

CARTER COUNTY

NATURAL HAZARD MITIGATION PLAN

Prepared For:

Carter County

Missouri

Prepared By:

Ozark Foothills Regional Planning Commission

3019 Fair Street

Poplar Bluff, MO 63901

2019

CONTRIBUTORS

Carter County Hazard Mitigation Planning Committee

Jurisdictional Representatives

Name	Title	Jurisdiction/Agency/ Organization
Tom Wilder	Public Works Manager	City of Ellsinore, MO
Lynn Murdick	Associate Commissioner	Carter County, MO
Ron Keeney	Presiding Commissioner	Carter County, MO
Andy Steiger	Associate Commissioner	Carter County, MO
Leona Stephens	County Clerk	Carter County, MO
Rick Julius	Mayor	City of Grandin, MO
Dr. Richard Sullivan	Superintendent	East Carter County School District
Dr. Jeff Davis	Superintendent	Van Buren School District
Curt Majors	Carter County EMD	Carter County, MO
Tammy Orchard	City Clerk	City of Van Buren, MO

Stakeholder Representatives

NAME	TITLE	JURISDICTION/ORGANIZATION	DEPARTMENT
Gerri Flatt	Resident	City of Van Buren, MO	Citizen
Tom Wilder	Public Works Manager/Resident	City of Ellsinore, MO	City Government/Citizen
Donald Black	Business Owner/Resident	Van Buren, MO	Business/Citizen
Wayne Ogden	Mayor/Resident	City of Ellsinore	City Government/Citizen
Mike Hoerner	Mayor/Business Owner	City of Van Buren	City Government/Business

Stakeholders are individuals or groups that are affected by a mitigation action or policy and include businesses, private organizations, and citizens. Unlike planning team members, stakeholders may not be involved in all stages of the planning process, but they inform the planning team on a specific topic or provide input from different points of view in the community.

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EXECUTIVE SUMMARY

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from natural hazards. Carter County, its participating jurisdictions and school/special districts developed this multi-jurisdictional local hazard mitigation plan update to reduce future losses from hazard events occurring within the County. The current document is an update of a plan that was approved in February 2013. The plan and the update were prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 to result in eligibility for the Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Programs.

Carter County's natural hazard mitigation plan is a multi-jurisdiction plan covering the following jurisdictions that participated in the planning process:

- Unincorporated Carter County in Missouri
- City of Grandin, MO
- City of Ellsinore, MO
- City of Van Buren, MO
- East Carter County School District
- Van Buren School District

Carter County and the entities listed above developed a multi-jurisdictional natural hazard mitigation plan that was approved by FEMA in February 2013 (hereafter referred to as the *2013 Carter County Hazard Mitigation Plan*). This current planning effort serves to update that previously approved plan.

The plan update process followed a methodology prescribed by FEMA, which began with the formation of a Mitigation Planning Committee (MPC) comprised of representatives from Carter County and its participating jurisdictions. The MPC updated the risk assessment that identified and profiled hazards posing a risk to Carter County and analyzed jurisdictional vulnerability to these hazards. The MPC also examined the capabilities in place to mitigate the hazard damages, with emphasis on changes that have occurred since the previously approved plan was adopted. The MPC determined that the planning area is vulnerable to several hazards which are identified, profiled, and analyzed in this plan. Riverine and flash flooding, winter storms, severe thunderstorms/hail/lightning/high winds, and tornadoes are among the hazards that historically have had a significant impact upon Carter County and its jurisdictions.

Based upon the risk assessment, the MPC updated its goals for reducing risk from natural hazards. The goals are listed below:

Goal 1: Implement mitigation actions that improve the protection of human life, health, and safety from the adverse effects of disasters.

Goal 2: Implement mitigation actions that improve the continuity of government and essential services from the adverse effects of disasters.

Goal 3: Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.

Goal 4: Implement mitigation actions that preserve community tranquility following a natural disaster.

To advance the identified goals, the MPC developed recommended mitigation actions, which are detailed in Chapter 4 of this plan. Further, the MPC developed an implementation plan for each action, which identifies priority level, background information, ideas for implementation, responsible agencies, timeline, cost estimate, potential funding sources, etc. The implementation plans can be found within Chapters 4 and 5 of this planning document.

PREREQUISITES

44 CFR requirement 201.6(c)(5): The local hazard mitigation plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan. For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

This plan has been reviewed and adopted via resolution by all participating jurisdictions and participating schools. Documentation of each adoption is included in Appendix B, and a model resolution can be found on the following page.

The following jurisdictions participated in the development of the current document and have adopted the multi-jurisdictional plan.

- Unincorporated Carter County in Missouri
- City of Grandin, MO
- City of Ellsinore, MO
- City of Van Buren, MO
- East Carter County School District
- Van Buren School District

Model Resolution

(LOCAL GOVERNING BODY/SCHOOL DISTRICT), Missouri RESOLUTION NO. _____

A RESOLUTION OF THE (LOCAL GOVERNING BODY /SCHOOL DISTRICT) ADOPTING THE (PLAN NAME)

WHEREAS the (local governing body/school district) recognizes the threat that natural hazards pose to people and property within the (local governing body/school district); and

WHEREAS the (local governing body/school district) has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the (plan name), hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the (local governing body/school district) from the impacts of future hazards and disasters; and

WHEREAS the (local governing body) recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the (local governing body/school district) will endeavor to integrate the Plan into the comprehensive planning process; and

WHEREAS adoption by the (local governing body/school district) demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED BY THE (LOCAL GOVERNMENT/SCHOOL DISTRICT), in the State of Missouri, THAT:

In accordance with (local rule for adopting resolutions), the (local governing body/school district) adopts the final FEMA-approved Plan.

ADOPTED by a vote of __ in favor and __ against, and __ abstaining, this _day of _____, _____.

By (Sig): _____
Print name: _____

ATTEST: By
(Sig.): Print _____
name: _____

APPROVED AS TO FORM:
By (Sig.): _____
Print name: _____

1 INTRODUCTION AND PLANNING PROCESS

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1.1 PURPOSE

Mitigation is the effort to reduce loss of life and property by lessening the impact of a disaster. For hazard mitigation to be effective, specific mitigation actions need to be ongoing so as to prevent injury, loss of life, and financial costs.

Following tornado and flooding events and a consequential presidential disaster declaration during the spring of 2002 (DR-1412), the Missouri State Emergency Management Agency (SEMA) received flood buyout project proposals from 23 communities in the State of Missouri. Fortunately, SEMA was able to assist some of these communities in relocating residents out of the floodplain with federal mitigation grant funding provided by the Federal Emergency Management Agency (FEMA).

- Effective November 1, 2004, communities that experience a natural disaster may receive federal disaster public assistance and individual assistance but are not eligible for pre-disaster mitigation assistance unless they have a FEMA approved disaster mitigation plan on file. For nearly 1,000 communities and 114 counties in Missouri, mitigation plans are required. All jurisdictions that participate in the development of the hazard mitigation plan and adopt the completed plan are eligible to receive federal mitigation grant funding. Jurisdictions that choose not to participate in the development or adoption of the plan are ineligible for mitigation funding. The resulting regulations established the requirements for local hazard mitigation plans and can be found in the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288).

The above described eligibility requirement for an adopted hazard mitigation plan pertaining to federal hazard mitigation grant funding is set forth in the following legislation:

- *The Disaster Mitigation Act of 2000* (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the *Federal Register* on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act or DMA).

1.2 BACKGROUND AND SCOPE

This plan is an update of the current *Carter County Hazard Mitigation Plan* that was approved during February 2013. FEMA approved hazard mitigation plans are required to be updated every five years to remain compliant, and valid, and to ensure the plan is addressing current trends and needs of the participating jurisdictions.

The *Carter County Hazard Mitigation Plan* that was approved in 2013 and this update were prepared by the Ozark Foothills Regional Planning Commission (OFRPC). The OFRPC, a member of the Missouri Association of Councils of Government (MACOG) was created in 1967. The commission serves the five county region that includes Butler, Carter, Wayne, Reynolds, and Ripley Counties, as well as all municipalities within those five counties.

Information in this plan should be used as a guide for the coordination of mitigation activities and decisions regarding local land use planning in the future. The actions included in this plan are not final solutions but should be thought of as ongoing efforts that will have long-term strategic impact when implemented.

1.3 PLAN ORGANIZATION

This plan update is organized into five chapters and an appendix. Following is the list of chapters and their respective titles.

- Chapter 1: Introduction and Planning Process
- Chapter 2: Planning Area Profile and Capabilities
- Chapter 3: Risk Assessment
- Chapter 4: Mitigation Strategy
- Chapter 5: Plan Implementation and Maintenance
- Appendices

1.4 PLANNING PROCESS

44 CFR Requirement 201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

As mentioned above, the OFRPC was contracted to facilitate the update of the multi-jurisdictional, local hazard mitigation plan. The roles and responsibilities of the OFRPC throughout the process were as follows:

- assist in establishing a Mitigation Planning Committee (MPC) as defined by the Disaster Mitigation Act (DMA);
- determine if the MPC established for the previously approved plan was a standing committee that met in the interim, and set forth any changes in the MPC membership and procedures since adoption of the previous plan;

- assess whether there was adherence to the maintenance process set forth in the previously approved plan (e.g., did the MPC meet regularly as specified in the previously approved plan), and explain how adherence occurred, and/or why it did not occur;
- ensure the updated plan meets the DMA requirements as established by federal regulations and follows the most current planning guidance of the Federal Emergency Management Agency (FEMA);
- facilitate the entire plan development process;
- identify the data that MPC participants could provide and conduct the research and documentation necessary to augment that data;
- assist in soliciting public input; and,
- produce the draft and final plan update in a FEMA-approvable document and Coordinate the Missouri State Emergency Management Agency (SEMA) and (FEMA) plan reviews.

Table 1.1. Mitigation Planning Team Membership

NAME	TITLE	JURISDICTION/ORGANIZATION	DEPARTMENT
Gerri Flatt	City Clerk	City of Van Buren, MO	City Government
Tom Wilder	Public Works Manager	City of Ellsinore, MO	City Government
Lynn Murdick	Associate Commissioner	Carter County, MO	County Government
Ron Keeney	Presiding Commissioner	Carter County, MO	County Government
Andy Steiger	Associate Commissioner	Carter County, MO	County Government
Leoan Stephens	County Clerk	Carter County, MO	County Government
Carol McNew	City Clerk	City of Grandin, MO	Local Government
Curt Majors	Emergency Management Director	Carter County, MO	County Government
Dr. Richard Sullivan	Superintendent	East Carter R-II Schools	Public Education
Dr. Jeff Davis	Superintendent	Van Buren R-I Schools	Public Education

The above listed individuals represented their respective organizations in the form of a committee to update the *Carter County Hazard Mitigation Plan*. Each participant fulfilled the requirements of attending a meeting and completing the survey for the jurisdiction he/she represented.

1.4.1 Multi-Jurisdictional Participation

44 CFR Requirement §201.6(a)(3): Multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.

The Ozark Foothills Regional Planning Commission (OFRPC), on behalf of Carter County, invited all cities, school districts, and private nonprofit entities in the County to participate in this update of the Carter County Multi-Jurisdictional Hazard Mitigation Plan. DMA 2000 requires that jurisdictions represented by a multi-jurisdictional plan participate in the planning process and formally adopt the plan. Each participating jurisdiction was required to meet plan participation requirements as defined by the MPC at the beginning of the planning process. Minimum participation requirements were defined as follows:

- Designation of a representative from each participating jurisdiction to serve on the MPC;
- Participation in planning area wide MPC meetings, including centralized, by either direct participation or authorized representation;
- Each participating jurisdiction must provide to the MPC sufficient information to support plan development by completion and return of Data Collection Questionnaires and validating/correcting critical facility inventories;
- provide progress reports on mitigation actions from the previously approved plan and identify additional mitigation actions for the plan;
- eliminate from further consideration those actions from the previously approved plan that were not implemented because they were impractical, inappropriate, not cost-effective, or were otherwise not feasible;
- review and comment on plan drafts;
- actively solicit input from the public, local officials, and other interested parties about the planning process and provide an opportunity for them to comment on the plan;
- provide documentation to show time donated to the planning effort; and
- Formally adopt the mitigation plan prior to submittal to SEMA and FEMA for final approval.

Table 1.2 shows the representation of each participating jurisdiction at the planning meetings, the provision of responses to the Data Collection Questionnaire, and, if they provided an update/development of mitigation actions.

Table 1.2. Jurisdictional Participation in Planning Process

Jurisdiction	Kick-off Meeting	Meeting #2	Meeting #3	Data Collection Questionnaire Response	Update/Develop Mitigation Actions
Carter County	x		x	x	x
City of Grandin			x	x	x
City of Ellsinore			x	x	x
City of Van Buren	x	x		x	x
East Carter R-2 School District		x	x	x	x
Van Buren R-I School District			x	x	x

1.4.2 The Planning Steps

Data for this plan was obtained through a series of public meetings held within Carter County. The planning process for the *Carter County Hazard Mitigation Plan* began during the summer of 2018, with presentations to elected officials, community members, and other interested parties. These individuals were invited to attend planning meetings, with a special effort to invite participants representing various business and service interests throughout Carter County communities. Participants were asked to donate their time by attending three pre-planned meetings to discuss the content of the updated plan. During each meeting the plan was broken into parts, shared with those in attendance, and asked for their input. Each person was able to count their time as donated match time toward the plans match need. Participants were asked to identify critical infrastructure, ranking the likelihood of disaster occurrence, perform a susceptibility analysis based on these factors, and determine appropriate mitigation strategies for each individual hazard. This data was recorded and assimilated into this plan by OFRPC staff.

Background and statistical data for this plan were collected from a variety of sources, including Data Collection Questionnaires, a public survey, the United States Census Bureau, the United

States Geological Society, the United States Corps of Engineers, the Missouri Department of Natural Resources, the Missouri Department of Conservation, the Center for Agricultural, Resources and Environmental Systems at the University of Missouri-Columbia, and the National Centers for Environmental Information. *The Missouri State Hazard Mitigation Plan* was last updated in 2018 and provided information regarding tornado, earthquake, and flood hazard affecting Carter County. Flood hazard data from the 2006 HAZUS-MH loss run for Carter County was incorporated into the plan providing updated information on vulnerable structures, shelter requirements, and loss estimates. Other sources of information including Comprehensive Land Use Plans, Zoning Ordinances, Building Codes, Storm Water Regulations, and Subdivision Regulations were reviewed for applicability to the plan.

