9	1,101	5.5	1,598	7.9	1,332	6.6
Choctaw (C)	517	5.5	184	2.0	607	6.4	263	2.8
Del City (C)	2,805	12.7	2,472	11.2	3,438	15.5	3,123	14.1
Edmond (C)	2,211	3.2	1,713	2.5	2,351	3.4	1,831	2.7
Forest Park (T)	2	0.2	0	0.0	2	0.2	0	0.0
Harrah (C)	171	3.7	43	0.9	277	6.0	123	2.7
Luther (T)	57	5.9	12	1.3	72	7.5	23	2.4
Midwest City (C)	2,628	4.9	2,315	4.3	2,864	5.3	2,584	4.8
Nichols Hills (C)	67	1.7	33	0.8	91	2.2	57	1.4
Nicoma Park (C)	103	4.3	23	1.0	133	5.5	36	1.5
Spencer (C)	126	3.4	35	0.9	143	3.8	48	1.3
The Village	439	4.3	366	3.6	548	5.4	457	4.5
Unincorporated County	895	6.8	289	2.2	1,164	8.9	457	3.5
Valley Brook (T)	74	8.9	74	8.9	81	9.8	81	9.8
Warr Acres (C)	662	6.0	570	5.2	762	6.9	680	6.2
Total	**12,164**	**5.4**	**9,235**	**3.3**	**14,164**	**6.7**	**11,103**	**4.2**

Source: HAZUS-MH 2.0
Note: The percent of the population displaced and seeking shelter was calculated using the 2000 U.S. Census data in HAZUS-MH 2.0.

Impact on General Building Stock

After considering the population exposed to the flood hazard, developed land, the HAZUS-MH 2.0 default value of general building stock exposed to, and damaged by, the 100- and 500-year MRP flood events was evaluated. Exposure in the flood zone includes those buildings located in the flood zone. Potential damage is the modeled loss that could occur to the exposed inventory, including structural and content value.

The HAZUS-MH 2.0 flood model does not estimate general building stock exposure to the flood hazard. To provide a general estimate of number of properties and structural/content replacement value exposure, the FEMA DFIRM flood boundaries and HAZUS-MH 2.0 general building stock inventory were used. The FEMA DFIRM 100- and 500-year flood zones were overlaid upon the HAZUS-MH 2.0 Census blocks. The HAZUS-MH 2.0 Census blocks with their centroid in the FEMA DFIRM flood zones were used to estimate the building replacement cost value exposed to this hazard (Table 5.3.6-5).

In summary, there are approximately 42,570 and 44,626 acres of land in Oklahoma County located in the DFIRM 100-year and 500-year floodplains, respectively. Approximately 8- to 9-percent of the developed land in the County is located within the 100- and 500-year DFIRM floodplains and thus exposed to the flood hazard (FEMA, 2009 USGS, 2011). Refer to Table 5.3.6-6 below.

According to the HAZUS Census block analysis (blocks with the centroid located in the flood zones), there is approximately $1.25 Billion of building/contents exposed to the 100-year flood in Oklahoma County. This represents approximately 4.7-percent of the County's total general building stock replacement value inventory (nearly $26.9 billion; see Section 4). For the 500-year event, it is estimated there is nearly $1.4 billion of buildings/contents exposed in Oklahoma County or 5.3-percent (Table 5.3.6-7).

HAZUS-MH 2.0 estimates the potential damage to the general building stock inventory associated with the 100-year flood is greater than $338 million or 1.3-percent of the County's general building stock inventory. For the 500-year event, the HAZUS-MH 2.0 potential damage estimate is nearly $465 million (structure and contents) or 1.7-percent of the County's general building stock inventory. HAZUS-MH damage assessments for Oklahoma County are displayed in Table 5.3.6-8.

Table 5.3.6-5. Land Use (2006) in the 100- and 500-year FEMA DFIRM Flood Boundaries

Land Use	Total Area (acres)	100-Year		500-Year	
		Area (acres)	Percent of Total	Area (acres)	Percent of Total
Barren (Quarry)	67.3	12.3	18.3	12.3	18.3
Developed	74,458.3	6,116.2	8.2	6,739.4	9.1
Farmland	29,372.6	12,742.2	43.4	14,172.8	48.3
Forested	146,477. 8	20,776.8	14.2	20,776.8	14.2
Water	4,055.4	2,918.7	72.0	2,920.8	72.0
Wetlands	6.6	4.0	60.6	4.0	60.6
Total	**254,438**	**42,570.2**	**16.7**	**44,626.1**	**17.5**

Source: FEMA, 2009; USGS, 2011 (2006 National Land Cover Database)

Table 5.3.6-6. Estimated HAZUS General Building Stock Replacement Value (Structure and Contents) Located in the 100- and 500-Year MRP Flood Boundaries

Municipality	Total Buildings (All Occupancy Classes)				Residential Buildings		Commercial Buildings		Industrial Buildings	
	100 Year	% Total	500 Year	% Total	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year
Arcadia (T)	$1,259,000	2.9	$1,466,000	3.4	$1,035,000	$1,242,000	$0	$0	$224,000	$224,000
Bethany (C)	$14,644,000	0.6	$14,644,000	0.6	$11,432,000	$11,432,000	$1,560,000	$1,560,000	$0	$0
Choctaw (C)	$32,651,000	3.2	$33,249,000	3.3	$25,911,000	$26,509,000	$4,869,000	$4,869,000	$1,191,000	$1,191,000
Del City (C)	$263,381,000	11.3	$327,238,000	14.0	$204,276,000	$261,031,000	$28,099,000	$33,325,000	$22,618,000	$22,618,000
Edmond (C)	$362,668,000	3.9	$383,384,000	4.1	$317,252,000	$335,205,000	$33,130,000	$35,506,000	$8,142,000	$8,405,000
Forest Park (T)	$0	0.0	$0	0.0	$0	$0	$0	$0	$0	$0
Harrah (C)	$32,169,000	7.2	$32,169,000	7.2	$25,554,000	$25,554,000	$4,155,000	$4,155,000	$2,002,000	$2,002,000
Luther (T)	$4,926,000	5.4	$5,213,000	5.7	$1,976,000	$2,263,000	$1,470,000	$1,470,000	$1,480,000	$1,480,000
Midwest City (C)	$209,401,000	3.8	$250,465,000	4.5	$156,104,000	$192,668,000	$29,566,000	$33,286,000	$8,525,000	$8,525,000
Nichols Hills (C)	$0	0.0	$13,530,000	1.8	$0	$13,138,000	$0	$392,000	$0	$0
Nicoma Park (C)	$36,504,000	12.2	$38,660,000	13.0	$24,676,000	$26,426,000	$5,408,000	$5,814,000	$5,302,000	$5,302,000
Spencer (C)	$16,271,000	4.2	$16,271,000	4.2	$13,017,000	$13,017,000	$392,000	$392,000	$0	$0
The Village (C)	$0	0.0	$8,609,000	0.7	$0	$8,453,000	$0	$156,000	$0	$0
Unincorporated County	$127,435,000	9.7	$128,356,000	9.7	$97,706,000	$98,627,000	$23,134,000	$23,134,000	$2,971,000	$2,971,000
Valley Brook (T)	$126,000	0.2	$126,000	0.2	$0	$0	$126,000	$126,000	$0	$0
Warr Acres (C)	$115,011,000	8.7	$115,011,000	8.7	$108,718,000	$108,718,000	$2,666,000	$2,666,000	$933,000	$933,000
Total	**$1,216,446,000**	**4.6**	**$1,368,391,000**	**5.1**	**$987,657,000**	**$1,124,283,000**	**$134,575,000**	**$146,851,000**	**$53,388,000**	**$53,651,000**

Source: HAZUS-MH 2.0

Notes:

1. Values represent replacement values (RV) for building structure and contents.
2. The general building stock valuations provided in HAZUS-MH 2.0 are Replacement Cost Value from RSMeans as of 2006.

Table 5.3.6-7. Estimated General Building Stock Replacement Value (Structure and Contents) Located in the 100- and 500-Year MRP Flood Boundaries

Municipality	Agricultural Buildings		Religious Buildings		Government Buildings		Educational Buildings	
	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year
Arcadia (T)	$0	$0	$0	$0	$0	$0	$0	$0
Bethany (C)	$0	$0	$0	$0	$1,652,000	$1,652,000	$0	$0
Choctaw (C)	$0	$0	$680,000	$680,000	$0	$0	$0	$0
Del City (C)	$0	$0	$3,710,000	$3,710,000	$1,870,000	$3,746,000	$2,808,000	$2,808,000
Edmond (C)	$294,000	$418,000	$724,000	$724,000	$0	$0	$3,126,000	$3,126,000
Forest Park (T)	$0	$0	$0	$0	$0	$0	$0	$0
Harrah (C)	$458,000	$458,000	$0	$0	$0	$0	$0	$0
Luther (T)	$0	$0	$0	$0	$0	$0	$0	$0
Midwest City (C)	$360,000	$484,000	$4,958,000	$5,614,000	$262,000	$262,000	$9,626,000	$9,626,000
Nichols Hills (C)	$0	$0	$0	$0	$0	$0	$0	$0
Nicoma Park (C)	$262,000	$262,000	$656,000	$656,000	$200,000	$200,000	$0	$0
Spencer (C)	$0	$0	$2,196,000	$2,196,000	$666,000	$666,000	$0	$0
The Village (C)	$0	$0	$0	$0	$0	$0	$0	$0
Unincorporated County	$1,596,000	$1,596,000	$464,000	$464,000	$0	$0	$1,564,000	$1,564,000
Valley Brook (T)	$0	$0	$0	$0	$0	$0	$0	$0
Warr Acres (C)	$0	$0	$0	$0	$0	$0	$2,694,000	$2,694,000
Total	**$2,970,000**	**$3,218,000**	**$13,348,000**	**$14,044,000**	**$4,650,000**	**$6,526,000**	**$19,818,000**	**$19,818,000**

Source: HAZUS-MH 2.0

Notes:

1. Values represent replacement values (RV) for building structure and contents.
2. The general building stock valuations provided in HAZUS-MH 2.0 are Replacement Cost Value from RSMeans as of 2006.

Table 5.3.6-8. Estimated Potential General Building Stock Loss (Structure and Contents) by the 100-Year and 500-Year MRP Flood Events

Municipality	Total Buildings (All Occupancies)		Percentage of Total Building Value		Residential Buildings		Commercial Buildings		Industrial Buildings	
	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year
Arcadia (T)	$2,172,000	$1,745,000	5.0	4.0	$676,000	$997,000	$420,000	$567,000	$106,000	$179,000
Bethany (C)	$15,556,000	$28,657,000	0.7	1.2	$17,317,000	$24,198,000	$1,603,000	$2,028,000	$313,000	$408,000
Choctaw (C)	$17,364,000	$23,112,000	1.7	2.3	$11,599,000	$15,847,000	$2,977,000	$3,721,000	$862,000	$1,320,000
Del City (C)	$58,949,000	$86,743,000	2.5	3.7	$43,111,000	$64,279,000	$6,676,000	$9,320,000	$5,719,000	$8,716,000
Edmond (C)	$93,748,000	$109,161,000	1.0	1.2	$72,979,000	$85,060,000	$15,516,000	$17,233,000	$2,935,000	$3,880,000
Forest Park (T)	$0	$330,000	0.0	0.3	$0	$100,000	$0	$230,000	$0	$0
Harrah (C)	$4,730,000	$8,156,000	1.1	1.8	$3,111,000	$5,606,000	$1,033,000	$1,585,000	$364,000	$696,000
Luther (T)	$1,938,000	$2,901,000	2.1	3.2	$1,038,000	$1,481,000	$512,000	$855,000	$129,000	$182,000
Midwest City (C)	$72,118,000	$94,107,000	1.3	1.7	$48,362,000	$63,405,000	$18,450,000	$24,355,000	$1,021,000	$1,538,000
Nichols Hills (C)	$1,282,000	$1,997,000	0.2	0.3	$983,000	$1,560,000	$299,000	$437,000	$0	$0
Nicoma Park (C)	$2,662,000	$4,396,000	0.9	1.5	$1,944,000	$3,137,000	$326,000	$524,000	$257,000	$501,000
Spencer (C)	$3,273,000	$4,480,000	0.8	1.2	$2,651,000	$3,527,000	$112,000	$180,000	$129,000	$210,000
The Village (C)	$15,000	$15,243,000	0.0	1.2	$4,941,000	$7,971,000	$3,763,000	$4,978,000	$25,000	$61,000
Unincorporated County	$36,676,000	$45,075,000	2.8	3.4	$17,272,000	$26,706,000	$11,184,000	$11,892,000	$4,743,000	$3,589,000
Valley Brook (T)	$0	$2,556,000	0.0	3.3	$0	$1,454,000	$0	$811,000	$0	$291,000
Warr Acres (C)	$15,888,000	$21,310,000	1.2	1.6	$12,828,000	$17,195,000	$1,673,000	$2,399,000	$172,000	$276,000
Total	**$326,371,000**	**$449,969,000**	**1.3**	**2.0**	**$238,812,000**	**$322,523,000**	**$64,544,000**	**$81,115,000**	**$16,775,000**	**$21,847,000**

Source: HAZUS-MH 2.0

Notes:

1. Values represent replacement values (RV) for building structure and contents.
2. The general building stock valuations provided in HAZUS-MH 2.0 are Replacement Cost Value from RSMeans as of 2006.

Table 5.3.6-8 Potential Estimated General Building Stock Loss (Structure and Contents) by the 100-Year and 500-Year MRP Flood Events (Continued)

Municipality	Agriculture Buildings		Religious Buildings		Government Buildings		Education Buildings	
	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year
Arcadia (T)	$0	$0	$0	$0	$0	$2,000	$0	$0
Bethany (C)	$12,000	$24,000	$1,121,000	$1,319,000	$274,000	$345,000	$165,000	$335,000
Choctaw (C)	$61,000	$78,000	$1,086,000	$1,367,000	$0	$0	$581,000	$779,000
Del City (C)	$6,000	$11,000	$1,365,000	$1,819,000	$1,076,000	$1,220,000	$996,000	$1,378,000
Edmond (C)	$452,000	$686,000	$1,139,000	$1,455,000	$76,000	$113,000	$551,000	$734,000
Forest Park (T)	$0	$0	$0	$0	$0	$0	$0	$0
Harrah (C)	$0	$0	$91,000	$123,000	$49,000	$73,000	$73,000	$73,000
Luther (T)	$9,000	$31,000	$61,000	$96,000	$0	$5,000	$189,000	$251,000
Midwest City (C)	$89,000	$114,000	$1,970,000	$2,415,000	$406,000	$506,000	$1,820,000	$1,774,000
Nichols Hills (C)	$0	$0	$0	$0	$0	$0	$0	$0
Nicoma Park (C)	$8,000	$17,000	$84,000	$122,000	$7,000	$16,000	$36,000	$79,000
Spencer (C)	$0	$0	$40,000	$63,000	$0	$0	$341,000	$500,000
The Village (C)	$15,000	$19,000	$307,000	$438,000	$178,000	$251,000	$1,080,000	$1,525,000
Unincorporated County	$1,249,000	$1,200,000	$1,033,000	$1,221,000	$81,000	$223,000	$205,000	$244,000
Valley Brook (T)	$0	$0	$0	$0	$0	$0	$0	$0
Warr Acres (C)	$20,000	$27,000	$124,000	$162,000	$916,000	$1,071,000	$155,000	$180,000
Total	**$1,921,000**	**$2,207,000**	**$8,421,000**	**$10,600,000**	**$3,063,000**	**$3,825,000**	**$6,192,000**	**$7,852,000**

Source: HAZUS-MH 2.0

Notes:

1. Values represent replacement values (RV) for building structure and contents.
2. The general building stock valuations provided in HAZUS-MH 2.0 are Replacement Cost Value from RSMeans as of 2006.

In addition to total building stock modeling, individual data available on flood policies, claims, RLP and severe RLP (SRLs) were analyzed. Oklahoma Water Resources Board provided a list of residential properties with NFIP policies, past claims and multiple claims (RLPs). According to the metadata provided: "The NFIP Repetitive Loss File contains losses reported from individuals who have flood insurance through the Federal Government. A property is considered a repetitive loss property when there are two or more losses reported which were paid more than $1,000 for each loss. The two losses must be within 10 years of each other & be as least 10 days apart. Only losses from (*sic* since) 1/1/1978 that are closed are considered."

Severe RLPs (SRL) were then examined in Oklahoma County. According to section 1361A of the National Flood Insurance Act, as amended (NFIA), 42 U.S.C. 4102a, an SRL property is defined as a residential property that is covered under an NFIP flood insurance policy and:

- Has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or
- For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.
- For both of the above, at least two of the referenced claims must have occurred within any 10-year period, and must be greater than 10 days apart.

Table 5.3.6-9 summarizes the NFIP policies, claims and repetitive loss statistics for Oklahoma County Plan participants. According to FEMA, there 16 repetitive loss properties and one severe repetitive loss property among the Plan participants (FEMA, 2011). This information was provided by FEMA in October 2011.

Table 5.3.6-9. NFIP Policies, Claims and Repetitive Loss Statistics

Municipality	# Policies	# Claims (Losses)	Total Loss Payments	# Rep. Loss Prop.	# Severe Rep. Loss Prop.	Type of Rep. Loss Structure	
Arcadia (T)	7	5	$169,600	0	0	N/A	
Bethany (C)	18	9	$19,455	1	0	Residential	
Choctaw (C)	69	9	$2,182	0	0	N/A	
Del City (C)	384	45	$179,532	2	0	Residential	
Edmond (C)	314	96	$1,426,809	2	0	Residential	
Forest Park (T)	3	0	$0	0	0	N/A	
Harrah (C)	23	0	$0	0	0	N/A	
Luther (T)	5	1	$0	0	0	N/A	
Midwest City (C)	265	35	$281,297	0	0	N/A	
Nichols Hills (C)	16	16	$59,602	2	0	Residential	
Nicoma Park (C)	8	3	$7,694	1	0	Commercial	
Spencer (C)	24	6	$35,792	3	0	Residential	
The Village (C)	41	1	$0	0	0	N/A	
Unincorporated County	102	47	$429,831	3	0	Residential	
Warr Acres (C)	15	6	$6,133	0	0	N/A	
Total	**1,295**	**280**	**$2,621,098**	**14**	**0**	**13- Residential**	**1- Commercial**

Source: FEMA, 2011

Notes:

(1) Data provided by FEMA in October 2011. Statistics are totals using the "Community Name" field.
(2) C = City; Prop. = Property; T = Town

Impact on Critical Facilities

In addition to considering general building stock at risk, the risk of flood to critical facilities, utilities and user-defined facilities was evaluated. HAZUS-MH was used to estimate the flood loss potential to critical facilities exposed to the flood risk. Using depth/damage function curves, HAZUS estimates the percent of damage to the building and contents of critical facilities. Tables 5.3.6-10 and 5.3.6-11 list the critical facilities and utilities located in the FEMA preliminary DFIRM flood zones and the percent damage HAZUS-MH 2.0 estimates to the facility as a result of a 100- and 500-year MRP events.

In cases where short-term functionality is impacted by a hazard, other facilities of neighboring municipalities may need to increase support response functions during a disaster event. Mitigation planning should consider means to reduce impact to critical facilities and ensure sufficient emergency and school services remain when a significant event occurs.

Table 5.3.6-10. Critical Facilities Located in the DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss			
			100-Yr	500-Yr	100-Yr Structure Damage %	100-Yr Content Damage %	500-Yr Structure Damage %	500-Yr Content Damage %
APOLLO ES	Bethany (C)	School			9.0	62.9	10.1	68.1
BETHANY CHRISTIAN ACADEMY	Bethany (C)	School			9.0	62.9	10.1	68.1
NICOMA PARK IES	Choctaw (C)	School	X	X	-	-	-	-
NICOMA PARK JHS	Choctaw (C)	School	X	X	-	-	-	-
Choctaw City Hall	Choctaw (C)	User Defined		X	14.0	83.5	13.1	74.9
Del City Fire Department	Del City (C)	Fire	X	X	-	-	0.1	0.1
City Hall	Del City (C)	User Defined		X	9.6	63.7	13.9	82.5
Public Works/Fleet Maintenance	Del City (C)	User Defined			11.7	44.5	12.7	60.5
CHISHOLM ES	Edmond (C)	School			8.6	49.6	6.9	37.2
HARRAH MS	Harrah (C)	School	X	X	-	-	-	-
VIRGINIA SMITH ES	Harrah (C)	School	X	X	-	-	-	-
CLARA REYNOLDS ES	Harrah (C)	School	X	X	-	-	-	-
HARRAH JHS	Harrah (C)	School	X	X	-	-	-	-
Luther Mill And Farm Supply	Luther (T)	User Defined	X	X	-	-	-	-
EOC At Public Works	Midwest City (C)	EOC	X	X	22.9	97.6	15.1	70.5
Crutcho Elementary School	Midwest City (C)	School	X	X	-	-	-	-
STEED ES	Midwest City (C)	School	X	X	9.1	64.3	9.0	52.7
Fairfax Apartments	Midwest City (C)	User Defined	X	X	-	-	-	-
Parkview Apartments	Midwest City (C)	User Defined		X	29.9	37.9	33.5	42.1
Vacant	Midwest City (C)	User Defined	X	X	-	-	-	-
YMCA	Midwest City (C)	User Defined	X	X	-	-	-	-
Gas Station- name unknown	Midwest City (C)	User Defined	X	X	-	-	-	-
Gas Station- name unknown	Midwest City (C)	User Defined	X	X	-	-	-	-
Gas Station- name unknown	Midwest City (C)	User Defined	X	X	-	-	-	-
Comfort Inn & Suites East	Midwest City (C)	User Defined		X	-	-	-	-

Name	Municipality	Type	Exposure		Potential Loss			
			100-Yr	500-Yr	100-Yr Structure Damage %	100-Yr Content Damage %	500-Yr Structure Damage %	500-Yr Content Damage %
Boeing Aero Space	Midwest City (C)	User Defined	X	X	-	-	-	-
Midwest Square Office Park	Midwest City (C)	User Defined		X	20.7	32.9	38.6	52.6
Concord Apartments	Midwest City (C)	User Defined			22.8	27.7	22.8	27.7
Village Oaks Plaza	Midwest City (C)	User Defined			16.0	56.0	4.3	11.8
Village Police Dept	The Village (C)	Police	X	X	9.7	18.6	11.3	43.5

Source: FEMA, 2009; HAZUS-MH 2.0
Notes:

(1) 'X' indicates the facility location as provided by Oklahoma County's Planning Committee is located in the DFIRM flood zone.

(2) HAZUS did not calculate potential loss estimates for some facilities located in the DFIRM flood zone. This is because these facilities are either located outside of the flood depth grid generated by HAZUS, or the depth of water is too shallow and no losses are estimated. When there is a difference between the flood depth grid generated by HAZUS and the DFIRM flood zones, it is most likely due to the resolution of the elevation model used (1/3 Arc Second or 10 meters) which differed from the elevation data used to generate the DFIRM itself.

(3) In some cases, HAZUS calculated potential flood loss to structures outside the FEMA DFIRM. These facilities are located inside the HAZUS flood depth grid.

Table 5.3.6-11. Utilities Located in the Preliminary DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss	
			100 Year	500 Year	100 Year Damage %	500 Year Damage %
Bethany Water Plant	Bethany (C)	Potable Water			40.0	40.0
Wastewater Treatment Complex	Del City (C)	WWTF	X	X	23.2	29.9
Oak Tree Lift Station	Edmond (C)	WW Pump		X	40.0	40.0
Well #34	Edmond (C)	Potable Water	X	X	5.2	40.0
Well #30	Edmond (C)	Potable Water	X	X	-	0.7
Well #56	Edmond (C)	Potable Water	X	X	40.0	40.0
Well #44	Edmond (C)	Potable Water	X	X	2.8	30.3
Williams Gas Pipeline / Compressor Station	Edmond (C)	Natural Gas	X	X	-	40.0
Garber Substation	Edmond (C)	Electric Substation		X	-	-
Fairfield Substation	Edmond (C)	Electric Substation	X	X	-	-
Well #22	Edmond (C)	Potable Water			1.1	1.0
Octagon Resources / Dynamic Booster Station	Luther (T)	Natural Gas	X	X	-	40.0
Wastewater Treatment Plant	Midwest City (C)	WWTF	X	X	20.2	10.9

Source: FEMA, 2009; HAZUS-MH 2.0

Notes:

(1) 'X' indicates the facility location as provided by Oklahoma County's Planning Committee is located in the DFIRM flood zone.

(2) HAZUS did not calculate potential loss estimates for some facilities located in the DFIRM flood zone. This is because these facilities are either located outside of the flood depth grid generated by HAZUS, or the depth of water is too shallow and no losses are estimated. When there is a difference between the flood depth grid generated by HAZUS and the DFIRM flood zones, it is most likely due to the resolution of the elevation model used (1/3 Arc Second or 10 meters) which differed from the elevation data used to generate the DFIRM itself.

(3) In some cases, HAZUS calculated potential flood loss to structures outside the FEMA DFIRM. These facilities are located inside the HAZUS flood depth grid.

Impact on Economy

For impact on economy, estimated losses from a flood event are considered. Losses include but are not limited to general building stock damages, agricultural losses, business interruption, impacts to tourism and tax base to Oklahoma County. Damages to general building stock can be quantified using HAZUS-MH as discussed above. Other economic components such as loss of facility use, functional downtime and social economic factors are less measurable with a high degree of certainty. For the purposes of this analysis, general building stock damages are discussed further.

Flooding can cause extensive damage to public utilities and disruptions to the delivery of services. Loss of power and communications may occur; and drinking water and wastewater treatment facilities may be temporarily out of operation. Flooded streets and road blocks make it difficult for emergency vehicles to respond to calls for service. Floodwaters can washout sections of roadway and bridges (Foster, Date Unknown).

Direct building losses are the estimated costs to repair or replace the damage caused to the building. The potential damage estimated to the general building stock inventory associated with the 100-year flood is greater than $338 million. This estimated building damage represents approximately 1.3-percent of the County's overall total general building stock inventory exposed to this hazard. For the 500-year event,

the potential damage estimate is nearly $465 million (structure and contents), or 1.7-percent of the total exposed building value. These dollar value losses to the County's total building inventory replacement value, in addition to damages to roadways and infrastructure, would greatly impact Oklahoma's tax base and the local economy.

When a flood occurs, the agricultural industry is at risk in terms of economic impact and damage (i.e., damaged crop, financial loss to the farmer). In 2007, according to the Census of Agriculture, the market value of all agricultural products sold from Oklahoma County was greater than $28.8 billion with a majority of the value (62-percent) in crop sales including nursery and greenhouse sales. The number of farms and the amount of farmland has increased in Oklahoma County from 2002 to 2007 by two-percent (USDA NASS, 2007). As noted in Table 5.3.6-8, approximately 43 to 46-percent of the farmland in Oklahoma County is located in the 100- and 500-year floodplains.

Specific agricultural loss information (monetary losses per agricultural product) was not available at the time this plan was drafted. However, given professional knowledge and historic loss information available, 40-percent and 60-percent loss estimates for crops as a result of major flood events is considered conservative estimates of potential losses for this hazard.

The cost to clean-up and dispose of debris can also impact the local economy. HAZUS-MH estimates the amount of debris generated from the flood events as a result of 100- and 500-year MRPs. The model breaks down debris into three categories: 1) finishes (dry wall, insulation, etc.); 2) structural (wood, brick, etc.) and 3) foundations (concrete slab and block, rebar, etc.). The distinction is made because of the different types of equipment needed to handle the debris. Table 5.3.6-12 summarizes the debris HAZUS-MH 2.0 estimates for each participating municipality.

Table 5.3.6-12. Estimated Oklahoma County Debris Generated from the 100-Year and 500-Year MRP Events

Municipality	100 Year				500 Year			
	Total (Tons)	Finish (Tons)	Structure (Tons)	Foundation (Tons)	Total	Finish	Structure	Foundation
Arcadia (T)	182	86	56	40	190	127	33	30
Bethany (C)	2,748	2,101	210	438	3,720	2,931	269	520
Choctaw (C)	1,066	853	78	135	1,487	1,074	170	243
Del City (C)	6,329	5,525	381	423	9,733	8,105	811	817
Edmond (C)	4,090	2,386	798	907	4,129	2,434	820	875
Forest Park (T)	14	13	1	0	15	11	3	2
Harrah (C)	344	224	46	74	673	357	123	193
Luther (T)	154	89	22	42	222	121	38	63
Midwest City (C)	7,746	4,995	1,411	1,340	11,045	6,247	2,532	2,267
Nichols Hills (C)	114	114	0	0	178	178	0	0
Nicoma Park (C)	226	153	23	50	359	235	44	80
Spencer (C)	550	298	98	153	836	374	182	280
The Village	693	693	0	0	1,084	1,084	0	1
Unincorporated County	3,159	1,207	830	1,123	5,083	1,755	1,390	1,939
Valley Brook (T)	197	191	4	2	266	198	42	27
Warr Acres (C)	1,322	1,164	83	75	1,964	1,544	214	206
Total	**28,935**	**20,092**	**4,040**	**4,802**	**40,984**	**26,773**	**6,670**	**7,541**

Source: HAZUS-MH 2.0

Effect of Climate Change on Vulnerability

The potential effects of climate change on Oklahoma County's vulnerability to flooding shall need to be considered as a greater understanding of regional climate change impacts develop.

Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the flood hazard if located within the identified hazard areas. Specific areas of development vulnerable to the flood hazard are also indicated on hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan. Figure 5.3.6-X illustrates the identified areas of potential new development in relation to the preliminary DFIRM flood boundaries.

Additional Data Needs and Next Steps

A modified Level 1 HAZUS-MH flood analysis was conducted for Oklahoma County using the default model data, with the exception of the updated critical facility inventory which included user-defined data. For future plan updates, a Level 2 HAZUS analysis can be conducted. A Level 2 analysis provides more accurate exposure and loss estimates by replacing the national default inventories with more accurate local inventories. Updated demographic and general building stock data would be needed to conduct a Level 2 HAZUS-MH analysis. In the future, FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) will be providing the flood depth and analysis grids as part of the DFIRM deliverable. These depth grids can be incorporated into HAZUS and used to calculate the potential losses to the County inventory. The utilization of the RiskMAP depth grids and the updated general building stock inventory on a structural level will provide more accurate flood loss estimates.

5.3.7 HAIL

This section provides a profile and vulnerability assessment for the hail hazards.

HAZARD PROFILE

Hazard profile information is provided in this section, including information on description, extent, location, previous occurrences and losses and the probability of future occurrences within Oklahoma County.

Description

According to the National Weather Service (NWS), hail is defined as a showery precipitation in the form of irregular pellets or balls of ice more than five millimeters in diameter, falling from a cumulonimbus cloud (NWS, 2005). Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight; they fall as precipitation, in the form of balls or irregularly shaped masses of ice. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size. Hailstorms are a potential damaging outgrowth of severe thunderstorms (Northern Virginia Regional Commission [NVRC], 2006). They cause over $1 billion in crop and property damages each year in the U.S., making hailstorms one of the most costly natural disasters (Federal Alliance for Safe Homes, Inc., 2006).

Extent

Hail can be produced from many different types of storms. Typically, hail occurs with thunderstorm events. The size of hail is estimated by comparing it to a known object. Most hail storms are made up of a variety of sizes, and only the very largest hail stones pose serious risk to people, if exposed (NSSL, Date Unknown). Table 5.3.7-1 shows the different types of hail and the comparison to real-world objects.

Table 5.3.7-1. Hail Size

Description	Diameter (in inches)
Pea	0.25
Marble or mothball	0.50
Penny or dime	0.75
Nickel	0.88
Quarter	1.00
Half Dollar	1.25
Walnut or Ping Pong Ball	1.50
Golf ball	1.75
Hen's Egg	2.00
Tennis Ball	2.75
Baseball	2.75
Tea Cup	3.00

Description	Diameter (in inches)
Grapefruit	4.00
Softball	4.50

Source: NWS, 2012

The peak periods for hailstorms, late spring and early summer, coincide with the Midwest's most critical agricultural season for wheat, corn, barley, oats, rye, tobacco, and fruit trees. The State of Oklahoma considers any hail of H4 or higher on the Tornado and Storm Research Organization (TORRO) hail scale to be a major severity. Table 5.3.7-2 displays the TORRO hail scale.

Table 5.3.7-2. TORRO Hailstorm Intensity Scale

Size Code	Intensity Category	Typical Hail Diameter (inches)	Typical Damage Impacts
H0	Hard Hail	Up to 0.33	No damage
H1	Potentially Damaging	0.33-0.60	Slight general damage to plants, crops
H2	Significant	0.60-0.80	Significant damage to fruit, crops, vegetation
H3	Severe	0.80-1.20	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	1.2-1.6	Widespread glass damage, vehicle bodywork damage
H5	Destructive	1.6-2.0	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	2.0-2.4	Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	2.4-3.0	Severe roof damage, risk of serious injuries
H8	Destructive	3.0-3.5	Severe damage to aircraft bodywork
H9	Super Hailstorms	3.5-4.0	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	4+	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

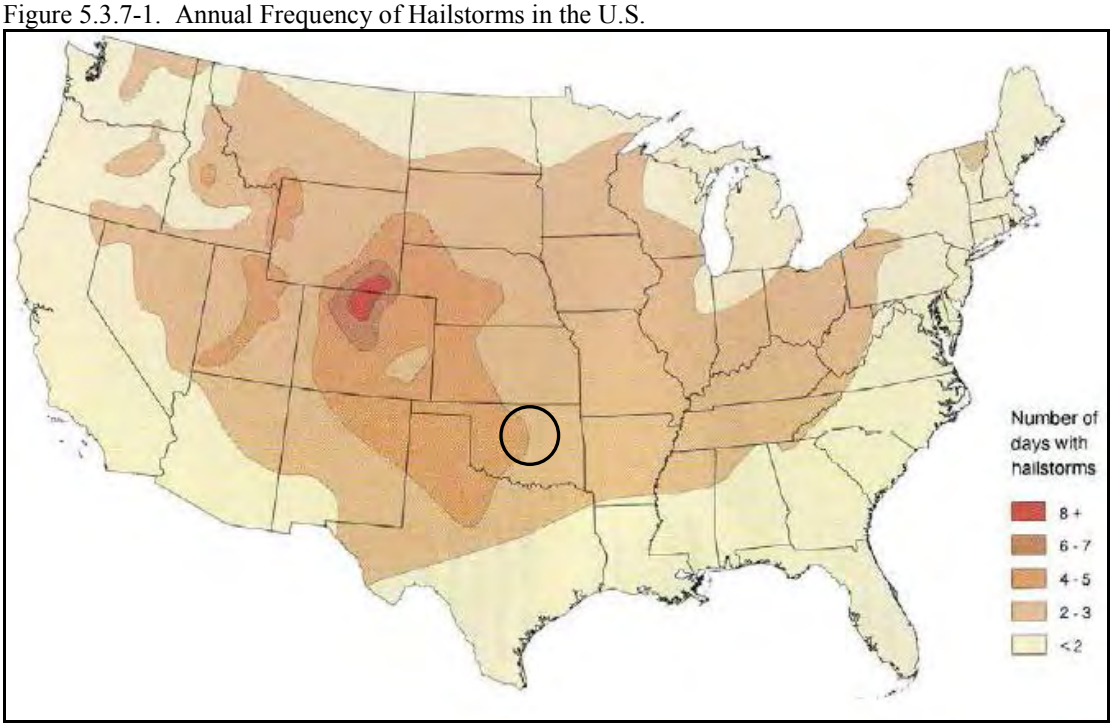
Source: TORRO, Date Unknown; Oklahoma State HMP, 2011

Based on the TORRO hail scale, Oklahoma County jurisdictions consider a severe event at H5 (1.6-2.0 inches). Once hail size approaches 2 inches, the County experiences an increase in damage claims.

Location

Hailstorms are more frequent in the southern and central plain states, where the climate produces violent thunderstorms. However, hailstorms have been observed in almost every location where thunderstorms occur (Federal Alliance for Safe Homes, Inc, 2006). The entire State of Oklahoma is susceptible to hailstorm events, include Oklahoma County. Figure 5.3.7-1 illustrates that Oklahoma County and most of Oklahoma experience between two and five hailstorms per year.

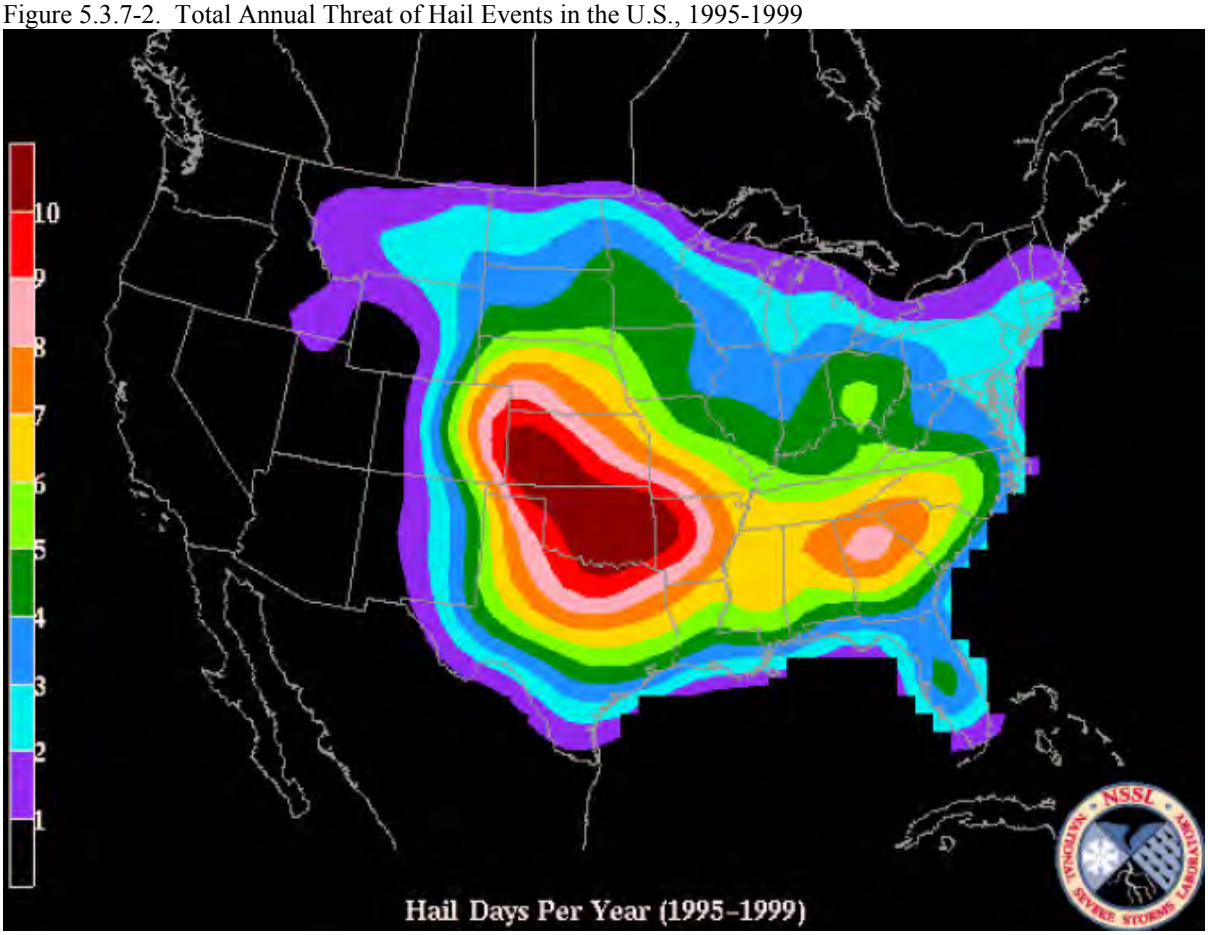
Figure 5.3.7-1. Annual Frequency of Hailstorms in the U.S.



Source: NVRC, 2006
Note: The black circle indicates the approximate location of Oklahoma County.

Figure 5.3.7-2 illustrates the number of hail days, per year, between 1995 and 1999 in the U.S. According to this figure, Oklahoma experiences between two and five days of hail each year, with Oklahoma County experiencing ten days.

Figure 5.3.7-2. Total Annual Threat of Hail Events in the U.S., 1995-1999



Source: NSSL, 2003
Note: The mean number of days per year with one or more events within 25 miles of a point is shown here.

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with severe storm events throughout the State of Oklahoma and Oklahoma County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

According to NOAA's NCDC storm events database, Oklahoma County experienced 315 hail events between April 30, 1950 and December 31, 2011. Total property damages, as a result of these hail events, were estimated at $3.10 million. This total also includes damages to other counties. According to the Hazard Research Lab at the University of South Carolina's Spatial Hazard Events and Losses Database for the U.S. (SHELDUS), between 1960 and 2010, 56 hail events occurred within the County. The database indicated that severe storm events and losses specifically associated with Oklahoma County and its municipalities totaled over $29.7 million in property damage and over $413,000 in crop damage. However, these numbers may vary due to the database identifying the location of the hazard event in various forms or throughout multiple counties or regions.

Based on all sources researched, known severe storm events that have affected Oklahoma County and its municipalities are identified in Table 5.3.7-3. With severe storm documentation for the State of

Oklahoma being so extensive, not all sources have been identified or researched. Therefore, Table 5.3.7-3 may not include all events that have occurred throughout the County and region.

Table 5.3.7-3. Hail Events between 1950 and 2012

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
April 28, 1960	Tornado, Wind, and Hail	N/A	N/A	$500K in property damage; 67 injuries	SHELDUS
May 16, 1960	Hail	N/A	N/A	$500K in property damage	SHELDUS
May 26, 1963	Severe Storm and Hail	N/A	N/A	$100K in property damage; $10K in crop damage	SHELDUS
May 23-24, 1968	Severe Storm and Hail	N/A	N/A	$5M in property damage and two deaths	SHELDUS
June 27, 1972	Hail	N/A	N/A	$500K in property damage	SHELDUS
July 2, 1972	Hail	N/A	N/A	$500K in property damage	SHELDUS
May 22, 1974	Hail	N/A	N/A	$100K in property damage; $100K in crop damage	SHELDUS
May 23, 1974	Hail	N/A	N/A	$250K in property damage; $250K in crop damage	SHELDUS
June 20, 1978	Hail	N/A	N/A	$5M in property damage	SHELDUS
June 1, 1981	Hail	N/A	N/A	$7M in property damage	SHELDUS
November 22, 1983	Hail	N/A	N/A	$500K in property damage	SHELDUS
May 15, 1988	Hail	N/A	N/A	$5M in property damage	SHELDUS
March 24, 1996	Hail	N/A	N/A	0.88-inch diameter hail fell in the Town of Choctaw at County Line Road and Northwest Expressway	NOAA-NCDC

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
April 21, 1996	Hail	N/A	N/A	One-inch diameter hail fell in the Town of Bethany at Northwest 36th and Thompson	NOAA-NCDC
March 24, 1997	Hail	N/A	N/A	¾-inch hail fell in the City of Harrah at SW 89th and Pennsylvania Avenue; 3/4-inch hail fell in Midwest City at NW 23rd and Council	NOAA-NCDC
June 10, 1997	Hail	N/A	N/A	Scattered strong to severe TSTMs developed over Oklahoma, bringing hail and high winds to the area. Overall, wind damage occurred in Oklahoma, Grady and Cleveland Counties. In Midwest City, 0.88-inch hail was reported at I-240 and Douglas.	NOAA-NCDC
April 21, 2004	Hail	N/A	N/A	A major hail storm moved through the Oklahoma City metro area. Hail up to the size of baseballs was observed in many areas, ranging from three inches deep to two feet deep. Hail damaged many structures and vehicles. The County had approximately $100M in damages.	SHELDUS, NOAA-NCDC
May 1, 2008	Hail	N/A	N/A	Severe TSTMs developed and produced large hail, wind gusts and tornadoes. The County had approximately $100K in property damage.	SHELDUS, NOAA-NCDC
July 16, 2009	Hail	N/A	N/A	Damaging TSTMs entered Oklahoma County, bringing large hail and strong winds. Baseball sized hail was reported near Midwest City.	NOAA-NCDC
August 5, 2009	Hail	N/A	N/A	Showers and TSTMs developed in Oklahoma, causing heavy rainfall and TSTMs that brought hail and strong winds. In the Town of Valley Brook, hail was reported near the corner of SW 44th Street and Western Avenue.	NOAA-NCDC
May 10, 2010	Hail	N/A	N/A	Between 3.5 and 4 inch diameter hail was reported in Del City; 1.75 inch diameter hail was reported in the City of Choctaw	NWS
May 16, 2010	Hail	N/A	N/A	A large supercell TSTM developed over Major County and moved southeast. It brought large hail and wind speeds of over 60 mph. Wind speeds averaged around 50 mph. Reports of damage to cars, trees, and vegetation in the Oklahoma City metro area. Hail sizes ranged from 0.88-inches in the City of Bethany to 4.25 inches in the City of Nichols Hills. In the City of Nichols Hills, hail broke windows.	NWS
May 24, 2011	Hail	N/A	N/A	Strong to violent tornadoes moved across parts of western and central Oklahoma. The storms that produced these tornadoes also brought hail to some areas. In Oklahoma County, hail sizes ranged from one inch in the City of Del City to 1.5 inch at Tinker Air Force base.	NWS

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
June 14, 2011	Hail	N/A	N/A	TSTMs developed over central and southern Oklahoma producing severe storms in some areas. The storms brought large hail and damaging winds. In Oklahoma County, the City of Edmond experienced 1.75-inch diameter hail heavily dented copper fixtures on a roof, damaged gutters and roof trim and stripped the leaves from trees. In Arcadia Lake, 2.25-inch diameter hail was reported near the intersection of SW 89th Street and Pennsylvania Avenue.	NOAA-NCDC
June 20, 2011	Hail	N/A	N/A	A strong storm system traveled through the southern and central plains. Very strong winds were common in Oklahoma, with wind gusts of over 40 mph. This system, combined with warm temperatures, produced TSTMs in central and north-central Oklahoma. The storms produced golf ball sized hail and wind gusts of up to 70 mph. In Oklahoma County, in the City of Warr Acres, hail was reported near the intersection of Western Avenue and Britton Road. In the City of the The Village, 0.75-inch diameter hail fell and wind speeds of up to 55 mph. Four car windows and six patio doors were broken by the hail. The County had approximately $7K in property damage.	NOAA-NCDC
October 22, 2011	Hail	N/A	N/A	Strong and severe TSTMs moved over the eastern half of Oklahoma, which produced large hail and damaging winds. In Midwest City, the hail was reported near SE 15th Street and Westminster Road.	NOAA-NCDC

Sources: NOAA-NCDC, NWS, SHELDUS
Note: Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.
K Thousand ($)
M Million ($)
NCDC National Climate Data Center
NOAA National Oceanic Atmospheric Administration
NWS National Weather Service
SHELDUS Spatial Hazard Events and Losses Database for the U.S.
TSTM Thunderstorms

Probability of Future Events

Based on historical events, it is likely that Oklahoma County will experience at least one hail event each year (OKC HMP, 2006).

In Section 5.3, the identified hazards of concern for Oklahoma County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for severe hail events in the County and all the jurisdictions included in this plan is considered 'Likely' (Event is probable within the next three years. Event has a 1 in 3 year's chance of occurring).

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For hail events, the entire Oklahoma County has been identified as the hazard area. Therefore, all assets in the County (population, structures, critical facilities and lifelines), as described in the County section, are vulnerable. The following text evaluates and estimates the potential impact of severe storms on the County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health of residents, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

The hail hazard is a significant concern to Oklahoma County because of their geographic location and climate. Convective weather (lightning, thunderstorms, tornado and hail) frequents the State with peak season for hail events in the middle to late spring months. The direct and indirect losses associated with these events include injury, damage to structures, utilities and personal assets, agricultural losses, and stress on community resources.

Data and Methodology

National weather databases, the Oklahoma State Hazard Mitigation Plan and local resources were used to collect and analyze hazard impacts on Oklahoma County and the participating municipalities.

Impact on Life, Health and Safety

The entire population of Oklahoma County is considered exposed to the hail hazard. People located outdoors (i.e., recreational activities, farming) are considered most vulnerable to the hazard. This is because there is little to no warning and shelter may not be available. Moving to a lower risk location will decrease a person's vulnerability.

Impact on General Building Stock, Critical Facilities and the Economy

For the purposes of this HMP, the entire general building stock, critical facilities, utilities and personal assets in the County are considered exposed to the hail hazard. Hail can be responsible for damages to buildings, roofs, windows and automobiles. Agricultural losses can also be devastating due to this hazard. Utility damage is mainly to power lines and communication towers (OKDEM, 2011). Please refer to Section 4 for a complete list of the replacement cost value of the County's building inventory and a list of identified critical facilities.

Future Growth and Development

As discussed and illustrated in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the hail hazard

because the entire planning area is exposed and vulnerable. Please refer to Section 4 (County Profile) for a map that illustrates where potential new development is located.

Effect of Climate Change on Vulnerability

The potential effects of climate change on Oklahoma County's vulnerability to hail shall need to be considered as a greater understanding of regional climate change impacts develop.

Additional Data and Next Steps

The assessment above identifies vulnerable populations and potential structural and economic losses associated with this hazard of concern. The collection of additional/actual loss data specific to the Plan participants will further enhance Oklahoma County's vulnerability assessment.

5.3.8 LIGHTNING

This section provides a profile and vulnerability assessment for the lightning hazard.

HAZARD PROFILE

Hazard profile information is provided in this section, including information on description, extent, location, previous occurrences and losses and the probability of future occurrences within Oklahoma County.

Description

According to the National Ocean and Atmospheric Administration (NOAA), the rising air in a thunderstorm cloud creates different types of frozen precipitation in the cloud. Small ice crystals are formed and are carried upward toward the top of the clouds by the rising air, while the heavier and denser pellets are either suspended by the rising air or began to fall to the ground. The ice crystals and small pellets collide and are the charging mechanism of the thunderstorm. The small ice crystals become negatively charged. As a result, the top of the clouds becomes positively charged and the middle to lower portion becomes negatively charged. At the same time, the ground underneath the clouds becomes charged opposite of the charges directly overhead (NOAA, Date Unknown).

When the charge difference between the ground and clouds become too large, a conductive channel of air develops between the clouds and ground, and a small amount of charge starts moving toward the ground. When the charge reaches the ground, it connects with the other charge and a powerful discharge occurs between the cloud and ground. This discharge is seen as a bright visible flash of lightning (NOAA, Date Unknown).

Lightning is one of the most underrated severe weather hazards; however, it ranks as the second leading weather killer in the U.S. It causes an average of 55 to 60 deaths and 400 injuries each year. Lightning occurs with all thunderstorms and costs more than $1 billion in insured losses each year (NOAA, Date Unknown).

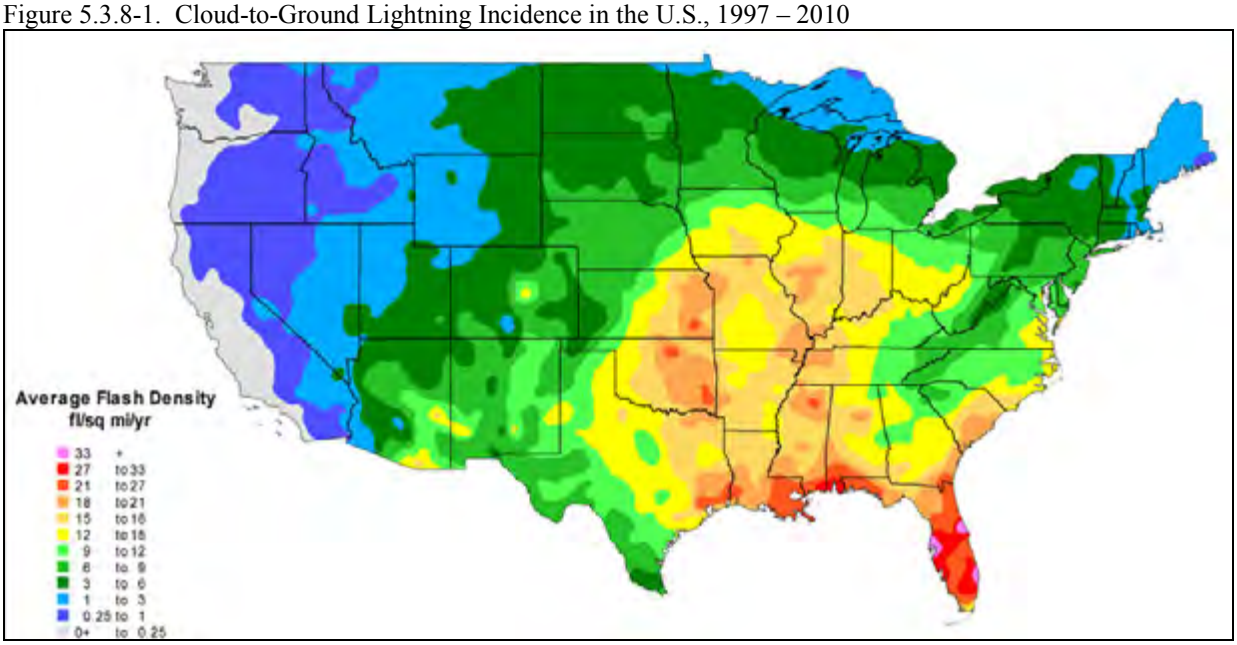
Extent

Cloud-to-ground lightning peak currents and electric fields are dependent on the polarity of the lightning discharge. For negative cloud-to-ground lightning, first return strokes have an average peak current of 30 kA and an electric field peak of 6 V/m at 100 km. Peak currents and fields for negative subsequent strokes are, on average, half of the respective values for negative first strokes. For positive cloud-to-ground lightning the average peak fields and currents are roughly a factor of two greater than those for negative first strokes (http://www.vaisala.com). The State of Oklahoma, Oklahoma County, and the County municipal planning partners consider a flash density of less than one to be a minor severity and a flash density of two and greater to be a major severity. Any lightning strike that causes death or property damage is considered a major severity.

The average areal density of cloud-to-ground lightning flashes in the U.S. has been measured by the National Lightning Detection Network (NLDN). The greatest flash density is found in central Florida and high flash densities are also found throughout the southeast and Midwest. Almost half of the U.S. has a flash density of greater than four flashes per square kilometer per year. The lightning flash rate decreases through the winter, with a minimum occurring during January. The summer months experience a higher flash rate. Most lightning occurs during the afternoon or early evening (NWS, 2002).

Figure 5.3.8-1 displays the cloud-to-ground lightning incidences in the U.S. from 1997 to 2010. This figure shows the average amount of lightning that occurs in any given area. According to this figure, Oklahoma County experiences approximately 15 to 18 flashes per square mile each year.

Figure 5.3.8-1. Cloud-to-Ground Lightning Incidence in the U.S., 1997 – 2010



Source: NOAA, 2011

Location

No place in the U.S. is free from a lightning threat. Lighting can occur anywhere at anytime during the year; however, lightning activity has a strong annual cycle in the U.S. The lightning rate peaks during the summer months and begins to decrease during September (NWS, 2002). The entire state of Oklahoma is at risk for lightning (OK HMP, 2011).

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with lightning events throughout the State of Oklahoma and Oklahoma County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

According to NOAA's NCDC storm events database, Oklahoma County experienced 62 lightning events between April 30, 1950 and April 30, 2012. Total property damages, as a result of these severe storm events, were estimated at $7.5 million. This total may include damages to other counties. According to the Hazard Research Lab at the University of South Carolina's Spatial Hazard Events and Losses Database for the U.S. (SHELDUS), between 1960 and 2010, 43 lightning events occurred within the County. The database indicated that severe storm events and losses specifically associated with Oklahoma County and its municipalities totaled over $7.1 million in property. However, these numbers may vary due to the database identifying the location of the hazard event in various forms or throughout multiple counties or regions.

Between 1954 and 2012, FEMA declared that the State of Oklahoma experienced 49 severe storm-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: tornadoes, straight-line winds, flooding, snowstorm, heavy rain, and hail. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations. Of those events, Oklahoma County has been declared as a disaster area as a result of 16 severe storm events (FEMA, 2012).

Based on all sources researched, known severe storm events that have affected Oklahoma County and its municipalities are identified in Table 5.3.8-1. With lightning documentation for the State of Oklahoma being so extensive, not all sources have been identified or researched. Therefore, Table 5.3.8-1 may not include all events that have occurred throughout the County and region.

Table 5.3.8-1. Lightning Events between 1950 and 2012

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
September 4, 1969	Lightning	N/A	N/A	The County had approximately $500K in property damage.	SHELDUS
May 29, 1970	Lightning	N/A	N/A	The County had approximately $50K in property damage	SHELDUS
September 3, 1973	TSTM, Lightning and Hail	N/A	N/A	The County had approximately $50K in property damage	SHELDUS
February 15, 1974	Lightning	N/A	N/A	The County had approximately $50K in property damage	SHELDUS
August 30, 1984	Lightning	N/A	N/A	The County had approximately $300K in property damage.	SHELDUS
September 12, 1987	Lightning	N/A	N/A	The County had approximately $140K in property damage.	SHELDUS
May 7-8, 1993	Lightning	N/A	N/A	The County had approximately $550K in property damage.	SHELDUS
September 2, 1993	Lightning	N/A	N/A	Severe thunderstorms on the afternoon and evening hours on the 2nd produced strong winds and hail to quarter-size. In Oklahoma County, a lightning strike started a fire which destroyed an oil tank battery on the south side of the City of Edmond.	NOAA-NCDC
May 26, 1996	Lightning	N/A	N/A	Lightning struck an 80-foot radio tower at city hall in the City of Warr Acres. The telephone and computer systems in the police and fire departments and the city offices were knocked out. The County had approximately $20K in property damage.	NOAA-NCDC, SHELDUS
June 19, 1996	Lightning	N/A	N/A	Lightning struck and set fire to a home in southeast Edmond. The fire was confined mainly to the roof and damages were estimated at $50,000.	NOAA-NCDC, SHELDUS
August 1, 1996	Lightning	N/A	N/A	Lightning struck a house, setting the attic on fire in the City of Edmund. Damage to the house and its contents was estimated at $55,000.	NOAA-NCDC, SHELDUS
August 2, 1996	Lightning	N/A	N/A	Lightning struck a house chimney, splitting the bricks and setting a fire in the attic in the City of Edmond. Damage was estimated at $1,250.	NOAA-NCDC

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
September 21, 1998	Lightning	N/A	N/A	The County had approximately $200K in property damage.	SHELDUS
October 28, 1998	Lightning	N/A	N/A	The County had approximately $200K in property damage.	SHELDUS
April 30, 2000	TSTM / Lightning	N/A	N/A	TSTMs formed over areas of western and central Oklahoma and brought strong winds, large hail, lightning and flooding. In Oklahoma County, numerous lightning strikes resulted in house fires and a chimney collapse. The County had approximately $50K in property damage.	NOAA-NCDC, SHELDUS
May 9, 2000	Lightning	N/A	N/A	TSTMs resulted in lightning strikes across Oklahoma and Payne Counties. In the City of Edmund, the roof of a house was set on fire due to a lightning strike, causing major damage to the roof and attic. Other homes in the area were struck by lightning as well. The County had approximately $150K in property damage.	NOAA-NCDC, SHELDUS
October 22, 2000	Lightning	DR-1349	Yes	Storms brought significant flash flooding and six tornadoes to the area. Rainfall amounts totaled between four and eight inches. In Oklahoma County, lightning struck a house in the City of Bethany, causing a fire and significant damage to the home. The County had approximately $30K in property damage.	NOAA-NCDC, SHELDUS, FEMA
September 3, 2001	Lightning	N/A	N/A	Lightning struck a man in a boat on Arcadia Lake, suffering only minor injuries.	NOAA-NCDC
August 13, 2002	Lightning	N/A	N/A	At Tinker Air Force Base, lightning struck a utility pole causing a power outage. In the City of Edmond, lightning struck a home, causing a fire. The County had approximately $125K in property damage.	NOAA-NCDC
August 28, 2004	Lightning	N/A	N/A	The County had approximately $250K in property damage	SHELDUS
August 12, 2005	Lightning	N/A	N/A	In the City of The Village, lightning struck a powerline that severed. The severed line set part of a yard and roof of a nearby home on fire.	NOAA-NCDC
July 27, 2006	Lightning	N/A	N/A	Lightning struck the UPS building at Will Rogers World Airport, injuring seven people.	NOAA-NCDC
May 13, 2009	TSTMs / Lightning	N/A	N/A	Supercell TSTMs developed over Oklahoma, causing baseball sized hail, wind gusts of over 60 mph and four tornadoes. In Oklahoma County, lightning struck four homes which caused a	NOAA-NCDC

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
				fire in the City of Midwest City. Four firefighters were injured.	

Sources: FEMA, NOAA-NCDC, NWS, SHELDUS
Note: Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.

FEMA	Federal Emergency Management Agency
K	Thousand ($)
M	Million ($)
NCDC	National Climate Data Center
NOAA	National Oceanic Atmospheric Administration
NWS	National Weather Service
SHELDUS	Spatial Hazard Events and Losses Database for the U.S.

Probability of Future Events

In Section 5.3, the identified hazards of concern for Oklahoma County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for lightning events in the County and all jurisdictions participating in this plan is considered '4 – Highly Likely' (Event is probable within the calendar year. Event has a 1 in 1 year chance of occurring).

It is estimated that Oklahoma County will continue to experience direct and indirect impacts of lightning events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, and fires.

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For lightning events, the entire Oklahoma County has been identified as the hazard area. Therefore, all assets in the County (population, structures, critical facilities and lifelines), as described in the County section, are vulnerable. The following text evaluates and estimates the potential impact of severe storms on the County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health of residents, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

The lightning hazard is a significant concern to Oklahoma County because of their climate. Being located southeast of the Rocky Mountains which provide cool air masses; proximate to the Gulf of Mexico, a source of moisture; and northeast of the dry hot southwest brings frequent convective weather (lightning, thunderstorms, tornado and hail) to the State of Oklahoma. The peak lightning season is from April to June, which is also the State's major tornado season (OKDEM, 2011). The direct and indirect losses associated with these events include injury and loss of life, damage to structures and infrastructure, agricultural losses, utility failure (power outages), and stress on community resources.

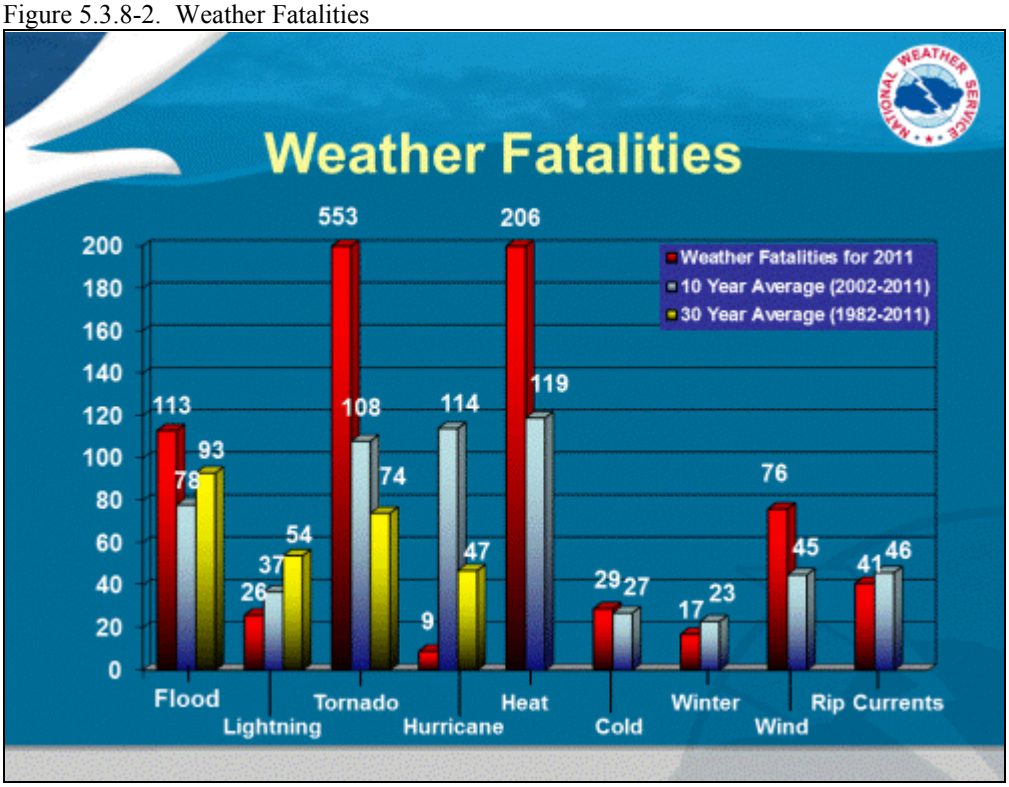
Data and Methodology

National weather databases and local resources were used to collect and analyze lightning impacts on Oklahoma County and the participating municipalities. The 2010 U.S. Census data and default HAZUS-MH 2.0 general building data was used to support an evaluation of assets exposed to this hazard and the potential impacts associated with this hazard.

Impact on Life, Health and Safety

Across the U.S., the ten year average (2001 to 2011) for fatalities caused by lightning is 37 while the 30-year average (1982 to 2011) is 54 (NOAA, 2012). Refer to Figure 5.3.8-2 for an illustration of these statistics. According to NOAA, in the State of Oklahoma there were 88 fatalities and 243 injuries as a result of lightning events from 1959 to 1994 (NOAA, 1997).

Figure 5.3.8-2. Weather Fatalities



Source: NOAA, 2012

The entire population of Oklahoma County is considered exposed to the lightning hazard. The peak lightning season in the State of Oklahoma is from April to June; however, the most fatalities occur in August. According to the State HMP, fatalities occur most often when people are outdoors and/or participating in some form of recreation. The following are considered vulnerable locations: 1) in water; 2) under a tree; 3) on the telephone; 4) outside in the open; 5) on a ball field; 6) golfing; 7) boating; 8) operating heavy equipment/construction; 9) camping and 10) proximate to antenna, towers, transmitters (OKDEM 2011; NOAA, 2012.) Population located outdoors is considered at risk and more vulnerable to a lightning strike compared to being inside a shelter. Moving to a lower risk location will decrease a person's vulnerability.

Impact on General Building Stock, Critical Facilities and the Economy

For the purposes of this HMP, the entire general building stock and all infrastructure of Oklahoma County are considered exposed to the lightning hazard. According to NOAA's Technical Paper on *Lightning Fatalities, Injuries, and Damage Reports in the United States from 1959 - 1994*, monetary losses for lightning events range from less than $50 to greater than $5 Million (larger losses associated with forest fires with homes destroyed and crops loss) (NOAA, 1997). Lightning can be responsible for damages to buildings; cause electrical, forest and/or wildfires; and damage infrastructure such as power transmission lines and communication towers. Agricultural losses can be devastating due to lightning and resulting fires.

Future Growth and Development

As discussed and illustrated in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the lightning hazard

because the entire planning area is exposed and vulnerable. Please refer to Section 4 (County Profile) for a map that illustrates where potential new development is located.

Effect of Climate Change on Vulnerability

The potential effects of climate change on Oklahoma County's vulnerability to lightning shall need to be considered as a greater understanding of regional climate change impacts develop.

Additional Data and Next Steps

The assessment above identifies vulnerable populations and potential structural and economic losses associated with this hazard of concern. According to the State HMP, research at NOAA and other private organizations is ongoing to improve warning and threat information for the public. The collection of additional/actual loss data specific to the Plan participants will further enhance Oklahoma County's vulnerability assessment.

Overall Vulnerability Assessment

Existing and future mitigation efforts including personal and structural lightning safety should continue to be developed and employed that will enable the study area to be prepared for these events when they occur and lower their risk.

5.3.9 WILDFIRE

This section provides a profile and vulnerability assessment for the wildfire hazard.

HAZARD PROFILE

This section provides profile information including description, location, extent, previous occurrences and losses and the probability of future occurrences.

Description

Wildfires are a naturally occurring process in all native ecosystems in the State of Oklahoma. The majority of wildfires occur in late fall through winter and into early spring. The number of wildfire occurrences declines during mid-spring and then a peak in wildfire activity during July and August. However, wildfires can occur during any month of the year, under a variety of weather conditions. Most wildfire activity occurs when fine fuels are dormant and at their driest due to low precipitation amounts. This pattern is usually consistent, unless there is some type of extreme weather event, such as drought (Weir et al., Date Unknown).

Wildfires are an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed and spread quickly and are usually signaled by dense smoke that fills the surrounding areas. Naturally occurring and non-native species of grasses, brush and trees fuel the wildfires (Oklahoma City HMP, 2011). Wildfires can occur under a variety of weather conditions during any month of the year, but the size of the fire is related to relative humidity, rainfall and wind speed (Weir et al., Date Unknown).

FEMA indicates that there are four categories of wildfires that are experienced throughout the U.S. These categories are defined as follows:

- Wildland fires – fueled almost exclusively by natural vegetation. They typically occur in national forests and parks, where Federal agencies are responsible for fire management and suppression.
- Interface or intermix fires – urban/wildland fires in which vegetation and the built-environment provide fuel
- Firestorms – events of such extreme intensity that effective suppression is virtually impossible. Firestorms occur during extreme weather and generally burn until conditions change or the available fuel is exhausted.
- Prescribed fires and prescribed natural burns – fires that are intentionally set or selected natural fires that are allowed to burn for beneficial purposes (FEMA, 1997).

The potential for wildfire, and its subsequent development (growth) and severity, is determined by three principal factors including the area's topography, the presence of fuel, and weather. These factors are described below:

Topography - Topography can have a powerful influence on wildfire behavior. The movement of air over the terrain tends to direct a fire's course. Gulches and canyons can funnel air and act as a chimney, intensifying fire behavior and inducing faster spread rates. Saddles on ridgetops tend to offer lower resistance to the passage of air and will draw fires. Solar heating of drier, south-facing slopes produces upslope thermal winds that can complicate behavior.

Slope is an important factor. If the percentage of uphill slope doubles, the rate at which the wildfire spreads will most likely double. On steep slopes, fuels on the uphill side of the fire are closer physically to the source of heat. Radiation preheats and dries the fuel, thus intensifying fire behavior. Terrain can inhibit wildfires: fire travels downslope much more slowly than it does upslope, and ridgetops often mark the end of wildfire's rapid spread (FEMA, 1997).

Fuel - Fuels are classified by weight or volume (fuel loading) and by type. Fuel loading can be used to describe the amount of vegetative material available. If this doubles, the energy released can also be expected to double. Each fuel type is given a burn index, which is an estimate of the amount of potential energy that may be released, the effort required to obtain a fire in a given fuel, and the expected flame length. Different fuels have different burn qualities and some burn more easily than others. Grass releases relatively little energy but can sustain very high rates of spread (FEMA, 1997). According to the U.S. Forest Service, a forest stand may consist of several layers of live and dead vegetation in the understory (surface fuels), midstory (ladder fuels), and overstory (crown fuels). Fire behavior is strongly influenced by these fuels. Each of these layers provides a different type of fuel source for wildfires (U.S. Forest Service, 2003).

Weather / Air Mass - Weather is the most important factor in the make-up of a fire's environment, yet it is always changing. Air mass, which is defined by the National Weather Service (NWS) as a body of air covering a relatively wide area and exhibiting horizontally uniform properties, can impact wildfire through climate, including temperature and relative humidity, local wind speed and direction, cloud cover, precipitation amount and duration, and the stability of the atmosphere at the time of the fire (National Rural Fire Authority, Date Unknown). Extreme weather leads to extreme events and it is often a moderation of the weather that marks the end of a wildfire's growth and the beginning of successful containment. High temperatures and low humidity can produce vigorous fire activity. Fronts and thunderstorms can produce winds that are capable of radical and sudden changes in speed and direction, causing similar changes in fire activity. The rate of spread of a fire varies directly with wind velocity. Winds may play a dominant role in directing the course of a fire. The most damaging firestorms are typically marked by high winds (FEMA, 1997).

The type and amount of fuel, as well as its burning qualities and moisture level, affect wildfire potential and behavior. Topography of an area affects the movement of air over the ground surface. The slope and shape of terrain can change the rate of speed at which wildfires travel. Natural features, such as rivers, lakes, rocky areas and previously burnt areas can obstruct the movement of wildfires (Oklahoma City HMP, 2011).

Wildfire threat is heightened by several factors in Oklahoma County, experienced both seasonally and on an on-going basis. Fuel loading generally peaks during late summer and early fall, after the growing season and during periods of minimal rainfall. Spring and fall weather conditions, including both low humidity and high winds, further contributes to wildfire threat (OKC HMP, 2007).

Extent

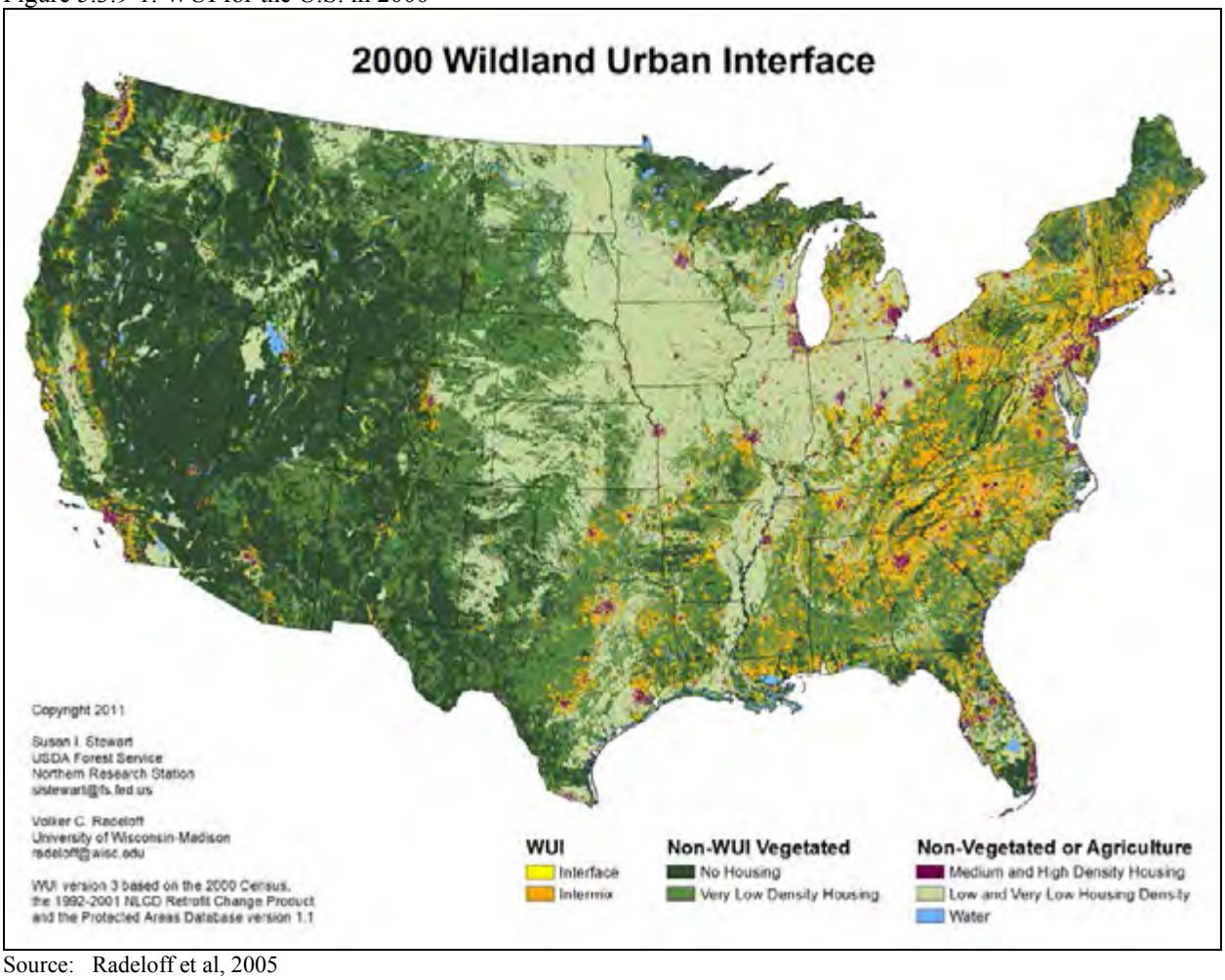
The extent (that is, magnitude or severity) of wildfires depends on weather and human activity. There are several tools available to estimate fire potential, extent, danger and growth including, but not limited to the following:

Wildland/Urban Interface (WUI) is the area where houses and wildland vegetation coincide. The WUI is divided into two categories: intermix and interface. Intermix WUI are areas where housing and vegetation 'intermingle'. Intermix areas have more than one house per 40 acres and have more than 50-

percent vegetation. Interface WUI are areas with housing in the vicinity of contiguous wildland vegetation. Interface areas have more than one house per 40 acres, have less than 50-percent vegetation, and are within 1.5 miles of an area over 1,235 acres that is more than 75-percent vegetated (Spatial Analysis for Conservation and Sustainability [SILVIS Lab], Date Unknown).

Concentrations of WUI can be seen along the east coast of the U.S., where housing density rarely falls below the threshold of one housing unit per 40 acres and forest cover is abundant. In the mid-Atlantic and north central regions of the U.S., the areas not dominated by agriculture have interspersed WUI and low density vegetated areas. Areas where recreation and tourism dominate are also places where WUI is common, especially in the northern Great Lakes and Missouri Ozarks (Stewart et al., 2003). Figure 5.3.9-1 depicts the WUI for the U.S. in 2000.

Figure 5.3.9-1. WUI for the U.S. in 2000



Source: Radeloff et al, 2005

Wildland Fire Assessment System (WFAS) is an internet-based information system that provides a national view of weather and fire potential, including national fires danger, weather maps and satellite-derived "Greenness" maps. It was developed by the Fire Behavior unit at the Fire Sciences Laboratory in Missoula, Montana and is currently supported and maintained at the National Interagency Fire Center (NIFC) in Boise, Idaho (USFS, 1994-2007).

Each day during the fire season, national maps of selected fire weather and fire danger components of the National Fire Danger Rating System (NFDRS) are produced by the WFAS (NWS, Date Unknown). Fire Danger Rating level takes into account current and antecedent weather, fuel types, and both live and dead fuel moisture. This information is provided by local station managers (USFS, 1994-2007). Table 5.3.9-1 shows the fire danger rating and color code.

Table 5.3.9-1. Fire Danger Rating and Color Code

Fire Danger Rating and Color Code	Description
Low (L) (Dark Green)	Fuels do not ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering, and burn in irregular fingers. There is little danger of spotting.
Moderate (M) (Light Green or Blue)	Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
High (H) (Yellow)	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High (VH) (Orange)	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
Extreme (E) (Red)	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash (trunks, branches, and tree tops) or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

Source: USFS, Date Unknown

The ***Fire Potential Index (FPI)*** is derived by combining daily weather and vegetation condition information and can identify the areas most susceptible to fire ignition. The combination of relative greenness and weather information identifies the moisture condition of the live and dead vegetation. The weather information also identifies areas of low humidity, high temperature, and no precipitation to identify areas most susceptible to fire ignition. The FPI enables local and regional fire planners to quantitatively measure fire ignition risk (USGS, 2005). FPI maps are provided on a daily basis by the U.S. Forest Service. The scale ranges from 0 (low) to 100 (high). The calculations used in the National Fire Danger Rating System (NFDRS) are not part of the FPI, except for a 10-hour moisture content (USFS, Date Unknown).

Fuel Moisture (FM) content is the quantity of water in a fuel particle expressed as a percent of the oven-dry weight of the fuel particle. FM content is an expression of the cumulative effects of past and present weather events and must be considered in evaluating the effects of current or future weather on fire potential. FM is computed by dividing the weight of the "water" in the fuel by the oven-dry weight of the fuel and then multiplying by 100 to get the percent of moisture in a fuel (NWS, Date Unknown).

There are two kinds of FM: live and dead. Live fuel moistures are much slower to respond to environmental changes and are most influenced by things such as a long drought period, natural disease and insect infestation, annuals curing out early in the season, timber harvesting, and changes in the fuel models due to blow down from windstorms and ice storms (NOAA, Date Unknown). Dead fuel moisture is the moisture in any cured or dead plant part, whether attached to a still-living plant or not. Dead fuels absorb moisture through physical contact with water (such as rain and dew) and absorb water vapor from the atmosphere. The drying of dead fuels is accomplished by evaporation. These drying and wetting processes of dead fuels are such that the moisture content of these fuels is strongly affected by fuel sizes, weather, topography, decay classes, fuel composition, surface coatings, fuel compactness and arrangement (Varnard and Kennard, 2008).

Fuels are classified into four categories which respond to changes in moisture. This response time is referred to as a time lag. A fuel's time lag is proportional to its diameter and is loosely defined as the time it takes a fuel particle to reach two-thirds of its way to equilibrium with its local environment. The four categories include:

- 1-hour fuels: up to ¼-inch diameter – fine, flashy fuels that respond quickly to weather changes. Computed from observation time, temperature, humidity, and cloudiness.
- 10-hour fuels: ¼-inch to one-inch in diameter - computed from observation time, temperature, humidity, and cloudiness or can be an observed value.
- 100-hour fuels: one-inch to three-inch in diameter - computed from 24-hour average boundary condition composed of day length (daylight hours), hours of rain, and daily temperature/humidity ranges.
- 1000-hour fuels: three-inch to eight-inch in diameter - computed from a seven-day average boundary condition composed of day length, hours of rain, and daily temperature/humidity ranges (USFS, Date Unknown).

The ***Keetch-Byram Drought Index (KBDI)*** is a drought index designed for fire potential assessment. It is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers (USFS, Date Unknown). It is a continuous reference scale for estimating the dryness of the soil and duff layers. The index increases each day without rain and decreases when it rains. The scale ranges from 0 (no moisture deficit) to 800 (maximum drought possible). The range of the index is determined by assuming that there is eight inches of moisture in a saturated soil that is readily available to the vegetation. For different soil types, the depth of soil required to hold eight inches of moisture varies. A prolonged drought influences fire intensity, largely because more fuel is available for combustion. The drying of organic material in the soil can lead to increased difficulty in fire suppression (Florida Department of Agriculture and Consumer Services, 2004-2008).

The ***Haines Index***, also known as the Lower Atmosphere Stability Index, is a fire weather index based on stability and moisture content of the lower atmosphere that measures the potential for existing fires to become large fires. It is named after its developer, Donald Haines, a Forest Service research meteorologist, who did the initial work and published the scale in 1988 (Storm Prediction Center [SPC], Date Unknown).

The Haines Index can range between 2 and 6. The drier and more unstable the lower atmosphere is, the higher the index (USFS, Date Unknown). It is calculated by combining the stability and moisture content to the lower atmosphere into a number that correlates well with large fire growth. The stability term is determined by the temperature difference between two atmospheric layers; the moisture term is determined by the temperature and dew point different. The index, as listed below, has shown to correlate

with large fire growth on initiating and existing fires where surface winds do not dominate fire behavior (USFS, Date Unknown).

- Very Low Potential (2) – moist, stable lower atmosphere
- Very Low Potential (3)
- Low Potential (4)
- Moderate Potential (5)
- High Potential (6) – dry, unstable lower atmosphere (USFS, Date Unknown)

The Haines Index is intended to be used all over the U.S. It is adaptable for three elevation regimes: low elevation, middle elevation, and high elevation. Low elevation is for fires at or very near sea level. Middle elevation is for fires burning in the 1,000 to 3,000 feet in elevation range. High elevation is intended for fires burning above 3,000 feet in elevation (NOAA, Date Unknown).

The ***Landscape Fire and Resource Management Planning Tools Project (LANDFIRE)*** is a five-year, multi-partner project. The project is producing comprehensive and consistent maps and data describing vegetation, fire and fuel characteristics for the entire U.S. LANDFIRE is a shared project between the U.S. Department of Agriculture Forest Service and the U.S. Department of the Interior. The project has several principal partners, which include the USFS Missoula Fire Sciences Laboratory, the USGS Center for Earth Resources Observation and Science, and the Nature Conservancy (LANDFIRE, Date Unknown).