Table 1.3 describes the 10-step planning process adapted from FEMA’s Community Rating System and Flood Mitigation Assistance Program. The 10-step process allowed the plan to meet the funding eligibility requirements of the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, Community Rating System, and the Flood Mitigation Assistance Program.

The sources for the plan update framework and development process used were FEMA’s *Local Mitigation Planning Handbook (March 2013)*, *Local Mitigation Plan Review Guide (October 1, 2011)*, and *Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials (March 1, 2013)*. The planning “How To” guides developed prior to 2012 are no longer current.

Table 1.3. Carter County Mitigation Plan Update Process

Community Rating System (CRS) Planning Steps (Activity 510)	Local Mitigation Planning Handbook Tasks (44 CFR Part 201)
Step 1. Organize	Task 1: Determine the Planning Area and Resources
	Task 2: Build the Planning Team 44 CFR 201.6(c)(1)
Step 2. Involve the public	Task 3: Create an Outreach Strategy 44 CFR 201.6(b)(1)
Step 3. Coordinate	Task 4: Review Community Capabilities 44 CFR 201.6(b)(2) & (3)
Step 4. Assess the hazard	Task 5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) & (iii)
Step 5. Assess the problem	
Step 6. Set goals	Task 6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii)
Step 7. Review possible activities	
Step 8. Draft an action plan	
Step 9. Adopt the plan	Task 8: Review and Adopt the Plan
Step 10. Implement, evaluate, revise	Task 7: Keep the Plan Current
	Task 9: Create a Safe and Resilient Community 44 CFR 201.6(c)(4)

Step 1: Organize the Planning Team (Handbook Tasks 1 & 2)

During the informational meeting that was held on May 14, 2018 those in attendance were given an overview of hazard mitigation, the planning area was recognized as Carter County. During the scoping meeting, a tentative schedule was set, identification of possible MPC members was established, and general methodology was discussed.

Table 1.4 provides a brief overview, with dates for the three planning meetings held in the process of updating the 2013 County Plan. The Data Collection Questionnaires were distributed to all jurisdictions represented at the first meeting and emailed to the jurisdictions not present at the informational meeting.

Table 1.4. Schedule of MPC Meetings

Meeting	Topic	Date
Kick-off Meeting	An overview of hazard mitigation was provided, jurisdictions were asked to name a representative to the MPC, future meeting dates and locations were selected, public input and solicitation for surveys were discussed.	May 14, 2018
Planning Meeting #2	Identify and profile hazards, previous disaster declarations, and discussion of data sources.	June 11, 2018
Planning Meeting #3	2013 Carter County goals were reviewed and updated. STAPLEE worksheets were utilized for determining future goals.	July 16, 2018 & October 1, 2018
Planning Meeting #4	Mitigation actions for each jurisdiction and school district were discussed and decided upon.	October 30, 2019

Step 2: Plan for Public Involvement (Handbook Task 3)

44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

A kickoff meeting was held on May 14, 2018 at the Carter County Courthouse in the Commission Chambers in Van Buren, Missouri. Those in attendance discussed the best and most effective way to solicit public input. A survey was provided to the group to share with their contacts and communities. The survey was also made available for pick up and drop-off at local city halls, fifty surveys were completed by the public. The public survey information was used during the process of creating and updating actions as well as other places throughout the plan. An online version of the survey was created using SurveyMonkey. The Link to the online survey was shared through emails, on Facebook pages, and on local websites. A draft of the plan was provided to each jurisdiction and placed on the OFRPC website for public comment and viewing.

Step 3: Coordinate with Other Departments and Agencies and Incorporate Existing Information (Handbook Task 3)

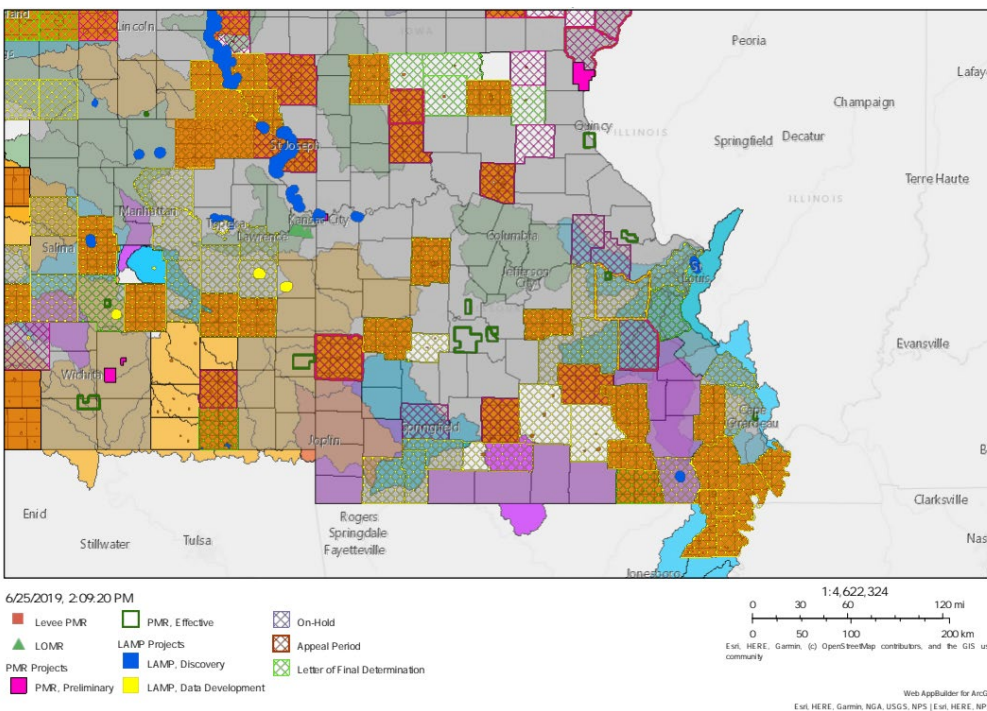
44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (2) An opportunity for neighboring communities, local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

Invitations were sent to a variety of organizations in addition to participating jurisdictions. The following organizations were included:

- Debbie Sandarciero, Administrator, Carter County Health Department
- Richard Stephens, Sheriff, Carter County, MO
- Fire Chiefs of all Fire Departments Serving Carter County, MO
- Dr. Jeff Davis, Superintendent, Van Buren R-I School District
- Dr. Richard Sullivan, Superintendent, East Carter R-II School District
- Carol McNew, City Clerk, City of Grandin, MO
- Leona Stephens, County Clerk, Carter County, MO
- Delaina Hathway, Clerk, City of Ellsinore, MO
- Gerri Flatt, Clerk, City of Van Buren, MO

Coordination with FEMA Risk MAP Project

There are no RiskMap projects currently underway in Carter County.



Integration of Other Data, Reports, Studies, and Plans

The update process was presented to neighboring counties and other interested parties at two regular meetings of the Ozark Foothills Regional Planning Commission. An opportunity to review and comment on the plan update was provided. The previous plan was made available on the OFRPC website as a reference for those who wished to review. Data was gathered from area agencies via phone, email, and fax. All participating jurisdictions and local agencies were eager to provide information when requested and often provided the information in a timely manner.

A variety of sources were used to gather technical data. Some of the resources included:

- *2018 Missouri State Hazard Mitigation Plan*
- Data from various university extensions
- Flood Insurance Studies
- Flood Insurance Rate Maps
- Missouri Department of Natural Resources
- Missouri Department of Transportation
- National Inventory of Dams
- State fire reports
- Wildland/Urban Interface and Intermix areas from SILVIS LAB
- Local comprehensive plans
- USDA, Risk Management Agency, Crop Loss Statistics
- Local city, county, and school district budgets.

All sources are cited throughout the plan as they are used to give credit for data, tables, and maps included in this plan.

Step 4: Assess the Hazard: Identify and Profile Hazards (Handbook Task 5)

During the Kickoff meeting at the Carter County Courthouse information was presented to the MPC that identified and profiled the hazards to be included within the plan. As a part of this discussion previous disaster declarations were discussed with local input provided by those who had experienced events surrounding those declarations. The hazards included in the 2018 State Plan were also presented to the MPC, along with the hazards identified in the previous Carter County Plan.

Data Collection Questionnaires were collected at this meeting for each jurisdiction. The questionnaires were discussed and the use of the data within the plan was also discussed with each jurisdiction represented. In reviewing the questionnaires, it was explained that information and data from the jurisdictions existing community's plans would be incorporated into this plan and that each participating jurisdiction was required to incorporate the final updated hazard mitigation plan into all future planning documents.

In addition to the questionnaires, the MPC discussed other data sources available that could be used in the plan update. These additional data sources included internet searches, GIS

analysis, local newspaper articles, and local officials. Included in Chapter 3 is a risk assessment, this assessment provides additional detail on conclusions drawn from the data collected.

Step 5: Assess the Problem: Identify Assets and Estimate Losses

A variety of sources were used to identify local assets in Carter County. The 2018 State Plan was used along with US Census Data, GIS data, HAZUS data, and the Data Collection Questionnaires distributed to all jurisdictions. Once assets were identified, losses were estimated utilizing information in the 2018 State Plan as well as other available data such as dam inundation maps and prior loss history for events.

Chapter 2 of this plan provides information regarding each jurisdiction's capabilities and area profiles. This section includes information on the participating jurisdiction's regulatory, personnel, fiscal, and technical capabilities. This information was collected through a review of local ordinances, staff members, and annual budgets.

Chapter 3 of this plan includes a discussion of vulnerabilities for each hazard in the plan. These vulnerability estimates were taken from the 2018 State Plan, as the best and most recent data available.

Step 6: Set Goals (Handbook Task 6)

During the third planning meeting held at the Carter County Courthouse in Van Buren, the MPC reviewed the goals from the previous plan. The 2013 County plan included six goals that members of the MPC suggested as needing to be updated to fit the needs of each jurisdiction. The four goals included in the 2018 State Plan were provided for review and the MPC felt that it was best to adopt the state goals as the goals for Carter County.

The 2013 Carter County plan included the following six goals:

1. Reduce loss of life and property.
2. Increase public education and awareness.
3. Improve warning systems and timing.
4. Eliminate hazard prone areas.
5. Promote strategies to protect against damages.
6. Decrease negative impacts on business and industry.

The goals for the updated plan are as follows:

1. Implement mitigation actions that improve the protection of human life, health, and safety from the adverse effects of disasters.
2. Implement mitigation actions that improve the continuity of government and essential services from the adverse effects of disasters.
3. Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
4. Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.

Step 7: Review Possible Mitigation Actions and Activities

The fourth planning meeting occurred at the Carter County Courthouse in Van Buren,

Missouri. At this meeting MPC members reviewed the mitigation strategies from the 2013 County plan and proposed new and different strategies. For participation, each jurisdiction was responsible for a minimum of one action being brought to this meeting. Members were asked to consider actions that substantially addressed long term risks identified in the risk assessment in Chapter 3 of this plan.

The FEMA publication *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013)* was used as a reference in the development of action projects. Participants were encouraged to focus on long term mitigation solutions and consideration was given to the potential cost of each project in relation to the anticipated future cost and savings. The MPC used a modified STAPLEE method to prioritize actions that are included in this update.

Step 8: Draft an Action Plan

At the third planning meeting, MPC members used a modified STAPLEE method to prioritize mitigation actions. Once all actions were scored, actions were prioritized based on the STAPLEE scores. Projects with lower scores were either not included in the plan or given lower priority.

Step 9: Adopt the Plan (Handbook Task 8)

Each jurisdiction adopted the plan at their respected board meetings via a resolution provided to the board for approval. A copy of the plan was provided for review and reference. A copy of the resolution is provided in the Executive Summary of this plan, and the approved resolutions are located in Appendix B.

Step 10: Implement, Evaluate, and Revise the Plan (Handbook Tasks 7 & 9)

At the final planning meeting, the MPC developed and agreed upon an overall strategy for plan implementation and for monitoring and maintaining the plan over time. Chapter 5 provides additional information on plan maintenance and monitoring over the five years following plan approval.

2 PLANNING AREA PROFILE AND CAPABILITIES

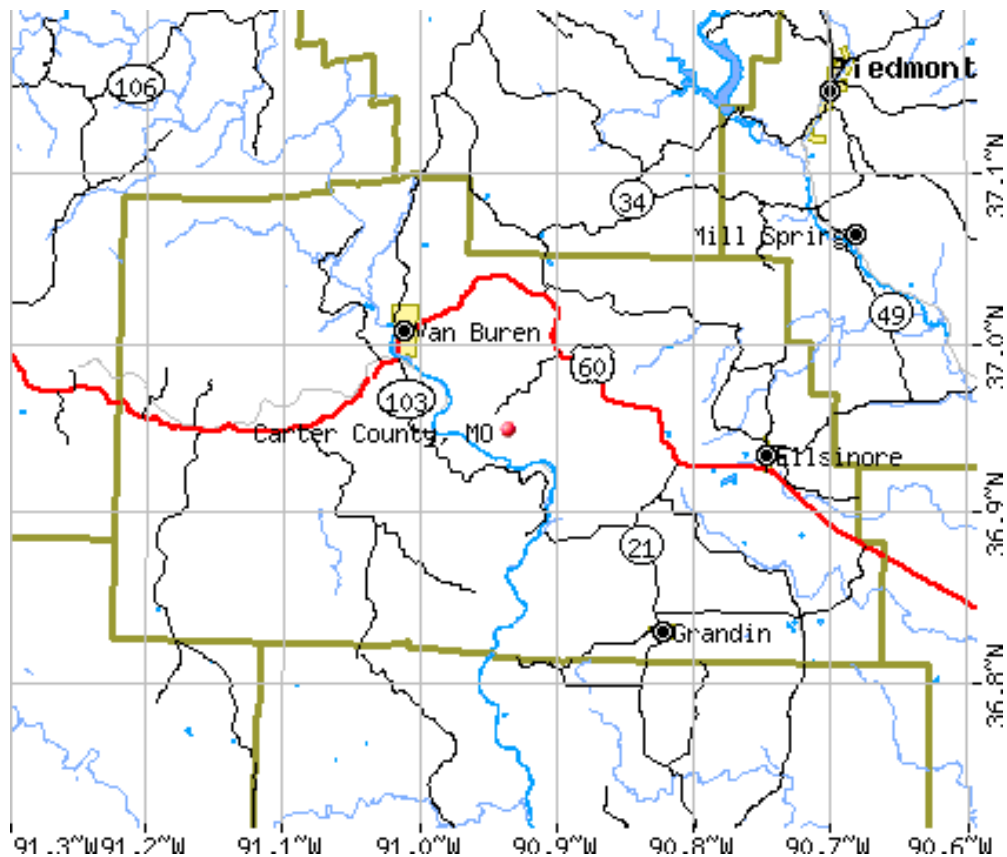
2	PLANNING AREA PROFILE AND CAPABILITIES.....	Error! Bookmark not defined.
2.1	<i>Carter County Planning Area Profile</i>	<i>Error! Bookmark not defined.</i>
2.1.2	Geography, Geology and Topography	Error! Bookmark not defined.
2.1.3	Climate.....	Error! Bookmark not defined.
2.1.4	Population/Demographics.....	Error! Bookmark not defined.
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2.2	<i>Jurisdictional Profiles and Mitigation Capabilities.....</i>	<i>Error! Bookmark not defined.</i>
2.2.1	Unincorporated Carter County.....	Error! Bookmark not defined.
2.2.2	City of Van Buren	Error! Bookmark not defined.
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2.2.3	Summary of Jurisdictional Capabilities	Error! Bookmark not defined.
2.2.4	Special District	Error! Bookmark not defined.
2.2.5	Public School District Profiles and Mitigation Capabilities.....	Error! Bookmark not defined.