Additionally, the U.S. Department of Agriculture Forest Service, Rocky Mountain Research Station developed a historical natural fire regimes dataset. The fire regimes are described in terms of frequency and severity and represent pre-settlement, historical fire processes. Fire regimes I and II represent frequent fire return intervals. The 0-35+ years/low severity fire regime (I) occurs mostly on forested land. The 0-35+years/stand-replacement regime (II) occurs mostly on grasslands and shrublands. Fire regimes III, IV, and V have longer fire return intervals and occur on forest lands, shrublands, and grasslands. These coarse-scale data were developed for national-level planning and were not intended to be used at finer spatial scales (Schmidt et al., 2002).

The ***Buildup Index (BUI)*** is cumulative numerical index derived from daily weather data, presumably indicates the moisture content in medium-driving forest fuels. The fuels to which BUI primarily applies are forest litter and duff, average 3 to 4 inches in depth. The amount of moisture in these forest floor fuels largely determines how deep a fire will burn and is therefore particularly useful for predicting the effects of both wild and prescribed fires (Johnson, 1968).

Location

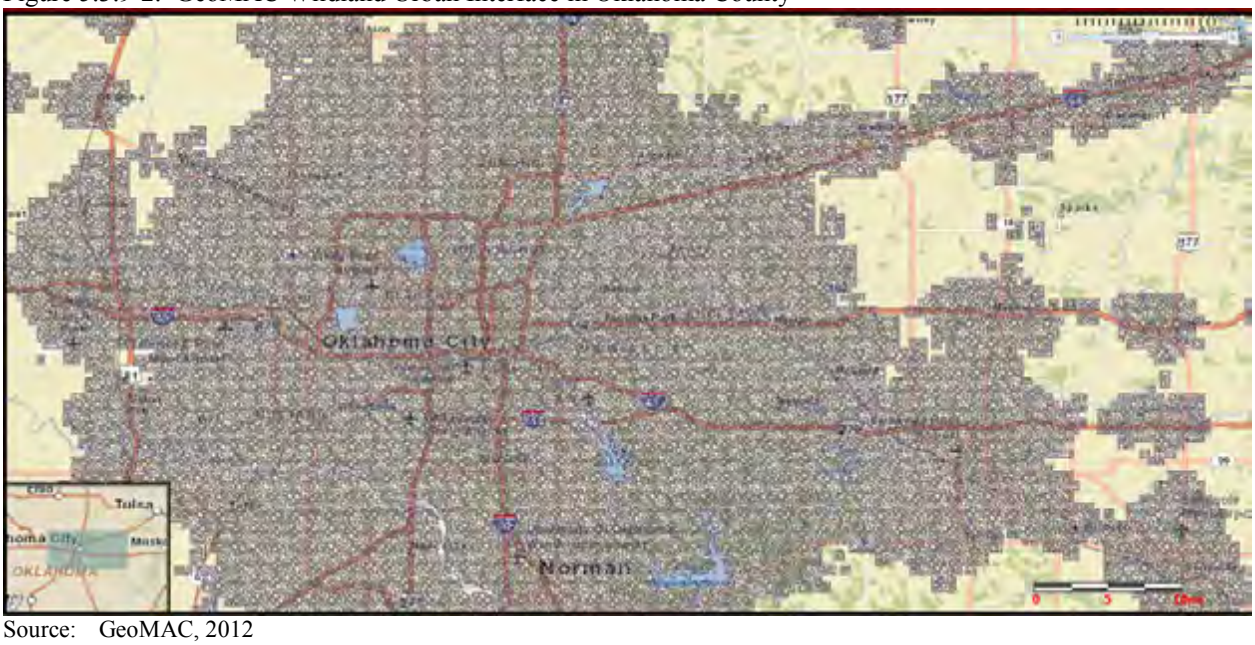
According to the U.S. Fire Administration (USFA), the fire problem in the U.S. varies from region to region. This often is a result of climate, poverty, education, demographics, and other causal factors (USFA, 2007). Wildfires occur in virtually all of the U.S. The western portion of the U.S. is subject to more frequent wildfires, due to their more arid climate and prevalent conifer and brush fuel types. Wildfires have proven to be the most destructive in California, but have become an increasingly frequent and damaging phenomenon nationwide (FEMA, 1997). States with a large amount of wooded, brush, and grassy areas, such as California, Colorado, New Mexico, Montana, Kansas, Mississippi, Louisiana, Georgia, Florida, North and South Carolina, Tennessee, Massachusetts, and the national forests of the western U.S. are at highest risk for wildfires (University of Florida, 1998).

Periods of drought, dry conditions, high temperatures, and low humidity provide an ideal setting for wildfires in pasture lands. Areas along railroads and homes in wooded, rural areas also have an increased risk of wildfires. Fire suppression is capable of creating larger fire hazards because live and dead vegetation is allowed to accumulate in areas where fire has been excluded (OKC HMP, 2007).

Wildfire/Urban Interface (WUI) in Oklahoma County

The Geospatial Multi-Agency Coordination Group (GeoMAC) is an internet-based mapping application developed by various government agencies, designed for fire managers to access online maps of current or recent fire locations (ranging from 2002 to 2012) and perimeters in the conterminous 48 states and Alaska (GeoMAC, 2012). This mapping application identifies not only where fires have occurred during that time period, but also identifies the WUI within the states and counties of the U.S. Figure 5.3.9-2 presents the entire Oklahoma County is located in the WUI.

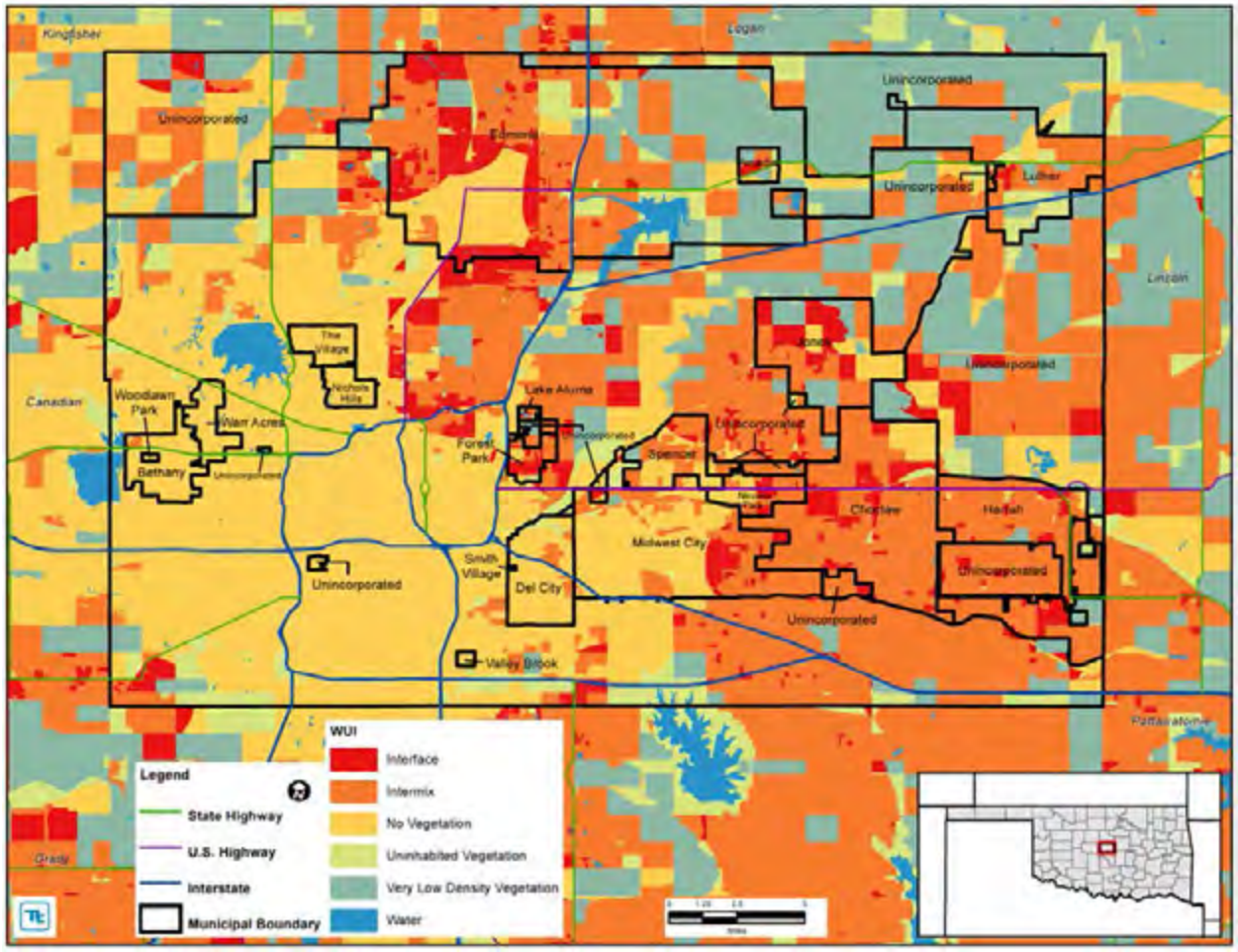
Figure 5.3.9-2. GeoMAC Wildland Urban Interface in Oklahoma County



Source: GeoMAC, 2012

A more detailed WUI (interface and intermix) was obtained through the SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison which also defines the wildfire hazard area. The California Fire Alliance determined that areas within 1.5 miles of wildland vegetation are the approximate distance that firebrands can be carried from a wildland fire to the roof of a house. Therefore, even structures not located within the forest are at risk to wildfire. This buffer distance, along with housing density and vegetation type were used to define the WUI illustrated in Figure 5.3.9- 3 below (University of Wisconsin, date unknown). Using this WUI, approximately 287 square miles or approximately 40-percent of the County is located in the WUI (interface and intermix).

Figure 5.3.9-3. SILVIS Lab Wildland Urban Interface in Oklahoma County



Source: Radeloff et al, 2005

Previous Occurrences and Losses

The short-term effects of wildfires can include destruction of timber, forest, wildlife habitats, scenic vistas, and watersheds. Business and transportation disruption can also occur in the short-term. Long-term effects can include reduced access to recreational areas, destruction of community infrastructure and cultural and economic resources (USGS, 2006).

The State of Oklahoma experiences frequent wildfires, with 3,519 wildfires burning approximately 70,000 acres in 2007 and 5,572 wildfires burning over 196,000 acres in 2008. Between 2000 and 2007, over 680,000 acres were burned by wildfires in the State (Weir et al., Date Unknown).

Table 5.3.9-2. Wildfire Events in Oklahoma County Between 1950 and 2012

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
January 1, 1990	Wildfire	N/A	N/A	A wildfire resulted in the loss of several homes throughout the County.	OKC HMP
February 1, 1990	Wildfire (Spencer Wildfire)	N/A	N/A	A wildfire resulted in the loss of over 80 homes in the County.	OKC HMP
July 26, 2000	Wildfire (Memorial and Douglas)	N/A	N/A	No reference and/or no damage reported.	OKC HMP
November 19-20, 2005	Wildfires	FM-2587 FM-2588 FM-2589	No	No reference and/or no damage reported.	GeoMAC, FEMA
January 1, 2006	Wildfires	DR-1623	No	In the City of Choctaw, all residents in the path of the wildfire were evacuated. Road within the affected area were closed. Sixty-eight homes were lost due to this wildfire.	Planning Committee Input
February 11-15, 2006	Wildfire (Hefner Wildfire)	N/A	N/A	No reference and/or no damage reported.	GeoMAC
March 12-18, 2006	Wildfire (Cedar Lake Wildfire)	N/A	N/A	No reference and/or no damage reported.	GeoMAC
March 22, 2008	Wildfire	FM-2756	N/A	The County numerous, wide-spread evacuations. Roads were closed for approximately six days. Deer Creek schools had approximately $6,000 in damages. The County had $120,000 in expenses for assistance with road closures.	Planning Committee Input
April 15, 2008	Wildfire (Blue Gate Wildfire)	N/A	N/A	No reference and/or no damage reported.	GeoMAC
April 9-12, 2009	Wildfires (Choctaw Wildfire)	DR-1846	Yes	A powerful early spring storm system moved into the State of Oklahoma. The system brought strong winds that moved across central and western Oklahoma. The winds brought dry air, and when combined with the warm temperatures, created favorable conditions for wildfires. Disaster assistance was approved for residents and business owners in Carter, Cleveland, Grady, Lincoln, McClain, Murray, Oklahoma, Payne, and Stephen Counties. In Oklahoma County, 100 structures were destroyed, with 12 homes destroyed in Midwest City and 58 homes destroyed in Choctaw.	Planning Committee Input, GeoMAC, OKOEM, FEMA

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
				In the City of Choctaw, all residents in the path of the wildfire were evacuated. Road within the affected area were closed. Eight homes were lost due to this wildfire. In the City of Del City, Fire personnel and equipment were used to contain and extinguish wildfires; City had over $10,000 in expenses. The County had over three miles of road closures within three days. Expenses totaled over $32,000 for personnel assistance with road closures.	
March 11-12, 2011	Midwest City Fire Complex	FM-2869	Yes	The Governor declared a state of emergency for all 77 counties in the State of Oklahoma. Over 24 wildfires were reported statewide during this timeframe. These fires were located in Beggs, Choctaw, Goldsby, Harrah, Kingfisher, Midwest City, Norman, Oklahoma City, Shaween, and Stroud. In Oklahoma County, 30 homes were destroyed, one home had major damage, one home had minor damage and dive homes were affected. In the City of Harrah, 29 residential and commercial buildings were lost or heavily damaged in the City; electrical, gas and cable services were out; roads were closed; shelters were open and several facilities were evacuated. In the City of Choctaw, the wildfires struck an area of approximately one square mile from SE 29th Street to just north of SE 15th Street and from Hiwassee Road to Henney Road. Seven homes were destroyed with an estimated $1.1 million in damages/losses. In Oklahoma County, more than $3M in damages to 39 properties, caused by wildfires that hit part of the southeastern portion of the County.	Planning Committee Input, OKC, Farley (Eastwood News), OKOEM, FEMA
April 2011	Jones-Spencer Fire	FM-2883	Yes	Hot and dry conditions combined with dormant vegetation produced critical wildfire conditions. A state of emergency was issued for all 77 counties in the State of Oklahoma (issued on March 11th). In Oklahoma County, a large fire was located in the Jones/Spencer area and evacuations occurred.	OKC

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
				Wildfires hit parts of Oklahoma County in early April. The Choctaw area was the hardest hit. The County had approximately $120,294 in damages from these wildfires.	
July – August 2011	Wildfires (Edmond Fire, Westminster Fire)	FM-2938 FM-2954	Yes	Prolonged drought, along with periods of extreme heat and gusty winds, created conditions that caused a series of wildfires across Oklahoma. Burn bands were ordered for counties in June, July and August. Overall, the Oklahoma Forestry Services battled 1,745 fires that burned over 132,000 acres.	NOAA, FEMA
August 30 – September 6, 2011	Wildfire (63rd Street Wildfire)	FM-2951	Yes	A wildfire scorched 3,000 acres and destroyed 21 houses on the edges of Oklahoma City as dry conditions and strong winds aided the fire.	Drought Impact Reporter, GeoMAC, FEMA

FEMA Federal Emergency Management Agency
FM Fire Management Assistance
HMP Hazard Mitigation Plan
OKC Oklahoma County
OKOEM Oklahoma County Office of Emergency Management
NOAA National Oceanic Atmospheric Administration

Probability of Future Events

Wildfire experts say there are four reasons why wildfire risks are increasing:

- Fuel, in the form of fallen leaves, branches and plant growth, have accumulated over time on the forest floor. Now this fuel has the potential to "feed" a wildfire.
- Increasingly hot, dry weather in the U.S.
- Changing weather patterns across the country.
- More homes built in the areas called the Wildland/Urban Interface, meaning homes are built closer to wildland areas where wildfires can occur (NYS HMP, 2011 – need proper reference).

Due to drought occurrences and the potential for high winds in Oklahoma County, wildfires are highly likely to occur in the future (OKC HMP, 2007).

In Section 5.3, the identified hazards of concern for Oklahoma County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Historically, many wildfires in the County and its jurisdictions have been caused accidentally or incendiary. Therefore, based on historical records and input from the Planning Committee, the probability of occurrence for wildfire in the County and all jurisdictions included in this plan is considered '3 – Likely' (Event is probable within the next three years. Event has a 1 in 3 year's chance of occurring).

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following text evaluates and estimates the potential impact of the wildfire hazard on Oklahoma County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

Wildfire hazards can impact significant areas of land, as evidenced by wildfires throughout the U.S. over the past several years. Fire in urban areas has the potential for great damage to infrastructure, loss of life, and strain on lifelines and emergency responders because of the high density of population and structures that can be impacted in these areas. Wildfire, however can spread quickly, become a huge fire complex consisting of thousands of acres, and present greater challenges for allocating resources, defending isolated structures, and coordinating multi-jurisdictional response. If a wildfire occurs at a WUI, it can also cause an urban fire and in this case has the potential for great damage to infrastructure, loss of life, and strain on lifelines and emergency responders because of the high density of population and structures that can be impacted in these areas. According to the State of Oklahoma HMP Update, the one of the two most vulnerable counties to the wildfire hazard is Oklahoma County. The State Oklahoma's fire season is from July through April; therefore the entire County is vulnerable 10 months of the year (OK DEM, 2011)

Data and Methodology

Information regarding the wildfire hazard included input and data from the Planning Committee, GeoMAC, SILVIS Lab and other local sources of documentation for this area. To determine what assets are exposed to wildfire, the both the WUI from SILVIS Lab and GeoMAC were used. The GeoMAC WUI is more conservative (the WUI covers the entire County). The asset data (population, building stock and critical facilities) presented in the County Profile section (Section 4) was used to support an evaluation of assets exposed and the potential impacts and losses associated with this hazard.

Impact on Life, Health and Safety, General Building Stock, Critical Facilities and the Economy

As demonstrated by historic wildfire events, potential losses include human health and life of residents and responders, structures, infrastructure and natural resources. In addition, wildfire events can have major economic impacts on a community from the initial loss of structures, the subsequent loss of revenue from destroyed business, agricultural losses and decrease in tourism.

Wildfires can cost thousands of taxpayer dollars to suppress and control and involve hundreds of operating hours on fire apparatus and thousands of volunteer man hours from the volunteer firefighters. There are also many direct and indirect costs to local businesses that excuse volunteers from work to fight these fires (Central Pine Barrens, 2007).

According to GeoMAC, all of Oklahoma County is located within a WUI zone (GeoMAC, 2011). Therefore, the entire population and all buildings are considered exposed to this hazard.

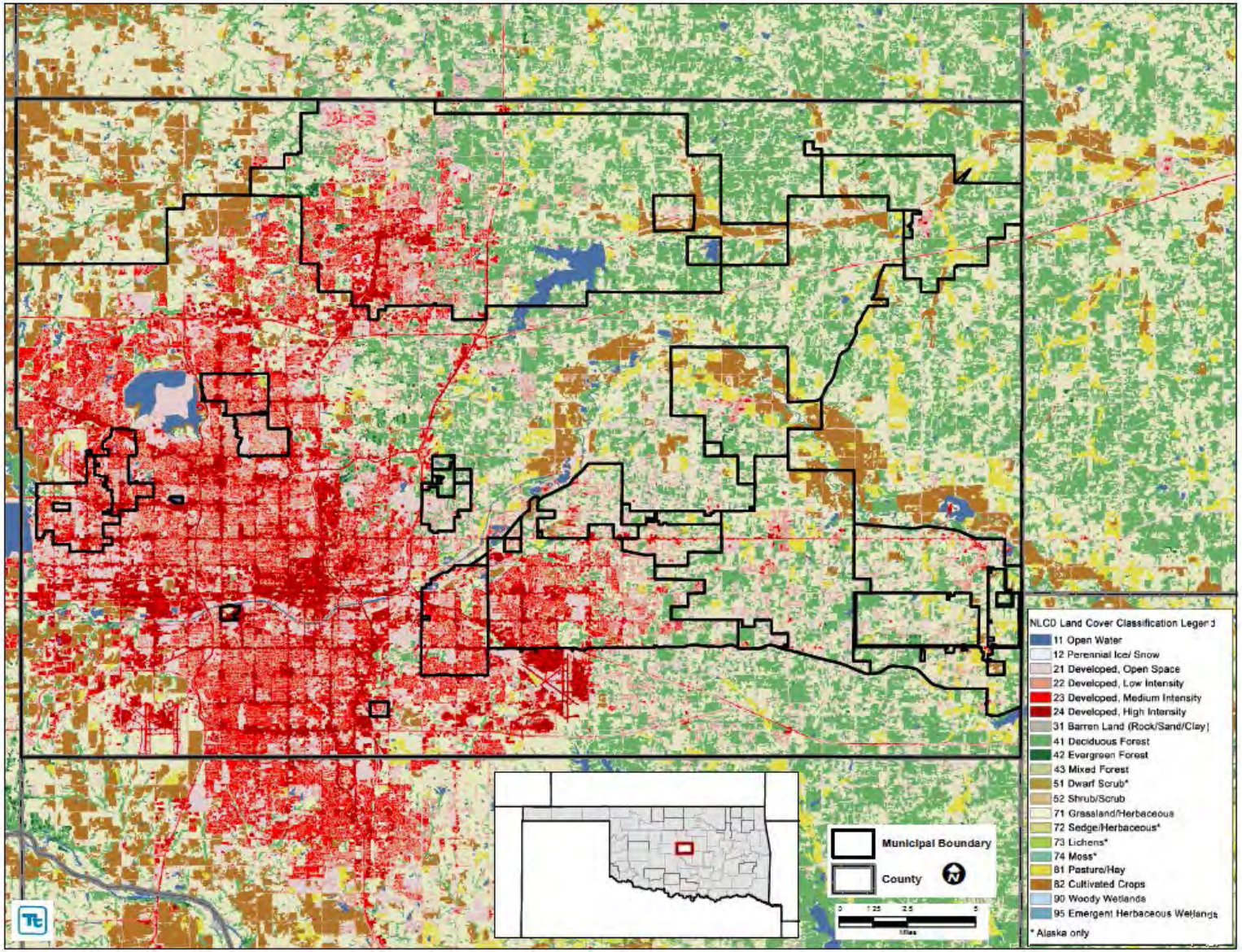
According to the State HMP, the State has experienced an increase in residential development in rural communities, small towns and cities (OK DEM, 2011). Residents within the WUI are surrounded by fuels that could potentially ignite and are thus vulnerable to the wildfire hazard. According to 2006 land use/land cover data, approximately 58% of the land in Oklahoma County is forested land and nearly 30% is developed (Table 5.3.9-2). As shown in Figure 5.3.9-4 below, urban areas are located adjacent to forested and farmlands. Both vegetation and structures serve as fuel for wildfire events.

Table 5.3.9-3. Land Use Summary for Oklahoma County

Land Use Category	Acres	Percent of Oklahoma County
Barren (Quarry)	67.3	<1
Developed	74,458.3	29.26
Farmland	29,372.6	11.54
Forested	146,477. 8	57.57
Water	4,055.4	1.59
Wetlands	6.6	<1
TOTAL	**254,438**	**100**

Source: 2006 NLCD Land Cover

Figure 5.3.9-4. Land Cover in Oklahoma County



Source: USGS, 2011 (2006 NLCD)

Buildings constructed of wood or vinyl siding are generally more likely to be impacted by the fire hazard than buildings constructed of brick or concrete. According to HAZUS-MH's default general building stock database, compiled from Census 2000 data, approximately 65% of the buildings in the County are constructed of wood.

Wildfire can also severely impact roads and infrastructure. Of particular note, Interstates 35, 235, 40 and 44 are located in the wildfire hazard area. Major north-south and east-west corridors through the County are vulnerable to this hazard which should be considered for evacuation route purposes.

It is recognized that a number of critical facilities are located in the wildfire hazard area, and are also vulnerable to the threat of wildfire. Many of these facilities are the locations for vulnerable populations (i.e., schools, senior facilities) and responding agencies to wildfire events (i.e., fire, police). Table 5.3.9-4 summarizes critical facilities identified by the Oklahoma County plan participants that are located within the wildfire hazard area (interface or intermix) obtained through the SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison.

Table 5.3.9-4. Facilities in the WUI

Name	Municipality	Type
Arcadia City Hall	Arcadia (C)	Government Facility
Bethany Water Treatment Plant	Bethany (C)	Government Facility
Choctaw Police Dept	Choctaw (C)	Police
Choctaw Police Dept	Choctaw (C)	Police
Choctaw Fire Department	Choctaw (C)	Fire
JAMES GRIFFITH IES	Choctaw (C)	School
NICOMA PARK IES	Choctaw (C)	School
NICOMA PARK JHS	Choctaw (C)	School
CHOCTAW ES	Choctaw (C)	School
CHOCTAW HS	Choctaw (C)	School
CHOCTAW JHS	Choctaw (C)	School
L. W. WESTFALL ES	Choctaw (C)	School
INDIAN MERIDIAN ES	Choctaw (C)	School
Choctaw City Hall	Choctaw (C)	Government Facility
Del Crest Jr. High	Del City (C)	School
Kerr Jr. High School	Del City (C)	School
Fire Station #4	Edmond (C)	Fire
Fire Station #3	Edmond (C)	Fire
Fire Station #5	Edmond (C)	Fire
Fire Dept Apparatus Storage Bdg	Edmond (C)	Fire
Edmond Medical Center	Edmond (C)	Medical
SEQUOYAH MS	Edmond (C)	School
CROSS TIMBERS ES	Edmond (C)	School
CHEYENNE MS	Edmond (C)	School
CIMARRON MS	Edmond (C)	School
OKLAHOMA CHRISTIAN SCHOOL	Edmond (C)	School
CHISHOLM ES	Edmond (C)	School
MAC - Senior Center	Edmond (C)	Shelter
PSC Admin Building	Edmond (C)	Government Facility

Name	Municipality	Type
PSC OPs Building	Edmond (C)	Government Facility
PSC OPs Yard	Edmond (C)	Government Facility
XTimbers Animal Welfare	Edmond (C)	Government Facility
Forest Park City Hall	Forest Park (C)	Government Facility
Forest Park Police Dept	Forest Park (T)	Police
Town of Forest Park Fire Dept.	Forest Park (T)	Fire
Family Care Center	Harrah (C)	Medical
RUSSELL BABB ES	Harrah (C)	School
HARRAH HS	Harrah (C)	School
HARRAH MS	Harrah (C)	School
VIRGINIA SMITH ES	Harrah (C)	School
CLARA REYNOLDS ES	Harrah (C)	School
HARRAH JHS	Harrah (C)	School
OKLAHOMA ACADEMY	Harrah (C)	School
Jones Police Dept	Jones (C)	Police
Jones Fire Dept	Jones (C)	Fire
Emergency Operations Center	Jones (C)	EOC
Town Hall/Police Dept.	Jones (C)	Government Facility
Jones City Hall	Jones (C)	Government Facility
Public Works Building	Jones (C)	Other
Jones Fire Department	Jones (T)	Fire
JONES HS	Jones (T)	School
JONES ES	Jones (T)	School
JONES MS	Jones (T)	School
Luther City Hall/Police Station	Luther (C)	Police
Luther City Hall	Luther (C)	Government Facility
Luther Mill And Farm Supply	Luther (C)	Other
Hickory Hills Volunteer Fire Department	Luther (T)	Fire
LUTHER ES	Luther (T)	School
LUTHER HS	Luther (T)	School
LUTHER MS	Luther (T)	School
Fire Station 5	Midwest City (C)	Fire
Midwest Regional Medical Center	Midwest City (C)	Medical
Renaissance Medical Center	Midwest City (C)	Medical
Telstar Elementary School	Midwest City (C)	School
Fairfax Apartments	Midwest City (C)	Apartment Complex
Orchard Springs Apartments	Midwest City (C)	Apartment Complex
Foam Brite Car Wash	Midwest City (C)	Auto Services
La Petite Child Care	Midwest City (C)	Child Care
Buy For Less	Midwest City (C)	Grocery
Walgreens	Midwest City (C)	Health Services
MWC Animal Shelter	Midwest City (C)	Municipal Government
MWC Water Treatment Plant	Midwest City (C)	Municipal Government
Midwest Square Office Park	Midwest City (C)	Office Park
Walmart	Midwest City (C)	Retail

Name	Municipality	Type
Kenwood Plaza	Midwest City (C)	Shopping Center
Nicoma Park City Hall	Nichoma Park C)	Government Facility
Nicoma Park Police Dept	Nicoma Park (C)	Police
Nicoma Park Fire Department	Nicoma Park (C)	Fire
Deaconess At Bethany Hospital	Oklahoma County	Medical
U.S. Filter--Deer Creek Wwtp	Oklahoma County	HAZMAT storage area
City Hall	Oklahoma County	Government Facility
GREEN PASTURES ES	Spencer (C)	School

Source: Radeloff et al, 2005; Oklahoma County HMP Committee

According to the State HMP, 'local economic impacts from catastrophic wildfires include disruptions to both consumption and production of local goods and services. Immediate effects may include decreased recreation / tourism and timber harvest in the fire region, as well as disruptions from evacuations and transportation delays. Increased use of local goods and services for fire protection also impacts local economies. Other effects include direct property losses (in the form of buildings, timber, livestock, and other capital), damage to human health, and possible changes in the long-term structure of the local economy' (OK DEM, 2011).

Secondary effects to wildfire include destroyed vegetation and organic matter increasing surface runoff leading to erosion, flooding and debris flows (OK DEM, 2011). Wildfires also have an effect on water supplies. According to the State HMP, 'the loss of ground-surface cover, such as pine needles and small branches, and the chemical transformation of burned soils make watersheds more susceptible to erosion from rainstorms' (OK DEM, 2011).

According to the Oklahoma Resources Water Board, Oklahoma County is serviced by both groundwater and surface water rural water systems (2000). Drought conditions and other natural disasters increase the probability of wildfires by producing fuel in both urban and rural areas. Local volunteer fire departments serve to protect residents from property loss; and Oklahoma City fire resources are also close by.

Due to a lack of data regarding past structural and economic losses specific to Oklahoma County or its municipalities, it is not possible to estimate losses due to wildfire events at this time.

Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Approximately 40 percent of the County is considered to lie within the WUI zone (University of Wisconsin, date unknown). Any areas of growth within this 40 percent could be potentially impacted by the wildfire hazard due to exposure and vulnerability.

Additional Data and Next Steps

Data regarding the construction of structures in the study area, such as roofing material, fire detection equipment, structure age, etc., and proximity to fast burning/high intensity vegetative communities should be identified for further evaluation. Development and availability of such data would permit a more detailed estimate of potential vulnerabilities, including loss of life and economic damages, based on the population and resources exposed to the hazard.

Historic wildfire extent maps were not readily available and will be required to identify the geographic locations where wildfires have taken place in the past and areas prone to wildfires. Such data can be

developed over time; however, based on the frequency of past wildfire events in the County, collection of this data is a lower priority than data collection for more prevalent hazard categories.

Overall Vulnerability Assessment

While it is not possible to predict when and where a fire will start, the Oklahoma County and its local fire departments are well-equipped and prepared to respond to fires as they arise.

The status of fire risk in the County will continue to be monitored and ongoing and new mitigation efforts to prevent fires and control them when they arise will continue to be developed.

5.3.10 TORNADO AND WIND

This section provides a profile and vulnerability assessment for the wind hazard, including tornadoes.

HAZARD PROFILE

Hazard profile information is provided in this section, including information on description, extent, location, previous occurrences and losses and the probability of future occurrences within Oklahoma County.

Description

For the purpose of this HMP and as deemed appropriated by Oklahoma County, the wind hazard includes windstorms and tornadoes, which are defined below.

Windstorm: According to the Federal Emergency Management Agency (FEMA), wind is air moving from high to low pressure. It is rough horizontal movement of air (as opposed to an air current) caused by uneven heating of the Earth's surface. It occurs at all scales, from local breezes generated by heating of land surfaces and lasting tens of minutes to global winds resulting from solar heating of the Earth (FEMA, 1997). A type of windstorm that is experienced often during rapidly moving thunderstorms is a derecho. A derecho is a widespread and long-lived windstorm associated with thunderstorms that are often curved in shape (Johns et al., 2011). The two major influences on the atmospheric circulation are the differential heating between the equator and the poles, and the rotation of the planet. Windstorm events are associated with cyclonic storms (for example, hurricanes), thunderstorms and tornadoes (FEMA, 1997).

Tornado: A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm (or sometimes as a result of a hurricane) and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. Tornado season is generally March through August, although tornadoes can occur at any time of year (FEMA, 2004). Tornadoes tend to strike in the afternoons and evening, with over 80 percent (%) of all tornadoes striking between noon and midnight (New Jersey Office of Emergency Management [NJOEM], 2007). The average forward speed of a tornado is 30 mph, but can vary from nearly stationary to 70 mph (NWS, 1995). The NOAA Storm Prediction Center (SPC) indicates that the total duration of a tornado can last between a few seconds to over one hour; however, a tornado typical lasts less than 10 minutes (Edwards, 2011). High-wind velocity and wind-blown debris, along with lightning or hail, result in the damage caused by tornadoes. Destruction caused by tornadoes depends on the size, intensity, and duration of the storm. Tornadoes cause the greatest damage to structures that are light, such as residential homes and mobile homes, and tend to remain localized during impact (NVRC, 2006).

Extent

The extent (that is, magnitude or severity) of a severe storm is largely dependent upon sustained wind speed. Straight-line winds, winds that come out of a thunderstorm, in extreme cases, can cause wind gusts exceeding 100 mph. These winds are most responsible for hailstorm and thunderstorm wind damage. One type of straight-line wind, the downburst, can cause damage equivalent to a strong tornado (NVRC, 2006).

Tornado

The magnitude or severity of a tornado was originally categorized using the Fujita Scale (F-Scale) or Pearson Fujita Scale introduced in 1971, based on a relationship between the Beaufort Wind Scales (B-Scales) (measure of wind intensity) and the Mach number scale (measure of relative speed). It is used to rate the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure (Tornado Project, Date Unknown). The F-Scale categorizes each tornado by intensity and area. The scale is divided into six categories, F0 (Gale) to F5 (Incredible) (Edwards, 2011). Table 5.3.10-1 explains each of the six F-Scale categories.

Table 5.3.10-1. Fujita Damage Scale

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

Source: SPC, Date Unknown

Although the F-Scale has been in use for over 30 years, there are limitations of the scale. The primary limitations are a lack of damage indicators, no account of construction quality and variability, and no definitive correlation between damage and wind speed. These limitations have led to the inconsistent rating of tornadoes and, in some cases, an overestimate of tornado wind speeds. The limitations listed above led to the development of the Enhanced Fujita Scale (EF Scale). The Texas Tech University Wind Science and Engineering (WISE) Center, along with a forum of nationally renowned meteorologists and wind engineers from across the country, developed the EF Scale (NOAA, 2007).

The EF Scale became operational on February 1, 2007. It is used to assign tornadoes a 'rating' based on estimated wind speeds and related damage. When tornado-related damage is surveyed, it is compared to a list of Damage Indicators (DIs) and Degree of Damage (DOD), which help better estimate the range of wind speeds produced by the tornado. From that, a rating is assigned, similar to that of the F-Scale, with six categories from EF0 to EF5, representing increasing degrees of damage. The EF Scale was revised from the original F-Scale to reflect better examinations of tornado damage surveys. This new scale has to

do with how most structures are designed (NOAA, 2008). Table 5.3.10-2 displays the EF Scale and each of its six categories.

Table 5.3.10-2. Enhanced Fujita Damage Scale

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

Source: SPC, 2007

In the Fujita Scale, there was a lack of clearly defined and easily identifiable damage indicators. The EF Scale takes into account more variables than the original F-Scale did when assigning a wind speed rating to a tornado. The EF Scale incorporates 28 DIs, such as building type, structures, and trees. For each damage indicator, there are eight DODs, ranging from the beginning of visible damage to complete destruction of the damage indicator. Table 5.3.10-3 lists the 28 DIs. Each one of these indicators has a description of the typical construction for that category of indicator. Each DOD in every category is given an expected estimate of wind speed, a lower bound of wind speed, and an upper bound of wind speed.

Table 5.3.10-3. EF Scale Damage Indicators

Number	Damage Indicator	Abbreviation	Number	Damage Indicator	Abbreviation
1	Small barns, farm outbuildings	SBO	15	School - 1-story elementary (interior or exterior halls)	ES
2	One- or two-family residences	FR12	16	School - jr. or sr. high school	JHSH
3	Single-wide mobile home (MHSW)	MHSW	17	Low-rise (1-4 story) bldg.	LRB
4	Double-wide mobile home	MHDW	18	Mid-rise (5-20 story) bldg.	MRB

Number	Damage Indicator	Abbreviation	Number	Damage Indicator	Abbreviation
5	Apt, condo, townhouse (3 stories or less)	ACT	19	High-rise (over 20 stories)	HRB
6	Motel	M	20	Institutional bldg. (hospital, govt. or university)	IB
7	Masonry apt. or motel	MAM	21	Metal building system	MBS
8	Small retail bldg. (fast food)	SRB	22	Service station canopy	SSC
9	Small professional (doctor office, branch bank)	SPB	23	Warehouse (tilt-up walls or heavy timber)	WHB
10	Strip mall	SM	24	Transmission line tower	TLT
11	Large shopping mall	LSM	25	Free-standing tower	FST
12	Large, isolated ("big box") retail bldg.	LIRB	26	Free standing pole (light, flag, luminary)	FSP
13	Automobile showroom	ASR	27	Tree - hardwood	TH
14	Automotive service building	ASB	28	Tree - softwood	TS

Source: SPC, Date Unknown

Since the EF Scale recently went into effect in February 2007, previous occurrences and losses associated with historic tornado events, described in the next section (Previous Occurrences and Losses) of this hazard profile, are based on the former Fujita Scale. Events after February 2007 are based on the Enhance Fujita Scale.

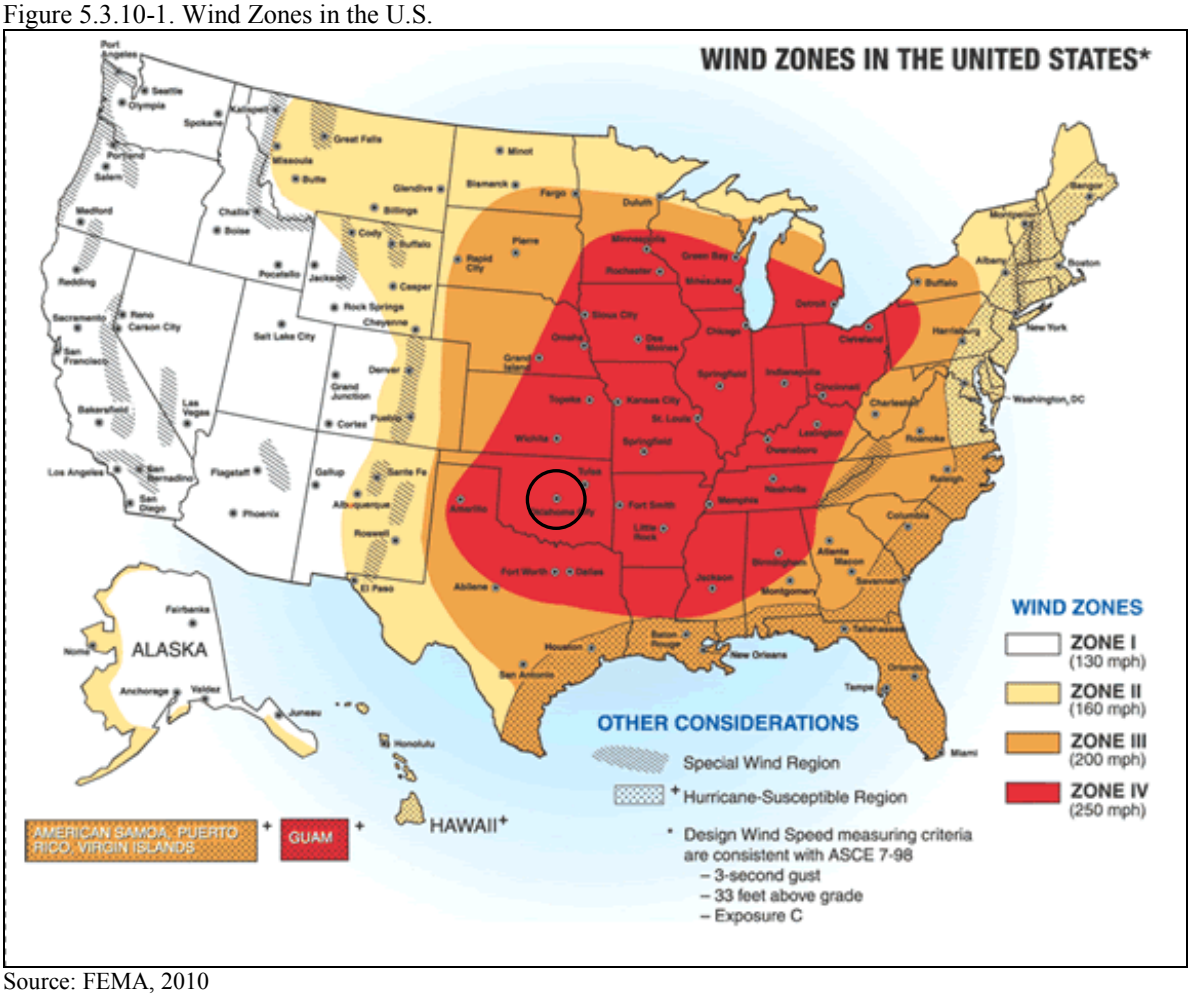
Location

Windstorms

Figure 5.3.10-5 indicates how the frequency and strength of windstorms impacts the U.S. and the general location of the most wind activity. This is based on 40 years of tornado history and 100 years of hurricane history, collected by FEMA. States located in Wind Zone IV have experienced the greatest number of tornadoes and the strongest tornadoes (NVRC, 2006).

Oklahoma County is located in Wind Zone IV with speeds up to 250 miles per hour (FEMA, 2008) (Figure 5.3.10-1).

Figure 5.3.10-1. Wind Zones in the U.S.



Source: FEMA, 2010
Note: The black circle indicates the approximate location of Oklahoma County.

Table 5.3.10-4. Wind Zones in the U.S.

Wind Zones	Areas Affected
Zone I (130 mph)	All of Washington, Oregon, California, Idaho, Utah, and Arizona. Western parts of Montana, Wyoming, Colorado and New Mexico. Most of Alaska, except the east and south coastlines.
Zone II (160 mph)	Eastern parts of Montana, Wyoming, Colorado, and New Mexico. Most of North Dakota. Northern parts of Minnesota, Wisconsin and Michigan. Western parts of South Dakota, Nebraska and Texas. All New England States. Eastern parts of New York, Pennsylvania, Maryland, and Virginia. Washington, DC.
Zone III (200 mph)	Areas of Minnesota, South Dakota, Nebraska, Colorado, Kansas, Oklahoma, Texas, Louisiana, Mississippi, Alabama, Georgia, Tennessee, Kentucky, Pennsylvania, New York, Michigan, and Wisconsin. Most or all of Florida, Georgia, South Carolina, North Carolina, Virginia, West Virginia. All of American Samoa, Puerto Rico, and Virgin Islands.
Zone IV (250 mph)	Mid US including all of Iowa, Missouri, Arkansas, Illinois, Indiana, and Ohio and parts of adjoining states of Minnesota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Louisiana, Mississippi, Alabama, Georgia, Tennessee, Kentucky, Pennsylvania, Michigan, and Wisconsin. Guam.
Special Wind Region	Isolated areas in the following states: Washington, Oregon, California, Idaho, Utah, Arizona, Montana, Wyoming, Colorado, New Mexico. The borders between Vermont and New Hampshire; between New York, Massachusetts and Connecticut; between Tennessee and North Carolina.

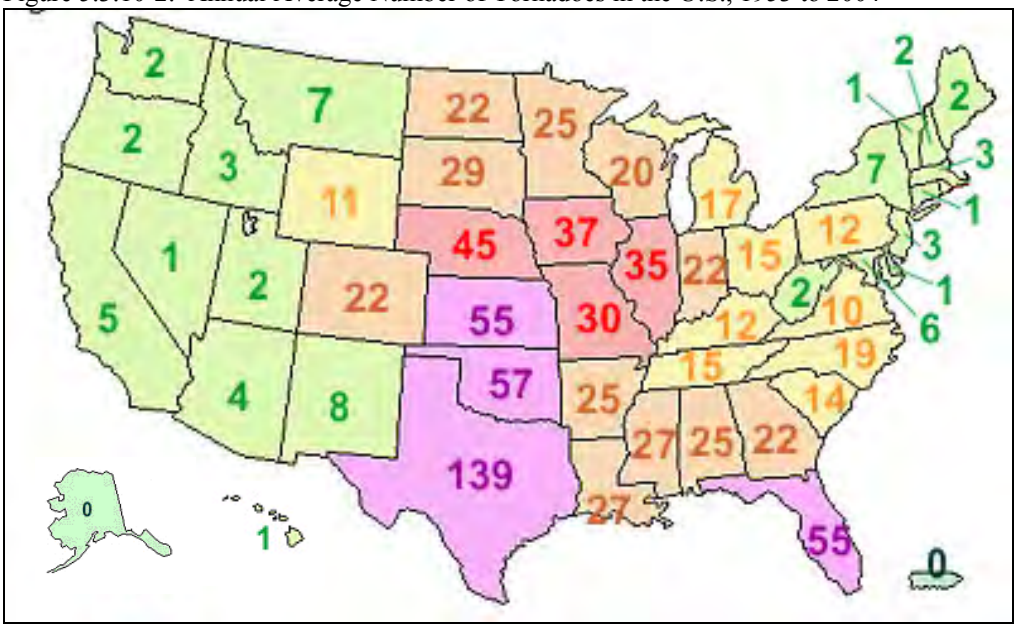
Wind Zones	Areas Affected
Hurricane Susceptible Region	Southern US coastline from Gulf Coast of Texas eastward to include entire state of Florida. East Coastline from Maine to Florida, including all of Massachusetts, Connecticut, Rhode Island, Delaware, and Washington DC. All of Hawaii, Guam, American Samoa, Puerto Rico and Virgin Islands.

Source: FEMA, Date Unknown

Tornado

The U.S. experiences more tornadoes than any other country. In a typical year, approximately 1,000 tornadoes affect the U.S. The peak of the tornado season is April through June, with the highest concentration of tornadoes in the central U.S. Figure 5.3.10-2 shows the annual average number of tornadoes between 1953 and 2004 (NWS, 2010). The State of Oklahoma experienced an average of 57 tornado events annually between 1953 and 2004.

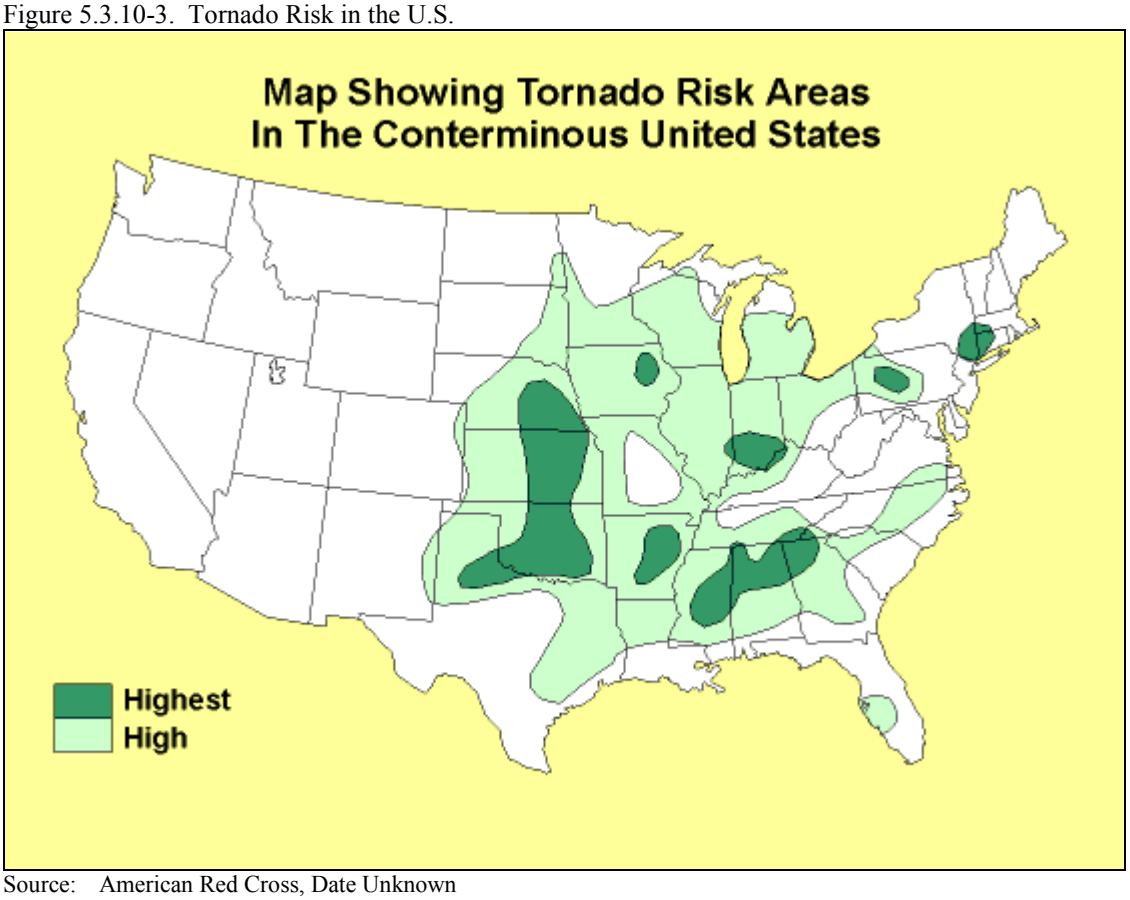
Figure 5.3.10-2. Annual Average Number of Tornadoes in the U.S., 1953 to 2004



Source: NWS, 2010
Note: Between 1953 and 2004, the State of Oklahoma experienced an average of 57 tornadoes each year.

Figure 5.3.10-3 indicates that the central portion of the State is at the highest risk for tornado activity, this includes Oklahoma County. The eastern and western ends of the State are at a high risk of tornado activity. Details regarding historical tornado events are discussed in the next section (Previous Occurrences and Losses) of this profile.

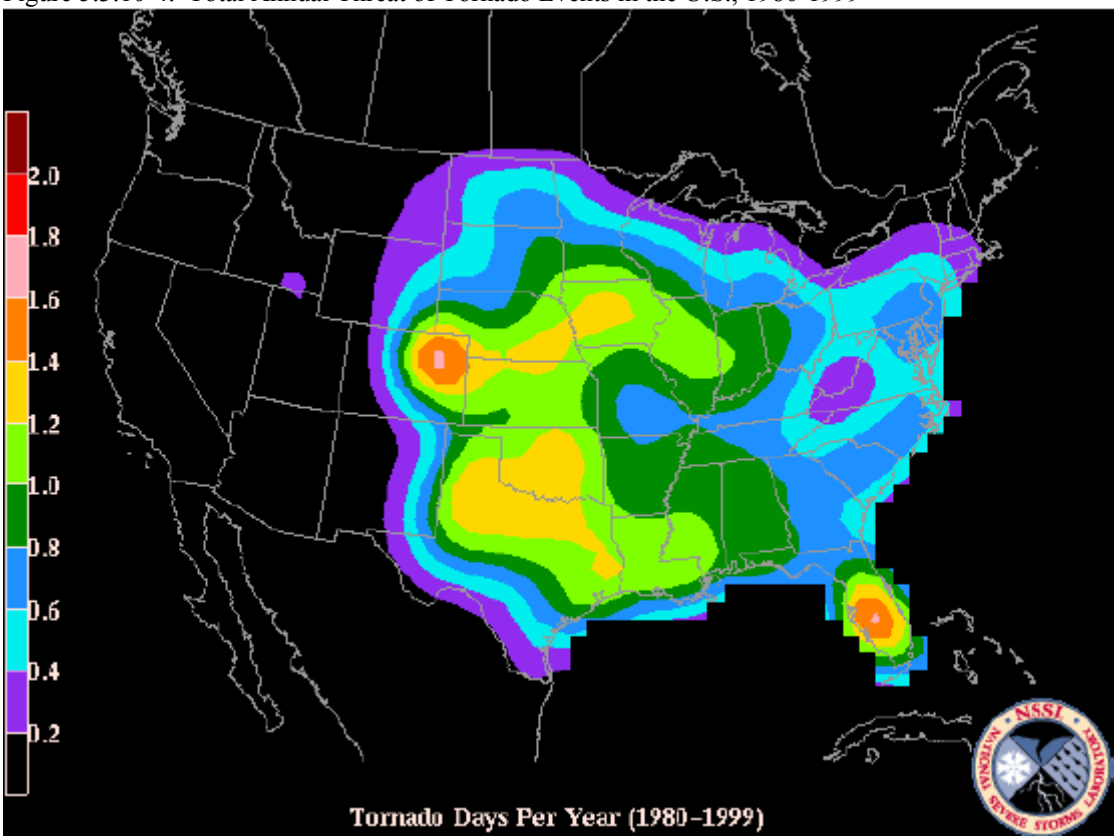
Figure 5.3.10-3. Tornado Risk in the U.S.



Source: American Red Cross, Date Unknown
Note: Oklahoma County is shown has having the highest risk of tornado occurrences.

A study from NOAA's National Severe Storms Laboratory (NSSL) provided estimates of the long-term threat from tornadoes. The NSSL used historical data to estimate the daily probability of tornado occurrences across the U.S., no matter the magnitude of the tornado. Figure 5.3.10-4 shows the estimates prepared by the NSSL. In the State of Oklahoma, it is estimated that the probability of a tornado occurring is 0.8 and 1.4 days per year. In Oklahoma County, it is estimated that the probability of tornado occurring is 1.2 to 1.4 days per year (NSSL, 2003).

Figure 5.3.10-4. Total Annual Threat of Tornado Events in the U.S., 1980-1999



Source: NSSL, 2003

Note: The mean number of days per year with one or more events within 25 miles of a point is shown here. The fill interval for tornadoes is 0.2, with the purple starting at 0.2 days. For the nontornadic threats, the fill interval is 1, with the purple starting at 1. For the significant (violent), it's 5 days per century (millennium)

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with wind events throughout the State of Oklahoma and Oklahoma County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

According to NOAA's NCDC storm events database, Oklahoma County experienced 620 wind and tornado events between April 30, 1950 and December 31, 2011. These events include funnel clouds, high winds, strong winds, thunderstorm winds and tornadoes. Total property damages, as a result of these severe storm events, were estimated at $240.8 million. This total also includes damages to other counties. According to the Hazard Research Lab at the University of South Carolina's Spatial Hazard Events and Losses Database for the U.S. (SHELDUS), between 1960 and 2010, 264 wind and tornado events occurred within the County. The database indicated that wind events and losses specifically associated with Oklahoma County and its municipalities totaled over $676.3 million in property damage and over $171,000 in crop damage. However, these numbers may vary due to the database identifying the location of the hazard event in various forms or throughout multiple counties or regions.

Between 1954 and 2011, FEMA declared that the State of Oklahoma experienced 32 wind-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types:

severe storms, tornadoes, straight-line winds, heavy rains, hail, and flooding. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations. Of those events, FEMA other sources indicate that Oklahoma County has been declared as a disaster area as a result of 11 wind and tornado events (FEMA, 2012).

Based on all sources researched, known severe storm events that have affected Oklahoma County and its municipalities are identified in Table 5.3.10-5. With wind event documentation for the State being so extensive, not all sources have been identified or researched. Therefore, Table 5.3.10-5 may not include all events that have occurred throughout the County and region.

Table 5.3.10-5. Tornado and Wind Events between 1950 and 2012

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
November 19, 1930	Tornado	N/A	N/A	The County had approximately $250K in response/recovery costs and 148 people were affected.	OKC HMP
June 12, 1942	Tornado	N/A	N/A	The County had approximately $500K in response/recovery costs and 135 people were affected.	OKC HMP
April 12, 1945	Tornado	N/A	N/A	The County had approximately $1M in response/recovery costs and 208 people were affected.	OKC HMP
March 20, 1948	Tornado	N/A	N/A	The County had approximately $10.25 M in response/recovery costs and eight people were affected.	OKC HMP
March 25, 1948	Tornado	N/A	N/A	The County had approximately $6.1 M in response/recovery costs and one person was affected.	OKC HMP
April 30, 1951	Tornado	N/A	N/A	The County had approximately $250K respond/recovery costs and one person was affected.	OKC HMP
June 1, 1955	Tornado, Flood	DR-35	Yes	No reference and/or no damage reported.	FEMA
April 28, 1960	Tornado	N/A	N/A	The County had approximately $2.5M respond/recovery costs and 57 people were affected. The County had approximately $500K in property damage.	OKC HMP, SHELDUS
July 15, 1960	Tornado	DR-104	Yes	No reference and/or no damage reported.	FEMA
May 4, 1960	Tornado	N/A	N/A	The County had approximately $250K respond/recovery costs and four people were affected.	OKC HMP
April 14 - June 1, 1990	Flooding, Severe Storm, Tornado	DR-866	Yes	No reference and/or no damage reported.	FEMA
May 8-26, 1993	Flooding, Severe Storm, Tornado	DR-991	Yes	No reference and/or no damage reported.	FEMA
July 21-August 6, 1995	Tornado	DR-1066	Yes	No reference and/or no damage reported.	FEMA

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
January 17, 1996	High Wind	N/A	N/A	Oklahoma City and the City of Edmond experienced high winds that damaged structures. The County had approximately $2.3M in property damage.	OKC HMP
July 2, 1996	High Wind	N/A	N/A	The County experienced high winds of over 100 knots, causing approximately $3K in property damage.	OKC HMP
October 8, 1997	TSTM Wind	N/A	N/A	A line of severe TSTMs developed and moved across western and central Oklahoma that produced large hail, damaging winds and two tornadoes. The tornadoes did not occur in Oklahoma County; however, golf ball-sized hail fell in the County. In the City of Edmond, winds downed many trees and limbs.	NOAA-NCDC
June 13, 1998	Strong Winds and Tornado (F2)	N/A	N/A	Four supercell TSTMs developed in western Oklahoma and tracked eastward. This storm produced seven tornadoes as it tracked from Canadian County to Oklahoma County. The most damaging tornado, an F2, touched down in northeast Oklahoma City and crossed I-35. Other tornadoes damaged the Oklahoma City Boat Club, portions of the Cities of The Village and Nichols Hills and the Highland Park and the area near May and Grand Ave. in Oklahoma City. Extensive straight-line winds were also reported in Lake Hefner, in the Cities of Nichols Hills and The Village and parts of northeast Oklahoma County. Wind speeds exceeded 100 mph in some areas. There were no fatalities and 21 injuries in the County. The County had over $1.65 M in property damage.	NWS, NOAA-NCDC, SHELDUS
September 21, 1998	High Winds	N/A	N/A	The County experienced high winds of over 100 knots that caused approximately $200K in property damage.	OKC HMP
May 3-4, 1999	Great Plains Tornado Outbreak	DR-1272	Yes	This tornado was a violent and long-tracked tornado that produced F5 damage in Bridge Creek, Oklahoma City and Moore. In Oklahoma County, the tornado moved through the City of Del City, crossing SE 44th and moved through the highly populated Del Aire housing, killing six people and damaging or destroying hundreds of homes, many with F3/F4 damage. The tornado crossed Sooner Road, where it damaged an entry gate and structures at Tinker Air Force Base. The tornado crossed 29th Street into Midwest City, destroying one building in the Boeing Complex and damaging two others. Widespread F3/F4 damage continued as the tornado moved across I-40. Approximately 800 vehicles were damaged at Hudiburg Auto Group. Some of the damage in this area was rated high F4 and low F5.	NWS, OKC HMP, FEMA

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
December 2, 1999	TSTM Wind	N/A	N/A	Severe TSTMs formed across portions of western Oklahoma and moved into central Oklahoma. As these storms reached central Oklahoma, straight-line winds caused minor tree damage five miles northwest of the City of Edmond in Oklahoma County.	NOAA-NCDC
July 21-22, 2000	TSTM Wind	N/A	N/A	Tees and utility poles were downed due to a line of severe TSTMs in the Cities of Edmond and Nichols Hills. At Lake Hefner, a 40-foot sailboat was blown off a trailer. Also in the City of Nichols Hills, massive damage was sustained to trees across the City and the roof of a church was damaged. In the Town of Bethany, several airplanes and hangers were damaged at Wiley Post Airport. The County had approximately $280K in property damage.	NOAA-NCDC, OKC HMP
May 27, 2001	TSTM Wind	N/A	N/A	A large and severe line of TSTMs formed across southwest Kansas and moved into Oklahoma. Widespread damage due to straight-line winds was reported. Over 160,000 customers were without power. In Okalhoma County, the roof of a YMCA sustained significant damage due to a severe storm. Rain then fell on the gym floor, destroying it, in the Town of Bethany. The County had approximately $3M in property damage.	NOAA-NCDC, OKC HMP
July 21, 2001	High Winds	N/A	N/A	Over 160,000 residents were without power from high winds that exceeded 100 knots. The County had approximately $175K in property damage.	OKC HMP
May 8-9, 2003	Tornado (F4)	DR-1465	Yes	In Oklahoma County, the May 8th tornado was an F4 when it struck. It injured 45 people. The May 9th tornado was an F1 to F3 tornado. It injured 10 people. Total property damage for this series of tornadoes was over $177 M. The May 9th event damaged the General Motors plant in the City of Del City. Other areas in the County affected by this even were the Cities of Midwest City and Choctaw. In Midwest City, multiple homes were heavily damaged and there were downed power lines. In the City of Harrah, a tornado on ground was reported. More than 1,500 homes were damaged, including 300 that were destroyed. The County had approximately $300K in property damage.	NWS, NOAA-NCDC, SHELDUS, OEM, FEMA, OKC HMP
August 10, 2004	TSTM Wind	N/A	N/A	In the City of Edmond, numerous trees and powerlines were downed. The hardest hit areas were in the southeast section of the City, near I-35. Trees up to 30 feet tall were down in roads and across roofs and lawns. The County had approximately $750K in property damage.	NOAA-NCDC

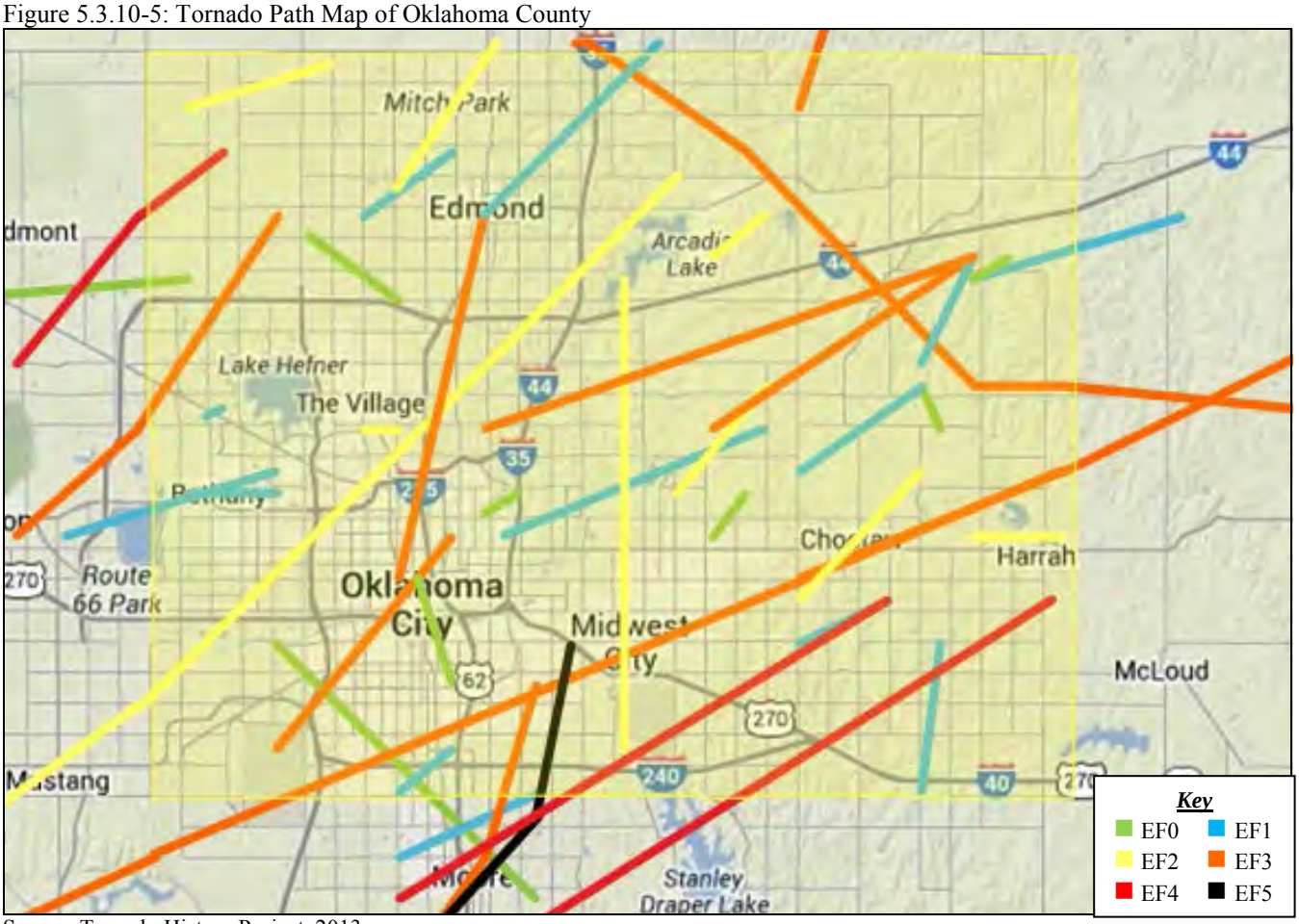
Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
August 12, 2005	TSTM Wind	N/A	N/A	In the City of Edmond, strong winds move two 450-pound air conditioners approximately 15 feet on top of a business at 9th and Broadway. The roof was blown off. The winds also downed many tree limbs. At Wiley Post Airport, several hangers were damaged. The County had approximately $30K in property damage.	NOAA-NCDC
June 10 – July 25, 2007	Severe Storms, Tornadoes, Flooding	DR-1712	Yes	No reference and/or no damage reported.	FEMA
August 18 – September 12, 2007	Severe Storms, Tornadoes and Flooding	DR-1718	Yes	No reference and/or no damage reported.	FEMA
July 16, 2009	TSTM Wind	N/A	N/A	TSTMs developed over half of the State that produced severe hail and damaging winds. The most damaging TSTM moved through Oklahoma City. In Midwest City, glass doors were blown in near SE 29th Street and Air Depot Boulevard. Minor roof damage was reported at Midwest City High School. In Del City, power lines were downed near Reno Avenue and Sunnyland Road. In the Town of Forest Park, three to four inch diameter tree limbs were downed near NE 23rd Street and I-35. The County had approximately $45K in property damage.	NOAA-NCDC
August 5, 2009	TSTM Wind	N/A	N/A	Showers and TSTMs developed over parts of Oklahoma, bringing heavy rainfall, hail and strong winds. In the City of Nicoma Park, winds downed utility poles near SE 35th Street and Hiwassee Road. The County had approximately $8K in property damage.	NOAA-NCDC
May 10-13, 2010	Severe Storms, Tornadoes, and Straight-Line Winds	DR-1917	Yes	In the City of Nichols Hills, several hundred homes were without power; city buildings had damage from hail, causing $310,000 in damages; most of the roofs of homes in Nichols Hills were destroyed; numerous windows and vehicles were damaged or destroyed, causing millions in damages; over 30 pine trees were removed due to disease from the hail, causing $40,000 in damages. An EF4 tornado was reported near the Cities of Choctaw and Harrah. There were two deaths and 49 injuries reported from this tornado.	Planning Committee Input, NWS
May 16, 2010	TSTM / Wind	N/A	N/A	A large supercell TSTM developed over Major County and moved southeast. It brought large hail and wind speeds of over 60 mph. Wind speeds averaged around 50 mph. Reports of	NWS

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
				damage to cars, trees, and vegetation in the Oklahoma City metro area. In the City of The Village, strong winds downed multiple trees and caused power outages near Penn and Britton Roads.	
June 13-15, 2010	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	In the City of Choctaw, roads were barricaded due to flooding in the City; bridges and culverts had to be repaired as a result of this event. In the City of Del City, roads and intersections were closed due to flooding; residential and commercial properties had damage due to flooding; debris removal from roadways and culverts; City had over $27,000 in expenses. In the City of Nichols Hills, three streets were damaged from this storm – Trenton Road, Huntington Ave., and Dorchester Drive, causing the City over $55,000 in expenses	Planning Committee Input
September 2, 2010	TSTM Wind	N/A	N/A	A line of TSTMs developed bringing strong winds and severe hail. Wind gusts of over 70 mph were reported in Oklahoma County. In the City of Edmond, widespread damage was reported between Council Road and MacArthur Avenue and between NW 150th and Hefner Road. Thousands of tree limbs were blown down. A roof of a nursing home was partially removed. The peak wind gusts were estimated at 75 mph. The County had approximately $2.5M in property damage.	NOAA-NCDC
May 24, 2011	Severe Storms / Tornado	N/A	N/A	Strong to violent tornadoes moved across parts of western and central Oklahoma. The storms that produced the tornadoes also brought strong winds. In Oklahoma County, wind gusts reached 69 mph at Tinker Air Force base.	NWS
August 8, 2011	TSTM Wind	N/A	N/A	A series of severe TSTMs struck the area, bringing wind gusts of over 70 mph, with maximum gusts of 96 mph. Widespread wind damage was reported including parts of Oklahoma County. In the Town of Bethany, numerous fences and utility poles were blown down. The County had approximately $15K in property damage.	NOAA-NCDC
August 9, 2011	TSTM Wind	N/A	N/A	A widespread damaging wind event occurred over a large portion of Oklahoma. TSTMs developed causing severe wind gusts. Widespread wind damage was reported over northern Oklahoma City. In the Towns of Arcadia and Luther, widespread tree damage was reported. In the City of Warr Acres, a few tree limbs and street signs were blown down. The County had approximately $7K in property damage.	NOAA-NCDC

Sources:	FEMA, NOAA-NCDC, NWS, SHELDUS
Note:	Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.
DR	Federal Disaster Declaration
EM	Federal Emergency Declaration
FEMA	Federal Emergency Management Agency
K	Thousand ($)
M	Million ($)
Mph	Miles Per Hour
NCDC	National Climate Data Center
NOAA	National Oceanic Atmospheric Administration
NWS	National Weather Service
OKC HMP	Oklahoma County Hazard Mitigation Plan
SHELDUS	Spatial Hazard Events and Losses Database for the U.S.

Figure 5.3.10-5 illustrates the path of recent tornado events in Oklahoma County.

Figure 5.3.10-5: Tornado Path Map of Oklahoma County



Source: Tornado History Project, 2013

Probability of Future Events

In Section 5.3, the identified hazards of concern for Oklahoma County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for wind and tornado events in the County is considered '4 – Highly Likely' (Event is probable within the calendar year. Event has a 1 in 1 year chance of occurring).

It is estimated that Oklahoma County will continue to experience direct and indirect impacts of wind events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents and inconveniences.

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For wind events, the entire Oklahoma County has been identified as the hazard area. Therefore, all assets in the County (population, structures, critical facilities and lifelines), as described in the County section, are vulnerable. The following text evaluates and estimates the potential impact of wind and tornadoes on the County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health of residents, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

The high winds of a wind storm, thunderstorm, and tornado often result in power outages, disruptions to transportation corridors and equipment, loss of workplace access, significant property damage, injuries and loss of life, and the need to shelter and care for individuals impacted by the events. A large amount of damage can be inflicted by trees, branches, and other objects that fall onto power lines, buildings, roads, vehicles, and, in some cases, people. Additionally, some storm events can bring heavy rainfall causing flooding and related damages.

The entire inventory in Oklahoma County is at risk of being damaged or lost due to impacts of wind. Certain areas, infrastructure, and types of building are at greater risk than others due to proximity to falling hazards and manner of construction. The vulnerability of various structure types was exampled for high wind speed events for Oklahoma County. The potential impacts on population, existing structures and critical facilities are presented below, following a summary of the data and methodology used.

Data and Methodology

HAZUS-MH 2.0 does not have the capabilities to model the wind hazard for Oklahoma County in the wind model. To analyze the wind hazard, the wind damage function curves for various building types in the HAZUS-MH 2.0 wind model were examined to discuss their vulnerability.

Impact on Life, Health and Safety

The impact of the tornado and wind hazard on life, health and safety is dependent upon several factors, including the severity of the event and whether or not adequate warning time was provided to residents. The entire population of Oklahoma County is exposed to the tornado and wind hazards.

Unfortunately some tornadoes strike with little or no warning and residents must act quickly. The following populations are more vulnerable to a tornado and wind event: 1) population located in communities without or have ineffective early warning systems; 2) population with functional needs and/or over the age of 65 because they may have more difficulty evacuating or seeking shelter; 3) economically disadvantaged populations because they are likely to evaluate their risk and make decisions based on the major economic impact to their family and may not have funds to evacuate; 4) population with a language barrier unable to following warning messages; 5) population in mobile homes; and 5) population in

automobiles at the time of a tornado. The elderly and functional needs populations are considered most vulnerable because they require extra time or outside assistance to seek shelter and are more likely to seek or need medical attention which may not be available due to isolation during and/or after an event.

Post-event residents should take extreme caution when returning home and walking through debris. Residents should not re-enter damaged buildings or homes until authorities say it is safe.

Impact on General Building Stock and Critical Facilities

After considering the population exposed to the wind hazard the vulnerability of the built environment was examined. The entire study area is considered at risk to the wind hazard. Please refer to Section 4 (County Profile) which presents the total exposure value for general building stock by occupancy class for Oklahoma County (nearly $27 billion for Plan participants).

Damage to buildings is dependent upon several factors including wind speed, storm duration, path of the tornado, distance from the tornado funnel and building construction. Because of differences in building construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Wood and masonry buildings in general, regardless of their occupancy class, tend to experience more damage than concrete or steel buildings. High-rise buildings are also very vulnerable structures. Mobile homes are the most vulnerable to damage, even if tied down, and offer little protection to people inside.

According to HAZUS-MH's wind model, direct wind-induced damage (wind pressures and windborne debris) to buildings is dependent upon the performance of components and cladding, including roof covering (shingles, tiles, membrane), roof sheathing (wood frame construction only), windows and doors and is modeled as such. Structural wall failures can occur for masonry and wood frame walls and uplift of whole roof systems due to failure at the roof/wall connections. Foundation failures (i.e., sliding, overturning and uplift) can potentially take place for manufactured homes.

Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting) transportation needs. Utility infrastructure (power lines, gas lines, electrical systems) could suffer damage and impacts can result in the loss of power, which can impact business operations and can impact heating or cooling provision to citizens (including the young and elderly, who are particularly vulnerable to temperature-related health impacts). Post-event, there is a risk of fire, electrocution or an explosion.

Impact on Economy

Wind events and tornadoes can greatly impact the economy, including: loss of business function, damage to inventory, relocation costs, wage loss and rental loss due to the repair/replacement of buildings. Recovery and clean-up costs can also be costly and impact the economy as well. In addition, smaller jurisdictions may fall upon economic hardship due to the destruction caused by a tornado/high wind event due to a lack of funding resources needed to repair or replace destroyed infrastructure.

Future Growth and Development

As discussed and illustrated in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the severe storm hazard because the entire County is exposed and vulnerable to the wind hazard associated with severe storms.

Additional Data and Next Steps

In time, HAZUS-MH will be released with modules that address straight-line wind and tornado events for the interior U.S. As updated versions of HAZUS-MH are released, Oklahoma County can run analyses for an overall picture of the wind damages and debris generated from these events.

Over time, Oklahoma County will obtain additional data to support the analysis of this hazard. Data that will support the analysis would include additional detail on past hazard events and impacts, and an updated building inventory to include specific building information such as type of construction and details on protective features (for example, shutters).

Overall Vulnerability Assessment

Oklahoma County is highly vulnerable to tornado and wind events which can cause significant impacts and losses to the area's structures, facilities, utilities, and population. Existing and future mitigation efforts should continue to be developed and employed that will enable the study area to be prepared for these events when they occur.

5.3.11 SEVERE WINTER STORM

This section provides a profile and vulnerability assessment for the severe winter storm hazard.

HAZARD PROFILE

This section provides profile information including description, extent, location, previous occurrences and losses and the probability of future occurrences.

Description

Winter storms can range from moderate snow over a few hours to blizzard conditions with high winds, freezing rain or sleet, heavy snowfall, and extreme cold temperatures (OKC HMP, 2007). The State of Oklahoma experiences significant winter weather during the winter months (Oklahoma City HMP, 2011). For the purpose of this HMP and as deemed appropriated by Oklahoma County, most severe winter storm hazards include heavy snow (snowstorms), blizzards, sleet, freezing rain, and ice storms. These types of winter events or conditions are further defined below.

Heavy Snow: According to the National Weather Service (NWS), heavy snow is generally snowfall accumulating to 4 inches or more in depth in 12 hours or less; or snowfall accumulating to six inches or more in depth in 24 hours or less. A snow squall is an intense, but limited duration, period of moderate to heavy snowfall, also known as a snowstorm, accompanied by strong, gusty surface winds and possibly lightning (generally moderate to heavy snow showers) (NWS, 2005). Snowstorms are complex phenomena involving heavy snow and winds, whose impact can be affected by a great many factors, including a region's climatologically susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and occurrence during the course of the day, weekday versus weekend, and time of season (Kocin and Uccellini, 2011).

Blizzard: Blizzards are characterized by low temperatures, wind gusts of 35 miles per hour (mph) or more and falling and/or blowing snow that reduces visibility to ¼-mile or less for an extended period of time (three or more hours) (National Weather Service [NWS], 2005).

Sleet or Freezing Rain Storm: Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces. Freezing rain is rain that falls as a liquid but freezes into glaze upon contact with the ground. Both types of precipitation, even in small accumulations, can cause significant hazards to a community (NWS, 2005).

Ice storm: An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous, and can create extreme hazards to motorists and pedestrians (NWS, 2005).

Extent

The magnitude or severity of a severe winter storm depends on several factors including a region's climatologically susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and time of occurrence during the day (e.g., weekday versus weekend), and time of season.

The NWS issues advisories to potential severe winter storms. The criteria for these advisories can vary from place to place. Those advisories include:

- Winter Storm Watch – A winter storm watch is issued by the NWS when there is a potential for heavy snow or significant ice accumulations, usually at least 24 to 36 hours in advance.
- Winter Storm Warning – A winter storm warning is issued when a winter storm is producing or is forecast to produce heavy snow or significant ice accumulations.
- Winter Weather Advisory – A winter weather advisory is issued when a low pressure system produces a combination of winter weather (snow, freezing rain, sleet) that present a hazard, but not does meet warning criteria.
- Blizzard Warning – A blizzard warning is issued for winter storms with sustained or frequent winds of 35 mph or greater with a considerable falling and/or blowing snow that reduces visibility to one-quarter of a mile or less. These conditions are expected to prevail for at least three hours.
- Frost Advisory – A frost advisory is issued during the growing season when widespread frost formation is expected over an extensive area. Surface temperatures are usually in the mid 30°Fs.
- Freeze Warning – A freeze warning is issued during the growing season when surface temperatures are expected to drop below freezing over a large area for an extended period of time, regardless whether or not frost develops (NWS, 2009).

The State of Oklahoma uses a range of physical intensities for winter storm events. These intensities are displayed in Table 5.3.11-1 and include potential effect for each intensity.

Table 5.3.11-1. Range of Physical Intensities for Winter Storm Events

Level	Type of Event	Effect
Level 1 – Nuisance Event No major impact	Little snow/ice accumulation. Roads not hazardous.	Little to no effect.
Level 2 – Minor Event Caution advised	Dusting to three inches of snow. No measurable ice. Winter weather advisory	Untreated roadways may be hazardous and slick. Livestock may need additional supplemental feed.
Level 3 – Major Event	Significant snow accumulation of four to eight inches. Ice accumulations of ¼ to ½ inch. Reduced visibility. Wind causing drifting snow. Winter storm warning.	Widespread hazardous road conditions. Travel discouraged. Areas isolated because of drifting snow. Isolated power outages because of down powerlines from ice accumulation. Tree damage. Livestock loss potential increases, supplemental feed necessary.
Level 4 – Extreme Event	Crippling event. Snow accumulations over eight inches; winds over 35 mph. Drifting snow, little to no visibility. Ice accumulations of more than ½ inch. Blizzard warning.	Road conditions hazardous to impassable. People and livestock isolated. Widespread power and utility outages. Infrastructure damage. High potential for loss of livestock. Structures threatened from accumulating snow and ice. Communications infrastructure lost from ice accumulation. May be a long lasting event.

Source: Oklahoma State HMP, 2011

Location

The entire State of Oklahoma is susceptible to winter storms.

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with severe winter storm events throughout the State of Oklahoma and Oklahoma County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

According to NOAA's NCDC storm events database, Oklahoma County experienced 18 snow and ice storm events between 1993 and April 30, 2012. Total property damages, as a result of these winter storm events, were estimated at $$250,000. This total may also include damages to other counties. According to the Hazard Research Lab at the University of South Carolina's Spatial Hazard Events and Losses Database for the U.S. (SHELDUS), between 1960 and 2010, one winter storm event occurred within the County. The database indicated that severe winter storm events and losses specifically associated with Oklahoma County and its municipalities totaled $20,000 in property damage. However, these numbers may vary due to the database identifying the location of the hazard event in various forms or throughout multiple counties or regions.

Between 1954 and 2012, FEMA declared that the State of Oklahoma experienced 16 winter storm-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: snowstorm, severe winter storm, snow, ice storm, and flooding. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations. Of those events, Oklahoma County has been included in eight winter storm-related disaster and/or emergency declarations (FEMA, 2012).

Based on all sources researched, known winter storm events that have affected Oklahoma County and its municipalities are identified in Table 5.3.11-2. With winter storm documentation for the State being so extensive, not all sources have been identified or researched. Therefore, Table 5.3.11-2 may not include all events that have occurred throughout the County and region.

Table 5.3.11-2. Winter Storm Events Between 1950 and 2012.