2.1 Carter County Planning Area Profile



Figure 2.1.

Map of Carter County



The population of Carter County, as reported in the 2010 United States Census, was 6,265, a growth of 433 residents from the 2000 US Census that was reported as 5,832. In reviewing the 2013-2017 American Community Survey 5-year Estimates, the population has not changed much since the 2010 Census.

In reviewing this census data, Carter County, as much of rural America, experienced a similar rate of growth as the State of Missouri and the country as a whole from 2000 through 2010. Carter County grew at a rate of 6.9% compared to Missouri's growth rate of 7.0%.

Carter County is also a county with a low median household income (MHI), as compared to the state of Missouri. According to the American Community Survey 5-year Estimates reports that the MHI for Carter County is \$37,875 an increase from the 2010 Census, where the Medium Household Income was reported as \$28,408.

According to the 2013-2017 American Community Survey 5-year estimates, the median value of a home in Carter County is \$90,400 compared to state median value of \$145,400 and the U.S. median value of \$193,500. In 2000, the state's median home value was \$89,900 and the U.S. had a median home value of \$119,600. No data is available for county-level median home value for 2000; however, median home values in Carter County in 2010 was \$88,100 representing a slight increase from 2010 to present.

2.1.1 Geography, Geology and Topography

Located at the eastern edge of the Ozark Mountains, Carter County, Missouri, has been fortunate to avoid many of the natural hazards that impact other areas of North America. The county is virtually unknown to hurricanes, tsunamis, tidal surges, landslides, and forest fires. However, Carter County is susceptible to other natural hazards. Tornadoes and severe thunderstorms, flooding, dam failure, wildfires, land subsidence/sinkholes, severe winter storms, earthquakes, drought, and heat waves are all hazards that impact the county on a routine basis, endangering both lives and property.

The county is a rural area and is sparsely populated, with a total land area of 507.36 square miles of hilly terrain with a population density of 12.3 persons per mile. Cities within the county have sustained population from 2010 to present, but have not experienced population growth.

According to the 2010 Census, 1.66 square miles of water area exists in the county. Watersheds in Carter County include the Current River and Little Black River.

2.1.2 Climate

According to the National Weather Service (NWS) the average annual precipitation is 49 inches, higher than the United States average of 37 inches. It is reported that of these 49 inches of precipitation, 10 inches of that is snowfall annually. The average US city gets 25 inches of snow per year. The number of days with any measurable precipitation is 97 annually. On average, there are 212 sunny days per year in Carter County. The month with the highest average temperature is July at 88 degrees. The month with the lowest average temperature is January with an average low of 22 degrees. The Midwestern Regional Climate Center provides monthly climate averages based on data collected from 1981-2010. According to this data the Maximum average monthly temperature in Carter County occurs in July and the Minimum occurs in January.

2.1.3 Population/Demographics

The following table (**Table 2.1**) provides the populations for each city and the unincorporated county for 2000 and 2010 along with the percentage change in population. The unincorporated population was determined by subtracting the populations of the incorporated areas from the overall county population.

Table 2.1 Carter County Population 2000-2010 by Community

Jurisdiction	2000	2010	2017 Annual Population Estimate or ACS Population	2000-2010 # Change	2000-2010 % Change
City of Van Buren	845	819	1,095	-26	-3.2%
City of Ellsinore	363	446	622	+83	+23%
City of Grandin	236	243	218	+7	+2.9%
Unincorporated County	4,497	4,757	4,320	+260	+5.7%
Total	5,941	6,265	6,255	+324	+5.2%

Source: U.S. Bureau of the Census, Decennial Census, 2017 American Community Survey Estimates

In reviewing population data provided by the 2013 – 2017 American Community Survey (ACS) 5-year estimates, vulnerable populations can also be identified. The first vulnerable populations to consider are those persons under the age of 5 years old. According to the ACS, there are 350 children under the age of 5 residing in Carter County. This number represents 5.5% of the total population of the county, a rate that is lower than the percentage of children under 5 in the State of Missouri (6.5%), and in the United States (6.5%). Other vulnerable populations to consider are those residents over the age of 65. In Carter County there are 1,174 persons over the age of 65, or 18.7% of the county population. This rate of seniors residing in the county is higher than the rates reported for the State of Missouri (14%) and the United States (13%). When considering hazard mitigation planning, measures need to be considered to address these vulnerable populations and their safety.

The Decennial Census reports that there are 2,559 households in Carter County, with an average household size of 2.43 persons. The average household size for Missouri is similar, being reported as 2.45 persons per household, while the average household size for the United States is slightly higher being reported as 2.58 persons per household.

American Community Survey data identifies the median age of residents in Carter County is 41.3 compared to Missouri as 37.9, and the United States being reported as 37.2 years of age. The largest percentage differences in population between Carter County and residents elsewhere is that 22.6% of all Carter County residents are over the age of 62. A much lower rate for persons over 62 exists in both the State of Missouri (17.2%) and the United States (16.2%).

The University of South Carolina developed an index to evaluate and rank the ability to respond to, cope with, recover from, and adapt to disasters. The index synthesizes 29 socioeconomic variables which research literature suggests contribute to a reduction in a community's ability to prepare for, respond to, and recover from hazards. After considering the afore-mentioned variables, Carter County falls within the high social vulnerability level in the 91.4% percentile category. The State of Missouri's FIPs code is 29, the County's FIPs code is 035. The 91.4% percentile category means that Carter County is less resilient to hazard events. Data sources include primarily those from the United States Census Bureau.

In the table below, further demographic data is provided to present a better picture of the local population in comparison to the State of Missouri and the United States as a whole. As can be seen from this data, the residents are poorer and less educated than residents across the state and the nation.

Table 2.2 Unemployment, Poverty, Education, and Language Percentage Demographics, Carter County, Missouri

Jurisdiction	Total in Labor Force	Percent of Population Unemployed	Percent of Families Below the Poverty Level	Percentage of Population (High School graduate)	Percentage of Population (Bachelor's degree or higher)	Percentage of population (spoken language other than English)
Carter County	2,667	3.7%	10.4%	79.4%	12.3%	1.7%
City of Van Buren	461	4.3%	10.6%	83.5%	18.5%	1.8%
City of Ellsinore	173	6.6%	13.6%	84.7%	11.4%	0%
City of Grandin	78	0%	25.6%	75%	5.9%	0%
State	3,054,519	5.3%	11.1%	88%	26.7%	6.1%
Nation	158,965,511	5.8%	11.5%	86.3%	29.3%	20.9%

Source: U.S. Census, 2013-2017 American Community Survey, 5-year Estimates.

2.1.4 History

Carter County, with a population of 6,265, is located in the central western portion of the Ozark Foothills Region. Some major industries and employers in the county include Royal Oak Enterprises, LLC, The Landing, Big Springs Medical Clinic, and Riverways Manor. Two healthcare clinics offer high-quality medical assistance to county residents, while two public school systems and one private school educate children living in the county. A variety of recreational areas exist, including Mark Twain National Forest, the Current River, the Ozark National Scenic Riverways, and Big Spring Natural Area.

2.1.5 Occupations

The table below (**Table 2.3**) provides occupation statistics for the incorporated cities and the county as a whole.

Table 2.3 Occupation Statistics, Carter County, Missouri

Place	Management, Business, Science & Arts Occupations	Service Occupations	Sales & Office Occupations	Natural Resources, Construction, & Maintenance Occupations	Production, Transportation, & Material Moving Occupations
Carter County	29.8	22.2	15.2	13.4	19.4
City of Van Buren	38.3	19.7	15.5	9.3	17.2
City of Ellsinore	25.7	28.4	11.5	8.1	26.4
City of Grandin	16.7	24.4	11.5	14.1	33.3

Source: U.S. Census, 2013-2017 American Community Survey, 5-year Estimates.

2.1.6 Agriculture

According to the United States Department of Agriculture, 73,642 acres in Carter County are utilized as farm land. There are reportedly 196 farms in the County with an average size of 376 acres. Carter County farms produce no row crops but a variety of livestock. This information was found via the most recent USDA's Census of Agriculture report that was produced in 2012.

Livestock and poultry farming is an important part of Carter County agriculture. According to the USDA Census of Agriculture, Carter County is home to 138 cattle farms. Cattle and calf farming comprise the majority of livestock farming, with an inventory of 7,071 head of cattle. Farmers also have an inventory of hogs, sheep, and poultry such as chickens.

2.1.7 FEMA Hazard Mitigation Assistance Grants in Planning Area

According to the Federal Emergency Management Agency, there have been four Hazard Mitigation Grant Awards made to jurisdictions within the boundaries of Carter County. Two of these grant awards were for school districts to construct tornado safe rooms and the other projects were removing structures from the floodplain through a flood buyout program conducted by the City of Van Buren and Carter County. The total dollar amount of these four projects is \$3,168,706.80 The table below provides information for each of the projects.

Table 2.4. FEMA HMA Grants in Carter County from 1993-2019

Disaster Declaration	Project Type	Sub applicant	Award Date	Project Total
DR-4317	Acquisition	Carter County	07/23/2018	\$650,125
DR-4317	Acquisition	Van Buren	07/23/2018	\$470,837
PDMC-PJ-07-MO	Safe Room	Van Buren School District	09/12/2008	\$918,784.80
PDMC-PJ-07-MO	Safe Room	Ellsinore School District	09/28/2007	\$1,128,960
Total				\$3,168,706.80

Source: Missouri State Emergency Management Agency, 2019

2.1.8 FEMA Public Assistance (PA) Grants in Planning Area

According to the Federal Emergency Management Agency, there have been many Public Assistance (PA) Grants within the boundaries of Carter County. The majority of these projects have been the Roads and Bridges project type and primarily small projects. The total amount awarded in Carter County is \$7,832,365.04. The table below provides information for each of the projects.

Disaster Declaration	Project Type	Project Size	Applicant	Project Total
1412	Protective Measures	Small	Carter	4011.8
1412	Public Buildings	Small	Carter	250
1412	Debris Removal	Small	Carter	28429.88
1412	Roads and Bridges	Large	Carter	52861.01
1412	Roads and Bridges	Small	Carter	2471.8
1412	Roads and Bridges	Small	Carter	10800
1412	Roads and Bridges	Small	Carter	16674.4
1412	Roads and Bridges	Small	Carter	1142.88
1412	Protective Measures	Small	Carter	1327.75
1412	Roads and Bridges	Small	Carter	34373.52
1412	Roads and Bridges	Small	Carter	49306.52
1412	Roads and Bridges	Small	Carter	0
1412	Roads and Bridges	Small	Carter	8433.61
1412	Roads and Bridges	Small	Carter	12207.91
1412	Roads and Bridges	Small	Carter	9849.6
1412	Roads and Bridges	Small	Carter	12180
1412	Roads and Bridges	Small	Carter	11908.24
1412	Roads and Bridges	Small	Carter	6442.8
1412	Roads and Bridges	Small	Carter	51569.54
1412	Roads and Bridges	Small	Carter	10635.67
1412	Roads and Bridges	Small	Carter	5856.25
1412	Roads and Bridges	Small	Carter	11334.06
1412	Roads and Bridges	Small	Carter	27629.81
1412	Roads and Bridges	Small	Carter	14798.6
1412	Roads and Bridges	Small	Carter	18625.58
1412	Roads and Bridges	Small	Carter	16037.98
1412	Roads and Bridges	Small	Carter	0
1412	Roads and Bridges	Small	Carter	8874.35
1412	Roads and Bridges	Small	Carter	19372.37
1412	Roads and Bridges	Large	Carter	65423.12
1412	Roads and Bridges	Small	Carter	38819.8
1412	Roads and Bridges	Small	Carter	2340.26
1412	Roads and Bridges	Small	Carter	19720.24
1412	Roads and Bridges	Large	Carter	131071.5