Incident Period	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
February 20-22, 1971	Blizzard	N/A	N/A	The County had approximately $20,000 in property damage.	SHELDUS
January 1, 1993	Ice Storm	N/A	N/A	Sleet and freezing rain fell in most parts of the State. Temperatures were below freezing and roads remained ice covered until temperatures warmed up. Many traffic accidents were reported, including accidents in Oklahoma County.	NOAA-NCDC
December 25, 2000 – January 10, 2001	Severe Winter Storm/Snow Storm	DR-1335 EM-3158	Yes	This was the first reported winter storm in Oklahoma County over the past 50 years. It was the worst ice storm in decades. Between one and two inches of rain and sleet accumulated in 24 hours.	OKC HMP, FEMA
November 27, 2001	Winter Storm	N/A	N/A	Between two and eight inches of snow fell across Oklahoma County	OKC HMP
December 23, 2002	Winter Storm	N/A	N/A	The State experienced its third winter storm in three years. It lasted three days and produced between six and eight inches of snow.	OKC HMP
January 30 – February 11, 2002	Ice Storm	DR-1401	Yes	A three-day winter storm struck the County, producing rain, freezing rain, sleet, and snow. This storm also produced an ice storm that caused massive power outages and traffic problems throughout the County.	OKC HMP, FEMA
January 4-5, 2005	Ice Storm	N/A	N/A	A powerful upper system moved toward the State of Oklahoma, bringing freezing temperatures, rain and freezing rain. In the hardest hit areas of the State, more than two inches of ice accumulated, downing tree limbs and power lines. Power outages were reported throughout the State, including Oklahoma County.	OEM
November 29-30, 2006	Winter Weather	N/A	N/A	Much of the State of Oklahoma was impacted by winter weather, bringing snow and ice to parts of the State. Road conditions throughout the State were dangerous. Many accidents were reported. Snowfall totals ranged from three to 13 inches, with drifts as high as three feet. Four inches of snow was reported at Will Rogers Airport in Oklahoma County.	OEM
January 12-26, 2007	Severe Winter Storms and Flooding	EM-3272	Yes	A strong winter storm affected most of Oklahoma, bringing snow, freezing rain and sleet. The freezing rain and sleet occurred mainly over central and southwest Oklahoma. The hardest hit areas with freezing rain were Atoka, Bryan, Coal, Cotton, Hughes, Seminole, and Johnston Counties. Many trees and power lines were downed, with thousands of customers without power. Fourteen deaths were associated with this	NOAA-NCDC, FEMA, OEM

Incident Period	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
				storm. The Oklahoma State Governor declared a state of emergency for all 77 counties. In Oklahoma County, in Del City, the school gymnasium roof collapsed. The County had approximately $50,000 in property damage.	
December 8, 2007 – January 3, 2008	Severe Winter Storms	EM-3280 DR-1735	Yes	An Arctic airmass moved into Oklahoma from Kansas, bringing freezing temperatures, freezing rain and ice. Areas in the State received between 1.5 inches and three inches of ice. At one point, over 600,000 customers were without power, which is considered one of the worst power outages in history. The storm caused over $200 M in damages statewide. Pecan crop loss was estimated at $25 M. In Oklahoma County, Jones High School burned. Seven deaths were reported in the County due to the storm.	OEM, FEMA, NOAA-NCDC
February 20-21, 2008	Winter Weather	N/A	N/A	A strong cold front brought near to below freezing temperatures to the area. Freezing rain developed north or I-40 and created slick spots on roadways, causing numerous car accidents. In Oklahoma County, more than 100 accidents were reported. The I-44 bridge in Oklahoma City was closed due to the ice. The County had approximately $200 K in property damage.	NOAA-NCDC
January 26-27, 2009	Winter Weather	DR-1823	No	A storm system moved over Oklahoma resulting in widespread freezing rain. The freezing rain amounts ranged from ¼ to ½ inches and caused travel problems throughout the State. The Governor declared a state of emergency for all 77 counties. Power outages occurred in many areas.	OEM, FEMA
December 24, 2009	Winter Weather	DR-1876	No	A storm system brought rain, freezing rain, sleet and snow to Oklahoma. Snowfall accumulations ranged from four to six inches, with 10 inches in some areas. At one point, all interstates roadways in Oklahoma City were closed. The Governor declared a state of emergency for all 77 counties. Blizzard warnings were issued for central, northeast and southeast Oklahoma. There were nine deaths attributed to this storm and 482 injuries. In Oklahoma County, snowfall accumulations ranged from seven to 11 inches, with isolated totals of over 12 inches. Frequent wind gusts of 50 to 60 mph caused blowing and drifting snow. A peak wind gust of 62 mph was recorded at Will Rogers Airport.	OEM, NWS, FEMA, NOAA-NCDC
January 28-29, 2010	Winter Weather	DR-1883	No	Freezing rain moved into southeast Oklahoma and spread northeast into Oklahoma County. Significant ice accumulations of one to 1.5 inches of ice occurred in southwest Oklahoma. Widespread power outages occurred. In central Oklahoma, ½ inch of ice fell, followed by sleet and four to six inches of snow.	OEM, FEMA, NOAA-NCDC

Incident Period	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
				At the height of the storm, over 180,000 customers were without power. The Governor declared a state of emergency for all 77 counties. In Oklahoma County, at least ¼-inch ice accumulated before it changed to sleet. Over an inch of sleet accumulated on top of the ice.	
March 20-21, 2010	Winter Storm	N/A	N/A	Heavy snow, rain and ice fell over Oklahoma. Widespread snowfall totals ranged from three to five inches. Strong wind gusts were also associated with this storm, with gusts of over 40 mph. In Oklahoma County, between two and four inches of snow fell, with 2.5 inches measured at Will Rogers Airport and four inches near Warr Acres and Edmond. Wind gusts of 35 to 45 mph caused blowing and drifting snow.	NOAA-NCDC
January 31 - February 1, 2011	Winter Storm	DR-1985 EM-3316	No Yes	A record-breaking winter storm hit all of Oklahoma, causing periods of heavy sleet and snow and strong wind gusts. The storm also brought cold temperatures and wind chills. There were over 460 car accidents from this storm. It also caused power outages in some areas. In Oklahoma County, 12 inches of snow was reported at Will Rogers Airport. Between eight and ten inches fell near Edmond and Bethany. Wind gusts of over 50 mph were also reported.	NOAA-NCDC, FEMA, NWS
February 8-9, 2011	Winter Storm	N/A	N/A	A significant winter storm affected the southern Plains, bringing up to a foot of snow in parts of northern Oklahoma. Widespread totals for the state ranged between four and eight inches. In additional to the snowfall, strong winds blew, causing blowing and drifting snow. Wind gusts of over 30 mph were reported, with visibility at 1/8 mile. Approximately 240 injuries and two deaths, statewide, resulted from this event. In Oklahoma County, four to six inches of snow fell, with 5.9 inches at Will Rogers Airport. Wind gusts of over 30 mph were reported for several hours.	NOAA-NCDC

Sources: NOAA-NCDC, FEMA, NWS, SHELDUS, OEM

Note: Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.

DR	Disaster Declaration	N/A	Not Applicable
EM	Emergency Declaration	NCDC	National Climatic Data Center
FEMA	Federal Emergency Management Agency	NOAA	National Oceanic and Atmospheric Administration
K	Thousand ($)	NWS	National Weather Service
M	Million ($)	OEM	Oklahoma Department of Emergency Management
Mph	Miles per hour	SHELDUS	Spatial Hazard Events and Losses Database for the United States

Probability of Future Events

Winter storm hazards in Oklahoma are typically mild in comparison with other states because these events are not as frequent and regular. Winter weather tends to magnify the effects on the population when it does occur. Every county in the State is at risk for winter storms and will experience winter storms and its effects at some point (Oklahoma State HMP, 2011). Oklahoma County will experience another winter storm in the near future and should expect similar characteristics and effects from winter storms (OKC HMP, 2006).

In Section 5.3, the identified hazards of concern for Oklahoma County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Due to the lack of large geographical elevation changes and based on historical records and input from the Planning Committee, the probability of occurrence for severe winter storms in the County and all plan participating jurisdictions is the same and is considered '3 - Likely' (Event is probable within the next three years. Event has a 1 in 3 year's chance of occurring).

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For severe winter storm events, the entire County has been identified as the hazard area. Therefore, all assets in Oklahoma County (population, structures, critical facilities and lifelines), as described in the County Profile section (Section 4), are vulnerable. The following section includes an evaluation and estimation of the potential impact severe winter storm events have on Oklahoma County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact, including: (1) impact on life, safety and health, (2) general building stock, (3) critical facilities (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

Severe winter storms are a concern to Oklahoma County because of their proximity to the Gulf of Mexico. Additionally, they are of significant concern due to the direct and indirect costs associated with these events; delays caused by the storms; and impacts on the people and facilities of the region related to snow and ice removal, health problems, cascade effects such as utility failure (power outages) and traffic accidents, and stress on community resources.

Data and Methodology

National weather databases and local resources were used to collect and analyze severe winter storm impacts on Oklahoma County and the participating municipalities. The 2010 U.S. Census data and default HAZUS-MH 2.0 general building data was used to support an evaluation of assets exposed to this hazard and the potential impacts associated with this hazard.

Impact on Life, Health and Safety

According to the NOAA National Severe Storms Laboratory (NSSL); every year, winter weather indirectly and deceptively kills hundreds of people in the U.S., primarily from automobile accidents, overexertion and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, drifting snow and extreme cold temperatures and dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. People can die in traffic accidents on icy roads, heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold. Heavy accumulations of ice can bring down trees and power lines, disabling electric power and communications for days or weeks. Heavy snow can immobilize a region and paralyze a city, shutting down all air and rail transportation and disrupting medical and emergency services. Storms near the coast can cause coastal flooding and beach erosion as well as sink ships at sea. The economic impact of winter weather each year is huge, with costs for snow removal, damage and loss of business in the millions (NSSL, 2006).

Heavy snow can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and

unprotected livestock may be lost. In the mountains, heavy snow can lead to avalanches. The cost of snow removal, repairing damages, and loss of business can have large economic impacts on cities and towns (NSSL, 2006).

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NSSL, 2006).

For the purposes of this HMP, the entire population of Oklahoma County is exposed to severe winter storm events (U.S. Census, 2010). Snow accumulation and frozen/slippery road surfaces increase the frequency and impact of traffic accidents for the general population, resulting in personal injuries. The elderly are considered most susceptible to this hazard due to their increased risk of injuries and death from falls and overexertion and/or hypothermia from attempts to clear snow and ice. In addition, severe winter storm events can reduce the ability of these populations to access emergency services. Residents with low incomes may not have access to housing or their housing may be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). Refer to the table in the County Profile for population statistics for each participating municipality and a summary of the more vulnerable populations (over the age of 65 and individuals living below the Census poverty threshold).

Impact on General Building Stock

The entire general building stock inventory in Oklahoma County is exposed and vulnerable to the severe winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Table 5.3.11-3 presents the total exposure value for general building stock for each participating municipality (structure only).

Current modeling tools are not available to estimate specific losses for this hazard. As an alternate approach, this plan considers percentage damages that could result from severe winter storm conditions. Table 5.3.11-3 below summarizes percent damages that could result from severe winter storm conditions for the County's total general building stock (structure only). Given professional knowledge and information available, the potential losses for this hazard are considered to be overestimated; hence, conservative estimates for losses associated with severe winter storm events.

Table 5.3.11-3. General Building Stock Exposure (Structure Only) and Estimated Losses from Severe Winter Storm Events in Oklahoma County

Municipality	Total (All Occupancies) RV	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Arcadia (T)	$26,418,000	$264,180	$1,320,900	$2,641,800
Bethany (C)	$1,427,258,000	$14,272,580	$71,362,900	$142,725,800
Choctaw (C)	$640,085,000	$6,400,850	$32,004,250	$64,008,500
Del City (C)	$1,459,942,000	$14,599,420	$72,997,100	$145,994,200
Edmond (C)	$5,820,032,000	$58,200,320	$291,001,600	$582,003,200
Forest Park (T)	$78,305,000	$783,050	$3,915,250	$7,830,500
Harrah (C)	$281,952,000	$2,819,520	$14,097,600	$28,195,200
Jones (T)	$152,124,000	$1,521,240	$7,606,200	$15,212,400
Luther (T)	$56,712,000	$567,120	$2,835,600	$5,671,200
Midwest City (C)	$3,508,200,000	$35,082,000	$175,410,000	$350,820,000

Municipality	Total (All Occupancies) RV	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Nichols Hills (C)	$488,990,000	$4,889,900	$24,449,500	$48,899,000
Nicoma Park (C)	$185,950,000	$1,859,500	$9,297,500	$18,595,000
Spencer (C)	$245,687,000	$2,456,870	$12,284,350	$24,568,700
The Village	$833,460,000	$8,334,600	$41,673,000	$83,346,000
Unincorporated County	$827,100,000	$8,271,000	$41,355,000	$82,710,000
Valley Brook (T)	$46,459,000	$464,590	$2,322,950	$4,645,900
Warr Acres (C)	$821,741,000	$8,217,410	$41,087,050	$82,174,100
Total	**$16,900,415,000**	**$169,004,150**	**$845,020,750**	**$1,690,041,500**

Source: HAZUS-MH 2.0
Notes: RV = Replacement Cost Value. The building values shown are building structure only because damage from the severe winter storm hazard generally impact structures such as the roof and building frame (rather than building content). The valuation of general building stock and the loss estimates determined in Oklahoma County were based on the default general building stock database provided in HAZUS-MH 2.0.

A specific area that is vulnerable to the severe winter storm hazard is the floodplain. At risk general building stock and infrastructure in floodplains are presented in the flood hazard profile (Section 5.3.11). Generally, losses from flooding associated with severe winter storms should be less than that associated with a 100-year or 500-year flood. In summary, snow and ice melt can cause both riverine and urban flooding. Estimated losses due to riverine flooding in Oklahoma County are discussed in Section 5.3.11.

Impact on Critical Facilities

Full functionality of critical facilities such as police, fire and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Because power interruption can occur, backup power is recommended for critical facilities and infrastructure. Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires infrastructure to clear roadways, alert citizens to dangerous conditions, and following the winter requires resources for road maintenance and repair. Additionally, freezing rain and ice storms impact utilities (i.e., power lines and overhead utility wires) causing power outages for hundreds to thousands of residents.

Impact on Economy

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. The potential secondary impacts from severe winter storms also impact the local economy including loss of utilities; interruption of transportation corridors; loss of business function, etc.

Future Growth and Development

As discussed and illustrated in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the severe winter storm hazard because the entire planning area is exposed and vulnerable. For the severe winter storm hazard, the entire County has been identified as the hazard area. Please refer to Section 4 (County Profile) for a map that illustrates where potential new development is located.

Effect of Climate Change on Vulnerability

The potential effects of climate change on Oklahoma County's vulnerability to winter storms shall need to be considered as a greater understanding of regional climate change impacts develop.

Additional Data and Next Steps

The assessment above identifies vulnerable populations and economic losses associated with this hazard of concern. Historic data on structural losses to general building stock are not adequate to predict specific losses to this inventory; therefore, the percent of damage assumption methodology was applied. This methodology is based on FEMA's How to Series (FEMA 386-2), Understanding Your Risks, Identifying and Estimating Losses (FEMA, 2001) and FEMA's Using HAZUS-MH for Risk Assessment (FEMA 433) (FEMA, 2004). The collection of additional/actual valuation data for general building stock and critical infrastructure losses would further support future estimates of potential exposure and damage for the general building stock inventory.

Overall Vulnerability Assessment

Existing and future mitigation efforts should continue to be developed and employed that will enable the study area to be prepared for these events when they occur. The cascade effects of severe winter storm events include utility losses and transportation accidents and flooding. Losses associated with the flood hazard are discussed in Section 5.3.11. Particular areas of vulnerability include low-income and elderly populations, mobile homes, and infrastructure such as roadways and utilities that can be damaged by such storms and the low-lying areas that can be impacted by flooding related to rapid snow melt.

SECTION 6: MITIGATION STRATEGIES

This section describes the process by which the Oklahoma County Planning Committee performed the update to the county and local mitigation strategies. This section includes:

(1) Review and Update Mitigation Goals and Objectives
(2) Update of Capability Assessment
(3) Review of Progress on 2006 Mitigation Strategy
(4) Identification, analysis, and implementation of potential mitigation actions

Review and Update Mitigation Goals and Objectives

According to CFR 201.6(c)(3)(i): "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards." Mitigation planning objectives, associated with the identified goals, are recommended in FEMA mitigation planning guidance.

Goals are general guidelines that explain what is to be achieved. They are usually broad, long-term, policy-type statements and represent global visions. Goals help define the benefits that the Plan is trying to achieve. The success of the Plan, once implemented, should be measured by the degree to which its goals have been met (that is, by the actual benefits in terms of hazard mitigation).

Objectives are short-term aims which, when combined, form a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

As part of the plan update process, the planning committee reviewed the mitigation planning goals and objectives identified in the 2006 plan. At the August 2011 Kick-Off meeting, all participating jurisdictions were provided a Goals and Objectives review worksheet (see Appendix F) to facilitate local input, and were asked to consider the following questions when performing their review:

- Do the goals and objectives identified in the previously approved plan reflect the updated risk assessment?
- Did the goals and objectives identified in the previously approved plan lead to mitigation projects and/or changes in policy that helped the jurisdiction(s) reduce vulnerability?
- Do the goals and objectives identified in the previously approved plan support any changes in mitigation priorities?
- Are goals identified in the updated Local Mitigation Plan reflective of current State goals?

Throughout the planning process, the relevance of the original goals and objectives continued to be evaluated for possible amendment based on the risk assessment results, discussions, research, and input from the committee, existing authorities, polices, programs, resources, and stakeholders within the planning area. The committee considered whether these goals and objectives complemented and supported other related planning documents and mechanisms including:

- Oklahoma State Standard Hazard Mitigation Plan (February 2011)
- County and Local Comprehensive/Master Plans
- Other county and municipal planning and land use documents

The Oklahoma State HMP (Feb 2011 Update) goals and objectives are:

1. Protect Life
2. Protect Property
3. Protect the Environment
4. Increase Public Preparedness for Disasters

Subsequent to this review, the planning committee elected to keep the goals and objectives of the 2006 Plan, with minor editorial changes, as they were found to embody the overarching needs and concerns of the planning partnership in addressing natural hazard risk reduction, and are in-line with the State mitigation goals.

The following are the mitigation goals and objectives for the ongoing Oklahoma County HMP:

Goal 1: Emergency Services

Goal Description: Improve the ability of the emergency services providers to respond to events and to aid in the overall recovery of the community. Promote interoperable communications between departments responsible for emergency operations and integrate the mitigation planning process into the overall emergency planning program for the community.

Objective 1. Set clear policy with high-level approval for the continued advancement of the community emergency management program.

Objective 2. Establish mutual aid programs and improve the ability for these various departments to communicate effectively in adverse conditions.

Objective 3. Establish mitigation projects to help ensure that critical emergency response facilities can continue operations during and after large-scale events.

Goal 2: Prevention

Goal Description: Prevention measures are intended to keep a hazard risk problem from occurring or getting worse. They help ensure that future development does not increase hazard losses. Communities can achieve significant progress toward hazard resistance through prevention measures. This is particularly true in areas that have not been developed or where capital investment has not been substantial. Using prevention measures, future development can be guided away from hazards, while maintaining other community goals such as economic development and quality of life.

Objective 1. Consider 'best-practices' mitigation measures when updating the comprehensive community land use and economic development plans.

Objective 2. Modify local codes to regulate the placement and construction of new facilities when the natural hazard risk is high for the specific area.

Objective 3. Integrate overall mitigation strategies into the community's current and future capital improvements program to help ensure that new projects have a minimal associated risk.

Goal 3: Protecting Critical Facilities

Goal Description: There are many locations throughout the community that are considered critical for any emergency response and others that are necessary for the recovery process. These locations must be protected in order to ensure that loss of life and additional damages can be avoided.

Objective 1. Avoid locating new facilities in high risk areas and work to make improvements to existing locations to aid in the mitigation of potential losses.

Objective 2. Implement voluntary and regulated programs to help ensure continued improvement to building structures, locations and on-going emergency planning initiatives.

Goal 4: Protection of Life and Property

Goal Description: This goal is associated with the implementation of activities that protect citizen life and property by making critical facilities, homes and businesses more resistant to damage from natural events. The goal is to reduce existing risk as much as possible and keep the community stable and capable of continuity when hazards strike.

Objective 1. Identify repetitive loss locations and reduce this impact on the public by convincing the individuals choosing to remain in high risk areas to accept responsibility for their choice. Promoting private insurance coverage, acquisition and relocation are ideal ways to achieve this objective.

Objective 2. Promote voluntary property improvements by individuals to reduce property vulnerability and related economic impacts.

Objective 3. Research funding opportunities to support increased mitigation activities.

Objective 4. Update and improve hazard assessment information in order to make better decisions about mitigation strategies.

Goal 5: Public Awareness and Partnerships

Goal Description: Promote coordination and communication between individual citizens, private businesses, public agencies and non-profit organizations to improve the overall ability of the community to respond to and recover from a natural disaster. From these partnerships, encourage leadership to prioritize and undertake specific projects for mitigation.

Objective 1. Educate the public about the risks associated with natural hazards and the steps they can take to be prepared.

Objective 2. Initiate programs to promote on-going partnerships within the community to address mitigation and emergency management.

Objective 3. Establish public programs and regulations for community involvement in emergency planning, including regular open forum meetings and an on-going public awareness campaign.

Goal 6: Structural Projects

Goal Description: Implement public works projects that improve the protection of important developed areas in the community.

Objective 1. Continually assess and evaluate the requirements for new structural projects that aid in the reduction of community risk.

Objective 2. Maintain these structural projects properly and regularly.

Capability Assessment

According to FEMA 386-3, a capability assessment is an inventory of a community's missions, programs and policies; and an analysis of its capacity to carry them out. This assessment is an integral part of the planning process. It identifies, reviews and analyzes local and state programs, polices, regulations, funding and practices currently in place that may either help facilitate or hinder mitigation.

For this plan update process, a capability assessment was prepared by the County and each participating jurisdiction. The capability assessments are presented in Section 9, Volume II of this Plan. By completing this assessment, the County and each jurisdiction learned how or whether they would be able to implement certain mitigation actions by determining the following:

- The range of local, state and federal administrative, programmatic, regulatory, financial and technical resources available to assist in implementing their mitigation actions;
- Limitations that may prohibit or hinder undertaking certain actions; and,
- Action is currently outside the scope of capabilities (funding)

Identification, Prioritization, Analysis, and Implementation of Mitigation Actions

The update of the county and municipal mitigation strategies included a review of past mitigation activities, progress on the mitigation strategies identified in the 2006 Plan, and identification of new mitigation actions to be included in this update. The following section describes how the county and local mitigation strategies were updated.

This plan update process was focused on improving the county and local mitigation strategies, and so addressed the updating of mitigation strategies from the outset of the planning process. At the Kick-Off meeting, the county and all municipalities were provided a survey to assist in identifying mitigation activities completed, ongoing and potential/proposed. Further, the county and each municipality with specific mitigation initiatives/projects identified in the 2006 Plan were provided with a worksheet to help identify progress on their local mitigation strategy, whether they wish to carry the actions forward in the Plan update, and if so, to provide additional details to support project implementation (see Appendix F for samples of the survey forms and worksheets used).

Throughout the planning process, the County and municipalities were encouraged to consider their natural hazard risks and vulnerabilities, as identified specifically by the jurisdiction based on past and recent experience, through the results of the updated risk assessment, and based on stakeholder input, and to identify appropriate projects or initiatives to help mitigate those risks.

To help support the identification of mitigation actions and initiatives that apply to the whole planning area and to address the broad range of mitigation action types (prevention, property protection, public education and awareness, protection of the environment, emergency services, structural projects), the planning committee conducted a "brain-storming" session (mitigation strategy workshop) detailed in the following section. This effort served to identify specific projects and initiatives to be included in both the county and local mitigation strategy updates, as well as general strategies to be considered by the plan participants for their relevance to their jurisdiction (mitigation catalog).

The County project management team (planning and emergency management) and contract consultant worked directly with each jurisdiction (phone, email, local support meetings) to assist with the development and update of their mitigation strategies, focusing on identifying well-defined, implementable projects with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).

Mitigation Strategy Workshop and Mitigation Catalog

On March 20, 2012, a mitigation strategy workshop was held with the Planning Committee and local and regional stakeholders. The purpose of this session was to review information garnered from the planning process to date (jurisdictional input, risk assessment, public and stakeholder input) to identify strengths, weaknesses, opportunities and obstacles in hazard mitigation within the planning area through a facilitated brainstorming session on risks, vulnerabilities, and capabilities. All information shared during this session was recorded and used to prepare catalogs of mitigation alternatives to be used by the Planning Committee as a resource in preparing their individual jurisdictional annexes. Many of the strategies (such as community outreach) identified in the catalogs could be applied to multiple hazards. This Plan identifies strategies for multiple hazards for Oklahoma County and each jurisdictional annex for participating jurisdictions (Section 9).

Based on information gathered during the mitigation strategy workshop as well as throughout the planning process, catalogs of mitigation actions were created that list initiatives that could manipulate the hazard, reduce exposure to the hazard, reduce vulnerability to the hazard, and increase the Planning Committee's ability to respond to or be prepared for a hazard (Appendix D). These catalogs are separated by responsibility for implementation (i.e., who would most likely implement the initiative: personal property owners, private sector business, or government). The hazards addressed by the catalogs were deemed to be those to which the planning area is most vulnerable based on the risk assessment.

The catalogs are not meant to be exhaustive or site-specific but rather to inspire thought and provide members of the Planning Committee a baseline of initiatives backed by a planning process, consistent with the goals and objectives of the planning area, and within the capabilities of the Partners.

All proposed mitigation actions were identified in relation to the goals and objectives presented above. The mitigation actions include a range of options in line with the six types of mitigation actions described in FEMA guidance (FEMA 386-3), including:

1. **Prevention:** Government, administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, local floodplain laws, capital improvement programs, open space preservation, and storm water management regulations.

2. **Property Protection:** Actions that involve (1) modification of existing buildings or structures to protect them from a hazard or (2) removal of the structures from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.

3. **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

4. **Natural Resource Protection:** Actions that minimize hazard loss and also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

5. **Emergency Services:** Actions that protect people and property, during and immediately following, a disaster or hazard event. Services include warning systems, emergency response services, and the protection of essential facilities.

6. **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, setback levees, floodwalls, retaining walls, and safe rooms.

Mitigation Actions

The mitigation actions are the key element of the natural hazards mitigation plan. It is through the implementation of these actions that Oklahoma County and the participating jurisdictions can strive to become disaster-resistant through sustainable hazard mitigation. For the purposes of this Plan, mitigation actions are defined as follows:

Mitigation actions are activities designed to reduce or eliminate losses resulting from natural hazards.

Although one of the driving influences for preparing this Plan was grant funding eligibility, its purpose is more than just access to federal funding. It was important to the Planning Committee to look at mitigation actions that will work through all phases of emergency management. Some of the actions outlined in this Plan may not be grant eligible as grant eligibility was not the focus of the selection. Rather, the focus was the actions' effectiveness in achieving the goals of the Plan and whether they are within the County or each jurisdiction's capabilities.

A series of mitigation actions were identified by the County and each participating jurisdiction. These actions are summarized in Section 9, Volume II of this Plan. Along with the hazards mitigated, goals and objectives met, lead agency, estimated cost, potential funding sources and the proposed timeline are identified. The parameters for the timeline are as follows:

- Short Term = To be completed in 1 to 5 years
- Long Term = To be completed in greater than 5 years
- Ongoing = Currently being funded and implemented under existing programs.

Prioritization

Section 201.c.3.iii of 44 CFR requires an action plan describing how the actions identified will be prioritized. Oklahoma County and the planning committee, along with their contract consultant, developed a prioritization methodology for the Plan that meets the needs of the County and participating jurisdictions while at the same time meeting the requirements of Section 201.6 of 44 CFR. The mitigation actions identified were prioritized according to the criteria defined below.

- **High Priority:** A project that meets multiple plan goals and objectives, benefits exceed cost, has funding secured under existing programs or authorizations, or is grant-eligible, and can be completed in 1 to 5 years (short-term project) once the project is funded.
- **Medium Priority:** A project that meets at least one plan goal and objective, benefits exceed costs, funding has not been secured and would require a special funding authorization under existing programs, grant eligibility is questionable, and could be completed in 1 to 5 years once the project is funded.
- **Low Priority:** A project that will mitigate the risk of a hazard, benefits exceed costs, funding has not been secured, and project is not grant-eligible and/or timeline for completion is considered long-term (5 to 10 years).

It should be noted that these priority definitions are considered to be dynamic and can change from one category to another based on changes to a parameter such as availability of funding. For example, a project might be assigned a medium priority because of the uncertainty of a funding source. This priority could be changed to high once a funding source has been identified such as a grant. The prioritization schedule for this Plan will be reviewed and updated as needed annually through the plan maintenance strategy described in Section 6 of this Plan.

The economic crisis of 2008 caused a great reduction in funding sources, and priorities have changed across the jurisdictions due to tightening funds and the type of and frequency of events. Floods, followed by long periods of drought, intermixed with occasional violent tornado outbreaks, have been the theme for the past few years. During this time, Oklahoma County has experienced record breaking heat and record breaking cold. The County has seen softball size hail storms and record snows in recent years. Top that off with numerous small earthquakes felt in the county over the past few years, and you can see how Oklahoma County's jurisdictions continue to be tugged in various directions after big events. The current change in priorities has been reflected in the prioritization of the mitigation projects. Many projects have been pushed to long term due to the aforementioned lack of funding sources and subsequent inability to meet matching funds required of grants.

Benefit/Cost Review

Section 201.6.c.3iii of 44CFR requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a cost/benefit review of the proposed projects and their associated costs. The Planning Area conducted a review of benefits and costs to determine if each project appears to be cost-effective and to assist the municipality with prioritizing their mitigation actions. This exercise allows the community to select the most cost-effective actions for implementation first, not only to use resources efficiently, but to make a realistic start toward mitigating risks. The same parameters were used by each of the participating jurisdictions as outlined in Volume II of this Plan.

Please note that this benefit/cost review did not include the level of detail required by FEMA for project grant eligibility under the Hazard Mitigation Assistance (HMA) grant programs. This qualitative

approach was used because projects may not be implemented for up to 10 years, and the associated costs and benefits could change dramatically in that time.

Mitigation benefits are future damages and losses that would be eliminated and/or reduced by implementing the proposed mitigation project. Where actual project benefits could be identified per FEMA's benefit calculation methodology (e.g., physical damages, loss of service or function, emergency management costs, etc.), the benefits were noted in Table F of each annex (Volume II, Section 9) and the appropriate rating as defined in Table 6-1 was assigned. When project benefits could not be reasonably established, a subjective rating was assigned based on the parameters outlined below.

Where the project cost for each mitigation initiative was reasonably estimated (including preliminary engineering, engineering, design, and construction) the appropriate rating as outlined in Table 6-1 was assigned in Table F of each annex (Volume II, Section 9). Where actual project costs could not be reasonably established at this time, a best estimate was provided and a subjective rating was assigned as defined below.

Table 6-1. Cost and Benefit Definitions

Costs	
High	Existing funding levels are not adequate to cover the costs of the proposed project, and implementation would require an increase in revenue through an alternative source (for example, bonds, grants, and fee increases) or project costs are greater than approximately $100,000.
Medium	The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years or project costs are between approximately $10,000 and $100,000.
Low	The project could be funded under the existing budget. The project is part of or can be part of an existing, ongoing program or project costs are less than approximately $10,000.
Benefits	
High	Project will have an immediate impact on the reduction of risk exposure to life and property or benefits are greater than approximately $100,000.
Medium	Project will have a long-term impact on the reduction of risk exposure to life and property or will provide an immediate reduction in the risk exposure to property or benefits are between approximately $10,000 and $100,000.
Low	Long-term benefits of the project are difficult to quantify in the short term or benefits are less than approximately $10,000.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly. For many of the initiatives identified, Oklahoma County and participating jurisdictions may seek financial assistance under FEMA's HMGP, PDM, FMA, or SRL programs. These programs require detailed benefit/cost analysis as part of the application process. These analyses will be performed when funding applications are prepared, using the FEMA model process. The Planning Committee is committed to implementing mitigation strategies with benefits that exceed costs. For projects not seeking financial assistance from grant programs that require this sort of analysis, the Planning Committee reserves the right to define "benefits" according to parameters that meet its needs and the goals and objectives of this plan.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly.

The annexes presented in Section 9, Volume II present the results of applying the prioritization methodology presented to the set of mitigation actions identified by the County and each participating jurisdiction, and includes the following prioritization parameters:

- Number of objectives met by the initiative
- Benefits of the project (high, medium, or low)
- Cost of the project (high, medium, or low)
- Do the benefits equal or exceed the costs?
- Is the project grant-eligible?
- Can the project be funded under existing programs and budgets?
- Priority (high, medium, or low)

The annexes in Section 9, Volume II of this Plan present the County's and each participating jurisdiction's mitigation action implementation strategy including:

- Mitigation actions for individual and multiple hazards
- Mitigation goals and objectives supported by each action.
- Implementation priority
- Potential funding sources for the mitigation action (grant programs, current operating budgets or funding, or the agency or jurisdiction that will supply the funding; additional potential funding resources are identified)
- Estimated budget for the mitigation action (financial requirements for new funding or indication that the action is addressed under current operating budgets)
- Time estimated to implement and complete the mitigation action
- Existing policies, programs, and resources to support implementation of the mitigation action (additional policies, programs, and resources identified)

Specific mitigation actions were identified to prevent future losses; however, current funding is not identified for all of these actions at present. Oklahoma County and the participating jurisdictions have limited resources to take on new responsibilities or projects. The implementation of these mitigation actions is dependent on the approval of the local elected governing body and the ability of the community to obtain funding from local or outside sources. Where such actions are high priorities, the community will work together with Oklahoma State Emergency Management, FEMA and other Federal, State and Planning Area agencies to secure funds.

In general, mitigation actions ranked as high priorities will be addressed first. However, medium or even low priority mitigation actions will be considered for concurrent implementation. Therefore, the ranking levels should be considered as a first-cut, preliminary ranking and will evolve based on input from planning area departments and representatives, the public, OEM, and FEMA as the Plan is implemented.

SECTION 7: PLAN MAINTENANCE PROCEDURES

This section describes the system that Oklahoma County and all participating jurisdictions have established to monitor, evaluate, and update the mitigation plan; implement the mitigation plan through existing programs; and solicit continued public involvement for plan maintenance.

MONITORING, EVALUATING AND UPDATING THE PLAN

This section presents the procedures for monitoring, evaluating, and updating the plan.

The Oklahoma County Hazard Mitigation Planning Committee ("Planning Committee") intends to remain intact as the organization responsible for monitoring, evaluating and updating this Plan. The Oklahoma County Hazard Mitigation Planning Coordinator, Mr. David Barnes (Oklahoma County Emergency Management) shall continue to act as the coordinator for the planning committee. Each participating jurisdiction is expected to maintain a municipal hazard mitigation representative to support their jurisdiction's input to the monitoring, evaluation and updating responsibilities identified in this Section. For most jurisdictions, the representative is the Emergency Manager or Fire Chief. Table 7-1 identifies the representation of the County Hazard Mitigation Team as of the date of this Plan. Ongoing municipal hazard mitigation planning points-of-contact are identified in each jurisdiction's annex (Section 9).

Oklahoma County will continue to include representatives from several departments and work groups to assist with in-house monitoring, work planning and follow-through for the Oklahoma County Hazard Mitigation Plan. Represented groups and departments include:

- Emergency Management
- Planning
- Engineering
- Floodplain Management
- Highway Districts (1, 2, 3)

It is recognized that individual commitments change over time, and it shall be the responsibility of each jurisdiction and its representatives to inform the County HMP Coordinator of any changes in representation by formal letter. The County HMP Coordinator shall maintain the current membership of the planning committee and municipal representatives on the Oklahoma County Hazard Mitigation Plan public website at http://www.oklahomacounty.org/emergencymanagement/documents/hmp.pdf .

Monitoring and Evaluating:

The County HMP Coordinator shall be responsible for monitoring progress on, and evaluating the effectiveness of the Plan, and documenting this with Oklahoma Department of Emergency Management (OEM) and FEMA. The evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, if the Plan goals are being reached, and whether changes are needed. These evaluations will assess whether:

- Goals and objectives address current and expected conditions.
- The nature or magnitude of the risks have changed.
- Current resources are appropriate for implementing the HMP and if different or additional resources are now available.

- Actions were cost effective.
- Schedules and budgets are feasible.
- Implementation problems, such as technical, political, legal or coordination issues with other agencies exist.
- Outcomes have occurred as expected.
- Changes in municipal resources impacted plan implementation (for example, funding, personnel, and equipment)
- New agencies/departments/staff should be included, including other local governments as defined under 44 CFR 201.6.
- Documentation for hazards that occurred during the last year

Finally, the planning committee will evaluate how other programs and policies have conflicted with or augmented planned or implemented measures, and shall identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions (see the "Implementation of Mitigation Plan through Existing Programs" subsection later in this Section).

Annual Plan Review:

Monitoring of plan progress and evaluating effectiveness shall be accomplished through an annual plan review process, initiated by the County HMP Coordinator and working directly with the participating municipalities.

The annual plan review process shall begin in May of each year, timed to coincide with the annual FEMA Hazard Mitigation Assistance (HMA) program announcement (and also the busiest severe weather month of the year). At this time, the County HMP Coordinator shall call a meeting of the County Hazard Mitigation Team to discuss how to conduct the annual review and reporting process for the year. At this meeting, the Hazard Mitigation Team shall determine the method by which participating departments and agencies and municipalities will be surveyed for information to go into the annual review and report, and set a schedule and assign responsibilities to complete the review and reporting process.

While the actual methods and tools for this review and reporting will be established by the Hazard Mitigation Team each year, it is anticipated that the process will include the following:

- Preparing an annual planning participant mitigation progress reporting form for distribution to all participants ahead of an annual meeting of the planning partnership.
- Inviting the planning partnership to the annual meeting, and providing the planning participant mitigation progress reporting form.
- Conducting an annual meeting of the planning partnership, at which the following will be discussed:
  - Mitigation progress and activity at the municipal, County, and regional level.
  - How to complete the planning partnership mitigation progress reporting form, and schedule for completion.
  - Adding and/or eliminating mitigation projects/activities/initiatives from the local mitigation action plans.
  - Mitigation successes, problems, concerns and issues regarding plan implementation at the local level.
  - Mitigation resources available, including upcoming and potential training programs.
  - Annual HMA grant program (process to apply, schedule, etc.)

- Preparing and submitting an annual progress report to OEM and FEMA Region VI.

For County-level activity, department and agency representatives will collect and process information on mitigation activity and progress from their respective departments and agencies. At the municipal level, the Hazard Mitigation Team shall collect and compile municipal survey forms, information provided at the annual plan review meeting with the communities, and conduct phone calls and meetings with persons responsible for initiating and/or overseeing the mitigation projects to obtain progress information. Copies of any grant applications filed on behalf of any of the participating jurisdictions shall be provided to the Hazard Mitigation Team. Further, the representatives shall obtain from their municipal supervisor/administrator or clerk any public comments made on the plan and provide to the Hazard Mitigation Team for inclusion in the annual report.

Through this process, the Hazard Mitigation Team and planning partnership representatives shall be expected to document, as needed and appropriate:

- Hazard events and losses occurring in their jurisdiction including their nature and extent and the effects that hazard mitigation actions have had on impacts and losses,
- Progress on the implementation of mitigation actions, including efforts to obtain outside funding for mitigation actions,
- Any obstacles or impediments to the implementation of actions,
- Additional mitigation actions believed to be appropriate and feasible,
- Public and stakeholder input and comment on the Plan.

The County HM Coordinator shall be responsible for preparing an Annual HMP Progress Report, based on the provided local annual progress reports from each participating jurisdiction, information presented at the annual Hazard Mitigation Team meeting, and other information as appropriate and relevant. While the main purposes of this report are to document progress on plan implementation at the county and local level, and to formally document updates to the county and local mitigation strategies, these annual reports will provide data for the 5-year update of this HMP and will assist in pinpointing implementation challenges. By monitoring the implementation of the Plan on an annual basis, the Hazard Mitigation Team will be able to assess which projects are completed, which are no longer feasible, and what projects may require additional funding.

The Annual HMP Progress Report shall be posted on the Oklahoma County Hazard Mitigation Plan website (http://www.oklahomacounty.org/emergencymanagement/documents/hmp.pdf) to keep the public apprised of the Plan's implementation. This report will also be provided to any community participating in the National Flood Insurance Program Community Rating System (CRS) to meet CRS Activity 510 and annual CRS recertification requirements. To meet this recertification timeline, the Oklahoma County Hazard Mitigation Team will strive to complete the review process and prepare an Annual HMP Progress Report by the end of October.

Post-Disaster:

After a declared disaster or major hazard event in the County, the County HMP Coordinator and ongoing County Hazard Mitigation Team may elect to meet with the planning partnership to:

- Discuss ongoing recovery and public assistance efforts.
- Discuss data and information collection on the disaster/event.

- Evaluate the effectiveness of mitigation projects completed in the county and participating municipalities.
- Identify specific areas of vulnerability evident in the wake of the disaster/event.
- Identify potential mitigation actions and opportunities to address new areas of vulnerability.
- Discuss current or anticipated grant opportunities (e.g. HMGP) in the wake of the disaster/event.

Plan Maintenance and Updating

44 CFR 201.6.d.3 requires that local hazard mitigation plans be reviewed, revised as appropriate, and resubmitted for approval in order to remain eligible for benefits awarded under DMA 2000. It is the intent of the Oklahoma County Hazard Mitigation Team to update this Plan on a five year cycle from the date of initial plan adoption. Ongoing maintenance and updating of the Plan shall be the responsibility of the County HM Coordinator, working with the County Hazard Mitigation Team and municipal planning partners.

To facilitate the update process, the Oklahoma County HMP Coordinator, with support of the Hazard Mitigation Team, shall use the **third** annual plan review process to develop and commence the implementation of a detailed Plan update program. The Oklahoma County HMP Coordinator shall invite representatives from OEM and FEMA to this meeting to provide guidance on plan update procedures. This program shall, at a minimum, establish who shall be responsible for managing and completing the Plan update effort, what needs to be included in the updated plan, and a detailed timeline with milestones to assure that the update is completed according to regulatory requirements. At this meeting, the County Hazard Mitigation Team shall determine what resources will be needed to complete the update. The Oklahoma County HMP Team shall be responsible for assuring that needed resources are secured.

Following each five year update of the mitigation plan, the draft updated plan will be distributed for public comment. After all comments are addressed, the HMP will be revised, approved and adopted and distributed to all municipal planning partners and the State Hazard Mitigation Officer.

Further, it is recognized that additional jurisdictions (e.g. special purpose districts) within the Oklahoma County planning partnership may elect to join this Plan. Any such new Plan participants shall be formally included and documented in the five-year formal Plan update. Procedures for the addition of new Plan participants shall be reviewed with OEM and FEMA prior to their formal inclusion in this Plan.

IMPLEMENTATION OF MITIGATION PLAN THROUGH EXISTING PROGRAMS

Participating jurisdictions have provided a detailed listing of related programs, through which mitigation planning may be implemented, in the local capability assessments provided in each jurisdictional annex (Volume II, Section 9). In addition, a full discussion on relevant county and regional programs is provided in Section 3, "Planning Process".

It is the intention of the County Hazard Mitigation Team and participating jurisdictions to incorporate mitigation planning as an integral component of daily government operations. County Hazard Mitigation Team members will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution (Appendix B) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the County Hazard Mitigation Team anticipates that:

1) Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts;
2) This Hazard Mitigation Plan and other planning documents and programs will become mutually supportive efforts that work in concert to meet the goals and needs of the county and municipalities; and
3) Duplication of effort can be minimized.

The information on hazard, risk, vulnerability and mitigation contained in this Plan is based on the best science and technology available at the time of the Plan's preparation. It is recognized by all participating jurisdictions that this information can be invaluable in making decisions under other planning programs, such as comprehensive, long-term community recovery plans, watershed management plans, capital improvement, and emergency management plans. Table 7-1 below includes existing processes and programs through which the mitigation plan should be implemented.

Table 7-1. Existing Processes and Programs for Mitigation Plan Implementation

Process	Action	Implementation of Plan
Administrative	Departmental or organizational work plans, policies, and procedural changes	• Planning Department • Public Works Department • Department of Emergency Management • Engineering • Environmental Health and Safety • Soil and Water Conservation District • Economic Development • Social Services
Administrative	Other organizations' plans	• Include reference to this plan in: o Comprehensive Emergency Management Plans o Comprehensive / Master Plans o Drought Management Plans o Other county and local plans as appropriate
Administrative	Job/Job Descriptions	• Unpaid internships to assist in hazard mitigation plan maintenance
Budgetary	Capital and operational budgets	• Continue to include mitigation related projects in annual Capital Improvement Program. • Leverage mitigation grant funding to support local funding for such mitigation projects.
Regulatory	Executive Orders, ordinances, policies and other directives	• Comprehensive Planning - Institutionalize hazard mitigation for new construction and land use. • Zoning and Ordinances • Building Codes-enforcement of codes or higher standard in hazard areas • Capital Improvements Plan - Ensure that the person responsible for projects under this plan evaluates if the new construction is in a high hazard area, floodplain, etc. so the construction is designed to mitigate the risk. Revise requirements for this plan to include hazard mitigation in the design of new construction. • National Flood Insurance Program – Continue participation in this program. • Prior to formal changes (amendments) to comprehensive plans, zoning, ordinances, capital improvement plans, or other mechanisms that control development must be reviewed to ensure they are consistent with the hazard mitigation plan

Process	Action	Implementation of Plan
Funding	Secure traditional sources of financing	• Apply for grants from federal (including FEMA Hazard Mitigation Assistance (HMA) and HMGP funding programs), state government, nonprofit organizations, foundations, and private sources. • Continue to make use of grant opportunities through U.S. Department of Housing and Urban Development's Community Development Block Grant (CDBG) • Other potential federal, state and regional funding sources include: o Stafford Act, Section 406 – Public Assistance Program Mitigation Grants o Federal Highway Administration o Catalog of Federal Domestic Assistance o United States Fire Administration – Assistance to Firefighter Grants o United States Small Business Administration Pre and Post Disaster Mitigation Loans o United States Department of Economic Development Administration Grants o United States Army Corps of Engineers o United States Department of Interior, Bureau of Land Management o Other sources as yet to be defined • See Appendix G for additional funding sources
Partnerships	Develop creative partnerships, funding and incentives	• Public-Private Partnerships • State Cooperation • In-kind resources
Partnership	Existing Committees and Councils	• Local Government Committees: o Planning Boards o Zoning Board of Appeals • Climate Change Task Force(s) • Chambers of Commerce • Property Owners Associations
Partnership	Working with other federal, state, and local agencies	• Army Corps of Engineers (USACE) • American Red Cross • Department of Homeland Security (DHS) • Federal Emergency Management Agency (FEMA) • National Oceanic and Atmospheric Administration (NOAA) • National Weather Service (NWS) • National Fire Protection Association (NFPA) • National Park Service • Oklahoma Department of Emergency Management (OEM) • United States Department of Agriculture (USDA) • United States Department of Transportation (USDOT) • United States Geological Survey (USGS) • United Way of Central Oklahoma • Other Non-Profit and NGO Partners

During the annual plan evaluation process, the County Hazard Mitigation Team will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions, and include these findings and recommendations in the Annual HMP Progress Report.

CONTINUED PUBLIC INVOLVEMENT

The Oklahoma County mitigation planning partnership has identified continued public outreach as a high priority mitigation initiative (see Section 9.1). Under this initiative, the partnership will continue to maintain and provide links to the Plan's hazard mitigation webpage, continue to provide ongoing media releases and other public notifications regarding where the public can review the Plan and provide ongoing input, and may include public meetings to further promote awareness of the Plan.

Full copies of the Plan shall continue to be made available in hard-copy for review during normal business hours at the following locations:

Oklahoma County Emergency Management – and –
Oklahoma County Planning Commission
Oklahoma County Annex Building
320 Robert S. Kerr Avenue, Okalhoma City, OK 73102

Municipalites are asked to make available hard-copy excerpts of the Plan at their muncipal building (e.g. clerk's office), including at a minimum the Introduction, County annex and applicable municipal annex to the Plan. Municipal supervisors/mayors or clerks and the Oklahoma County HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP.

The public will have an opportunity to comment on the Plan at the annual review meeting for the HMP and during the 5-year plan update. The annual progress reports will be posted on the Oklahoma County Hazard Mitigation website http://www.oklahomacounty.org/emergencymanagement/documents/hmp.pdf. Oklahoma County will maintain this website, posting the annual progress reports and maintaining an active link to collect public comments.

The Oklahoma County HMP Coordinator is responsible for coordinating the Plan evaluation portion of the meeting, soliciting feedback, collecting and reviewing the comments, and ensuring their incorporation in the 5-year plan update as appropriate. Additional meetings may also be held as deemed necessary by the planning group. The purpose of these meetings would be to provide the public an opportunity to express concerns, opinions, and ideas about the mitigation plan. Annual progress reports will also be posted to the project web site.

Municipal representatives shall be responsible to assure that:

- Public comments and input on the Plan, and hazard mitigation in general, are recorded and addressed, as appropriate. Opportunity to comment on the plan will be provided directly on the project web site. Provisions for public comment in writing will also be made. All public comments shall be addressed to:

  Oklahoma County Hazard Mitigation Coordinator
  Oklahoma County Emergency Management
  320 Robert S. Kerr Avenue, Suite 101
  Oklahoma City, OK 73102

- Copies of the latest approved Plan (or draft in the case that the five year update effort is underway) are available for review at the locations identified above along with forms and instructions to facilitate public input and comment on the Plan.
- Appropriate local links to the Oklahoma County Hazard Mitigation Plan website are maintained by participating jurisdictions. The web site will be maintained throughout the course of the project, and during the plan implementation phase.
- Public notices are made as appropriate to inform the public of the availability of the Plan, particularly during Plan update cycles.

The Oklahoma County HMP Coordinator shall be responsible to assure that:

- Public comments and input on the Plan, and hazard mitigation in general, are recorded and addressed, as appropriate.
- The Oklahoma County Planning Area HMP website is maintained and updated as appropriate.
- All public and stakeholder comments received are documented and maintained.
- Copies of the latest approved Plan (or draft in the case that the five year update effort is underway) are available for review at the locations identified above, along with instructions to facilitate public input and comment on the Plan.
- Public notices, including media releases, are made as appropriate to inform the public of the availability of the Plan, particularly during Plan update cycles.

SECTION 8: PLANNING PARTNERSHIP

BACKGROUND

Section 201.6.a(4) of Chapter 44 of the Code of Federal Regulations (44CFR) states: "Multi-jurisdictional plans (e.g. watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan." The Federal Emergency Management Agency (FEMA) and Oklahoma Department of Emergency Management (OEM) both encourage multi-jurisdictional planning. Therefore, in the preparation of the Oklahoma County Hazard Mitigation Plan (HMP) Update, a Planning Partnership was formed to pursue grant funding for the plan and to meet requirements of the federal Disaster Mitigation Act of 2000 (DMA) for as many eligible local governments in Oklahoma County as possible.

The DMA defines a local government as follows: "Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity."

THE PLANNING PARTNERSHIP

Oklahoma County solicited the participation of all local governments in the County at the commencement of this project. In addition to Unincorporated Oklahoma County, fourteen (14) of the incorporated jurisdictions in the County elected to participate in the planning process.

Table 3-1. Participating Jurisdictions

Participating Jurisdictions		
Oklahoma County	City of Edmond	City of Nichols Hills
Town of Arcadia	Town of Forest Park	City of Nicoma Park
City of Bethany	City of Harrah	City of Spencer
City of Choctaw	Town of Luther	City of The Village
City of Del City	City of Midwest City	City of Warr Acres

A Planning Committee was assembled consisting of representatives from the various Unincorporated County departments and agencies, and representatives from each of the participating municipalities. The Planning Committee was charged with the following:

- Represent their jurisdiction throughout the planning process;
- Ensure that the Plan meets the requirements of DMA 2000 and FEMA and OEM guidance;
- Solicit and encourage the participation of regional agencies, a range of stakeholders, and citizens in the Plan development process;
- Assist in gathering information for inclusion in the Plan, including the use of previously developed reports and data;
- Assist with the update of the hazard mitigation planning Goals and Objectives
- Assist with the review of a broad range of potential mitigation initiatives

- Identify, develop and prioritize appropriate mitigation initiatives.
- Develop, revise, adopt, and maintain Volume I of the Plan in its entirety and their local jurisdictional annex in Volume II.

Jurisdiction Annexes

A major organizational change in this update from the 2006 Plan is the development and incorporation of jurisdictional annexes, or chapters, to the Plan. Each annex provides the jurisdiction-specific elements of the Plan, including their updated local mitigation strategy.

Jurisdictional annex templates were created to help the plan participants prepare their jurisdiction-specific annexes and ensure all criteria of Section 201.6 of 44CFR would be met, based on the partners' capabilities and mode of operation. A template and detailed instructions were designed to lead each partner through a series of steps that would generate the DMA-required elements that are specific for each partner. Each participating jurisdiction was tasked with completing the template according to detailed instructions, with guidance and technical assistance from the County and planning consultant.

A jurisdictional annex workshop and local support meetings were held in March, 2012 for all plan participants. Technical support to complete the annexes was available to all plan participants through plan finalization in October 2012.

The jurisdictional annexes include the following sections/elements:

Section A: Local Mitigation Points-of-Contact

This section identifies the local hazard mitigation planning points-of-contact who provided the primary local support for the plan update (see Section 3, "Planning Process"), and for ongoing plan implementation and maintenance as described in Section 7.

Section B: Municipal Profile

This section provides a profile description of the municipality, and further identifies:

- Any known or anticipated growth and development as provided by the municipality;
- Specific hazard vulnerabilities;
- Completed or ongoing mitigation projects and activities in the municipality, including progress on any local initiatives in the 2006 Plan.

Section C: Natural Hazard Event History Specific to the Municipality

This section allows for each municipality to identify local damages and losses from specific hazard events. The hazard profiles/vulnerability assessments in Section 5 provide further event information on the county and regional level.

Section D: Capability Assessment

This section allows for each municipality to identify their local mitigation capabilities organized as:
Table D.1 – Legal and Regulatory Capabilities
Table D.2 – Administrative and Technical Capabilities
Table D.3 – Fiscal Capabilities

Table D4 – Community Classifications

Section E: Proposed Hazard Mitigation Initiatives

The section provides each jurisdiction's updated local mitigation strategy, including those initiatives that have been carried forward from the 2006 plan, as well as new initiatives. Section 6, "Mitigation Strategy", provides full details on the process by which the county and each municipality updated their mitigation strategy.

Section F: Analysis of Mitigation Actions

This might be eliminated if we include a column in the mitigation action table, perhaps in lieu of the "Applies to New and/or Existing Structures".

Section G: Prioritization of Mitigation Initiatives

This section presents how each mitigation initiative was prioritized according the prioritization methodology described in Section 6, "Mitigation Strategy" and in the following subsection.

BENEFIT/COST REVIEW

Each jurisdiction's annex includes an action plan of prioritized initiatives to mitigate natural hazards. Section 201.6.c.3iii of 44CFR requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a cost/benefit review of the proposed projects and their associated costs. In addition, the County and each jurisdiction was requested to provide a project status for each of the projects included in the 2006 HMP as well as summarizing how the 2006 plan was integrated into their planning process.

As part of jurisdiction annex template completion, the Planning Committee was asked to weigh the estimated benefits of a project versus the estimated costs to establish a parameter to be used in the prioritization of a project. This benefit/cost review was qualitative; that is, it did not include the level of detail required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) grant program. This qualitative approach was used because projects may not be implemented for up to 10 years, and the associated costs and benefits could change dramatically in that time. Each project was assessed by assigning subjective ratings (high, medium, and low) to its costs and benefits, as follows:

Table 8-2. Benefit/Cost Review

Costs	
High	Existing funding levels are not adequate to cover the costs of the proposed project, and implementation would require an increase in revenue through an alternative source (e.g., bonds, grants, and fee increases).
Medium	The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
Low	The project could be funded under the existing budget. The project is part of or can be part of an existing, ongoing program.
Benefits	
High	Project will have an immediate impact on the reduction of risk exposure to life and property.

Medium	Project will have a long-term impact on the reduction of risk exposure to life and property or will provide an immediate reduction in the risk exposure to property.
Low	Long-term benefits of the project are difficult to quantify in the short term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly. For many of the initiatives identified in the action plans, participating jurisdictions may seek financial assistance under FEMA's HMGP or PDM programs. Both of these programs require detailed benefit/cost analysis as part of the application process. These analyses will be performed when funding applications are prepared, using the FEMA model process. The Planning Committee is committed to implementing mitigation strategies with benefits that exceed costs. For projects not seeking financial assistance from grant programs that require this sort of analysis, the Planning Committee reserves the right to define "benefits" according to parameters that meet its needs and the goals and objectives of this plan.

COMPLETION OF THE PLANNING PROCESS

All participating municipalities in the County completed the planning and annex-preparation process. Completed jurisdictional annexes are presented in Section 9.

9.1 COUNTY OF OKLAHOMA

This section presents the jurisdictional annex for Unincorporated County of Oklahoma.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Mr. David Barnes, Director Oklahoma County Emergency Management 320 Robert S. Kerr, Suite 101 Oklahoma City, OK 73102 (405) 713-1369 DBarnes@oklahomacounty.org	Greg Whitworth, Resource Specialist Oklahoma County Emergency Management 320 Robert S. Kerr, Suite 101 Oklahoma City, OK 73102 (405) 605-8991 gwhitworth@oklahomacounty.org

B.) COUNTY PROFILE

Please refer to Section 4, Volume I of this Plan for details on Oklahoma County's population, location, climate, history, growth and development. Please refer to the hazard profiles in Section 5 for information on identified hazard vulnerabilities throughout the County.

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE COUNTY

Please refer to the Previous Occurrences and Losses section of the appropriate hazard profiles in Section 5.4 of this Plan in Section 5.4, Volume 1. A summary of losses within the County to major hazard events is provided below in the table below.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Severe Storms, Flooding	DR-441	Yes	The County had approximately $620 K in property damage and 14 injuries.
October 17-19, 1983	Severe Storms, Flooding	DR-693	Yes	The County had approximately $656 K in property damage and $2.1 M in crop damage.
September 29 – October 1, 1986	Severe Storms, Flooding	DR-778	Yes	The County had approximately $2 M in property damage and $892 K in crop damage.
May 2, 1990	Flooding, High Wind, Tornado	DR-866	Yes	The County had approximately $500 K in property damage and one fatality.
May 8, 1993	High Wind, Tornadoes	DR-991	Yes	Four fatalities; $50 M in property damage
June 9, 1993	Flash Flooding	N/A	N/A	Severe TSTMs moved across northern Oklahoma, causing lightning, large hail, damaging winds, flash flooding and three tornadoes. The three tornadoes were not in Oklahoma County. Oklahoma County had approximately $50 K in property damage.
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	The County had approximately $268 K in property damage.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
April 24-26, 1999	Flooding	N/A	N/A	Between five and seven inches of rain across portions of the State. Some areas had over 10 inches of rain. In Oklahoma County, the Town of Choctaw NE 23rd was closed due to flooding. Oklahoma County had approximately $932 K in property damage.
May 3-4, 1999	Tornadoes, Severe Storms and Flooding	DR-1272	Yes	The County had over $450 M in property damage, 234 injuries and 12 fatalities.
June 23, 1999	Flash Flooding	N/A	N/A	TSTMs formed across portions of central Oklahoma, causing widespread street flooding. In Oklahoma County, on West Reno in Oklahoma City was flooded. A pick-up truck was almost submerged. Water had to bed removed by pumps at NW 6th and Penn, which sections of SE 74th near Hiawassee Road caved in. Oklahoma County had approximately $50 K in property.
October 21-29, 2000	Severe Storms and Flooding	DR-1349	Yes	The County had approximately $670 K in property damage.
May 30, 2001	Flooding	N/A	N/A	Severe TSTMs formed over portions of northern and western Oklahoma. Strong winds and hail accompanied the TSTMs and flooding occurred in many areas. In Oklahoma County, portions of Interstate 35 were inundated with one foot of water in Oklahoma City. Cars were stalled in high water on the Interstate, near SW 89th. The North Deer Creek at SE 59th and Dobbs Road overflowed its banks. Oklahoma County had approximately $30 K in property damage.
September 7, 2001	Urban Flooding	N/A	N/A	In Oklahoma City, a car stalled in high water at the intersection of NE 18th and Walnut, and four vehicles stalled in high water at NW 79th and Broadway Ave. The County had approximately $25 K in property damage.
August 11-12, 2004	Flash Flood	N/A	N/A	Strong TSTMs brought heavy rainfall and flooding to the north central portion of Oklahoma, affecting Garfield, Logan, Oklahoma, and Pottawatomie Counties. Rainfall totals ranged between 2.5 inches and five inches. The heavy rain caused flash and riverine flooding in the affected counties. In Oklahoma County, there was minor flooding along the North Canadian River, which crested at 19.1 feet. Deer Creek overflowed its banks and flooded Meridian Avenue. Flash flooding was reported in Oklahoma City, which closed the underpass on NE 23rd Avenue at the junction of Interstate 235. Flood depths were up to six feet in some locations. In the City of Bethany, Eldon Lynn Park was inundated by flash flooding. Water had to be pumped out of the park. In the City of Edmund, flash flooding inundated the intersection of Western Avenue and NE 234th Street. In Midwest City, Soldier Creek

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
				overflowed its banks and flooded the intersection of NE 10th Street and Midwest Boulevard, and Woodside Drive and E. Reno Avenue. The flooding caused the City to close the NE 10th Street/Midwest Boulevard intersection. Approximately 50 apartment units were flooded in this area. Many residents were evacuated. Crutcho Creek overflowed its banks near the intersection of NE 23rd Street and Air Depot Boulevard. Interstate 40 was closed due to flooding. The County had approximately $500 K in property damage.
January 12-26, 2007	Severe Winter Storms	DR-1678	No	Yes
March 29, 2007	Severe Storms and Tornadoes	N/A	N/A	Yes
May 4-11, 2007	Severe Storms, Tornadoes, and Flooding	DR-1707	No	TSTMs brought large hail, high winds, tornadoes and heavy rain to the area. The heavy rains caused flooding in Oklahoma County. In Oklahoma City, there were reports of widespread flash flooding. One to two feet of water was on Morgan Road. Two feet of water was reported on Interstate 40. Ramps to the Interstate were closed. High water rescues were performed. Two vehicles were swept into the North Canadian River near Sooner Road. In the City of Harrah, NE 50th and Harrah Road were closed due to flooding. The County had over $45,000 in road and bridge repairs.
May 24, 2007 to June 1, 2007	Severe Storms, Flooding, and Tornadoes	DR-1723	No	May 30th - Oklahoma City - Several tree limbs were downed due to high winds, causing power outages to some parts of the City. Property damage was approximately $10 K.
June 10, 2007 to July 25, 2007	Severe Storms, Flooding, and Tornadoes	DR-1712	Yes	June 14th – Showers and TSTMs developed over the State, bringing heavy rains, hail and wind. The heavy rains caused flooding in many locations. In the City of Harrah, two of water was reported on the roadway at NE 50th and Harrah Road. June 26th – Intense showers and TSTMs moved through the eastern two-thirds of the State, bringing heavy rainfall and flash flooding. In the City of Bethany, high water covered the road at Ski Island. Water rescues were performed. The County had approximately $5 K in property damage. June 29th – Slow moving showers and TSTMs developed and moved northeast into the State. Flash flooding resulted over parts of southwest and central Oklahoma. In Oklahoma City, numerous roads were closed in the northern portion of the City due to flooding.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
				July 10th – TSTMs brought hail, high winds and flash flooding to the area. In Oklahoma City, a bridge north of Danforth Road on Western Avenue was closed due to a creek overflowing its banks.
Aug. 18, 2007 to Sept. 12, 2007	Severe Storms, Tornadoes, and Flooding	DR-1718	Yes	Remnants of Tropical Storm Erin brought heavy rainfall to the area. Sustained wind speeds of 35 to 45 mph struck the area. The heavy rain caused flooding and rivers and creeks to overflow their banks. In Oklahoma City, several feet of water inundated the intersection of NW 36th and Broadway. Numerous City streets were closed due to flooding. The County had approximately $15 K in property damage.
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	Heavy ice accumulations damaged trees and limbs, resulting in heavy vegetative debris and hanging limbs, blocking public access to walkways and entrances to the courthouse. Many roadways and right-of-ways were blocked due to downed trees. Heavy ice accumulations on roadways. Roadways were damaged. The County had over $2 M in expenses.
March 22, 2008	Wildfire	N/A	N/A	The County numerous, wide-spread evacuations. Roads were closed for approximately six days. Deer Creek schools had approximately $6,000 in damages. The County had $120,000 in expenses for assistance with road closures.
March 30-31, 2008	Severe Storms	N/A	N/A	City of Edmund - A tornado developed near the intersection of NW 178th Street and Pennsylvania Avenue. The tornado caused most of its damage in the Valencia neighborhood. Many homes sustained roof, window, garage door and fence damage. The tornado continued northeast towards the intersection of NW 192nd Street and Western Avenue where large utility poles were blown down. $450 K in property damage.
April 9-28, 2008	Severe Storms, Tornadoes, and Flooding	DR-1754	No	A cold front moved through the State, bringing strong TSTMs, heavy rain and hail. Numerous locations had up to several inches of rain, causing flash flooding. In Oklahoma City, several streets were closed due to flooded roadways. The County had approximately $5 K in property damage.
April 30, 2008	Hail/Damaging Winds	N/A	N/A	Yes
August 20, 2008	Flooding	N/A	N/A	Yes, Deer Creek flooding
April 9-12, 2009	Wildfires	DR-1846	Yes	The County had over three miles of road closures within three days. Expenses totaled over $32,000 for personnel assistance with road closures.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
December 24-2285, 2009	Severe Winter Storm	DR-1876	No	The County had nine deaths and hundreds of injuries. 160 miles of roads were closed. Power outages were reported county-wide. The County had over $150,000 in expenses for personnel assistance with road closures.
May 10-13, 2010	Severe Storms, Tornadoes, and Straight-Line Winds	DR-1917	Yes	Yes
June 13-15, 2010	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	Significant flooding occurred over parts of central Oklahoma. Many homes and cars were flooded. One person died, 136 injured. At the end of the storm, widespread rainfall totals ranged between five and nine inches. At Will Rogers Airport in Oklahoma City, the largest daily precipitation was reported, with 7.61 inches. In Oklahoma City, the heavy rain led to flash flooding. Several roadways were flooded and closed. The County had received almost a foot of rain after this event. This storm affected 122 homes – 52 with minor damage, 11 with major damage and one completely destroyed. Damages to Oklahoma County included a two-lane roadway and culvert washed out by floodwaters. In the City of Forest Park, floodwaters washed out a roadway and two culverts. Roadways throughout the County were flooded and damaged. The County had over $340,000 in expenses. Overall, the County had approximately $5.5 M in property damage.
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	In the County, snow had to be removed from roadways due to the snow storm. Businesses were closed, motorists were stranded, schools were closed and there were adverse effects for emergency vehicles. The County had over $97,000 in expenses.
March 11, 2011	Wildfire	N/A	N/A	Yes

Notes: TSTM = Thunderstorm

Number of FEMA Identified Repetitive Flood Loss Properties: 3 residential

Number of FEMA Identified Severe Repetitive Flood Loss Properties:

Source: Oklahoma Water Resources Board (OWRB)

D.) CAPABILITY ASSESSMENT

This section identifies the following mitigation capabilities within Unincorporated Oklahoma County:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances., Plans)	Do you have this? (Y or N)	Code Citation (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	Regulated at local and state levels.
Comprehensive / Master Plan	Y	Oklahoma County Master Plan (Sept. 2007)
Zoning Ordinance	Y	Zoning Regulations (Dec. 2008)
Subdivision Ordinance	Y	Subdivision Regulations (June 2008)
Site Plan Review Requirements	Y	
NFIP Flood Damage Prevention Ordinance	Y	For unincorporated County.
Floodplain Management Plan	Y	Integrated in OK All Hazard Mitigation Plan
Stormwater Management Plan / Ordinance	Y	Stormwater Quality and Erosion Control Regulations
Stream Corridor Management or Protection Plan	N	
Erosion Management Ordinance	Y	Stormwater Quality and Erosion Control Regulations
Capital Improvements Plan	Y	
Open Space Plan	N	
Economic Development Plan	N	
Comprehensive Emergency Management Plan	Y	
Emergency Response Plan	N	
Post Disaster Recovery Plan / Ordinance	N	
Real Estate Disclosure Requirements	N	
Highway Management Plan	N	
COOP/COG Plan	N	
Other (Special Purpose Ordinances such as critical or sensitive areas)		

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Y	County Engineering (incl. County Planning)
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Y	County Engineering (incl. County Planning)
Planners or engineers with an understanding of natural hazards	Y	County Engineering (incl. County Planning)
NFIP Floodplain Administrator	N	N/A; NFIP Floodplain Administrators are local assignments
Surveyor(s)	Y	
Personnel skilled or trained in "GIS" applications	Y	County Planning
Scientist(s) familiar with natural hazards in the County.	N	
Emergency Manager	Y	County Emergency Management
Grant Writer(s)	Y	
Staff with expertise or training in benefit/cost analysis	Y	County Engineering (incl. County Planning)

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for specific purposes	Yes
User fees for water, sewer, gas or electric service	No
Impact Fees for homebuyers or developers of new development/homes	No
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activity bonds	No
Withhold public expenditures in hazard-prone areas	No
Other	

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	TBD	TBD
Public Protection	TBD	TBD
Storm Ready	County	3/4/2005
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. The Oklahoma County Master Plan provides an opportunity to expand on and improve the policies and programs identified herein by providing land use guidance and zoning information (flooding and wildfire risk management opportunities) and demographic trends (knowledge of vulnerable aging populations). Zoning regulations present an opportunity to control the positioning of large quantities of hazardous materials that may be a secondary threat after a natural hazard incident and supports Goal #6 (Structural Projects – reducing community risk). The Floodplain Management Plan and local floodplain management present good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). Personnel skilled in "GIS" applications support Goal #2 (Prevention) and Goal #3 (Protecting Critical Facilities) by identifying risk areas. Having Planners and Engineers with knowledge of land development and land management practices increases the ability to mitigate against wildfire, flooding, and other hazards, and supports Goal #2 (Prevention) in the plan. Having a County Emergency Manager with a fire background provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). The fiscal capabilities of items such of items such as Community Development Block Grants, Capital Improvements Project Funding present opportunities for monies to support Goal #6 (Structural Projects).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) HAZARD MITIGATION STRATEGY

The following section identifies progress on the county-level and county-wide mitigation strategies identified in the 2006 plan, and the updated mitigation strategy.

E.1) Review of Progress on 2006 County-Level Mitigation Strategy

The following table identifies progress on the County-level mitigation strategies identified in the 2006 plan. Progress has been identified as "No Progress / Unknown", "In Progress / Not Yet Complete", "Continuous", "Completed" or "Discontinued". Those projects being carried forward in this update have been identified in the updated County mitigation strategy in Table E.2.

2006 Project Name and Description	Status	Review Comments
NW 192nd Street Bridge Replacement	In Progress / Not Yet Complete	Currently under environmental review and evaluation.
NW 178th Street Bridge Replacement - NW 178th Street between Council Road and Rockwell Avenue	Discontinued	Unknown why listed – these bridges do not have any currently known deficiencies..
Henney Road Bridge Replacement - Henney Road Bridge, between Sorghum Mill Road and Waterloo Road	Discontinued	Unknown why listed – these bridges do not have any currently known deficiences.
Bridge Replacement - Soldier Creek Bridge - Near Midwest Boulevard and south of NE 10th Street.	In Progress / Not Yet Complete	This project will be co-sponsored with the City of Midwest City. It is currently in the design phase.
Crooked Oak Creek Drainage Improvement – Town of Valley Brook	No Progress / Unknown	
Deep Fork River & Cottonwood Creek - Install rip/rap to prevent erosion and provide flood control assistance.	On Hold	No current plans in place, seeking funding sources and evaluating overall prioritization.
North Canadian River Erosion Control Project - Erosion control and channelization at the North Canadian River bridge structure at Hogback Road.	On Hold	No current plans in place, seeking funding sources and evaluating overall prioritization.
Critical Utility Infrastructure Planning - Work with utility service providers to identify critical service vulnerabilities and the locations of potentially "exposed" resources and/or installations that could be adversely affected by the issues or situations listed. Strive to identify methods of prioritizing protection measures and plans for restoration should an event actually cause service interruption.	Deleted	Continued discussions and interaction with critical utility infrastructure providers. This is a long-term, very dynamic project. (This is not County mitigation - work is done by utility companies.)

NW 178th Flood Control - Installation of CGMP's and raising roadway.	Discontinued	Unknown why listed – raising the road would create problems (a bowl)..
NW 234th Flood Control - Installation of CGMP's and raising roadway near MacArthur Blvd.	Ongoing	Currently planning to elevate one roadway segment, providing a "flood-resistant" access corridor. This is a multi-phase project with several key areas to be addressed.
NW 220th Flood Control - Installation of CGMP's and raising roadway.	On hold	Waiting on the identification and provision of adequate funding.
NW 234th Flood Control- Installation of CGMP's and raising roadway between Portland and May Ave.	On hold	Waiting on the identification and provision of adequate funding.
Rockwell Flood Control - : Installation of CGMP's and raising roadway.	On hold	Waiting on the identification and provision of adequate funding.
Waterloo Flood Control - Installation of CGMP's and raising roadway.	On hold	Waiting on the identification and provision of adequate funding.
Crutcho Flood Control - Improve drainage of rainwater out of the Crutcho area.	In Progress / Not Yet Complete	Voluntary property acquisition continues under a Federal Hazard Mitigation Grant. Three phases have been completed, two phases still underway. As of 10-5-12, have removed fifty-nine (59) single family residences at a cost of approximately $5,495,920. Phases IV and V are still moving forward.
Deep Fork River - Improve flow of the Deep Fork River under State Highway 66 bridge.	Discontinued	This is the State's jurisdiction, not the County.
Council Flood Control - Installation of CGMP's and raising roadway.	No Progress / Unknown	
Public Awareness of Buildings - Establishment of public awareness on building codes and infrastructure of new developments.	Ongoing	Oklahoma County Building Codes are periodically reviewed and updated, last revision approved by the Board of County Commissioners on 10-1-12. On-going review additionally occurs at routine Planning Commission Meetings.
Public Education & Planning - Canton Dam Failure	Ongoing	Using the information in the plan and the EAP, identify those locations/citizens potentially affected and prepare and deliver educational materials to help them prepare, or at least be aware of the possible threat. This will be done in collaboration with eastern Oklahoma County neighboring jurisdictions that could be affected including Choctaw, Del City, Harrah, Midwest City, and Spencer.
Severe Thunderstorm (flood, hail, high wind and tornado) Education in Choctaw, Forest Park, Luther, Del City, Valley Brook (not a plan participant) **and in Unincorporated OK County** - Public Awareness of Severe Thunderstorm Hazards.	Continuous	Flooding, hail, high wind and tornado public education efforts continue throughout Oklahoma County, including within these specifically listed jurisdictions at school talks and booths at scheduled events. Severe weather threats continue to be high-risk factors within our region and public education, exercise, mitigation and response-related

		enhancements for dealing with these situations continue in all jurisdictions.
Spencer Multi-Hazard Public Awareness Information	Continuous	Develop a mitigation brochure. All-hazards public education efforts continue throughout Oklahoma County, including within Spencer. Severe weather threats continue to be high-risk factors within our region and public education, exercise, mitigation and response-related enhancements for dealing with these situations continue in all jurisdictions.
Fire Hydrant Project - Residential area, located on N.E. 63rd Street between Bryant and Coltrane Roads.	Discontinued	Grant opportunities were explored and potentially made available (partial funding), however, this "gated community" chose to pursue agreements with the City of Oklahoma City for the provision of extended waterlines and associated fire hydrants.
Dam Failure Preparedness - Countywide	Continuous	Continued All-Hazard public efforts are addressing the awareness side by providing maps and emergency routes and they will continue indefinitely. (Not mitigation)
Earthquake Preparedness - Countywide	Continuous	Continued All-Hazard public efforts are addressing the awareness side of this issue and they will continue indefinitely. (Not mitigation)
Extreme Temperatures - Public Education - Countywide	Continuous	Continued All-Hazard public efforts are addressing the awareness side of this issue prior to onset by providing literature and they will continue indefinitely.
Extreme Temperatures - Community Program - Countywide	Continuous	Extensive planning and regional coordination efforts continue in addressing sheltering (heating and cooling stations) and emergency protective measures for a variety of threats and risks. Multiple local partners are involved.
Increase Hail Damage Prevention Standards.	Discontinued	Surrounding jurisdictions do not have higher standards than the County which follows the International Building Code.
Hail - Establish Public Awareness and Education	Deleted	Not mitigation.
Earthquake - Oklahoma County-Pipeline Identification	Continuous	Collaborative efforts are on-going with owners and operators of these lines, including awareness, public education and applicable safety measures. These issues are additionally part of All-Hazards public awareness and education efforts. (Non-mitigation action)
Wildfire - Fire Awareness Program - Countywide	Continuous	Uncontrolled wildland fires continue to be a significant threat for our area. Public education and awareness combined with applicable fire prevention efforts will continue indefinitely.
Winter Storms - Improve Line Installation. The County will collaborate with the local utilities to plan the installation of new underground power lines.	Discontinued	Oklahoma County will not fund the installation of utility lines for private companies.
Winter Storms - Create List of Vulnerable Citizens -	Deleted	Multiple agencies and service providers continue to update and utilize lists

Countywide		and routine contact with potentially vulnerable citizens in a variety of situations, including "Winter Storms." (Non-mitigation action)
Building Updates - Oklahoma County - New/Existing Buildings	Deleted	Poorly worded action mostly covered by other educational actions.
Drought - Increase public drought awareness to the public - Countywide	Continuous	Continued All-Hazard public efforts are addressing the awareness side of this issue and they will continue indefinitely (Non-mitigation action)

E.2) 2012 Updated County-Level Mitigation Strategy

Note some of the identified mitigation initiatives in the following table are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in County priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	NW 192nd Street Bridge Replacement - Construct a complete bridge replacement. OK County District #3 has planned to do a complete bridge replacement between Council Road and County Line Road to prevent flooding and the closing of local access for emergency responders and other resources. Currently under environmental review and evaluation.									
	See above.	Existing	Flood		OK Co. Hwy District #3	Medium - High	High - $300,000	The funding will be provided by the county, state BRO program.	Short. Currently under environmental review and evaluation.	Low
	Bridge Replacement - Soldier Creek Bridge. The city of Midwest City would put out a bid to replace the bridge structure at Soldier Creek, which is subject to repeated flooding. This is located near Midwest Boulevard and is South of NE 10th Street. This project will be co-sponsored with the City of Midwest City. It is currently in the design phase.									
	See above.	Existing	Flood		City of Midwest City	High	High - $1,570,000	The city of Midwest City would try to do an in-kind match, HMGP with a 80/20 match, Oklahoma State BRO	Short. Currently in design phase.	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
								program.		
	Crooked Oak Creek Drainage Improvement. Silt has built up in the creek from a neighboring landfill and shopping mall causing flooding problems within the Town of Valley Brook (not a plan participant). The removal of silt buildup will be a major project in the very near future.									
	See Above.	N/A	Flood		Town of Valley Brook w/ County Engineer	Medium	Medium - $50,000	County funds would be used for this project.	Short	Low
	Deep Fork River & Cottonwood Creek - Install rip/rap along the Deep Fork River and Cottonwood Creek to prevent erosion and provide flood control assistance. The Oklahoma County Highway District #1 will install rip rap along the Deep Fork River and Cottonwood Creek, which directly affect the community by threatening flooding and contributing to significant soil erosion.									
	See Above.	N/A	Flood		OK Co. Hwy District #3	High	High - $400,000	Oklahoma County funds.	Long term DOF. No current plans in place, seeking funding sources and evaluating overall prioritization.	Medium
	North Canadian River Erosion Control Project - Erosion control and channelization at the North Canadian River bridge structure at Hogback Road. This proposed project will control the erosion at the bridge structure and will prolong the life of the bridge. A combination of channelization and rip-rap would prove most effective.									
	See Above.	Existing	Flood		OK Co. Hwy District #1	High	High - $300,000	To be identified.	Long term DOF. No current plans in place, seeking funding sources and evaluating overall prioritization.	Low
	NW 234th Flood Control - Installation of CGMP's and raising roadway. OK County Hwy Dist. #3 plans to raise and install tinhorns near NW 234th and MacArthur. Currently planning to elevate one roadway segment, providing a "flood-resistant" access corridor. This is a multi-phase project with several key areas to be addressed.									
	See Above.	Existing	Flood		OK Co. Hwy District #3	High	High - $250,000	Ok Co. Hwy District #3	Short (Continuous)	Medium
	NW 220th Flood Control - Installation of CGMP's and raising roadway Oklahoma County District #3 will be raising NW 220th Street and installing corrugated									

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	galvanized metal pipes to minimize the flooding during heavy precipitation. Doing nothing ensures that NW 220th Street will have to be shut down during heavy rainfall.									
	See Above.	Existing	Flood		OK Co. Hwy District #3		High - $250,000	HMGP, County Funds	Long term - Waiting on the identification and provision of adequate funding.	Low
	NW 234th Flood Control- Installation of CGMP's and raising roadway. District #3 has proposed installing tinhorns and raising NW 234th Street between Portland Ave. and May Ave. to alleviate flooding during heavy rainfall.: Providing no mitigation structures allows NW 234th Street to be flooded and shut down during heavy rainfall.									
	See Above.	Existing	Flood		OK Co. Hwy District #3		High - $250,000	HMGP, County Funds	Long term - Waiting on the identification and provision of adequate funding.	Low
	Rockwell Flood Control - : Installation of CGMP's and raising roadway. Installing corrugated galvanized metal pipes and raising the roadway will alleviate high inundation on Rockwell Ave. Providing no mitigation measures allows Rockwell Ave. to be shut down during heavy rainfall.									
	See Above.	Existing	Flood		OK Co. Hwy District #3		High - $250,000	HMGP, County Funds	Long term - Waiting on the identification and provision of adequate funding.	Low
	Waterloo Flood Control - Installation of CGMP's and raising roadway. Oklahoma County Highway District #3 will install tinhorns and raise Waterloo Road to prevent localized flooding and elimination of access for emergency vehicles during heavy rainfall. Doing nothing allows Waterloo Rd to be flooded during heavy rainfall.									
	See Above.	Existing	Flood		OK Co. Hwy District #3		High - $250,000	HMGP, County Funds	Long term - Waiting on the identification and provision of adequate funding.	Low
	Crutcho Flood Control - Improve drainage of rainwater out of the Crutcho area during times of high volumes of rain within a short time. Future plans also include									

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	property buy-out as funded. Install tinhorns and clean out bar ditches for better drainage. Survey the land to determine the best line of defense for flooding. Pumps were rented to help pump water over the dike. Since then a 4" gasoline operated water pump has been purchased to help pump rainwater over the dike. Future plans call for a substation to be built with an automatic, float activated pump. This is an on-going, repetitive loss area with the most cost effective results to be obtained through property buy-out. Voluntary property acquisition continues under a Federal Hazard Mitigation Grant. Three phases have been completed, two phases still underway. As of 10-5-12, have removed fifty-nine (59) single family residences at a cost of approximately $5,495,920. Phases IV and V are still moving forward.									
	See Above.	Existing	Flood		OK Co. Hwy District #1	High	Medium - $16,476 (2006 cost)	Primary funding from District 1, Oklahoma County. Additional grant opportunities and other funds as identified and available would be utilized.	Ongoing	High
	Council Flood Control - Installation of CGMP's and raising roadway. Oklahoma County District #3 has planned to install tinhorns and elevate Council Road to minimize flooding during heavy rainfall. Providing no assistance on Council Road allows it to be flooded during heavy rainfall, thus blocking a major means of egress and access for emergency resources and other vehicles.									
	See Above.	Existing	Flood		OK Co. Hwy District #3	High	High - $300,000 (2006 cost)	Oklahoma County funds.	Long term DOF	Low
	Public Awareness of Building Codes - Establishment of public awareness on building codes and infrastructure of new developments. Oklahoma County will establish a periodic review of building codes with the county planners, developers, and available private contractors to help identify code-related issues affecting mitigation strategies. Oklahoma County Building Codes are periodically reviewed and updated, last revision approved by the Board of County Commissioners on 10-1-12. On-going review additionally occurs at routine Planning Commission Meetings.									
	See Above.	New	Flood, Wind		OK Co. Planning	High	Low - $500	The funding for this project is minimal and would come directly from the county funds.	Ongoing (continuous)	High
	Public Education & Planning - Canton Dam Failure. Potential dam failure that would affect Oklahoma County. Per information provided by the Corp of									

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Engineers, the dam structure at Canton Lake, located in NW Blaine County, has deteriorated and is structurally not in the condition it was originally designed to be. Water table levels have been intentionally lowered to accommodate the situation. Should failure occur, it is estimated that significant flooding will occur in Oklahoma City and Oklahoma County. Gather information to identify actual risks involved and probabilities of incident. Using the information in the plan and the EAP, identify those locations/citizens potentially affected and prepare and deliver educational materials to help them prepare, or at least be aware of the possible threat. This will be done in collaboration with eastern Oklahoma County neighboring jurisdictions that could be affected including Choctaw, Del City, Harrah, Midwest City, and Spencer. Collaborative efforts with the Army Corp of Engineers continue, including planning, exercise and updated threat/risk analysis. The Corp of Engineers is additionally nearing completion of significant modifications and enhancements to the Canton Dam facility which will, and already has, greatly improved overall safety and structural integrity of this facility. Dam breach or related threat(s) are included in current planning and education activities at Oklahoma County as part of the All-Hazards approach.									
	See above.	Existing	Dam Failure, Flood		OK Co. Emergency Management with support from Planning	High	Low - $2,000 (2006 cost)	Oklahoma County - Funding will likely come from Oklahoma County funds, although additional resources may be available from the Corp of Engineers, or through other funding sources.	Long term DOF	Medium
	Severe Thunderstorm (flood, hail, high wind and tornado) Education in Choctaw, Forest Park, Luther, Del City, Valley Brook (not a plan participant) **and Unincorporated County** - Public Awareness of Severe Thunderstorm Hazards listed below. Develop a comprehensive method of delivering public awareness/education related to the many dangerous aspects of severe thunderstorms, not just tornadic activity. Gather statistical information related to the wide variety of severe thunderstorm hazards (including hail, flooding, lightning, and high winds), combine with relevant safety information and put into a usable document for provision to the public at school talks and booths at scheduled events. All-hazards public education efforts continue throughout Oklahoma County, including within these specifically listed jurisdictions. Severe weather threats continue to be high-risk factors within our region and public education, exercise, mitigation and response-related enhancements for dealing with these situations continue in all jurisdictions.									
	See above.	N/A	Hail, Lightning, Wind (incl. tornado), Flood		OK Co. Emergency Management	Medium - High	Low - $5,000 (2006 cost)	County funds and any possible grant opportunities	Ongoing (continuous)	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
								or sponsorships from public or private sources as identified.		
	Drought Education. Educate students on water saving techniques. This includes conservation measures such as low flow faucets, shower heads and toilets. Turning off water when brushing teeth and cleaning, adjusting sprinklers to water the lawn and not the sidewalk, running the dishwasher and washing machine only when full, checking for dripping faucets, installing rain-capturing device to water plants, and xeriscaping.									
	See above.	N/A	Drought		OK Co. Emergency Management	Medium	Low	County funds, HMGP	Short	Medium
	Spencer Multi-Hazard Public Awareness Information. Develop a comprehensive, multi-hazard public education/awareness/mitigation brochure or document and distribute or make available for all citizens. Identify risks, combine with potential solutions, solicit funding for printing and disseminate at businesses and events. All-hazards public education efforts continue throughout Oklahoma County, including within Spencer. Severe weather threats continue to be high-risk factors within our region and public education, exercise, mitigation and response-related enhancements for dealing with these situations continue in all jurisdictions.									
	See above.	N/A	Hail, Lightning, Wind (incl. tornado),		OK Co. Emergency Management working with the City of Spencer	Medium - High	Low - $5,000 (2006 cost)	Potential combination of local funds, solicited grants and possible local sponsorships.	Ongoing (continuous)	Medium
	Dam Failure Preparedness.- The county and jurisdictions will provide the citizens with emergency routes and mapping of high risk areas of dam inundation. Continued All-Hazard public efforts are addressing the awareness side of this issue and they will continue indefinitely.									
	See above.	N/A	Non Mitigation Action		Oklahoma Water Resources Board (OWRB)	Medium - High	Low - $3,000 (2006 cost)	Oklahoma County and local jurisdictions	Ongoing (continuous)	Medium
	Earthquake Preparedness. Provide documents and procedures to county residents and contractors (residential/commercial) on minimizing effects of earthquakes. Continued All-Hazard public efforts are addressing the awareness side of this issue and they will continue indefinitely.									
	See above.	N/A	Non Mitigation Action		OK Co. EM	Low - Medium	Low - $5,000 (2006 cost)	Oklahoma County	Ongoing (continuous)	Medium
	Extreme Temperatures - Public Education. Distribute literature throughout the county (i.e., public library, city halls, local/county schools, etc.) informing the citizens on procedures to implement prior to onset of extreme temperatures. Continued All-Hazard public efforts are addressing the awareness side of this issue and they will continue indefinitely.									
	See above.	N/A	Extreme Temperatures		OK Co. EM in cooperation	Medium	Low - $1,000	Oklahoma County	Ongoing (continuous)	Low

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
					with local jurisdictions		(2006 cost)			
	Extreme Temperatures - Community Program. The County will work with local churches and other non-profit organizations to inform citizens of designated buildings providing shelter during extreme temperatures. Extensive planning and regional coordination efforts continue in addressing sheltering and emergency protective measures for a variety of threats and risks. Multiple local partners are involved.									
	See above.	N/A	Extreme Temperatures		OK Co. EM	Medium	Low - $1,000 (2006 cost)	Oklahoma County	Ongoing (continuous)	High
	Earthquake - Oklahoma County-Pipeline Identification. The county will provide a yearly check on the location of the pipelines within the county. In addition, they will also provide a geographic map denoting high risk areas for pipeline ruptures. Collaborative efforts are on-going with owners and operators of these lines, including awareness, public education and applicable safety measures. These issues are additionally part of All-Hazards public awareness and education efforts.									
	See above.	Existing	Non-Mitigative Action		OK Co. EM	Medium	Low - $5,000 (2006 cost)	Oklahoma County	Ongoing (continuous)	High
	Wildfire - Fire Awareness Program. The County will collaborate with the fire departments within the jurisdictions and establish a program to reduce the risk of wildfires. This program will inform the citizens of how to prevent and minimize the effects of wildfires. Uncontrolled wildland fires continue to be a significant threat for our area. Public education and awareness combined with applicable fire prevention efforts will continue indefinitely.									
	See above.	N/A	Wildfire		OK Co. EM working with local fire departments	Medium	Low - $1,000 (2006 cost)	Oklahoma County	Ongoing (continuous)	High
	Drought - Increase drought awareness to the public. Establish a working relationship with local newspapers, local radio stations, and county weather professionals to effectively communicate with county agricultural producers. Continued All-Hazard public efforts are addressing the awareness side of this issue and they will continue indefinitely.									
	See above.	N/A	Non-Mitigative Action		County Planning Commission	Medium – High	Low - $1,000 (2006 cost)	Oklahoma County	Ongoing (continuous)	High
	Identify, prioritize and implement fixed site generator projects as funding is secured. Targeted facilities include county office building and courthouse, county commissioner highway districts, social services, etc. Generators can be used to power items	N/A	All hazards that result in power failure (Dam Failure, Earthquake, Extreme Temperatures, Flooding, Lightning, Hail Wind (incl. tornado), Severe Winter		OK Co. EM	Medium (continuity of operations and government)	Medium	Available grant programs (EMPG [SLA], HMPG 5% initiative)	Long-term DOF	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	after a dam failure takes down poles, an earthquake shakes lines down, rolling blackouts during extreme temps, outages caused by floods, lightning, hail destroying power insulators, wildfires burning up poles, and ice taking down lines in winter storms.		Storm), Wildfire							
	Crutcho Creek – Ongoing acquisition program of properties in floodplains. This is an on-going, repetitive loss area with the most cost effective results to be obtained through property buy-out. Voluntary property acquisition continues under a Federal Hazard Mitigation Grant. Three phases have been completed, two phases still underway. As of 10-5-12, have removed fifty-nine (59) single family residences at a cost of approximately $5,495,920. Phases IV and V are still moving forward.									
	See Above.	Existing	Flood		OK Co. Hwy District #1	High	High	County District #1 budget, FEMA HMGP, other grants	Ongoing	High
	Demolition of bridge collapsed in Crutcho Creek	N/A	Flood		OK Co. Hwy District #1	Medium - High	Low - Medium	County District #1 budget	Short	TBD
	Retrofit structures located in hazard-prone areas in Unincorporated Oklahoma County to protect structures from future damage, with repetitive loss and severe repetitive loss properties as priority. Phase 1: Identify appropriate candidates for retrofitting based on	Existing	Flood		County (via county engineer/NFIP Floodplain Administrator) with support from OEM, FEMA	High	High	FEMA HMGP, local budget (or property owner) for cost share	Long-term DOF	Medium-High*

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	cost-effectiveness versus relocation. Phase 2: Where retrofitting is determined to be a viable option, work with property owners toward implementation of that action based on available funding from FEMA and local match availability.									
	Purchase, or relocate structures located in hazard-prone areas in Unincorporated Oklahoma County to protect structures from future damage, with repetitive loss and severe repetitive loss properties as priority. Phase 1: Identify appropriate candidates for relocation based on cost-effectiveness versus retrofitting. Phase 2: Where relocation is determined to be a viable option, work with property owners toward implementation of that action based on available funding from FEMA and local match	Existing	Flood		County (via county engineer/NFIP Floodplain Administrator) with support from OEM, FEMA	High	High	FEMA Mitigation Grant Programs and local budget (or property owner) for cost share	Long-term DOF	Medium-High*

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	availability.									
	Adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community.	New & Existing	(NFIP Compliance)		County (via County Engineer /NFIP Floodplain Administrator)	High	Low - Medium	County Budget	Ongoing	High
	Conduct and facilitate community and public education and outreach for residents and businesses to include, but not be limited to, the following to promote and effect natural hazard risk reduction: • Provide and maintain links to the HMP website, and regularly post notices on the County/municipal homepage(s) referencing the HMP webpages. • Prepare and distribute informational letters to flood vulnerable property owners and neighborhood associations, explaining the availability of mitigation grant funding to mitigate their properties, and instructing them on how they can learn more and implement mitigation. • Use email notification systems and newsletters to better educate the public on flood insurance, the availability of mitigation grant funding, and personal natural hazard risk reduction measures. • Work with neighborhood associations, civic and business groups to disseminate information on flood insurance and the availability of mitigation grant funding.									
	See above.	NA	Flood		OK Co. Planning Department	Low - Medium	Low - Medium	County Budget	Short	High
	Participate in the Community Rating System (CRS) to further manage flood risk and reduce flood insurance premiums for NFIP policyholders. This shall start with the submission to FEMA-DHS of a Letter of Intent to join CRS,	NA	(NFIP Complaince)		NFIP Floodplain Administrator	Low	Low	County Budget	Short (year 1)	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	followed by the completion and submission of an application to the program.									
	Archive elevation certificates	NA	(NFIP Compliance)		NFIP Floodplain Administrator	Low	Low	County Budget	On-going	High
	Distribute NOAA All-hazard radios to multiple occupancy sites, including schools, nursing homes, assisted living centers and daycares.	N/A	Dam Failure, Drought, Earthquake, Extreme Temperatures, Flood, Hail, Lightning, Wildfire, Wind, Winter Storm		OK Co. EM	High	Low	HMGP Grant, County budget	Short	Medium
	Install a mass notification system for the unincorporated area and possibly in conjunction with incorporated municipalities	N/A	Dam Failure, Drought, Earthquake, Extreme Temperatures, Flood, Hail, Lightning, Wildfire, Wind, Winter Storm		OK Co. EM	High	Medium	HMGP Grant, EMPG (SLA) Grant, County budget	Short	Medium
	Build or procure a structure to protect County EM assets (including vehicles and trailers) from hail and extreme temperature fluctuations that can damage interior, sensitive electronic equipment, emergency supplies on support vehicles	N/A	Hail, Extreme Temperatures		OK Co. EM	Medium	Low	County budget	Short	High
	Enact a regulation to		Expansive		OK Co.	High	Low	County	Short	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	require a check for expansive soils and perform subsequent soil stabilization before construction of new buildings on county property.		Soil		Planning w/ County Commissioners			budget		
	Create an expansive soils public education mitigation page on the public County website to inform the public how to prevent expansive clay soil damage to their homes before a home is built and after. The county Engineer and Planning can refer citizens and builders to the page.		Expansive Soil		OK Co EM w/ OK County IT	Medium	Low	County budget	Short	Medium
	Collect high hazard dam inundation maps from Oklahoma City if they are ever created.	Existing	Dam Failure		Oklahoma City EM	High	Low	(Free – Oklahoma City provides)	Long Term	Low

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.