1412	Roads and Bridges	Large	Carter	51638.98
1412	Roads and Bridges	Small	Carter	7875.15
1412	Roads and Bridges	Small	Carter	8558.25
1412	Roads and Bridges	Small	Carter	31554.2
1412	Roads and Bridges	Small	Carter	31018.18
1412	Roads and Bridges	Small	Carter	29166.5
1412	Roads and Bridges	Small	Carter	0
1412	Roads and Bridges	Small	Carter	10026.49
1748	Protective Measures	Small	Carter	14768.12
1749	Protective Measures	Small	Carter	4029
1749	Public Buildings	Small	Carter	0
1749	Public Buildings	Small	Carter	12770.29
1749	Roads and Bridges	Small	Carter	53241.3
1749	Roads and Bridges	Small	Carter	3356.57
1749	Roads and Bridges	Small	Carter	38115.09
1749	Roads and Bridges	Large	Carter	113177.8
1749	Roads and Bridges	Small	Carter	43745.44
1749	Roads and Bridges	Small	Carter	30925.6
1749	Roads and Bridges	Small	Carter	22316.01
1749	Roads and Bridges	Small	Carter	44340.92
1749	Roads and Bridges	Large	Carter	112010
1749	Debris Removal	Small	Carter	5684.25
1749	Roads and Bridges	Small	Carter	56192.62
1749	Roads and Bridges	Small	Carter	21222.11
1749	Roads and Bridges	Small	Carter	8980.17
1749	Roads and Bridges	Small	Carter	18575.23
1749	Roads and Bridges	Small	Carter	14710
1749	Roads and Bridges	Small	Carter	26808.45
1749	Roads and Bridges	Small	Carter	22747.93
1749	Roads and Bridges	Small	Carter	53235.7
1749	Roads and Bridges	Small	Carter	9704.93
1749	Roads and Bridges	Small	Carter	45287.24
1749	Roads and Bridges	Small	Carter	33848.41
1749	Roads and Bridges	Small	Carter	23250.85
1749	Roads and Bridges	Small	Carter	53114.76
1749	Roads and Bridges	Small	Carter	16127.7
1749	Roads and Bridges	Small	Carter	60484.08
1749	Roads and Bridges	Small	Carter	32300.02
1749	Roads and Bridges	Small	Carter	44304.36
1749	Roads and Bridges	Small	Carter	52649.78
1749	Roads and Bridges	Small	Carter	33927.3
1749	Recreational or Other	Small	Carter	2686.25

1749	Roads and Bridges	Small	Carter	19737
1822	Protective Measures	Small	Carter	3084.7
1822	Protective Measures	Small	Carter	3771.3
1822	Protective Measures	Small	Carter	31951.25
1822	Protective Measures	Small	Carter	9551.28
1822	Debris Removal	Small	Carter	12671.24
1822	Protective Measures	Small	Carter	2534.55
1980	Protective Measures	Small	Carter	1336.87
1980	Roads and Bridges	Small	Carter	31669.94
1980	Debris Removal	Small	Carter	2914.14
1980	Roads and Bridges	Small	Carter	24946.83
1980	Roads and Bridges	Small	Carter	56048.25
1980	Roads and Bridges	Small	Carter	32384.86
1980	Roads and Bridges	Large	Carter	69011.14
1980	Roads and Bridges	Small	Carter	3489.8
1980	Roads and Bridges	Large	Carter	89670.99
1980	Roads and Bridges	Small	Carter	26080.61
1980	Debris Removal	Small	Carter	1824
1980	Roads and Bridges	Small	Carter	11689.27
1980	Roads and Bridges	Small	Carter	3647.86
1980	Roads and Bridges	Small	Carter	3114.83
1980	Roads and Bridges	Small	Carter	25044.95
1980	Roads and Bridges	Small	Carter	7061.62
1980	Roads and Bridges	Small	Carter	5606.09
1980	Roads and Bridges	Small	Carter	15008.16
1980	Roads and Bridges	Small	Carter	8955.74
1980	Roads and Bridges	Small	Carter	9307.21
4317	Debris Removal	Large	Carter	322796.6
4317	Debris Removal	Small	Carter	66632.1
4317	Debris Removal	Large	Carter	191498.8
4317	Protective Measures	Small	Carter	11924.53
4317	Recreational or Other	Small	Carter	0
4317	Public Utilities	Small	Carter	75995.02
4317	Protective Measures	Large	Carter	130750
4317	Protective Measures	Small	Carter	32302.65
4317	Protective Measures	Large	Carter	104382.9
4317	Roads and Bridges	Small	Carter	116656.8
4317	Public Buildings	Small	Carter	33975
4317	Public Utilities	Small	Carter	113931.3
4317	Protective Measures	Small	Carter	22844.78
4317	Roads and Bridges	Small	Carter	120393.3
4317	Public Buildings	Small	Carter	0

4317	Roads and Bridges	Large	Carter	131108.7
4317	Roads and Bridges	Large	Carter	259140
4317	Public Buildings	Large	Carter	646622.3
4317	Debris Removal	Large	Carter	410426.7
4317	Roads and Bridges	Large	Carter	296254.4
4317	Roads and Bridges	Large	Carter	171023.5
4317	Protective Measures	Small	Carter	40441.44
4317	Roads and Bridges	Small	Carter	58449.31
4317	Roads and Bridges	Large	Carter	322980.9
4317	Roads and Bridges	Large	Carter	388088.3
4317	Public Buildings	Small	Carter	33976.82
4317	Roads and Bridges	Large	Carter	518128.7
4317	Protective Measures	Small	Carter	68379.55
4317	Protective Measures	Large	Carter	130043.8
4317	Public Buildings	Large	Carter	423091.9
4317	Public Buildings	Large	Carter	27833.65
4317	Protective Measures	Small	Carter	6405
4317	Protective Measures	Small	Carter	40514.99
Total				\$7,832,365.04

Source: Missouri State Emergency Management Agency, 2019

2.2 Jurisdictional Profiles and Mitigation Capabilities

This section will include individual profiles for each participating jurisdiction. It will also include a discussion of previous mitigation initiatives in the planning area. There will be a summary table indicating specific capabilities of each jurisdiction that relate to their ability to implement mitigation opportunities. The unincorporated county is profiled first, followed by the incorporated communities, and the public school districts.

2.2.1 Unincorporated Carter County

Carter County is a third-class county administered by a three-member County Commission. One commissioner from each of the two County Districts join a Presiding Commissioner elected at-large for terms of four years. County property taxes are collected to support the road, school, and library infrastructure of the county. The Commission has general supervision of the county public roads and maintains the courthouse and other county-owned buildings. The Commission oversees the budgets of a number of independently elected officers such as the County Clerk, Sheriff, Prosecuting Attorney, Coroner, Public Administrator, Assessor, Collector, and Treasurer.

The County Commission meets weekly in the Courthouse located in the county seat of Van Buren on Friday mornings and the last day of each month from 9:00am-12:00pm and at other times in special session as needed. The County Clerk is also present for these meetings and serves as the Chief Financial Officer of the Commission.

Following is a list of county officials:

-
- Presiding County Commissioner, Ron Keeney
 - Associate Commissioner East District, Andy Steiger
 - Associate Commissioner West District, Lynn Murdick
 - County Clerk, Leona Stephens
 - Prosecuting Attorney, Hannah Pender
 - Recorder, Pauline Peterman
 - Assessor, Gary Rector
 - County Sheriff, Richard Stephens
 - County Collector, Lisa Goodwin
 - Emergency Management Director, Curt Majors
 - Treasurer, Velvet Ricker
 - Public Administrator, Heidi Truncone
 - Circuit Clerk, Mary Godsy
 - Coroner, Erik McSpadden

Mitigation Initiatives/Capabilities

Carter County is a small, poor, rural county that lacks in many staffed positions. The County highway department has a supervisor that manages the maintenance of the county roads and reports directly to the commissioners.

Due to the size of Carter County, its small staff and lack of resources, many times planning is conducted on a regional basis as opposed to county level. The county works often with the Ozark Foothills Regional Planning Commission on projects such as developing a regional Comprehensive Economic Development Strategy Plan, or on transportation planning such as the Regional Transportation Plan and the regional Public Transit-Human Services Transportation Plan. The county also works with a regional Local Emergency Planning District (LEPD).

Carter County utilizes its elected prosecuting attorney for legal direction and services. Its Highway Department supervisor is responsible for overseeing the county's transportation infrastructure, which consists primarily of gravel-surfaced roadways. The county funds a sheriff's department, which is responsible for maintaining order and enforcing law within the county. The county's emergency management director also serves as the county floodplain manager. Carter County has established no planning and zoning committee or land use designations within the balance of the county.

Carter County participates within the Ozark Foothills Local Emergency Planning District (LEPD), and is, consequently, included within the district's *Local Emergency Operations Plan*. The data found in Table 2.5 below is based upon information reported via the county's *Data Collection Questionnaire*.

Table 2.5 Unincorporated Carter County Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	None
Builder's Plan	None
Capital Improvement Plan	None
City Emergency Operations Plan	None
County Emergency Operations Plan	<i>Local Emergency Operations Plan, 2004</i>
Local Recovery Plan	None
County Recovery Plan	None
City Mitigation Plan	None
County Mitigation Plan	<i>Carter County Hazard Mitigation Plan, 2019</i>
Debris Management Plan	None
Economic Development Plan	<i>Ozark Foothills Comprehensive Economic Dev. Strat., 2018</i>
Transportation Plan	<i>STIP – July 2019</i>
Land-use Plan	None
Flood Mitigation Assistance (FMA) Plan	None
Watershed Plan	None
Firewise or other fire mitigation plan	None
School Mitigation Plan	<i>Carter County Hazard Mitigation Plan, 2019</i>
Critical Facilities Plan (Mitigation/Response/Recover y)	None
Policies/Ordinance	
Zoning Ordinance	None
Building Code	None
Floodplain Ordinance	Yes
Subdivision Ordinance	None
Tree Trimming Ordinance	None
Nuisance Ordinance	None
Storm Water Ordinance	None
Drainage Ordinance	None
Site Plan Review Requirements	None
Historic Preservation Ordinance	None
Landscape Ordinance	None
Seismic Construction Ordinance	None
Program	
Zoning/Land Use Restrictions	None
Codes Building Site/Design	None
Hazard Awareness Program	None
National Flood Insurance Program (NFIP)	Yes
Community Rating System (CRS) program under the National Flood Insurance Program	None
National Weather Service (NWS) Storm Ready	None
Firewise Community Certification	None
Building Code Effectiveness Grading (BCEGs)	None
ISO Fire Rating	None

Capabilities	Status Including Date of Document or Policy
Economic Development Program	<i>Ozark Foothills Comprehensive Economic Dev. Strat., 2018</i>
Land Use Program	None
Public Education/Awareness	Yes
Property Acquisition	None
Planning/Zoning Boards	None
Stream Maintenance Program	None
Tree Trimming Program	None
Engineering Studies for Streams (Local/County/Regional)	None
Mutual Aid Agreements	None
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	<i>Carter County Hazard Mitigation Plan, 2019</i>
Hazard Analysis/Risk Assessment (County)	<i>Carter County Hazard Mitigation Plan, 2019</i>
Flood Insurance Maps	Yes
FEMA Flood Insurance Study (Detailed)	None
Evacuation Route Map	None
Critical Facilities Inventory	None
Vulnerable Population Inventory	None
Land Use Map	None
Staff/Department	
Building Code Official	None
Building Inspector	None
Mapping Specialist (GIS)	None
Engineer	None
Development Planner	None
Public Works Official	None
Emergency Management Director	Yes
NFIP Floodplain Administrator	Yes
Bomb and/or Arson Squad	None
Emergency Response Team	None
Hazardous Materials Expert	None
Local Emergency Planning Committee	None
County Emergency Management Commission	Yes
Sanitation Department	None
Transportation Department	Yes
Economic Development Department	None
Housing Department	None
Planning Consultant	None
Regional Planning Agencies	Yes
Historic Preservation	Yes
Non-Governmental Organizations (NGOs)	
American Red Cross	None
Salvation Army	None
Veterans Groups	None
Local Environmental Organization	None
Homeowner Associations	Yes
Neighborhood Associations	None
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.)	Yes
Local Funding Availability	
Apply for Community Development Block Grants	Yes
Fund projects through Capital Improvements funding	None

Capabilities	Status Including Date of Document or Policy
Authority to levy taxes for a specific purpose	None
Fees for water, sewer, gas, or electric services	None
Impact fees for new development	None
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	None
Withhold spending in hazard prone areas	None

Source: Data Collection Questionnaire, 2018

2.2.2 City of Van Buren

The City of Van Buren is generally located in central Carter County and is the county's seat. Leadership of the city is comprised of a Mayor and Board of Aldermen consisting of 5 elected positions. The population as of the 2010 Census is 819 persons, as compared to 845 in the 2000 Census. This represents a 3.1% decline in population. The city operates a police department, water and sewer department, an emergency management office, city clerk's office, and receives fire and ambulance services through private districts.

The City of Van Buren's mitigation initiatives include the following:

- Seek funding to update the city's tornado sirens.
- Implement projects that protect the city from flood hazards.
- Increase public education and awareness of natural hazard risks.

Total Population	819
Median Age	43.4
Classification Class	4
Leadership	Mayor/Board of Aldermen
Total Housing Units	431
Median Gross Rent	\$500
Median Housing Value	Owner-Occupied \$69,700
Median Household Income, 2010	\$20,515
Median Family Income, 2010	\$31,125
Per Capita Personal Income, 2010	\$14,364
Persons 16 Yrs. & Over in Labor Force	970
Comprehensive Plan	No
Zoning Regulations	Flood Zone
Building Regulations	Yes
Subdivision Regulations	Yes
Floodplain Regulations	Yes
NFIP	Yes
Water Service	City of Van Buren
Sewer Service	City of Van Buren
Electric Service	Ozark Border Electric Coop
Natural Gas Service	Van Buren Fuel
Telephone Service	Century Link
Law Enforcement	City of Van Buren
Fire Service	City of Van Buren

The table beginning on the following page (**Table 2.6**) is based on the *Data Collection Questionnaire* distributed to each jurisdiction.