Costs:
Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:

Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

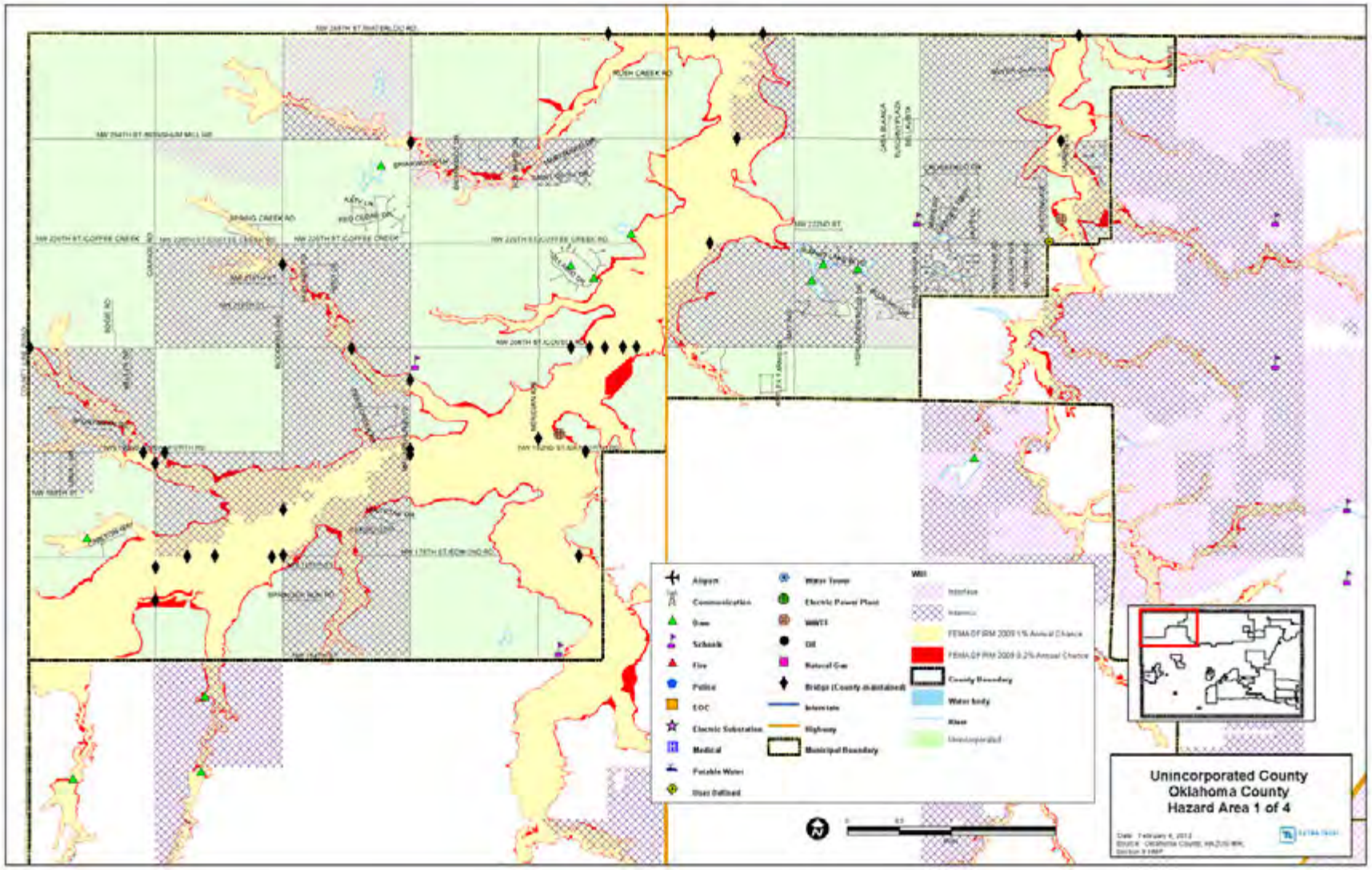
None at this time.

G.) HAZARD AREA EXTENT LOCATION

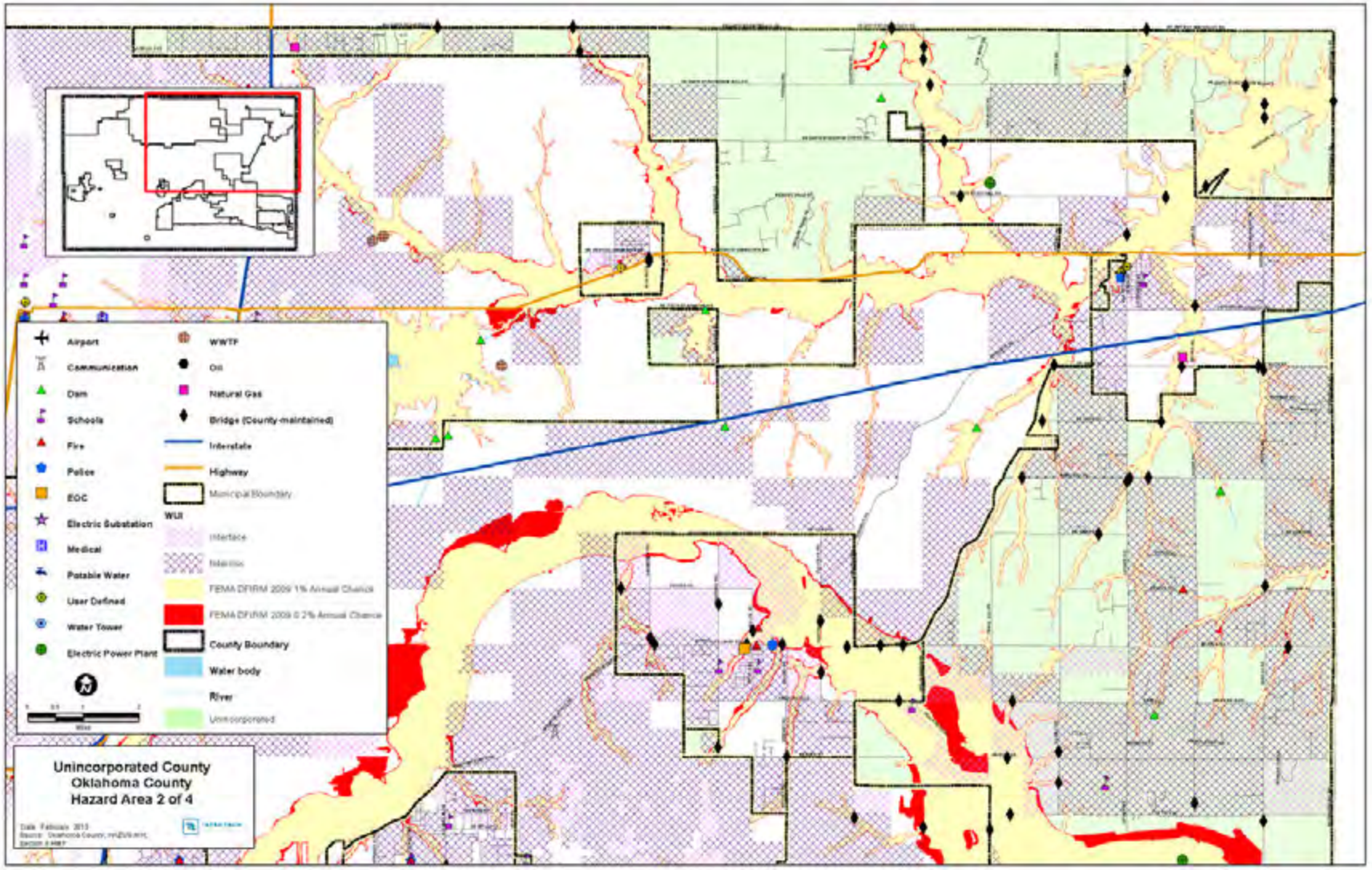
A hazard area extent and location map has been generated and is provided below for Oklahoma County to illustrate the probable areas impacted within the County. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the County has significant exposure. Additional county maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

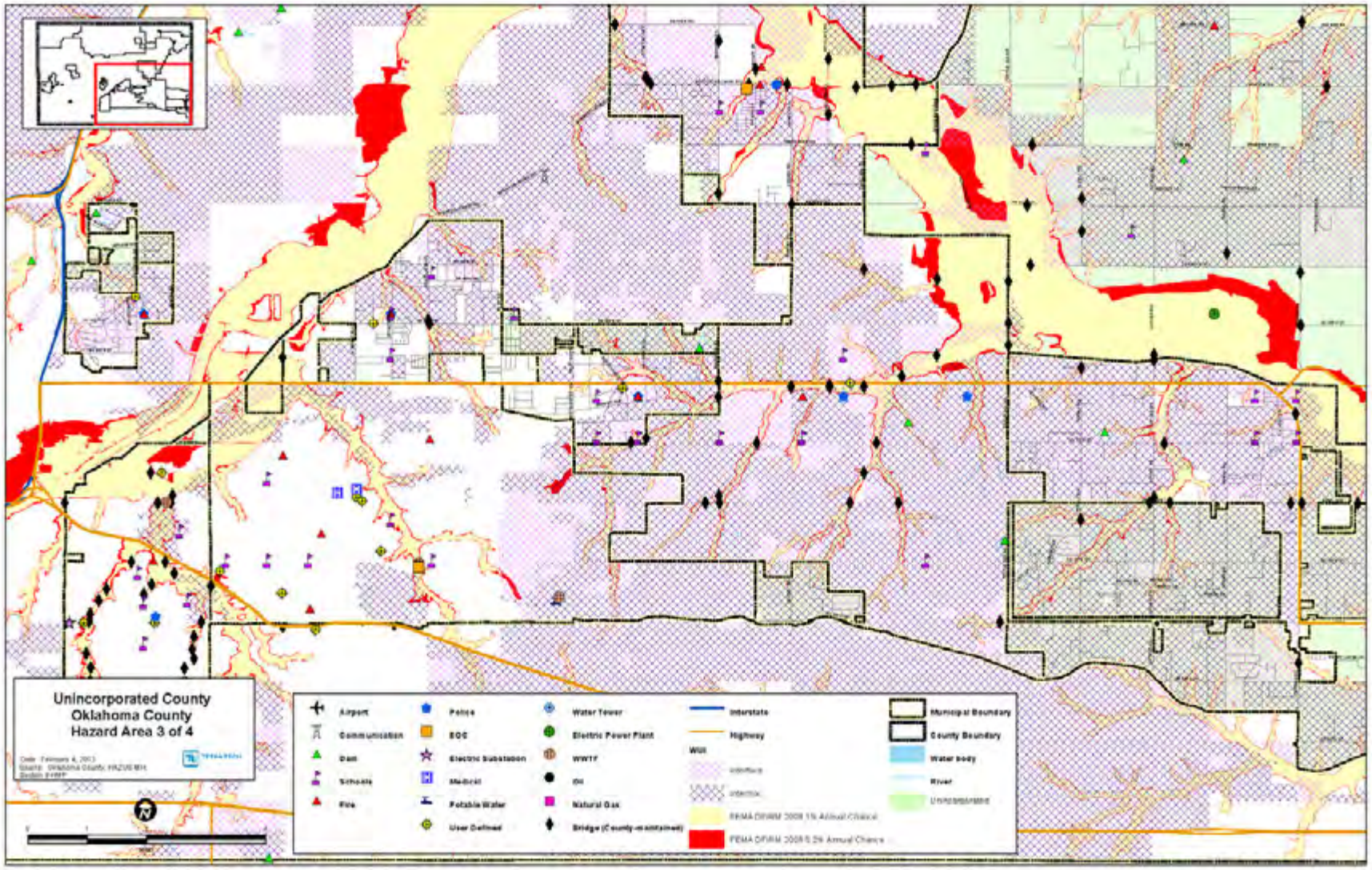
No additional comments at this time.



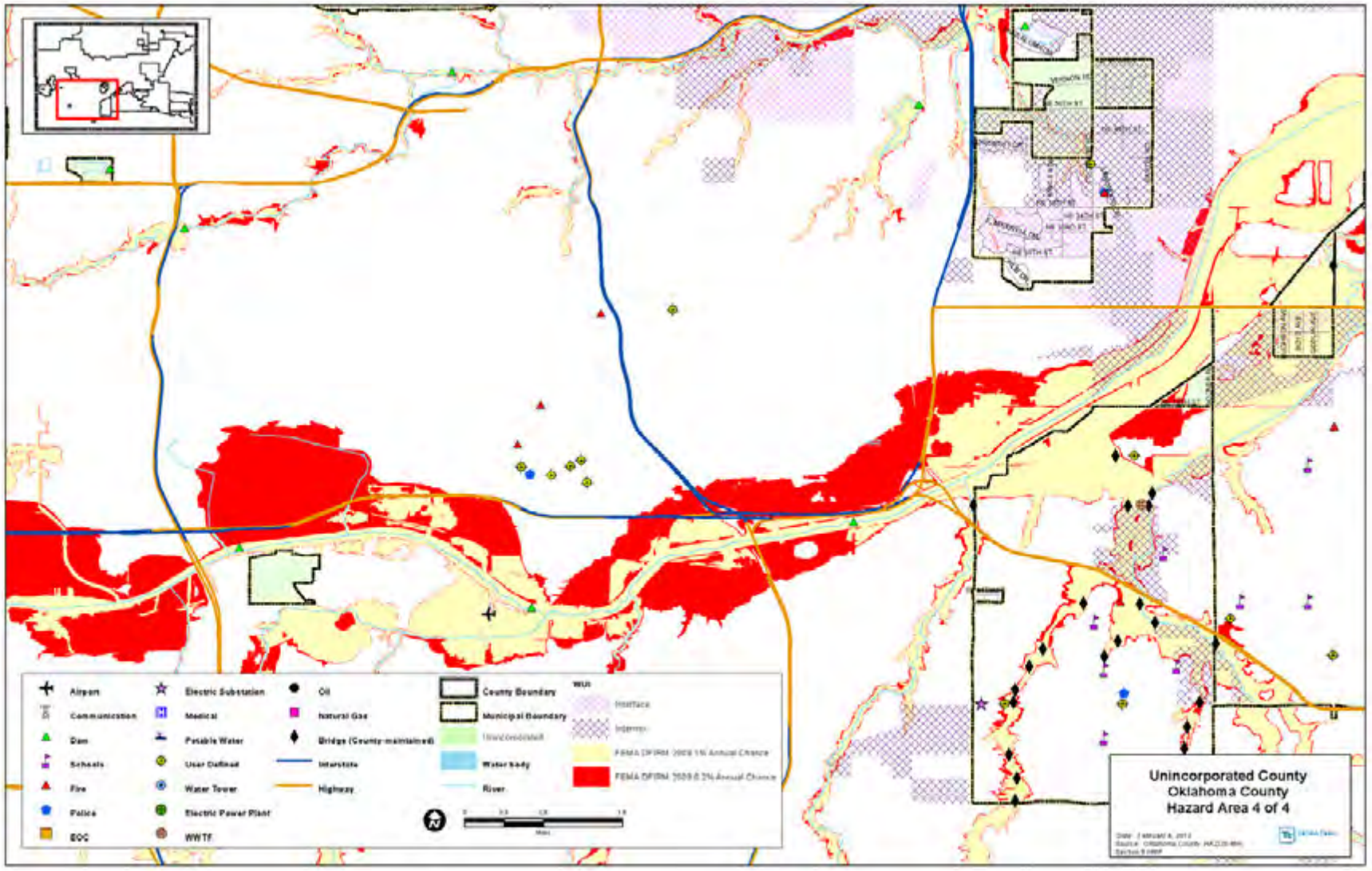
Northwest Oklahoma County



Northeast Oklahoma County



Southeast Oklahoma County



Southwest Oklahoma County

9.2 TOWN OF ARCADIA

This section presents the jurisdictional annex for the Town of Arcadia.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Gerald McCauley, Police Department P.O. Box 268, Arcadia, OK 73007 (405) 396-2899 policedept@townofarcadia.com	

B.) MUNICIPAL PROFILE

The Town of Arcadia is located in northern Oklahoma County. The Town is located along Route 66, 15 miles north of Oklahoma City. The Town of Arcadia has a total land area of 1.5 square miles, all of it land. The Town is governed by a mayor and two member Town Board. The 2010 U.S. Census population for the Town of Arcadia was 247.

Growth/Development Trends

No known or anticipated new development has been identified in the Town of Arcadia at this time.

Past Mitigation Activity/Efforts

Arcadia adopted an 18" freeboard ordinance to reduce the possibility of structural flooding.

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the Town of Arcadia is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	Yes	Arcadia Lake - See local hazard map end of section
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	Yes	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the Town of Arcadia, the following have been identified as specific hazard vulnerabilities in the City:

A few businesses and few homes near the intersection of Highway 66 and S. Odor St. are shown to be in FEMA's 1% SFHA. A convenience store in the southwest part of town is on elevated ground but is in the Arcadia lake dam failure swash zone.

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE TOWN

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Flooding	DR-441	Yes	
November 26, 1974	Flooding	DR-453	Yes	
May 20, 1977	Tornado	N/A	N/A	
May 17, 1981	Tornado	N/A	N/A	
October 17-19, 1983	Flooding	DR-693	Yes	
September 29 – October 1, 1986	Flooding	DR-778	Yes	
May 2, 1990	Flooding, Severe Storm, Tornado	DR-866	Yes	
May 10, 1992	Tornado	N/A	N/A	
May 8, 1993	Severe Storm, Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
September 7, 2001	Urban Flooding	N/A	N/A	
August 11-12, 2004	Flash Flood	N/A	N/A	
March 12, 2006	Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	
January 12-26, 2007	Severe Winter Storms	DR-1678	No	
March 29, 2007	Tornadoes	N/A	N/A	
May 4-11, 2007	Tornadoes, Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Flooding, Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Severe Storms, Flooding, Tornadoes	DR-1712	Yes	
Aug. 18, 2007 to Sept. 12, 2007	Tornadoes, Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	
March 17-23, 2008	Tornadoes, Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	
March 30-31, 2008	Severe Storms	N/A	N/A	
April 9-28, 2008	Tornadoes, Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 9, 2008	Floods	DR-1754	No	
May 10-13, 2008	Tornadoes, Flooding	DR-1756	No	
June 3-20, 2008	Flooding	DR-1775	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Tornadoes, Flooding	DR-1803	No	
February 10-11, 2009	Tornadoes	DR-1820	Yes	
March 24, 2009	Severe T-Storms	N/A	N/A	
March 26-27, 2009	Snow/Ice/Severe T-Storm	N/A	N/A	
March 30, 2009	Severe Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	
May 13, 2009	Severe Storm	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Tornadoes, Straight-Line Winds	DR-1917	Yes	
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
May 10-13, 2010	Tornadoes, and Straight-Line Winds	DR-1917	Yes	
July 7-8, 2010	Flooding	N/A	N/A	
Oct. 13, 2010	Earthquake	N/A	N/A	
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	
April 14, 2011	Tornadoes, Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Flooding	DR-1988	No	
May 22-25, 2011	Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Extreme Heat	N/A	N/A	

Number of FEMA Identified Repetitive Flood Loss Properties: 0
Number of FEMA Identified Severe Repetitive Flood Loss Properties: 0

Source: Oklahoma Water Resources Board (OWRB)

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances, Plans)	**Do you have this?** (Y or N)	**Code Citation** (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	1992 – Part 5, Chapter 1
Comprehensive / Master Plan	N	
Zoning Management Ordinance	Y	1987 – Part 13, Chapter 15
Subdivision Management Ordinance	N	
Site Plan Review Requirements	Y	1992 – Part 5, Chapter 1
NFIP Flood Damage Prevention Ordinance (if you are in the NFIP, you must have this!)	Y	2005
NFIP Elevation Certificates Maintained	Y	
Floodplain Management Plan	Y	
Stormwater Management Plan / Ordinance	N	
Stream Corridor Management or Protection Plan	N	
Erosion Management Ordinance	N	
Capital Improvements Plan	Y	2003
Open Space Plan	N	
Economic Development Plan	N	
Emergency Response Plan	Y	
Post Disaster Recovery Plan / Ordinance	N	
Real Estate Disclosure Requirements	N	
Highway Management Plan	N	
COOP/COG Plan	N	
Other (Special Purpose Ordinances such as critical or sensitive areas)	N	

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Y	
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Y	
Planners or engineers with an understanding of natural hazards	N	
NFIP Floodplain Administrator	Y	
Surveyor(s)	N	
Personnel skilled or trained in "GIS" applications	N	
Scientist familiar with natural hazards	N	
Emergency Manager	Y	
Grant Writer(s)	Y	
Staff with expertise or training in benefit/cost analysis	Y	

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	Yes
Capital Improvements Project Funding	
Authority to Levy Taxes for specific purposes	Yes
User fees for water, sewer, gas or electric service	Don't Know
Impact Fees for homebuyers or developers of new development/homes	
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	
Incur debt through private activity bonds	Don't Know
Withhold public expenditures in hazard-prone areas	Don't Know
Other	

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	TBD	TBD
Public Protection	TBD	TBD
Storm Ready	County	TBD
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Arcadia's small size and limited tax base present challenges to mitigation capabilities and the ability to expand on and improve these capabilities without assistance from outside resources. Building codes and zoning management ordinances could be reviewed to determine if an update would support the mitigation strategy and would support Goal #6 (Structural Projects). With the North Canadian River nearby, the Floodplain Management Plan presents good opportunities to promote the mitigation strategies in this Plan and supports Goal #3 (Protecting Critical Facilities). Having a planner available with knowledge of land development and land management practices increases the ability to mitigate against wildfire, flooding, and other hazards, and supports Goal #2 (Prevention) in the plan. Having a designated Emergency Manager provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). Contract grant writers assist in accomplishing the mitigation actions laid out in this plan. The fiscal capabilities of items such as Community Development Block Grants and other fees and debts present opportunities for monies for mitigation projects and for public education and Goal #5 (Public Awareness).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Maintain compliance with and good-standing in the NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community.	New & Existing	NFIP Compliance		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, ISO FEMA	High	Low - Medium	Local Budget	Ongoing	High
	Conduct and facilitate community and public education and outreach for residents and businesses to include, but not be limited to, the following to promote and effect natural hazard risk reduction: • Provide and maintain links to the HMP website, and regularly post notices on the County/municipal homepage(s) referencing the HMP webpages. • Prepare and distribute informational letters to flood vulnerable property owners and neighborhood associations, explaining the availability of mitigation grant funding to mitigate their properties, and instructing them on how they can learn more and implement mitigation. • Use email notification systems and newsletters to better educate the public on flood insurance, the availability of mitigation grant funding, and personal natural hazard risk reduction measures. • Work with neighborhood associations, civic and business groups to disseminate information on flood insurance and the availability of mitigation grant funding.									
	See above.	NA	Flood		Municipality with support from Planning Partners, OEM, FEMA	Low - Medium	Low - Medium	Municipal Budget; HMA programs with local or county match	Short	High
	Participate in the	NA	NFIP		NFIP	Low	Low	Municipal	Short	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Community Rating System (CRS) to further manage flood risk and reduce flood insurance premiums for NFIP policyholders. This shall start with the submission to FEMA-DHS of a Letter of Intent to join CRS, followed by the completion and submission of an application to the program once the community's current compliance with the NFIP is established.		Compliance		Floodplain Administrator with support from OEM, FEMA			Budget	(year 1)	
	Archive elevation certificates	NA	NFIP Compliance		NFIP Floodplain Administrator	Low	Low	Local Budget	On-going	High
	Purchase Weather Radios to warn workers in city buildings		Dam Failure, Drought, Earthquake, Extreme Temperatures, Flood, Hail, Lightning, Wind, Wildfire, Winter Storm		Police w/ Fire Dept.	High	Low	HMGP	Short	Medium
	Create mitigation education brochures and distribute to residents public city venues and through the town website.		Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperatures, Flood, Hail, Lightning, Wildfire, Wind, Winter Storms		Town Admin. (Mayor)	High	Low	Town budget	Short	Medium
	Enact a regulation to	New	Expansive		Code	Medium	Medium to	Town	Long	Low

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	require a check for expansive soils prior to building a public building and perform soil stabilization if expansive soils are found.		Soil		Enforcement		High	budget		
	Install permanent backup generators at Town Hall and Fire Station. Generators can be used to power items after a dam failure takes down poles, an earthquake shakes lines down, rolling blackouts during extreme temps, outages caused by floods, lightning, hail destroying power insulators, wildfires burning up poles, and ice taking down lines in winter storms.	Existing	Dam Failure, Earthquake, Extreme Temperatures, Flood, Hail, Lightning, Wildfire, Wind, Winter Storms		Fire Dept.	High	Low	HMGP with town match	Short	High

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.

Costs:
Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000

High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

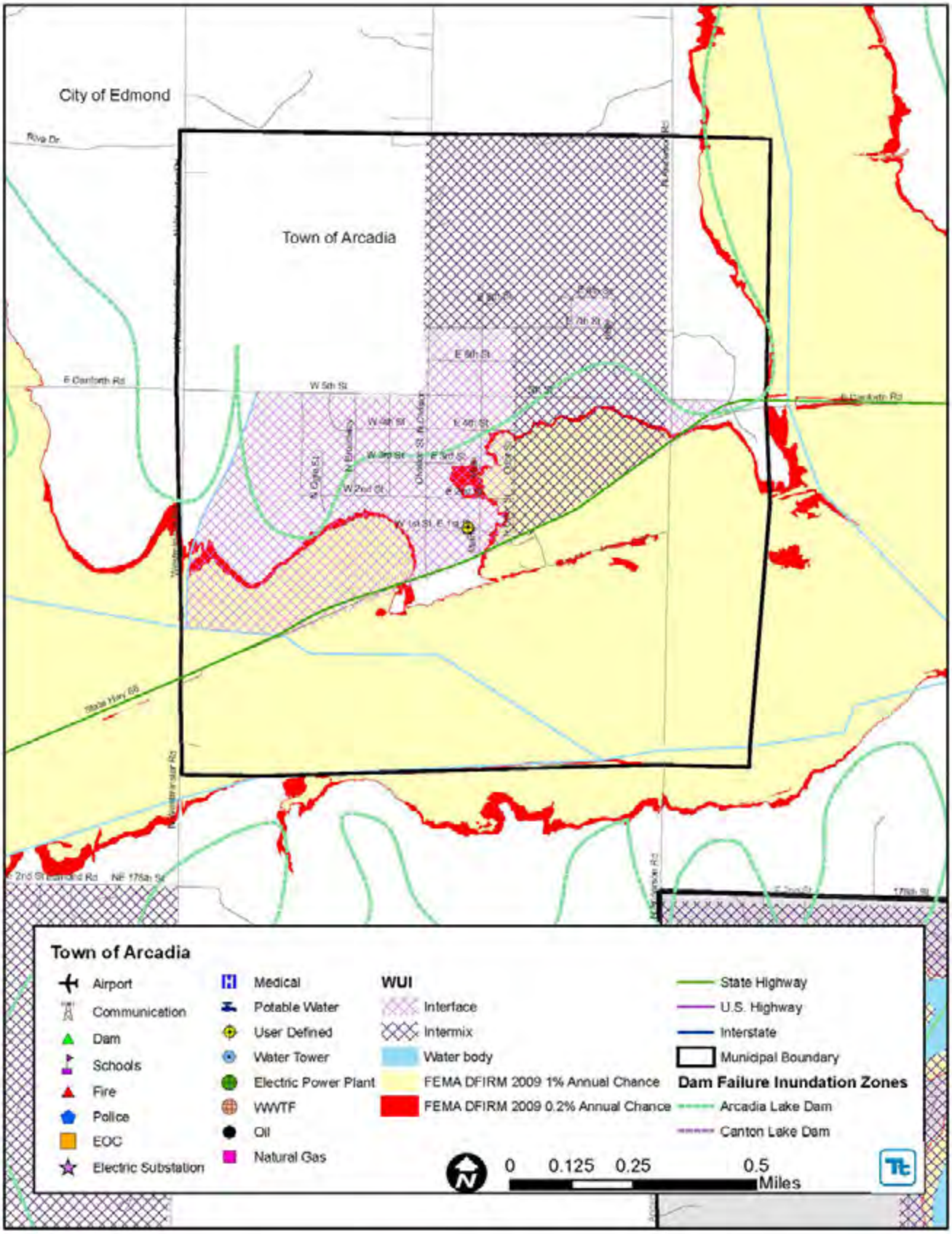
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the Town of Arcadia to illustrate the probable areas impacted within the Town of Arcadia. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the Town of Arcadia has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


City of Edmond
Town of Arcadia
Town of Arcadia
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
Water body
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
State Highway
U.S. Highway
Interstate
Municipal Boundary
Dam Failure Inundation Zones
Arcadia Lake Dam
Canton Lake Dam
0
0.125
0.25
0.5
Miles

9.3 CITY OF BETHANY

This section presents the jurisdictional annex for the City of Bethany.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Scott Schroder, Fire Chief/Emergency Manager 3919 Rockwell Avenue, Bethany, OK 73008 (405) 789-2218 scott.schroder@bethanyok.org	

B.) MUNICIPAL PROFILE

The City of Bethany is located in southwestern Oklahoma County. The City is bordered to the north by Oklahoma City and the City of Warr Acres, to the east by the City of Warr Acres and to the south and west by Oklahoma City. The City of Bethany has a total land area of 5.2 square miles, all of it land. The City is governed by a mayor and eight member (two members from each of the four wards) City Council. The 2010 U.S. Census population for the City of Bethany was 19,051.

Growth/Development Trends

Commercial development is taking place at the 7200 blk. of NW 23rd where three lots are platted. One big box store has a building planned for this location.

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the City of Bethany in the 2006 plan. Bethany did not adopt the FEMA approved 2006 County plan so the following information is provided as reference only:

2006 Initiative Description	Status	Comments
Replace existing six (6) mechanical storm siren warning system with a new system comprising eight (8) electronic state-of-the-art horns. This system could not only be used for advancing storm notification, but could also be utilized (by voice messaging) for any other disaster requiring immediate notification to the community.	New (Previous plan not adopted)	Currently, the City of Bethany has no dedicated funds for this project. We are hopeful that at some point, this project would qualify for state or federal grant funding.

Further details on mitigation activities completed or ongoing in the City include:

- Installed a steel gable roof on the fire department in 2012 to mitigate hail.
- The local electric company has temporarily mitigated ice storm concerns by trimming the trees in the area.
- Adopted an ordinance in 2009 increasing freeboard requirements. The change includes a requirement for a "no rise certificate" where the SFHA cannot be elevated where it may cause flooding elsewhere.

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the City of Bethany is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	Yes	Canton Lake - See local hazard map end of section
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	
Hail	Yes	
Lightning	Yes	
Wildfire	Yes	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the City of Bethany, the following have been identified as specific hazard vulnerabilities in the City:

Bethany has a dam failure risk from Canton Lake but not Overholser since it is upstream from the dam.
A trailer park exists in a floodplain north of 50th St. and Peniel Ave. It is privately owned. This area is identified as being in the FEMA 1% annual chance SFHA.
Road flooding occurs north of 25th St. and Peniel Ave. after heavy rains. No notable road damage has occurred.
NW 39th St. and Rockwell is impassable at times after heavy rains.
A wildfire risk exists in the McMillian Park and Riverside Park areas north of NW 39th near Council Rd where numerous trees exist.
The water plant has vulnerability to wildfire due to trees that are on nearby private property, however there is a water canal between the trees and the facility so the vulnerability is low.

Vulnerability assessment modeling has identified the following flood vulnerabilities (see Flood Hazard Profile in Section 5.3):

Critical Facilities Located in the DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss			
			100-Yr	500-Yr	100-Yr Structure Damage %	100-Yr Content Damage %	500-Yr Structure Damage %	500-Yr Content Damage %
APOLLO ES	Bethany (C)	School			9.0	62.9	10.1	68.1
BETHANY CHRISTIAN ACADEMY	Bethany (C)	School			9.0	62.9	10.1	68.1

Source: FEMA, 2009; HAZUS-MH 2.0

Utilities Located in the Preliminary DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss	
			100 Year	500 Year	100 Year Damage %	500 Year Damage %
Bethany Water Plant	Bethany (C)	Potable Water			40.0	40.0

Source: FEMA, 2009; HAZUS-MH 2.0
Notes:

(1) 'X' indicates the facility location as provided by Oklahoma County's Planning Committee is located in the DFIRM flood zone.

(2) HAZUS did not calculate potential loss estimates for some facilities located in the DFIRM flood zone. This is because these facilities are either located outside of the flood depth grid generated by HAZUS, or the depth of water is too shallow and no losses are estimated. When there is a difference between the flood depth grid generated by HAZUS and the DFIRM flood zones, it is most likely due to the resolution of the elevation model used (1/3 Arc Second or 10 meters) which differed from the elevation data used to generate the DFIRM itself.

(3) In some cases, HAZUS calculated potential flood loss to structures outside the FEMA DFIRM. These facilities are located inside the HAZUS flood depth grid.

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE CITY

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Flooding	DR-441	Yes	
November 26, 1974	Flooding	DR-453	Yes	
October 17-19, 1983	Flooding	DR-693	Yes	
September 29 – October 1, 1986	Flooding	DR-778	Yes	
May 2, 1990	Flooding, Tornado	DR-866	Yes	
May 8, 1993	Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
May 9, 2003	Tornado	N/A	N/A	Eight injuries, tornado affected Warr Acres as well.
August 11-12, 2004	Flash Flood	N/A	N/A	In the City of Bethany, Eldon Lyon Park was inundated by flash flooding. Water had to be pumped out of the park.
March 12, 2006	Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
January 12-26, 2007	Severe Winter Storms	DR-1678	No	Extensive power line damage from ice and downed trees. House fires resulted in Bethany.
March 29, 2007	Tornadoes	N/A	N/A	
May 4-11, 2007	Tornadoes, Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Flooding, Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Flooding, Tornadoes	DR-1712	Yes	
Aug. 18, 2007 to Sept. 12, 2007	Tornadoes, Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	
March 17-23, 2008	Tornadoes, Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	
March 30-31, 2008	Severe Storms	N/A	N/A	
April 9-28, 2008	Tornadoes, Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 9, 2008	Flooding	DR-1754	No	
May 10-13, 2008	Tornadoes, Flooding	DR-1756	No	
June 3-20, 2008	Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Tornadoes, Flooding	DR-1803	No	
February 10-11, 2009	Tornadoes	DR-1820	Yes	
March 24, 2009	Severe Storms	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	
March 30, 2009	Severe Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	
May 13, 2009	Severe Storms	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Tornadoes, Straight-Line Winds	DR-1917	Yes	
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	
May 10-13, 2010	Tornadoes, and Straight-Line Winds	DR-1917	Yes	
July 7-8, 2010	Flooding	N/A	N/A	
Oct. 13, 2010	Earthquake	N/A	N/A	
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
April 14, 2011	Tornadoes, Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Flooding	DR-1988	No	
May 22-25, 2011	Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Severe Heat	N/A	N/A	

Number of FEMA Identified Repetitive Flood Loss Properties: 1 residential*
Number of FEMA Identified Severe Repetitive Flood Loss Properties: 0

Source: Oklahoma Water Resources Board (OWRB), Bethany Floodplain Manager
*Note: The Bethany Floodplain manager indicates that this property flooded in the 1980s from clogged drainage that has been consistently maintained since then.

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances, Plans)	**Do you have this?** (Y or N)	**Code Citation** (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	2009 IBC
Comprehensive / Master Plan	Y	New plan in budget
Zoning Management Ordinance	Y	
Subdivision Management Ordinance	Y	
Site Plan Review Requirements	Y	
NFIP Flood Damage Prevention Ordinance (if you are in the NFIP, you must have this!)	Y	Title XV, Chapter 156
NFIP Elevation Certificates Maintained	Y	
Floodplain Management Plan	N	
Stormwater Management Plan / Ordinance	Y	
Stream Corridor Management or Protection Plan	N	
Erosion Management Ordinance	Y	
Capital Improvements Plan	Y	
Open Space Plan	N	
Economic Development Plan	N	
Emergency Response Plan	Y	
Post Disaster Recovery Plan / Ordinance		
Real Estate Disclosure Requirements		
Highway Management Plan	N	
COOP/COG Plan		
Other (Special Purpose Ordinances such as critical or sensitive areas)		

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Y	
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Y	
Planners or engineers with an understanding of natural hazards	Y	
NFIP Floodplain Administrator	Y	Appointed by City Council
Surveyor(s)	N	
Personnel skilled or trained in "GIS" applications	N	
Scientist familiar with natural hazards	N	
Emergency Manager	Y	
Grant Writer(s)	Y	
Staff with expertise or training in benefit/cost analysis	Y	

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for specific purposes	Yes
User fees for water, sewer, gas or electric service	Yes
Impact Fees for homebuyers or developers of new development/homes	Yes (for utilities for new construction)
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activity bonds	
Withhold public expenditures in hazard-prone areas	
Other	

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	TBD	TBD
Public Protection	TBD	TBD
Storm Ready	County	TBD
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. The new comprehensive plan in the budget is a great opportunity to expand on and improve the policies and programs identified herein. Local floodplain management presents good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). Adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. Zoning management presents an opportunity to regulate positioning large quantities of hazardous materials that may be a secondary threat after a natural hazard incident and supports Goal #6 (Structural Projects). Having Planners and Engineers with knowledge of land development and land management practices increases the ability to mitigate against wildfire, flooding, and other hazards, and supports Goal #2 (Prevention) in the plan. Having a local Emergency Manager provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). The fiscal capabilities of items such as Community Development Block Grants and other fees and debts present opportunities for monies for public education and Goal #5 (Public Awareness).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Replace existing six (6) mechanical storm siren warning system with a new system comprising eight (8) electronic state-of-the-art horns. This system could not only be used for advancing storm notification, but could also be utilized (by voice messaging) for any other disaster requiring immediate notification to the community. (2006 Plan – technically a new action, old plan was never adopted)		Wind		Fire Dept.	High	$125,000	HMGP, Bonds	Short	High
	Maintain compliance with and good-	New & Existing	NFIP Compliance		Municipality (via Municipal Engineer/NFIP	High	Low - Medium	Local Budget	Ongoing	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	standing in the NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community.				Floodplain Administrator) with support from OEM, ISO FEMA					
	Conduct and facilitate community and public education and outreach for residents and businesses to include, but not be limited to, the following to promote and effect natural hazard risk reduction: • Provide and maintain links to the HMP website, and regularly post notices on the County/municipal homepage(s) referencing the HMP webpages. • Prepare and distribute informational letters to flood vulnerable property owners and neighborhood associations, explaining the availability of mitigation grant funding to mitigate their properties, and instructing them on how they can learn more and implement mitigation. • Use email notification systems and newsletters to better educate the public on flood insurance, the availability of mitigation grant funding, and personal natural hazard risk reduction measures. • Work with neighborhood associations, civic and business groups to disseminate information on flood insurance and the availability of mitigation grant funding.									
	See above.	NA	Flood		Municipality with support from Planning Partners, OEM, FEMA	Low - Medium	Low - Medium	Municipal Budget; HMA programs with local or county match	Short	High
	Archive elevation certificates	NA	NFIP Compliance		NFIP Floodplain Administrator	Low	Low	Local Budget	On-going	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Increase the size of open channels to upgrade capacity at NW 39th St. and Rockwell Ave. to eliminate the likelihood of impassable streets after heavy rains		Flood		Community Development	High	High	HMGP, Bonds	Long term DOF	Medium
	Revise a regulation to limit height of structures to reduce likelihood of neighboring structural damage in an earthquake		Earthquake		Community Development	HIgh	Low	City Budget	Short	Medium
	Install generators where critical city communication infrastructure exists (i.e. Police and Fire Dept.). Generators can be used to power items after a dam failure takes down poles, an earthquake shakes lines down, rolling blackouts during		Dam Failure, Earthquake, Extreme Temps, Flood, Hail, Lightning, Wildfire, Wind, Winter Storm		Police Dept.	High	Low	HMGP	Short	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	extreme temps, outages caused by floods, lightning, hail destroying power insulators, wildfires burning up poles, and ice taking down lines in winter storms.									
	Purchase trailer park located in the SFHA at NW 50th St. and Peniel Ave. to ensure land becomes green space.		Flood		Community Development	High	High	Bond, City Budget	Short	Medium
	Create and distribute dam failure, flood, drought, earthquake, expansive soil, extreme temperature, hail, lightning, wildfire, winter storm mitigation educational newsletters to include in resident utility bills, on city website and public access TV graphics.		Dam Failure, Drought, Earthquake, Expansive Soil, Extreme Temps, Flood, Hail, Lightning, Wildfire, Wind, Winter Storm		Community Development Director	High	Low	Storm water Mgmt. Fee	Short	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Obtain a mass notification system with text message, phone and email capability to warn residents prior to hazards and actions to take/avoid after an incident.		Dam Failure, Drought, Earthquake, Extreme Temps, Flood, Hail, Lightning, Wildfire, Wind, Winter Storm		Fire Dept.	High	Medium (Annual renewal)	Utility Fee	Short	High
	Enact a water rationing regulation for use during periods of drought.		Drought		Public Works	High	Low	City Budget	Short	High
	Establish an agreement with OKC and establish connections to obtain water during drought		Drought		Public Works	High	High	City Budget	Short	Medium
	Enact a regulation to require a check for expansive soils prior to building a city building and perform soil stabilization if expansive soils are found.		Expansive Soil		City Engineer	High	Medium	City Budget	Long	Low

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.
Costs:

Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

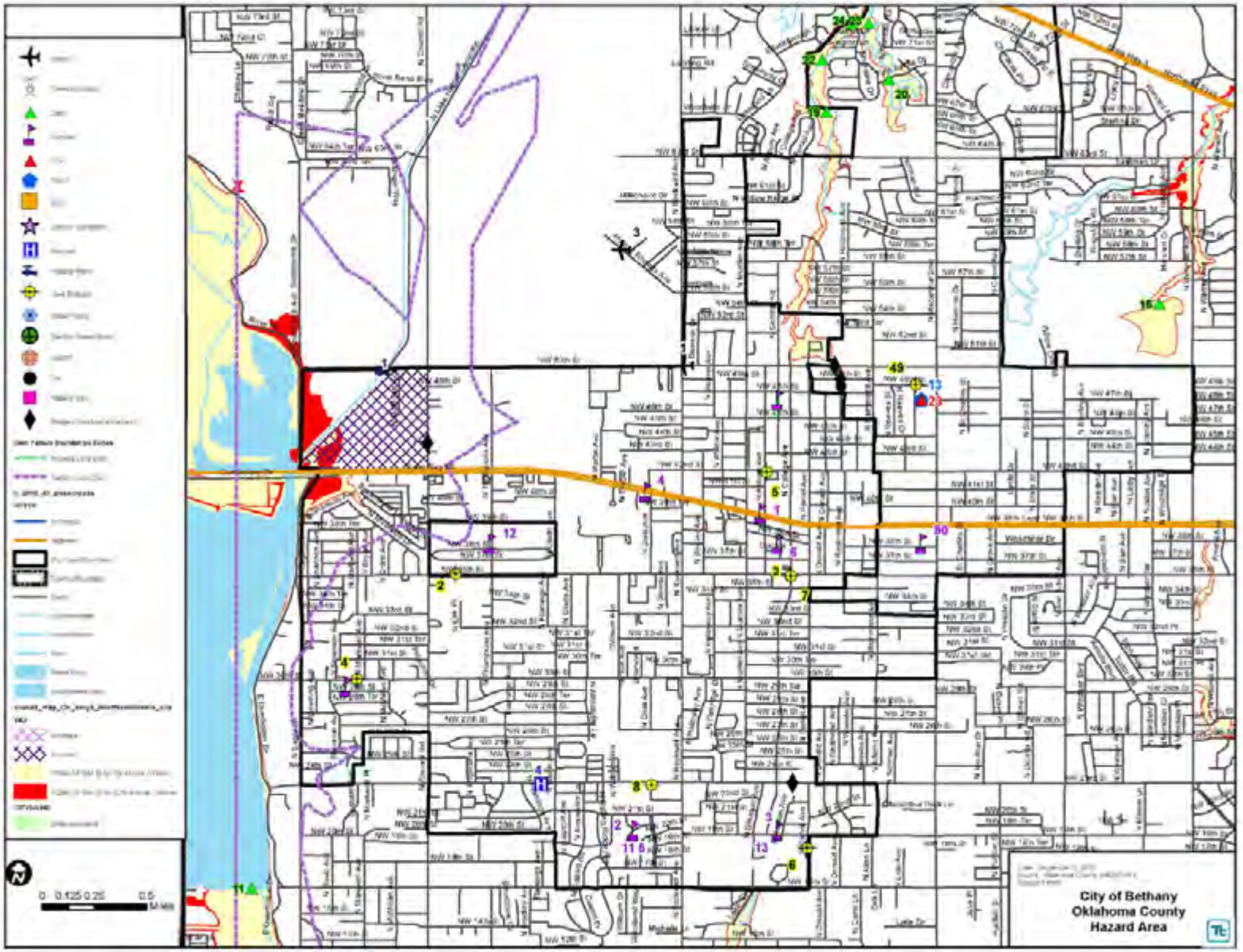
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the City of Bethany to illustrate the probable areas impacted within the City of Bethany. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the City of Bethany has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


City of Bethany
Oklahoma County
Hazard Area

9.4 CITY OF CHOCTAW

This section presents the jurisdictional annex for the City of Choctaw.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Loren Bumgarner, Fire Chief P.O. Box 567, Choctaw, OK (405) 310-3232 lbumgarner@choctawcity.org	

B.) MUNICIPAL PROFILE

The City of Choctaw is located in the southeastern section of Oklahoma County. The City of Oklahoma City and the Town of Jones border the City to the north; the City of Harrah to the east; the City of Oklahoma City to the south; and the City of Midwest City to the west. The City of Choctaw has a total land area of 27.1 square miles, of which, 27.1 square miles is land and 0.04 square miles is water. The City is governed by a mayor and six member City Council. The 2010 U.S. Census population for the City of Choctaw was 11,146.

The City has low-lying areas that are subject to periodic flooding caused by overflow of the Choctaw Creek and its tributaries, along with the North Canadian River. The most severe flooding occurs upstream from roadways that restrict the flow. Flooding along the Creek has not caused extensive property damage; however, future development could increase the threat of flood problems.

Growth/Development Trends

No known or anticipated new development has been identified in the City of Choctaw at this time.

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the City of Choctaw in the 2006 plan.

2006 Initiative Description	Status	Comments
The City of Choctaw has had to clean out the debris, trees, and underbrush from the Choctaw Creek on a regular basis. They would like to purchase a track hoe allowing them to keep the location consistently clean to alleviate unnecessary flooding.	Completed, however there is currently no funded program to support long term channel maintenance.	Track Hoe was purchased though a lease purchase program, and Choctaw Creek was cleaned out in 2007. The creek at this time needs to be cleaned again. It is full of trees, brush, trash and sediment. The City of Choctaw does not have the man power or time to perform this task again.

Further details on mitigation activities completed or ongoing in the City include:

- The City has taken advantage of the Residential Safe Room (Personal Shelter) Rebate Program retrofit residences with safe rooms throughout the City

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the City of Choctaw is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	Yes	Canton Lake, Overholser - See local hazard map end of section
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	Yes	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the City of Choctaw, the following have been identified as specific hazards:

- Choctaw Creek runs through a major area of the City. State Highway 62, or NE 23rd, is a four lane highway with commercial and residential areas that runs along the Creek. Choctaw Creek floods two to three times in a year, which the highway has to be shut down and some occupants have to be evacuated. The cause is the Creek fills with debris such as trees, brush, and sediment from other areas.

Vulnerability assessment modeling has identified the following flood vulnerabilities (see Flood Hazard Profile in Section 5.3):

Table 5.4.X-X Critical Facilities Located in the DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss			
			100-Yr	500-Yr	100-Yr Structure Damage %	100-Yr Content Damage %	500-Yr Structure Damage %	500-Yr Content Damage %
Choctaw City Hall	Choctaw (C)	User Defined		X	14.0	83.5	13.1	74.9

Source: FEMA, 2009; HAZUS-MH 2.0

Notes:

(1) 'X' indicates the facility location as provided by Oklahoma County's Planning Committee is located in the DFIRM flood zone.

(2) HAZUS did not calculate potential loss estimates for some facilities located in the DFIRM flood zone. This is because these facilities are either located outside of the flood depth grid generated by HAZUS, or the depth of water is too shallow and no losses are estimated. When there is a difference between the flood depth grid generated by HAZUS and the DFIRM flood zones, it is most likely due to the resolution of the elevation model used (1/3 Arc Second or 10 meters) which differed from the elevation data used to generate the DFIRM itself.

(3) In some cases, HAZUS calculated potential flood loss to structures outside the FEMA DFIRM. These facilities are located inside the HAZUS flood depth grid.

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE TOWN

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Flooding	DR-441	Yes	
November 26, 1974	Flooding	DR-453	Yes	
October 17-19, 1983	Flooding	DR-693	Yes	
September 29 – October 1, 1986	Flooding	DR-778	Yes	
May 2, 1990	Flooding, Tornado	DR-866	Yes	
May 8, 1993	Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	NE 23rd Street was closed due to flooding.
May 3-4, 1999	Tornadoes, Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
August 11-12, 2004	Flash Flood	N/A	N/A	
January 1, 2006	Wildfires	DR-1623	No	All residents in the path of the wildfire were evacuated. Road within the affected area were closed. Sixty-eight homes were lost due to this wildfire.
March 12, 2006	Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
January 12-26, 2007	Severe Winter Storms	DR-1678	No	
March 29, 2007	Tornadoes	N/A	N/A	
May 4-11, 2007	Tornadoes, Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Flooding, and Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Flooding, and Tornadoes	DR-1712	Yes	
Aug. 18, 2007 to Sept. 12, 2007	Tornadoes, and Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	Snow plowing, salting and sanding of all main roads in the City; removal of large amount of debris
March 17-23, 2008	Tornadoes, Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	
March 30-31, 2008	Severe Storms	N/A	N/A	
April 9-28, 2008	Tornadoes, Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 9, 2008	Flooding	DR-1754	No	
May 10-13, 2008	Tornadoes, Flooding	DR-1756	No	
June 3-20, 2008	Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Tornadoes, Flooding	DR-1803	No	
February 10-11, 2009	Tornadoes	DR-1820	Yes	
March 24, 2009	Severe Storms	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	
March 30, 2009	Severe Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	All residents in the path of the wildfire were evacuated. Road within the affected area were closed. Eight homes were lost due to this wildfire.
May 13, 2009	Severe Storms	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	Snow plowing, salting, and sanding of all main roads in the City
January 26-28, 2009	Severe Winter Storm	DR-1823	No	Yes
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	Snow plowing, salting, and sanding of all main roads in the City
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Tornadoes, Straight-Line Winds	DR-1917	Yes	
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	Roads were barricaded due to flooding in the City; bridges and culverts had to be repaired as a result of this event
May 10-13, 2010	Tornadoes, Straight-Line Winds	DR-1917	Yes	
July 7-8, 2010	Flooding	N/A	N/A	
Oct. 13, 2010	Earthquake	N/A	N/A	
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	Snow Plowing, Salting, Sanding of all main roads in the City

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 11, 2011	Wildfires	N/A	N/A	Yes
April 14, 2011	Tornadoes, Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Flooding	DR-1988	No	
May 22-25, 2011	Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Severe Heat	N/A	N/A	

Number of FEMA Identified Repetitive Flood Loss Properties: 0
Number of FEMA Identified Severe Repetitive Flood Loss Properties: 0

Source: Oklahoma Water Resources Board (OWRB)

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances., Plans)	Do you have this? (Y or N)	Code Citation (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	Adopted 2009 IBC
Comprehensive / Master Plan	Y	Pending Approval of City Council, updated plan
Zoning Management Ordinance	Y	Section 12, Chapters 2 and 3
Subdivision Management Ordinance	Y	Section 19, Ordinance 19-103
Site Plan Review Requirements	Y	Section 5, Ordinance 5-107
NFIP Flood Damage Prevention Ordinance	Y	Section 18, Chapter 2, Ordinance 18-101
NFIP Elevation Certificates Maintained	Y	Section 18, Ordinance 18-222
Floodplain Management Plan	N	
Stormwater Management Plan / Ordinance	Y	Section 17, Chapter 3
Stream Corridor Management or Protection Plan	N	
Erosion Management Ordinance	Y	Section 18, Ordinance 18-414
Capital Improvements Plan	N	
Open Space Plan	N	
Economic Development Plan	Y	CEDP
Emergency Response Plan	Y	County Plan
Post Disaster Recovery Plan / Ordinance	N	
Real Estate Disclosure Requirements	N	
Highway Management Plan	N	
COOP/COG Plan	Y	Members of ACOG
Other (Special Purpose Ordinances such as critical or sensitive areas)		

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Y	1 City Engineer, 1 City Planner
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Y	1 City Engineer
Planners or engineers with an understanding of natural hazards	Y	1 City Engineer, 1 City Planner
NFIP Floodplain Administrator	Y	1 City Engineer
Surveyor(s)	N	
Personnel skilled or trained in "GIS" applications	Y	1 City Engineer, 1 City Planner
Scientist(s) familiar with natural hazards in the County.	N	
Emergency Manager	Y	1 Emergency Director
Grant Writer(s)	N	
Staff with expertise or training in benefit/cost analysis	N	

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	Yes
Capital Improvements Project Funding	Yes (one cent sales tax)
Authority to Levy Taxes for specific purposes	Yes (City Council)
User fees for water, sewer, gas or electric service	Yes (Water and Sewer)
Impact Fees for homebuyers or developers of new development/homes	Yes
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activity bonds	Yes
Withhold public expenditures in hazard-prone areas	No
Other	

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	TBD	TBD
Public Protection	TBD	TBD
Storm Ready	County	TBD
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. Revisions to the comprehensive plan may provide an opportunity to expand on and improve the policies and programs identified herein. Zoning management and the Economic Development Plan present opportunities to regulate positioning large quantities of hazardous materials that may be a secondary threat after a natural hazard incident and supports Goal #6 (Structural Projects). Local floodplain management presents a good opportunity to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). Having a City Planner and a City Engineer with knowledge of land development and land management practices increases the ability to mitigate against wildfire, flooding, and other hazards, and supports Goal #2 (Prevention) in the plan. Their "GIS" skill sets support Goal #2 (Prevention) and Goal #3 (Protecting Critical Facilities) by identifying risk areas. Having a local Emergency Manager provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). The fiscal capabilities of items such Community Development Block Grants and Capital Improvements Project Funding, fees and debts present opportunities for monies to projects and Goal #6 (Structural Projects) public education and Goal #5 (Public Awareness).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures *	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Removal of debris (trees, brush, trash and sediment) from miles of Choctaw Creek. This will allow the Creek to flow better. This project will be implemented as part of anticipated commercial development plans. This project may be done in conjunction with Oklahoma County to reduce or eliminate flooding over a larger area.	N/A	(Non Mitigation)		DPW, with County Support	Medium (reduced or eliminated local flooding)	High	Local Budgets, HMGP	Short	High
	Conduct and facilitate community and public education and outreach for residents and businesses to include, but not be limited to, the following to promote and effect natural hazard risk reduction: • Provide and maintain links to the HMP website, and regularly post notices on the County/municipal homepage(s) referencing the HMP webpages. • Prepare and distribute informational letters to flood vulnerable property owners and neighborhood associations, explaining the availability of mitigation grant funding to mitigate their properties, and instructing them on how they can learn more and implement mitigation. • Use email notification systems and newsletters to better educate the public on flood insurance, the availability of mitigation grant funding, and personal natural hazard risk reduction measures. • Work with neighborhood associations, civic and business groups to disseminate information on flood insurance and the availability of mitigation									

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures *	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	grant funding.									
	See above.	NA	Flood		Municipality with support from Planning Partners, OEM, FEMA	Low - Medium	Low - Medium	Municipal Budget; HMA programs with local or county match	Short	High
	Archive elevation certificates	NA	NFIP Compliance		NFIP Floodplain Administrator	Low	Low	Local Budget	On-going	High
	Distribute All-Hazard Weather Radios to senior centers, and high risk residents		Dam Failure, Drought, Earthquake, Extreme Temperatures, Flood, Hail, Lightning, Wildfire, Wind, Winter Storms		Emergency Management	High	Low	HMGP, City budget	Long	Low
	Create mitigation education pamphlets and distribute at booths during large public events and at public city venues.		Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperatures, Flood, Hail, Lightning, Wildfire, Wind, Winter Storms		Emergency Management	High	Low	HMGP, City budget	Long	Low
	Educate students at schools on how to mitigate against flooding, hail, high winds (including tornadoes) and		Flood, Hail, Lightning, Wind		Emergency Management	Medium	Low	City budget	Long	Low

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures *	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	lightning and be better prepared for storm season.									
	Enact a regulation to require a check for expansive soils prior to building a city building and perform soil stabilization if expansive soils are found.		Expansive Soil		City Engineer	High	Medium	City Budget	Long	Low

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.
Costs:
Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

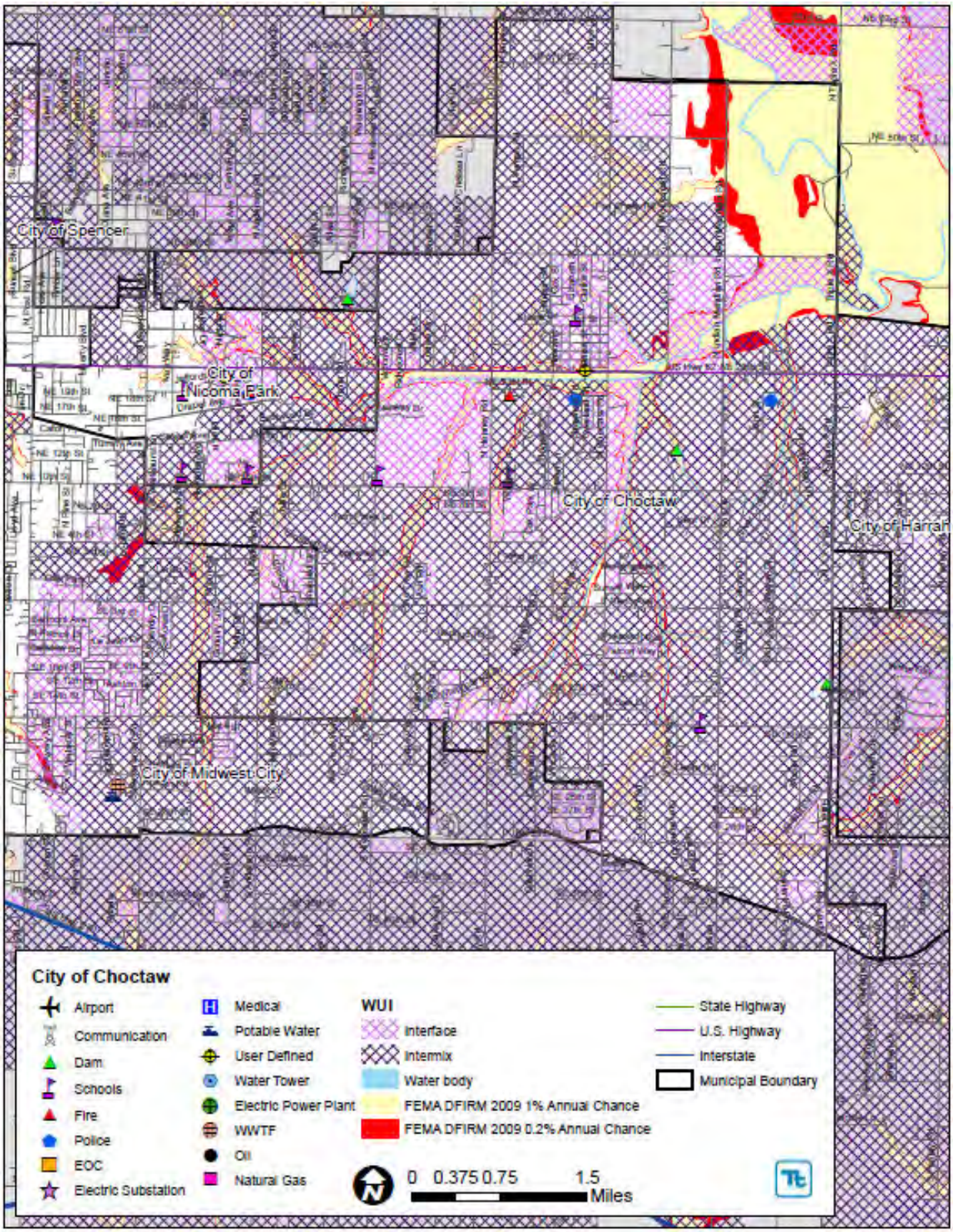
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the City of Choctaw to illustrate the probable areas impacted within the City of Choctaw. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the City of Choctaw has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


City of Spencer
City of Nicoma Park
City of Choctaw
City of Harrah
City of Midwest City
City of Choctaw
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
Water body
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
State Highway
U.S. Highway
Interstate
Municipal Boundary
0 0.375 0.75 1.5
Miles

9.5 CITY OF DEL CITY

This section presents the jurisdictional annex for the City of Del City.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Jim Hock, Fire Chief Del City Fire Department 4501 SE 15th Del City, OK 73115 (405) 671-2891 dcfd101@sbcglobal.net	Monica Kynaston City Planner/Community Services Department 3701 SE 15th Street Del City, OK 73115 (405) 671-2815 mkynaston@cityofdelcity.org

B.) MUNICIPAL PROFILE

The City of Del City is located in the southwestern section of Oklahoma County and is part of the Oklahoma City metropolitan area. The City is bordered to the north, south and west by Oklahoma City, and to the east Midwest City. The City of Del City has a total land area of 7.5 square miles, all of it land. The City is governed by a mayor and a four member City Council. The 2010 U.S. Census population for the City of Del City was 21,332.

Del City is situated at the bottom of two major drainage basins. A large amount of stormwater conveyed through the City originates in areas outside of the City's control. The City has 1,354 parcels in the NFIP Special Flood Hazard Area, with 2 NFIP Repetitive Loss properties. Flooding in the City is mainly caused by the Crutcho and Cherry Creeks. Areas where natural and man-made obstructions in the floodplains have an increased severity of flooding. (FEMA FIS - 2009)

Known or Anticipated Future Development

The following table summarizes major residential/commercial development and major infrastructure development that are identified for the next five (5) years in the City. Refer to the map at the end of this annex which illustrates the hazard areas along with the location of potential new development.

Property Name	Type (Residential or Commercial)	Number of Structures	Address	Known Hazard Zone	Description/Status
I-40 and Sooner	C	12-20	5300-5500 Main Street	Yes	Crutcho Creek and Crutcho Creek Tributary B: Remediated Using Public Funding and LOMR Approved
I-40 and Scott	C	?	759 S. Scott Street	Yes	Crooked Oak Creek: Public Funding Approved for Remediation as part of TIF District
Kristie Manor Redevelopment	C	1	5500 SE 29th Street	Yes	Crutcho Creek Tributary B: Partially Remediated using Public/Private Partnership

Police Station	C	1	4517 SE 29th Street	Yes	Localized Drainage Problem: Currently under Engineering Review
New Fire Station	C	1	2800 Epperly Drive	Not in NFIP SFHA	
Large Home Residential	R	900	South of SE 29th Street between S Sunnylane Rd and Bryant Ave.	Yes	Cherry Creek

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the City of Del City in the 2006 plan.

2006 Initiative Description	Status	Comments
Citywide flood prevention – replace broken drop boxes and channel lining citywide	Completed	
Oakbrook 1 – Continue lining of Oakbrook Channel north of SE 44th	Completed	
Oakbrook Channel II – Line Oakbrook Channel south of SE 29th	Completed	
Cherry Creek Flood Prevention – Line Cherry Creek, Del Road to Mallard (completed 2007)	Completed (2007)	
Brookdale Channel – Line Brookdale Channel north of SE 15th	Ongoing	Is in engineering stage; should be completed 2013-2014

The City of Del City has identified the following additional mitigation projects/activities that are ongoing or have been completed:

- The City has adopted new floodplain management, stormwater detention and stormwater quality ordinances supporting higher regulatory standards.
- Installed/implemented a tornado notification and warning system.
- In August 2011, the City hosted a Discovery Meeting for the Lower North Canadian watershed RiskMAP program.
- Cleaned out and widened 3 barrels on I-40 to improve stormwater management
- Modified all well houses to accept rolling generators
- Property maintenance codes have supported the City to require residential supplemental electrical grounding that reduces the risk of structural fires, particularly during ice storm events
- The City enforces the 2003 Urban Wildland Interface codes which allows the City to put protective measures in place, including vegetation management
- The City installed massive lightning protection at City Hall and did upgrades to their secondary EOC to protect against loss of service
- The City installed a Community Storm Cellar
- Lariet Lane closed from 27th Street to Del Road every time it rains. The drainage has been improved in this location to take the water off the street.
- Installed new outdoor warning system with voice capability.
- Gena and Gena Place – Stormwater Drainage Improvements

- 19th and Vicky – Detention Pond and Creek Improvements (secondary channel)

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the City of Del City is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	Yes	Canton Lake, Overholser - See local hazard map end of section
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	Yes	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the City of Del City, the following have been identified as specific hazard vulnerabilities in the City:

Repetitive street flooding on Del View Drive and Hampton Drive.
The Oakbrook channel can flood from Woodview to SE 29th.
The Brookdale channel can flood north of SE 15th St.
The Cherry Creek channel in the Hartsdel Addition is subject to backup and flooding after heavy rain.
Flooding on Lariet Lane occurs due to lack of sufficient drainage.
Crutcho Creek appears to have a faulty gate under SW 29th St.
Street and residential flooding can occur at NE 10th and Sunnylane after heavy rains.
A few residents and businesses are in the SFHA near the North Canadian River.

Vulnerability assessment modeling has identified the following flood vulnerabilities (see Flood Hazard Profile in Section 5.4):

Critical Facilities Located in the DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss			
			100-Yr	500-Yr	100-Yr Structure Damage %	100-Yr Content Damage %	500-Yr Structure Damage %	500-Yr Content Damage %
Del City Fire Department #1	Del City (C)	Fire	X	X	-	-	0.1	0.1
City Hall	Del City (C)	User Defined		X	9.6	63.7	13.9	82.5
Public Works/Fleet Maintenance	Del City (C)	User Defined			11.7	44.5	12.7	60.5

Source: FEMA, 2009; HAZUS-MH 2.0

Utilities Located in the Preliminary DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss	
			100 Year	500 Year	100 Year Damage %	500 Year Damage %
Wastewater Treatment Complex*	Del City (C)	WWTF	X	X	23.2	29.9

*Facility has no history of flooding.
Source: FEMA, 2009; HAZUS-MH 2.0
Notes:

(1) 'X' indicates the facility location as provided by Oklahoma County's Planning Committee is located in the DFIRM flood zone.
(2) HAZUS did not calculate potential loss estimates for some facilities located in the DFIRM flood zone. This is because these facilities are either located outside of the flood depth grid generated by HAZUS, or the depth of water is too shallow and no losses are estimated. When there is a difference between the flood depth grid generated by HAZUS and the DFIRM flood zones, it is most likely due to the resolution of the elevation model used (1/3 Arc Second or 10 meters) which differed from the elevation data used to generate the DFIRM itself.
(3) In some cases, HAZUS calculated potential flood loss to structures outside the FEMA DFIRM. These facilities are located inside the HAZUS flood depth grid.

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE CITY

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Flooding	DR-441	Yes	
November 26, 1974	Flooding	DR-453	Yes	
October 17-19, 1983	Flooding	DR-693	Yes	
September 29 – October 1, 1986	Flooding	DR-778	Yes	
May 2, 1990	Flooding, Tornado	DR-866	Yes	
May 8, 1993	Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
August 11-12, 2004	Flash Flood	N/A	N/A	
January 1, 2006	Wildfires	DR-1623	No	
March 12, 2006	Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
January 12-26, 2007	Severe Winter Storms	DR-1678	No	
March 29, 2007	Tornadoes	N/A	N/A	
May 4-11, 2007	Tornadoes, Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Flooding, Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Flooding, and Tornadoes	DR-1712	Yes	
Aug. 18, 2007 to Sept. 12, 2007	Tornadoes, and Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	There were 446 fire responses associated with this event; over 458 hours in overtime for fire department personnel; total of $22,299 associated with life safety efforts; many residents without power; downed power lines; many homes and public property experienced damages; roadways required plowing, sanding and salting. The City maintains detailed records of damages, outages and municipal costs from this event.
March 17-23, 2008	Tornadoes, and Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	
March 30-31, 2008	Severe Storms	N/A	N/A	
April 9-28, 2008	Tornadoes, and Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 9, 2008	Floods	DR-1754	No	
May 10-13, 2008	Tornadoes, and Flooding	DR-1756	No	
June 3-20, 2008	Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Tornadoes, and Flooding	DR-1803	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
February 10-11, 2009	Tornadoes	DR-1820	Yes	
March 24, 2009	Severe Storms	N/A	N/A	
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	
March 30, 2009	Severe Storm	N/A	N/A	
April 9-11, 2009	Wildfires	DR-1846	Yes	Fire personnel and equipment were used to contain and extinguish wildfires The City has detailed records documenting impacts and over $10,000 in municipal expenses.
May 13, 2009	Severe Storms	N/A	N/A	
December 24-29, 2009	Severe Winter Storm	DR-1876	No	Downed power lines and trees, causing power outages and road closures; roadways required plowing, salting and sanding The City has detailed records documenting impacts and over $28,000 in municipal expenses.
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Tornadoes, and Straight-Line Winds	DR-1917	Yes	
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	Roads and intersections were closed due to flooding; residential and commercial properties had damage due to flooding; debris removal from roadways and culverts. The City has detailed records documenting impacts and over $27,000 in municipal expenses.
July 7-8, 2010	Flooding	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
Oct. 13, 2010	Earthquake	N/A	N/A	
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	Road closures and power outages; roadways required plowing, sanding and salting; schools, businesses and public offices were closed. The City has detailed records documenting impacts and over $37,000 in municipal expenses.
April 14, 2011	Tornadoes, and Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Flooding	DR-1988	No	
May 22-25, 2011	Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Severe Heat	N/A	N/A	

Number of FEMA Identified Repetitive Flood Loss Properties: 2 residential
Number of FEMA Identified Severe Repetitive Flood Loss Properties:

Source: Repetitive Loss info from City of Del City Community Services

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances., Plans)	Do you have this? (Y or N)	Code Citation (Section, Paragraph, Page Number, Date of adoption)
Building Code	Yes	2003 I-Codes, 2002 NEC adopting 2012 I-Codes, 2011 NEC
Comprehensive / Master Plan	Yes	Currently Under Revision
Zoning Management Ordinance	Yes	Appendix A- Del City Code
Subdivision Management Ordinance	Yes	Included in the Zoning Ordinance
Site Plan Review Requirements	Yes	Included in the Zoning Ordinance
NFIP Flood Damage Prevention Ordinance	Yes	Higher Standards Ordinance 2009
NFIP Elevation Certificates Maintained	Yes	
Floodplain Management Plan	Yes	
Stormwater Management Plan / Ordinance	Yes	2011 - Ordinance 1344
Stream Corridor Management or Protection Plan	No	
Erosion Management Ordinance	Yes	2011 - Ordinance 1344
Capital Improvements Plan	Yes	Yes
Open Space Plan	No	
Economic Development Plan	No	
Emergency Response Plan	Yes	
Post Disaster Recovery Plan / Ordinance	Yes	
Real Estate Disclosure Requirements	Yes	State Requirements
Highway Management Plan	No	
COOP/COG Plan	Yes	Included in Disaster Plan
Other (Special Purpose Ordinances such as critical or sensitive areas)	Yes	Drainage/Detention Ordinance/Airport Overlays/Accident Protection Zones

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Yes	Community Services/Del City/Director, Planner
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Yes	Community Services/Del City/Director, Chief Building Inspector, Building Inspector
Planners or engineers with an understanding of natural hazards	Yes	Community Services/Del City/Director and Planner
NFIP Floodplain Administrator	Yes	Community Services/Del City/Director and City Planner (Insurance Coordinator)
Surveyor(s)	No	
Personnel skilled or trained in "GIS" applications	Yes	Community Services/Del City/Director and Planner
Scientist(s) familiar with natural hazards in the County.	No	
Emergency Manager	Yes	Chief Hock
Grant Writer(s)	No	Fire Department/ Police Department/Community Service Staff
Staff with expertise or training in benefit/cost analysis	Yes	Community Services/Del City/Director, Planner

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	Not Generally
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for specific purposes	Yes
User fees for water, sewer, gas or electric service	Yes, Stormwater Utility
Impact Fees for homebuyers or developers of new development/homes	No
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activity bonds	Yes - TIF
Withhold public expenditures in hazard-prone areas	No
Other	Development Grants

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	TBD	TBD
Public Protection	4	12-10-10
Storm Ready	City and County	12-17-09
Firewise	TBD	TBD

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. Revisions to the comprehensive plan provide an opportunity to expand on and improve the policies and programs identified herein. Zoning management presents an opportunity to regulate positioning large quantities of hazardous materials that may be a secondary threat after a natural hazard incident and supports Goal #6 (Structural Projects). The Floodplain Management Plan and local floodplain management present good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). Personnel skilled in "GIS" applications support Goal #2 (Prevention) and Goal #3 (Protecting Critical Facilities) by identifying risk areas. Having Planners and Engineers with knowledge of land development and land management practices increases the ability to mitigate against wildfire, flooding, and other hazards, and supports Goal #2 (Prevention) in the plan. Having a local Emergency Manager with a fire background provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). The fiscal capabilities of items such Capital Improvements Project Funding, fees and debts present opportunities for monies to support Goal #6 (Structural Projects) public education and Goal #5 (Public Awareness).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Oakbrook I – Rehabilitate Oakbrook Channel from Woodview to SE 29th Street (carried over from 2006 plan)	Existing	Flood		Community Services	High – reduced local flooding due to improved conveyance	High (est. $125,00)	Local Funding	Ongoing	Medium
	Brookdale Channel – Repair channel north of SE 15th (carried over from 2006 plan)	Existing	Flood		Community Services	High – reduced local flooding due to improved conveyance	High (est. $225,00)	TBD, some local funds available	Ongoing	Medium
	City Wide Flood Prevention – Replace broken drop boxes and channel lining city wide (carried over from 2006 plan)	Existing	Flood		Community Services	High – reduced local flooding due to improved conveyance	High (est. $450,00)	Local Funding	Ongoing	High (critical)
1	Cherry Creek in the Hartsdel Addition – Increase channel capacity (in-channel storage) and installation of detention facilities to improve conveyance and attenuate peak flows.	Existing	Flood		Community Services	High – Reduced flooding and damage to structures and infrastructure, reduced emergency services.	High – projects #1, 2 3 est. $3MM	Bonding (2011 Bond Issue)	Short	High
2	Lariet Lane Flood Remediation – a) capture stormwater coming off Cemetery property south of SE		Flood		Community Services	High – Reduced flooding along Lariet Lane,	High – projects #1, 2 3 est. $3MM	Bonding (2011 Bond Issue)	Short	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	29th Street and divert to detention then to Cherry Creek, b) install storm sewer along Lariet Lane to capture remaining stormwater and conduct to Cherry Creek. Once complete, submit LOMR to FEMA Region 6.					removal of areas from 500-year floodplain, increased safety of route to elementary school				
3	Judy/Howard/Leslie Storm Sewer Project – Install and upgrade storm sewers in the areas of these three roads		Flood		Community Services	High – reduced street flooding and flood risk to residential structures, increased safety of route to school	High – projects #1, 2 3 est. $3MM	Bonding (2011 Bond Issue)	Short	High
	Oakbrook Channel – Streambank Stabilization		(Non Mitigation until more details are provided)		Community Services		High	HMGP or city funds	Long	Medium
	Install generator for backup power systems for POTW wells and system. Generators can be used to power items after a dam failure takes down poles, an earthquake shakes lines down, rolling blackouts during extreme temps, outages caused by floods, lightning, hail destroying power insulators, wildfires burning up poles, and		Dam Failure, Earthquake, Extreme Temp, Flood, Hail, Wind, Lightning, Wildfire, Winter Storm		City Fire / Emergency Management		High	HMGP or city funds	Long	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	ice taking down lines in winter storms.									
	Expand current city siren system with private and public mass notification system.	N/A	Earthquake, Flood, Wildfire, Wind		City Fire / Emergency Management	Medium – High (life safety)	$215K	Bonding	1 year (currently receiving bids)	High
	Install lightning protection at WWTP.	Existing	Lightning		Public Works	Medium – continuity of operations	Medium	City Budget	Short	High
	Construct new public works administration building to address flood vulnerability by relocation.	Existing	Flood		Community Services	Reduced flood vulnerability of critical facility	High	Limited purpose sales tax renewal	Short	High
	Remove an apparently faulty flap gate on Crutcho Creek under SW 29th Street.	Existing	Flood		Community Services	Medium – High May reduce local flooding and risk of undermining of SW 29th Street Bridge	Low-Medium	FEMA (through Risk Map)	Short	High
	Address flooding issues in the area of NE 10th and Sunnylane, which may involve acquisition.	Existing	Dam Failure, Flood		Community Services	High – reduced local flooding to structures and infrastructure	High - ~$1.5MM	HMGP funding; EPA 206 funding	Long	Low
	Address flooding issues in the area of NE 10th and Sunnylane, which may involve construction of stormwater detention.	New and Existing	Dam Failure, Flood		Community Services	High – reduced local flooding to structures and infrastructure	High - ~$1.5MM	HMGP funding; EPA 206 funding	Long	Low
	Create a Residential Safe Room Rebate Program	Existing	Tornado		City EM with County and State OEM support	High – Public Safety, reduced reliance on public storm	Medium	HMGP	Long	Low

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
						shelters				
	Install backup generators at the following facilities: • Police Department • City Hall with EOC inside • New Fire Station • Wells (portable) • Fire Department 1/Community Center	Existing	Flooding, Earthquake, Extreme Temps, Flooding, Hail, Lightning, Wildfire, Wind, Winter Storm		City EM / Fire Department	Essential City Functions maintained	High	HMGP and Local Budget	Long	High
	Implement property maintenance codes to require residential supplemental grounding.	New and Existing	Wind, Lightning, Severe Winter Storm		Community Services	In addition to lightning mitigation, winter storms (with ice) have pulled power lines away from house connections and can cause shorts.	Low	Del City Budget	Ongoing	High
	Adopt and implement the 2012 Urban Wildland Interface code, including updated Urban Wildland Interface maps.	N/A	Wildfire		Fire Department		Medium	Del City Budget	Short	High
	Purchase, or relocate structures located in hazard-prone areas to protect structures from future damage, with	Existing	Flood		Municipality (via Municipal Engineer/NFIP Floodplain	High	High	FEMA Mitigation Grant Programs and	Long-term DOF	Medium-High*

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	repetitive loss and severe repetitive loss properties as priority. Specifically identified are the following: Properties along the North Canadian River Phase 1: Identify appropriate candidates for relocation based on cost-effectiveness versus retrofitting. Phase 2: Where relocation is determined to be a viable option, work with property owners toward implementation of that action based on available funding from FEMA and local match availability.				Administrator) with support from OEM, FEMA			local budget (or property owner) for cost share		
	Maintain compliance with and good-standing in the NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community.	New & Existing	Flood		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, ISO FEMA	High	Low - Medium	Local Budget	Ongoing	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Adopted higher regulatory standards to manage flood risk (i.e. increased freeboard, cumulative substantial damage/improvements).	New & Existing	Flood		City (via NFIP Floodplain Administrator) with support from OEM, FEMA	Low	Low	City Budget	Short	High
	Enact a city code to perform soil stabilization when expansive soils are found during engineering studies and compaction tests on fill land.	New	Expansive Soil		Community Services	Medium	Medium	Local budget	Short	High
	When citizens apply for building and remodel permits, provide a pamphlet with expansive soil mitigation information.	New & Existing	Expansive Soil		Community Services	Medium	Low	Local budget	Long	Low
	Drill additional water wells to insure adequate water supply is available		Drought, Wildfire		Public Works	Ensure adequate water supply maintained	High	City budget	Short	High
	Conduct a public education to educate citizens on water conservation		Drought		Community Services	Reduce water use in city	Low	City budget	Short	Medium
	Adopt 2013 building code and enforce through city inspector		Earthquake, Flood, Lightning, Wind, Wildfire		Community Services	Reduce damage to buildings	Low	City budget	Short	High
	Increase earthquake risk awareness – through public education pamphlets distributed at community gatherings (fire dept. open house,		Earthquake		EM / Fire Department	Reduce loss of life through education – residents should have a plan - and reduce	Low	City budget	Short	Low

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	police dept. open house, pool safety day, etc.)					damage to buildings				
	Public education on the dangers associated with extreme temperature events prior to the onset of extremes		Extreme Temps		EM / Fire Department	Reduce loss of life	Low	City budget	Short	Medium
	Establish heating and cooling stations to protect citizens from extreme temperatures, and provide a location with electricity and water during winter storms and after high winds		Extreme Temps, Wind, Winter Storm		EM / Fire Departments	Reduce loss of life	Medium	City budget	Short	Low
	Provide shelters for jurisdiction owned emergency vehicles to protect from hail damage		Hail		Fire w/ Public Works	Reduction in losses of vehicles	High	HMGP or City Budget	Short	High
	Install lightning protection and suppression systems protecting radios, computers, and other essential equipment at critical facilities throughout the jurisdiction	Existing	Lightning		Community Services	Reduction in loss of electronic equipment	High	City Budget	Short	High
	Create fire breaks along fence rows to thwart road jumping of wildland fires		Wildfire		Fire Department	Reduced structure loss	Low	City Budget	Short	High
	Purchase All Hazard Weather Radios for schools and other public facilities		Dam Failure, Drought, Earthquake, Extreme		EM / Fire Department	Reduced loss of life	Low	HMGP or City Budget	Short	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
			Temp, Flood, Hail, Lightning, Wildfire, Wind, Winter Storm							

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.
Costs:
Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

I.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

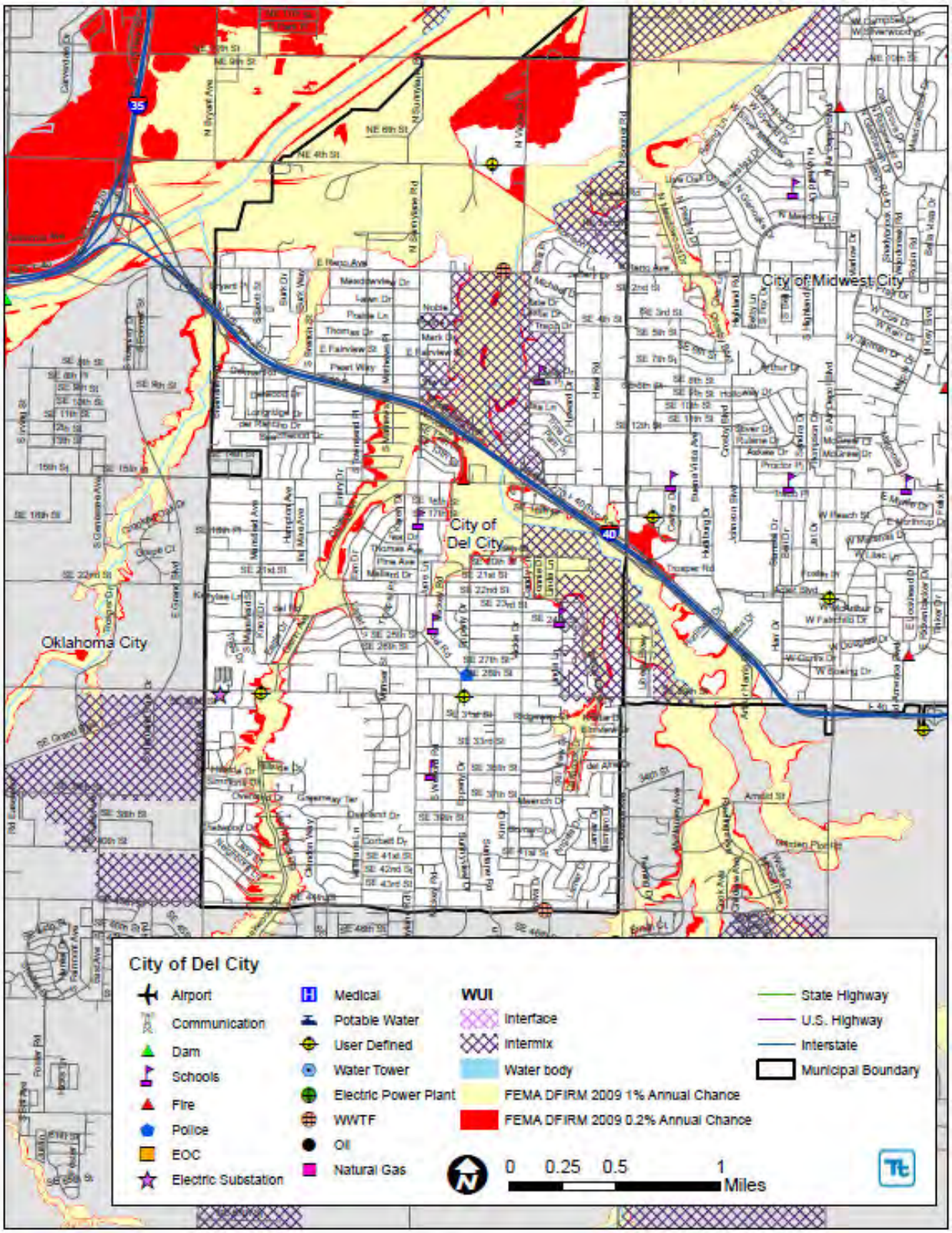
None at this time.

J.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the City of Del City to illustrate the probable areas impacted within the City of Del City. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the City of Del City has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

K.) ADDITIONAL COMMENTS

No additional comments at this time.


City of Midwest City
City of Del City
Oklahoma City
City of Del City
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
Water body
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
State Highway
U.S. Highway
Interstate
Municipal Boundary
0 0.25 0.5 1
Miles

9.6 CITY OF EDMOND

This section presents the jurisdictional annex for the City of Edmond.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Michael J. Magee, Emergency Management Coordinator P.O. Box 2970, Edmond, OK 73083 (405) 359-4378 mike.magee@edmondok.com	

B.) MUNICIPAL PROFILE

The City of Edmond is located in the northcentral section of Oklahoma County and is part of the Oklahoma City metropolitan area. The City is bordered to the south, east and west by Oklahoma City. The City has a total land area of 87.9 square miles; with 85.1 square miles of it is land and 2.8 square miles of water. The City is governed by a mayor and a five member City Council. The 2010 U.S. Census population for the City of Edmond was 81,405.

Flooding in the City typically results from intense thunderstorms associated with squall line activity. The greatest potential for flood damage in the City exists along the upper portion of Spring Creek, west of Bryant Avenue. The main reasons why this area floods is due to increased urbanization, residential development along the floodplain, and inadequate bridge and culvert openings. (FEMA FIS – 2009)

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the City of Edmond in the 2006 plan.

2006 Initiative Description	Status	Comments
Turtle Creek Detection Pond - Rehabilitating existing detention pond to restore capacity and lessen overtopping of 15th Street during heavy rains. .	Complete	This project was completed in 2004 using city funding.
Underground Electric Service - Replace overhead power transmission lines with buried cables, thus virtually eliminating the issue of severe weather-related interruptions for a primary business district within the City. Bury underground feeder and sub-feeder lines to the business district south of 15th Street to the City limits, primarily along South Broadway.	Ongoing	Edmond Electric has an ongoing program to underground utilities in areas where it has been deemed necessary and/or cost-effective.
Willowood Addition Flood Mitigation Project - Repeated flooding events of numerous homes in the floodplain and floodway. Acquisitions of flood-prone properties and construction of improvements.	Ongoing	Currently being advertised for bids as of Summer 2013. This will mitigate the one repetitive loss property, using HMGP funds.

Further details on mitigation activities completed or ongoing in the City include:

- City ordinances require 2' freeboard, and do not allow any building in the floodplain (Title 23).
- City site plan review requires that all new construction projects identify floodplains and inundated areas and designate such as open space.

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the City of Edmond is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	Yes	Arcadia Lake - See local hazard map end of section
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	Yes	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the City of Edmond, the following have been identified as specific hazard vulnerabilities in the City:

- Flooding has damaged public infrastructure, such as waterlines, sanitary sewers, buildings, streets and bridges
- Drought increases the threat of wildfires
- Hail has damaged City vehicles and roofs
- High winds have damaged street signs and lights, as well as interrupting power when trees damage electrical lines
- Severe thunderstorms produce high winds, hail and sudden rain; all causing damage to City property
- Tornadoes have impacted the City many times, causing significant damage to private and public property
- Wildfires have significantly impacted the City, causing significant damage to private and public property, as well as impacting the City's operations and provision of services, including emergency services
- Winter storms have caused the City to 'shut down', closing roads, stranded motorists, opening of shelters, interruption of services and closing businesses
- The City notes that an average of 45 trains/day move through Edmond on the Burlington Northern with unknown and potentially hazardous materials

Vulnerability assessment modeling has identified the following flood vulnerabilities (see Flood Hazard Profile in Section 5.4):

Utilities Located in the Preliminary DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss	
			100 Year	500 Year	100 Year Damage %	500 Year Damage %
Oak Tree Lift Station	Edmond (C)	WW Pump	X	X	40.0	40.0
Well #34	Edmond (C)	Potable Water	X	X	5.2	40.0
Well #30	Edmond (C)	Potable Water	X	X	-	0.7
Well #56	Edmond (C)	Potable Water	X	X	40.0	40.0
Well #44	Edmond (C)	Potable Water	X	X	2.8	30.3
Williams Gas Pipeline / Compressor Station	Edmond (C)	Natural Gas	X	X	-	40.0
Garber Substation	Edmond (C)	Electric Substation		X	-	-
Fairfield Substation*	Edmond (C)	Electric Substation	X	X	-	-

Source: FEMA, 2009; HAZUS-MH 2.0

Notes:

(1) 'X' indicates the facility location as provided by Oklahoma County's Planning Committee is located in the DFIRM flood zone.

(2) HAZUS did not calculate potential loss estimates for some facilities located in the DFIRM flood zone. This is because these facilities are either located outside of the flood depth grid generated by HAZUS, or the depth of water is too shallow and no losses are estimated. When there is a difference between the flood depth grid generated by HAZUS and the DFIRM flood zones, it is most likely due to the resolution of the elevation model used (1/3 Arc Second or 10 meters) which differed from the elevation data used to generate the DFIRM itself.

(3) In some cases, HAZUS calculated potential flood loss to structures outside the FEMA DFIRM. These facilities are located inside the HAZUS flood depth grid.

(4) Fairfield substation is shown to be in the AE-Zone per DFIRM overlay. The gravel pad looks to be above the BFE per 2010 contour/spot elevation data. The substation needs a survey of the existing "pad" and structure(s) elevation(s) to be sure of a correct zone designation.

Growth/Development Trends

The following major residential/commercial development and major infrastructure development are currently known or anticipated in the City of Edmond:

New Development/Potential Development in Municipality*						
Property Name	**Type Residential or Commercial**	**Number of Structures**	**Address**	**Block and Lot**	**Known Hazard Zone**	**Description/Status**
Banc First	Commercial	1	1100 S. Bryant			
Oklahoma Municipal Assurance	Commercial	1	3650 S. Boulevard			
Oakview Professional Offices	Commercial	2	Memorial and I-35			
Uptown Grocery Company	Commercial	3	1200, 1230 and 1260 W. Covell			
Chicken Express	Commercial	1	SW side of Danforth and Kelly			
Mercy Health	Commercial	1	South of 15th, West of I-35			
Ranken Energy	Commercial	1	457 W. 18th Street			
Arbor Creek Retail West	Commercial	1	West of Saints Blvd., North of 2nd			
Fisher Hall – OK Cataract Institute	Commercial	1	3840 S. Boulevard			
Hidden Prairie at Kelley Pointe Retail	Commercial	1	North of 33rd and west of Kelley			

* Per site plans approved 2011

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE CITY

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Flooding	DR-441	Yes	
November 26, 1974	Flooding	DR-453	Yes	
October 17-19, 1983	Flooding	DR-693	Yes	
September 29 – October 1, 1986	Flooding	DR-778	Yes	
May 2, 1990	Flooding, Tornado	DR-866	Yes	
May 8, 1993	Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
August 11-12, 2004	Flash Flood	N/A	N/A	In Oklahoma County, flash flooding inundated the intersection of Western Avenue and NE 234th Street.
March 12, 2006	Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	
January 12-26, 2007	Severe Winter Storms	DR-1678	No	Yes

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 29, 2007	Tornadoes	N/A	N/A	Yes
May 4-11, 2007	Tornadoes, Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Flooding, Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Flooding, Tornadoes	DR-1712	Yes	
Aug. 18, 2007 to Sept. 12, 2007	Tornadoes, Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	Yes
March 17-23, 2008	Tornadoes, Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	Yes
March 30-31, 2008	Tornado	N/A	N/A	City of Edmond - A tornado developed near the intersection of NW 178th Street and Pennsylvania Avenue. The tornado caused most of its damage in the Valencia neighborhood. Many homes sustained roof, window, garage door and fence damage. The tornado continued northeast towards the intersection of NW 192nd Street and Western Avenue where large utility poles were blown down. $450 K in property damage.
April 9-28, 2008	Tornadoes, Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	Yes
May 9, 2008	Floods	DR-1754	No	
May 10-13, 2008	Tornadoes, Flooding	DR-1756	No	
June 3-20, 2008	Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Tornadoes, Flooding	DR-1803	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
February 10-11, 2009	Tornadoes	DR-1820	Yes	
March 24, 2009	Severe Storms	N/A	N/A	
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	
March 30, 2009	Severe Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	
May 13, 2009	Severe Storms	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Tornadoes, and Straight-Line Winds	DR-1917	Yes	Yes
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	
July 7-8, 2010	Flooding	N/A	N/A	
Oct. 13, 2010	Earthquake	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	
March 11, 2011	Wildfire	N/A	N/A	Yes
April 14, 2011	Tornadoes, And Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Flooding	DR-1988	No	
May 22-25, 2011	Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Severe Heat	N/A	N/A	

Number of FEMA Identified Repetitive Flood Loss Properties: 1 residential
Number of FEMA Identified Severe Repetitive Flood Loss Properties: 0

Source: Edmond Emergency Management

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances., Plans)	Do you have this? (Y or N)	Code Citation (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	Title 16 & 17, latest revision 2009
Comprehensive / Master Plan	Y	April 2007
Zoning Management Ordinance	Y	March 1, 2007
Subdivision Management Ordinance	Y	Title 21, latest revision June 24, 2002
Site Plan Review Requirements	Y	March 1, 2007
NFIP Flood Damage Prevention Ordinance	Y	Title 23 Stormwater Drainage Latest Revision 12/18/09 The City requires 2' freeboard. The City does not allow any building in the floodplain, and requires that all new construction projects identify floodplains and inundated areas and designate such as open space.
NFIP Elevation Certificates Maintained	Y	Title 23 Stormwater Drainage Latest Revision 12/18/09
Floodplain Management Plan and Additional Master Floodplain Studies	Y	Title 23 Stormwater Drainage Latest Revision 12/18/09
Stormwater Management Plan / Ordinance	Y	Title 23 Stormwater Drainage Latest Revision 12/18/09
Stream Corridor Management or Protection Plan	Y	Title 23 Stormwater Drainage Latest Revision 12/18/09
Erosion Management Ordinance	Y	Title 23 Stormwater Drainage Latest Revision 12/18/09
Capital Improvements Plan	Y	
Open Space Plan	N	Title 25 and STD-400 (12-18-09); For development regulations – All areas lying below 100 year WSL must be in HOA common area.
Economic Development Plan	N	
Emergency Response Plan	Y	EOP update August 2013
Post Disaster Recovery Plan / Ordinance	N	
Real Estate Disclosure Requirements	N	
Highway Management Plan	Y	Edmond Transportation Plan 6/28/07
COOP/COG Plan	N	
Other (Special Purpose Ordinances such as critical or sensitive areas)		

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Y	Engineering/Public Works Engineer Engineering/Director of Engineering Planning Director
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Y	Engineering/Public Works Engineer Engineering/Director of Engineering Engineering/Capital Projects Engineer Building Inspector Emergency Management – Public Works Department
Planners or engineers with an understanding of natural hazards	Y	Engineering/Stormwater Management Hydrologist
NFIP Floodplain Administrator	Y	Engineering/Stormwater Management
Surveyor(s)	N	
Personnel skilled or trained in "GIS" applications	Y	
Scientist(s) familiar with natural hazards in the County.	N	
Emergency Manager	Y	
Grant Writer(s)	Y	
Staff with expertise or training in benefit/cost analysis	N	

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	Yes
Capital Improvements Project Funding	Yes. Had a capital improvements project committee, and a sales tax for funding.
Authority to Levy Taxes for specific purposes	Yes, had a sales tax to fund capital improvements
User fees for water, sewer, electric service, sanitation, stormwater	Yes, including Edmond Electric
Impact fees for builders and commercial structures	TBD
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	TBD
Incur debt through private activity bonds	TBD
Withhold public expenditures in hazard-prone areas	TBD
Other	

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	Class 7	10-01-2008
Building Code Effectiveness Grading Schedule (BCEGS)	TBD	TBD
Public Protection	TBD	TBD
Storm Ready	County and City	03-04-2011
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. Zoning management presents an opportunity to regulate positioning of large quantities of hazardous materials that may be a secondary threat after a natural hazard incident and supports Goal #6 (Structural Projects). The staff Hydrologist, along with Title 23 Stormwater Drainage Plan and local floodplain management present good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). Personnel skilled in "GIS" applications support Goal #2 (Prevention) and Goal #3 (Protecting Critical Facilities) by identifying risk areas. Having Planners and Engineers with knowledge of land development and land management practices increases the ability to mitigate against wildfire, flooding, and other hazards, and supports Goal #2 (Prevention) in the plan. Having a local Emergency Manager provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). The fiscal capabilities of items such Community Development Block Grants Capital Improvements Project Funding, fees and debts present opportunities for monies to support Goal #6 (Structural Projects) public education and Goal #5 (Public Awareness). Edmond's unique situation of having its own electric utility provides further opportunity to mitigate power outages caused by various disasters.

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Underground Electric Service - Replace overhead power transmission lines with buried cables, thus virtually eliminating the issue of severe weather-related interruptions for a primary business district within the City. Bury underground feeder and sub-feeder lines to the business district south of 15th Street to the City limits, primarily along South Broadway. (2006 Plan)	Existing	Hail, Wind/Tornado, Lightning, Severe Winter Storms, Wildfire		Edmond City Electric Dept.	Decrease or eliminate threat of downed lines from high winds, ice loading, insulators destroyed by hail, lightning damage, and wildfires burning poles	$148,030 (2006)	City of Edmond Funds	Long	High
	Complete the Willowood Addition Flood Mitigation Project - Repeated flooding events of numerous homes in the floodplain and floodway. Acquisitions of flood-prone properties and construction of improvements. (HMGP DR-1678-OK	Existing	Flood		Emergency Management	Reduce or eliminate chances of floodwaters entering homes in this area	$ 3,222,129 (2011)	Hazard Mitigation Grant Program and City of Edmond Drainage Utility Funds	To be completed prior to 5/26/2014	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Project #52)									
	Maintain a three year cycle for tree maintenance to reduce vulnerability to power outages.	Existing and New	Wind/Tornado, Lightning, Severe Winter Storms		Edmond Electric	Reduced power outages	Medium - High	Service Fees	Ongoing	High
	Continue to enforce local requirements that all new roadway construction must manage the 100-year flood	New	NFIP Continued Compliance		Code Enforcement	Reduced roadway closures and road infrastructure damage	Medium	City Budget	Ongoing	medium
	Continue to manage and implement the City's stormwater improvement / retrofit program – providing periodic review and prioritization of drainage problem area for mitigation		NFIP Continued Compliance		Drainage Utility	Reduced risk to structures and roadway	Medium - High	Storm Water Fees, CDGB grant or HMGP	Ongoing	Medium
	Maintain enforcement of Title 23 which incorporates specific higher regulatory standards for managing flood risk, including no new development in the SFHA, 2' freeboard.	New & Existing	NFIP Continued Compliance		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, FEMA	High	Low	Municipal Budget	Short	High
	Provide dam failure risk information with with inundation depth and times for residents downstream of Lake Arcadia.	NA	Dam Failure		Municipality with support from Planning Partners, OEM, FEMA	High	Low - Medium	Municipal Budget; HMGP	Short	Low
	Purchase All-Hazard (NOAA) Weather Radios	(Neither)	Dam Failure, Drought, Earthquake,		Emergency Management	Alert citizens before disaster to	Low	City Funds and	Short (1 year)	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
			Extreme Temperatures, Floods, Hail, Lightning, Wildfire, Wind, Winter Storm			save lives and after earthquakes to advise of life protective measures		FEMA HM Grant funds		
	Drill Additional Water Wells	Neither	Drought		Water Resources	Drill additional water wells ensuring that an adequate water supply is available.	High	FEMA HM Grant	Short	Medium
	Conduct a public education campaign; advise citizens of the benefits of using Xeriscape to conserve water	Neither	Drought		Water Resources	Conserves water	Low	FEMA HM Grant	Short	Low
	Bury overhead power lines and enclose grid support equipment in earthquake and expansive soil resistant structures.	New and Existing	Earthquake, Expansive Soils, Hail, Lightning, Winter Storm, Wildfire		Edmond Electric	Decrease or eliminate threat of downed lines from high winds, ice loading, insulators destroyed by hail, lightning damage, and wildfires burning poles	High	FEMA HM Grant	Long	Low
	Conduct a public education campaign; advise citizens regarding protecting their homes and	New and Existing	Earthquake		Emergency Management	Decreases the damage caused by earthquakes.	Low	FEMA HM Grant	Short	Low

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	private property against the consequences of earthquakes.									
	Educate citizens and developers regarding how to mitigate Expansive Soil risks.	New and Existing	Expansive Soils		Engineering	Decreases property damage.	Low	FEMA HM Grant	Short	Low
	Map expansive soil risk areas within the city	New	Expansive Soils (Non mitigation)		Engineering	Sheds more light on the scope of the threat.	Low	FEMA HM Grant	Long	Low
	Provide public education on the dangers associated with extreme temperature events.	Neither	Extreme Temperatures		Emergency Management	Causes people to take personal responsibility and take appropriate actions.	Low	FEMA HM Grant	Short	Low
	Establish cooling and heating (warming) stations to protect the public from extreme temperatures.	New and Existing	Extreme Temperatures		Emergency Management	Allows citizens to escape extreme temperature conditions.	Medium	FEMA HM Grant	Medium	High
	Construct shelters for city owned vehicles to protect those vehicles from damaging hail.	New	Hail		Engineering	Protect vehicles and people from hail.	Medium	FEMA HM Grant	Medium	Medium
	Post warning signs at parks and other outdoor public areas warning people of the hazards of hail and other severe weather threats.	New	Hail		Parks	Educate citizens about the threats of hail.	Low	City budget, FEMA HM Grant	Low	Low
	Construct shelters at city parks to protect	New	Hail		Engineering and Parks	Protect people from	Medium	FEMA HM	Medium	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	citizens from injuring hail.					hail.		Grant		
	Purchase lightning prediction/warning system for Mitch and Hafer city parks.	New	Lightning		Engineering	Will warn people of impending lightning in recreation areas allowing them to seek shelter.	Medium	FEMA HM Grant	Short	High
	Purchase lightning suppressions systems for city real property.	New and Existing	Lightning		Engineering	Will minimize the destructive effects of lightning strikes.	Medium	FEMA HM Grant	Medium	Medium
	Create wildfire buffers around public buildings	New and Existing	Wildfire		Engineering	Will minimize the destructive effects of wildfires.	Medium	FEMA HM Grant	Medium	High
	Bury overhead power lines around electrical grid support equipment	N/A	Wildfire		Edmond Electric	Will minimize the destructive effects of wildfires on the power grid.	Medium	FEMA HM Grant	Medium	High
	Create defensible space / buffer zones around electrical grid support equipment.	N/A	Wildfire		Edmond Electric	Will minimize the destructive effects of wildfires on the power grid.	Medium	FEMA HM Grant	Medium	High
	Acquire and install high-powered voice warning devices for	Neither	Winds		Emergency Management	Will allow warnings to be made to	Medium	FEMA HM Grant	Medium	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	city parks and high density public areas.					the public so citizens can take protective measures and seek shelter.				
	Install hail and wind shelters in public parks and other outdoor areas.	Neither	Winds		Engineering	This will provide shelter to the public during these types of events.	High	FEMA HM Grant	High	Medium
	Acquire and install carbon monoxide monitors and alarms in concert with a public education campaign.	New and Existing	Winter Storms		Emergency Management	This will provide warnings to citizens during times they use alternative heating sources.	Low	FEMA HM Grant	Low	Low

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.

Costs:
Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000

Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

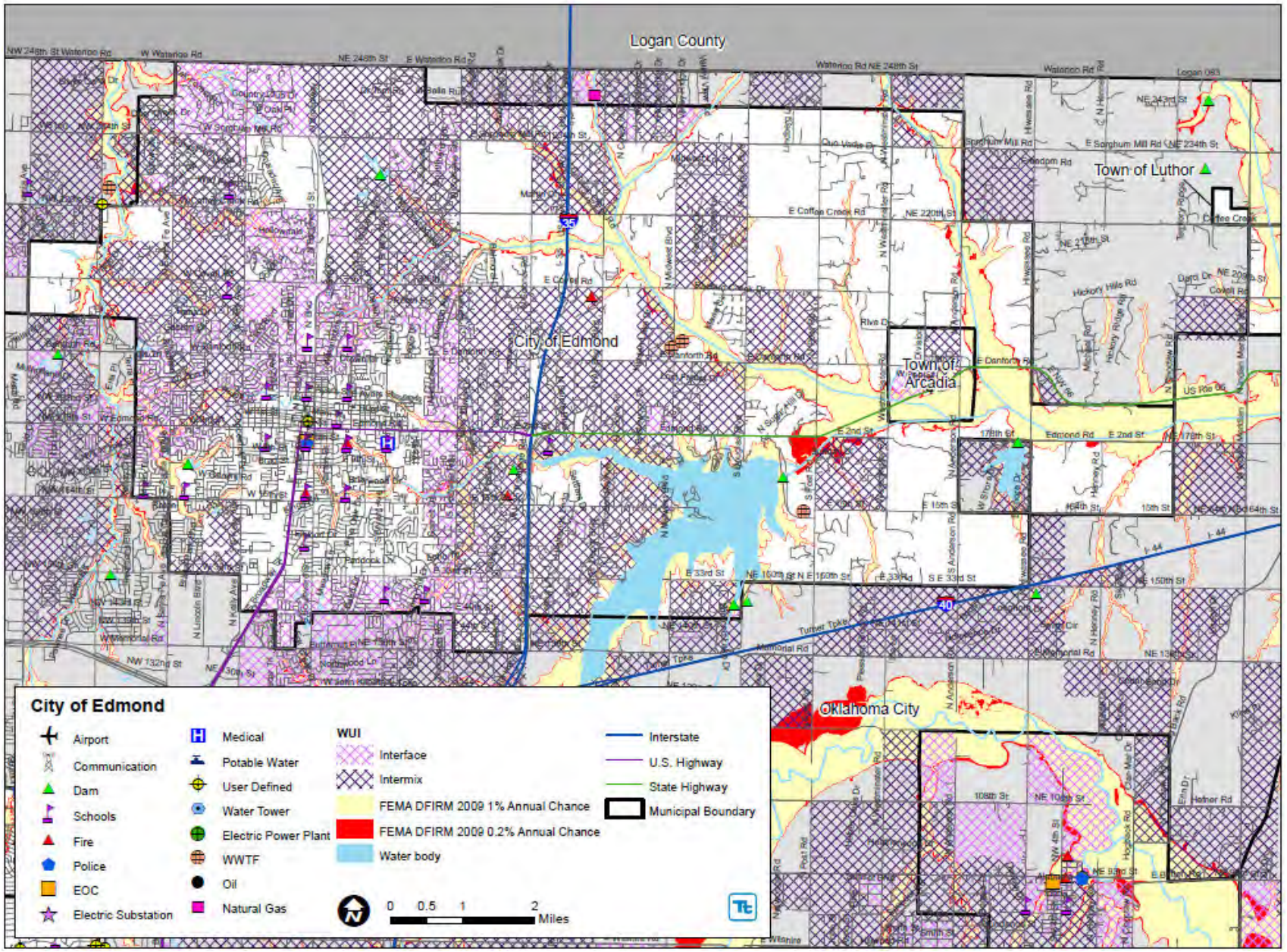
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the City of Edmond to illustrate the probable areas impacted within the City of Edmond. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the City of Edmond has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


Logan County
City of Edmond
Town of Arcadia
Town of Luthor
Oklahoma City
City of Edmond
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
Water body
Interstate
U.S. Highway
State Highway
Municipal Boundary
0 0.5 1 2 Miles

9.7 TOWN OF FOREST PARK

This section presents the jurisdictional annex for the Town of Forest Park.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Wesley "Chuck" Blair Fire Chief / Emergency Manager Town of Forest Park 4203 N. Coltrane Forest Park, OK 73121 (405) 424-1212 webgbs@aol.com	

B.) MUNICIPAL PROFILE

The Town of Forest Park is located in central Oklahoma County. The Town is bordered to the north by the Town of Lake Alma, to the south, east and west by Oklahoma City. The Town of Forest Park has a total land area of 2.1 square miles, all of it land. The 2010 U.S. Census population for the Town of Forest Park was 998.

Growth/Development Trends

No known or anticipated new development has been identified in the Town of Forest Park at this time.

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the Town of Forest Park in the 2006 plan.

2006 Initiative Description	Status	Comments
Forest Park Fire Department needs equipment that is sufficient to respond to flood victims or those displaced by severe weather. Forest Park would use chainsaws, portable hydraulic cutting apparatus, and GPS locating devices; however, gaining access still presents a significant challenge.	Not complete.	Deleted – not mitigation.

Further details on mitigation activities completed or ongoing in the Town of Forest Park include:

- Construction of a non-public storm shelter/command post. This facility can house emergency responders in the event of any emergency situation including tornadoes. It can serve as a communications hub with most radios capable of communicating with most emergency service providers, has internet access and local public programing. It is powered by an emergency backup generator.
- Forest park has purchased and installed outdoor warning devices to alert the public of impending severe weather.

- Forest park has purchased and maintains firefighting equipment to mitigate the effects of wild fires that are common in our area (2006 plan initiative).

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the Town of Forest Park is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	No	
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	Yes	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the Town of Forest Park, the following have been identified as specific hazard vulnerabilities in the City:

- Forest Park is a moderately wooded community; as such ice accumulations on trees can cause considerable damage disruption of essential services and monetary losses.
- The large quantity of old growth trees, egress issues and lack of fire hydrants make the town vulnerable to devastating wild fires. Large fast moving fires have threatened the town.
- During periods of heavy rain low areas of Town flood disrupting emergency response and causing infrastructural damage.
- Forest Park has high-impact occupancy that poses a mass casualty threat in the event of a significant weather event (tornado in particular). We have a public school and a highly populated golf course. High winds, hail and lightning have caused damage in forest park.
- There are 3 NFIP policies in the community. Forest Park currently has no Repetitive Loss (RL) or Severe Repetitive Loss (SRL) properties.

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE TOWN

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 8, 1974	Tornado	N/A	N/A	One injury occurred as a result of this F1 tornado.
June 8-10, 1974	Flooding	DR-441	Yes	
November 26, 1974	Flooding	DR-453	Yes	
October 17-19, 1983	Flooding	DR-693	Yes	
September 29 – October 1, 1986	Flooding	DR-778	Yes	
May 2, 1990	Flooding, Tornado	DR-866	Yes	
May 8, 1993	Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
August 11-12, 2004	Flash Flood	N/A	N/A	
March 12, 2006	Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
January 12-26, 2007	Severe Winter Storms	DR-1678	No	
March 29, 2007	Tornadoes	N/A	N/A	
May 4-11, 2007	Tornadoes, Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Flooding, Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Flooding, Tornadoes	DR-1712	Yes	
Aug. 18, 2007 to Sept. 12, 2007	Tornadoes, Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	Yes
March 17-23, 2008	Tornadoes, Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	
March 30-31, 2008	Severe Storms	N/A	N/A	
April 9-28, 2008	Tornadoes, Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 9, 2008	Floods	DR-1754	No	
May 10-13, 2008	Tornadoes, Flooding	DR-1756	No	
June 3-20, 2008	Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Tornadoes, Flooding	DR-1803	No	
February 10-11, 2009	Tornadoes	DR-1820	Yes	
March 24, 2009	Severe Storms	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	
March 30, 2009	Severe Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	
May 13, 2009	Severe Storms	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Tornadoes, Straight-Line Winds	DR-1917	Yes	
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	
May 10-13, 2010	Tornadoes, and Straight-Line Winds	DR-1917	Yes	
July 7-8, 2010	Flooding	N/A	N/A	
Oct. 13, 2010	Earthquake	N/A	N/A	
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
April 14, 2011	Tornadoes, Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Flooding	DR-1988	No	
May 22-25, 2011	Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Severe Heat	N/A	N/A	

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances., Plans)	Do you have this? (Y or N)	Code Citation (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	
Comprehensive / Master Plan	Y	
Zoning Management Ordinance	Y	
Subdivision Management Ordinance	Y	
Site Plan Review Requirements	Y	
NFIP Flood Damage Prevention Ordinance	?	
NFIP Elevation Certificates Maintained	?	
Floodplain Management Plan	Y	
Stormwater Management Plan / Ordinance	N	
Stream Corridor Management or Protection Plan	N	
Erosion Management Ordinance	N	
Capital Improvements Plan	N	
Open Space Plan	N	
Economic Development Plan	N	
Emergency Response Plan	Y	
Post Disaster Recovery Plan / Ordinance	N	
Real Estate Disclosure Requirements	N	
Highway Management Plan	N/A	
COOP/COG Plan	?	
Other (Special Purpose Ordinances such as critical or sensitive areas)	?	

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	N	
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	N	
Planners or engineers with an understanding of natural hazards	N	
NFIP Floodplain Administrator	Y	
Surveyor(s)	N	
Personnel skilled or trained in "GIS" applications	N	
Scientist(s) familiar with natural hazards in the County.	N	
Emergency Manager	Y	
Grant Writer(s)	Y	
Staff with expertise or training in benefit/cost analysis	N	

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	TBD
Capital Improvements Project Funding	Working on a plan
Authority to Levy Taxes for specific purposes	Yes
User fees for water, sewer, gas or electric service	No
Impact Fees for homebuyers or developers of new development/homes	No
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	TBD
Incur debt through private activity bonds	No
Withhold public expenditures in hazard-prone areas	Yes
Other	

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	TBD	TBD
Public Protection	TBD	TBD
Storm Ready	County	TBD
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Adopting and adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. The comprehensive plan provides an opportunity to expand on and improve the policies and programs identified herein. Zoning management presents an opportunity to regulate positioning large quantities of hazardous materials that may be a secondary threat after a natural hazard incident and supports Goal #6 (Structural Projects). Goal #2 (Prevention) is supported by the Zoning Management Ordinance, however this area could use work to support comprehensive land use, economic development and regulating the placement of new facilities where natural hazard risks are high. Two concerns are flooding and wildfire due to the trees and hilly nature of Forest Park. The Floodplain Management Plan and local floodplain management present good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). The Emergency Response Plan supports Goal #1 (Emergency Services). Having a local Emergency Manager with a fire background provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). The fiscal capabilities of levying taxes for specific purposes and incurring debt through general obligation bonds provides opportunities to advance mitigation projects (including Goal #6) and monies to support Goal #5 (Public Awareness).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Expand the existing outdoor warning system with additional devices to improve public threat warnings / notifications.		Wind		Forest Park Emergency Management working with Town DPW	High (life safety)	Medium-High	Federal and State Emergency Preparedness Grants; Local Budgets	Short	Medium
	Maintain compliance with and good-standing in the NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community.	New & Existing	NFIP Compliance		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, ISO FEMA	High	Low - Medium	Local Budget	Ongoing	High
	Begin the process to adopt higher regulatory standards to manage flood risk (i.e. increased freeboard, cumulative substantial	New & Existing	NFIP Complaince		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM,	Low	Low	Municipal Budget	Short	Low

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	damage/improvements).				FEMA					
	Conduct and facilitate community and public education and outreach for residents and businesses to include, but not be limited to, the following to promote and effect natural hazard risk reduction: • Provide and maintain links to the HMP website, and regularly post notices on the County/municipal homepage(s) referencing the HMP webpages. • Prepare and distribute informational letters to flood vulnerable property owners and neighborhood associations, explaining the availability of mitigation grant funding to mitigate their properties, and instructing them on how they can learn more and implement mitigation. • Use email notification systems and newsletters to better educate the public on flood insurance, the availability of mitigation grant funding, and personal natural hazard risk reduction measures. • Work with neighborhood associations, civic and business groups to disseminate information on flood insurance and the availability of mitigation grant funding.									
	See above.	NA	Flood		Municipality with support from Planning Partners, OEM, FEMA	Low - Medium	Low - Medium	Municipal Budget; HMA programs with local or county match	Short	High
	Archive elevation certificates	NA	NFIP Compliance		NFIP Floodplain Administrator	Low	Low	Local Budget	On-going	High
	Widen the drainage ditches at NE 36th and NE 50th between Bryant and Coltrane to prevent road damage		Flood		EM	High	Medium	HMGP	Short	Medium
	Distribute All-Hazards Weather Radios to elderly and special needs citizens and others		Drought, Flood, Earthquake, Extreme Temps, Hail, Lightning, Wind, Wildfire, Winter Storm		EM	High	Low	HMGP	Short	High
	Distribute mitigation information materials at schools to students		Drought, Earthquake, Expansive Soil, Extreme		EM	High	Low	Local budget	Short	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
			Temps, Flood, Hail, Lightning, Wind, Wildfire, Winter Storm							
	Enact a regulation to require a check for expansive soils prior to building a city building and perform soil stabilization if expansive soils are found.	New	Expansive Soil		City Inspector	High	Low	Local budget	Short	Medium
	Enact a building code requiring hail resistant materials for roofing and siding on residential and commercial structures	New & Existing	Hail		City Inspector	Medium	Low	Local budget	Short	Low
	Install lightning protection and suppression systems protecting radios, computers, and other essential equipment at critical facilities	Existing	Lightning		City Inspector	High	Low	Local budget	Short	Low
	Manage a residential safe room installation program to reduce the risk of injury and/or loss of life	New & Existing	Wind		EM, with City Inspector	High	High	HMGP	Short	Low
	Install dry hydrant in city pond for additional wildfire suppression support	Existing	Wildfire		Fire Chief	High	Medium	HMGP or Local budget	Short	High
	Adopt ordinances regulating defensible space around	New and Existing	Wildfire		Code Officer	High	Low	Local budget	Short	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	structures in the Wildland-Urban Interface zone									

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.

Costs:
Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

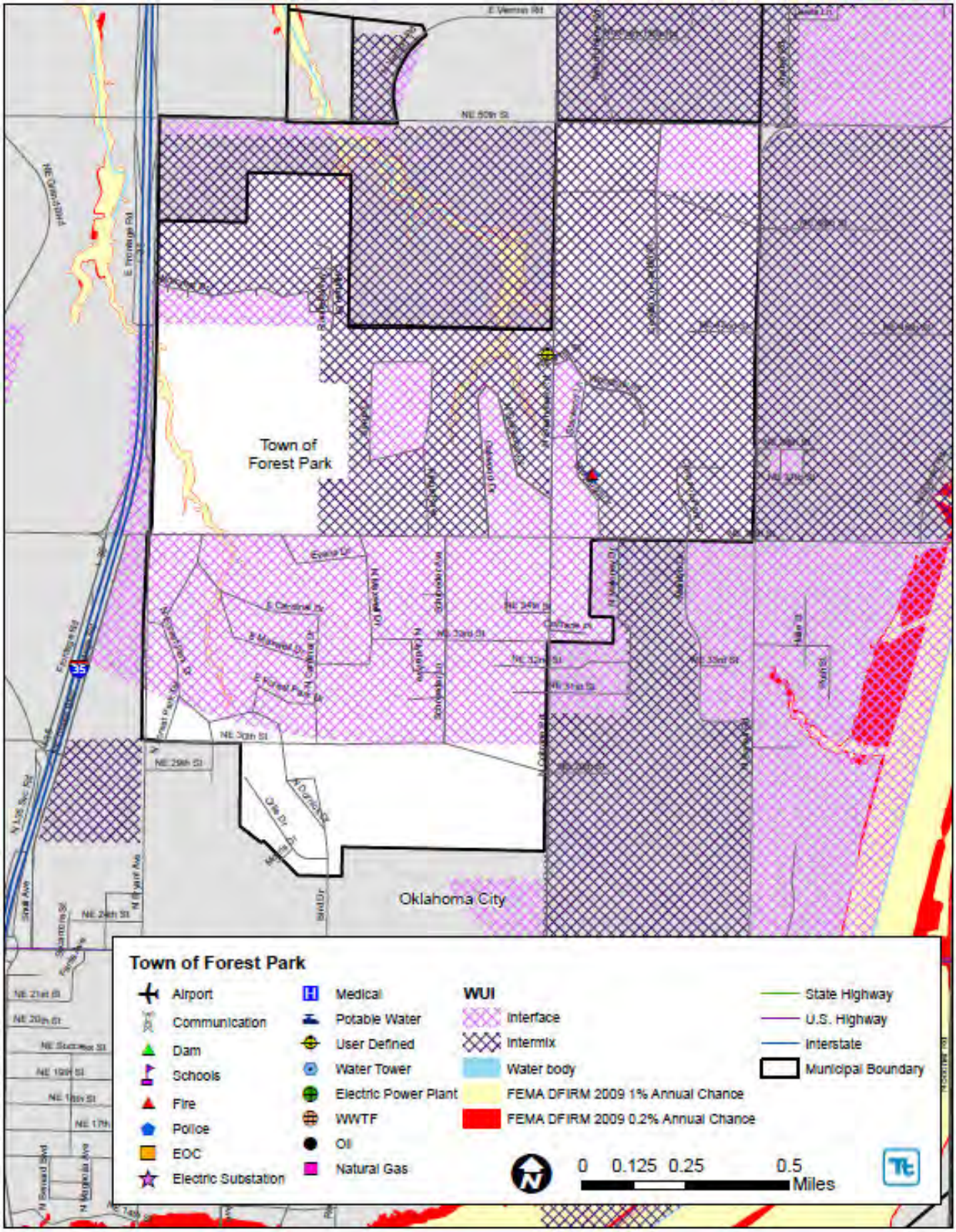
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the Town of Forest Park to illustrate the probable areas impacted within the Town of Forest Park. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the Town of Forest Park has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


Town of Forest Park
Oklahoma City
Town of Forest Park
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
Water body
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
State Highway
U.S. Highway
Interstate
Municipal Boundary
0 0.125 0.25 0.5
Miles

9.8 CITY OF HARRAH

This section presents the jurisdictional annex for the City of Harrah.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Murrel Coleman, Fire Chief 19625 NE 23rd, P.O. Box 636, Harrah, OK 73045 (405) 454-2111 harrahfirechief@hotmail.com	

B.) MUNICIPAL PROFILE

The City of Harrah is located in the southeast corner Oklahoma County. The City is bordered to the north by Oklahoma City, to the south by Oklahoma City, to the east by Lincoln County and to the west by the City of Choctaw. The City of Harrah has a total land area of 11.9 square miles, all of it land. The City is governed by a mayor and four member city council. The 2010 U.S. Census population for the City of Harrah was 5,095.

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the City of Harrah in the 2006 plan.

2006 Initiative Description	Status	Comments
2001 AC/DC Emergency Storm Siren. Device to be centrally located within the city limits to alert citizens of Harrah and surrounding areas of severe weather conditions, wildfires, floods, and hazardous chemical spills and other types of emergencies.	Ongoing	Harrah has purchased one new siren since the last plan, all new receivers, and narrow banded the radios on all the sirens in the area.

Further details on mitigation activities completed or ongoing in the City of Harrah include:

- Straight Street flooding – completed
- Drainage improvement, building elevation – on-going

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the City of Harrah is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	Yes	Canton Lake, Overholser - See local hazard map end of section

Hazard	Local Vulnerability	Comments
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	Yes	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the City of Harrah, the following have been identified as specific hazard vulnerabilities in the City:

- Flood Zone Areas around North Canadian River

Vulnerability assessment modeling has identified the following flood vulnerabilities (see Flood Hazard Profile in Section 5.4):

Critical Facilities Located in the DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss			
			100-Yr	500-Yr	100-Yr Structure Damage %	100-Yr Content Damage %	500-Yr Structure Damage %	500-Yr Content Damage %
HARRAH MS	Harrah (C)	School	X	X	-	-	-	-
VIRGINIA SMITH ES	Harrah (C)	School	X	X	-	-	-	-
CLARA REYNOLDS ES	Harrah (C)	School	X	X	-	-	-	-
HARRAH JHS	Harrah (C)	School	X	X	-	-	-	-

Source: FEMA, 2009; HAZUS-MH 2.0
Notes:

(1) 'X' indicates the facility location as provided by Oklahoma County's Planning Committee is located in the DFIRM flood zone.

(2) HAZUS did not calculate potential loss estimates for some facilities located in the DFIRM flood zone. This is because these facilities are either located outside of the flood depth grid generated by HAZUS, or the depth of water is too shallow and no losses are estimated. When there is a difference between the flood depth grid generated by HAZUS and the DFIRM flood zones, it is most likely due to the resolution of the elevation model used (1/3 Arc Second or 10 meters) which differed from the elevation data used to generate the DFIRM itself.

(3) In some cases, HAZUS calculated potential flood loss to structures outside the FEMA DFIRM. These facilities are located inside the HAZUS flood depth grid.

Growth/Development Trends

The following major residential/commercial development and major infrastructure development are currently known or anticipated in the City of Harrah:

New Development/Potential Development in the City of Harrah						
Property Name	**Type Residential or Commercial**	**Number of Structures**	**Address**	**Block and Lot**	**Known Hazard Zone**	**Description/Status**
Fall Creek	Residential	60	Reno & S. Harrah Road			In Progress
Capella	Residential Commercial	13 2	20225 Block of NE 23rd Street	20225		In Progress
Padre Pio	Residential	56	½ mile south of SE 29th-East Side of Harrah Road			In Progress
Cambria	Residential	4	¼ mile south of NE 23rd-West Side of Luther Road			In Progress
Red Cedar Housing (senior housing)	Residential	20	Harrah Road-West Side, South of NE 10th			Just Started

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE CITY

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Flooding	DR-441	Yes	
November 26, 1974	Flooding	DR-453	Yes	
October 17-19, 1983	Flooding	DR-693	Yes	
September 29 – October 1, 1986	Flooding	DR-778	Yes	
May 2, 1990	Flooding, Tornado	DR-866	Yes	
May 8, 1993	Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
August 11-12, 2004	Flash Flood	N/A	N/A	
March 12, 2006	Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	
January 12-26, 2007	Severe Winter Storms	DR-1678	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 29, 2007	Tornadoes	N/A	N/A	
May 4-11, 2007	Tornadoes, Flooding	DR-1707	No	NE 50th and Harrah Road were closed due to flooding.
May 24, 2007 to June 1, 2007	Flooding, Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Flooding, Tornadoes	DR-1712	Yes	Two feet of water was reported on the roadway at NE 50th and Harrah Road.
Aug. 18, 2007 to Sept. 12, 2007	Tornadoes, Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	Multiple power outages/lines down due to ice. Inaccessible roadways due to down trees/powerlines. Areas w/o power 10 days.
March 17-23, 2008	Tornadoes, Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	
March 30-31, 2008	Severe Storms	N/A	N/A	
April 9-28, 2008	Tornadoes, Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 9, 2008	Floods	DR-1754	No	
May 10-13, 2008	Tornadoes, Flooding	DR-1756	No	
June 3-20, 2008	Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Tornadoes, Flooding	DR-1803	No	
February 10-11, 2009	Tornadoes	DR-1820	Yes	
March 24, 2009	Severe Storms	N/A	N/A	
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 30, 2009	Severe T-Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	
May 13, 2009	Severe Storms	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Tornadoes, Straight-Line Winds	DR-1917	Yes	Multiple structures damaged/destroyed. Search/Rescue efforts. Power outages. Lights set up in heavily damaged areas. Inaccessible roadways due to debris. 1 fatality reported as a result of the storm.
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	
May 10-13, 2010	Tornadoes, Straight-Line Winds	DR-1917	Yes	
July 7-8, 2010	Flooding	N/A	N/A	
Oct. 13, 2010	Earthquake	N/A	N/A	
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	
March 11, 2011	Wildfires	N/A	N/A	29 residential and commercial buildings were lost or heavily damaged in the City; electrical, gas and cable services were out; roads were

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
				closed; shelters were open and several facilities were evacuated.
April 14, 2011	Tornadoes, Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Flooding	DR-1988	No	
May 22-25, 2011	Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Severe Heat	N/A	N/A	

Number of FEMA Identified Repetitive Flood Loss Properties: 0
Number of FEMA Identified Severe Repetitive Flood Loss Properties: 0

Source: Oklahoma Water Resources Board (OWRB)

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances., Plans)	Do you have this? (Y or N)	Code Citation (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	5-101 Ord 1984-6, February 16, 1984
Comprehensive / Master Plan	N	Expired 2010
Zoning Management Ordinance	Y	12-215, 1986
Subdivision Management Ordinance	Y	12-215, 1986
Site Plan Review Requirements	Y	In-house requirements
NFIP Flood Damage Prevention Ordinance (if you are in the NFIP, you must have this!)	Y	12-215.5 Ord 1991-13, August 1, 1991 Ord 2002-08-114
NFIP Elevation Certificates Maintained	Y	12-215, 1986
Floodplain Management Plan	Y	12-215, 1986
Stormwater Management Plan / Ordinance	Y	12-215, 1986
Stream Corridor Management or Protection Plan	Y	12-215, 1986
Erosion Management Ordinance	Y	12-215, 1986
Capital Improvements Plan	N	
Open Space Plan	N	
Economic Development Plan	Y	Industrial Trust
Emergency Response Plan	Y	
Post Disaster Recovery Plan / Ordinance	Y	Hazard Mitigation Plan
Real Estate Disclosure Requirements	N	
Highway Management Plan	N	
COOP/COG Plan	N	
Other (Special Purpose Ordinances such as critical or sensitive areas)		

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Y	Myers Engineering Wiley Rice, City Planner
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Y	Myers Engineering Wiley Rice, City Planner
Planners or engineers with an understanding of natural hazards	Y	Myers Engineering Wiley Rice, City Planner
NFIP Floodplain Administrator (if you are in the NFIP, you must have this person designated – often your code official)	Y	Chris Bain, Floodplain Manager Code Enforcement / Building Inspector
Surveyor(s)	Y	George Davis, Surveyor
Personnel skilled or trained in "GIS" applications	N	
Scientist(s) familiar with natural hazards in the County.	N	
Emergency Manager	Y	DeWayne Jenkins, Sr. Firefighter
Grant Writer(s)	Y	Sue Musch, PT Receptionist / City Manager Secretary
Staff with expertise or training in benefit/cost analysis	Y	Michele Cogdill, Finance / HR Director

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	Yes, previously used
Capital Improvements Project Funding	Yes, previously used
Authority to Levy Taxes for specific purposes	Yes, previously used
User fees for water, sewer, gas or electric service	Yes, previously used
Impact Fees for homebuyers or developers of new development/homes	Yes, previously used
Incur debt through general obligation bonds	Yes, previously used
Incur debt through special tax bonds	Yes
Incur debt through private activity bonds	Don't Know
Withhold public expenditures in hazard-prone areas	Don't Know
Other	

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	TBD	TBD
Public Protection	TBD	TBD
Storm Ready	County	TBD
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. Updating from the 1984 building codes to 2011 or 2013 could provide an opportunity to improve support for the mitigation strategies in the Plan. Revisions to the comprehensive plan are needed and could provide an opportunity to expand on and improve the policies and programs identified herein. Zoning management presents an opportunity to regulate positioning large quantities of hazardous materials that may be a secondary threat after a natural hazard incident and supports Goal #6 (Structural Projects). However, Zoning Management and the Floodplain Management Plan were written long ago and a review and update could provide additional mitigation support opportunities. Local floodplain management present good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). Having Planners and Engineers with knowledge of land development and land management practices increases the ability to mitigate against wildfire, flooding, and other hazards, and supports Goal #2 (Prevention) in the plan. Having a local Emergency Manager with a fire background provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). The fiscal capabilities of items such as Community Development Block Grants, Capital Improvements Project Funding, fees and debts present opportunities for monies to support Goal #6 (Structural Projects) public education and Goal #5 (Public Awareness).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
1	AC/DC Emergency Storm Sirens –to alert the citizens of Harrah and surrounding areas of severe weather conditions, wildfires, floods, and hazardous chemical spills and other types of emergencies (2006 Plan)	N/A	Flood, Wind, Wildfire		City Fire Department	High (life safety)	Medium $25,000 each	City Funds, HMGP, other grants	Ongoing, Long Term	High
	Maintain compliance with and good-standing in the NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community.	New & Existing	NFIP Compliance		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, ISO FEMA	High	Low - Medium	Local Budget	Ongoing	High
	Begin the process to adopt higher regulatory standards to manage flood risk (i.e. increased freeboard, cumulative substantial damage/improvements).	New & Existing	NFIP Compliance		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, FEMA	Low	Low	Municipal Budget	Short	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Conduct and facilitate community and public education and outreach for residents and businesses to include, but not be limited to, the following to promote and effect natural hazard risk reduction: • Provide and maintain links to the HMP website, and regularly post notices on the County/municipal homepage(s) referencing the HMP webpages. • Prepare and distribute informational letters to flood vulnerable property owners and neighborhood associations, explaining the availability of mitigation grant funding to mitigate their properties, and instructing them on how they can learn more and implement mitigation. • Use email notification systems and newsletters to better educate the public on flood insurance, the availability of mitigation grant funding, and personal natural hazard risk reduction measures. • Work with neighborhood associations, civic and business groups to disseminate information on flood insurance and the availability of mitigation grant funding.									
	See above.	NA	Flood		Municipality with support from Planning Partners, OEM, FEMA	Low - Medium	Low - Medium	Municipal Budget; HMA programs with local or county match	Short	High
	Have designated NFIP Floodplain Administrator (FPA) become a Certified Floodplain Manager through the ASFPM, and pursue relevant continuing education training such as FEMA Benefit-Cost Analysis.	N/A	NFIP Compliance		NFIP Floodplain Administrator	Medium	Low	Municipal Budget	Short (DOF)	High
	Archive elevation certificates	NA	NFIP Compliance		NFIP Floodplain Administrator	Low	Low	Local Budget	On-going	High
2	Conduct All-Hazard mitigation classes through town hall meetings and senior centers		Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperatures, Flood, Hail, Lightning, Wind, Wildfire, Winter Storms		Fire Department	High	$6,000	City budget	Long	Medium
3	Distribute All-Hazard		Dam Failure,		Fire	High	$130,000	HMGP,	5 years	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Weather Radios to senior centers and other high risk residents		Drought, Earthquake, Extreme Temperatures, Flood, Hail, Lightning, Wind, Wildfire, Winter Storms		Department			City budget		
4	Enact a regulation to require a check for expansive soils prior to building a city building and perform soil stabilization if expansive soils are found.		Expansive Soil		Public Works	High	Medium	City Budget	Long	Medium

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.

Costs:
Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

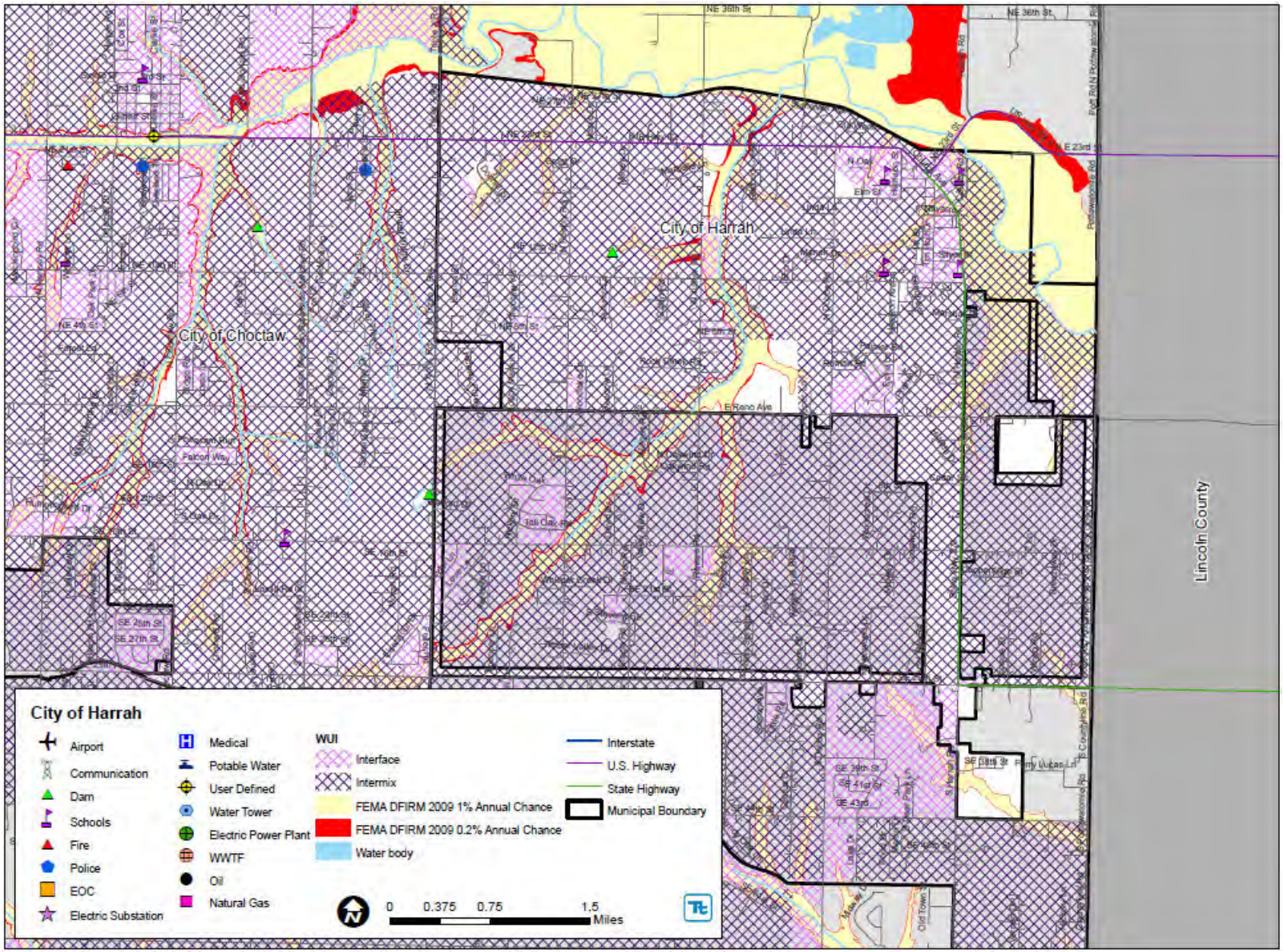
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the City of Harrah to illustrate the probable areas impacted within the City of Harrah. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the City of Harrah has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


City of Harrah
City of Choctaw
Lincoln County
City of Harrah
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
Water body
Interstate
U.S. Highway
State Highway
Municipal Boundary
0 0.375 0.75 1.5
Miles

9.9 TOWN OF LUTHER

This section presents the jurisdictional annex for the Town of Luther.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Jason Miller, Fire Chief, Emergency Manager (405) 277-3883 Lutherfire702@gmail.com	

B.) MUNICIPAL PROFILE

The Town of Luther is located in northeastern Oklahoma County. The Town is bordered to the north and south by Oklahoma City, to the east by Lincoln County and to the west by the Town of Edmond and Oklahoma City. The Town of Luther has a total land area of 4.5 square miles, all of it land. The 2010 U.S. Census population for the Town of Luther was 1,221.

Growth/Development Trends

Modest residential development is anticipated on the north side of Route 66.

The Luther Fire Department has received a grant to expand the size of the building and create an EOC. This is located at the corner of Luther Road and 2nd street, and is not in the NFIP Special Flood Hazard Area.

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the Town of Luther in the 2006 plan.

2006 Initiative Description	Status	Comments
The Oklahoma County Highway District #3 will need to rebuild the apron of the State Highway 66 bridge and/or rebuild the south side of the bridge to help improve flow of the Deep Ford River under it, and to reduce the buildup of floating debris which causes localized flooding and endangers the bridge structure.	TBD…this project is County and State property, not the Town of Luther.	This is not a local project.

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the Town of Luther is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	Yes	Arcadia Lake - See local hazard map end of section
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	Yes	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the Town of Luther, the following have been identified as specific hazard vulnerabilities:

- Route 66 floods leaving the only way out of town to the south.
- Wastewater lift stations are vulnerable to flooding
- Potable water system is vulnerable to lightning
- Residences and potential new development on the north side of Route 66 lack fire protection
- Warning systems are inadequate and lack sirens to the north
- Many residents lack storm sheltering
- Town hall is vulnerable to hazard events (esp. wind).
- Public Works has hazardous materials and city equipment located adjacent to the flood plain

Vulnerability assessment modeling has identified the following flood vulnerabilities (see Flood Hazard Profile in Section 5.4):

Critical Facilities Located in the DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss			
			100-Yr	500-Yr	100-Yr Structure Damage %	100-Yr Content Damage %	500-Yr Structure Damage %	500-Yr Content Damage %
Luther Mill And Farm Supply	Luther (T)	User Defined	X	X	-	-	-	-

Source: FEMA, 2009; HAZUS-MH 2.0

Utilities Located in the Preliminary DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss	
			100 Year	500 Year	100 Year Damage %	500 Year Damage %
Octagon Resources / Dynamic Booster Station	Luther (T)	Natural Gas	X	X	-	40.0
Wastewater Treatment Plant	Midwest City (C)	WWTF	X	X	20.2	10.9

Source: FEMA, 2009; HAZUS-MH 2.0

Notes:

(1) 'X' indicates the facility location as provided by Oklahoma County's Planning Committee is located in the DFIRM flood zone.

(2) HAZUS did not calculate potential loss estimates for some facilities located in the DFIRM flood zone. This is because these facilities are either located outside of the flood depth grid generated by HAZUS, or the depth of water is too shallow and no losses are estimated. When there is a difference between the flood depth grid generated by HAZUS and the DFIRM flood zones, it is most likely due to the resolution of the elevation model used (1/3 Arc Second or 10 meters) which differed from the elevation data used to generate the DFIRM itself.

(3) In some cases, HAZUS calculated potential flood loss to structures outside the FEMA DFIRM. These facilities are located inside the HAZUS flood depth grid.

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE TOWN

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Flooding	DR-441	Yes	
November 26, 1974	Flooding	DR-453	Yes	
May 13, 1975	Tornado	N/A	N/A	
October 17-19, 1983	Flooding	DR-693	Yes	
September 29 – October 1, 1986	Flooding	DR-778	Yes	
May 2, 1990	Flooding, Tornado	DR-866	Yes	
May 8, 1993	Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
May 9, 2003	Tornado	N/A	N/A	Two injuries resulted from the F3 tornado. This tornado affected Jones as well.
August 11-12, 2004	Flash Flood	N/A	N/A	
November 10, 2004	Tornado	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 12, 2006	Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	
January 12-26, 2007	Severe Winter Storms	DR-1678	No	
March 29, 2007	Severe Storms and Tornadoes	N/A	N/A	
May 4-11, 2007	Tornadoes, Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Flooding, Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Flooding, Tornadoes	DR-1712	Yes	
Aug. 18, 2007 to Sept. 12, 2007	Tornadoes, Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	
March 17-23, 2008	Tornadoes, Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	
March 30-31, 2008	Severe T-Storms	N/A	N/A	
April 9-28, 2008	Tornadoes, Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 9, 2008	Floods	DR-1754	No	
May 10-13, 2008	Tornadoes, Flooding	DR-1756	No	
June 3-20, 2008	Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Tornadoes, Flooding	DR-1803	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
February 10-11, 2009	Tornadoes	DR-1820	Yes	
March 24, 2009	Severe Storms	N/A	N/A	
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	
March 30, 2009	Severe Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	
May 13, 2009	Severe Storms	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Tornadoes, Straight-Line Winds	DR-1917	Yes	
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	Yes, documentation of damages TBD.
May 10-13, 2010	Tornadoes, Straight-Line Winds	DR-1917	Yes	
July 7-8, 2010	Flooding	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
Oct. 13, 2010	Earthquake	N/A	N/A	
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	
April 14, 2011	Tornadoes, Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Flooding	DR-1988	No	
May 22-25, 2011	Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Extreme Heat	N/A	N/A	

Number of FEMA Identified Repetitive Flood Loss Properties: 0
Number of FEMA Identified Severe Repetitive Flood Loss Properties: 0

Source: Oklahoma Water Resources Board (OWRB)

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances., Plans)	Do you have this? (Y or N)	Code Citation (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	IRC 2009; State IBC August 2012
Comprehensive / Master Plan	N	Not formalized
Zoning Management Ordinance	Y	12-101
Subdivision Management Ordinance	Y	12-301
Site Plan Review Requirements	Y	5-101
NFIP Flood Damage Prevention Ordinance	Y	12-401; pre-1980 community
NFIP Elevation Certificates Maintained	Y	Per OWRD, since July 2011
Floodplain Management Plan	Y	12-401; also through All Hazards Plan (2006, updating 2012)
Stormwater Management Plan / Ordinance	N	
Stream Corridor Management or Protection Plan	N	
Erosion Management Ordinance	N	
Capital Improvements Plan	Y	August 2010 completed
Open Space Plan	N	
Economic Development Plan	Y	Formed Economic Development Authority for the town in Spring 2011
Emergency Response Plan	N	
Post Disaster Recovery Plan / Ordinance	N	
Real Estate Disclosure Requirements	N	
Highway Management Plan	N	
COOP/COG Plan	N	
Other (Special Purpose Ordinances such as critical or sensitive areas)	N	

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Y	Chris Bridges / Building Official
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Y	Chris Bridges / Building Official
Planners or engineers with an understanding of natural hazards	Y	Chris Bridges / Building Official and NFIP FPA
NFIP Floodplain Administrator	Y	Chris Bridges / Building Official and NFIP FPA
Surveyor(s)	Y	Contracted
Personnel skilled or trained in "GIS" applications	Y	Chris Bridges and private contractor
Scientist(s) familiar with natural hazards in the County.	N	
Emergency Manager	Y	Beginner level – Kim Bournes, Councilman
Grant Writer(s)	Y	Tami McDaniels – Independent Sandy Graber – General Manager, LEDA
Staff with expertise or training in benefit/cost analysis	N	

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	Yes. Used for addition to the FD approved in 2011
Capital Improvements Project Funding	Yes. ACOG REAP grant to repave 3 streets.
Authority to Levy Taxes for specific purposes	No
User fees for water, sewer, gas or electric service	Yes. Water, sewer, solid waste.
Impact Fees for homebuyers or developers of new development/homes	No
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activity bonds	No
Withhold public expenditures in hazard-prone areas	No
Other	No

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	TBD	TBD
Public Protection	TBD	TBD
Storm Ready	County	TBD
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. Zoning management presents an opportunity to regulate positioning of hazardous materials that may be a secondary threat after a natural hazard incident and supports Goal #6 (Structural Projects). The Floodplain Management Plan which was recently updated and local floodplain management present good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). The Economic Development Plan supports Goal #2 (Prevention). Having a Building Official with "GIS" skills, knowledge of land development and land management practices who also is the NFIP administrator increases the ability to mitigate against wildfire, flooding, and other hazards, and supports Goal #2 (Prevention) in the plan and Goal #3 (Protecting Critical Facilities) by identifying risk areas. Developing/training a local Emergency Manager provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). The fiscal capabilities of items such Community Development Block Grants and Capital Improvements Project Funding, fees and debts have already proven the ability to support Goal #6 (Structural Projects) and could support Goal #5 (Public Awareness).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Install floodwalls (approx. 20' x 20') for two (2) wastewater lift stations	Existing	Flood		Engineering; DPW	High (protection of critical infrastructure)	$65K each station	HMA Grant Funding; Local Budgets	Short	Medium
	Provide backup power for two (2) wastewater lift stations		Dam Failure, Flood, Earthquake, Extreme Temps, Hail, Lightning, Wildfire, Wind, Winter Storm		Engineering; DPW	High (protection of critical infrastructure)	Medium	HMA Grant Funding; Local Budgets	Short	High
	Provide lightning protection for three potable water wells	Existing	Lightning,		Engineering; DPW	High (protection of critical infrastructure)	Medium	HMA Grant Funding; Local Budgets	Short	Medium
	Provide backup power for three potable water wells		Dam Failure, Flood, Earthquake, Extreme Temps, Hail, Lightning, Wildfire, Wind, Winter Storm		Engineering; DPW	High (protection of critical infrastructure)	$20K each well for backup power	HMA Grant Funding; Local Budgets	Short	High
	Install a storm siren on the north side of town	Existing	Wind		Engineering; DPW	High (protection of critical infrastructure)	Medium	HMA Grant Funding; Local Budgets	Short	High
	Install backup power at Town Hall	Existing	Dam Failure, Flood, Earthquake, Extreme		Engineering; DPW	High (protection of critical infrastructure)	$20K	HMA Grant Funding; Local Budgets	Short	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
			Temps, Hail, Lightning, Wildfire, Wind, Winter Storm							
	Upgrade early warning system(s) including adding a mass notification system	N/A	Dam Failure, Drought, Flood, Earthquake, Extreme Temps, Hail, Lightning, Wildfire, Wind, Winter Storm		Local EM	High (life safety)	Medium	Emergency preparedness grant programs; local budgets for match	Long	Low
	Distribute All-Hazards Weather Radios to elderly and special needs citizens	N/A	Dam Failure, Drought, Flood, Earthquake, Extreme Temps, Hail, Lightning, Wildfire, Wind, Winter Storm		Fire / EM	High (life safety)	Low	HMGP; local budgets for match	Long	Low
	Relocate sewer lines through the main drainage in the Special Flood Hazard Area. A sewer line here is exposed.	Existing	Flood		Engineering; DPW	High (protection of critical infrastructure)	$25k	HMA Grant Funding; Local Budgets	Short (<1 yr)	High
	Raise 15 manholes above Base Flood Elevation	Existing	Flood		Engineering; DPW	High (protection of critical infrastructure – including lift stations and possibly sewage lagoons)	$4-5k each	HMA Grant Funding; Local Budgets	Short (<1 yr)	High
	Relocate equipment and hazardous	Existing	Flood		Engineering; DPW	Medium	TBD	TBD	Long	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	materials associated with public works, that are currently located adjacent to the floodplain									
	Maintain compliance with and good-standing in the NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community.	New & Existing	NFIP Compliance		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, ISO FEMA	High	Low - Medium	Local Budget	Ongoing	High
	Begin the process to develop and adopt an ordinance for additional freeboard (18" in 100-year zone, 12" in 500-year zone).	New & Existing	Flood		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, FEMA	Medium (reduced flood vulnerability)	Low	Municipal Budget	Short (1 year)	High
	Adopt ordinance requiring any mobile homes, campers, RVs to be required to get a building permit if occupied more than 180 days. Building permits will require compliance with FDPO	New & Existing	Flood		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from municipal legal counsel	Medium (reduced flood vulnerability)	Low	Municipal Budget	Short (1 year)	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	and 18" freeboard requirement.									
	Conduct and facilitate community and public education and outreach for residents and businesses to include, but not be limited to, the following to promote and effect natural hazard risk reduction: • Provide and maintain links to the HMP website, and regularly post notices on the County/municipal homepage(s) referencing the HMP webpages. • Prepare and distribute informational letters to flood vulnerable property owners and neighborhood associations, explaining the availability of mitigation grant funding to mitigate their properties, and instructing them on how they can learn more and implement mitigation. • Use email notification systems and newsletters to better educate the public on flood insurance, the availability of mitigation grant funding, and personal natural hazard risk reduction measures. • Work with neighborhood associations, civic and business groups to disseminate information on flood insurance and the availability of mitigation grant funding. • Participate in regional public awareness and education initiatives through the LEPCs.									
	See above.	NA	Flood		Municipality with support from Planning Partners, OEM, FEMA	Low - Medium	Low - Medium	Municipal Budget; HMA programs with local or county match	Short	High
	Create mitigation education pamphlets and distribute at booths during large public events and at public city venues.		Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperatures, Flood, Hail, Lightning, Wildfire, Wind, Winter Storms		Fire / EM	High	Low	HMGP, Local budget	Long	Low
	Enact a regulation to require a check for expansive soils prior to building a city building and perform soil stabilization if expansive soils are found.		Expansive Soil		Public Works	High	Medium	Local budget	Long	Low
	Replace Tin-Horns at several major intersections		Flood		Public Works w/ County	High	High	HMGP w/ local match	Long	Medium

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.
Costs:
Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

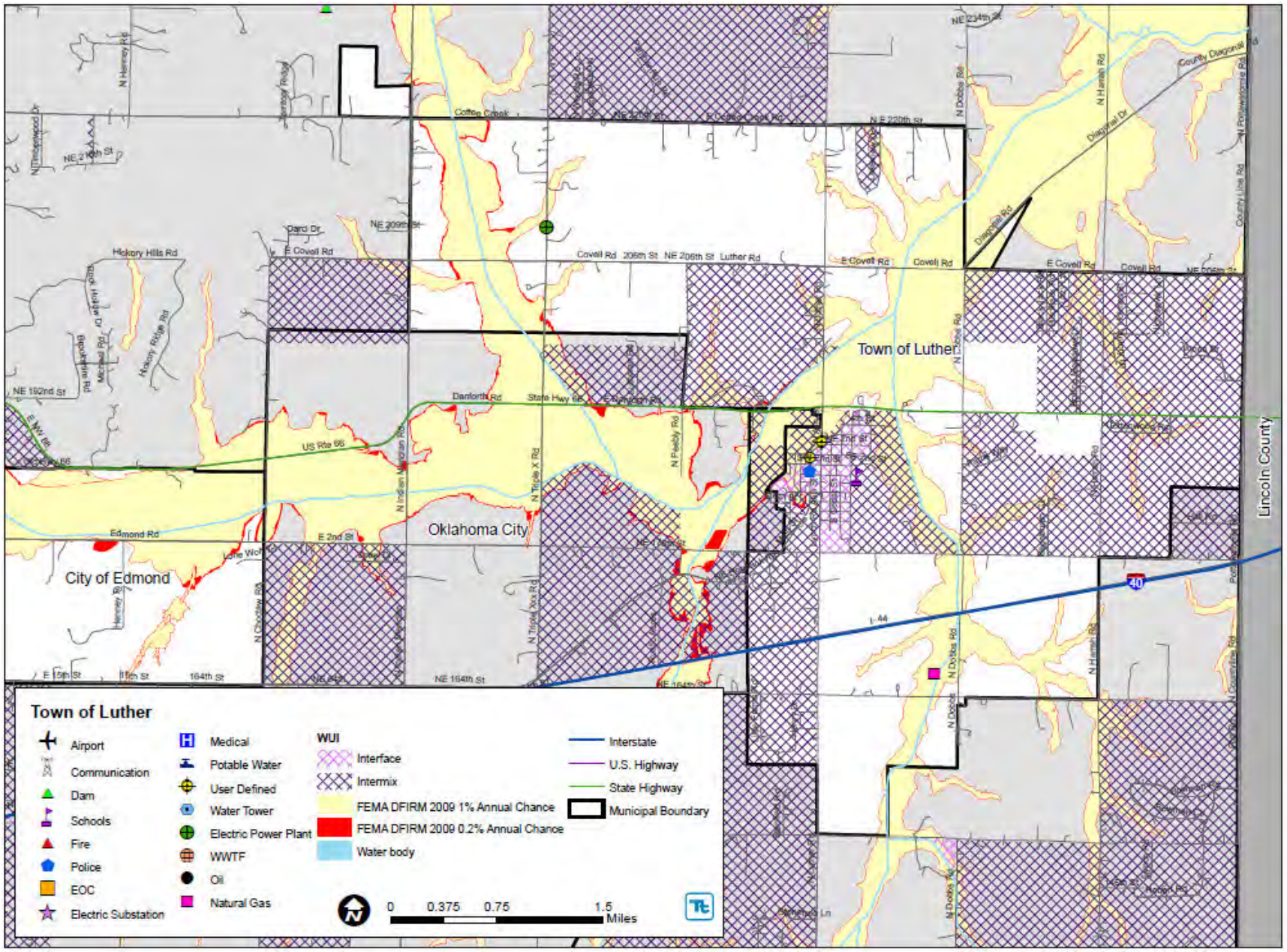
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the Town of Luther to illustrate the probable areas impacted within the Town of Luther. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the Town of Luther has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


Town of Luther
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
Water body
Interstate
U.S. Highway
State Highway
Municipal Boundary
0 0.375 0.75 1.5 Miles
Town of Luther
Oklahoma City
City of Edmond
Lincoln County
Coffee Creek
Covell Rd
Luther Rd
Danforth Rd
State Hwy 66
US Rte 66
Edmond Rd
E 2nd St
NE 164th St
I-44
40

9.10 CITY OF MIDWEST CITY

This section presents the jurisdictional annex for the City of Midwest City.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Mike Bower Emergency Management 100 North Midwest Boulevard, Midwest City, OK 73110 (405) 739-1386 mbower@midwestcityok.org	Patrick Menefee, PE City Engineer 100 North Midwest Boulevard, Midwest City, OK 73110 405.739.1220 PMenefee@MidwestCityOK.org

B.) MUNICIPAL PROFILE

The City of Midwest City is located in southern Oklahoma County. It is bordered to the north by the Town of Spencer, to the south by Oklahoma City, to the east by the City of Choctaw, and to the west by the City of Del City. The City of Midwest City has a total land area of 24.6 square miles, all of it land. The City is governed by a mayor and six member City Council. The 2010 U.S. Census population for the City of Midwest City was 54,371.