Table 2.6 City Of Van Buren Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	None
Builder's Plan	None
Capital Improvement Plan	None
Local Emergency Plan	None
County Emergency Plan	<i>Ozark Foothills Emergency Operations Plan, 2004</i>
Local Recovery Plan	None
County Recovery Plan	None
Local Mtigation Plan	<i>Carter County Hazard Mitigation Plan, 2019</i>
County Mtigation Plan	<i>Carter County Hazard Mitigation Plan, 2019</i>
Local Mtigation Plan (PDM)	None
County Mtigation Plan (PDM)	None
Economic Development Plan	<i>Ozark Foothills Comprehensive Economic Dev. Strat., 2018</i>
Transportation Plan	<i>STIP, July-2019</i>
Land-use Plan	None
Flood Mtigation Assistance (FMA) Plan	None
Watershed Plan	None
Firewise or other fire mitigation plan	None
School Mtigation Plan	<i>Carter County Hazard Mitigation Plan, 2019</i>
Critical Facilities Plan (Mtigation/Response/Recovery)	None
Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	Yes
Building Code	Yes
Floodplain Ordinance	Yes
Subdivision Ordinance	None
Tree Trimming Ordinance	None
Nuisance Ordinance	Yes
Storm Water Ordinance	None
Drainage Ordinance	None
Seismic Construction Ordinance	None
Capability	Status Including Date of Document or Policy
Site Plan Review Requirements	None
Historic Preservation Ordinance	None
Landscape Ordinance	None
Iowa Wetlands and Riparian Areas Conservation Plan	None
Debris Management Plan	None
Program	Status Including Date of Document or Policy
Zoning/Land Use Restrictions	None
Codes Building Site/Design	None
National Flood Insurance Program (NFIP) Participant	Yes
NFIP Community Rating System (CRS) Participating Community	None
Hazard Awareness Program	None
National Weather Service (NWS) Storm Ready	None
Building Code Effectiveness Grading (BCEGs)	None
ISO Fire Rating	None
Economic Development Program	<i>Ozark Foothills Comprehensive Economic Dev. Strat., 2018</i>
Land Use Program	None
Public Education/Awareness	None
Property Acquisition	None
Planning/Zoning Boards	None

Stream Maintenance Program	None
Tree Trimming Program	None
Engineering Studies for Streams (Local/County/Regional)	None
Mutual Aid Agreements	None
Studies/Reports/Maps	Status Including Date of Document or Policy
Hazard Analysis/Risk Assessment (Local)	<i>Carter County Hazard Mitigation Plan, 2019</i>
Hazard Analysis/Risk Assessment (County)	<i>Carter County Hazard Mitigation Plan, 2019</i>
Flood Insurance Maps	Yes
FEMA Flood Insurance Study (Detailed)	None
Evacuation Route Map	None
Critical Facilities Inventory	None
Vulnerable Population Inventory	None
Land Use Map	None
Staff/Department	Status Including Date of Document or Policy
Building Code Official	None
Building Inspector	None
Mapping Specialist (GIS)	None
Engineer	None
Development Planner	None
Public Works Official	Yes
Emergency Management Coordinator	Yes
NFIP Floodplain Administrator	Yes
Bomb and/or Arson Squad	None
Emergency Response Team	None
Hazardous Materials Expert	None
Local Emergency Planning Committee	None
County Emergency Management Commission	Yes
Sanitation Department	None
Transportation Department	None
Economic Development Department	None
Housing Department	None
Planning Consultant	None
Regional Planning Agencies	Yes
Historic Preservation	None
Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	None
Salvation Army	None
Capability	Status Including Date of Document or Policy
Veterans Groups	None
Environmental Organization	None
Homeowner Associations	None
Neighborhood Associations	None
Chamber of Commerce	None
Community Organizations (Lions, Kiwanis, etc.)	Yes
Local Funding Availability	Status Including Date of Document or Policy
Ability to apply for Community Development Block Grants	Yes
Ability to fund projects through Capital Improvements funding	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	None
Ability to incur debt through general obligation bonds	None
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	None
Ability to withhold spending in hazard prone areas	None

Source: *Data Collection Questionnaire, 2018*

2.2.3 City of Ellsinore

Total Population, (2010)	446
Median Age	37.3
Classification Class	4
Leadership	Mayor/City Council
Total Housing Units	225
Median Gross Rent	\$570
Median Housing Value, Owner-Occupied	\$73,100
Median Household Income, 2017	\$35,341
Median Family Income, 2017	\$38,036
Per Capita Personal Income, 2017	\$14,182
Persons 16 Yrs. & Over in Labor Force	173
Comprehensive Plan	No
Zoning Regulations	No
Building Regulations	No
Subdivision Regulations	No
NFIP	Yes
Water Service	City of Ellsinore
Sewer Service	City of Ellsinore
Electric Service	Ozark Border Electric Cooperative
Propane Gas Service	Chilton Oil Company, Ferrell Gas/ Empire Gas
Telephone Service	Century Link
Law Enforcement	City of Ellsinore
Fire Service	East Carter Co Fire Protection District
Ambulance Service	East Carter Co Ambulance District

The table beginning on the following page (**Table 2.7**) is based on the *Data Collection Questionnaire* distributed to each jurisdiction.

Table 2.7 CityOf Ellsinore Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	<i>City of Ellsinore Comprehensive Plan, 2012</i>
Builder's Plan	None
Capital Improvement Plan	None
Local Emergency Plan	<i>City of Ellsinore Emergency Operations Plan, 2012</i>
County Emergency Plan	<i>Ozark Foothills Emergency Operations Plan, 2004</i>
Local Recovery Plan	None
County Recovery Plan	None
Local Mtigation Plan	<i>Carter County Hazard Mitigation Plan, 2019</i>
County Mtigation Plan	<i>Carter County Hazard Mitigation Plan, 2019</i>
Local Mtigation Plan (PDM)	None
County Mtigation Plan (PDM)	None
Economic Development Plan	<i>Ozark Foothills Comprehensive Economic Dev. Strat., 2018</i>
Transportation Plan	<i>STIP, July-2019</i>
Land-use Plan	None
Flood Mtigation Assistance (FMA) Plan	None
Watershed Plan	None
Firewise or other fire mitigation plan	None
School Mtigation Plan	<i>Carter County Hazard Mitigation Plan, 2019</i>
Critical Facilities Plan (Mtigation/Response/Recovery)	None
Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	Yes
Building Code	None
Floodplain Ordinance	Yes
Subdivision Ordinance	None
Tree Trimming Ordinance	None
Nuisance Ordinance	None
Storm W ater Ordinance	None
Drainage Ordinance	None
Seismic Construction Ordinance	None
Capability	Status Including Date of Document or Policy
Site Plan Review Requirements	None
Historic Preservation Ordinance	None
Landscape Ordinance	None
Iowa Wetlands and Riparian Areas Conservation Plan	None
Debris Management Plan	None
Program	Status Including Date of Document or Policy
Zoning/Land Use Restrictions	None
Codes Building Site/Design	None
National Flood Insurance Program (NFIP) Participant	Yes
NFIP Community Rating System (CRS) Participating Community	None
Hazard Awareness Program	None
National Weather Service (NWS) Storm Ready	None
Building Code Effectiveness Grading (BCEGs)	None
ISO Fire Rating	None
Economic Development Program	<i>Ozark Foothills Comprehensive Economic Dev. Strat., 2018</i>
Land Use Program	None
Public Education/Awareness	None
Property Acquisition	None
Planning/Zoning Boards	Yes
Stream Maintenance Program	None
Tree Trimming Program	Yes
Engineering Studies for Streams (Local/County/Regional)	None
Mutual Aid Agreements	None
Studies/Reports/Maps	Status Including Date of Document or Policy
Hazard Analysis/Risk Assessment (Local)	<i>Carter County Hazard Mitigation Plan, 2019</i>

Hazard Analysis/Risk Assessment (County)	<i>Carter County Hazard Mitigation Plan, 2019</i>
Flood Insurance Maps	Yes
FEMA Flood Insurance Study (Detailed)	None
Evacuation Route Map	Yes
Critical Facilities Inventory	Yes
Vulnerable Population Inventory	Yes
Land Use Map	Yes
Staff/Department	Status Including Date of Document or Policy
Building Code Official	None
Building Inspector	None
Mapping Specialist (GIS)	None
Engineer	None
Development Planner	None
Public Works Official	Yes
Emergency Management Coordinator	Yes
NFIP Floodplain Administrator	Yes
Bomb and/or Arson Squad	None
Emergency Response Team	Yes
Hazardous Materials Expert	None
Local Emergency Planning Committee	Yes
County Emergency Management Commission	Yes
Sanitation Department	Yes
Transportation Department	Yes
Economic Development Department	Yes
Housing Department	None
Planning Consultant	None
Regional Planning Agencies	Yes
Historic Preservation	None
Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	None
Salvation Army	None
Capability	Status Including Date of Document or Policy
Veterans Groups	None
Environmental Organization	None
Homeowner Associations	None
Neighborhood Associations	None
Chamber of Commerce	None
Community Organizations (Lions, Kiwanis, etc.)	Yes
Local Funding Availability	Status Including Date of Document or Policy
Ability to apply for Community Development Block Grants	Yes
Ability to fund projects through Capital Improvements funding	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	None
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	None
Ability to incur debt through private activities	Yes
Ability to withhold spending in hazard prone areas	None

Source: *Data Collection Questionnaire, 2018*

2.2.4 City of Grandin

Total Population, (2010)	243
Median Age	37.3
Classification Class	4
Leadership	Mayor/Board of Aldermen
Total Housing Units	116
Median Gross Rent	\$633
Median Housing Value, Owner-Occupied	\$61,300
Median Household Income, 2017	\$19,722
Median Family Income, 2017	\$31,563
Per Capita Personal Income, 2017	\$14,503
Persons 16 Yrs. & Over in Labor Force	78
Comprehensive Plan	No
Zoning Regulations	No
Building Regulations	No
Subdivision Regulations	No
NFIP	Yes
Water Service	City of Grandin
Sewer Service	City of Grandin
Electric Service	Ozark Border Electric Cooperative
Propane Gas Service	Chilton Oil Company, Ferrell Gas, Empire Gas Atmos Energy
Telephone Service	AT&T & Windstream
Law Enforcement	City of Grandin
Fire Service	East Carter Co. Fire Protection District
Ambulance Service	East Carter County Ambulance District

The table beginning on the following page (**Table 2.8**) is based on the Data Collection Questionnaire distributed to each jurisdiction.

Table 2.8 City of Grandin Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	None
Builder's Plan	None
Capital Improvement Plan	None
Local Emergency Plan	<i>City of Grandin Emergency Operations Plan,</i>
County Emergency Plan	<i>Ozark Foothills Emergency Operations Plan, 2004</i>
Local Recovery Plan	None
County Recovery Plan	None
Local Mitigation Plan	<i>Carter County Hazard Mitigation Plan, 2019</i>
County Mitigation Plan	<i>Carter County Hazard Mitigation Plan, 2019</i>
Local Mitigation Plan (PDM)	None
County Mitigation Plan (PDM)	None
Economic Development Plan	<i>Ozark Foothills Comprehensive Economic Dev. Strat., 2018</i>
Transportation Plan	<i>Statewide Transportation Improvement Program, July 2019</i>
Land-use Plan	None
Flood Mitigation Assistance (FMA) Plan	None
Watershed Plan	None
Firewise or other fire mitigation plan	None
School Mitigation Plan	<i>Carter County Hazard Mitigation Plan, 2019</i>
Critical Facilities Plan (Mitigation/Response/Recovery)	None
Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	None
Building Code	None
Floodplain Ordinance	None
Subdivision Ordinance	None
Tree Trimming Ordinance	None
Nuisance Ordinance	None
Storm Water Ordinance	None
Drainage Ordinance	None
Seismic Construction Ordinance	None
Capability	Status Including Date of Document or Policy
Site Plan Review Requirements	None
Historic Preservation Ordinance	None
Landscape Ordinance	None
Iowa Wetlands and Riparian Areas Conservation Plan	None
Debris Management Plan	None
Program	Status Including Date of Document or Policy
Zoning/Land Use Restrictions	None
Codes Building Site/Design	None
National Flood Insurance Program (NFIP) Participant	No
NFIP Community Rating System (CRS) Participating Community	None
Hazard Awareness Program	None
National Weather Service (NWS) Storm Ready	None
Building Code Effectiveness Grading (BCEGs)	None
ISO Fire Rating	None
Economic Development Program	<i>Ozark Foothills Comprehensive Economic Dev. Strat., 2018</i>
Land Use Program	None
Public Education/Awareness	None
Property Acquisition	None
Planning/Zoning Boards	None
Stream Maintenance Program	None
Tree Trimming Program	None
Engineering Studies for Streams (Local/County/Regional)	None
Mutual Aid Agreements	Yes for Fire Suppression Services
Studies/Reports/Maps	Status Including Date of Document or Policy
Hazard Analysis/Risk Assessment (Local)	<i>Yes, Carter County Hazard Mitigation Plan, 2019</i>

Hazard Analysis/Risk Assessment (County)	Yes, <i>Carter County Hazard Mitigation Plan, 2019</i>
Flood Insurance Maps	Yes
FEMA Flood Insurance Study (Detailed)	None
Evacuation Route Map	None
Critical Facilities Inventory	None
Vulnerable Population Inventory	None
Land Use Map	None
Staff/Department	Status Including Date of Document or Policy
Building Code Official	None
Building Inspector	None
Mapping Specialist (GIS)	None
Engineer	None
Development Planner	None
Public Works Official	Yes
Emergency Management Coordinator	None
NFIP Floodplain Administrator	None
Bomb and/or Arson Squad	None
Emergency Response Team	None
Hazardous Materials Expert	None
Local Emergency Planning Committee	None
County Emergency Management Commission	None
Sanitation Department	None
Transportation Department	None
Economic Development Department	None
Housing Department	None
Planning Consultant	None
Regional Planning Agencies	Yes
Historic Preservation	None
Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	None
Salvation Army	None
Capability	Status Including Date of Document or Policy
Veterans Groups	None
Environmental Organization	None
Homeowner Associations	None
Neighborhood Associations	None
Chamber of Commerce	None
Community Organizations (Lions, Kiwanis, etc.)	None
Local Funding Availability	Status Including Date of Document or Policy
Ability to apply for Community Development Block Grants	Yes
Ability to fund projects through Capital Improvements funding	Yes
Authority to levy taxes for a specific purpose	No
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	None
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	None
Ability to incur debt through private activities	None
Ability to withhold spending in hazard prone areas	None

Source: *Data Collection Questionnaire, 2018*

The following table summarizes the mitigation capabilities of Carter County, Missouri and the incorporated communities within Carter County.

Table 2.10 Mitigation Capabilities Summary Table

CAPABILITIES	Unincorporated Carter County	City of Van Buren	City of Ellsinore	City of Grandin
Planning Capabilities				
Comprehensive Plan	None	None	Yes	None
Builder's Plan	None	None	None	None
Capital Improvement Plan	None	None	None	None
Local Emergency Plan	None	None	Yes - 2012	Yes -
County Emergency Plan	Yes - 2004	Yes - 2004	Yes - 2004	Yes - 2004
Local Recovery Plan	None	None	None	None
County Recovery Plan	None	None	None	None
Local Mitigation Plan	Yes - 2019	Yes - 2019	Yes - 2019	Yes - 2019
County Mitigation Plan	Yes - 2019	Yes - 2019	Yes - 2019	Yes - 2019
Local Mitigation Plan (PDM)	None	None	None	None
County Mitigation Plan (PDM)	Yes - 2019	Yes - 2019	Yes - 2019	Yes - 2019
Debris Management Plan	None	None	None	None
Economic Development Plan	Yes –CEDS Plan 2018	Yes -CEDS Plan 2018	Yes –CEDS Plan 2018	Yes –CEDS Plan 2018
Transportation Plan	Yes - July 2019	Yes - July 2019	Yes - July 2019	Yes - July 2019
Land-use Plan	None	None	None	None
Flood Mitigation Assistance (FMA) Plan	None	None	None	None

CAPABILITIES	Unincorporated Carter County	City of Van Buren	City of Ellsinore	City of Grandin
Watershed Plan	None	None	None	None
Firewise or other fire mitigation plan	None	None	None	None
School Mitigation Plan	Yes – 2019	Yes – 2019	Yes – 2019	Yes - 2019
Critical Facilities Plan (Mitigation/Response/Recovery)	None	None	None	None
Policies/Ordinance				
Zoning Ordinance	None	Yes	Yes	None
Building Code	None	Yes	None	Yes
Floodplain Ordinance	Yes	Yes	Yes	None
Subdivision Ordinance	None	None	None	None
Tree Trimming Ordinance	None	None	None	None
Nuisance Ordinance	None	Yes	None	None
Storm Water Ordinance	None	None	None	None
Drainage Ordinance	None	None	None	None
Site Plan Review Requirements	None	None	None	None
Historic Preservation Ordinance	None	None	None	None
Landscape Ordinance	None	None	None	None
Seismic Construction Ordinance	None	None	None	None
Program				
Zoning/Land Use Restrictions	None	None	None	None
Codes Building Site/Design	None	None	None	None
National Flood Insurance Program (NFIP) Participant	Yes	Yes	Yes	No
NFIP Community Rating System (CRS) Participating Community	None	None	None	None
Hazard Awareness Program	None	None	None	None
National Weather Service (NWS) Storm Ready	None	None	None	None

CAPABILITIES	Unincorporated Carter County	City of Van Buren	City of Ellsinore	City of Grandin
Building Code Effectiveness Grading (BCEGs)	No	No	No	No
ISO Fire Rating	No	No	No	No
Economic Development Program	Yes – 2018	Yes – 2018	Yes – 2018	Yes - 2018
Land Use Program	No	No	No	No
Public Education/Awareness	Yes	No	Yes	No
Property Acquisition	No	No	No	Yes
Planning/Zoning Boards	No	No	Yes	Yes
Stream Maintenance Program	No	No	No	No
Tree Trimming Program	No	No	Yes	No
Engineering Studies for Streams (Local/County/Regional)	No	No	No	No
Mutual Aid Agreements	Yes	No	Yes	Yes
Studies/Reports/Maps				
Hazard Analysis/Risk Assessment (Local)	Yes - 2019	Yes – 2019	Yes – 2019	Yes - 2019
Hazard Analysis/Risk Assessment (County)	Yes – 2019	Yes – 2019	Yes – 2019	Yes - 2019
Flood Insurance Maps	Yes – 2/4/1987	Yes – 2/4/1987	Yes – 2/4/1987	Yes – 2/4/1987
FEMA Flood Insurance Study (Detailed)	Yes – 1/23 1974	No	No	No
Evacuation Route Map	No	No	Yes	No
Critical Facilities Inventory	No	No	Yes	No
Vulnerable Population Inventory	No	No	Yes	No
Land Use Map	No	No	Yes	No

CAPABILITIES	Unincorporated Carter County	City of Van Buren	City of Ellsinore	City of Grandin
Staff/Department				
Building Code Official	No	No	No	No
Building Inspector	No	No	No	No
Mapping Specialist (GIS)	No	No	No	No
Engineer	No	No	No	No
Development Planner	No	No	No	No
Public Works Official	No	Yes	Yes	Yes
Emergency Management Coordinator	Yes	Yes	Yes	No
NFIP Floodplain Administrator	Yes	Yes	Yes	No
Bomb and/or Arson Squad	No	No	No	No
Emergency Response Team	No	No	Yes	Yes
Hazardous Materials Expert	No	No	No	No
Local Emergency Planning Committee	No	No	Yes	No
County Emergency Management Commission	Yes	Yes	Yes	No

Sanitation Department	None	None	None	None
Transportation Department	Yes	None	Yes	None
Economic Development Department	None	None	None	None
Housing Department	None	None	None	None
Planning Consultant	None	None	None	None
Regional Planning Agencies	Yes	Yes	Yes	Yes
Historic Preservation	Yes	No	No	No
Non-Governmental Organizations (NGOs)				
American Red Cross	No	No	No	No
Salvation Army	No	No	No	No
Veterans Groups	No	No	No	No
Environmental Organization	No	No	No	No
Homeowner Associations	Yes	No	No	No
Neighborhood Associations	No	No	No	No
Chamber of Commerce	Yes	No	No	No
Community Organizations (Lions, Kiwanis, etc.)	No	Yes	Yes	No
Financial Resources				
Apply for Community Development Block Grants	Yes	Yes	Yes	Yes
Fund projects through Capital Improvements funding	No	Yes	Yes	Yes

CAPABILITIES	Unincorporated Carter County	City of Van Buren	City of Ellsinore	City of Grandin
Authority to levy taxes for specific purposes	No	No	No	No
Fees for water, sewer, gas, or electric services	No	Yes – Water/Sewer	Yes – Water/Sewer	Yes – Water/Sewer
Impact fees for new development	No	No	No	No
Incur debt through general obligation bonds	Yes	No	Yes	Yes
Incur debt through special tax bonds	Yes	Yes	No	No
Incur debt through private activities	No	No	Yes	No
Withhold spending in hazard prone areas	No	No	No	No

Source: *Data Collection Questionnaires, 2018*

2.2.5 Special District

There are no special districts represented in Carter County.

2.2.6 Public School District Profiles and Mitigation Capabilities

Both school districts within Carter County, Missouri participated within the current plan update. The two school Districts include Van Buren R-I School district and East Carter County R-2 School District. Van Buren R-I School School District is headquartered in Van Buren, Missouri while Ellsinore R-2 is headquartered in Ellsinore, Missouri. A map of the school districts within Carter County is depicted below.

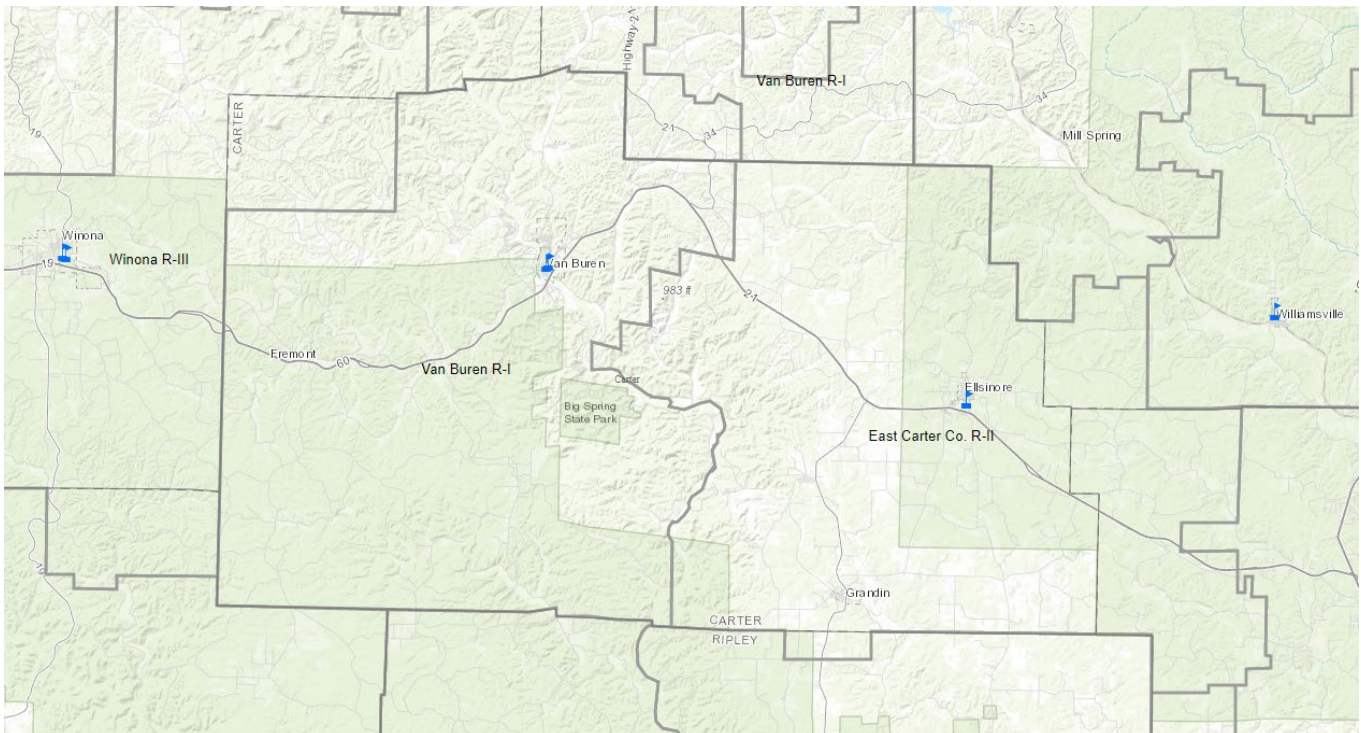


Table 2.11 Van Buren R-I and East Carter County R-2 Buildings and Enrollment Data, 2019

District Name	Building Name	Building Enrollment
Van Buren R-I School District	Elementary School	293
Van Buren R-I School District	High School	213
East Carter County R-2 School District	Elementary School	302
East Carter County R-2 School District	Middle School	150
East Carter County R-2 School District	High School	224

<http://mcds.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx>

Table 2.12 below summarizes the school districts capabilities for hazard mitigation. The information in this table was also received from the completed *Data Collection Questionnaires*.

Table 2.12 Summary of Mitigation Capabilities-School District Van Buren R-I, East Carter County R-II

Capability	Van Buren R-I School District	East Carter County R-2 School District
Planning Elements		
Master Plan/ Date	Yes 08/2010	Yes 12/2016
Capital Improvement Plan/Date	Yes 08/2010	Yes 01/2015
School Emergency Plan / Date	Yes 08/2010	Yes 09/2017
Weapons Policy/Date	Yes 08/2017	Yes
Personnel Resources		
Full-Time Building Official (Principal)	Yes Principal	Yes Principal
Emergency Manager	Yes Superintendent	Yes Superintendent
Grant Writer	No	No
Public Information Officer	Yes Superintendent	Yes Superintendent
Financial Resources		
Capital Improvements Project Funding	Yes	Yes
Local Funds	Yes	Yes
General Obligation Bonds	Yes	Yes
Special Tax Bonds	No	No
Private Activities/Donations	No	No
State and Federal Funds/Grants	Yes	Yes
Other		
Public Education Programs	Yes	Yes
Capability	Van Buren R-I School District	East Carter County R-2 School District
Privately or Self-Insured?	Privately	Privately
Fire Evacuation Training	Yes	Yes
Tornado Sheltering Exercises	Yes	Yes
Public Address/Emergency Alert System	Yes	Yes
NOAA Weather Radios	Yes	Yes
Lock-Down Security Training	Yes	Yes
Mitigation Programs	Yes	Yes
Tornado Shelter/Saferoom	Yes	Yes
Campus Police	Yes	Yes

Source: Data Collection Questionnaires, 2019

3 RISK ASSESSMENT

3.1 Hazard Identification	3.4
3.1.1 <i>Review of Existing Mitigation Plans</i>	3.4
3.1.2 <i>Review Disaster Declaration History</i>	3.5
3.1.3 <i>Research Additional Sources</i>	3.6
3.1.4 <i>Hazards Identified</i>	3.9
3.1.5 <i>Multi-Jurisdictional Risk Assessment</i>	3.10
3.2 Assets at Risk	3.10
3.2.1 <i>Total Exposure of Population and Structures</i>	3.10
3.2.2 <i>Critical and Essential Facilities and Infrastructure</i>	3.12
3.2.3 <i>Other Assets</i>	3.17
3.3 Land Use and Development	3.19
3.3.1 <i>Development Since Previous Plan Update</i>	3.19
3.3.2 <i>Future Land Use and Development</i>	3.20
3.4 Hazard Profiles, Vulnerability, and Problem Statements	3.20
Hazard Profiles	3.20
Vulnerability Assessments	3.22
Problem Statements	3.23
3.4.1 <i>Flooding (Riverine and Flash)</i>	3.24
Hazard Profile	3.24
Vulnerability.....	3.31
Problem Statement.....	3.32
3.4.2 <i>Dam Failure</i>	3.33
Hazard Profile	3.33
Vulnerability.....	3.36
Problem Statement.....	3.38
3.4.3 <i>Earthquakes</i>	3.38
Hazard Profile	3.38
Vulnerability.....	3.43
Problem Statement.....	3.44
3.4.4 <i>Land Subsidence/Sinkholes</i>	3.44
Hazard Profile	3.44
Vulnerability.....	3.45
Problem Statement.....	3.46
3.4.5 <i>Drought</i>	3.47

Hazard Profile	3.47
Vulnerability.....	3.52
Problem Statement.....	3.53
3.4.6 Extreme Temperatures.....	3.54
Hazard Profile	3.54
Vulnerability.....	3.59
Problem Statement.....	3.60
3.4.7 Severe Thunderstorms Including High Winds, Hail, & Lightning	3.61
Hazard Profile	3.61
Vulnerability.....	3.68
Problem Statement.....	3.69
3.4.8 Severe Winter Weather.....	3.70
Hazard Profile	3.70
Vulnerability.....	3.75
Problem Statement.....	3.76
3.4.9 Tornado.....	3.76
HazardProfile.....	3.76
Vulnerability.....	3.80
Problem Statement.....	3.81
3.4.10 Wildfires.....	3.82
Hazard Profile	3.82
Vulnerability.....	3.83
Problem Statement.....	3.84

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

Following is a community-wide risk assessment for Carter County, Missouri. The data used to compile this assessment can be found throughout the body of this document, primarily in the profile of each hazard and capabilities of each jurisdiction. The natural hazards discussed throughout this document were examined using available data relevant and necessary for determining the types of hazard, frequency and strength of those hazards, areas vulnerable to those hazards, potential impacts, and probability that each hazard will occur.