Low-lying areas in the City are subject to periodic flooding caused by overflow of Crutcho, Soldier and Silver Creeks. Most flooding occurs upstream from roadways that restrict the flow. Urban expansion and future development in floodplains could increase the severity of flooding in the City. (FEMA NFIP FIS – 2009)

Known or Anticipated Future Development

The following table summarizes major residential/commercial development and major infrastructure development that are identified for the next five (5) years in the City. Refer to the map at the end of this annex which illustrates the hazard areas along with the location of potential new development.

Property Name	Type (Residential or Commercial)	Number of Structures	Address	Known Hazard Zone	Description/Status
Soldier Creek Industrial Park	Commercial	Unknown	7500 blk of NE 23rd St.	No SHFA	Pending

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the City of Midwest City in the 2006 plan.

2006 Initiative Description	Status	Comments
The City of Midwest City would put out a bid to replace the bridge structure at Soldier Creek, which is subject to repeated flooding. This is located near Midwest Boulevard and is South of NE 10th Street. The City of Midwest City would try to do an in-kind march, HMGP with a 80/20 match, Oklahoma State BRO program.	In Progress	Carry forward in update.

Further details on mitigation activities completed or ongoing in the City include:

- Ridgewood Channel – 116 Ridgewood/207 and 211 Guy Drive. The channel was improved with gabion rock lining, improving flow and reducing flooding.
- The City made improvements to the Crutcho Creek by cleaning and widening it.
- Containment project, pumps and improvements at the depot bridge have reduced the depth of inundation in the Riverside Mobile Home park area.
- Through HMGP funding, the City installed three fixed weather stations to provide critical information about local weather that can be used by city departments and the public in decision-making (e.g. burn days). Project completed in May, 2010.
- The City installed storm shelters and added two additional sirens. Siren project completed February 2012 using HMGP funding.
- The City provided 912 weather radios to citizens living in CDBG area and/or mobile homes to improve severe weather notification. Project completed April 2010 using HMGP funding.
- The City has a strong household hazardous waste program that serves to mitigate hazardous waste releases during hazard events (e.g. flood, tornado).

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the City of Midwest City is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	Yes	Canton Lake, Overholser - See local hazard map end of section
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	Yes	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

Additional vulnerabilities noted by the City of Midwest City include:
Flooding at SE 15th St. and Westminister to Anderson Rd where two creeks cross.
An apartment complex on NE 10th has repeat flood problems.
Three residences have flooded near the 300 block of Post Rd.
Residents desire additional safe rooms.

Vulnerability assessment modeling has identified the following flood vulnerabilities (see Flood Hazard Profile in Section 5.4):

Critical Facilities Located in the DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss			
			100-Yr	500-Yr	100-Yr Structure Damage %	100-Yr Content Damage %	500-Yr Structure Damage %	500-Yr Content Damage %
EOC At Public Works	Midwest City (C)	EOC	X	X	22.9	97.6	15.1	70.5
Crutcho Elementary School	Midwest City (C)	School	X	X	-	-	-	-
STEED ES	Midwest City (C)	School	X	X	9.1	64.3	9.0	52.7
Fairfax Apartments	Midwest City (C)	User Defined	X	X	-	-	-	-
Parkview Apartments	Midwest City (C)	User Defined		X	29.9	37.9	33.5	42.1
Vacant	Midwest City (C)	User Defined	X	X	-	-	-	-
YMCA	Midwest City (C)	User Defined	X	X	-	-	-	-
Gas Station- name unknown	Midwest City (C)	User Defined	X	X	-	-	-	-
Gas Station- name unknown	Midwest City (C)	User Defined	X	X	-	-	-	-
Gas Station- name unknown	Midwest City (C)	User Defined	X	X	-	-	-	-
Comfort Inn & Suites East	Midwest City (C)	User Defined		X	-	-	-	-
Boeing Aero Space	Midwest City (C)	User Defined	X	X	-	-	-	-
Midwest Square Office Park	Midwest City (C)	User Defined		X	20.7	32.9	38.6	52.6
Concord Apartments	Midwest City (C)	User Defined			22.8	27.7	22.8	27.7
Village Oaks Plaza	Midwest City (C)	User Defined			16.0	56.0	4.3	11.8

Source: FEMA, 2009; HAZUS-MH 2.0

Utilities Located in the Preliminary DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss	
			100 Year	500 Year	100 Year Damage %	500 Year Damage %
Wastewater Treatment Plant	Midwest City (C)	WWTF	X	X	20.2	10.9

Source: FEMA, 2009; HAZUS-MH 2.0

Notes:

(1) 'X' indicates the facility location as provided by Oklahoma County's Planning Committee is located in the DFIRM flood zone.

(2) HAZUS did not calculate potential loss estimates for some facilities located in the DFIRM flood zone. This is because these facilities are either located outside of the flood depth grid generated by HAZUS, or the depth of water is too shallow and no losses are estimated. When there is a difference between the flood depth grid generated by HAZUS and the DFIRM flood zones, it is most likely due to the resolution of the elevation model used (1/3 Arc Second or 10 meters) which differed from the elevation data used to generate the DFIRM itself.

(3) In some cases, HAZUS calculated potential flood loss to structures outside the FEMA DFIRM. These facilities are located inside the HAZUS flood depth grid.

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE CITY

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Flooding	DR-441	Yes	
November 26, 1974	Flooding	DR-453	Yes	
October 17-19, 1983	Flooding	DR-693	Yes	
September 29 – October 1, 1986	Flooding	DR-778	Yes	
May 2, 1990	Flooding, Tornado	DR-866	Yes	
May 8, 1993	Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
August 11-12, 2004	Flash Flood	N/A	N/A	
March 12, 2006	Tornadoes	DR-1637	No	Yes
December 28-30, 2006	Severe Winter Storm	DR-1677	No	
January 12-26, 2007	Severe Winter Storms	DR-1678	No	Yes. City experienced $113,000 in property/infrastructure damage and public assistance. Utility outages lasted about 3 days.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 29, 2007	Tornadoes	N/A	N/A	Yes
May 4-11, 2007	Tornadoes, Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Flooding, Tornadoes	DR-1723	No	Yes. Damages unspecified.
June 10, 2007 to July 25, 2007	Flooding, Tornadoes	DR-1712	Yes	Yes. City experienced about $7,000 of damage due to flooding.
Aug. 18, 2007 to Sept. 12, 2007	Tornadoes, Flooding	DR-1718	Yes	Yes
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	Yes. Damages unspecified.
March 17-23, 2008	Tornadoes, Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	
March 30-31, 2008	Severe Storms	N/A	N/A	
April 9-28, 2008	Tornadoes, Flooding	DR-1754	No	Yes. City experienced $4.4 million in property/infrastructure damage and public assistance. City provided sheltering for 72 hours, then transferred to central shelter in OKC. Utilities for much of the city were out, some as long as 14 days.
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 9, 2008	Floods	DR-1754	No	
May 10-13, 2008	Tornadoes, Flooding	DR-1756	No	
June 3-20, 2008	Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Tornadoes, Flooding	DR-1803	No	
February 10-11, 2009	Tornadoes	DR-1820	Yes	
March 24, 2009	Severe Storms	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	
March 30, 2009	Severe Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	Yes. 11 homes destroyed.
May 13, 2009	Severe Storms	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Severe Storms, Tornadoes, and Straight-Line Winds	DR-1917	Yes	
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	
May 10-13, 2010	Severe Storms, Tornadoes, and Straight-Line Winds	DR-1917	Yes	
July 7-8, 2010	Flooding	N/A	N/A	
Oct. 13, 2010	Earthquake	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	
April 14, 2011	Severe Storms, Tornadoes, And Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Severe Storms And Flooding	DR-1988	No	
May 22-25, 2011	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Severe Heat	N/A	N/A	

Number of FEMA Identified Repetitive Flood Loss Properties: 0
Number of FEMA Identified Severe Repetitive Flood Loss Properties: 0

Source: Oklahoma Water Resources Board (OWRB)

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances., Plans)	Do you have this? (Y or N)	Code Citation (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	2006 IBC – Adopted 2007
Comprehensive / Master Plan	Y	Midwest City Comprehensive Plan – 2008 (updated)
Zoning Management Ordinance	Y	Midwest City Zoning Ordinance – 2010
Subdivision Management Ordinance	Y	Midwest City Zoning Ordinance – 2010
Site Plan Review Requirements	Y	Midwest City Zoning Ordinance – 2010
NFIP Flood Damage Prevention Ordinance	Y	Midwest City Floodplain Regulations – 2009
NFIP Elevation Certificates Maintained	Y	Since 1983
Floodplain Management Plan	Y	Part of All Hazards Mitigation Plan – 2006, updating 2012
Stormwater Management Plan / Ordinance	Y	Oklahoma County Storm Water Quality & Erosion Control Regulations – 2009
Stream Corridor Management or Protection Plan	N	
Erosion Management Ordinance	Y	Oklahoma County Storm Water Quality & Erosion Control Regulations – 2009
Capital Improvements Plan	Y	C.I.P. Fund Committee
Open Space Plan	Y	Midwest City Zoning Ordinance – 2010
Economic Development Plan	Y	Chamber of Commerce
Emergency Response Plan	Y	City has an Emergency Operations Plan and an active LEPC
Post Disaster Recovery Plan / Ordinance	N	
Real Estate Disclosure Requirements	N	
Highway Management Plan	N	
COOP/COG Plan	Y	City is a member of the Association of Central Oklahoma Governments (ACOG)
Other (Special Purpose Ordinances such as critical or sensitive areas)		

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Y	Engineering Department – one engineer; four planners
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Y	One Chief Building Official; two building inspectors
Planners or engineers with an understanding of natural hazards	Y	Engineering Department – one engineer; one planner
NFIP Floodplain Administrator	Y	Engineering Department – planner and floodplain administrator; two CFMs
Surveyor(s)	N	
Personnel skilled or trained in "GIS" applications	Y	GIS Supervisor and Tech
Scientist(s) familiar with natural hazards in the County.	N	
Emergency Manager	Y	Emergency Management: one EM director and two assistants
Grant Writer(s)	Y	Three grant writers
Staff with expertise or training in benefit/cost analysis	Y	Emergency Manager and grants

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	Yes – one grants manager and two assistants
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for specific purposes	No
User fees for water, sewer, gas or electric service	No
Impact Fees for homebuyers or developers of new development/homes	Yes
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activity bonds	No
Withhold public expenditures in hazard-prone areas	Yes
Other	

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	TBD	TBD
Public Protection	TBD	TBD
Storm Ready	County	TBD
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. The comprehensive plan provides an opportunity to expand on and improve the policies and programs identified herein. Zoning management presents an opportunity to regulate positioning hazardous materials that may be a secondary threat after a natural hazard incident and supports Goal #6 (Structural Projects). The updated Floodplain Management Plan and local floodplain management present good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). Having a GIS supervisor and tech support Goal #2 (Prevention) and Goal #3 (Protecting Critical Facilities) by identifying risk areas. Having Planners and an Engineer with knowledge of land development, land management practices and especially natural hazards increases the ability to mitigate against wildfire, flooding, and other hazards, and supports Goal #2 (Prevention) in the plan. Having an Emergency Management staff with an Emergency Management Director with a fire background provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). Grant writing staff furthers the ability to obtain funds for mitigation projects listed below. The fiscal capabilities of items such as Community Development Block Grants and Capital Improvements Project Funding present opportunities for monies to support Goal #6 (Structural Projects).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	SE 15th Street from Westminster to Anderson. Street reconstruction, including two creek crossings. Both will be enlarged, reducing the cane of backwater buildup and road overtopping.	Existing	Flood		City Engineering with ODOT	Reduced local flooding	High	ODOT	Short	High
	Replace the bridge structure at Soldier Creek, which in its current configuration causes repeated flooding. This is located near Midwest Boulevard and is south of NE 10th Street (2006 Plan) The bridge is currently being reconstructed as of summer 2013.	Existing	Flood		City Engineering	Reduced local flooding	High $1,570,000 (2006)	In-kind match, HMGP, State BRO program	Short	High
	Soldier Creek Industrial Park – 7900 Block of NE 23rd Street. FEMA LOMR and CLOMR applications will be filed updating the flood area and model for the property.	Existing	Flood		City Engineering	Improved floodplain delineation	Medium - High	EDA Grant	Short	High
	Implement the City-wide safe room program, providing a total of 800 safe rooms to Midwest City residents through the two FEMA HMGP grants (DR-	Existing	Tornado		City Emergency Management working with OEM and Community	High – Life Safety for 800 residential properties	~1.8MM	FEMA HMGP	Short	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	1917 and DR-1803).				Development					
	Maintain compliance with and good-standing in the NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community.	New & Existing	NFIP Compliance		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, ISO FEMA	High	Low - Medium	Local Budget	Ongoing	High
	Conduct and facilitate community and public education and outreach for residents and businesses to include, but not be limited to, the following to promote and effect natural hazard risk reduction: • Provide and maintain links to the HMP website, and regularly post notices on the County/municipal homepage(s) referencing the HMP webpages. • Prepare and distribute informational letters to flood and other hazard vulnerable property owners and neighborhood associations, explaining the availability of mitigation grant funding to mitigate their properties, and instructing them on how they can learn more and implement mitigation. • Use email notification systems and monthly newsletters (water bills) to better educate the public on flood insurance, the availability of mitigation grant funding, personal natural hazard risk reduction measures, and the household hazardous waste program. • Leverage strong public outreach resources and channels of the stormwater quality division. • Work with neighborhood associations, civic and business groups to disseminate information on flood insurance and the availability of mitigation grant funding. • Participate in regional public awareness and education initiatives through the LEPCs.									
	See above.	NA	Flood		Municipality with support from Planning Partners, OEM, FEMA	Low - Medium	Low - Medium	Municipal Budget; HMA programs with local or county match	Short	High
	Participate in the Community Rating System (CRS) to further manage flood risk and reduce flood insurance premiums for NFIP policyholders. This	NA	NFIP Compliance		NFIP Floodplain Administrator with support from OEM, FEMA	Low	Low	Municipal Budget	Short (year 1)	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	shall start with the submission to FEMA-DHS of a Letter of Intent to join CRS, followed by the completion and submission of an application to the program.									
	Continue to archive elevation certificates	NA	NFIP Compliance		NFIP Floodplain Administrator	Low	Low	Local Budget	On-going	High
	Purchase structures in the area of 7801 NE 10th (Fairfax apartments) that are repeatedly flooded by heavy rains and convert the area to green space.	Existing	Flood		NFIP Coordinator with City Engineer	High	High	HMGP with local match	Short	Medium
	Install new underground drainage with drop inlets at the 300 block of Post Road to reduce or eliminate flooding of three residences.	Existing	Flood		NFIP Coordinator with City Engineer	High	High	HMGP and/or City budget	Short	Medium
	Create mitigation education pamphlets and distribute at booths during large public events and at public city venues.		Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperatures, Flood, Hail, Lightning, Wildfire, Wind, Winter Storms		Emergency Management	High	Low	HMGP, City budget	Long	Low
	Distribute All-Hazard Weather Radios to senior centers, and high risk residents		Dam Failure, Drought, Earthquake, Extreme Temperatures, Flood, Hail, Lightning,		Emergency Management	High	Low	HMGP, City budget	Short	Low

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
			Wildfire, Wind, Winter Storms							
	Enact a regulation to require a check for expansive soils prior to building a city building and perform soil stabilization if expansive soils are found.		Expansive Soil		City Engineer	High	Medium	City Budget	Short	Medium

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.

Costs:
Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

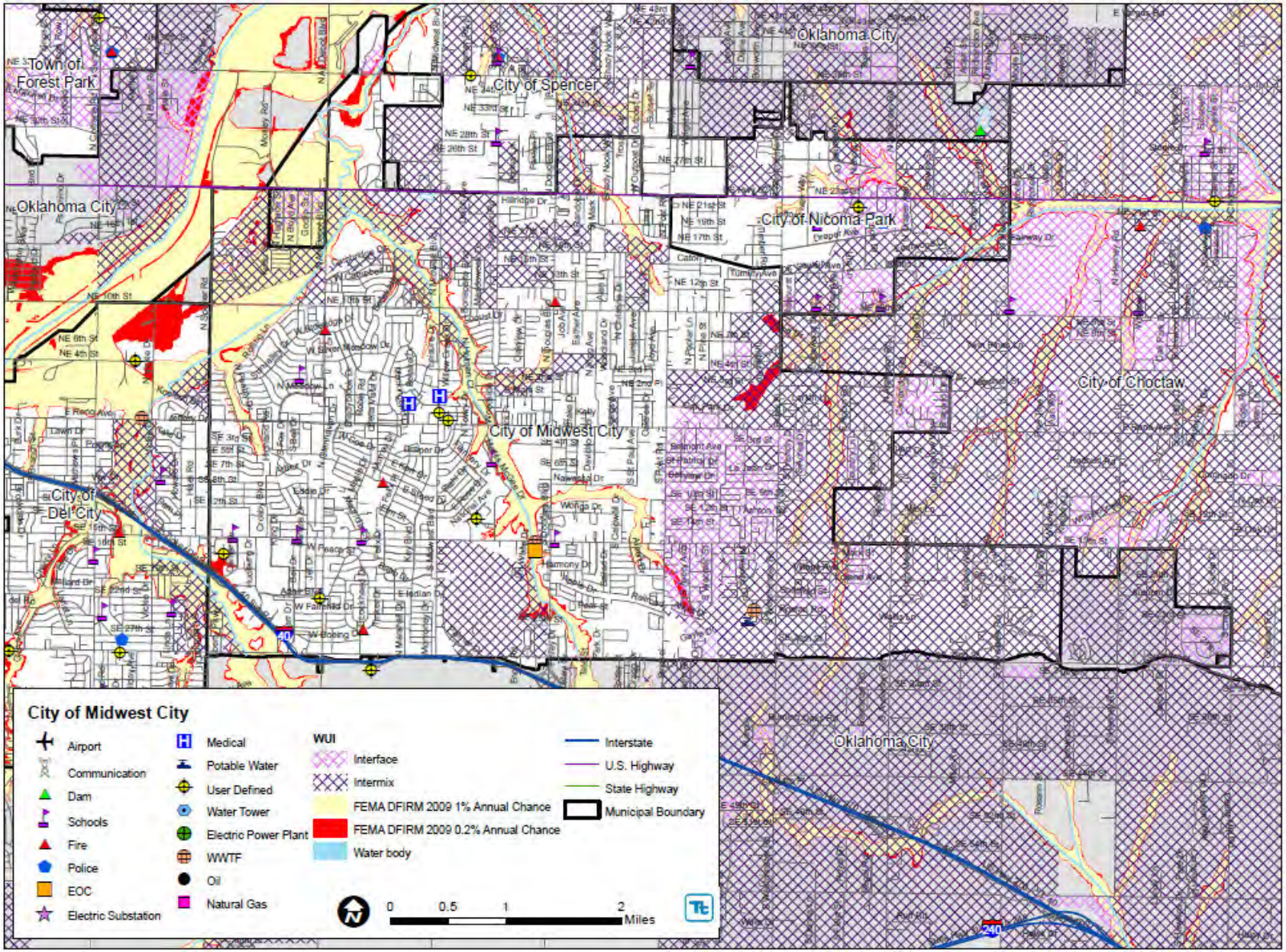
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the City of Midwest City to illustrate the probable areas impacted within the City of Midwest City. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the City of Midwest City has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


Town of Forest Park
City of Spencer
Oklahoma City
Oklahoma City
City of Nicoma Park
City of Choctaw
City of Midwest City
City of Del City
Oklahoma City
City of Midwest City
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
Water body
Interstate
U.S. Highway
State Highway
Municipal Boundary
0
0.5
1
2
Miles

9.11 CITY OF NICHOLS HILLS

This section presents the jurisdictional annex for the City of Nichols Hills.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Terry Hamilton, Fire Chief City of Nichols Hills Fire Department 6407 Avondale Drive Nichols Hills, OK 73116 (405) 843-8526 thamilton@nicholshills.net	Randy Lawrence, Director Nichols Hills Public Works 1009 NW 75th Street Nichols Hills, OK 73116 pworks@nicholshills.net (405) 843 5222

B.) MUNICIPAL PROFILE

The City of Nichols Hills is located in western Oklahoma County. It is bordered to the east, south and west by Oklahoma City and to the north by the City of The Village. The City has a total land area of 2.5 square miles, all of it land. The City is governed by a mayor and three member City Council. The 2010 U.S. Census population for the City of Nichols Hills was 3,710.

Known or Anticipated New Development

The following major residential/commercial development and/or major infrastructure development are currently known or anticipated in the City of Nichols Hills:

Property Name	Type Residential or Commercial	Number of Structures	Address	Known Hazard Zone(s)	Description/Status
The Glenbrook Park, LLC	Res.	14 Units	1601 63rd Street		Application submitted to planning commission

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the City of Nichols Hills in the 2006 plan.

2006 Initiative Description	Status	Comments
Provide for interoperability of communications with the City's major mutual aid and automatic aid agencies. Purchase an 800mHz radio system that will allow for direct communication with multiple key agencies across the State. System to be built out of Oklahoma City's 800mHz backbone.	Completed.	The project was funded by a 90/10 matching Fire Act Grant.
Install a Reverse 911 System - Public notification and employee callback. To provide	Completed.	The project was funded out of the general budget.

2006 Initiative Description	Status	Comments
public service of both emergency and non-emergency notification events and allow City to call back employees for emergencies. The city will be able to provide non-emergency information to its citizens and to the surrounding community.		

Further details on mitigation activities completed or ongoing in the City include:

- Installed a $3.5 million drainage system to alleviate flooding issues along Stratford Street.
- Installed drainage improvements along sections of Grant and Brentwood to alleviate flooding issues.
- To address expansive soils, the City has replaced most of their well field with PVC (flexible) piping, and continues to address the rest of their system as available resources allows.
- Completed a drainage control project at Wilshire Blvd. and Waverly Ave.
- Repaired a collapsed storm drain on Devonshire that backs up and flooded two properties.

The City has managed their vulnerability to power outages as follows:

- Stand-by generator at City Hall
- Generator at Public Works for essential uses
- One rolling generator with backup hookups for 3 of their 23 potable wells

In addition, Chesapeake undergrounded utilities along the north side of NW 63rd St. from Western to Grand Ave.

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the City of Nichols Hills is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	No	
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	No	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the City of Nichols Hills, the following have been identified as specific hazards:
Utilities are vulnerable to ice storms as evidenced by recent events.

Along Grand Boulevard, the City has boxed in 200-300 feet of the Grand Canal through general obligation bonding to mitigate bank scouring when it overflows. There is another 300 feet that needs to be addressed.

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE CITY

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Flooding	DR-441	Yes	
November 26, 1974	Flooding	DR-453	Yes	
October 17-19, 1983	Flooding	DR-693	Yes	
September 29 – October 1, 1986	Flooding	DR-778	Yes	
May 2, 1990	Flooding, Tornado	DR-866	Yes	
May 8, 1993	Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
August 11-12, 2004	Flash Flood	N/A	N/A	
March 12, 2006	Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	
January 12-26, 2007	Severe Winter Storms	DR-1678	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 29, 2007	Tornadoes	N/A	N/A	
May 4-11, 2007	Tornadoes, and Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Flooding, and Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Flooding, Tornadoes	DR-1712	Yes	
Aug. 18, 2007 to Sept. 12, 2007	Tornadoes, Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	Several homes were without electricity in the City; the City had to remove approximately 24,000 cubic yards of vegetative debris from public property
March 17-23, 2008	Tornadoes, Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	
March 30-31, 2008	Severe Storms	N/A	N/A	
April 9-28, 2008	Tornadoes, and Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 9, 2008	Floods	DR-1754	No	
May 10-13, 2008	Tornadoes, Flooding	DR-1756	No	
June 3-20, 2008	Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Tornadoes, Flooding	DR-1803	No	
February 10-11, 2009	Tornadoes	DR-1820	Yes	
March 24, 2009	Severe Storms	N/A	N/A	
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 30, 2009	Severe Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	
May 13, 2009	Severe Storms	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	Three streets were damaged from this storm – Trenton Road, Huntington Ave., and Dorchester Drive, causing the City over $55,000 in expenses
May 10-13, 2010	Tornadoes, and Straight-Line Winds	DR-1917	Yes	Several hundred homes were without power; city buildings had damage from hail, causing $310,000 in damages; most of the roofs of homes in Nichols Hills were destroyed; numerous windows and vehicles were damaged or destroyed, causing millions in damages; over 30 pine trees were removed due to disease from the hail, causing $40,000 in damages
July 7-8, 2010	Flooding	N/A	N/A	
Oct. 13, 2010	Earthquake	N/A	N/A	
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	The City had ten water main breaks and overtime for public works employees, resulting in $12,000 in expenses

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
April 14, 2011	Tornadoes, And Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Flooding	DR-1988	No	
May 22-25, 2011	Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Severe Heat	N/A	N/A	

Number of FEMA Identified Repetitive Flood Loss Properties: 2 residential
Number of FEMA Identified Severe Repetitive Flood Loss Properties: 0

Source: Oklahoma Water Resources Board (OWRB)

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances., Plans)	Do you have this? (Y or N)	Code Citation (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	IBC
Comprehensive / Master Plan	Y	Last four years
Zoning Management Ordinance	Y	
Subdivision Management Ordinance		
Site Plan Review Requirements	Y	
NFIP Flood Damage Prevention Ordinance	Y	Chapter 12
NFIP Elevation Certificates Maintained	Y	
Floodplain Management Plan	Y	2006 Countywide All Hazards Mitigation Plan
Stormwater Management Plan / Ordinance	Y	
Stream Corridor Management or Protection Plan		
Erosion Management Ordinance		
Capital Improvements Plan	Y	Annually budgeted
Open Space Plan		
Economic Development Plan		
Emergency Response Plan	Y	
Post Disaster Recovery Plan / Ordinance		
Real Estate Disclosure Requirements		
Highway Management Plan		
COOP/COG Plan		
Other (Special Purpose Ordinances such as critical or sensitive areas)		

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Y	Contract planner and engineer
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Y	
Planners or engineers with an understanding of natural hazards	Y	
NFIP Floodplain Administrator	Y	Code Enforcement Officer (designated by City Council per City code)
Surveyor(s)	Y	Through engineering contractor
Personnel skilled or trained in "GIS" applications	Y	
Scientist(s) familiar with natural hazards in the County.	Y	
Emergency Manager	Y	Terry Hamilton
Grant Writer(s)	N	Some police and fire grants; no mitigation grants
Staff with expertise or training in benefit/cost analysis		

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	Yes
Capital Improvements Project Funding	Yes, annually budgeted
Authority to Levy Taxes for specific purposes	
User fees for water, sewer, gas or electric service	
Impact Fees for homebuyers or developers of new development/homes	
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	
Incur debt through private activity bonds	
Withhold public expenditures in hazard-prone areas	
Other	

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	TBD	TBD
Public Protection	TBD	TBD
Storm Ready	County	TBD
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. The comprehensive plan provides an opportunity to expand on and improve the policies and programs identified herein. Zoning management supports Goal #6 (Structural Projects). Local floodplain management present good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). The Capital Improvements Plan supports Goal #6 (Structural Projects). Having contract personnel skilled in "GIS" applications support Goal #2 (Prevention) and Goal #3 (Protecting Critical Facilities) by identifying risk areas. Access to Planners and Engineers with knowledge of land development and land management practices increases the ability to mitigate against flooding and other hazards, and supports Goal #2 (Prevention) in the plan. Having a local Emergency Manager with a fire background provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). The fiscal capabilities of items such Community Development Block Grants and Capital Improvements Project Funding, fees and debts present opportunities for monies to support Goal #6 (Structural Projects) and Goal #5 (Public Awareness).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Replace ductile iron piping with PVC in potable water system as resources permit (est. nearly 20 miles still need retrofitting).	Existing	Expansive Soils		Public Works	Eliminate water main breaks due to shifting soils	High	City budget with other funding sources as available (project dependent)	Longterm (for complete system retrofit)	Med – Low
	Box-in the remaining 300 feet of the Grand Canal adjacent to Grand Boulevard to mitigate bank scouring when it overflows	Existing	Flood		Public Works	Mitigate bank scouring that threatens Grand Boulevard	High	General Obligation Bonds or FEMA mitigation grant funding	Short	Medium
	Maintain compliance with and good-standing in the NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community.	New & Existing	NFIP Compliance		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, ISO FEMA	High	Low - Medium	Local Budget	Ongoing	High
	Participate in the Community Rating System (CRS) to further	NA	NFIP Compliance		NFIP Floodplain Administrator	Low	Low	Municipal Budget	Short (year 1)	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	manage flood risk and reduce flood insurance premiums for NFIP policyholders. This shall start with the submission to FEMA-DHS of a Letter of Intent to join CRS, followed by the completion and submission of an application to the program once the community's current compliance with the NFIP is established.				with support from OEM, FEMA					
	Archive elevation certificates	NA	NFIP Compliance		NFIP Floodplain Administrator	Low	Low	Local Budget	On-going	High
	Perform Soil Stabilization at Public Works New Facility	New	Expansive Soil		Public Works with City Engineer	High	High	Local budget	Short	High
	Distribute mitigation information materials at schools and during Earth Day events		Drought, Earthquake, Extreme Temps, Flood, Hail, Lightning, Wind, Winter Storm		Fire Dept.	High	Low	Local budget	Short	Medium
	Build a retention pond at Grand and Sherwood to eliminate road flooding damage		Flood		Public Works	High	High	Bonds, HMGP	Short	Medium
	Drill Water Wells to increase water supply		Drought		Public Works	More reliable pressure	High	Bonds, HMGP	Short	High
	Adopt and enforce 2012 Building Codes, which include provisions for	New	Earthquake, Wind		Code Inspector	Reduce earthquake damage	Low	Local budget	Short	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	building to earthquake standards									
	Publish heat/cold prevention /mitigation newsletters in utility bills prior to extreme heat and cold		Extreme Temps		Fire Dept.	Reduced loss of life	Low	Local budget	Short	Low
	Distribute All-Hazards Weather Radios to elderly and special needs citizens		Flood, Earthquake, Extreme Temps, Hail, Lightning, Wind, Winter Storm		Fire Dept.	High (life safety)	Low	HMGP; Local budget	Short	Low

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.

Costs:
Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

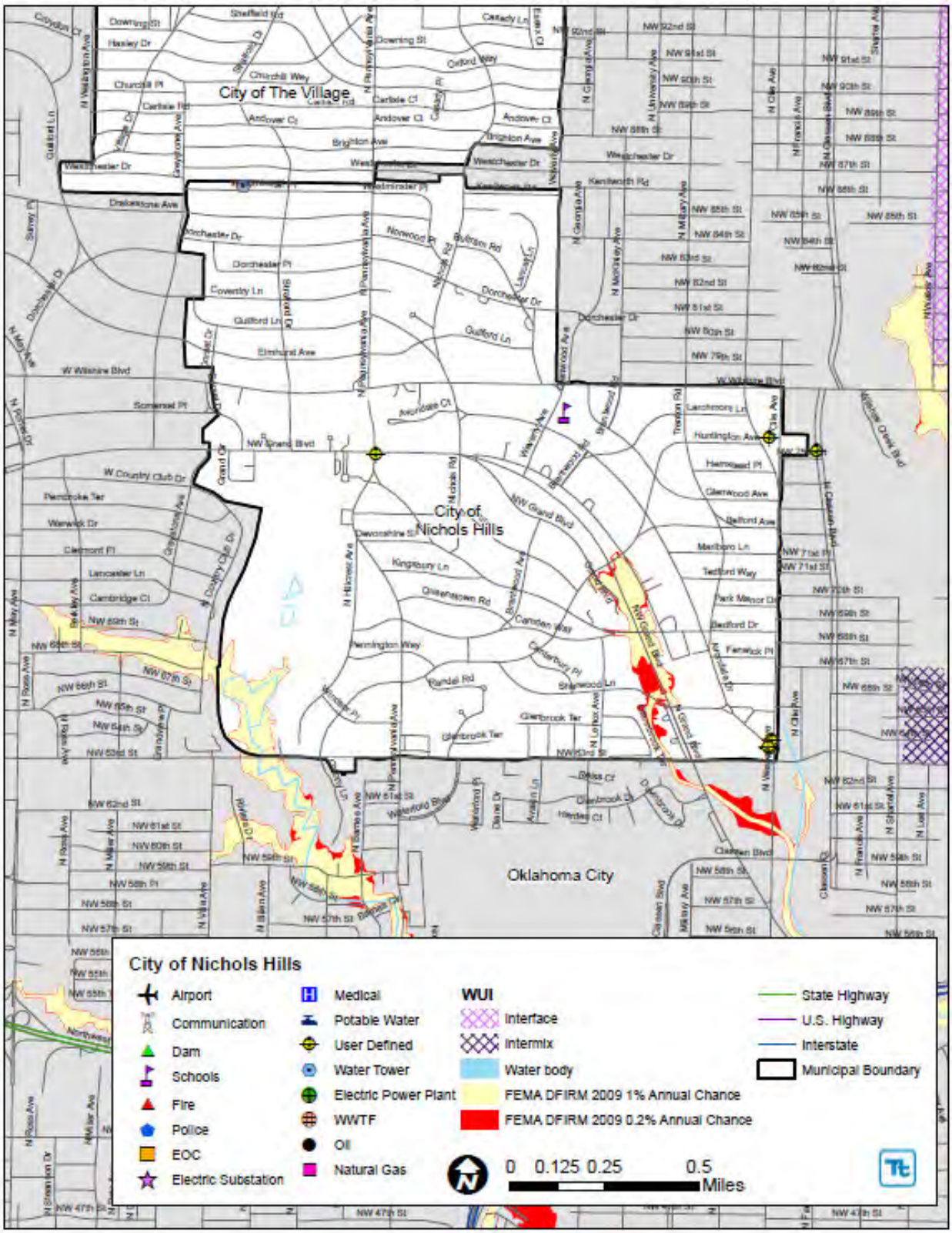
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the City of Nichols Hills to illustrate the probable areas impacted within the City of Nichols Hills. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the City of Nichols Hills has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


City of The Village
City of Nichols Hills
Oklahoma City
City of Nichols Hills
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
Water body
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
State Highway
U.S. Highway
Interstate
Municipal Boundary
0 0.125 0.25 0.5
Miles

9.12 CITY OF NICOMA PARK

This section presents the jurisdictional annex for the City of Nicoma Park.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
James King, Fire Chief P.O. Box 250, Nicoma Park, OK 73066 (405) 769-4593 npfirechief@nicomapark.net	Jim Shonts, Emergency Manager P.O. Box 144, Nicoma Park, OK 73066 (405) Np601@hotmail.com

B.) MUNICIPAL PROFILE

The City of Nicoma Park is located in western Oklahoma County. It is bordered to the north by Oklahoma City, to the south and east by the City of Choctaw, to the west by the City of Midwest City. The City of Nicoma Park has a total land area of 3.7 square miles, all of it land. The City is governed by a mayor and six member City Council. The 2010 U.S. Census population for the City of Nicoma Park was 2,393.

Low-lying areas in the Town are subject to periodic flooding caused by overflow of Choctaw Creek and its tributaries. The most severe flooding occurs as a result of thunderstorms and intense rainfall. Most flooding occurs upstream from roadways that restrict the flow. (NFIP FIS – 2009)

Growth/Development Trends

No known or anticipated new development has been identified in the City of Nicoma Park at this time.

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the City of Nicoma Park in the 2006 plan.

2006 Initiative Description	Status	Comments
Nicoma Park would hire a contractor to design and build severe weather shelters to house 300-500 individuals. The funding would be provided by the Hazard Mitigation Grant Program, Oklahoma County, with possible supplementation by local funds.	Discontinued.	Project consideration was discontinued due to lack of funding and liability exposure from operation.

Further details on mitigation activities completed or ongoing in the City include:

- Drainage improvements: enlarge/replace culvert at North Anderson Choctaw Creek Tributary 6; replace bridge at North Anderson Choctaw Creek Tributary 7
- Ordinances: Stormwater Ordinance 373, March 4, 2008; Flood Hazards Ordinance 387, November 3, 2009
- Replaced culverts in the Meyers Terrace and 17th area.

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the City of Nicoma Park is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	No	
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	Yes	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the City of Nicoma Park, the following have been identified as specific hazards:

- Ice storm – damage to dwellings – accessory buildings and electrical lines and equipment
- Fires, drought, severe storms – hail, floods, tornado, straight-line winds, snow, ice storm
- Floods – business damage

Flooding is a risk from undersized culverts in the Spring Shadows housing addition. Creeks around the city are silted in with debris. A flood risk exists around the 2000 Block of N. Westminister.

It is estimated that in Nicoma Park, 148 residents live within the 1% annual chance flood area (NFIP Special Flood Hazard Area). $36,504,000 (12.2%) of the municipality's general building stock replacement cost value (structure and contents) is located within the 1% annual chance flood area. There are 8 NFIP policies in the community, including 1 Repetitive Loss (RL) and 0 Severe Repetitive Loss (SRL) properties.

HAZUS-MH estimates that for a 1% annual chance flood, $2,662,000 (0.9%) of the municipality's general building stock replacement cost value (structure and contents) will be damaged, 103 people may be displaced, 23 people may seek short-term sheltering, and an estimated 226 tons of debris could be generated.

Vulnerability assessment modeling has identified the following flood vulnerabilities (see Flood Hazard Profile in Section 5.4):

Table 5.4.9-1 Critical Facilities Located in the DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure	Potential Loss

			100-Yr	500-Yr	100-Yr Structure Damage %	100-Yr Content Damage %
NICOMA PARK IES	Nicoma Park (C)	School	X	X	-	-
NICOMA PARK JHS	Nicoma Park (C)	School	X	X	-	-

Source: FEMA, 2009; HAZUS-MH 2.0

Notes:

(1) 'X' indicates the facility location as provided by Oklahoma County's Planning Committee is located in the DFIRM flood zone.

(2) HAZUS did not calculate potential loss estimates for some facilities located in the DFIRM flood zone. This is because these facilities are either located outside of the flood depth grid generated by HAZUS, or the depth of water is too shallow and no losses are estimated. When there is a difference between the flood depth grid generated by HAZUS and the DFIRM flood zones, it is most likely due to the resolution of the elevation model used (1/3 Arc Second or 10 meters) which differed from the elevation data used to generate the DFIRM itself.

(3) In some cases, HAZUS calculated potential flood loss to structures outside the FEMA DFIRM. These facilities are located inside the HAZUS flood depth grid.

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE CITY

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Severe Storms, Flooding	DR-441	Yes	
November 26, 1974	Severe Storms, Flooding	DR-453	Yes	
October 17-19, 1983	Severe Storms, Flooding	DR-693	Yes	
September 29 – October 1, 1986	Severe Storms, Flooding	DR-778	Yes	
May 2, 1990	Flooding, Severe Storm, Tornado	DR-866	Yes	
May 8, 1993	Severe Storm, Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Severe Storms and Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Severe Storms and Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
August 11-12, 2004	Flash Flood	N/A	N/A	
March 12, 2006	Severe Storms and Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	
January 12-26, 2007	Severe Winter Storms	DR-1678	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 29, 2007	Severe Storms and Tornadoes	N/A	N/A	
May 4-11, 2007	Severe Storms, Tornadoes, and Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Severe Storms, Flooding, and Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Severe Storms, Flooding, and Tornadoes	DR-1712	Yes	
Aug. 18, 2007 to Sept. 12, 2007	Severe Storms, Tornadoes, and Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	Utility outages, commercial closures, road and tree damage; City had over $379,000 in costs related to this storm
March 17-23, 2008	Severe Storms, Tornadoes, and Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	
March 30-31, 2008	Severe Storms	N/A	N/A	
April 9-28, 2008	Severe Storms, Tornadoes, and Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 9, 2008	Severe Storms & Floods	DR-1754	No	
May 10-13, 2008	Severe Storms, Tornadoes, and Flooding	DR-1756	No	
June 3-20, 2008	Severe Storms and Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Severe Storms, Tornadoes, and Flooding	DR-1803	No	
February 10-11, 2009	Severe Storms and Tornadoes	DR-1820	Yes	
March 24, 2009	Severe Storms	N/A	N/A	
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 30, 2009	Severe Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	
May 13, 2009	Severe Storms	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Severe Storms, Tornadoes, and Straight-Line Winds	DR-1917	Yes	
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	
May 10-13, 2010	Severe Storms, Tornadoes, and Straight-Line Winds	DR-1917	Yes	
July 7-8, 2010	Flooding	N/A	N/A	
Oct. 13, 2010	Earthquake	N/A	N/A	
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
April 14, 2011	Severe Storms, Tornadoes, And Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Severe Storms And Flooding	DR-1988	No	
May 22-25, 2011	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Severe Heat	N/A	N/A	

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) LEGAL AND REGULATORY CAPABILITY

Regulatory Tools (Codes, Ordinances., Plans)	**Do you have this?** (Y or N)	**Code Citation** (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	Ord. 346 – March 5, 2008; Ord. 345 – August 2, 2005
Comprehensive / Master Plan	Y	January 1973
Zoning Management Ordinance	Y	Ord. 1973 2.1
Subdivision Management Ordinance	Y	Ord. 1973
Site Plan Review Requirements	Y	IBC Ord. 345 – August 5, 2005
NFIP Flood Damage Prevention Ordinance	Y	Ord. 387 – November 3, 2009
NFIP Elevation Certificates Maintained	Y	Ord. 387 – November 3, 2009
Floodplain Management Plan	Y	Ord. 387 – November 3, 2009; repeated 233 – April 7, 1987
Stormwater Management Plan / Ordinance	Y	Ord. 373 – March 4, 2008
Stream Corridor Management or Protection Plan	N	
Erosion Management Ordinance	Y	Ord. 373 – March 4, 2008
Capital Improvements Plan	Y	Resolution Sept. 12, 2007 – May 2007
Open Space Plan	N	
Economic Development Plan	N	
Emergency Response Plan	N	
Post Disaster Recovery Plan / Ordinance	N	
Real Estate Disclosure Requirements	N	
Highway Management Plan	N	
COOP/COG Plan	N	
Other (Special Purpose Ordinances such as critical or sensitive areas)		

D.2) ADMINISTRATIVE AND TECHNICAL CAPABILITY

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	N	
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	N	
Planners or engineers with an understanding of natural hazards	N	
NFIP Floodplain Administrator	Y	Fire Chief
Surveyor(s)	N	
Personnel skilled or trained in “GIS” applications	N	
Scientist(s) familiar with natural hazards in the County.	N	
Emergency Manager	Y	Vice Mayor
Grant Writer(s)	N	
Staff with expertise or training in benefit/cost analysis	N	

D.3) FISCAL CAPABILITY

Financial Resources	Accessible or Eligible to use (Yes/No/Don’t know)
Community Development Block Grants (CDBG)	ACOG
Capital Improvements Project Funding	ACOG
Authority to Levy Taxes for specific purposes	
User fees for water, sewer, gas or electric service	Sewer fees
Impact Fees for homebuyers or developers of new development/homes	
Incur debt through general obligation bonds	
Incur debt through special tax bonds	
Incur debt through private activity bonds	
Withhold public expenditures in hazard-prone areas	
Other	

D.4) COMMUNITY CLASSIFICATIONS

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	3,4	2004
Public Protection	TBD	TBD
Storm Ready	County	TBD
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. The Comprehensive Plan dates back to 1973. A new comprehensive plan could provide an opportunity to expand on and improve the policies and programs identified herein. The Zoning management plan is also from 1973 and an update could support Goal #6 (Structural Projects). The Floodplain Management Plan and local floodplain management present good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). The fiscal capabilities of items such Capital Improvements Project Funding through ACOG, presents opportunities for monies to support Goal #6 (Structural Projects). In addition to the items listed above, Nicoma Park has mutual aid agreements with neighboring jurisdictions and the County to assist in providing emergency services to support Goal #1 in the Plan. The actions contained herein below support Goal #2 (Prevention), such as reducing fire risk and addressing flood problems in the jurisdiction, and Goal #5 (Public Awareness). This planning process supports Goal #4 (Protection of Life and Property).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Create firebreak to protect residences in the 11th and Whitehurst area (approx.. 25' x 572' long).	Existing	Wildfire		Fire Dept.	High	Low	General Fund	Long Term DOF	Low
	Address problems with flow capacity in the area of the Spring Shadows Housing addition by clearing creeks of overgrowth and replacing undersized culverts.	Existing	Flood		Public Works	High	High	OK County D2	Long Term DOF	Medium
	Address overflow problems in and along city creeks. Request OK County D2 for assistance in clearing creeks of debris, silt and ensure water channels are open.		(Non mitigation)		Public Works with OK Co District 2	High	Medium	OK County D2	Long Term DOF	Low
	Provide flood protection for Hiwassee lift station which may eventually flood from erosion during flooding. Provide rip raff and sod to mitigate the flooding and redirect the small channel.	Existing	Flood		Public Works	High	High	CNP DA - OK County D2	Short	Medium
	Retrofit Community Center to serve as a warming/cooling center, including oxygen and a small triage station.	Existing	Extreme Temps		Contractor w/ Public Works	High	High	Grants and matching funds	Long Term DOF	Low
	Educational programs to retrofit structures with	Existing	Wind		Emergency Manager	High	Low	Grants and matching	Long Term DOF	Low

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	personal safe rooms.							funds		
	Upgrade public notification and warning systems by implementing reverse 911 system and well as utilizing email and text messaging.		Wind		Emergency Manager	High	Medium	HMGP and matching funds	Long Term DOF	Medium
	Retrofit structures located in hazard-prone areas to protect structures from future damage, with repetitive loss and severe repetitive loss properties as priority. Specifically identified are the following: -2000 Blk. N. Westminister Rd. Phase 1: Identify appropriate candidates for retrofitting based on cost-effectiveness versus relocation.	Existing	Flood		Municipal Engineer/NFIP Floodplain Administrator with support from OEM, FEMA	High	High	FEMA Mitigation Grant Programs and local budget (or property owner) for cost share	Long-term DOF	Medium-High*
	Maintain compliance with and good-standing in the NFIP including adoption and enforcement of floodplain management requirements, floodplain identification and mapping, and flood outreach to the community.	New & Existing	NFIP Compliance		Municipal Engineer/NFIP Floodplain Administrator with support from OEM, ISO FEMA	High	Low - Medium	Local Budget	Ongoing	Medium
	Educate public on water and soil conservation as well as climate conditions.		Drought		Emergency Management	High	Low to Medium	Local Budget	Short/ Continuous	Low
	Monitor state, county and local drought conditions		Drought		Fire Dept.	High	Low to Medium	Local Budget	Short/ Continuous	Low

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	and prohibit any outdoor burning when conditions prohibit such activity.									
	Establish regular public notification system via website when drought conditions exist by using 3-tiered warning system from low to high risk, with a request to conserve water.		Drought		Emergency Management	High	Low to Medium	Local Budget	Short/ Continuous	Low
	Enact an ordinance for all future construction to require burial of utility lines. Lines may sway and come down in an earthquake, be taken down in a winter storm, poles burned in a wildfire, insulators destroyed by hail, equipment damaged by lightning, and be taken down by high wind or floods.	New	Flood, Earthquake, Hail, Lightning, Wind, Wildfire, Winter Storm		Code Enforcement	High	Low to Medium	Local Budget	Short/ Continuous	Low
	Adopt and enforce IBC building codes related to soil conditions.	New	Expansive Soils, Earthquake		Code Enforcement	High	Low to Medium	Local Budget	Short/ Continuous	Low
	Provide public education via newsletter and website with regards to expansive soil conditions. Climatic changes such as droughts followed by heavy rainfall and potential damage to property require an ongoing public outreach system.		Expansive Soils		Code Enforcement	High	Low to Medium	Local Budget	Short/ Continuous	Low
	Educate public about the potential hazards		Extreme Temp		Emergency Management	High	Low to Medium	Local Budget	Short/ Continuous	Low

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	associated with extreme temperature conditions via newsletters, website and FD billboard.									
	Using demographics, identify highest vulnerable group of citizens such as seniors and children and develop strategy to assist those with the highest need of either fans and or heaters.		Extreme Temp		City Planning with Fire Dept.	High	Low to Medium	Local Budget	Short/ Continuous	Low
	Replace the roof on City Hall with a metal roof.	Existing	Hail		Emergency Management	High	High	FEMA Grant program and matching local funds.	Short	High
	Educate public about the potential material and human damage from hail. Item 1. Insurance coverage for home, auto and crops.		Hail		Fire Dept.	High	Low to Medium	Local Budget	Short/ Continuous	High
	Utilize city website to provide public warning system and preventative measures to take during severe lightning storms.		Lightning		Emergency Manager	High	Low to Medium	Local Budget	Short/ Continuous	High
	Retrofit municipal facilities with lightning detection and arrestor systems.	Existing	Lightning		Public Works	High		FEMA Grant programs and matching local funds.	Long-Term DOF	Medium
	Educate public about the potential material and human damage from hail. Item 1. Insurance		Lightning		Code Enforcement with Fire Dept.	High	Low to Medium	FEMA Grant programs and	Short/ Continuous	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	coverage for home, auto and crops against lightning. Item 2. Encourage adoption of lightning arresters for businesses and residences.							matching local funds.		
	Locate safe areas or safe harbors from high winds and earthquakes in city facilities and retrofit facilities deemed as not having a safe area for municipal employees.	Existing	Earthquake, Wind		Code Enforcement with Public Works	High	High	FEMA Grant programs and matching local funds.	Short	Low
	Educate public about the potential material and human damage from hail. Item 1. Insurance coverage for home, auto and crops.		Wind		Emergency Management with Code Enforcement	High	Low to Medium	FEMA Grant programs and matching local funds.	Short/ Continuous	Medium
	Acquire front loader, tractor or truck with snow plow to help alleviate high snow drifts along interior roads and especially around first responder stations.	New	(Non-Mitigation)		Public Works	High	Low to Medium	FEMA Grant programs and matching local funds.	Short/ Continuous	Low
	Educate public about the potential dangers of severe winter storms and develop an outreach program to assist citizens isolated or stranded without power during winter storms.		Winter Storms		Emergency Management	High	Low to Medium	FEMA Grant programs and matching local funds.	Short/ Continuous	Medium

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.
Costs:
Where actual project costs have been reasonably estimated:

Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

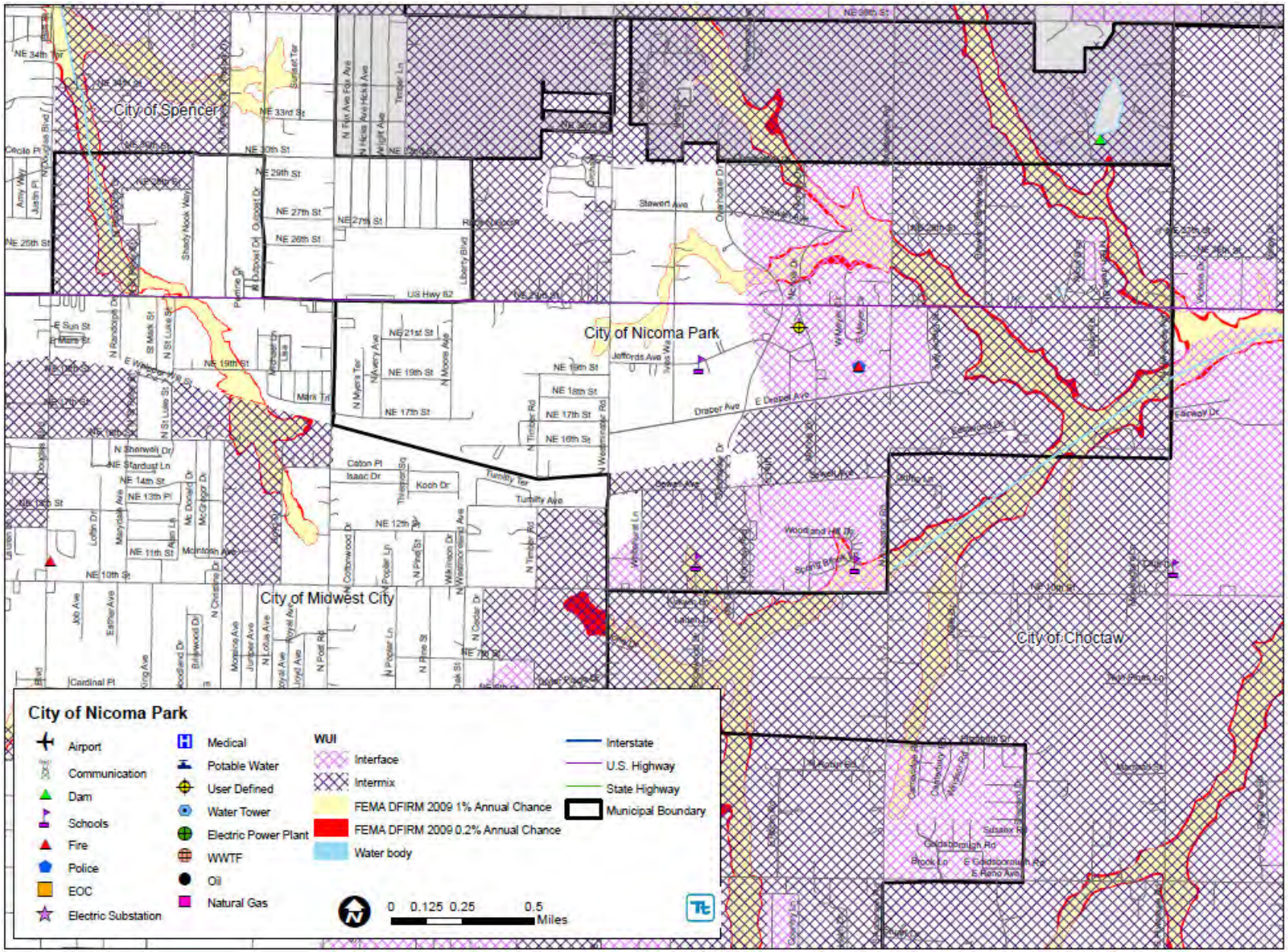
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the City of Nicoma Park to illustrate the probable areas impacted within the City of Nicoma Park. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the City of Nicoma Park has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


City of Spencer
City of Nicoma Park
City of Midwest City
City of Choctaw
US Hwy 62
City of Nicoma Park
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
Water body
Interstate
U.S. Highway
State Highway
Municipal Boundary
0 0.125 0.25 0.5
Miles

9.13 CITY OF SPENCER

This section presents the jurisdictional annex for the City of Spencer.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Robert Taylor, Fire Chief 8310 NE 36th St., Spencer, OK 73084 (405) 771-3621 spencerfdchief@sbcglobal.net	Dwight Peoples, Code Enforcement Officer 8200 NE 36th St, Spencer, OK 73084 (405) 771-3226 spencercodeofficer@sbcglobal.net

B.) MUNICIPAL PROFILE

The City of Spencer is located in central Oklahoma County. The City is bordered to the north and west by Oklahoma City, to the south by the City of Midwest City, and to the east by the City of Nicoma Park. The City has a total land area of 5.3 square miles, all of it land. The City is governed by a mayor and four member City Council. The 2010 U.S. Census population for the City of Spencer was 3,912.

Low-lying areas in the City are subject to periodic flooding caused by overflow from the North Canadian River, Crutcho Creek, Silver Creek and Tributary 9. The most severe flooding typically occurs after thunderstorms with intense rainfall. Most flooding occurs upstream from roadways that restrict the flow. (FEMA NFIP FIS – 2009)

Growth/Development Trends

The City of Spencer has not had any growth over the past few years. Growth is anticipated over the next few years.

New Development/Potential Development in the City of Spencer						
Property Name	Type Residential or Commercial	Number of Structures	Address	Block and Lot	Known Hazard Zone	Description/Status
DCCH Lumber	Commercial	1	8420 NE 36th St.			Planned

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the City of Spencer in the 2006 plan.

2006 Initiative Description	Status	Comments
The City of Spencer engineer planned to implement a channel along the bed of Silver Creek to prevent further erosion. Estimated cost in 2006 was $75000. Funding was to be provided by the City of Spencer. Local priority was high.	Not started	Researching funding sources other than a 75%/25% match.

Further details on mitigation activities completed or ongoing in the City include:

A generator has been installed to power the critical facilities that support the city government.

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the City of Spencer is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	Yes	Canton Lake, Overholser - See local hazard map end of section
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	Yes	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the City of Spencer, the following have been identified as specific hazards:

Approximately 8 to 10 homes flood in the Silver Creek area every time heavy amounts of rain occur.

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE CITY

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Tornadoes, Flooding	DR-441	Yes	
November 26, 1974	Severe Storms, Flooding	DR-453	Yes	
October 17-19, 1983	Severe Storms, Flooding	DR-693	Yes	
September 29 – October 1, 1986	Severe Storms, Flooding	DR-778	Yes	
May 2, 1990	Flooding, Severe Storm, Tornado	DR-866	Yes	
May 8, 1993	Severe Storm, Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Severe Storms and Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Severe Storms and Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
August 11-12, 2004	Flash Flood	N/A	N/A	
November 10, 2004	Tornado	N/A	N/A	
March 12, 2006	Severe Storms and Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
January 12-26, 2007	Severe Winter Storms	DR-1678	No	
March 29, 2007	Severe Storms and Tornadoes	N/A	N/A	
May 4-11, 2007	Severe Storms, Tornadoes, and Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Severe Storms, Flooding, and Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Severe Storms, Flooding, and Tornadoes	DR-1712	Yes	
Aug. 18, 2007 to Sept. 12, 2007	Severe Storms, Tornadoes, and Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	
March 17-23, 2008	Severe Storms, Tornadoes, and Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	
March 30-31, 2008	Severe Storms	N/A	N/A	
April 9-28, 2008	Severe Storms, Tornadoes, and Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 9, 2008	Severe Storms & Floods	DR-1754	No	
May 10-13, 2008	Severe Storms, Tornadoes, and Flooding	DR-1756	No	
June 3-20, 2008	Severe Storms and Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Severe Storms, Tornadoes, and Flooding	DR-1803	No	
February 10-11, 2009	Severe Storms and Tornadoes	DR-1820	Yes	
March 24, 2009	Severe Storms	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	
March 30, 2009	Severe Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	
May 13, 2009	Severe Storms	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Severe Storms, Tornadoes, and Straight-Line Winds	DR-1917	Yes	
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	
May 10-13, 2010	Severe Storms, Tornadoes, and Straight-Line Winds	DR-1917	Yes	
July 7-8, 2010	Flooding	N/A	N/A	
Oct. 13, 2010	Earthquake	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	
April 14, 2011	Severe Storms, Tornadoes, And Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Severe Storms And Flooding	DR-1988	No	
May 22-25, 2011	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Severe Heat	N/A	N/A	

Number of FEMA Identified Repetitive Flood Loss Properties: 3 residential
Number of FEMA Identified Severe Repetitive Flood Loss Properties: 0

Source: Spencer Fire Department

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances., Plans)	Do you have this? (Y or N)	Code Citation (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	
Comprehensive / Master Plan		
Zoning Management Ordinance	Y	
Subdivision Management Ordinance	Y	
Site Plan Review Requirements	Y	
NFIP Flood Damage Prevention Ordinance (if you are in the NFIP, you must have this!)	Y	
NFIP Elevation Certificates Maintained	Y	
Floodplain Management Plan	Y	
Stormwater Management Plan / Ordinance	N	
Stream Corridor Management or Protection Plan	N	
Erosion Management Ordinance	N	
Capital Improvements Plan	Y	
Open Space Plan	Y	
Economic Development Plan	Y	
Emergency Response Plan		
Post Disaster Recovery Plan / Ordinance		
Real Estate Disclosure Requirements		
Highway Management Plan		
COOP/COG Plan		
Other (Special Purpose Ordinances such as critical or sensitive areas)		

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Y	
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Y	
Planners or engineers with an understanding of natural hazards	Y	
NFIP Floodplain Administrator (if you are in the NFIP, you must have this person designated – often your code official)	Y	
Surveyor(s)		
Personnel skilled or trained in "GIS" applications		
Scientist(s) familiar with natural hazards in the County.		
Emergency Manager	Y	
Grant Writer(s)		
Staff with expertise or training in benefit/cost analysis		

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	
Capital Improvements Project Funding	
Authority to Levy Taxes for specific purposes	Yes
User fees for water, sewer, gas or electric service	Yes
Impact Fees for homebuyers or developers of new development/homes	
Incur debt through general obligation bonds	
Incur debt through special tax bonds	
Incur debt through private activity bonds	
Withhold public expenditures in hazard-prone areas	
Other	

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	TBD	TBD
Public Protection	TBD	TBD
Storm Ready	County	TBD
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. Zoning management presents an opportunity to regulate positioning large quantities of hazardous materials that may be a secondary threat after a natural hazard incident and supports Goal #6 (Structural Projects). The Floodplain Management Plan and local floodplain management present good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). Having Planners and Engineers with knowledge of land development and land management practices increases the ability to mitigate against wildfire, flooding, and other hazards, and supports Goal #2 (Prevention) in the plan. Having a local Emergency Manager provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). The fiscal capabilities of fees present opportunities for monies to support Goal #5 (Public Awareness).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Implement a concrete lined channel along the bed of Silver Creek to prevent further erosion.		Flood		City Engineering Department	High	High	Community Funds, Grants	Long (DOF)	High
	Purchase, or relocate structures located in hazard-prone areas to protect structures from future damage, with repetitive loss and severe repetitive loss properties as priority. Specifically identified are the following: -three (3) repetitive loss properties Phase 1: Identify appropriate candidates for relocation based on cost-effectiveness versus retrofitting. Phase 2: Where relocation is determined to be a viable option, work with property owners toward implementation of that action based on available funding from FEMA and local match availability.	Existing	Flood		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, FEMA	High	High	FEMA Mitigation Grant Programs and local budget (or property owner) for cost share	Long-term DOF	Medium-High*
	Maintain compliance with and good-standing in the	New & Existing	NFIP Compliance		Municipality (via Municipal	High	Low - Medium	Local Budget	Ongoing	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community.				Engineer/NFIP Floodplain Administrator) with support from OEM, ISO FEMA					
	Conduct and facilitate community and public education and outreach for residents and businesses to include, but not be limited to, the following to promote and effect natural hazard risk reduction: • Provide and maintain links to the HMP website, and regularly post notices on the County/municipal homepage(s) referencing the HMP webpages. • Prepare and distribute informational letters to flood and dam failure vulnerable property owners and neighborhood associations, explaining the availability of mitigation grant funding to mitigate their properties, and instructing them on how they can learn more and implement mitigation. • Use email notification systems and newsletters to better educate the public on flood insurance, the availability of mitigation grant funding, and personal natural hazard risk reduction measures. • Work with neighborhood associations, civic and business groups to disseminate information on flood insurance and the availability of mitigation grant funding.									
	See above.	NA	Dam Failure, Flood		Municipality with support from Planning Partners, OEM, FEMA	Low - Medium	Low - Medium	Municipal Budget; HMA programs with local or county match	Short	High
	Archive elevation certificates	NA	NFIP Compliance		NFIP Floodplain Administrator	Low	Low	Local Budget	On-going	High
	Develop a location listing or map that identifies buildings and critical facilities within the Lake Overholser and Canton Lake inundation area.	Existing	NFIP Compliance		Municipal Engineer	High	Low-Medium	HMGP, Local Budget, Other Grants	Short	Medium
	Enact a regulation to prevent structures from	New	NFIP Compliance,		Municipal Engineer	High	Low	Local Budget	Short	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	being built in in swash zone areas and the Special Flood Hazard Area.		Dam Failure, Flood							
	Drill additional water wells ensuring that an adequate water supply is available.	Existing	Drought		Municipal Engineer	High	High	OWRB REAP Grant	Short	High
	Conduct a public education campaign to inform the citizens how to conserve water and mitigate drought using Xeriscape.		Drought		Municipal Engineer	High	High	Local Budget	Short	High
	Develop detailed fault maps to determine areas most likely to be effected by earthquakes and at risk structures.	New and Existing	Earthquake		Municipal Engineer	High	High	HMGP, Local Budget, other grants	Long	Medium
	Enact a regulation to require power lines to be buried in new housing developments.	New	Dam Failure, Earthquake, Flooding, Hail, Lightning, Wildfire, Wind, Winter Storm		Code Enforcement	High – insulators will not be destroyed by hail; lines not stretched during winter storms or taken down by swinging from an earthquake, lightning, flood, wildfires, or wind	High	Local Budget	Long	Medium
	Provide public literature to high risk populations on the dangers associated with extreme temperature events through distribution		Extreme Temperatures		Fire Department	High	Low	City Budget	Short	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	at public events and at public facilities.									
	Plant trees in public areas around buildings and in parks to provide shade		Extreme Temperatures		Public Works	High	Low	OK Dept of Forestry, City Budget	Short	High
	Establish pre-determined heating and cooling stations to protect the public		Extreme Temperatures		Fire Department	High	Low	City Budget	Short	High
	Widen and increase the drainage upstream from the repetitive loss properties, including installing tinhorns and possibly riprap	New and Existing	Flood		Public Works	High	High	OWRB REAP Grant, HMGP, City Budget	Long, DOF	High
	Develop a mitigation educational program and present it to farmers and ranchers explaining the need for crop insurance and how to make buildings more resistant to hail through improved roofing materials.	New and Existing	Hail		Code Enforcement	High	Low	City Budget	Short	Medium
	Enact a building code requiring hail resistant materials for roofing and siding on all new homes.	New	Hail		Code Enforcement	High	Low	City Budget	Short	Medium
	Install lightning protection and suppression systems protecting radios, computers and other critical equipment at city owned facilities.	Existing	Lightning		Public Works	High	Medium	City Budget, Grants	Short	Medium
	Include lightning mitigation and safety brochures with monthly water bills	Existing	Lightning		Code Enforcement	High	Low	City Budget	Short	Medium
	Purchase and install		Lightning		Public Works	High	High	HMGP	Long	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	lightning detection systems with alarms for city parks and public areas.									
	Enact an ordinance to require the securing of mobile homes and other small structures helping reduce damage from high winds.	New and Existing	Wind		Code Enforcement	High	Low	City Budget	Short	High
	Provide tie downs to secure mobile homes and other small structures from high winds	New and Existing	Wind		Code Enforcement	High	Low	HMGP, City Budget	Short	High
	Purchase and install generators for city police, fire departments and EOC facilities. Generators can be used to power items after an earthquake shakes lines down, rolling blackouts during extreme temps, outages caused by floods, lightning, hail destroying power insulators, wildfires burning up poles, and ice taking down lines in winter storms.	New and Existing	Earthquake, Extreme Heat, Flood, Hail, Lightning, Wildfire, Wind, Winter Storm		Public Works	High	Medium	HMGP, USDA REAP	Short	High
	Provide public education through pamphlets and business group meetings to inform individuals and companies how to mitigate against winter storms		Winter Storm		Fire Department	High	Low	City Budget	Short	High
	Inform citizens and developers how to mitigate expansive soil events through literature distributed during building	New	Expansive Soils		Code Enforcement	High	Low	City Budget	Short	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	permitting									
	Pass an ordinance that establish building code requirements to check for expansive soils and perform soil stabilization before construction	New	Expansive Soils		Code Enforcement	High	Low	City Budget	Short	High

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.
Costs:
Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

OWRB REAP = Oklahoma Water Resources Board, Rural Economic Action Plan
USDA REAP = U.S. Dept. of Ag Rural Energy for America Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

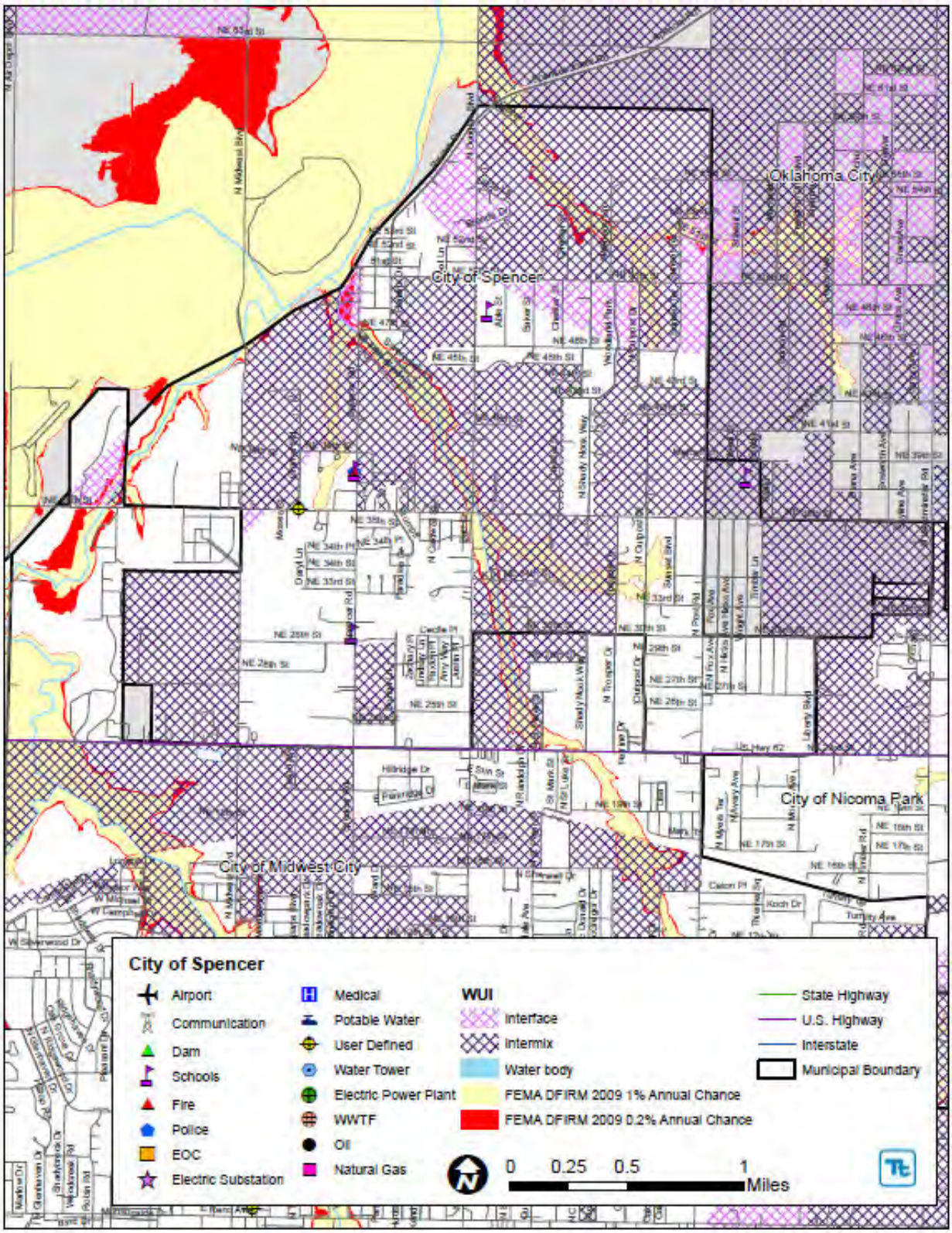
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the City of Spencer to illustrate the probable areas impacted within the City of Spencer. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the City of Spencer has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


Oklahoma City
City of Spencer
City of Midwest City
City of Nicoma Park
City of Spencer
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
Water body
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
State Highway
U.S. Highway
Interstate
Municipal Boundary
0 0.25 0.5 1
Miles

9.14 CITY OF THE VILLAGE

This section presents the jurisdictional annex for the City of The Village.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Wes Tollison, Fire Chief City of The Village 2201 W. Britton Road The Village, OK 73120 (405) 755-2499 wes_tollison@thevillageok.org	Randy Neal, Deputy Fire Chief City of The Village 2201 W. Britton Road The Village, OK 73120 (405) 755-2250 randy.neal@coxinet.net

B.) MUNICIPAL PROFILE

The City of The Village is located in western Oklahoma County. It is bordered to the north, east and west by Oklahoma City and to the south by the City of Nichols Hills. The City has a total land area of 2.5 square miles, all of it land. The City is governed by a mayor and five member City Council. The 2010 U.S. Census population for the City of The Village was 8,929.

Growth/Development Trends

The City has identified no known or anticipated residential or commercial development at this time.

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the City of The Village in the 2006 plan.

2006 Initiative Description	Status	Comments
Procure and install five (5) outdoor warning devices to cover all locations of the Village. The City of Village will replace the old warning devices which were installed in the 1950's. This will allow the residents in the Village to be forewarned of tornadic activity.	100% complete.	Some old warning sirens remain but they are functional and there are no plans to replace them at this time.

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the City of The Village is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	No	
Drought	Yes	
Earthquake	Yes	

Hazard	Local Vulnerability	Comments
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	No	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the City of The Village, the following have been identified as specific hazards:

- Potential for flood damage exists within the City along the Chisholm Creek channel from Barclay Road downstream to Hefner Road. The potential for the greatest flood damage exists for the homes bordering Village Drive from Goldstone Terrace to Finley Drive and within the apartment complex along the floodplains from Finley Drive to Cavanaugh. (FEMA NFIP FIS – 2009)

Vulnerability assessment modeling has identified the following flood vulnerabilities (see Flood Hazard Profile in Section 5.4):

Critical Facilities Located in the DFIRM Flood Boundaries and Estimated Potential Damage from the 100- and 500-Year MRP Events

Name	Municipality	Type	Exposure		Potential Loss			
			100-Yr	500-Yr	100-Yr Structure Damage %	100-Yr Content Damage %	500-Yr Structure Damage %	500-Yr Content Damage %
Village Police Dept	The Village (C)	Police	X	X	9.7	18.6	11.3	43.5

Source: FEMA, 2009; HAZUS-MH 2.0

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE CITY

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Severe Storms, Flooding	DR-441	Yes	
November 26, 1974	Severe Storms, Flooding	DR-453	Yes	
October 17-19, 1983	Severe Storms, Flooding	DR-693	Yes	
September 29 – October 1, 1986	Severe Storms, Flooding	DR-778	Yes	
May 2, 1990	Flooding, Severe Storm, Tornado	DR-866	Yes	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
May 8, 1993	Severe Storm, Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Severe Storms and Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Severe Storms and Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
August 11-12, 2004	Flash Flood	N/A	N/A	
March 12, 2006	Severe Storms and Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	
January 12-26, 2007	Severe Winter Storms	DR-1678	No	
March 29, 2007	Severe Storms and Tornadoes	N/A	N/A	
May 4-11, 2007	Severe Storms, Tornadoes, and Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Severe Storms, Flooding, and Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Severe Storms, Flooding, and Tornadoes	DR-1712	Yes	
Aug. 18, 2007 to Sept. 12, 2007	Severe Storms, Tornadoes, and Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 17-23, 2008	Severe Storms, Tornadoes, and Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	
March 30-31, 2008	Severe Storms	N/A	N/A	
April 9-28, 2008	Severe Storms, Tornadoes, and Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 9, 2008	Severe Storms & Floods	DR-1754	No	
May 10-13, 2008	Severe Storms, Tornadoes, and Flooding	DR-1756	No	
June 3-20, 2008	Severe Storms and Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Severe Storms, Tornadoes, and Flooding	DR-1803	No	
February 10-11, 2009	Severe Storms and Tornadoes	DR-1820	Yes	
March 24, 2009	Severe Storms	N/A	N/A	
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	
March 30, 2009	Severe Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	
May 13, 2009	Severe Storms	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Severe Storms, Tornadoes, and Straight-Line Winds	DR-1917	Yes	
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	
May 10-13, 2010	Severe Storms, Tornadoes, and Straight-Line Winds	DR-1917	Yes	
July 7-8, 2010	Flooding	N/A	N/A	
Oct. 13, 2010	Earthquake	N/A	N/A	
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	
April 14, 2011	Severe Storms, Tornadoes, And Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Severe Storms And Flooding	DR-1988	No	
May 22-25, 2011	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Severe Heat	N/A	N/A	

Number of FEMA Identified Repetitive Flood Loss Properties: 0
Number of FEMA Identified Severe Repetitive Flood Loss Properties: 0

Source: Oklahoma Water Resources Board (OWRB)

D.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances., Plans)	Do you have this? (Y or N)	Code Citation (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	2009 IBC
Comprehensive / Master Plan		
Zoning Management Ordinance	Y	
Subdivision Management Ordinance		
Site Plan Review Requirements	Y	
NFIP Flood Damage Prevention Ordinance	Y	Chapter 9
NFIP Elevation Certificates Maintained	Y	
Floodplain Management Plan	Y	Through the countywide All Hazards Plan (2006, updating 2012)
Stormwater Management Plan / Ordinance		
Stream Corridor Management or Protection Plan		
Erosion Management Ordinance		
Capital Improvements Plan	Y	
Open Space Plan		
Economic Development Plan	Y	
Emergency Response Plan	Y	
Post Disaster Recovery Plan / Ordinance		
Real Estate Disclosure Requirements		
Highway Management Plan		
COOP/COG Plan		
Other (Special Purpose Ordinances such as critical or sensitive areas)		

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Y	Contract Engineer
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Y	Contract Engineer
Planners or engineers with an understanding of natural hazards		
NFIP Floodplain Administrator	Y	Emergency Management Director, per Flood Damage Prevention Ordinance
Surveyor(s)	N	
Personnel skilled or trained in "GIS" applications	N	
Scientist(s) familiar with natural hazards in the County.	N	
Emergency Manager	Y	
Grant Writer(s)	N	
Staff with expertise or training in benefit/cost analysis	N	

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for specific purposes	Yes
User fees for water, sewer, gas or electric service	Yes
Impact Fees for homebuyers or developers of new development/homes	Yes
Incur debt through general obligation bonds	No
Incur debt through special tax bonds	No
Incur debt through private activity bonds	No
Withhold public expenditures in hazard-prone areas	
Other	

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	4	TBD
Fire Public Protection	5	TBD
Storm Ready	County	TBD
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. Zoning management presents an opportunity to regulate positioning of quantities of hazardous materials that may be a secondary threat after a natural hazard incident and supports Goal #6 (Structural Projects). Local floodplain management present good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). Personnel skilled in "GIS" applications support Goal #2 (Prevention) and Goal #3 (Protecting Critical Facilities) by identifying risk areas. The Emergency Response Plan supports Goal #1 (Emergency Services). Having access to Planners and Engineers with knowledge of land development and land management practices increases the ability to mitigate against flooding and other hazards, and supports Goal #2 (Prevention) in the plan. Having a local Emergency Manager provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). The fiscal capabilities of items such Capital Improvements Project Funding, fees and debts present opportunities for monies to support Goal #6 (Structural Projects) and Goal #5 (Public Awareness).

\The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Increase drainage capacity (incl. upsizing of culverts) along Hefner Road and Village Drive; and just west of May at the Lutheran Church	Existing	Flood		City of the Village working along with Oklahoma City who owns one side of the road	High – Reduced flood vulnerability to infrastructure	High	FEMA Mitigation Grants; local funding for match	Long	Medium
	Address shortfalls in public sheltering capacity by starting a city safe room rebate program.	Existing	Wind		City EM with County and State OEM support	High – Public Safety, reduced reliance on public storm shelters	High	HMGP with local funding match	Short	High
	Install permanent generator at Fire Station and DPW building. Generators can be used to power items after an earthquake shakes lines down, rolling blackouts during extreme temps, outages caused by floods, lightning, hail destroying power insulators, wind and ice taking down lines in winter storms.	Existing	Earthquake, Extreme Temps, Flood, Hail, Lightning, Wind, Winter Storm		City EM, City DPW; working with State OEM/FEMA	High (protection of critical facilities and maintenance of emergency services)	Medium - High	FEMA Mitigation and/or Emergency Management grants; local funding for match	Short	High
	Maintain compliance with and good-standing in the NFIP including adoption	New & Existing	NFIP Compliance		Municipality (via Municipal Engineer/NFIP	High	Low - Medium	Local Budget	Ongoing	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community.				Floodplain Administrator) with support from OEM, ISO FEMA					
	Conduct and facilitate community and public education and outreach for residents and businesses to include, but not be limited to, the following to promote and effect natural hazard risk reduction: • Provide and maintain links to the HMP website, and regularly post notices on the County/municipal homepage(s) referencing the HMP webpages. • Prepare and distribute informational letters to flood vulnerable property owners and neighborhood associations, explaining the availability of mitigation grant funding to mitigate their properties, and instructing them on how they can learn more and implement mitigation. • Use email notification systems and newsletters to better educate the public on flood insurance, the availability of mitigation grant funding, and personal natural hazard risk reduction measures. • Work with neighborhood associations, civic and business groups to disseminate information on flood insurance and the availability of mitigation grant funding. • Participate in regional public awareness and education initiatives through the LEPCs.									
	See above.	NA	Flood		Municipality with support from Planning Partners, OEM, FEMA	Low - Medium	Low - Medium	Municipal Budget; HMA programs with local or county match	Short	High
	Archive elevation certificates	NA	NFIP Compliance		NFIP Floodplain Administrator	Low	Low	Local Budget	On-going	High
	Conduct a public education campaign through newsletters in utility bills, the city cable channel and website to inform residents how to mitigate against drought (using Xeriscape, low		Drought, Expansive Soils, Extreme Temps, Hail, Lightning, Winter		City Manager	High	Low	City budget	Short	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	flow faucets), expansive soils (soil replacement), extreme temps (how to prevent frostbite, signs of heat exhaustion/stroke), hail (hail resistant roofing), lightning (using surge protectors), and winter storms (including the dangers of carbon monoxide)		Storm							
	Establish water conservation regulations to enact during times of drought to align with OKC policy.		Drought		City Manager	High	Low	City budget	Short	Medium
	Adopt IBC 2012 building code with earthquake guidance	New	Earthquake		Building Official	High	Low	City budget	Short	Low
	Enact a regulation to require a check for expansive soils prior to building a city building and perform soil stabilization if expansive soils are found.	New	Expansive Soil		City Inspector	High	Low	City budget	Short	Medium

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.
Costs:
Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where actual project costs cannot reasonably be established at this time:
Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits:
Where possible, an estimate of project benefits (per FEMA's benefit calculation methodology) has been evaluated against the project costs, and is presented as:
Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000
Where numerical project benefits cannot reasonably be established at this time:
Low = Long term benefits of the project are difficult to quantify in the short term.
Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

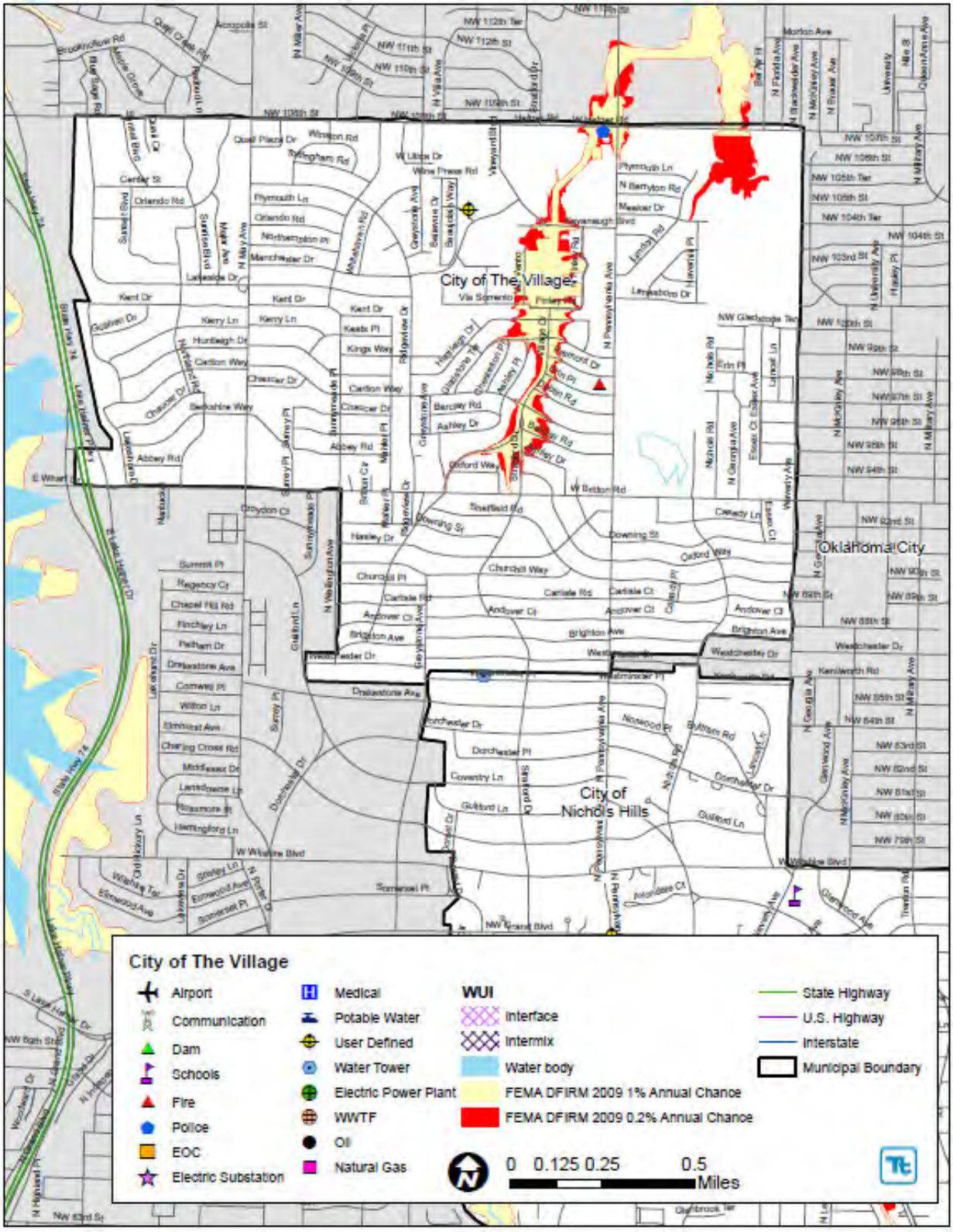
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the City of The Village to illustrate the probable areas impacted within the City of The Village. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the City of The Village has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


City of The Village
Oklahoma City
City of Nichols Hills
City of The Village
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
Water body
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
State Highway
U.S. Highway
Interstate
Municipal Boundary
0 0.125 0.25 0.5
Miles

9.15 CITY OF WARR ACRES

This section presents the jurisdictional annex for the City of Warr Acres.