The goal of the risk assessment is to estimate potential loss in the planning area, including loss of life, personal injury, property damage, and economic loss, from a hazard event. The risk assessment process allows communities and school/special districts in the planning area to better understand their potential risk to the identified hazards. It will provide a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

The previously approved Carter County Hazard Mitigation Plan was approved in April of 2013. Since that time there has been little change in the development of the county. Carter County has had a negligible population decrease of 10 persons since the last update occurred. There have been no areas annexed by any of the cities within Carter County in the past five years. Officials also report that there have not been any large multifamily housing complexes constructed.

This chapter is divided into four main parts:

- **Section 3.1 Hazard Identification** identifies the hazards that threaten the planning area and provides a factual basis for elimination of hazards from further consideration;
- **Section 3.2 Assets at Risk** provides the planning area's total exposure to natural hazards considering critical facilities and other community assets at risk;
- **Section 3.3 Land Use and Development** discusses development that has occurred since the last plan update and any increased or decreased risk that resulted. This section also discusses areas of planned future development and any implications on risk/vulnerability; and,
- **Section 3.4 Hazard Profiles and Vulnerability Analysis** provides more detailed information about the hazards impacting the planning area. For each hazard, there are three sections:
 - 1) Hazard Profile provides a general description and discusses the threat to the planning area, the geographic location at risk, potential severity/magnitude/extent, previous occurrences of hazard events, probability of future occurrence, risk summary by jurisdiction, impact of future development on the risk;
 - 2) Vulnerability Assessment further defines and quantifies populations, buildings, critical facilities, and other community/school or special district assets at risk to natural hazards; and,

-
- 3) Problem Statement briefly summarizes the problem and develops possible solutions.

3.1 Hazard Identification

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

The Carter County Hazard Mitigation Planning Committee has determined that this updated plan, as with past county plans, will address only natural hazards. Natural hazard has been defined by I. Burton, R. Kates, and G. W hite in *The Environment as Hazard*, as “those elements of the physical environment, harmful to man and caused by forces extraneous to him.” Consistent with this definition, war, chemical contamination, and other manmade phenomena are excluded from classification as natural hazards.

Natural hazards can take many forms (e.g. tornado, wildfire, flood, landslide, and earthquake). Happenings such as those listed above, which occur in a populated area, are, according to the Organization of American States, referred to as hazardous events. It is not until significant property damage and loss of life result from a natural hazard that the phenomena can legitimately be classified as a natural disaster.

3.1.1 Review of Existing Mitigation Plans

The planning committee reviewed the hazard identified in the 2013 Carter County Hazard Mitigation Plan. In the 2013 plan there were ten natural hazards that were identified:

- Tornado
- Floods
- Severe Winter Weather
- Drought
- Heat Wave
- Earthquake
- Dam Failure
- Levee Failure
- Wildfire
- Land Subsidence/Sinkholes

The planning committee reviewed these hazards and compared them to the known historical hazards that have impacted jurisdictions within Carter County. After this review the committee added the hazard of thunderstorm/high winds/lightning/hail to the above list. The committee then decided to order the hazards alphabetically for cleaner presentation in this updated version of the hazard mitigation plan. Levee failure will not be reviewed in this plan, according to the Carter County Commission no levees exist within Carter County. The updated plan will review and analyze the following natural hazards in the order listed below:

- Flooding
- Dam Failure
- Earthquakes
- Land Subsidence/Sinkholes
- Drought

-
- Extreme Temperatures
 - Severe Thunderstorms Including High Winds, Hail, and Lightning
 - Severe Winter Weather
 - Tornado
 - Wildfire

All of the above listed phenomena have either occurred within Carter County at some point in time, or could occur given the geography and other environmental conditions which exist within the county. Some of the above hazards are more likely to occur in this area, while some are less likely. In the pages that follow, each hazard will be described, its history of occurrence in Carter County examined, and its probability of reoccurrence assessed.

Due to the location and geography of Carter County, the occurrence of certain natural hazards, which may take place elsewhere in the world, is virtually impossible. The following list contains natural hazards, which have been determined to be insignificant threats within Carter County:

- Hurricane and other Tropical Storm-related phenomena
- Tsunami
- Volcano and other volcanic-related phenomena
- Arid and Semi-Arid-related phenomena
- Levee Failure

Hurricanes, tropical storms, and tsunamis do not occur in or near Carter County due to its central location within North America. Furthermore, the geologic and soil structure found in Carter County does not encourage volcanic activity. Because of this, there are no volcanoes within or near the county. As stated above, no levees exist in Carter County. Finally, arid and semi-arid-related phenomena do not occur in Carter County due to its climate and geology.

The planning committee discussed including man-made hazard in the *Carter County Hazard Mitigation Plan*. However, as only natural hazards are required by FEMA regulations, the committee decided to only include natural hazards.

3.1.2 Review Disaster Declaration History

The federal government may, at times, issue disaster declarations. These declarations are made when the severity and magnitude of an event surpasses the ability of the local government to respond and recover without assistance. The first step in the declaration process is that a state may issue a disaster declaration that would allow for the provision of assistance to the local jurisdictions from the state government. If the disaster is so severe that both the local and state governments' capacities are surpassed, a federal emergency or disaster may be declared, allowing for assistance to be provided to local jurisdictions from the federal government.

The Stafford Act provides for two types of disaster declarations: emergency declarations and major disaster declarations. All declarations discussed within this plan are major disaster declarations. The emergency declarations authorize the President to provide supplemental disaster assistance. A major disaster declaration provides for a wide range of federal assistance programs for individuals and public entities for both emergency and permanent repairs.

Individual assistance includes assistance to individuals and households for things such as crisis

counseling, case management, unemployment assistance, legal services and supplemental nutrition assistance program. Public assistance provides assistance to states, tribes, and local governments for things such as debris removal, emergency protective measures, roads and bridges, water control facilities, buildings and equipment, utilities, and park, recreational and other facilities.

FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs of major disaster declarations. Determinations for declaration type are based on scale and type of damages and institutions or industrial sectors affected.

The following table (**Table 3.1**) is a list of all federal disaster declarations issued from 1990-2016 that covered Carter County. The table lists the disaster number, a short description, the date of declaration, the period of incident, and the amounts of Individual Assistance (IA) and Public Assistance (PA) provided for the entire State of Missouri.

Table 3.1 FEMADisaster Declarations that included Carter County, Missouri, 1990-2017

Disaster Number	Description	Declaration Date Incident Period	Individual Assistance (IA) Public Assistance (PA)
DR-4317	Severe Storms, Tornadoes, Straight Line Winds, Flooding	6/2/2017 4/28/2017 – 5/11/2017	IA-\$12,527,583.31 PA-\$64,268,021.45
EM-3374	Severe Storms, Tornadoes, Straight Line Winds, Flooding	1/2/2016 12/22/2018 – 1/9/2016	N/A
DR-1980	Severe Storms, Flooding, Tornado	5/9/2011 4/19/2011 – 6/6/2011	IA - \$37,062,310.48 PA-\$160,170,851.47
EM-3317	Severe Winter Storm	2/3/2011 1/31/2011 – 2/5/2011	N/A
DR-1822	Severe Winter Storms	2/17/2009 1/26/2009 – 1/28/2009	PA-\$135,879,596.0
EM-3303	Severe Winter Storms	1/30/2009 1/29/2009 – 1/28/2009	N/A
DR-1809	Severe Storm, Flooding, Tornadoes	11/13/2008 9/11/2008 – 9/24/2008	IA - \$6,869,983.55 PA - \$8,529,243.13
DR-1749	Flooding, Severe Storm	3/19/2008 3/17/2008 – 5/9/2008	IA - \$13,924,227.09 PA - \$26,045,574.54
DR-1748	Severe Winter Storms, Flooding	3/12/2008 2/10/2008 – 2/14/2008	PA-\$10,068,998.77
EM-3281	Severe Winter Storm	12/12/2007 12/8/2007 – 12/15/2007	N/A
EM-3232	Hurricane Katrina Evacuation Route	9/10/2005 8/29/2005 – 10/1/2005	N/A
DR-1412	Severe Storms, Tornadoes, and Flooding	5/6/2002 4/24/2002 – 6/10/2002	PA - \$35,299,777.93
DR-1006	Severe Storms, Tornadoes, and Flooding	12/1/1993 11/13/1993 – 11/19/1993	N/A

Source: Federal Emergency Management Agency <http://www.fema.gov/disasters>

3.1.3 Research Additional Sources

A number of sources were utilized for research during the development of this plan. Data sources used for this plan includes the following:

-
- *Missouri Hazard Mitigation Plans* (2018)
 - Previously approved *Carter County Hazard Mitigation Plan* (2013)
 - Federal Emergency Management Agency (FEMA)
 - Missouri Department of Natural Resources (MDNR)
 - National Drought Mitigation Center Drought Reporter
 - US Department of Agriculture's (USDA) Risk Management Agency Crop Insurance Statistics
 - National Agricultural Statistics Service (Agriculture production/losses)
 - Data Collection Questionnaires completed by each jurisdiction
 - State of Missouri GIS data
 - Environmental Protection Agency
 - Flood Insurance Administration
 - Hazards US (HAZUS)
 - Missouri Department of Transportation
 - Missouri Division of Fire Marshal Safety
 - National Fire Incident Reporting System (NFIRS)
 - National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI)
 - Carter County Emergency Management Agency
 - Carter County Flood Insurance Rate Map, FEMA
 - Flood Insurance Study, FEMA
 - SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin
 - U.S. Army Corps of Engineers
 - U.S. Department of Transportation
 - United States Geological Survey (USGS)
 - Various articles and publications available on the internet (citations provided in the body of the plan when applicable).

The only centralized source of data for many of the weather-related hazards is the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI). Although it is usually the best and most current source, there are limitations to the data which should be noted. The NCEI documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce. In addition, it is a partial record of other significant meteorological events, such as record maximum or minimum temperatures or precipitation that occurs in connection with another event. Some information appearing in the NCEI may be provided by or gathered from sources outside the National Weather Service (NWS), such as the media, law enforcement and/or other government agencies, private companies, individuals, etc. An effort is made to use the best available information but because of time and resource constraints, information from these sources may be unverified by the NWS.

The NCEI damage amounts are estimates received from a variety of sources, including those listed above in the Data Sources section. For damage amounts, the NWS makes a best guess using all available data at the time of the publication. Property and crop damage figures should

be considered as a broad estimate. Damages reported are in dollar values as they existed at the time of the storm event and do not represent current dollar values.

The database currently contains data from January 1950 to March 2014, as entered by the NWS. Due to changes in the data collection and processing procedures over time, there are unique periods of record available depending on the event type. The following timelines show the different time spans for each period of unique data collection and processing procedures.

1. Tornado: From 1950 through 1954, only tornado events were recorded.
2. Tornado, Thunderstorm Wind and Hail: From 1955 through 1992, only tornado, thunderstorm wind and hail events were keyed from the paper publications into digital data. From 1993 to 1995, only tornado, thunderstorm wind and hail events have been extracted from the Unformatted Text Files.
3. All Event Types (48 from Directive 10-1605): From 1996 to present, 48 event types are recorded as defined in NWS Directive 10-1605.

Injuries and deaths caused by a storm event are reported on an area-wide basis. When reviewing a table resulting from an NCEI search by county, the death or injury listed in connection with that county search did not necessarily occur in that county. When local information is available, the information regarding the numbers of injuries and deaths are listed specifically for Carter County.

3.1.4 Hazards Identified

Not all of the hazards included in this plan impact the entire planning area in the same manner; yet, some hazards do have the potential to impact the entire planning area. For example, winter weather will impact the entire planning area as the county, all cities and school districts will be impacted to some degree when severe winter weather strikes the county. The table below lists each jurisdiction and each hazard. An “x” indicates that the hazard has the potential to impact a jurisdiction whereas an “-” indicates the hazard is not applicable to the jurisdiction.

Table 3.2. Hazards Identified for Each Jurisdiction

Jurisdiction	Dam Failure	Drought	Earthquake	Extreme Heat	Fires (Structural/Urban/Wild)	Flooding (River and Flash)	Land Subsidence/Sinkholes	Severe Winter Weather	Thunderstorm/Lightning/Hail/High Wind	Tornado
Carter County	x	x	x	x	x	x	x	x	x	x
City of Van Buren	x	-	x	x	x	x	x	x	x	x
City of Ellsinore	-	-	x	x	x	x	x	x	x	x
City of Grandin	-	-	x	x	x	x	x	x	x	x
Schools and Special Districts										
Van Buren School District	x	x	x	x	x	x	x	x	x	x
East Carter County School District	-	x	x	x	x	x	x	x	x	x

3.1.5 Multi-Jurisdictional Risk Assessment

Following is a multi-jurisdictional hazard profile for Carter County, Missouri and all the jurisdictions within the boundaries of Carter County. The data used to compile this assessment can be found throughout the body of Section 3 as well as the tables included in this section. This plan is an update of the *Carter County Natural Hazard Mitigation Plan* approved in 2013. The data and information included reflect changes and updates in the time since the approval.

Each of the hazards has a profile that includes an assessment of the risks to the local participating jurisdictions. Some hazards, such as flooding, vary in risk across the planning area. These variations in risk are discussed within the profile of each hazard.

Carter County is located in the western portion of the Ozark Foothills Region. The climate in Carter County is consistent throughout the year; temperatures and precipitation are fairly uniform. There are some variations of topography throughout the county. A variety of recreational areas, including Mark Twain National Forest, Current River, Ozarks National Scenic Riverways, Big Spring State Park, and the Irish Wilderness are also located in Carter County. These topographical differences and the relative impact of hazards will be discussed in more detail throughout the hazard profiles.

In addition to topographical differences there are other variations across the county that will be discussed in greater detail throughout the hazard profiles. Some of these differences include the locations of dams that can impact certain areas, flooding that will impact different areas of the county in various extents, and sinkholes.

3.2 Assets at Risk

This section assesses the planning area population, structures, critical facilities and infrastructure, and other important assets that maybe at risk of damage from natural hazards. There have been limited changes to the planning areas since the approval of the *2013 Carter County Hazard Mitigation Plan*.

Missouri Mitigation Viewer

With the 2018 Hazard Mitigation Plan Update, SEMA now provides online access to risk assessment data and associated mapping for the 114 counties in the State, including the independent City of St. Louis. Through the web-based Missouri Hazard Mitigation Viewer, local planners or other interested parties can obtain all State Plan datasets.