A.) HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact	Alternate Point of Contact
Kenny Koger, Fire Chief 5930 NW 48th, Warr Acres, OK 73122 (405) 789-5912 kkoger@fire.warracres-ok.gov	

B.) MUNICIPAL PROFILE

The City of Warr Acres is located in southern Oklahoma County. It is bordered to the north, east and south by Oklahoma City and to the west by the Town of Bethany. It is generally bounded by Wilshire Boulevard on the north, Mueller Avenue on the west, Thirty-Third Street on the south, and Meridian Avenue on the east. State Highway 3 (Northwest Expressway) and U.S. Highway 66 (Northwest Thirty-ninth Street Expressway) pass through the community. The Putnam City School District serves some parts of Oklahoma City and almost all of Warr Acres, although some residents live in the Oklahoma City School District.

The City has a total land area of 2.8 square miles, all of it land. The City is governed by a mayor and eight member city council. The 2010 U.S. Census population for the City was 10,043.

Low-lying areas in the City are subject to periodic flooding caused by overflow of Spring Creek. The most severe flooding occurs as a result of thunderstorms and intense rainfall. Most flooding occurs upstream from roadway and ponds that restrict the flow (FEMA NFIP FIS - 2009)

Warr Acres considers their overall risk for wildfire as near zero as they have no significant areas of WUI.

Past Mitigation Activity/Efforts

The following table summarizes progress on the mitigation strategy identified by the City of Warr Acres in the 2006 plan.

2006 Initiative Description	Status	Comments
The City of Warr Acres to install a bigger drainage system at the intersection of NW 34th and Hammond. This intersection consistently floods during average-heavy rainfall.	No progress.	Carry forward in update.

Further details on mitigation activities completed or ongoing in the City include:

- Dam 2 at the Twin Lakes Housing development was reworked and rebuilt approximately two years ago
- OG&E has been upgrading service with new poles and wires to reduce power outages
- There are an estimated 150 private residential safe rooms in the City.
- 2012 - installed an Immediate Response Information System (IRIS)
- The City recently reiterated their policies on audible tornado warnings – what, when and why

- With the upgrading of their emergency communications to an 800 MHz system, the City installed lightning protection to their communications tower which suffered ~$120,000 damage previously.
- All (3) three wastewater lift stations have been upgraded with backup power.

Hazard Vulnerabilities Identified

Hazard profiling, Section 5.3, has identified that the City of Warr Acres is vulnerable to the following hazards of concern:

Hazard	Local Vulnerability	Comments
Dam Failure	Yes	Twin Lakes East and West
Drought	Yes	
Earthquake	Yes	
Expansive Soils	Yes	
Extreme Temperatures	Yes	
Flooding	Yes	See local hazard map end of section
Hail	Yes	
Lightning	Yes	
Wildfire	No	See local hazard map end of section
Wind (incl. tornado)	Yes	
Severe Winter Storm	Yes	

According to the City of Warr Acres, the following have been identified as specific hazards:

- The City has an area in the southern portion of the City that has very poor drainage. Several times a year, the City has several R-1 homes that flood.

Growth/Development Trends

The following major residential/commercial development and major infrastructure development are currently known or anticipated in the City of Warr Acres:

New Development/Potential Development in the City of Warr Acres						
Property Name	Type Residential or Commercial	Number of Structures	Address	Block and Lot	Known Hazard Zone	Description/Status
Cherokee Crossings II	Both	Up to 160	700 Cherokee Crossing/west/east	Many	Not in NFIP floodplain. All utilities are being undergrounded, reducing the risk of power outages.	12 to 15 R-1 so far

C.) NATURAL HAZARD EVENT HISTORY SPECIFIC TO THE CITY

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
June 8-10, 1974	Severe Storms, Flooding	DR-441	Yes	
November 26, 1974	Severe Storms, Flooding	DR-453	Yes	
October 17-19, 1983	Severe Storms, Flooding	DR-693	Yes	
September 29 – October 1, 1986	Severe Storms, Flooding	DR-778	Yes	
May 2, 1990	Flooding, Severe Storm, Tornado	DR-866	Yes	
May 8, 1993	Severe Storm, Tornadoes	DR-991	Yes	
June 9, 1993	Flash Flooding	N/A	N/A	
July 26 – August 2, 1995	Tornado, Flooding	DR-1066	Yes	
April 24-26, 1999	Flooding	N/A	N/A	
May 3-4, 1999	Tornadoes, Severe Storms and Flooding	DR-1272	Yes	
June 23, 1999	Flash Flooding	N/A	N/A	
October 21-29, 2000	Severe Storms and Flooding	DR-1349	Yes	
May 30, 2001	Flooding	N/A	N/A	
September 7, 2001	Urban Flooding	N/A	N/A	
May 9, 2003	Tornado	N/A	N/A	Eight injured during this F1 tornado. Affected Bethany as well.
August 11-12, 2004	Flash Flood	N/A	N/A	
March 12, 2006	Severe Storms and Tornadoes	DR-1637	No	
December 28-30, 2006	Severe Winter Storm	DR-1677	No	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
January 12-26, 2007	Severe Winter Storms	DR-1678	No	
March 29, 2007	Severe Storms and Tornadoes	N/A	N/A	
May 4-11, 2007	Severe Storms, Tornadoes, and Flooding	DR-1707	No	
May 24, 2007 to June 1, 2007	Severe Storms, Flooding, and Tornadoes	DR-1723	No	
June 10, 2007 to July 25, 2007	Severe Storms, Flooding, and Tornadoes	DR-1712	Yes	
Aug. 18, 2007 to Sept. 12, 2007	Severe Storms, Tornadoes, and Flooding	DR-1718	Yes	
Dec. 8, 2007 to Jan. 3, 2008	Severe Winter Storms	DR-1735	Yes	
March 17-23, 2008	Severe Storms, Tornadoes, and Flooding	DR-1752	No	
March 22, 2008	Wildfire	N/A	N/A	Warr Acres not affected
March 30-31, 2008	Severe Storms	N/A	N/A	
April 9-28, 2008	Severe Storms, Tornadoes, and Flooding	DR-1754	No	
April 30, 2008	Hail/Damaging Winds	N/A	N/A	
May 7, 2008	Tornado	N/A	N/A	
May 9, 2008	Severe Storms & Floods	DR-1754	No	
May 10-13, 2008	Severe Storms, Tornadoes, and Flooding	DR-1756	No	
June 3-20, 2008	Severe Storms and Flooding	DR-1775	No	
August 20, 2008	Flooding	N/A	N/A	
September 12-19, 2008	Severe Storms, Tornadoes, and Flooding	DR-1803	No	
February 10-11, 2009	Severe Storms and Tornadoes	DR-1820	Yes	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
March 24, 2009	Severe Storms	N/A	N/A	
March 26-27, 2009	Snow/Ice/Severe Storm	N/A	N/A	
March 30, 2009	Severe Storm	N/A	N/A	
April 9-12, 2009	Wildfires	DR-1846	Yes	Warr Acres not affected
May 13, 2009	Severe Storms	N/A	N/A	
December 24-25, 2009	Severe Winter Storm	DR-1876	No	
January 26-28, 2009	Severe Winter Storm	DR-1823	No	
2010-2011	Severe Drought	N/A	N/A	
January 28-30, 2010	Severe Winter Storm	DR-1883	No	
Jan. 30-Feb. 9, 2010	Severe Winter Storm	N/A	N/A	
March 19, 2010	Severe Winter Storm	N/A	N/A	
2010-2011	Severe Drought	N/A	N/A	
May 10-13, 2010	Severe Storms, Tornadoes, and Straight-Line Winds	DR-1917	Yes	
May 16, 2010	Hail Storm	N/A	N/A	
May 19, 2010	Severe Storm	N/A	N/A	
June 13-15, 2010	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1926	Yes	
May 10-13, 2010	Severe Storms, Tornadoes, and Straight-Line Winds	DR-1917	Yes	
July 7-8, 2010	Flooding	N/A	N/A	

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Local Damages and Losses
Oct. 13, 2010	Earthquake	N/A	N/A	
Jan. 31, 2011 to Feb. 5, 2011	Severe Winter Storm and Snowstorm	DR-1985	No	
April 14, 2011	Severe Storms, Tornadoes, And Straight-Line Winds	DR-1970	No	
April 21-28, 2011	Severe Storms And Flooding	DR-1988	No	
May 22-25, 2011	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1989	No	
June-August 2011	Severe Heat	N/A	N/A	

Number of FEMA Identified Repetitive Flood Loss Properties: 0
Number of FEMA Identified Severe Repetitive Flood Loss Properties: 0

Source: Oklahoma Water Resources Board (OWRB)

E.) CAPABILITY ASSESSMENT

This section identifies the following capabilities of the local jurisdiction:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability
- Community classification.

D.1) Legal and Regulatory Capability

Regulatory Tools (Codes, Ordinances., Plans)	Do you have this? (Y or N)	Code Citation (Section, Paragraph, Page Number, Date of adoption)
Building Code	Y	IBC 2006 / Ord. 1017§ 1, 2006
Comprehensive / Master Plan	Y	Warr Acres Comprehensive / Master Plan map
Zoning Management Ordinance	Y	Warr Acres Zoning in Title 19 / Ord. 1017§ 1, 2006
Subdivision Management Ordinance	Y	Title 19 / Ord. 1017§ 1, 2006
Site Plan Review Requirements	Y	Title 19 / Ord. 1017§ 1, 2006
NFIP Flood Damage Prevention Ordinance (if you are in the NFIP, you must have this!)	Y	Title 16:20:180, updated 2009
NFIP Elevation Certificates Maintained	Y	Title 16:20:180, updated 2009
Floodplain Management Plan	Y	Title 16, Chapter 16.20
Stormwater Management Plan / Ordinance	Y	Title 13 and MS-4 / Ord. 1076§ 1, 2009
Stream Corridor Management or Protection Plan	Y	National Flood Prevention NFIP form maps
Erosion Management Ordinance	Y	Title 13 and MS-4 / Ord. 1076§ 1, 2009
Capital Improvements Plan	Y	Mayor Woolley has a five-year plan
Open Space Plan	N	
Economic Development Plan	Y	City has Economic Development Authority
Emergency Response Plan	Y	City has an Emergency Operations Plan
Post Disaster Recovery Plan / Ordinance	N	
Real Estate Disclosure Requirements	N	
Highway Management Plan	Y	Five-year highway plan by each county commissioner district
COOP/COG Plan	Y	City is a member of the Association of Central Oklahoma Governments (ACOG)
Other (Special Purpose Ordinances such as critical or sensitive areas)	N	

D.2) Administrative and Technical Capability

Staff/ Personnel Resources	Available (Y or N)	Department/ Agency/ Position
Planner(s) or Engineer(s) with knowledge of land development and land management practices	Y	Warr Acres City Planner
Engineer(s) or Professional(s) trained in construction practices related to buildings and/or infrastructure	Y	Warr Acres City Engineer / Legacy Engineering
Planners or engineers with an understanding of natural hazards	Y	Warr Acres Public Works Director / Engineer
NFIP Floodplain Administrator	Y	Warr Acres Public Works Director
Surveyor(s)	N	
Personnel skilled or trained in "GIS" applications	Y	Warr Acres in-house IT person
Scientist(s) familiar with natural hazards in the County.	N	
Emergency Manager	Y	Warr Acres Fire Chief
Grant Writer(s)	Y	Warr Acres City contract position
Staff with expertise or training in benefit/cost analysis	N	

D.3) Fiscal Capability

Financial Resources	Accessible or Eligible to use (Yes/No/Don't know)
Community Development Block Grants (CDBG)	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for specific purposes	Yes
User fees for water, sewer, gas or electric service	Yes
Impact Fees for homebuyers or developers of new development/homes	Don't Know
Incur debt through general obligation bonds	No
Incur debt through special tax bonds	No
Incur debt through private activity bonds	No
Withhold public expenditures in hazard-prone areas	Don't Know
Other	

D.4) Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	4	TBD
Public Protection	TBD	TBD
Storm Ready	County	TBD
Firewise	NP	N/A

N/A = Not applicable. NP = Not participating. - = Unavailable. TBD = To Be Determined

These capabilities will help promote the mitigation strategies presented in this plan. Adhering to the International Building Codes promotes building infrastructure more resistant to many of the hazards presented in the plan. The latest adoption was in 2006 and adoption of newer codes may present an opportunity for improvement. The comprehensive master plan provides an opportunity to expand on and improve the policies and programs identified herein. Zoning management presents an opportunity to regulate positioning quantities of hazardous materials that may be a secondary threat after a natural hazard incident and supports Goal #6 (Structural Projects). The Floodplain Management Plan and local floodplain management present good opportunities to promote the mitigation strategies presented in the actions below and supports Goal #3 (Protecting Critical Facilities). The Emergency Response Plan supports Goal #1 (Emergency Services). Having IT staff skilled in "GIS" applications support Goal #2 (Prevention) and Goal #3 (Protecting Critical Facilities) by identifying risk areas. Having a Planner and contract Engineers with knowledge of land development and land management practices increases the ability to mitigate against flooding and other hazards, and supports Goal #2 (Prevention) in the plan. Having a local Emergency Manager with a fire background provides the opportunity to expand on Goal #1, Emergency Services, Goal #4 (Protection of Life and Property) and Goal #5 (Public Awareness and Partnerships). Having a contract grant writer further supports completion of actions in the Plan. The fiscal capabilities of items such as Community Development Block Grants and Capital Improvements Project Funding, and fees present opportunities for monies to support Goal #6 (Structural Projects) and Goal #5 (Public Awareness).

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

Criteria for classification credits are outlined in the following documents:

- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm

- The National Firewise Communities website at http://firewise.org/

E.) PROPOSED HAZARD MITIGATION INITIATIVES

Note some of the identified mitigation initiatives in Table F are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Install a bigger drainage system and detention pond at the intersection of NW 34th and Hammond. This intersection consistently floods during average-heavy rainfall. (2006 Plan).	Existing	Flood		Public Works working with Bethany	Some 20 residential structures flood here	$3,000,000 (2006)	Federal mitigation grant funding with local match	Long	Medium
	Detention pond in the south district of the City to solve flooding issues in that area	Existing	Flood		Public works with County	High	High	HMGP, City budget	Short	High
	39th and MacArthur – support ODOT project to rebuild MacArthur, which will address drainage issues at this location	Existing	Flood		ODOT with support from the City	Eliminate chronic street closures	High	ODOT	3-5 years	Medium
	Add an annex shelter to the Community/Senior Center which serves as the alternate EOC, including installing backup power, to support additional sheltering and provide a secondary command / communications center.	Existing	Wind		Civil Defense	High	High	Private Funding, HMGP, City budget	Short	Medium
	Install backup power to the Community/Senior Center which serves as	Existing	Wind		Civil Defense	Medium	High	Private Funding, HMGP,	Short	Medium

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	the alternate EOC							City budget		
	Install backup power at the public works facility so that fuel is available for public service vehicles during power outages.	Existing	(Non Mitigation)		Public Works with Civil Defense	Preparedness: Provide a source of fuel for emergency responses	Medium	HMGP, City budget	Short	Medium
	Institute necessary programs and measures to reduce the City ISO rating to a 3 (from current 4).	New and Existing	(Non Mitigation)		Fire Department	Reduced urban fire hazard vulnerabilities and insurance premiums for all policyholders in the City	Medium	Local	1 year	High
	Maintain compliance with and good-standing in the NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community.	New & Existing	NFIP Compliance		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, ISO FEMA	High	Low - Medium	Local Budget	Ongoing	High
	Adopt 2012 IBC (building code) and enforce compliance.	New & Existing	NFIP Compliance		Municipality (via Municipal Engineer/NFIP Floodplain Administrator) with support from OEM, FEMA	Low	Low	Municipal Budget	Short	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	Conduct and facilitate community and public education and outreach for residents and businesses to support personal hazard preparedness and mitigation, including information on flood and other hazard insurance, the availability of mitigation grant funding, and personal natural hazard risk reduction measures. Specific methods for public outreach and education shall include: • Provide and maintain links to the HMP website, and regularly post notices on the City homepage(s) referencing the HMP website; • Information flyers in utility bills; • Information via the Bethany Tribune; • Work with neighborhood associations, civic and business groups to disseminate information on flood and other hazard insurance and the availability of mitigation grant funding; • Participate in regional public awareness and education initiatives through the LEPCs.									
	See above.	NA	Flood		Municipality with support from Planning Partners, OEM, FEMA	Low - Medium	Low - Medium	Municipal Budget; HMA programs with local or county match	Short	High
	Archive elevation certificates	NA	NFIP Compliance		NFIP Floodplain Administrator	Low	Low	Local Budget	On-going	High
	Create/enhance/ maintain mutual aid agreements with neighboring communities for continuity of operations.	New & Existing	Non Mitigation		Municipality with support from Surrounding municipalities and County	Low	Low	Local Budget	Ongoing	High
	Install window film on city buildings	Existing	Extreme Temperatures, Hail		Civil Defense	Medium	Medium	HMGP, City budget	Short	Medium
	Install a steel gable roof on a city building that has been replaced twice due to hail damage	Existing	Hail		Civil Defense	Medium	Medium	HMGP	Short	Medium
	Install covered parking to protect city vehicles from hail and extreme heat damage		Extreme Temperatures, Hail		Civil Defense	Medium-High	Medium	HMGP	Short	Medium
	Create mitigation		Dam Failure,		Civil Defense	High	Low	HMGP,	Short	High

Initiative	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Goals and Objectives Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	education pamphlets and distribute at booths during large public events and at public city venues.		Drought, Earthquake, Expansive Soils, Extreme Temperatures, Flood, Hail, Lightning, Wind, Winter Storms					City budget		
	Conduct All-Hazard mitigation classes through town hall meetings and senior centers		Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperatures, Flood, Hail, Lightning, Wind, Winter Storms		Civil Defense	High	Low	City budget	Short	High
	Distribute All-Hazard Weather Radios to senior centers, and high risk residents		Dam Failure, Drought, Earthquake, Extreme Temperatures, Flood, Hail, Lightning, Wind, Winter Storms		Civil Defense	High	Low	HMGP, City budget	Short	High
	Enact a regulation to require a check for expansive soils prior to building a city building and perform soil stabilization if expansive soils are found.		Expansive Soil		Public Works	High	Medium	City Budget	Short	Medium

Notes:
*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (NA) is inserted if this does not apply.
Costs:

Where actual project costs have been reasonably estimated:
Low = < $10,000
Medium = $10,000 to $100,000
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Where numerical project benefits cannot reasonably be established at this time:
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Medium = Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
High = Project will have an immediate impact on the reduction of risk exposure to life and property.

Potential FEMA HMA Funding Sources:
PDM = Pre-Disaster Mitigation Grant Program
FMA = Flood Mitigation Assistance Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program
HMGP = Hazard Mitigation Grant Program

Timeline:
Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.
DOF = Depending on funding.

Explanation of Priorities

- ***High Priority*** - A project that meets multiple objectives (i.e., multiple hazards), benefits exceeds cost, has funding secured or is an on-going project and project meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Grant Program (PDM) programs. High priority projects can be completed in the short term (1 to 5 years).

- ***Medium Priority*** - A project that meets goals and objectives, benefits exceeds costs, funding has not been secured but project is grant eligible under, HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is completed. Medium priority projects will become high priority projects once funding is secured.

- ***Low Priority*** - Any project that will mitigate the risk of a hazard, benefits do not exceed the costs or are difficult to quantify, funding has not been secured and project is not eligible for HMGP or PDM grant funding, and time line for completion is considered long term (1 to 10 years). Low priority projects may be eligible other sources of grant funding from other programs. A low priority project could become a high priority project once funding is secured as long as it could be completed in the short term.

Prioritization of initiatives was based on above definitions: Yes

Prioritization of initiatives was based on parameters other than stated above: Not applicable.

F.) FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

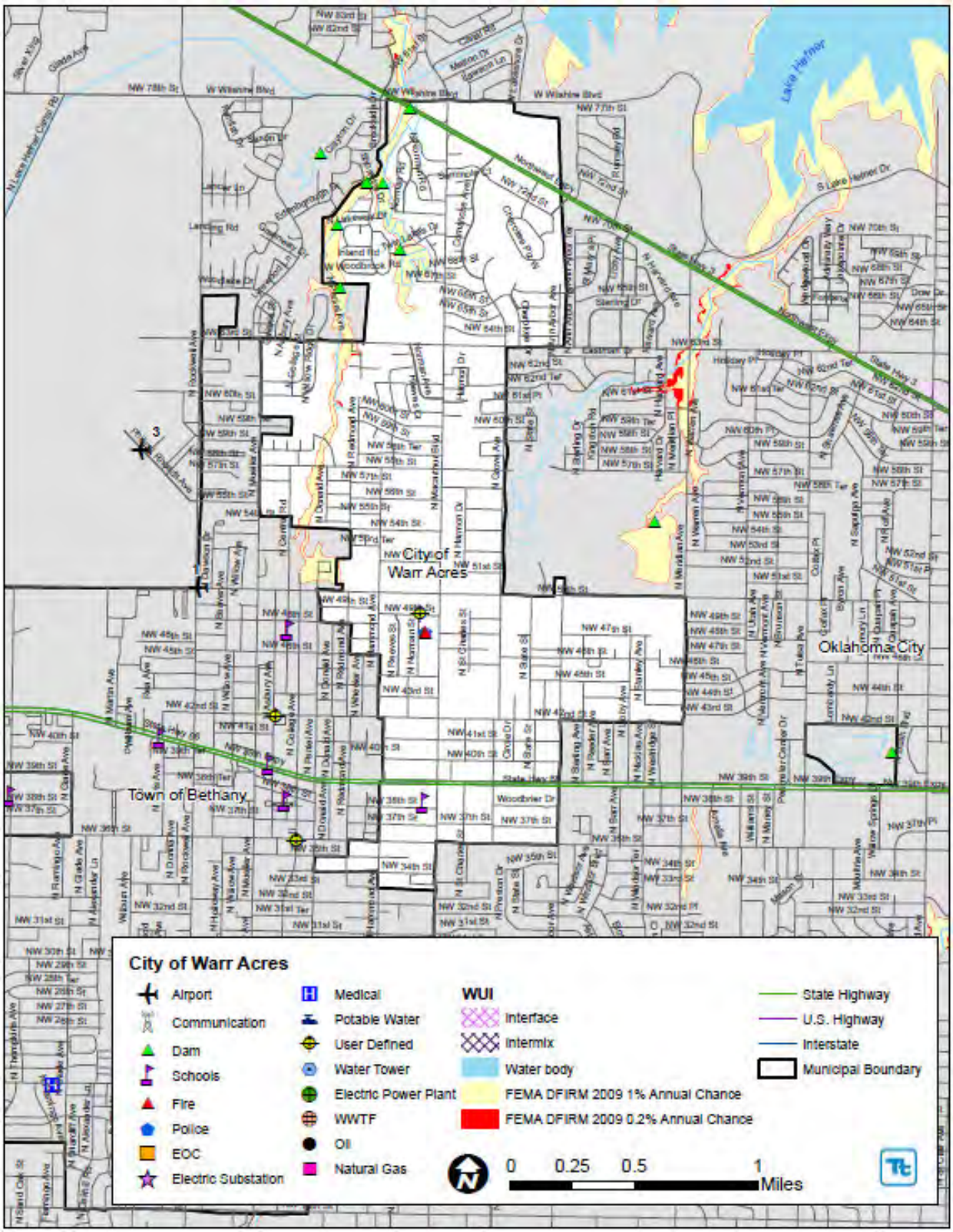
None at this time.

G.) HAZARD AREA EXTENT AND LOCATION

A hazard area extent and location map has been generated and is provided below for the City of Warr Acres to illustrate the probable areas impacted within the City of Warr Acres. This map is based on the best available data at the time of the preparation of this Plan, and is considered to be adequate for planning purposes. Maps have only been generated for those hazards that can be clearly identified using mapping techniques and technologies, and for which the City of Warr Acres has significant exposure. The Planning Area maps are provided in the hazard profiles within Section 5.4, Volume I of this Plan.

H.) ADDITIONAL COMMENTS

No additional comments at this time.


City of Warr Acres
Town of Bethany
Oklahoma City
Lake Hefner
City of Warr Acres
Airport
Communication
Dam
Schools
Fire
Police
EOC
Electric Substation
Medical
Potable Water
User Defined
Water Tower
Electric Power Plant
WWTF
Oil
Natural Gas
WUI
Interface
Intermix
Water body
FEMA DFIRM 2009 1% Annual Chance
FEMA DFIRM 2009 0.2% Annual Chance
State Highway
U.S. Highway
Interstate
Municipal Boundary
0 0.25 0.5 1
Miles

ACOG	Association of Central Oklahoma Governments
ASFPM	Association of State Floodplain Managers
BCA	Benefit Cost Analysis
BFE	Base Flood Elevation
CDC	Center of Disease Control
CEMP	Comprehensive Emergency Management Program
CFR	Code of Federal Regulations
CREC	Central Rural Electric Cooperative
CRREL	Cold Regions Research and Engineering Laboratory
CRS	Community Rating System
DEM	Digital Elevation Model
DFIRMs	Digital Flood Insurance Rate Maps
DIs	Damage Indicators
DHS	Department of Homeland Security
DMA 2000	Disaster Mitigation Act of 2000
DOD	Degrees of Damage
EFS	Enhanced Fujita Scale
EMS	Emergency Medical Services
EOC	Emergency Operations Center
DPW	Department of Public Works
DR	Disaster Declarations
EM	Emergency Management
EMS	Emergency Management Services
EOC	Emergency Operation Center
EOP	Emergency Operation Plan
FAA	Federal Aviation Administration
FD	Fire Department
FEMA	Federal Emergency Management Agency
FIA	Flood Insurance Administration
FIRM	Flood Insurance Rate Map
FIT	Flood Information Tool
FIS	Flood Insurance Study
FM	Fuel Moisture
FY	Fiscal Year

GIS	Geographic Information System
HAZUS	Hazards U.S.
HAZUS-MH	Hazards U.S. Multi-Hazard
HAZMAT	Hazardous Materials
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HUC	Hydrologic Unit Code
ICLR	Institute for Catastrophic Loss Reduction
IPCC	Intergovernmental Panel of Climate Change
IT	Information Technology
Mi	Mile
MGD	Million Gallons per Day
Mph	Miles per Hour
MRP	Mean Return Period
N/A	Not Applicable
NA	Not Available
NCDC	National Climate Data Center
NEHRP	National Earthquake Hazard Reduction Program
NESEC	Northeast States Emergency Consortium
NESIS	Northeast Snowfall Impact Scale
NFIP	National Flood Insurance Program
NGDC	National Geophysical Data Center
NHC	National Hurricane Center
NID	National Inventory of Dams
NIMS	National Incident Management System
NLCD	National Land Cover Dataset
NOAA	National Oceanic and Atmospheric Administration
NPDP	National Performance of Dams Program
NRCS	Natural Resource Conservation Service
NSSL	National Severe Storms Library
NVRC	Northern Virginia Regional Commission
NWS	National Weather Service
OCARTS	Oklahoma City Area Regional Transportation Study
ODOT	Oklahoma Department of Transportation

OEM	Oklahoma Emergency Management
OEC	Oklahoma Electric Cooperative
OG&E	Oklahoma Gas & Electric
OKC	Oklahoma County
OKC CP	Oklahoma County Planning
OKEM	Oklahoma County Emergency Management
OKWB	Oklahoma Water Board
ONG	Oklahoma Natural Gas
OTA	Oklahoma Turnpike Authority
%	Percent
%g	Percent Acceleration Force of Gravity
PD	Police Department
PDM	Pre-Disaster Mitigation Program
PGA	Peak Ground Acceleration
Pop.	Population
RLP	Repetitive Loss of Property
RCV	Replacement Cost Value
Q3	Quality 3
SHELDUS	Spatial Hazard Events and Losses Database for United States
SPC	Storm Prediction Center
Sq. Mi.	Square mile
SRL	Severe Repetitive Loss
SWOO	Strengths, Weaknesses, Obstacles and Opportunities
TBD	To Be Determined
TMA	Transportation Management Area
TRI	Toxic Release Inventory
TSTM	Thunderstorm
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USD	U.S. Dollar
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

WCI	Wind Chill Index
WCT	Wind Chill Temperatures
WMA	Watershed Management Area
WWTP	Wastewater Treatment Plant

This resource defines terms that are used in or support the risk assessment document. These definitions were based on terms defined in documents included in the reference section, with modifications as appropriate to address the Oklahoma County specific definitions and requirements.

100-year flood – A flood that has a 1-percent chance of being equaled or exceeded in any given year. This flood event is also referred to as the base flood. The term "100-year flood" can be misleading; it is not the flood that will occur once every 100 years. Rather, it is the flood elevation that has a 1- percent chance of being equaled or exceeded each year. Therefore, the 100-year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the standard used by most federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management to determine the need for flood insurance.

500-year flood – A flood that has a 0.2-percent chance of being equaled or exceeded in any one year.

Aggregate Data – Data gathered together across an area or region (for example, census tract or census block data).

Annualized Loss – The estimated long-term value of losses from potential future hazard occurrences of a particular type in any given single year in a specified geographic area. In other words, the average annual loss that is likely to be incurred each year based on frequency of occurrence and loss estimates. Note that the loss in any given year can be substantially higher or lower than the estimated annualized loss.

Annualized Loss Ratio – Represents the annualized loss estimate as a fraction of the replacement value of the local building inventory. This ratio is calculated using the following formula: Annualized Loss Ratio = Annualized Losses / Exposure at Risk. The annualized loss ratio gauges the relationship between average annualized loss and building value at risk. This ratio can be used as a measure of relative risk between hazards as well as across different geographic units

Asset – Any man-made or natural feature that has value, including but not limited to people, buildings, infrastructure (such as bridges, roads, and sewer and water systems), and lifelines (such as electricity and communication resources or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks).

At-Risk – Exposure values that include the entire building inventory value in census blocks that lie within or border the inundation areas or any area potentially exposed to a hazard based on location.

Base Flood – Flood that has a 1-percent probability of being equaled or exceeded in any given year. It is also known as the 100-year flood.

Base Flood Elevation (BFE) – Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The BFE is used as the standard for the National Flood Insurance Program.

Benefit – Net project outcomes, usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of conducting a benefit-cost analysis of proposed mitigation measures, benefits are limited to specific, measurable, risk reduction factors, including a reduction in expected property losses (building, content, and function) and protection of human life.

Benefit-cost analysis (BCA) – Benefit-cost analysis is a systematic, quantitative method of comparing the projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Blizzard – Characterized by low temperatures, wind gusts of 35 mph or more and falling and/or blowing snow that reduces visibility to 0.25 miles or less for an extended period of time (three or more hours).

Building – A structure that is walled and roofed, principally aboveground and permanently fixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Building Codes – Regulations that set forth standards and requirements for construction, maintenance, operation, occupancy, use, or appearance of buildings, premises, and dwelling units. Building codes can include standards for structures to withstand natural disasters.

Buildup Index – Cumulative numerical index derived from daily weather data, presumably indicates the moisture content in medium-driving forest fuels.

Capability Assessment – An assessment that provides a description and analysis of a community or state's current capacity to address the threats associated with hazards. The capability assessment attempts to identify and evaluate existing policies, regulations, programs, and practices that positively or negatively affect the community or state's vulnerability to hazards or specific threats.

Climate – The meteorological elements, including temperature, precipitation, and wind, that characterizes the general conditions of the atmosphere over a period of time (typically 30-years) for a particular region.

Community Rating System (CRS) – CRS is a program that provides incentives for National Flood Insurance Program communities to complete activities that reduce flood hazard risk. When the community completes specific activities, the insurance premiums of these policyholders in communities are reduced.

Comprehensive Plan – A document, also known as a "general plan", covering the entire geographic area of a community and expressing community goals and objectives. The plan lays out the vision, policies, and strategies for the future of the community, including all of the physical elements that will determine the community's future development. This plan can discuss the community's desired physical development, desired rate and quantity of growth, community character, transportation services, location of growth, and siting of public facilities and transportation. In most states, the comprehensive plan has no authority in and of itself, but serves as a guide for community decision-making.

Critical Facility – Facilities that are critical to the health and welfare of the population and that are especially important following a hazard. Critical facilities include essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities, and hazardous material facilities. As defined for the Fulton County risk assessment, this category includes police stations, fire and/or EMS stations, major medical care facilities and emergency communications.

Dam - An artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material for the purpose of storage or control of water.

Dam Failure – A partial or complete breach in a dam, which impacts its integrity. Dam failures occur for a number of reasons such as flash flooding, inadequate size of spillways, mechanical failure of valves and other equipment, rodent activities in earthen dams, freezing and thawing cycles, earthquakes, and intentional destruction.

Debris – The scattered remains of assets broken or destroyed during the occurrence of a hazard. Debris caused by a wind or water hazard event can cause additional damage to other assets.

Digital Elevation Model (DEM) – U.S. Geological Survey (USGS) Digital Elevation Model (DEM) data files that are digital representations of cartographic information in a raster form. DEMs include a sampled array of elevations for a number of ground positions at regularly spaced intervals. These digital cartographic/geographic data files are produced by USGS as part of the National Mapping Program.

Digital Flood Insurance Rate Maps (DFIRMs) – These maps are used to calculate the cost insurance premiums, establish flood risk zones and base flood elevations to mitigate against potential future flood damages to properties.

Displacement Time – After a hazard occurs, the average time (in days) that a building's occupants must operate from a temporary location while repairs are made to the original building due to damages resulting from the hazard.

Disaster Mitigation Act of 2000 (DMA 2000) – Law that requires and rewards local and state pre-disaster planning, promotes sustainability as a strategy for disaster resistance, and is intended to integrate state and local planning with the aim of strengthening state-wide mitigation planning.

Drought - A deficiency of moisture that results in adverse impacts on people, animals, or vegetation over a sizeable area.

Duration – The length of time a hazard occurs.

Earthquake – A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.

Essential Facility – A facility that is important to ensure a full recovery of a community or state following the occurrence of a hazard. These facilities can include: government facilities, major employers, banks, schools, and certain commercial establishments (such as grocery stores, hardware stores, and gas stations). For the Fulton County risk assessment, this category was defined to include schools, colleges, shelters, adult living and adult care facilities, medical facilities and health clinics, hospitals.

Expansive Soils - Soils and soft rock that tend to swell or shrink due to changes in moisture content.

Exposure – The number and dollar value of assets that are considered to be at risk during the occurrence of a specific hazard.

Extent – The size of an area affected by a hazard or the occurrence of a hazard.

Extreme Cold - Extreme cold and its effects can vary across different areas of the country. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered "extreme cold".

Extreme Heat - Temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks.

Extreme Temperatures – Includes both cold and hot events, which can have a significant impact to human health, commercial/agricultural businesses and primary and secondary effects on infrastructure.

Federal Emergency Management Agency (FEMA) – Independent agency (now part of the Department of Homeland Security) created in 1978 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery.

Fire Potential Index (FPI) - Derived by combining daily weather and vegetation condition information and can identify the areas most susceptible to fire ignition. The combination of relative greenness and weather information identifies the moisture condition of the live and dead vegetation.

Flash Flood – A flood occurring with little or no warning where water levels rise at an extremely fast rate.

Flood – A general and temporary condition of partial or complete inundation of normally dry land areas resulting from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

Flood Depth – Height of the flood water surface above the ground surface.

Flood Elevation – Height of the water surface above an established datum (for example, the National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or mean sea level).

Flood Hazard Area – Area shown to be inundated by a flood of a given magnitude on a map.

Flood Information Tool (FIT) – Hazard U.S. Multi-Hazard (HAZUS-MH)- related tool designed to process and convert locally available flood information to data that can be used by the HAZUS-MH Flood Module. The FIT is a system of instructions, tutorials and geographic information system (GIS) analysis scripts. When provided with user-supplied inputs (such as ground elevations, flood elevations, and floodplain boundary information), the FIT calculates flood depth and elevation for river and coastal flood hazards.

Flood Insurance Rate Map (FIRM) – Map of a community, prepared by the FEMA that shows both the special flood hazard areas and the risk premium zones applicable to the community.

Flood Insurance Study (FIS) – A study that provides an examination, evaluation, and determination of flood hazards and, if appropriate, corresponding water surface elevations in a community or communities.

Flood Mitigation Assistance (FMA) Program – A program created as a part of the National Flood Insurance Report Act of 1994. FMA provides funding to assist communities and states in implementing actions that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other NFIP insurance structures, with a focus on repetitive loss properties.

Floodplain – Any land area, including a watercourse, susceptible to partial or complete inundation by water from any source.

Flood Polygon – A geographic information system vector file outlining the area exposed to the flood hazard. HAZUS-MH generates this polygon at the end of the flood computations in order to analyze the inventory at risk.

Freezing Rain – Rain that falls as a liquid but freezes into glaze upon contact with the ground.

Frequency – A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average.

Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1-percent chance of happening in any given year. The reliability of this information varies depending on the kind of hazard being considered.

Fuel Moisture (FM) Content - The quantity of water in a fuel particle expressed as a percent of the oven-dry weight of the fuel particle.

Fujita Scale of Tornado Intensity – Rates tornadoes with numeric values from F0 to F5 based on tornado wind speed and damage sustained. An F0 (wind speed less than 73 mph) indicates minimal damage such as broken tree limbs or signs, while an F5 (wind speeds of 261 to 318 mpg) indicated severe damage sustained.

Geology – The scientific study of the earth, including its composition, structure, physical properties, and history.

Goals – General guidelines that explain what you want to achieve. They are usually broad policy-type statements, long term in nature, and represent global visions.

Geographic Information Systems (GIS) – A computer software application that relates data regarding physical and other features on the earth to a database to be used for mapping and analysis.

GIS Shape Files – A type of GIS vector file developed by ESRI for their ArcView software. This type of file contains a table and a graphic. The records in the table are linked to corresponding objects in the graphic.

Hailstorm – Storm associated with spherical balls of ice. Hail is a product of thunderstorms or intense showers. It is generally white and translucent, consisting of liquid or snow particles encased with layers of ice. Hail is formed within the higher reaches of a well-developed thunderstorm. When hailstones become too heavy to be caught in an updraft back into the clouds of the thunderstorm (hailstones can be caught in numerous updrafts adding a coating of ice to the original frozen droplet of rain each time), they fall as hail and a hailstorm ensues.

Haines Index - A fire weather index based on stability and moisture content of the lower atmosphere that measures the potential for existing fires to become large fires.

Hazard – A source of potential danger or an adverse condition that can cause harm to people or cause property damage. For this risk assessment, priority hazards were identified and selected for the pilot project effort. A natural hazard is a hazard that occurs naturally (such as flood, wind, and earthquake). A man-made hazard is one that is caused by humans (for example, a terrorist act or a hazardous material spill). Hazards are of concern if they have the potential to harm people or property.

Hazards of Interest – A comprehensive listing of hazards that may affect an area.

Hazards of Concern – Those hazards that have been analytically determined to pose significant risk in an area, and thus the focus of the particular mitigation plan for that area (a subset of the Hazards of Interest).

Hazard Identification – The process of identifying hazards that threaten an area.

Hazardous Material Facilities – Facilities housing industrial and hazardous materials, such as corrosives, explosives, flammable materials, radioactive materials, and toxins.

Hazard Mitigation – Sustained actions taken to reduce or eliminate the long-term risk and effects that can result from the occurrence of a specific hazard. For example, building a retaining wall can protect an area from flooding.

Hazard Mitigation Grant Program (HMGP) – Authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster.

Hazard Mitigation Plan – A collaborative document in which hazards affecting the community are identified, vulnerability to hazards assessed, and consensus reached on how to minimize or eliminate the effects of these hazards.

Hazard Profile – A description of the physical characteristics of a hazard, including a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

Hazard Risk Gauge – The graphic icon used during the initial planning process to convey the relative risk of a given hazard in the study area. The scale ranges from green indicating relatively low or no risk to red indicating severe risk.

Hazards U.S. (HAZUS) – A GIS-based nationally standardized earthquake loss estimation tool developed by FEMA. HAZUS was replaced by HAZUS-MH (see below) in 2003.

Hazards U.S. – Multi-Hazard (HAZUS-MH) – A GIS-based nationally standardized earthquake, flood, and wind loss estimation tool developed by FEMA. The purpose of this pilot project is to demonstrate and implement the use of HAZUS-MH to support risk assessments

HAZUS-MH Risk Assessment Methodology – This analysis uses the HAZUS-MH modules (earthquake, wind--hurricane and flood) to analyze potential damages and losses. For this pilot project risk assessment, the flood and hurricane hazards were evaluated using this methodology.

HAZUS-MH-Driven Risk Assessment Methodology – This analysis involves using inventory data in HAZUS-MH combined with knowledge such as (1) information about potentially exposed areas, (2) expected impacts, and (3) data regarding likelihood of occurrence for hazards. For this risk assessment, a HAZUS-Driven Risk Assessment Methodology could not be used to estimate losses associated with any hazards because of a lack of adequate data. However, the methodology was used, based on more limited data to estimate exposure for the dam failure, urban fire, fuel pipeline breach, and HazMat release hazards.

Heat Index - The temperature the body feels when heat and humidity are combined.

Heavy Snow – Snowfall accumulating to 4" or more in depth in 12 hours or less; or snowfall accumulating to 6" or more in depth in 24 hours or less.

High Potential Loss Facilities – Facilities that would have a high loss associated with them, such as nuclear power plants, dams, and military installations.

Hydraulics – That branch of science, or of engineering, which addresses fluids (especially, water) in motion, its action in rivers and canals, the works and machinery for conducting or raising it, its use as a prime mover, and other fluid-related areas.

Hydrology – The science of dealing with the waters of the earth (for example, a flood discharge estimate is developed through conduct of a hydrologic study).

Infrastructure – The public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or Internet access, vital services such as public water supplies and sewer treatment facilities, transportation system (such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, dry docks, piers and regional dams).

Ice Storm – Term used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication.

Intensity – A measure of the effects of a hazard occurring at a particular place.

Inventory – The assets identified in a study region. It includes assets that can be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Keetch-Byram Drought Index (KBDI) - A drought index designed for fire potential assessment. It is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers.

Landscape Fire and Resource Management Planning Tools Project (LANDFIRE) - A five-year, multi-partner project. The project is producing comprehensive and consistent maps and data describing vegetation, fire and fuel characteristics for the entire U.S. LANDFIRE is a shared project between the U.S. Department of Agriculture Forest Service and the U.S. Department of the Interior.

Level 1 Analysis – A HAZUS-MH analysis that yields a rough estimate or preliminary analysis based on the nationwide default database included in HAZUS-MH. A Level 1 analysis is a great way to begin the risk assessment process and prioritize high-risk communities without collecting or using local data.

Level 2 Analysis – A HAZUS-MH analysis that requires the input of additional or refined data and hazard maps that will produce more accurate risk and loss estimates. Assistance from local emergency management personnel, city planners, GIS professionals, and others may be necessary for this level of analysis.

Level 3 Analysis – A HAZUS-MH analysis that yields the most accurate estimate of loss and typically requires the involvement of technical experts such as structural and geotechnical engineers who can modify loss parameters based on the specific conditions of a community. This level analysis will allow users to supply their own techniques to study special conditions such as dam breaks and tsunamis. Engineering and other expertise is needed at this level.

Lifelines – Critical facilities that include utility systems (potable water, wastewater, oil, natural gas, electric power facilities and communication systems) and transportation systems (airways, bridges, roads, tunnels and waterways).

Lightning – A visible electrical discharge produced by a thunderstorm. The discharge may occur within or between clouds or between a rain cloud and the ground.

Loss Estimation – The process of assigning hazard-related damage and loss estimates to inventory, infrastructure, lifelines, and population data. HAZUS-MH can estimate the economic and social loss for specific hazard occurrences. Loss estimation is essential to decision making at all levels of government and provides a basis for developing mitigation plans and policies. It also supports planning for emergency preparedness, response, and recovery.

Lowest Floor – Under the NFIP, the lowest floor of the lowest enclosed area (including basement) of a structure. For the HAZUS-MH flood model, this information can be used to assist in assessing the damage to buildings.

Magnitude – A measure of the strength of a hazard occurrence. The magnitude (also referred to as severity) of a given hazard occurrence is usually determined using technical measures specific to the hazard. For example, ranges of wind speeds are used to categorize tornados.

Major Disaster Declarations – Post-disaster status requested by a state's governor when local and state resources are not sufficient to meet disaster needs. It is based on the damage assessment, and an agreement to commit state funds and resources to the long-term recovery. The event must be clearly more than the state or local government can handle alone.

Mean Return Period (MRP) – The average period of time, in years, between occurrences of a particular hazard (equal to the inverse of the annual frequency of exceedance).

Mitigation Actions – Specific actions that help you achieve your goals and objectives.

Mitigation Goals – General guidelines that explain what you want to achieve. They are usually broad policy-type statements, long term, and represent global visions.

Mitigation Objectives – Strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable.

Mitigation Plan – A plan that documents the process used for a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in a state or community. The plan includes a description of actions to minimize future vulnerability to hazards. This plan should be developed with local experts and significant community involvement.

National Flood Insurance Program (NFIP) – Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations in 44 Code of Federal Regulations (CFR) §60.3.

Objectives – Objectives define strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable.

Occupancy Classes – Categories of buildings used by HAZUS-MH (for example, commercial, residential, industrial, government, and "other").

Ordinance – A term for a law or regulation adopted by local government.

Outflow – Associated with coastal hazards and follows water inundation creating strong currents that rip at structures and pound them with debris, and erode beaches and coastal structures.

Parametric Model – A model relating to or including the evaluation of parameters. For example, HAZUS-MH uses parametric models that address different parameters for hazards such as earthquake, flood and wind (hurricane). For example, parameters considered for the earthquake hazard include soil type, peak ground acceleration, building construction type and other parameters.

Planimetric – Maps that indicate only man-made features like buildings.

Planning – The act or process of making or carrying out plans; the establishment of goals, policies and procedures for a social or economic unit.

Post-disaster mitigation – Mitigation actions taken after a disaster has occurred, usually during recovery and reconstruction.

Presidential Disaster Declaration – A post-disaster status that puts into motion long-term federal recovery programs, some of which are matched by state programs, and designed to help disaster victims, businesses, and public entities in the areas of human services, public assistance (infrastructure support), and hazard mitigation. If declared, funding comes from the President's Disaster Relief Fund and disaster aid programs of other participating federal agencies.

Preparedness – Actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Priority Hazards – Hazards considered most likely to impact a community based on frequency, severity, or other factors such as public perception. These are identified using available data and local knowledge.

Provided Data – The databases included in the HAZUS-MH software that allow users to run a preliminary analysis without collecting or using local data.

Probability – A statistical measure of the likelihood that a hazard event will occur.

Public Education and Outreach Programs – Any campaign to make the public more aware of hazard mitigation and mitigation programs, including hazard information centers, mailings, public meetings, etc.

Q3 Flood Zone Data – FEMA flood data that delineate the 100- and 500-year flood boundaries. The Q3 Flood Data are digital representations of certain features of FEMA's Flood Insurance Rate Map (FIRM) product, intended for use with desktop mapping and GIS technology.

Recovery – The actions taken by an individual or community after a catastrophic event to restore order and lifelines in the community.

Regulation – Most states have granted local jurisdictions broad regulatory powers to enable the enactment and enforcement of ordinances that deal with public health, safety, and welfare. These include building codes, building inspections, zoning, floodplain and subdivision ordinances, and growth management initiatives.

Recurrence Interval – The average time between the occurrences of hazardous events of similar size in a given location. This interval is based on the probability that the given event will be equaled or exceeded in any given year.

Repetitive Loss Property – A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least $1,000 each have been paid within any 10-year period since 1978.

Replacement Value – The cost of rebuilding a structure. This cost is usually expressed in terms of cost per square foot and reflects the present-day cost of labor and materials to construct a building of a particular size, type and quality.

Resolutions – Expressions of a governing body's opinion, will, or intention that can be executive or administrative in nature. Most planning documents must undergo a council resolution, which must be supported in an official vote by a majority of representatives to be adopted. Other methods of making a statement or announcement about a particular issue or topic include proclamations or declarations.

Resources – Resources include the people, materials, technologies, money, etc., required to implement strategies or processes. The costs of these resources are often included in a budget.

Risk – The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment – A methodology used to assess potential exposure and estimated losses associated with priority hazards. The risk assessment process includes four steps: (1) identifying hazards, (2) profiling hazards, (3) conducting an inventory of assets, and (4) estimating losses. This pilot project report documents this process for selected hazards addressed as part of the pilot project.

Risk Factors – Characteristics of a hazard that contribute to the severity of potential losses in the study area.

Riverine – Of or produced by a river (for example, a riverine flood is one that is caused by a river overflowing its banks).

Scale – A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the earth's surface.

Scour – Removal of soil or fill material by the flow of floodwaters. This term is frequently used to describe storm-induced, localized, conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence.

Special Flood Hazard Area (SFHA) – An area within a floodplain having a 1-percent or greater chance of flood occurrence in any given year (that is, the 100-year or base flood zone); represented on FIRMS as darkly shaded areas with zone designations that include the letter "A" or "V."

Stafford Act – The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law (PL) 100-107 was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act is the statutory authority for most Federal disaster response activities, especially as they pertain to FEMA and its programs.

Stakeholder – Stakeholders are individuals or groups, including businesses, private organizations, and citizens, that will be affected in any way by an action or policy.

State Hazard Mitigation Officer (SHMO) – The representative of state government who is the primary point of contact with FEMA, other state and Federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

Structure – Something constructed (for example, a residential or commercial building).

Study Area – The geographic unit for which data are collected and analyzed. A study area can be any combination of states, counties, cities, census tracts, or census blocks. The study area definition depends on the purpose of the loss study and in many cases will follow political boundaries or jurisdictions such as city limits.

Substantial Damage – Damage of any origin sustained by a structure in a SFHA, for which the cost of restoring the structure to its pre-hazard event condition would equal or exceed 50 percent of its pre-hazard event market value.

Thunderstorm – A local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder. It forms from a combination of moisture, rapidly rising warm air and a force capable of lifting air such a warm and cold front, a sea breeze, or a mountain.

Topographic – Map that shows natural features and indicate the physical shape of the land using contour lines based on land elevation. These maps also can include man-made features (such as buildings and roads).

Tornado – A violently rotating column of air extending from a thunderstorm to the ground.

Transportation Systems – One of the lifeline system categories. This category includes: airways (airports, heliports, highways), bridges, tunnels, roadbeds, overpasses, transfer centers; railways (tracks, tunnels, bridges, rail yards, depots), and waterways (canals, locks, seaports, ferries, harbors, dry docks, piers).

Utility Systems – One of the lifeline systems categories. This category includes potable water, wastewater, oil, natural gas, electric power facilities and communication systems.

Vulnerability – Description of how exposed or susceptible an asset is to damage. This value depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. If an electric substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Often, indirect affects can be much more widespread and damaging than direct affects.

Vulnerability Assessment – Evaluation of the extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard occurrences on the existing and future built environment.

Watershed – Area of land that drains down gradient (from areas of higher land to areas of lower land) to the lowest point; a common drainage basin. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers, which

become progressively larger as the water moves downstream, eventually reaching an estuary, lake, or ocean.

Wildland Fire Assessment System (WFAS) - An internet-based information system that provides a national view of weather and fire potential, including national fires danger, weather maps and satellite-derived "Greenness" maps.

Wildland/Urban Interface (WUI) –The area where houses and wildland vegetation coincide. The WUI is divided into two categories: intermix and interface.

Wildfire – An uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures.

Wind Chill Index (WCI) – The temperature your body feels when the air temperature is combined with the wind speed. It is based on the rate of heat loss from exposed skin caused by the effects of wind and cold.

Zone – A geographical area shown on a National FIRM that reflects the severity or type of flooding in the area.

Zoning Ordinance – Designation of allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

"$120,000 Damage from April Wildfires". Oklahoma County. 26 April 2011. Accessed 2012 <http://www.oklahomacounty.org/assessor/NewsRelease/Web_04_26_2011_AprilWildFireDamageTotals.txt>.

American Red Cross. "Tornado Risk Areas in the Conterminous United States". Map Catalog. Date Unknown. Accessed 2012 <https://maps.redcross.org/website/Maps/>.

Association of State Floodplain Managers (ASFPM). National Flood Insurance Program (NFIP): Floodplain Management Requirements, a Study Guide and Desk Reference for Local Officials, FEMA 480. Feb. 2005. Accessed 2012 <http://www.floods.org/Certification/FEMA_480.asp>.

Brown, W. et al. U.S. Geological Survey (USGS) Hazard Maps Help Save Lives and Property. Last Modified 2001. Accessed 2012 < http://pubs.usgs.gov/fs/1996/fs183-96/fs183-96.pdf >.

Center for Disease Control and Prevention (CDC). Emergency Preparedness and Response - Extreme Cold: A Prevention Guide to Promote Your Personal Health and Safety. Last Modified 22 Mar. 2005. Accessed 2012 <http://www.bt.cdc.gov/disasters/winter/guide.asp#def>.

City of Oklahoma. City of Oklahoma All-Hazard Mitigation Plan Update. 30 Sept. 2011.

City of Sacramento Development Service Department. City of Sacramento General Plan Update: Technical Background Report. Jun. 2005. Accessed 2012 <http://www.sacgp.org/GP_Documents/TBR/Public-Draft/TBR_Section_7-2_Flood-Hazards.pdf>.

Climate Prediction Center (CPC). National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS). Climate Glossary. Last Modified 21 Sept. 2004. Accessed 2012 <http://www.cpc.noaa.gov/products/outreach/glossary.shtml#D>.

Climate Prediction Center (CPC). National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS). Climate Divisions with Counties. Last Modified 6 Jan. 2005. Accessed 2012 <http://www.cpc.noaa.gov/products/analysis_monitoring/regional_monitoring/CLIM_DIVS/states_counties_climate-divisions.shtml>.

Climate Prediction Center (CPC). National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS). Drought. 15 June 2005. Accessed 2012 <http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/palmer_drought/wpdanote.shtml>.

Dinicola, K. U.S. Geological Survey (USGS). The "100-Year Flood". Last Modified 22 July 2009. Accessed 2012 <http://pubs.usgs.gov/fs/FS-229-96/>.

"Disaster Management in the 21st Century." Institute for Crisis, Disaster, and Risk Management 1 (1 Dec. 2002). George Washington University. 1 Dec. 2002. Accessed 2012 <http://www.seas.gwu.edu/~emse232/emse232book2>.

Edwards, B. et al. Australian Institute of Family Studies. Social and economic impacts of drought on farm families and rural communities. Date Unknown. Accessed 2010 <www.pc.gov.au/__data/assets/pdf_file/0006/83058/sub092.pdf>.

Edwards, R. National Oceanic and Atmospheric Administration (NOAA). Storm Prediction Center (SPC). The Online Tornado FAQ. Last Modified 23 March 2012. Accessed 2012 <http://www.spc.noaa.gov/faq/tornado/#The %20Basics>.

"Expansive Soil and Expansive Clay: The hidden force behind basement and foundation problems". Geology.com. Date Unknown. Accessed 2012 <http://geology.com/articles/expansive-soil.shtml>.

Federal Alliance for Safe Homes, Inc (FAST). Hail. 2006. Accessed 2012 <http://www.blueprintforsafety.org/doc.php?d=Hail_Introduction>.

Federal Emergency Management Agency (FEMA). Are You Ready? Guide. Last Modified 11 Aug. 2010. Accessed 2012 <http://www.fema.gov/areyouready/earthquakes.shtm>.

Federal Emergency Management Agency (FEMA). Community Rating System. Last Modified 13 April 2012. Accessed 2012 <http://www.fema.gov/business/nfip/crs.shtm>.

Federal Emergency Management Agency (FEMA). Community Rating System (CRS) Communities and their Classes. Oct. 2011. Accessed 2012 <http://www.fema.gov/library/viewRecord.do?id=3629>.

Federal Emergency Management Agency (FEMA). Fast Facts about Earthquakes. Last Modified 11 Aug. 2010. Accessed 2012 <http://www.fema.gov/hazard/earthquake/facts.shtm>.

Federal Emergency Management Agency (FEMA). Federal Guidelines for Dam Safety: Glossary of Terms (FEMA 148). Last Modified 11 Aug. 2011. Accessed 2012 <http://www.fema.gov/plan/prevent/damfailure/fema148.shtm>.

Federal Emergency Management Agency (FEMA). Flood Insurance Study for Oklahoma County, Oklahoma. Revised 18 Dec. 2009.

Federal Emergency Management Agency (FEMA). Floodplain Management – Principles and Current Practices. 2008. Accessed 2012 <http://training.fema.gov/EMIWeb/edu/fmpcp.asp>.

Federal Emergency Management Agency (FEMA). How to Read a Flood Insurance Rate Map Tutorial. 2003.

Federal Emergency Management Agency (FEMA). Multi-Hazard Identification and Risk Assessment (MHIRA). January 1997. Accessed 2012 <http://www.fema.gov/library/viewRecord.do?id=2214>.

Federal Emergency Management Agency (FEMA). Wind Zones in the United States. Date Unknown. Accessed 2012 <http://www.fema.gov/safe-rooms/wind-zones-united-states>.

Federal Emergency Management Agency (FEMA). Wind Zones in the United States. Last Modified 11 Aug. 2010. Accessed 2012 <http://www.fema.gov/plan/prevent/saferoom/tsfs02_wind_zones.shtm>.

Federal Emergency Management Agency (FEMA). Understand Your Risks: Identifying Hazards and Estimating Losses. Aug. 2001.

Federal Emergency Management Agency (FEMA). Multi-Hazard Identification and Risk Assessment. Accessed June 2012. < http://www.fema.gov/library/viewRecord.do?id=2214>

Florida Forest Service. Florida Department of Agriculture and Consumer Services. "About the Keetch-Byram Drought Index (KBDI)". Fire Weather. Date Unknown. Accessed 2012 <http://www.floridaforestservice.com/fire_weather/information/kbdi.html>.

Floodsmart.gov. Resources: Glossary. Last Modified 27 July 2012. Accessed 2012 <http://www.floodsmart.gov/floodsmart/pages/glossary_A-I.jsp>.

Geospatial Multi-Agency Coordination (GeoMAC). GeoMAC Viewer 2002 - 2012. Last Modified 10 Apr. 2011. Accessed March 15, 2012 <http://www.geomac.gov/index.shtml>.

Graham, W. J. A Simple Procedure for Estimating Loss of Life From Dam Failure. U.S. Bureau of Reclamation. Sept. 1999. Accessed 2012 <http://www.environment.fi/download.asp?contentid=16864&lan=en>.

Harris, T. "How Floods Work". Howstuffworks.com. 7 June 2001. Accessed 2012 <http://science.howstuffworks.com/flood.htm>.

Hayes, M. National Drought Mitigation Center. (NDMC). What is Drought? 2006. Accessed 2012 <http://drought.unl.edu/whatis/indices.htm>.

Hazards & Vulnerability Research Institute. University of South Carolina (USC), Department of Geology, Columbia, SC. Spatial Hazard Events and Losses Database for the United States (SHELDUS): Version 9.0. Last Modified 18 May 2011. Accessed 2012 <http://webra.cas.sc.edu/hvri/products/sheldus.aspx >.

"It's Because of the Wilzetta Fault". Countywide & Sun. Date Unknown. Accessed 2012 <http://countywidenews.com/its-because-of-the-wilzetta-fault-p4919-94.htm>.

Johns, R. et al. Storm Prediction Center. National Oceanic Atmospheric Administration. About Derechos. Last Modified 22 Aug. 2012. Accessed 2012 <http://www.spc.noaa.gov/misc/AbtDerechos/derechofacts.htm>.

Kocin, P. J., and Uccellini, L. W. National Oceanic and Atmospheric Administration (NOAA). National Climate Date Center (NCDC). The Northeast Snowfall Impact Scale (NESIS). Last Modified 25 Feb. 2011. Accessed 2012 < http://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis>.

Kocin, P.J., and Uccellini, L. W. National Oceanic and Atmospheric Administration (NOAA). A Snowfall Impact Scale Derived from Northeast Storm Snowfall Distributions. Feb. 2004. Accessed 2012 <http://www.ncdc.noaa.gov/snow-and-ice/docs/kocin-uccellini.pdf>.

LANDFIRE. LANDFIRE Fact Sheet. Date Unknown. Accessed 2012 <http://www.landfire.gov/documents/LF_fact_sheet.pdf>.

Leonard Geophysical Observatory. Oklahoma Geological Survey. Observatory. Date Unknown. Accessed 2012 <http://www.okgeosurvey1.gov/pages/home.php>.

Louie, J. N. Nevada Seismological Laboratory. University of Nevada, Reno. The Modified Mercalli Scale

of Earthquake Intensity. 10 Oct. 1996. Accessed 2012 <http://www.seismo.unr.edu/ftp/pub/louie/class/100/mercalli.html>.

Luza, K. and Johnson, K. Oklahoma Geological Survey. Geologic Hazards in Oklahoma. 2008. Accessed 2012 <http://www.ogs.ou.edu/pubsscanned/EP9p15hazards.pdf>.

McLeman, R. et al. "Drought adaptation in rural eastern Oklahoma in the 1930s: Lessons for climate change adaptation research." Mitigation and Adaption Strategies for Global Change 13 (2008). Springer.

Michigan Tech University. "Modified Mercalli Intensity Scale." UPSeis. Last Modified 16 Apr. 2007. Accessed 2012 <http://www.geo.mtu.edu/UPSeis/Mercalli.html>.

National Climatic Data Center (NCDC). National Oceanic and Atmospheric Administration (NOAA). Storm Events Database. 2012. Accessed 2012 < http://www.ncdc.noaa.gov/stormevents/>.

National Climate Data Center (NCDC). National Oceanic and Atmospheric Administration (NOAA). "Standard Precipitation Index (SPI)". North American Drought: A Paleo Perspective. Date Unknown. Accessed 2012 <http://www.ncdc.noaa.gov/paleo/drought/drght_spi.html>.

National Climate Data Center (NCDC). National Oceanic and Atmospheric Administration (NOAA). U.S. Tornado Climatology. Last Modified 7 March 2012. Accessed 2012 <http://www.ncdc.noaa.gov/oa/climate/severeweather/tornadoes.html>.

National Drought Mitigation Center (NDMC). University of North Carolina at Chapel Hill. Drought Impact Reporter. 2012. Accessed 2012 <http://drought.unl.edu/MonitoringTools/DroughtImpactReporter.aspx>.

National Drought Mitigation Center (NDMC). University of North Carolina at Chapel Hill. Drought Severity Classification. 2 Jan. 2002. Accessed April 2012 <http://www.unc.edu/~rowlett/units/scales/drought.html>.

National Drought Mitigation Center (NDMC). University of North Carolina at Chapel Hill. Drought Severity Classification. Last Modified 29 Jan. 2002. Accessed 2012 <http://www.unc.edu/~rowlett/units/scales/drought.html>.

National Oceanic and Atmospheric Administration (NOAA). Drought Information Center. Last Modified 24 Feb. 2009. Accessed 2012 <http://www.drought.noaa.gov/>.

National Oceanic and Atmospheric Administration (NOAA). The Palmer Drought Severity Index. Date Unknown. Accessed 2012 <http://www.drought.noaa.gov/palmer.html>.

National Oceanic and Atmospheric Administration (NOAA). Technical Memorandum NWS SR-193 Lightning Fatalities, Injuries and Damage Reports in the United States from 1959 to 1994. October 1997. Accessed 2012. < http://www.nssl.noaa.gov/papers/techmemos/NWS-SR-193/techmemo-sr193.html>

National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS). 2012. Natural Hazard Statistics. Accessed 2012. < http://www.nws.noaa.gov/om/hazstats.shtml>

National Park Service (NPS). U.S. Department of the Interior. Fire and Aviation Management.

Understanding Fire Danger. Date Unknown. Accessed 2012 <http://www.nps.gov/fire/public/pub_und_understandingfire.cfm>.

National Severe Storms Laboratory (NSSL). National Oceanic and Atmospheric Administration (NOAA). What is the total annual threat of severe thunderstorms in the United States?. Last Modified 29 Aug. 2003. Accessed 2012 <http://www.nssl.noaa.gov/hazard/totalthreat.html>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Albany, NY. Hail Size Chart. Last Modified 16 April 2012. Accessed 2012 <http://www.erh.noaa.gov/aly/Severe/HailSize_Chart.htm>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Norman, OK. A Review of the December 24, 2009 Christmas Eve Blizzard. Last Modified 17 Sept. 2010. Accessed 2012 <http://www.srh.noaa.gov/oun/?n=events-20091224>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Norman, OK. Information About the May 10, 2010 Tornado Outbreak in Oklahoma. Last Modified 3 Dec. 2010. Accessed 2012 <http://www.srh.noaa.gov/oun/?n=events-20100510>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Norman, OK. Preliminary Storm Reports Associated with the May 24, 2011 Tornado Outbreak. Last Modified 24 June 2012. Accessed 2012 <http://www.srh.noaa.gov/oun/?n=events-20110524-stormdata>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Norman, OK. Storm Data for the May 8, 2003 Oklahoma City Area Tornadoes. Last Modified 17 May 2011. Accessed 2012 <http://www.srh.noaa.gov/oun/?n=events-20030508-stormdata>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Norman, OK. The Great Plains Tornado Outbreak of May 3-4, 1999 Storm A Information. Last Modified 3 May 2010. Accessed 2012 <http://www.srh.noaa.gov/oun/?n=events-19990503-storma>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Norman, OK. The May 16, 2010 Hail Storm in Central Oklahoma. Last Modified 15 Sept. 2010. Accessed 2012 < http://www.srh.noaa.gov/oun/?n=events-20100516>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Norman, OK. The Winter Storm of January 31-February 1, 2011. Last Modified 9 Feb. 2011. Accessed 2012 <http://www.srh.noaa.gov/oun/?n=events-20110131>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Tulsa, OK. A Recap of the 2011 Drought. Last Modified 23 Feb. 2012. Accessed 2012 <http://www.srh.noaa.gov/tsa/?n=weather-event_2011drought#summer>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). La Crosse, WI. The Enhanced Fujita Scale (EF Scale). Last Modified 24 June 2008. Accessed 2012 <http://www.crh.noaa.gov/arx/efscale.php>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Heat: A Major Killer. Last Modified 21 May 2012. Accessed 2012 <http://www.nws.noaa.gov/os/heat/index.shtml>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). National Weather Service Glossary. Last Modified 25 June 2009. Accessed 2012 <http://www.weather.gov/glossary/>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Thunderstorms, Tornadoes, Lightning…Nature's Most Violent Storms. 2010. Accessed 2012 <http://www.lightningsafety.noaa.gov/resources/ttl6-10.pdf>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Updated AMS Recommendations for Lightning Safety – 2002. Date Unknown. Accessed 2012 <http://www.lightningsafety.noaa.gov/ams_lightning_rec.htm>.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). Office of Climate, Water, and Weather Services. Windchill: Frequently Asked Questions, Terms and Definitions. Last Modified 17 Dec. 2009. Accessed 2012 <http://www.weather.gov/om/windchill/index.shtml>.

National Weather Service (NWS). National Oceanic Atmospheric Administration (NOAA). Winter Storms…the Deceptive Killers. November 1991. Accessed 2012 <http://www.nws.noaa.gov/om/brochures/wntrstm.htm>.

New Jersey Office of Emergency Management (NJOEM). "Family Preparedness: Tornadoes". Plan & Prepare. Date Unknown. Accessed 2012 <http://www.state.nj.us/njoem/plan/tornado.html>.

New York State Disaster Preparedness Commission (NYSDPC). Draft 2011 New York State Standard Multi-Hazard Mitigation Plan. New York State Emergency Management Office (NYSEMO). 2011.

North Carolina Forest Service. Fire Environment Working Group. What is the Buildup Index?. 4 April 2007. Accessed 2012 <http://ncforestservice.gov/fire_control/pdf/technotes/FDTN03.pdf>.

Northern Virginia Regional Commission (NVRC). Northern Virginia Regional Hazard Mitigation Plan. March 2006. Accessed 2012 < http://www.novaregion.org/index.aspx?NID=661>.

Oklahoma Department of Emergency Management. Fire Event. 9 April 2009. Accessed 2012 <http://www.ok.gov/OEM/Emergencies_&_Disasters/2009/Fire_Event_20090409_-_Master/>.

Oklahoma Department of Emergency Management. Situation Update. 6 April 2011. Accessed 2012 <http://www.ok.gov/OEM/Emergencies_&_Disasters/2011/20110406_Wildfire_Event_Situation_Update_1.html>.

Oklahoma Department of Emergency Management. January 12-14, 2007 Ice Storm. 2007. Accessed 2012 < http://www.ok.gov/OEM/Emergencies_&_Disasters/Jan._12,_2007_-_Winter_Weather/index.html>.

Oklahoma Department of Emergency Management. January 2005 – Winter Weather Event. 6 Jan. 2005.

Accessed 2012 <http://www.ok.gov/OEM/Emergencies_&_Disasters/January_4-5,_2005_-_Winter_Weather_Event.html>.

Oklahoma Department of Emergency Management. Wildfire Event – March 11, 2011. 2011. Accessed 2012 <http://www.ok.gov/OEM/Emergencies_&_Disasters/2011/Wildfire_Event_20110311/>.

Oklahoma Department of Emergency Management. Winter Weather Event November 30, 2006. 2006. Accessed 2012 <http://www.ok.gov/OEM/Emergencies_&_Disasters/Nov._30,_2006_-_Winter_Weather/index.html>.

Oklahoma Climatological Survey. Map of Oklahoma Climate Divisions. 2000. Accessed 2012 <http://climate.ok.gov/index.php/climate/map/map_of_oklahoma_climate_divisions/oklahoma_south-central_u.s>.

Oklahoma County Emergency Management (OKEM). Oklahoma County Local Hazard Mitigation Plan. 2007.

"Oklahoma Earthquake 2011: Quake Rattles Area Stretching Into Texas, Arkansas, Kansas, Missouri". Huff Post Green 5 Nov. 2011. Accessed 2012 <http://www.huffingtonpost.com/2011/11/05/oklahoma-earthquakes-today-texas_n_1077918.html>.

Oklahoma Geological Survey. Earthquakes in Oklahoma. 2011. Accessed 2012 <http://www.ogs.ou.edu/earthquakes/Okseismicity11_6_2011.pdf>.

Oklahoma Water Resources Board. Geospatial Vector Digital Data: Rural Water Systems in Oklahoma. 2000. <http://www.owrb.state.ok.us/ >

Oklahoma Water Resources Board. Map of Major Aquifers. Date Unknown. Accessed 2012 <http://www.owrb.ok.gov/maps/pdf_map/major_aquifers.pdf>.

Oklahoma Water Resources Board. Dam Safety Program. 2012. Accessed June 2012. <http://www.owrb.ok.gov/hazard/dam/dams.php>

Oklahoma Water Resources Board. Update of the Oklahoma Comprehensive Water Plan. 1995. Accessed 2012 <http://www.owrb.ok.gov/supply/ocwp/pdf_ocwp/1995_OCWP.pdf>.

Organization of American States (OAS). Department of Regional Development and Environment. Primer on Natural Hazard Management in Integrated Regional Development Planning. 1991. Accessed 2012 <http://www.oas.org/dsd/publications/unit/oea66e/begin.htm#Contents>.

Radeloff, V.C., R.B. Hammer, S.I Stewart, J.S. Fried, S.S. Holcomb, and J.F. McKeefry. 2005. The Wildland Urban Interface in the United States. Ecological Applications 15: 799-805

Rosenzweig, C. et al. "Climate change and extreme weather events - Implications for food production, plant diseases, and pests." Global Change & Human Health 2 (2001). DigitalCommons@University of Nebraska - Lincoln. Date Unknown. NASA Publications. Date Accessed 2012 <http://digitalcommons.unl.edu/nasapub/24/>.

Schmidt, K. et al. U.S. Fire Service (USFS). Development of Coarse-Scale Spatial Data for Wildland

Fire and Fuel Management. April 2002. Accessed 2012 <http://www.fs.fed.us/rm/pubs/rmrs_gtr087.pdf>.

Schroeder, M. and Buck, C. U.S. Forest Service. Fire Weather. Agriculture Handbook 360. 1970. Accessed 2012 <http://www.firemodels.org/index.php/behaveplus-introduction/behaveplus-publications#Fire weather>.

Spatial Analysis for Conservation and Sustainability (SILVIS Lab). Date Unknown. The Wildland Urban Interface (version 3). Retrieved from: http://silvis.forest.wisc.edu/maps/wui.

Shedlock, K. M., and Pakiser L. C. U.S. Geological Survey (USGS). Earthquakes. 23 October 1997. Accessed 2012 <http://pubs.usgs.gov/gip/earthq1/>.

State of Oklahoma Department of Emergency Management (OK DEM). Standard Hazard Mitigation Plan Update for the Great State of Oklahoma. February 2011.

Stewart, S. et al. U.S. Forest Service (USFA). The Wildland-Urban Interface in the United States. 2006. Accessed 2012 < http://www.nrs.fs.fed.us/pubs/gtr/gtr_nrs1/stewart_1_197.pdf>.

Storm Prediction Center (SPC). National Oceanic and Atmospheric Administration (NOAA). Enhanced F Scale for Tornado Damage. Date Unknown. Accessed 2012 <http://www.spc.noaa.gov/faq/tornado/ef-scale.html>.

Storm Prediction Center (SPC). National Oceanic and Atmospheric Administration (NOAA). Fujita Tornado Damage Scale. Last Modified 23 March 2012. Accessed 2012 <http://www.spc.noaa.gov/faq/tornado/f-scale.html>.

Storm Prediction Center (SPC). National Oceanic and Atmospheric Administration (NOAA). Haines Index Info. Date Unknown. Accessed 2012 <http://www.spc.noaa.gov/exper/firecomp/INFO/hainesinfo.html>.

Tantala, M. et al. The New York City Consortium for Earthquake Loss Mitigation (NYCEM) Earthquake Risks and Mitigation in New York, New Jersey, and Connecticut Region. 2003. Accessed 2010 <http://nycem.org/techdocs/FinalReport/03-SP02p.pdf>.

The Illinois Association for Floodplain and Stormwater Management. Section 1 Natural Aspects of Flooding: Part 1 Flooding and Floodplain Management. Mar. 2006. Accessed 2012 <http://www.illinoisfloods.org/documents/home_study_course/1%20Natural%20Aspects%20of%20Flooding.pdf>.

The Tornado and Storm Research Organization (TORR). Hail Scale. Date Unknown. Accessed 2012 <http://www.torro.org.uk/site/hscale.php>.

The Tornado Project. The Fujita Scale. Date Unknown. Accessed 2012 <http://www.tornadoproject.com/fscale/fscale.htm>.

U.S. Department of Agriculture (USDA). National Agricultural Statistics Service (NASS). 2007 Census of Agriculture Oklahoma County, Oklahoma. 2007. Accessed March 2012 <http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/County_Profiles/Oklahoma/cp40109.pdf>

U.S. Drought Monitor. Oklahoma. 3 July 2012. Accessed 2012 <http://droughtmonitor.unl.edu/DM_state.htm?OK,S>.

U.S. Energy Information Administration. "Details of U.S. Climate Zones". Consumption & Efficiency. Date Unknown. Accessed 2012 <http://www.eia.gov/emeu/cbecs/climate_zones_explanation.html>.

U.S. Geological Survey (USGS). Earthquake Probability Mapping. 2009. Accessed March 2012 <https://geohazards.usgs.gov/eqprob/2009/>.

U.S. Geological Survey (USGS). NLCD 2006 Land Cover. Remote-Sensing Image. 2011. Accessed 2012 <http://www.mrlc.gov/nlcd2006.php>.

U.S. Geological Survey (USGS). The Richter Magnitude Scale. 1989. Accessed 2012 <http://earthquake.usgs.gov/learning/topics/richter.php>.

U.S. Geological Survey (USGS). The Severity of an Earthquake. Last Modified 29 Sept. 2004. Accessed 2012 <http://pubs.usgs.gov/gip/earthq4/severitygip.html>.

U.S. Geological Survey (USGS). Earthquake Hazards Program. 2008 NSHM Figures. Last Modified 26 Oct. 2009. Accessed 2012 <http://earthquake.usgs.gov/hazards/products/conterminous/2008/maps/>.

U.S. Geological Survey (USGS). Earthquake Hazards Program. DYFI Historical Events. Last Modified 3 Aug. 2011. Accessed 2012 <http://earthquake.usgs.gov/earthquakes/dyfi/archives.php?query=oklahoma&search=Search+Archives&pageNumber=0>.

U.S. Geological Survey (USGS). Earthquake Hazards Program. Earthquake Glossary. Last Modified 8 June 2012. Accessed 2012 <http://earthquake.usgs.gov/learn/glossary/>.

U.S. Geological Survey (USGS). Earthquake Hazards Program. Lower 48 States, 2002. Last Modified 7 June 2012. Accessed 2012 <http://earthquake.usgs.gov/hazards/products/conterminous/2002/>.

U.S. Geological Survey (USGS). Earthquake Hazards Program. Oklahoma. Last Modified 30 March 2010. Accessed 2012 <http://earthquake.usgs.gov/hazards/qfaults/eusa/sokla.php>.

U.S. Geological Survey (USGS). Earthquake Hazards Program. Revision III Maps. Last Modified 7 June 2012. Accessed 2012 <http://earthquake.usgs.gov/hazards/products/conterminous/2008/update_201001/maps/>.

U.S. Geological Survey (USGS). Earthquake Hazards Program. ShakeMap Scientific Background. Last Modified 9 March 2011. Accessed 2012 <http://earthquake.usgs.gov/earthquakes/shakemap/background.php>.

U.S. Geological Survey (USGS). Earthquake Hazards Program. Shakemap usb0006klz. 28 Oct. 2009. Accessed 2012 <http://earthquake.usgs.gov/earthquakes/shakemap/global/shake/b0006klz/>.

U.S. Geological Survey (USGS). National Earthquake Information Center (NEIC). Earthquake Search. Last Modified 5 May 2011. Accessed 2012 <http://earthquake.usgs.gov/earthquakes/eqarchives/epic/>.

U.S. Forest Service (USFS). Influence of Forest Structure on Wildfire Behavior and the Severity of Its Effects: An Overview. U.S. Department of Agriculture (USDA). May 2003. Accessed 2012 <http://www.fs.fed.us/projects/hfi/docs/forest_structure_wildfire.pdf>.

U.S. Forest Service (USFS). Western Wildland Environmental Threat Assessment Center. Wildfire Threats. Date Unknown. Accessed 2012 <http://www.fs.fed.us/wwetac/threats/wildfire.html>.

U.S. Forest Service (USFS). Wildland Fire Assessment System (WFAS). Adjective Class Rating. Date Unknown. Accessed 2012 <http://www.wfas.net/index.php/fire-danger-rating-fire-potential--danger-32/class-rating-fire-potential--danger-51>.

U.S. Forest Service (USFS). Wildland Fire Assessment System (WFAS). Fire Danger Rating. Date Unknown. Accessed 2012 <http://www.wfas.net/index.php/fire-danger-rating-fire-potential--danger-32>.

U.S. Forest Service (USFS). Wildland Fire Assessment System (WFAS). Haines Index. Date Unknown. Accessed 2012 <http://www.wfas.net/index.php/haines-index-fire-potential--danger-34>.

U.S. Forest Service (USFS). Wildland Fire Assessment System (WFAS). Keetch-Byram Drought Index. Date Unknown. Accessed 2012 <http://www.wfas.net/index.php/keetch-byram-index-moisture--drought-49>.

U.S. Geological Survey (USGS). Fact Sheet 2006-3015: Wildfire Hazards – A National Threat. Feb. 2006. Accessed 2012 <http://pubs.usgs.gov/fs/2006/3015/2006-3015.pdf>.

U.S. Geological Survey (USGS). Fact Sheet 2006-3066: USGS Fire Science: Fire Danger Monitoring and Forecasting. March 2005. Accessed 2012 <http://pubs.usgs.gov/fs/2005/3066/FS-2005-3066.pdf>.

University of Florida. The Disaster Handbook 1998 National Edition - Chapter 14: Backgrounder-Wildland Fires. Institute of Food and Agricultural Sciences. 1998. Accessed 2012 <http://disaster.ifas.ufl.edu/PDFS/CHAP14/D14-03.PDF>.

University of Utah Seismograph Stations (UUSS). NEHRP Site Class. Date Unknown. Accessed 2012 <http://www.seis.utah.edu/urban/nehrp.shtml>.

Weir, J. et al. Oklahoma Cooperative Extension Service. Wildfires in Oklahoma. Date Unknown. Accessed 2012 <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-8109/NREM-2888web.pdf>.

"Wildfires Damage or Destroy 39 Homes More Than $3 Million in Damages. Oklahoma County. 17 March 2012. Accessed 2012 <http://www.oklahomacounty.org/assessor/NewsRelease/Web_03_17_2011_Wildfire.txt>.

This appendix includes an example resolution to be submitted by each participating jurisdiction authorizing adoption of the Oklahoma County Hazard Mitigation Plan Update.

RESOLUTION NO. XXXX-XX
A RESOLUTION OF THE Governing Body OF THE Jurisdiction Name
AUTHORIZING THE ADOPTION OF THE
OKLAHOMA COUNTY
HAZARD MITIGATION PLAN – 2013 UPDATE

WHEREAS, Unincorporated Oklahoma County and its incorporated municipalities have exposure to natural hazards that increase the risk to life, property, environment and the economy; and
WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and
WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and
WHEREAS; a coalition of Oklahoma County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the County; and
WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;
NOW, THEREFORE, BE IT RESOLVED that the **jurisdiction name**:

1) Adopts in its entirety, the 2013 Update of the Oklahoma County Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the planning partnership no less than every five years.

PASSED AND ADOPTED on this Xst, Xnd, Xrd, Xth day of month, 2013, by the following vote:

AYES:
NOES:
ABSENT:
ABSTAIN:

_____
Mayor, Town/City of _____

ATTEST:
_____
Clerk, Town/City of _____

This appendix includes agendas, sign-in sheets, minutes and other documentation (where applicable and as available) for meetings convened during the development of the Oklahoma County Hazard Mitigation Plan Update. Documentation of public and stakeholder outreach is provided in Appendix C.

Kick-Off Meeting - Agenda
Tuesday, August 16, 2011 – 1:30 PM
Regional Multi-Agency Coordination Center
4600 N. Martin Luther King Blvd., Oklahoma City, OK

- Welcoming Remarks
- Project Overview
    - What is a Hazard Mitigation Plan?
    - Why we are we updating the 2007 Plan?
    - What having an approved plan does and does not gain you?
    - What goes into the planning process?
    - What is the general timeline and schedule of activities?
    - What will be expected of each participant?
- Review of 2007 Plan, Crosswalk and State Plan (provided on CD)
- Hazards of Concern – Review and Update
- Data Collection, incl. Critical Facilities
- Hazard Events and Losses – Municipal Level (Worksheet)
- Municipal Information and Local Capability Assessment (Worksheet)
- Goals and Objectives (Worksheet)
- Public and Stakeholder Outreach
- Mitigation Grant Funding Opportunities
- Tools and Resources
- Questions and Answers

OK County Multi-Jurisdictional Natural Hazards Mitigation Plan Sign-In Sheet

August 17, 2011-1:30 p.m.

Name	Title	Mailing Address	Jurisdiction	Contact Phone	EMail
1. DAVID K. BARNES	DIRECTOR	320 R.S. KERR # 121	OK CO	405-8950	dbarnes@[illegible]county.org
2. Jim Heck	Del City Fire Chief	4501 SE 15th St Del City, OK 73115	Del City	601-3890	dcfd101@sbcglobal.net
3. Ruth Walters	Planner	320 [illegible] Suite 01	OK CO	713-1357	[illegible]
4. Ryan Smith	Project Engineer	1 N [illegible] Ave Suite 700 73102	Tetra Tech	405-606-8600	ryan.smith@tetratech.com
5. JONATHAN FRASER	Pub. Mgmt	1000 THE AMER. RD, MORRIS PLAINS	"	973-630-8092	JONATHAN.FRASER@TETRATECH.
6. Jim Shontz	Fire marshal	P.O. Box 144 Nicoma Park	OK Co	821-4052	NPOFM@Hotmail.com
7. James King	Fire Chief	P.O. Box 824 Nicoma Park OK	OK Co.	409 1572	npinspector@nicomapark.net
8. Merrel Coleman	Fire Chief	P.O. Box 136 HARRAH, OKLA 73045	HARRAH	664-1560	harrahFireChief@Hotmail.com
9. Michele Coogdill	Finance	PO Box 636 Harrah, OK 73045	HARRAH	454-2451	Michele.Coogdill@harrah-OK.gov
10. MIKE MAGEE	Em Coord.	PO Box 2970 EDMOND OK 73083	EDMOND	405 359-4371	mike.magee@edmondok.com
11. CHUCK BLAIR	FIRE CHIEF	2225 MACHINBIRD MWS	FOREST PARK	405 [illegible] 2728	WBBLUES@HOT
12. Scott Schroder	Fire Chief	3919 N. Rockwell Ave Bethany 73008	OK County	789-2218	scott-schroder@bethanyok.org
13. Jon Hall	Em. Mngr	6500 S. MacArthur Blvd OKC 73125	FAA Command Center	954-8122	jon.d.hall@faa.gov
14. Kevin Burns	Engr in Training	100 N Midwest MC. OK 73110	Midwest City	405-869-8612	kburns@midwestcityok.org
15. Mike [illegible]	Em	[illegible]	[illegible]	405-613-8511	mbrown@midwestcityok.org
16. Jason Miller	Chief	P.O. Box 56 Luther OK 73054	Luther	405-657-6024	lutherfire702@gmail.com
17. KIM BOURNS	Emer. MGR	P.O. Box 218, Luther, OK 73054	Luther	405-206-6360	bournsk@ATT.NET
18. Robert Freund	City Manager	P.O. Box 567, CHOCTAW, OK 73020	CHOCTAW	405-390-8198	citymanager@choctawok.org
19. DAVID BURRIGHT	OEM OFFICER	320 ROBERT S. KERR OKC, OK 73102	OK County	405-605-8991	davbur@OKcounty.org
20. Matt Stillwell	DIRECTOR	101 E. 1ST ST, EDMOND, OK 73034	EDMOND	405 359-4371	Matt.stillwell@edmondok.com
21. WES TOLLISON	FIRE CHIEF	2201 W. BRITTON RD OKC, OK 73120	THE VILLAGE	405-755-2499	wes_tollison@thevillageok.org
22. Terry Hamilton	Deputy Chief	6407 Avondale Dr. Nichols Hills, OK 73116	Nichols Hills	405-843-9526	thamilton@nicholshills.net
23.					
24.					
25.					
26.					
27.					
28.					

Planning Committee and Stakeholder Outreach Meeting - Agenda
Tuesday, January 17, 2012 – 9:00 AM
Regional Multi-Agency Coordination Center
4600 N. Martin Luther King Blvd., Oklahoma City, OK

- Welcoming Remarks
- Project Overview
    - What is a Hazard Mitigation Plan?
    - Why we are we updating the 2007 Plan?
    - What having an approved plan does and does not gain you?
    - What goes into the planning process?
    - What is the general timeline and schedule of activities?
- Mitigation Grant Funding Opportunities
- Discussion on Mitigation Activities in the County (Strengths, Weaknesses, Obstacles, Opportunities)
- Question and Answer

OKLAHOMA COUNTY, OKLAHOMA
HAZARD MITIGATION PLAN UPDATE - OUTREACH MEETING
DATE: January 17, 2012

Name	Title/Agency	Phone Number	E-mail
Ruth Walters	OK County - County Planner	405/713-1357	enruswal@oklahomacounty.org
JONATHAN RASER	TETRA TECH	973-630-8042	JONATHAN.RASER@TETRATECH.COM
David Barnes	OK-County - EM Director	405/596-3069	dbarnes@oklahomacounty.org
Marilyn Murrell	Mayor, Arcadia	405/396-2899	Mayorm@townofarcadia.com
GERALD MCCAULEY	POLICE CHIEF, ARCADIA	405-396-2882	POLICEdept@Townofarcadia.com
Michele Cogdill	Finance/HR Harrah	405-454-2951	Michele.Cogdill@harrah-OK.gov
Murrel Coleman	HARRAH Fire Chief	405-454-2111	harrahfirechief@Hotmail.com
Jim 3 Honts	Nicoma Park EM	405-821-4652	NP601@Hotmail.com
JAMES KING	Nicoma Park Fire Chief	405-709-4593	NPfirechief@Nicoma Park.net
Dale Griffith	Spencer Fire, Capt.	405-771-3621	Fire512Fire@Yahoo.com
DAVID BURRIGHT	OK CO EM	405-605-8991	dauburr@okcounty.org

OKLAHOMA COUNTY, OKLAHOMA
HAZARD MITIGATION PLAN UPDATE - OUTREACH MEETING
DATE: January 17, 2012

Name	Title/Agency	Phone Number	E-mail
Kevin Burns	MWC	405 869 8612	kburns@midwestcityok.org
WES TOLLISON	THE VILLAGE	405-755-2499	wes_tollison@thevillageok.org
JASON Miller	Luther	405-657-6024	lutherfire702@gmail.com
Kenny Koger	WARR ACRES F.D.	405-789-5912	KKoger@fire.warracres-ok.gov
Stephen Coy	Warr Acres Fire Dept	405-789-5912	scoy@fire.warracres-ok.gov
KIM Bourns	Luther F.D	405 206 6360	bournsk@att.net.
Logan Bumgarner	Choctaw	390-3232	
James H. Woodard	ARCADIA. Fire Dept	405-396-2510	Jwoodard@iowk.net
JON Hall	EM - FAA	405-954-8422	jon.d.hall@faa.gov
David R. Cross	Tetra Tech - Project Mgr.	918-249-3909	david.cross@tetratech.com
Ryan Smith	Tetra Tech	405-416-2030	ryan.smith@tetratech.com

OKLAHOMA COUNTY, OKLAHOMA
HAZARD MITIGATION PLAN UPDATE - OUTREACH MEETING
DATE: January 17, 2012

Name	Title/Agency	Phone Number	E-mail
Jim Hock	Fire chief / Del City F.D.	671-2890/250-4830	dctd101@sbcglobal.net
Mary Jane Coffman	Lead Disaster Services Coordinator / American Red Cross	405-228-9572	mcoffman@arcok.org
Greg Whitworth	Okla State Emergency Management	405-521-3150	greg.whitworth@oem.ok.gov
PATRICK MENEFEE	CITY ENG. / MIDWEST CITY	405-739-1220	pmenefee@midwestcity ok.org
DAVID K. BARNES	DIRECTOR OF CO EM	405-596-3069	dbarnes@oklahomacounty.org

OKLAHOMA COUNTY, OKLAHOMA
HAZARD MITIGATION PLAN UPDATE - OUTREACH MEETING
DATE: January 17, 2012

Name	Title/Agency	Phone Number	E-mail

OKLAHOMA COUNTY, OKLAHOMA
HAZARD MITIGATION PLAN UPDATE - OUTREACH MEETING – THE VILLAGE
DATE: January 17, 2012 – 1:30 P.M.

Name	Title/Agency	Phone Number	E-mail
VES TOLLISON	THE VILLAGE F.D.		
RANDY NEAL	THE VILLAGE F.D.		
David Cross	Tetra Tech		
Ruth Walters	OK County		
Ryan Smith	Tetra Tech		
Larry Walton	The Village P.W.		
Bruce Stone	The Village City Mgr		
DAVID K BARNES	OK CO EM		
JONATHAN RASER	TETRA TECH		

OKLAHOMA COUNTY, OKLAHOMA
HAZARD MITIGATION PLAN UPDATE - OUTREACH MEETING – NICOMA PARK
DATE: January 17, 2012

Name	Title/Agency	Phone Number	E-mail
Ruth Walters	OK County Planner	405/713-1357	enrutwa@oklahomacounty.org
DAVID K. BARNES	DIRECTOR – OKCO EM	405-713-1369	dbarnes@oklahomacounty.org
Jim Shonts	Nicoma Park E.M.	405-821-4652	NP6081@Hotmail.com
ERIC CREWS	Nicoma Park PD	405-808-5621	eric.crews@nicomaparkpolice.com
JONATHAN RASER	TETRA TECH	973-630-8042	JONATHAN.RASER@TETRATECH.COM
James King	Nicoma Park FD	405 769 4593	npfirechief@nicomapark.net

OKLAHOMA COUNTY, OKLAHOMA
HAZARD MITIGATION PLAN UPDATE - OUTREACH MEETING
DATE: January 17, 2012 – DEL CITY MEETING

Name	Title/Agency	Phone Number	E-mail
BILL GRAHAM	PUBLIC WORKS DIR	405 671 2874	BGRAHAM@CITYOFDELCITY.COM
Mike Davis	Public Works WWTF	405-671-2878	mdavis@cityofdelcity.org
Monica Kyracos	City Planner - Comm. Svc.	405-671-2815	mkyracos@cityofdelcity.org
Ruth Walters	OK County - Planner	405-713-1357	
MIKE CANTRELL	DEPUTY PUBLIC WORKS DIRECTOR	405-671-287	MCANTRELL@CITYOFDELCITY.ORG
Jim Hock	Fire Chief / emergency manager	405 671-2890	dcfd101@sbcglobal.net
DAVID K. BARNES	DIRECTOR - OK CO EM	405 - 713-1369	dbarnes@oklahomacounty.org

OKLAHOMA COUNTY, OKLAHOMA
HAZARD MITIGATION PLAN UPDATE - OUTREACH MEETING – LUTHER
DATE: January 18, 2012

Name	Title/Agency	Phone Number	E-mail
Ruth Walters	OK County Planner	405/713-1357	
JONATHAN GASCH	TETRA TECH	973-630-8042	
Kim Bourns	Luther	405 206 6360	
DAVID K. BARNES	DIRECTOR - OK CO EM	405-596-3069	
Chris Carpenter	Water Operator	405-420-2274	
Jason Miller	Luther Fire	(405) 657-6024	
Kevin Dixon	Luther Fire	405-812-9955	

9:00a -

Oklahoma County
Hazard Mitigation Planning Workshop
March 20, 2012
PLEASE PRINT !!!!

NAME	ORGANIZATION	E-MAIL ADDRESS
Jim SHONTS	NICOMA PARK	NP601@HOTMAIL.COM
David Burkeight	OK CO EM	davbur@okcounty.org
ROBERT TAYLOR	Spencer Fire Dept	Spencer fd chief@SBC.net
MIKE MAGEE	EDMOND EM	mike.magee@edmondok.com
MATT STILLWELL	Edmond	Matt.stillwell@edmondok.com
Brook Pinters	EDMOND	brook.pinters@edmondok.com
michele Cogdill	HARRAH	michele.cogdill@harrah-ok.gov
Murrel Coleman	HARRAH	harrah fire chief@Hotmail.com
Durland Lewis	Choctaw	lbengarden@choctawcity.org
Terry Hamilton	Nichols Hills	thamilton@nicholshills.net
DAVID BARNES	OK CO	dbarnes@oklahomacounty.org
Mike Bower	Midwest City	mbower@midwestcityokmog
Kevin Dixon	Luther Fire	Kjdixon31@Yahoo.com
JASON Miller	Luther Fire	lutherfire702@gmail.com
KIM BOURNS	Luther Council / E.M.	bournsk@att.net
James KING	Nicoma Park Fire	npfirechief@nicomapark.net
WES TOLLISON	THE VILLAGE	wes_tollison@thevillageok.org
RANDY NEAL	THE VILLAGE	randy.neal@cokinet.net
CHUCK BLAIR	FOREST PARK	WEBGBS@AOL.COM
David Cross	Tetra Tech	david.cross@tetratech.com
Ruth Walters	OK County	enrutwale@oklahomacounty.org
GERALD MCCAULEY	ARCADIA	Pol.chief@TOWNOFARCADIA.COM
Marilyn Murrell	Arcadia	mayorm@townofarcadia.com
Jon Razer	T+	
Scott Schroder	Bethany Fire	scott.schroder@bethanyok.org
Jim Heck	Del City Fire Dept.	dcfd101esbcglobal.net
Kenny Koger	Warr Acres	KKoger@fire.warracres-OK.gov
Stephen Coy	WARR ACRES FD	scoy@fire.warracres-ok.gov

MITIGATION PLANNING MEETING, 20 MARCH 2012

	NAME	ORGANIZATION	PHONE	EMAIL
1	MIKE MAGEE	EDMOND E.M.	405-359-4378	mike.magee@edmondok.com
2	Herb MASON	Edmond Public Works STREET Dept	405-216-7747	HERB.MASON@edmondok.com
3	Dean Sherrick	Edmond Electric	405.216.7660	dean.sherrick@edmondok.com
4	Glenn Fisher	"	"	glenn.fisher@edmondok.com
5	David Cross	Tetra Tech	918-249-3909	david.cross@tetratech.com
6	JONATHAN RASER	TETRA TECH	973-630-8042	JONATHAN.RASER@TETRATECH.COM
7	Ruth Walters	OK County	713-1357	enruthwal@oklahomacounty.org
8	Brook Pintens	EDMOND.E.M.	359-4564	brook.pintens@edmondok.com
9	Brett Griffin	Edmond Electric	405 216-7660	brett.griffin@edmondok.com
10	JEFF BYRAM	EDMOND DRAINAGE UTIL.	359-4765	jeff.byram@edmondok.com
11				
12				
13				
14				
15				
16				
17				
18				

3-21-12 3:00p.

Spencer Annex MTG

Ruth Walters	OK Laundry	Planner
Tim Jones	Spencer	Public Works Director
DWIGHT W Peoples	SPENCER	Code Enforcement
ROBERT TAYLOR	Spencer	Fire Dept. Chief

3-22-12 11:00a

Arcadia Annex MTG

Ruth Walters	Oklahoma County	County Planner
J. Raser	Tetra Tech	T
GERALD McCAWLEY	ARCADIA	Police Chief
Marilyn Murrell	Arcadia	Mayor

3-22-12 1:00p.

Luther Annex MTG

-Ruth Walters OK County County Planner

J. Raser T+

KIM Bourns

Chris Cuspeut-r

Richard Smith

[illegible] Chris Bridgeos

Kevin Dixon Luther Fire

Jason Miller Luther Fire

3-22-12 9:30a

MWC Annex Mtg

Ruth Walters

J. Raeen

Mike Bowen	EM	MWC
Patrick Menefee	Engineer	MWC
Gary Henson	City MGR	MWC

3-21-12 1:30p - 2:30p

Del City Annex MTG

Ruth Walters	OK County	County Planner
J. Raser		IT
Jim Heck	Del City Fire Dept.	Fire Chief
Bill Graham	Del City	Public Works
Tom Leatherbee	Del City	Comm. Svc. Director
Monica Wynaston	Del City	Comm. Svc. City Planner

9:00a - 10:00a

3-21-12

Warr Acres Annex MTG

- Ruth Walters OK County
Kenny Koger WARR ACRES F.C.
Stephen Coy Warr Acres FD
Jonathan Roser TEMA Tech

10:30a - 11:00a

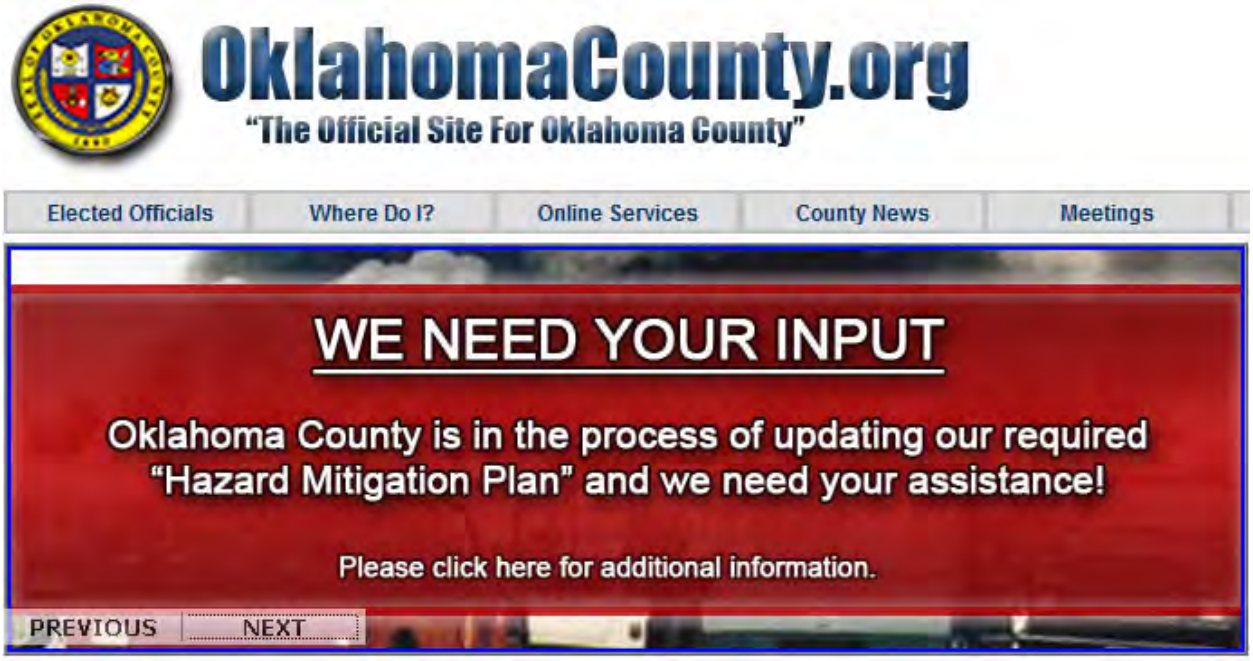
3-21-12

Nichols Hills Annex MTG

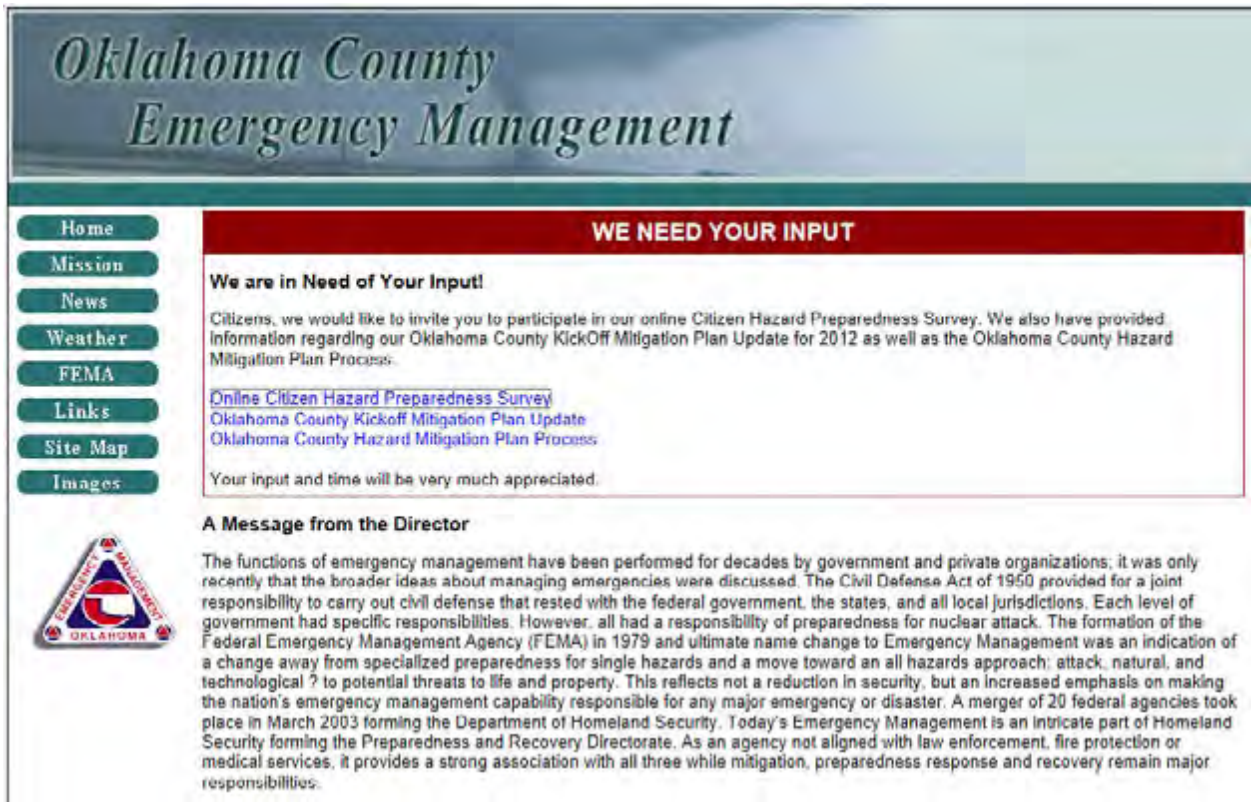
- Ruth Walters OKCO Planner
- Jon Raser T+
- Randy Smith Nichols Hills Pub. Works Dir.
- Terry Hamilton " " FC
- Kelly Hurley Code Enforcement
- Randy Smith ~~Public Works~~ Director
- David Poole City Manager
- Lindy Stormont Risk Manager

This Appendix provides documentation of public and stakeholder outreach conducted as part of the 2013 Plan Update process.

Oklahoma County Home Page – Advertising HMP Project



Oklahoma Emergency Management Home Page – Providing Links to Project Pages and Survey



All Hazards Mitigation Plan 2012 Update

For Oklahoma County and its Inclusive Municipalities

Presented by Tetra Tech, Inc.

What is Hazard Mitigation?

"Mitigation" -

Sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event

Oklahoma County HMP – 2012 Update

Why are we Preparing these Plans?

- To establish a framework under which we can fulfill our highest mission – to protect our citizens

- To reduce our losses from natural hazards –
  - to make our communities more “disaster resistant”
  - to make our communities more “sustainable”

- To become eligible for federal funds for pre-disaster mitigation planning

  - Hazard Mitigation Grant Program (HMGP)
  - Pre-Disaster Mitigation Grant Program (PDM)
  - Flood Mitigation Assistance Program (FMA)

Oklahoma County HMP – 2012 Update

What does the All-Hazards Plan provide?

- A detailed action plan the county and communities will implement to reduce risk to natural hazards

"provides the blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and local ability…" (CFR).

- Access to Federal Mitigation grant funding (HMGP, PDM, FMA)

- Coordination of mitigation efforts with other local, county, regional, state and federal entities

A Local Mitigation Plan demonstrates a jurisdiction's commitment to reducing risks from natural hazards and serves as a guide for decision makers as they commit resources to minimize the effects of natural hazards.

Oklahoma County HMP – 2012 Update

Who must have a "Plan" under Federal law?

- All "local governments"
  - States – Oklahoma has a "Standard" Plan
  - Counties (for county assets)
  - Municipalities (cities, towns, unincorporated areas)

The Oklahoma County Plan and Update

- Oklahoma County and 16 municipalities developed their original HMP in 2005/6.
- The Final HMP was approved by FEMA in September, 2007.
- By regulation, local HMPs must be formally updated, approved by FEMA, and adopted by all jurisdictions every 5 years.

Oklahoma County (through Emergency Management and Planning and Engineering) is facilitating the plan update process for the County and participating municipalities.

Oklahoma County HMP – 2012 Update

Why is Updating these Plans Important?

- These Plans are intended to guide and direct risk reduction activities – thus they need to stay relevant.

- Our Exposure and Vulnerability to natural hazard risk changes:
  - As nature changes
  - As man does things to increase or decrease our vulnerability
  - As our capabilities to manage risk change (knowledge about risk, funding, etc.)

- How we propose to continue to manage natural hazard risk at the County, Local and Personal levels continually needs to be monitored, assessed and adjusted.

Oklahoma County HMP – 2012 Update

Plan Update Process Steps

- Organize Resources
- Re-Assess the Risk
- Review and Update the Mitigation Plan
- Develop Procedures for Plan Implementation, Monitoring and Update
- ODEM / FEMA Approval
- Adopt the Plan

Engage a Wide Range of "Stakeholders"

- Federal, State, Regional and Local Agencies
- Business and Civic Groups
- Academic Institutions
- Other "local governments"
- The Public

Oklahoma County HMP – 2012 Update

Organize the Resources

Oklahoma County HMP – 2012 Update

Municipal Participation

- Attend planning partnership meetings/workshops scheduled throughout the planning process (~ 5 meetings over 6 months)
- Provide data and information in a timely manner
- Support public and stakeholder outreach in your jurisdiction
- Assist with the development of your jurisdictional annex
- Review and provide feedback on Draft and Final Plan documents
- Facilitate the adoption process – Governing Body must pass an Adoption Resolution
- Implement and Maintain the Plan

Review of Original Plan – What needs to be updated?

In order to determine what needs to be updated, you are encouraged to review the following (available on the project Share Site) and provide your input as to what you believe needs to be included in the update:

- Oklahoma County Multi-Jurisdictional Hazards Mitigation Plan (original)
- FEMA Region VI Plan Review Crosswalk of original Plan
- Standard Hazard Mitigation Plan Update for the Great State of Oklahoma (February 17, 2011)
- Tt Plan Update Requirements document

Oklahoma County HMP – 2012 Update

Hazards of Concern (HOC)

Those hazards that pose significant risk to the Planning Area – and we can address through mitigation rather than only through preparedness, response and recovery

Original Plan Hazards

- Dam Failure
- Drought
- Earthquake
- Expansive Soils
- Extreme Heat
- Flooding
- Hail
- High Winds
- Severe Thunderstorms
- Tornado
- Wildfires
- Winter Storms

Should some hazards be deleted?

Are there other hazards that we should be considering…in the context of mitigation planning?

Is there an opportunity to group some hazards?

Please provide your thoughts on the Municipal Information Worksheet

Assess the Risk – Hazard Profiling

- Hazards are profiled (characterized) according to:
  - Background and local conditions
  - Historic frequency and probability of occurrence
  - Severity
  - Historic losses and impacts
  - Designated hazard areas

- What hazard events have occurred since the 2007 Plan (both declared and un-declared)?

- What County and Local Losses have occurred as a result of these events?

Homework:

Please complete, to the best of your ability, the Hazard Event and Loss worksheets for your community.

Assess the Risk - Inventory of Assets

What is at risk? People, Property, Economy, Environment

- Population and Demographics – Has this changed since 2007?
- Building Stock (Residential, Commercial, Industrial, Educational, etc.) – Has this changed since 2007?
- Critical Facilities (essential facilities, utilities, transportation features, high-potential loss facilities and user-defined facilities)

"Critical Facilities" - Standard FEMA definition:

Facilities/infrastructure that are critical to the health and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, and hospitals.

Oklahoma County HMP – 2012 Update

Oklahoma County
Hazard Mitigation Plan Update
Data "Wish-List"

Suggested format (if available):

GIS / Access Database

Other

Homework:

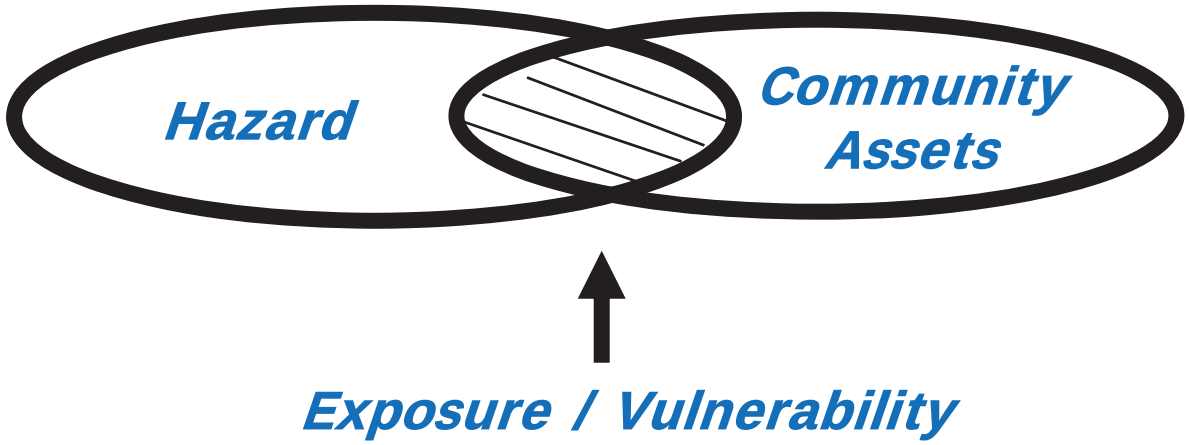
Please review the Data “Wish List” and provide the county with any such available data, particularly with respect to “Critical Facilities”.

Next meeting we will be providing each community with a map and table of your Critical Facilities for your review and correction/amendment.

Police		Lakes	
Fire		Drainage Basins	
Ambulance and EMS		Wetlands	
EOCs		Reservoirs	
Hospitals and Medical Centers		Dams	
Shelters		Levees	
Schools (public and private)		Flood control structures	

Assess the Risk – Vulnerability Assessment

- Vulnerability Assessment - What do we predict our suffering to be if we do nothing to mitigate our risk:
  - Given current conditions, which have changed since 2007?
  - Given our improved understanding of risk, and tools to assess that risk, which have changed since 2007?



Oklahoma County HMP – 2012 Update

Update Hazard Mitigation Goals and Objectives

Goals: General guidelines that state what we want to achieve. Should be consistent with the State and other local goals.

Example: "*Protection of Life and Property*"

Objectives: Define strategies or implementation steps to attain a stated goal.

Example: "*Identify repetitive loss locations and reduce this impact on the public….*"

Actions: Specific activities that will achieve our goals and objectives and manage natural hazard risk

Collectively, the Partnership shall be reviewing and updating the Goals and Objectives – Please complete "Updating Goals…" Worksheet.

Individually, each jurisdiction shall be reviewing and updating their Mitigation Action Plan.

Capability Assessments

What resources do we have at our disposal to Mitigate Risk?

"Proposed mitigation actions will be evaluated against the backdrop of what is feasible in terms of your government's legal, administrative, fiscal and technical capacities" (FEMA 386-3)

- Serve to identify legal authority and administrative, technical and fiscal capabilities in the state, county and jurisdictions that will facilitate or hinder hazard mitigation goals and objectives.
- Part of this Planning Process is to build County and Local Mitigation Capabilities to facilitate mitigation

Homework:

Please complete the Municipal Information and Capability Assessment Worksheet.

Identification and Analysis of Mitigation Actions

- Mitigation actions need to be realistic, achievable and action-oriented.
- Will include both regional actions, as well as jurisdiction-specific.
- Will address both public and private property.
- For each proposed mitigation strategy, the following will be identified:
  - Implementation timeline
  - Estimated cost
  - Estimated benefits (avoided losses)
  - Potential funding sources
  - Lead agency or department
  - Supporting agencies

Mitigation Actions? Like What?

- ***Prevention.*** Measures such as planning and zoning, open space preservation, land development regulations, building codes, storm water management.

- ***Property Protection***. Measures such as acquisition, relocation, storm shutters, rebuilding, barriers, flood-proofing, insurance, and structural retrofits for high winds.

- ***Public Education and Awareness.*** Measures such as outreach projects, real estate disclosure, hazard information centers, technical assistance.

- ***Natural Resource Protection.*** Measures such as erosion and sediment control, stream corridor protection, vegetative management, and wetlands preservation.

- ***Emergency Services.*** Measures such as hazard threat recognition, hazard warning systems, emergency response, protection of critical facilities, and health and safety maintenance.

- ***Structural Projects.*** Measures such as dams, levees, seawalls, bulkheads, retaining walls, channel modifications, storm sewers, and retrofitted buildings and elevated roadways.

Update of Local Mitigation Action Plans

- Identify progress made on mitigation actions identified in 2007 plan.
- If an action wasn't completed, why not?
- This strategy review process is NOT meant to blame or punish. The answer can reveal things that need to be addressed to allow mitigation to progress (new initiatives), for example:
  - *Obstacle: We do not have the technical resources to prepare a grant application.*
  - *Possible Action: Develop a county-level support team trained in application development.*
- What new projects, activities, initiatives would you like to add?

Other Planning Tasks

- **Assuring wide involvement and public participation**
  - Notices and new releases on planning effort
  - HMP Webpage detailing effort, providing downloadable drafts of the plan, and providing a way for public input (local contact information and email link)
  - Public presentations and meetings
  - Public access to draft and final plan documents (incl. libraries, town halls)
  - Questionnaire (on-line and/or hard copy)
- **Documentation of the Planning Process**
- **Plan implementation and maintenance procedures**
- **Adoption by local governments**

Oklahoma County HMP – 2012 Update

National Flood Insurance Program (NFIP)

Municipality	NFIP Policies*	Coverage*	Premiums*	Participate in CRS**
Arcadia (T - Inc.)	7	$1,506,800	$9,243	No
Bethany (City - Inc.)	19	$3,597,000	$5,248	No
Choctaw (City - Inc.)	71	$14,008,000	$62,212	No
Del City (City - Inc.)	395	$41,720,900	$281,231	No
Edmond (City - Inc.)	317	$78,400,300	$143,365	Yes - Class 7 (15% disc.)
Forest Park (T - Inc.)	3	$630,000	$889	No
Harrah (City - Inc.)	22	$2,813,100	$14,019	No
Jones (T - Inc.)	37	$3,661,100	$23,979	No
Luther (T - Inc.)	5	$1,524,500	$6,299	No
Midwest City (City - Inc.)	262	$45,752,000	$180,022	No
Nichols Hills (City - Inc.)	17	$4,989,000	$6,112	No
Nicoma Park (City - Inc.)	8	$1,171,200	$4,349	No
Spencer (City - Inc.)	25	$3,510,700	$19,715	No
The Village (City - Inc.)	43	$6,219,400	$31,267	No
Valley Brook (T - Inc.)	1	$31,000	$312	No
Warr Acres (City - Inc.)	16	$3,571,900	$10,549	No

* = NFIP Statistics as of May 2011

** = CRS Participation as of Oct. 2010

Plan Implementation

- Your mitigation strategy section provides a "blueprint" to follow for progressively reducing your community's natural hazard risk.
- It will includes two type of initiatives/projects – those that your community can "self fund", and those that will require outside (e.g. grant) funding.
- Mitigation grant opportunities open regularly:
  - *The annual HMA grant window opens in June of each year.*
  - *HMGP funding comes in the wake of Declared Disasters in the State.*
- Oklahoma County Emergency Management will continue to alert planning partners of grant opportunities as they arise, including all guidance and instructions provided by OEM and FEMA Region VI.

Oklahoma County HMP – 2012 Update

Why do I want to do this again?
…show me the money

- Grant applications across all mitigation programs are similar (almost identical) and can often be submitted to more than one program, and re-submitted if not awarded the first time.

- The grant process starts with a simple “Letter Of Intent” (LOI). OEM will review the LOI and advise the community whether they should move forward with their application.

- Projects often address private property (e.g. residential, commercial), however the town or county must apply on their behalf as the “sub-applicant”.

- Grants typically require a 25% local match…for private property projects, the property owner is typically responsible for fronting the 75% reimbursable portion, along with providing the 25% local match.

Here's how it works…

Example: Consider a $200,000 storm water improvement project in your 5-year Capital Budget for FY13

	No Grant	With Grant
Base Project Cost:	$ 200,000	
Project cost with grant support:		$ 220,000
Less 75% FEMA reimbursement:		($ 165,000)
Net Project cost to Town:	$ 200,000	$ 55,000
Savings:		$ 145,000 (73%)

…and this doesn't consider long term cost benefits

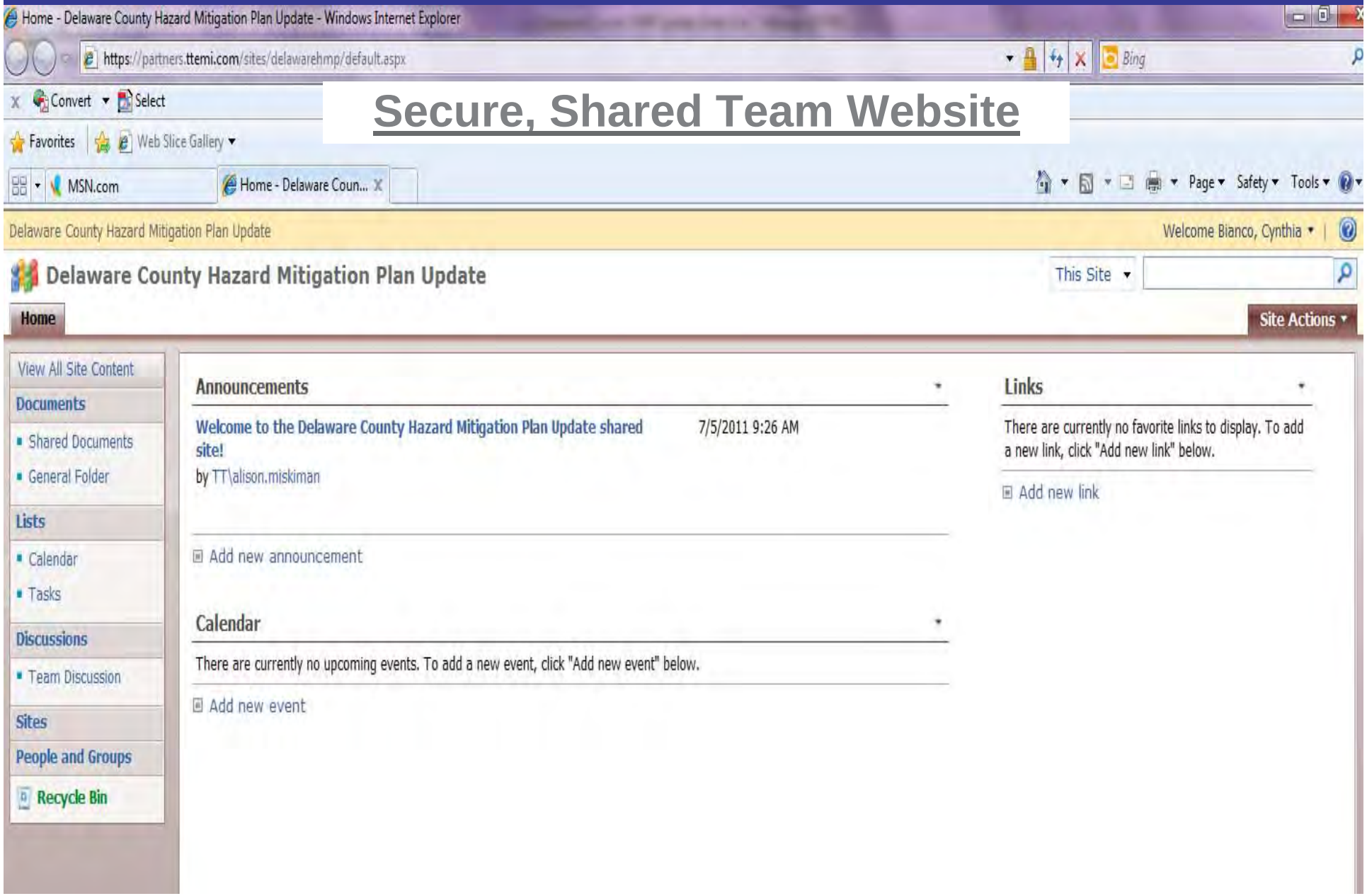
Plan Document

- Volume 1 will contain all information that applies to the whole planning area (all participating jurisdictions) such as description of the planning process, risk assessment, goals and objectives, multi-jurisdictional mitigation strategies and a plan maintenance program.

- Volume 2 will contain those elements that are “jurisdiction-specific”, and will include a jurisdictional annex for each participating local government within the planning area. These annexes will meet DMA requirements for each jurisdiction.

- The input each municipality shall provide throughout this Plan Update process shall be captured in their Jurisdictional Annex.

Oklahoma County HMP – 2012 Update



Secure, Shared Team Website

General Questions, Issues and Concerns

Oklahoma County Survey

SurveyMonkey

1. Please indicate your age range:

		Response Percent	Response Count
18 to 30		11.1%	21
31 to 40		16.3%	31
41 to 50		27.4%	52
51 to 60		**34.2%**	**65**
60 or over		11.1%	21
		answered question	**190**
		skipped question	**3**

2. Please indicate what municipality you live in Oklahoma County:

	Response Percent	Response Count
Town of Arcadia	0.0%	0
City of Bethany	2.6%	5
City of Choctaw	3.7%	7
City of Del City	3.7%	7
City of Edmond	14.3%	27
Town of Forest Park	0.5%	1
City of Harrah	3.2%	6
Town of Jones	0.5%	1
Town of Luther	1.1%	2
City of Midwest City	4.8%	9
City of Nichols Hills	0.0%	0
City of Nicoma Park	1.1%	2
Oklahoma City	**59.8%**	**113**
City of Spencer	1.1%	2
City of The Village	0.0%	0
Town of Valley Brook	0.0%	0
City of Warr Acres	1.6%	3
Unincorporated OK County	2.1%	4
	answered question	**189**
	skipped question	**4**

3. How long have you lived in Oklahoma County?

	Response Percent	Response Count
Less than 1 year	5.8%	11
1 to 5 years	15.3%	29
6 to 9 years	8.9%	17
10 to 19 years	21.1%	40
20 years or more	**48.9%**	**93**
	answered question	**190**
	skipped question	**3**

4. Do you own or rent your place of residence?

	Response Percent	Response Count
Own	**83.8%**	**160**
Rent	16.2%	31
	answered question	**191**
	skipped question	**2**

5. What is your zip code?

Response Count
189
answered question 189
skipped question 4

6. What is your home address? (optional, will be kept confidential - only used to identify localized hazard areas such as flooding)

	Response Count
	106
answered question	106
skipped question	87

7. Please rank how prepared you feel you and your household are for the probable impacts of natural hazard events likely to occur within Oklahoma County. Rank on a scale of 1 to 5, with 5 representing the most prepared.

		Response Percent	Response Count
1 (least)		9.7%	17
2		22.9%	40
3		28.0%	49
4		**29.7%**	**52**
5 (Most)		9.7%	17
	answered question		175
	skipped question		18

8. In what ways do you believe you are prepared for the probable impacts from natural hazard events that may occur within Oklahoma County? (Please check all that apply)

	Response Percent	Response Count
I have taken precautionary measures to protect my property though retrofits or when constructed	25.1%	43
I have a preparedness kit consisting of basic supplies and materials for my family and myself	52.6%	90
I have identified the location of the nearest severe weather shelter	55.0%	94
I have a personal family emergency preparedness plan, and have discussed it with my family and others for whom I have responsibility	50.3%	86
I have at least two methods for receiving emergency notifications and for information during severe weather or other potential emergency situations	70.8%	121
Emergency preparedness information from a government source (e.g., federal, state, or local emergency management)	45.6%	78
Locally provided news or other media information	**76.6%**	**131**
Schools and other academic institutions	19.9%	34
I have attended meetings that have dealt with disaster preparedness	26.3%	45
Other (please specify)	10.5%	18
	answered question	**171**

skipped question	22

9. In the past 10 years, which of the following types of hazard events have you or someone in your household experienced or sustained damage as a result of within Oklahoma County, and how concerned are you about the following natural hazards impacting the area? (In the first column indicate if you have experienced the hazard, then indicate your level of concern).

	Have Experienced	Not Concerned	Somewhat Concerned	Very Concerned	Extremely Concerned	Rating Count
Dam Failure	0.0% (0)	**92.6% (113)**	7.4% (9)	0.0% (0)	0.0% (0)	122
Drought	**53.7% (79)**	10.9% (16)	37.4% (55)	24.5% (36)	11.6% (17)	147
Earthquake	**62.7% (99)**	14.6% (23)	47.5% (75)	15.8% (25)	4.4% (7)	158
Epidemic/Pandemic	1.7% (2)	**42.5% (51)**	38.3% (46)	14.2% (17)	5.8% (7)	120
Extreme Temperatures	**61.4% (97)**	19.6% (31)	32.3% (51)	16.5% (26)	10.1% (16)	158
Flooding - Property	11.9% (15)	**54.0% (68)**	34.1% (43)	4.8% (6)	5.6% (7)	126
Flooding - Basement	5.0% (6)	**88.2% (105)**	8.4% (10)	0.0% (0)	0.8% (1)	119
Flooding - 1st Floor	4.1% (5)	**66.9% (81)**	23.1% (28)	6.6% (8)	2.5% (3)	121
Flooding - Above 1st Floor	0.8% (1)	**89.0% (105)**	6.8% (8)	2.5% (3)	0.8% (1)	118
Flooding - Street	29.9% (40)	**44.8% (60)**	30.6% (41)	11.2% (15)	4.5% (6)	134
Hail	**73.2% (123)**	10.1% (17)	25.0% (42)	27.4% (46)	12.5% (21)	168
Hurricane\Tropical Storm	12.6% (15)	**78.2% (93)**	14.3% (17)	3.4% (4)	1.7% (2)	119
Ice Storm	**70.1% (117)**	7.2% (12)	28.1% (47)	28.7% (48)	13.8% (23)	167
Infestation	11.1% (13)	**52.1% (61)**	33.3% (39)	8.5% (10)	3.4% (4)	117
Land Subsidence/Sinkholes	5.8% (7)	**62.5% (75)**	26.7% (32)	5.8% (7)	2.5% (3)	120
Landslide	0.8% (1)	**88.1% (104)**	7.6% (9)	2.5% (3)	0.8% (1)	118
Severe Storms	**70.1% (115)**	6.7% (11)	25.6% (42)	29.3% (48)	18.3% (30)	164
Severe Winter Storms (Blizzard, Heavy Snow, Ice)	**70.6% (113)**	8.8% (14)	25.0% (40)	28.8% (46)	17.5% (28)	160

Tornado	**54.4% (87)**	6.3% (10)	20.6% (33)	30.0% (48)	31.3% (50)	160
Utility Failure	**64.4% (103)**	11.3% (18)	26.3% (42)	25.6% (41)	17.5% (28)	160
Wildfire	25.5% (36)	22.7% (32)	**34.8% (49)**	20.6% (29)	16.3% (23)	141
Other	6.6% (4)	**80.3% (49)**	6.6% (4)	0.0% (0)	9.8% (6)	61
					answered question	**174**
					skipped question	**19**

10. Information on the impacts of and how to prepare for a natural disaster can be disseminated to the public in various ways. Of the information sources below, please identify the top three (3) that are MOST EFFECTIVE in providing you with information to make your home safer and better able to withstand the impact of natural hazard events.

	Response Percent	Response Count
Newspaper - Oklahoman	17.4%	30
Newspaper - Black Chronicle	0.0%	0
Newspaper - Journal Record	0.0%	0
Newspaper - Gazette	2.3%	4
County and/or Local Gov't. Websites	20.3%	35
Local Government E-Mail	9.3%	16
Police, Fire, EMS, 9-1-1	11.0%	19
Telephone Book	0.0%	0
Informational Brochures	10.5%	18
Public Meetings	5.2%	9
Workshops	4.7%	8
Schools	2.9%	5
TV News	**66.9%**	**115**
TV Advertising	6.4%	11

Radio News		39.0%	67
Radio Advertisements		7.0%	12
Outdoor Advertisements		5.8%	10
Internet		**66.9%**	**115**
Chamber of Commerce		1.7%	3
Fire Department/EMS Agency		11.6%	20
Academic Institutions		2.3%	4
Public Awareness Event		5.2%	9
Books		1.7%	3
Public Library		5.8%	10
Other (please specify)		10.5%	18
		answered question	**172**
		skipped question	**21**

11. To the best of your knowledge is your property located in a designated floodplain?

		Response Percent	Response Count
Yes		2.9%	5
No		**84.6%**	**148**
Not Sure		12.6%	22
		answered question	**175**
		skipped question	**18**

12. Do you have flood insurance?

	Response Percent	Response Count
Yes	8.7%	15
No	**91.3%**	**157**
	answered question	**172**
	skipped question	**21**

13. If you do NOT have flood insurance, what is the primary reason?

	Response Percent	Response Count
I don't need it/my property has never flooded	32.9%	52
Don't need it/located on high ground	**37.3%**	**59**
It is too expensive	4.4%	7
Not familiar with it/don't know about it	12.0%	19
Insurance company will not provide	5.7%	9
My homeowners insurance will cover me	4.4%	7
It is not worth it	3.2%	5
	answered question	**158**
	skipped question	**35**

14. Do you or did you have problems getting homeowners/renters insurance due to risks from natural hazards?

	Response Percent	Response Count
Yes	4.6%	8
No	**95.4%**	**167**
	answered question	**175**
	skipped question	**18**

15. If you answered "yes" to the previous question, please identify the natural hazard risk that caused you to have problems obtaining homeowners/renters insurance.

	Response Count
	8
	answered question	**8**
	skipped question	**185**

16. Did you consider the impact a natural disaster could have on your home before you purchased/moved into your home?

	Response Percent	Response Count
Yes	44.0%	74
No	**56.0%**	**94**
	answered question	**168**
	skipped question	**25**

17. Was the presence of a natural hazard risk zone (i.e. flood zone) disclosed to you by a real estate agent, seller, or landlord before you purchased/moved into your home?

	Response Percent	Response Count
Yes	27.1%	45
No	**72.9%**	**121**
	answered question	**166**
	skipped question	**27**

18. Would the disclosure of this type of information influence your decision to purchase/move into a home?

	Response Percent	Response Count
Yes	**86.8%**	**145**
No	13.2%	22
	answered question	**167**
	skipped question	**26**

19. How much money would you be willing to spend on your current home to retrofit it from the impacts of potential future natural disasters within our community? Examples of retrofitting are: Elevating a flood-prone home; elevating utilities in flood-prone basements; installing a tornado safe room or shelter; retrofitting your roof, siding or windows to withstand high winds.

	Response Percent	Response Count
$5,000 or above	15.4%	26
$2,500 to $4,999	24.9%	42
$1,000 to $2,499	11.2%	19
$500 to $999	7.7%	13
$100 to $499	5.9%	10
Less than $100	1.2%	2
Nothing	7.7%	13
Don't know	**26.0%**	**44**
	answered question	**169**
	skipped question	**24**

20. If available, which of the following incentives would help to encourage you to spend money to retrofit your home from the possible impacts of natural disasters? (Please check all that apply)

	Response Percent	Response Count
Building permit fee waiver	41.3%	69
Insurance premium discount	68.3%	114
Low interest rate loan	38.9%	65
Property tax break or incentive	**79.0%**	**132**
Mortgage discount	34.7%	58
Grant funding that requires a "cost-share"	49.7%	83
None	10.2%	17
Other (please specify)	6.0%	10
	answered question	**167**
	skipped question	**26**

21. If your property were located in a designated "high hazard" area, or had received repeated damages from a natural hazard event, would you consider a "buyout", elevation of the structure, or relocation offered by a public agency should it be made available?

	Response Percent	Response Count
Yes	**81.1%**	**133**
No	18.9%	31
	answered question	**164**
	skipped question	**29**

22. What types of projects do you believe local, county, state or federal government agencies should be doing in order to reduce the damage and disruption of natural hazards in Oklahoma County? Rate these by importance on a scale of H (high), M (medium), or L (low):

	H	M	L	Rating Count
Retrofit and strengthen essential facilities such as police, schools, hospitals	**55.1% (87)**	32.9% (52)	12.0% (19)	158
Retrofit infrastructure, such as elevating roadways and improving drainage systems	**53.7% (87)**	40.1% (65)	6.2% (10)	162
Work on improving the damage resistance of utilities (electricity, communications, etc.)	**68.8% (110)**	26.3% (42)	5.0% (8)	160
Install or improve protective structures, such as floodwalls or levees	23.9% (38)	36.5% (58)	**39.6% (63)**	159
Replace inadequate or vulnerable bridges and causeways	**61.3% (98)**	31.9% (51)	6.9% (11)	160
Strengthen codes, ordinances and plans to require higher hazard risk management standards and/or provide greater control over development in high hazard areas	34.6% (55)	**37.7% (60)**	27.7% (44)	159
Acquire vulnerable properties and maintain as open-space	23.9% (38)	31.4% (50)	**44.7% (71)**	159
Inform property owners of ways they can mitigate damage to their properties	**54.5% (85)**	37.2% (58)	8.3% (13)	156
Provide better information about hazard risks and high-hazard areas	**57.9% (92)**	37.1% (59)	5.0% (8)	159
Assist vulnerable property owners with securing funding to mitigate their properties	**41.3% (66)**	31.3% (50)	27.5% (44)	160
			Other (please specify)	4

answered question	163
skipped question	30

23. Other Comments:

	Response Count
	19

answered question	19
skipped question	174

Page 3, Q8. In what ways do you believe you are prepared for the probable impacts from natural hazard events that may occur within Oklahoma County? (Please check all that apply)		
1	HR Crisis Management Training & Activities for Employer	Jun 2, 2013 11:23 AM
2	emergency generation	Dec 23, 2012 12:51 AM
3	Actively Serving with Oklahoma Army National Guard	Nov 2, 2012 4:05 PM
4	CERT federal certified	Oct 25, 2012 7:32 PM
5	Have taken FEMA test at work	Oct 9, 2012 8:54 PM
6	First Responder	Jul 19, 2012 5:37 PM
7	CERT	Jul 9, 2012 8:35 PM
8	Volunteer with the American Red Cross locally	Jun 19, 2012 9:28 AM
9	basic CERT training	May 24, 2012 2:05 AM
10	Ham Radio Operator	May 18, 2012 12:33 AM
11	Dont watch tv. Word from family or radio or common sense for warn.	Apr 19, 2012 7:08 PM
12	ICS trained	Mar 22, 2012 10:53 PM
13	Have in-garage in-ground storm shelter for tornadic activity.	Feb 13, 2012 2:21 PM
14	Taken FEMA CERT training for both myslf and my wife	Feb 7, 2012 2:45 PM
15	Armed	Feb 2, 2012 1:08 PM
16	Built Tornado Shelter	Jan 27, 2012 11:22 AM
17	none of the above	Jan 27, 2012 10:35 AM
18	MEMBER OF MWC CERTS	Jan 26, 2012 1:57 PM

Page 3, Q10. Information on the impacts of and how to prepare for a natural disaster can be disseminated to the public in various ways. Of the information sources below, please identify the top three (3) that are MOST EFFECTIVE in providing you with information to make your home safer and better able to withs...

1	TV news	Mar 29, 2013 10:05 AM
2	scanner	Feb 14, 2013 3:54 AM
3	Common Sense	Jan 30, 2013 10:18 PM
4	Neighborhood Association	Jan 15, 2013 3:57 PM
5	family or neighbors	Nov 20, 2012 11:17 PM
6	Texting	Oct 31, 2012 4:55 PM
7	CERT CONTACT & NEIGHOBORHOOD WATCH CONTACTS	Oct 25, 2012 7:32 PM
8	Social Media (Twitter, Facebook, Etc)	Jun 19, 2012 9:28 AM
9	weather radio	May 24, 2012 2:05 AM
10	Smart phone applications	May 15, 2012 10:17 PM
11	I get text msgs to my iPhone and computer. Very helpful!	Feb 13, 2012 2:21 PM
12	leaflettes in my utility bill	Feb 7, 2012 2:49 PM
13	The LDS Church has more information than anywhere	Feb 7, 2012 2:45 PM
14	personal responsibility, find out information on your own!	Feb 2, 2012 1:08 PM
15	aps on phone	Jan 30, 2012 1:17 PM
16	work	Jan 27, 2012 11:01 AM
17	Android app with push notifications	Jan 27, 2012 8:54 AM
18	EM Training	Jan 26, 2012 11:30 AM

Page 3, Q15. If you answered "yes" to the previous question, please identify the natural hazard risk that caused you to have problems obtaining homeowners/renters insurance.		
1	2 year ago 100 year flood in my neighborhood	Nov 20, 2012 11:17 PM
2	higher premiums due to 'tornado alley'	Aug 7, 2012 6:06 PM
3	Fire	Jun 19, 2012 9:28 AM
4	earthquake	Jun 18, 2012 3:32 PM
5	wood shingles were not covered by our preferred insurer due to wildfires	May 24, 2012 2:05 AM
6	earthquakes over .5	Feb 3, 2012 3:56 PM
7	Earthquake	Jan 27, 2012 10:44 AM
8	Potential Hail Damage	Jan 27, 2012 9:13 AM

Page 4, Q20. If available, which of the following incentives would help to encourage you to spend money to retrofit your home from the possible impacts of natural disasters? (Please check all that apply)		
1	INCENTIVE FOR STORM SHELTER	May 27, 2013 8:38 AM
2	Not sure	Mar 29, 2013 10:08 AM
3	Give me the cash back that ive spent on ridiculous traffic violations	Jan 30, 2013 10:37 PM
4	Stimulus	Nov 2, 2012 4:09 PM
5	Cost of living raise! haha	Oct 18, 2012 12:43 PM
6	A federal grant with tax write-off	Jul 20, 2012 2:11 PM
7	accessible credit	Mar 5, 2012 3:37 PM
8	Tornado shelter assistance	Feb 6, 2012 11:16 AM
9	Safe room	Jan 27, 2012 3:35 PM
10	REBATE FOR COST	Jan 26, 2012 3:40 PM

Page 4, Q22. What types of projects do you believe local, county, state or federal government agencies should be doing in order to reduce the damage and disruption of natural hazards in Oklahoma County? Rate these by importance on a scale of H (high), M (medium), or L (low):

1	TREE TRIMMING AND REMOVAL	Oct 25, 2012 7:43 PM
2	Require tornado shelters or safe rooms in new construction.	Feb 7, 2012 3:46 PM
3	Stay out of the way	Feb 2, 2012 1:10 PM
4	NONE	Jan 30, 2012 8:26 AM

Page 4, Q23. Other Comments:		
1	Sharing of information across the county would be very helpful. I have two specific real-life examples: 1.) I'm checking the local media sites to determine what roads are closed as we plan our Monday work commute from Harrah to central OKC on 6/3/13 following the flooding. The street closing information on all three local news channels (KFOR, KOCO and KWTV) appears significantly dated. At this point, we don't know which roads are opened or closed. 2.) Our municipality (Harrah) offered the opportunity to sign up for an emergency messaging system following the March 11, 2011 wildfires. We enrolled; and if this past Friday night (5/31/13) wasn't an occasion to send a message regarding the flooding, I don't know what is. All that to say we feel unprotected and uninformed, and it would be a mitigating action to have a county-wide information source for citizens. Thank you.	Jun 2, 2013 11:32 AM
2	Storm shelters. This is something we need more of. A local grant to help eat the cost would be helpful.	Jan 31, 2013 6:24 PM
3	Please limit government activity. People can and will survive without the assistance of those in government that are seeking a reason to validate their own need in society. Common sense is still valid even in this day and age. For example there is no need for the sheriffs office to block roads where people cant get home or cant assist others in certain cases of natural hazards. We pay for these roads through various taxations, it should not be the authority of any government agency (which are also paid for by taxation) to control access to them for reasons validated for reason of public safety. Let the public decide what's safe (common sense), not the sheriffs office. Who knows, if people where allowed to return home to fight their own fires these fires would likely would not spread as they do currently with the very limited assistance of various municipalities.	Jan 30, 2013 10:37 PM
4	OK County needs a storm shelter rebate program. I would participate in that if it was available.	Jan 25, 2013 6:47 PM
5	Some consideratoin might be given to assisting the elderly - people who live on their own, live on social security and don't have the means to improve their property. There should also be some consideration for a plan to have some idea where these people live and a method put in place to check on them in cases of natural 'events' . A lot of these people don't have anyone to look after them. For instance, my mother was without electricity for 3 to 4 days with only one gas space heater and her kitchen stove to keep her warm. She used mainly electrical heaters to warm her house. If she hadn't had family to look after her, she might not have survived the severe ice storm that hit OKC a couple years ago.	Dec 15, 2012 12:27 PM
6	WE SHOULD BE MORE FOCUSED ON CERTIAN STRUCTURES AS IN SCHOOLS, POLICE DEPARTMENTS AND MORE FOR NATURAL DISATERS... PEOPLE SHOULD KNOW WHERE TO GO AS A GROUP VERSES BEING LEFT ALONE IN THEIR 'SAFE' HOME. WE NEED TO GIVE ANYONE AND EVERYONE A PLACE TO GO THATS WALKING/RUNNING DISTANCE FROM HOMES. THESE PLACES NEED TO BE FLOOD PROOFED, FIRE PROTECTED AND SECURE FROM ANY OTHER MAJOR ISSUE THAT COULD ARISE. ALL IN ALL, WE NEED TO KNOW WHERE TO GO, SOMEWHERE THAT HAS SPACE AND COMMUNICATION.	Oct 29, 2012 12:13 PM

Page 4, Q23. Other Comments:		
7	I would like to see a program to assist residents, especially seniors and disabled persons, with trimming of trees, especially, but removal in situations where a tree has died or become diseased and is presenting a potential hazard. I remember what the cost to me was during the last big ice storm. $4000.00+ I would have attempted the job myself (a female senior citizen), but my power was disrrupted for almost 2 weeks and I only had an electric chain saw ... and a limited income.	Oct 25, 2012 7:43 PM
8	NA	Jul 12, 2012 11:06 AM
9	Don't allow developers to build in 100 year flood plains, regardless of how influential these developers may be (i.e. Butch Curry and Tim Smith), unless these developers are willing to provide flood insurance to each and every home in and around that flood plain.	Jun 18, 2012 3:36 PM
10	During the Spring months, ALL stations, including all satellite and cable stations should be required to have the state of Oklahoma map displayed with colors indicating severity. Many times I notify friends/family that severe weather is in the state and headed our way and they reply they had no idea because they're watching movie on cable, home improvement show, et cetera. The emergency banners are too little too late AND do not show up on all channels during the time we need to be preparing - getting kids home, family at work notified, etc.	May 8, 2012 10:29 PM
11	Supply 100% grants funding for low income individuals who can't afford grants with cost sharing.	May 4, 2012 3:15 PM
12	This abused priveledged hoodlum ridden place is just lost. Horrible roads with a devon observing tower being built. Lord help us now.	Apr 19, 2012 7:13 PM
13	I am also very concerned by the fact that flood damage to a creek that runs through my property sustanined substantial erosion. All previous attempts to correct/repair/prevent further erosion was substantially damaged by this flood June 14, 2010. Nothing has been done to this creek bed since then to fix it. It looks terrible plus it will continue to erode. Substantial washout has occurred. If this happens again, our fence that used to be several feet away from the creek bed edge, will be washed away. Is this the responsibility of the City of Edmond or some other entity?	Feb 29, 2012 2:24 PM
14	I would charge any real estate agent/and their parent company with fraud who sell homes to new owners when the realtor knows of such hazards or liabilities. Only then will there be any way we can rid ourselves of such problem areas. And if the company knows they cannot get away with this, then it cannot be perpertrated on unsuspecting buyers. I have bought enough homes to now ask (1) Is this home in a flood plain, (2) under a flight path, etc... then end up asking (3) any other hazardous or mitagating information, which, by law, you should reveal to me? Most owners lie about the condition of the home. Best to require an inspection of the house.	Feb 13, 2012 2:28 PM
15	Assist Ham radio operators in establishing base stations to aid in communications during natural disasters.	Feb 7, 2012 3:46 PM
16	At the cost of home owners insurance these days, and continuing to increase. Ins companys should not be allowed to omit ANY Natural disaster from your policy. Thats what insurance is for. Any Natural disaster that occurs should be	Feb 3, 2012 4:06 PM

Page 4, Q23. Other Comments:		
	covered by your Homeowners policy and not have to take a 3 or 4 seperate policies to protect your home..	
17	Stop wasting our tax money	Jan 30, 2012 8:26 AM
18	There are some hazardous areas such as known floodplains we shouldn't have home residences in.	Jan 27, 2012 1:47 PM
19	The info I found on flood ins. was for the year, due at one time. I would try to get it if it was a monthly bill, kind of like other utility bills, where I could setup an auto-pay out of my expense account, but asking me for $156+ right now is out of the question. I just don't have it. And truly, anything over $10 a month right now is just not within our family budget. $9.99 a month would certainly make me was to try it for a year.	Jan 27, 2012 10:27 AM

APPENDIX D: FEDERAL MITIGATION PROGRAMS, ACTIVITIES AND INITIATIVES

This appendix provides a summary of available federal programs that relate to mitigation planning and may provide possible sources of funding or technical support for mitigation initiatives.

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Program/Activity	Type of Assistance	Agency and Contact
Basic and Applied Research/Development		
Center for Integration of Natural Disaster Information	**Technical Assistance**: Develops and evaluates technology for information integration and dissemination	Department of Interior (**DOI**) –US Geological Survey (**USGS**), The Center for Integration of Natural Hazards Research: (703) 648-6059 hazinfo@usga.gov
Hazard Reduction Program	**Funding** for research and related educational activities on hazards.	National Science Foundation (**NSF**), Directorate for Engineering, Division of Civil and Mechanical Systems, Hazard Reduction Program: (703) 306-1360
Decision, Risk, and Management Science Program	**Funding** for research and related educational activities on risk, perception, communication, and management (primarily technological hazards)	**NSF** – Directorate for Social, Behavioral and Economic Science, Division of Social Behavioral and Economic Research, Decision, Risk, and Management Science Program (DRMS): (703) 306-1757 www.nsf.gov/sbe/drms/start.htm
Societal Dimensions of Engineering, Science, and Technology Program	**Funding** for research and related educational activities on topics such as ethics, values, and the assessment, communication, management and perception of risk	**NSF** – Directorate for Social, Behavioral and Economic Science, Division of Social, Behavioral and Economic Research, Societal Dimensions of Engineering, Science and Technology Program: (703) 306-1743
National Earthquake Hazard Reduction Program (NEHRP) in Earth Sciences	**Research** into basic and applied earth and building sciences.	**NSF** – Directorate for Geosciences, Division of Earth Sciences: (703) 306-1550
Technical and Planning Assistance		
Planning Assistance to States	**Technical and planning assistance** for the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources.	Department of Defense (**DOD**) US Army Corps of Engineers (**USACE**) Contact the Floodplain Management Staff in the Appropriate USACE Regional Office North Atlantic: (212) 264-7813 South Atlantic: (404) 331-4441 Great Lakes and Ohio River: (513) 684-6050 Mississippi Valley: (601) 634-5827 Northwestern: (503) 808-3853 Southwestern: (214-767-2613 South Pacific: (415) 977-8164 Pacific Ocean: (808) 438-8863
Disaster Mitigation Planning and Technical Assistance	**Technical and planning assistance** grants for capacity building and mitigation project activities focusing on creating disaster resistant jobs and workplaces.	Department of Commerce (**DOC**), Economic Development Administration (**EDA**): (800) 345-1222 **EDA**'s Disaster Recovery Coordinator: (202) 482-6225 www.doc.gov/eda

Program/Activity	Type of Assistance	Agency and Contact
Watershed Surveys and Planning	**Surveys and planning studies** for appraising water and related resources, and formulating alternative plans for conservation use and development. Grants and advisory/counseling services to assist w/ planning and implementation improvement.	US Department of Agriculture (**USDA**) – National Resources Conservation Service (**NRCS**) Watersheds and Wetlands Division: (202) 720-4527 Deputy Chief for Programs: (202) 690-0848 www.nrcs.usda.gov
National Flood Insurance Program	**Formula grants to States** to assist communities to comply with NFIP floodplain management requirements (Community Assistance Program).	**FEMA**
Emergency Management / Mitigation Training	**Training** in disaster mitigation, preparedness, planning.	**FEMA**
National Dam Safety Program	**Technical assistance,** training, and grants to help improve State dam safety programs.	**FEMA**
National Earthquake Hazards Reduction Program	**Training, planning and technical assistance** under grants to States or local jurisdictions.	**FEMA; DOI-USGS** **USGS** Earthquake Program Coordinator: (703) 648-6785
Volcano Hazards Program	**Technical assistance**: Volcano hazard warnings and operation of four volcano observatories to monitor and assess volcano hazard risk.	**DOI-USGS** Volcanic Hazards Program Coordinator: (703) 648-6708 (650) 329-5228
Floodplain Management Services	**Technical and planning assistance** at the local, regional, or national level needed to support effective floodplain management.	**DOD-USACE** North Atlantic: (212) 264-7813 South Atlantic: (404) 331-4441 Great Lakes and Ohio River: (513) 684-6050 Mississippi Valley: (601) 634-5827 Northwestern: (503) 808-3853 Southwestern: (214-767-2613 South Pacific: (415) 977-8164 Pacific Ocean: (808) 438-8863
Watershed Protection and Flood Prevention Program	**Technical and financial assistance** for installing works of improvement to protect, develop, and utilize land or water resources in small watersheds under 250,000 acres.	**USDA-NRCS** Director, Watersheds and Wetlands Division: (202) 720-3042 (202) 690-4614 www.nrcs.usda.gov
Environmental Quality Incentives Program (EQIP)	**Technical**, educational, and limited **financial assistance** to encourage environmental enhancement.	**USDA-NRCS** NRCS County Offices Or NRCS EQUIP Program Manager: (202) 720-1834 www.nrcs.usda.gov

Program/Activity	Type of Assistance	Agency and Contact
National Earthquake Hazard Reduction Program	**Technical and planning assistance** for activities associated with earthquake hazards mitigation.	FEMA, DOI-USGS Earthquake Program Coordinator: (703) 648-6785
HAZARD Identification and Mapping		
National Flood Insurance Program: Flood Mapping	**Flood insurance rate maps** and flood plain management maps for all NFIP communities;	FEMA
National Flood Insurance Program: Technical Mapping Advisory Council	**Technical guidance and advice** to coordinate FEMA's map modernization efforts for the National Flood Insurance Program.	**DOI-USGS** **USGS** – National Mapping Division: (573) 308-3802
National Digital Orthophoto Program	Develops **topographic quadrangles** for use in mapping of flood and other hazards.	**DOI-USGS** **USGS** – National Mapping Division: (573) 308-3802
Stream gauging and Flood Monitoring Network	Operation of a **network of over 7,000 stream gauging stations** that provide data on the flood characteristics of rivers.	**DOE-USGS** Chief, Office of Surface Water, **USGS:** (703) 648-5303
Mapping Standards Support	**Expertise in mapping and digital data** standards to support the National Flood Insurance Program.	**DOI-USGS** USGS – National Mapping Division: (573) 308-3802
Soil Survey	**Maintains soil surveys** of counties or other areas to assist with farming, conservation, mitigation or related purposes.	**USDA-NRCS** NRCS – Deputy Chief for Soil Science and Resource Assessment: (202) 720-4630
National Earthquake Hazards Reduction Program	**Seismic mapping for U.S.**	**DOI-USGS** USGS Earthquake Program Coordinator: (703) 648-6785
Project Support		
Aquatic Ecosystem Restoration	**Direct support** for carrying out aquatic ecosystem restoration projects that will improve the quality of the environment.	**DOD-USACE** Chief of Planning @ appropriate USACE Regional Office North Atlantic: (212) 264-7111 South Atlantic: (404) 331-4580 Great Lakes and Ohio River Chicago: (312) 886-5468 Cincinnati: (513) 684-3008 Mississippi Valley Division: (601) 634-7880 Northwestern Division Portland: (503) 808-3850 Omaha: (402) 697-2470 Southwestern Division: (214) 767-2314 South Pacific Division: (415) 977-8171 Pacific Ocean Division: (808) 438-3850

Program/Activity	Type of Assistance	Agency and Contact
Beneficial Uses of Dredged Materials	**Direct assistance** for projects that protect, restore, and create aquatic and ecologically related habitats, including wetlands, in connection with dredging an authorized Federal navigation project.	**DOD-USACE** Same as above
Wetlands Protection – Development Grants	**Grants** to support the development and enhancement of State and tribal wetlands protection programs.	US Environmental Protection Agency (**EPA**) EPA Wetlands Hotline: (800) 832-7828 Or EPA Headquarters, Office of Water Chief, Wetlands Strategies and State Programs: (202) 260-6045
Clean Water Act Section 319 Grants	**Grants to States** to implement non-point source programs, including support for non-structural watershed resource restoration activities.	**EPA** Office of Water Chief, Non-Point Source Control Branch: (202) 260-7088, 7100
Coastal Zone Management Program	**Grants** for planning and implementation of non-structural coastal flood and hurricane hazard mitigation projects and coastal wetlands restoration.	Department of Commerce **DOC** National Oceanic and Atmospheric Administration (**NOAA**) National Ocean Service Office of Ocean and Coastal Resource Management Chief, Coastal Programs Division: (301) 713-3102
Community Development Block Grant (CDBG) State Administered Program	**Grants to States** to develop viable communities (e.g., housing, a suitable living environment, expanded economic opportunities) in non-entitled areas, for low- and moderate-income persons.	US Department of Housing and Urban Development **(HUD)** State CDBG Program Manager Or State and Small Cities Division, Office of Block Grant Assistance, HUD Headquarters: (202) 708-3587
Community Development Block Grant Entitlement Communities Program	**Grants** to entitled cities and urban counties to develop viable communities (e.g., decent housing, a suitable living environment, expanded economic opportunities), principally for low- and moderate-income persons.	**HUD** City and county applicants should call the Community Planning and Development staff of their appropriate HUD field office. As an alternative, they may call the Entitlement Communities Division, Office of Block Grant Assistance, HUD Headquarters: (202) 708-1577, 3587
Emergency Watershed Protection Program	Provides **technical and financial assistance** for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by severe natural hazard events.	**USDA – NRCS** National Office – (202) 690-0848 Watersheds and Wetlands Division: (202) 720-3042
Rural Development Assistance -- Utilities	Direct and guaranteed rural economic **loans and business enterprise grants** to address utility issues and development needs.	**USDA**-Rural Utilities Service (RUS) Program Support: (202) 720-1382 Northern Regional Division: (202) 720-1402 Electric Staff Division: (202) 720-1900 Power Supply Division: (202) 720-6436

Program/Activity	Type of Assistance	Agency and Contact
Rural Development Assistance – Housing	**Grants, loans, and technical assistance** in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary.	**USDA**-Rural Housing Service (RHS) Community Programs: (202) 720-1502 Single Family Housing: (202) 720-3773 Multi Family Housing: (202) 720-5177
Project Impact: Building Disaster Resistant Communities	**Funding and technical assistance** to communities and States to implement a sustained pre-disaster mitigation program.	**FEMA**
Flood Mitigation Assistance	**Grants to States** and communities for pre-disaster mitigation to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program.	**FEMA**
Hazard Mitigation Grant Program	**Grants to States and communities** for implementing long-term hazard mitigation measures following a major disaster declaration.	**FEMA**
Public Assistance Program (Infrastructure)	**Grants to States and communities** to repair damaged infrastructure and public facilities, and help restore government or government-related services. Mitigation funding is available for work related to damaged components of the eligible building or structure.	**FEMA**
National Flood Insurance Program	Makes available **flood insurance** to residents of communities that adopt and enforce minimum floodplain management requirements.	**FEMA**
HOME Investments Partnerships Program	**Grants to States, local government** and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons.	**HUD** Community Planning and Development, Grant Programs, Office of Affordable Housing, HOME Investment Partnership Programs: (202) 708-2685 (202) 708 0614 extension 4594 1-800-998-9999
Disaster Recovery Initiative	**Grants** to fund gaps in available recovery assistance after disasters (including mitigation).	**HUD** Community Planning and Development Divisions in their respective HUD field offices or HUD Community Planning and Development: (202) 708-2605

Program/Activity	Type of Assistance	Agency and Contact
Non-Structural Alternatives to Structural Rehabilitation of Damaged Flood Control Works	**Direct planning and construction grants** for non-structural alternatives to the structural rehabilitation of flood control works damaged in floods or coastal storms. $9 million FY99	**DOD-USACE** Emergency Management contact in respective **USACE** field office: North Atlantic: (718) 491-8735 South Atlantic: (404) 331-6795 Great Lakes and Ohio River: (513) 684-3086 Mississippi Valley: (601) 634-7304 Northwestern: (503) 808-3903 Southwestern: (214) 767-2425 South Pacific: (415) 977-8054 Pacific Ocean: (808) 438-1673
Partners for Fish and Wildlife	**Financial and technical assistance** to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.	Department of Interior (**DOI**) – Fish and Wildlife Service (**FWS**) National Coordinator, Ecological Services: (703) 358-2201 A list of State and Regional contacts is available from the National Coordinator upon request.
Project Modifications for Improvement of the Environment	Provides for **ecosystem restoration** by modifying structures and/or operations or water resources projects constructed by the USACE, or restoring areas where a USACE project contributed to the degradation of an area.	**DOD-USACE** Chief of Planning @ appropriate USACE Regional Office North Atlantic: (212) 264-7111 South Atlantic: (404) 331-6270 Great Lakes and Ohio River Chicago: (312) 886-5468 Cincinnati: (513) 684-3008 Mississippi Valley Division: (601) 634-5762 Northwestern Division Portland: (503) 808-3850 Omaha: (402) 697-2470 Southwestern Division: (214) 767-2310 South Pacific Division: (415) 977-8171 Pacific Ocean Division: (808) 438-8880
Post-Disaster Economic Recovery Grants and Assistance	**Grant funding** to assist with the long-term economic recovery of communities, industries, and firms adversely impacted by disasters.	Department of Commerce (**DOC**) – Economic Development Administration (**EDA**) EDA Headquarters Disaster Recovery Coordinator: (202) 482-6225
Public Housing Modernization Reserve for Disasters and Emergencies	**Funding** to public housing agencies for modernization needs resulting from natural disasters (including elevation, flood proofing, and retrofit).	**HUD** Director, Office of Capital Improvements: (202) 708-1640
Indian Housing Assistance (Housing Improvement Program)	**Project grants and technical assistance** to substantially eliminate sub-standard Indian housing.	Department of Interior (**DOI**)-Bureau of Indian Affairs (**BIA**) Division of Housing Assistance, Office of Tribal Services: (202) 208-5427
Land Protection	**Technical assistance** for run-off retardation and soil erosion prevention to reduce hazards to life and property.	**USDA-NRCS** Applicants should contact the National NRCS office: (202) 720-4527

Program/Activity	Type of Assistance	Agency and Contact
North American Wetland Conservation Fund	**Cost-share grants** to stimulate public/private partnerships for the protection, restoration and management of wetland habitats.	**DOI-FWS** North American Waterfowl and Wetlands Office: (703) 358-1784
Land Acquisition	**Acquires or purchases easements** on high-quality lands and waters for inclusion into the National Wildlife Refuge System.	**DOI-FWS** Division of Realty, National Coordinator: (703) 358-1713
Federal Land Transfer / Federal Land to Parks Program	**Identifies, assesses, and transfers available Federal real** property for acquisition for State and local parks and recreation, such as open space.	**DOI-NPS** General Services Administration Offices Fort Worth, TX: (817) 334-2331 Boston, MA: (617) 835-5700 Or Federal Lands to Parks Leader **NPS** National Office: (202) 565-1184
Wetlands Reserve Program	**Financial and technical assistance** to protect and restore wetlands through easements and restoration agreements.	**USDA-NRCS** National Policy Coordinator NRCS Watersheds and Wetlands Division: (202) 720-3042
Transfers of Inventory Farm Properties to Federal and State Agencies for Conservation Purposes	Transfers title of certain inventory farm properties owned by FSA to Federal and State agencies for **conservation** purposes (including the restoration of wetlands and floodplain areas to reduce future flood potential)	US Department of Agriculture (**USDA**) – Farm Service Agency (**FSA**) Farm Loan Programs National Office: (202) 720-3467, 1632
Financing and Loan Guarantees		
Physical Disaster Loans and Economic Injury Disaster Loans	**Disaster loans** to non-farm, private sector owners of disaster damaged property for uninsured losses. Loans can be increased by up to 20 percent for mitigation purposes.	Small Business Administration (**SBA**) National Headquarters Associate Administrator for Disaster Assistance: (202) 205-6734
Conservation Contracts	**Debt reduction** for delinquent and non-delinquent borrowers in exchange for conservation contracts placed on environmentally sensitive real property that secures FSA loans.	**USDA-FSA** Farm Loan Programs FSA National Office: (202) 720-3467, 1632 or local FSA office
Clean Water State Revolving Funds	**Loans** at actual or below-market interest rates to help build, repair, relocate, or replace wastewater treatment plants.	**EPA** EPA Office of Water State Revolving Fund Branch Branch Chief: (202) 260-7359 A list of Regional Offices is available upon request
Section 108 Loan Guarantee Program	**Loan guarantees** to public entities for community and economic development (including mitigation measures).	**HUD** Community Planning and Development staff at appropriate HUD field office, or the Section 108 Office in HUD Headquarters: (202) 708-1871

Program/Activity	Type of Assistance	Agency and Contact
Section 504 Loans for Housing	**Repair loans, grants and technical assistance** to very low-income senior homeowners living in rural areas to repair their homes and remove health and safety hazards.	US Department of Agriculture (**USDA**) – Rural Housing Service (**RHS**) Contact local RHS Field Office, or RHS Headquarters, Director, Single Family Housing Direct Loan Division: (202) 720-1474
Section 502 Loan and Guaranteed Loan Program	Provides **loans, loan guarantees, and technical assistance** to very low and low-income applicants to purchase, build, or rehabilitate a home in a rural area.	**USDA-RHS** Contact the Local RHS Field Office, or the Director, Single Family Housing Guaranteed Loan Division, RHS: (202) 720-1452
Rural Development Assistance -- Utilities	Direct and guaranteed **rural economic loans and business enterprise grants** to address utility issues and development needs.	**USDA**-Rural Utility Service (**RUS**) Contact Rural Development Field Offices, or RHS, Deputy Administrator, Community Programs Division: (202) 720-1490
Farm Ownership Loans	**Direct loans, guaranteed / insured loans, and technical assistance** to farmers so that they may develop, construct, improve, or repair farm homes, farms, and service buildings, and to make other necessary improvements.	**USDA-FSA** Director, Farm Programs Loan Making Division, FSA: (202) 720-1632