The Missouri Hazard Mitigation Viewer includes a Map Viewer with a legend of clearly labeled features, a north arrow, a base map that is either aerial imagery or a street map, risk assessment data symbolized the same as in the 2018 State Plan for easy reference, search and query capabilities, ability to zoom to county level data and capability to download PDF format maps. The Missouri Hazard Mitigation Viewer can be found at this link:

- <http://bit.ly/MoHazardMitigationPlanViewer2018>
 - <http://drive.google.com/file/d/1bPkc0jgF9ofwQLnTL9N0u-oPFWi9hkst/view> - User Guide
- Assets at Risk available from the Mitigation Viewer include:
- State Owned Facilities
 - State Leased Facilities

- Department of Higher Education Facilities
- State Owned Bridges

Flood Risk Datasets

Data sources include:

- FEMA Flood Insurance Rate Maps (FIRM)
<https://msc.fema.gov/portal/home>
- FEMA National Flood Hazard Layer
<https://hazards.fema.gov/femaportal/wps/portal/NFHLWMS>
- FEMA Hazus Program
<https://www.fema.gov/hazus>
- SEMA Flood Mapping Project Status for Missouri Counties
<http://bit.ly/MOSEMAOutreach>
- 2010 US Census Population and Housing Unit Counts
<https://www.census.gov/geo/maps-data/data/tiger-data.html>

Assets at risk in Carter County include one state-leased facility within .05 buffer of Tier II facilities and 32 state-owned bridges.

3.2.1 Total Exposure of Population and Structures

For the 2018 State Plan, SEMA utilized a structure inventory dataset developed by the University of Missouri GIS Department (MSDIS) to determine the number of structures exposed to risks. MSDIS created a point and/or footprint dataset for every roof line in every county in the state of Missouri. This dataset is attributed with the type of structure such as Residential, Commercial, etc.

In the following three tables, population data is based on 2010 Census Bureau data. Building counts and building exposure values are based on parcel data provided by the State of Missouri Geographic Information Systems (GIS) database which can be obtained directly from the SEMA Mitigation Management Section. Contents exposure values were calculated by factoring a multiplier to the building exposure values based on usage type. The multipliers were derived from the HAZUS MH 2.1 and are defined below in **Table 3.3**. Land values have been purposely excluded from consideration because land remains following disasters, and subsequent market devaluations are frequently short term and difficult to quantify. Another reason for excluding land values is that state and federal disaster assistance programs generally do not address loss of land (other than crop insurance). It should be noted that the total valuation of buildings is based on Carter County Assessors' data which may not be current. In addition, government-owned properties are usually taxed differently or not at all, and so may not be an accurate representation of true value. Note that public school district assets and special districts assets are included in the total exposure tables by community and county.

Table 3.3 shows the total population, building count, estimated value of buildings, estimated value of contents and estimated total exposure to parcels for the unincorporated portion of the county and each incorporated city. **Table 3.4** that follows provide the building value exposures for the county and each city in the planning area broken down by usage type. Finally, **Table 3.5** provides the building count

total for the county and each city in the planning area broken out by building usage types (i.e. residential, commercial, industrial, and agricultural). Values are in thousands of dollars.

Table 3.3. Maximum Population and Building Exposure by Jurisdiction-

Jurisdiction	2010 Population	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
City of Van Buren	511	316	46,652	27,096	73,748
City of Ellsinore	1,977	1,221	24,655	12,486	37,141
City of Grandin	342	211	15,320	8,243	23,563
Unincorporated Carter County	10,5022	6,487	240,087	132,578	372,665
Totals	13,521	8,352	326,713	180,404	507,117

Sources: Population, 2010 U.S. Census; Building Count and Building Exposure, Missouri GIS Database: http://sema.dps.mo.gov/programs/mitigation_management_ent.php; Contents Exposure derived by applying multiplier to Building Exposure based on HAZUS MH 2.1 standard contents multipliers per usage type as follows: Residential (50%), Commercial (100%), Industrial (150%), Agricultural (100%). For purposes of these calculations, government, school, and utility were calculated at the commercial contents rate.

Table 3.4. Building Values/Exposure by Usage Type

The table below calculates the total value of buildings and contents within each jurisdiction of the County. The total exposure values for the County were derived from the inventory data associated with FEMA's loss estimation software Hazus. Content values were also included and were estimated as a percentage of building value based on their property type, using FEMA/HAZUS estimated content replacement values. Those content values are 50% residential, 100% commercial and governmental and 150% for industrial. Values are in the thousands of dollars.

Building Value

Jurisdiction	Agriculture	Commercial	Education	Government	Industrial	Residential	Grand Total
Carter	\$1,670	\$9,058	\$0	\$0	\$8,841	\$220,518	\$240,087
Ellsinore	\$4	\$1,575	\$4,436	\$3,182	\$0	\$15,457	\$24,655
Grandin	\$15	\$1,181	\$0	\$0	\$0	\$14,123	\$15,320
Van Buren	\$1	\$11,027	\$3,486	\$0	\$0	\$32,138	\$46,652
Grand Total	\$1,690	\$22,842	\$7,922	\$3,182	\$8,841	\$282,237	\$326,713

Content Value

Jurisdiction	Agriculture	Commercial	Education	Government	Industrial	Residential	Grand Total
Carter	\$0	\$9,058	\$0	\$0	\$13,261	\$110,259	\$132,578
Ellsinore	\$0	\$1,575	\$0	\$3,182	\$0	\$7,729	\$12,486
Grandin	\$0	\$1,181	\$0	\$0	\$0	\$7,061	\$8,243
Van Buren	\$0	\$11,027	\$0	\$0	\$0	\$16,069	\$27,096
Grand Total	\$0	\$22,842	\$0	\$3,182	\$13,261	\$141,118	\$180,404

Total Value

Jurisdiction	Agriculture	Commercial	Education	Government	Industrial	Residential	Grand Total
Carter	\$1,670	\$18,116	\$0	\$0	\$22,102	\$330,777	\$372,665
Ellsinore	\$4	\$3,151	\$4,436	\$6,364	\$0	\$23,186	\$37,141
Grandin	\$15	\$2,363	\$0	\$0	\$0	\$21,184	\$23,563
Van Buren	\$1	\$22,054	\$3,486	\$0	\$0	\$48,207	\$73,748
Grand Total	\$1,690	\$45,684	\$7,922	\$6,364	\$22,102	\$423,355	\$507,117

Source: Missouri GIS Database, http://sema.dps.mo.gov/programs/mitigation_management.php;

Table 3.5. Building Counts by Usage Type

Jurisdiction	Agriculture	Commercial	Education	Government	Industrial	Residential	Grand Total
Carter	1401	23			27	1983	3434
Ellsinore	3	4	14	2		139	162
Grandin	13	3				127	143
Van Buren	1	28	11			289	329
Grand Total	1418	58	25	2	27	2538	4068

Source: Missouri GIS Database, http://sema.dps.mo.gov/programs/mitigation_management.php; Public School Districts and Special Districts

Even though schools and special districts' total assets are included in the tables above, additional discussion is needed, based on the data that is available from the districts' completion of the Data Collection Questionnaire and district maintained websites. The number of enrolled students at the participating school districts is provided in **Table 3.6** below. Additional information includes the number of buildings including sheds and other small service buildings, building values (building exposure) and contents value (contents exposure). These numbers will represent the total enrollment and building count for the public school districts regardless of the county in which they are located.

Table 3.6. Population and Building Exposure by Public School Districts

Public School District	Enrollment	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
East Carter County R-2	812	13	\$22,090,717	\$3,624,080	\$25,714,797
Van Buren R-1	1,000	11	\$29,425,668	\$4,117,493	\$33,543,161

Source: <http://mcids.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx>

Carter County is a Paper Only Map at the current time and digital floodplains are not available as of yet. SEMA has received special funds under the Paper Inventory Reduction (PIR) funding mechanism to update the floodplains countywide. SEMA is currently developing that data and plans to have draft data available for the county/communities to review in the coming months. The data will not be ready in time to use for the current update of the Carter County Hazard Mitigation Plan, but it should be noted that the process is underway and the new data will be ready to use in the next plan update.

3.2.2 Critical and Essential Facilities and Infrastructure

This section will include information from the Data Collection Questionnaire and other sources concerning the vulnerability of participating jurisdictions' critical, essential, high potential loss, and transportation/lifeline facilities to identified hazards. Definitions of each of these types of facilities are provided below.

- **Critical Facility:** Those facilities essential in providing utility or direction either during the response to an emergency or during the recovery operation.
- **Essential Facility:** Those facilities that, if damaged, would have devastating impacts on disaster response and/or recovery.
- **High Potential Loss Facilities:** Those facilities that would have a high loss or impact on the community.
- **Transportation and Lifeline Facilities:** Those facilities and infrastructure critical to transportation, communications, and necessary utilities.

Table 3.7 includes a summary of the inventory of critical and essential facilities and infrastructure in the planning area. The list was compiled from the Data Collection Questionnaires as well as the following sources:

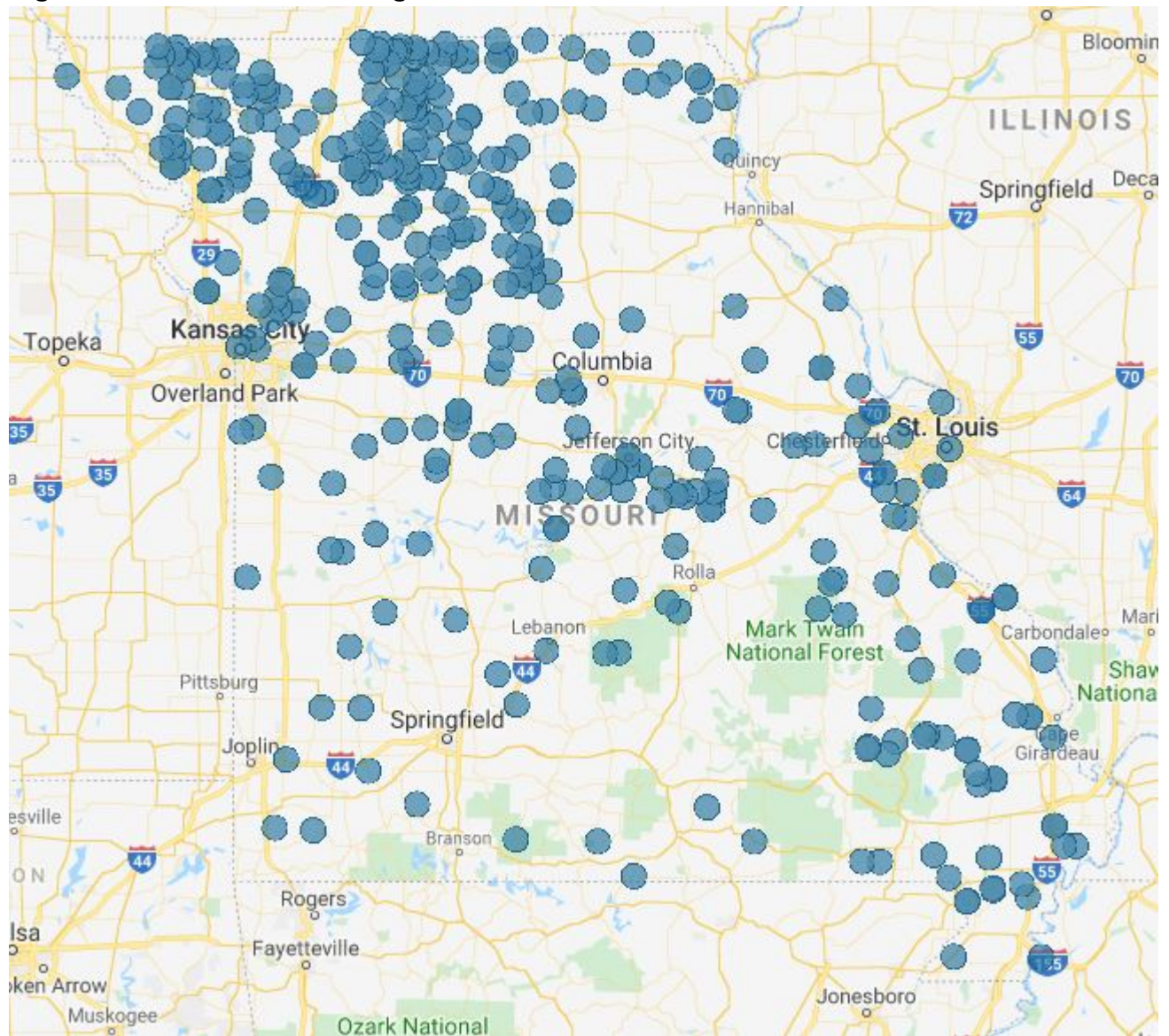
- 2018 Missouri State Hazard Mitigation Plan and Hazard Mitigation Viewer <http://bit.ly/MoHazardMitigationPlanViewer2018>
- Chemical Facilities (Tier II Facilities) information can be obtained by contacting the county LEPC. The LEPC will then request information (name, address, purpose for asking, etc.) and then provide the information. In order to find out who the LEPC contact is for your planning areas, see https://semo.dps.mo.gov/docs/programs/executive/MERC/LEPC_Manual/LEPC-addresses.pdf
- HAZUS contains an inventory of critical facilities that can be exported for each jurisdiction.
- The Homeland Security Infrastructure Protection Program (HSIPP) is another source.

Table 3.7. Inventory of Critical/Essential Facilities and Infrastructure by Jurisdiction

Jurisdiction	Airport Facility	Bus Facility	Childcare Facility	Communications Tower	Electric Power Facility	Emergency Operations	Fire Service	Government	Housing	Shelters	Highway Bridge	Hospital/Health Care	Military	Natural Gas Facility	Nursing Homes	Police Station	Potable Water Facility	Rail	Sanitary Pump Stations	School Facilities	Stormwater Pump Stations	Tier II Chemical Facility	Wastewater Facility	Total
City of Van Buren	1	0	1	1	1	1	1	1	0	0	1	1	0	0	1	1	1	0	1	2	0	0	1	16
City of Ellsinore	0	0	1	1	1	0	1	1	0	0	1	1	0	0	1	1	1	0	1	3	0	0	1	15
City of Grandin	0	0	1	1	1	0	1	1	0	0	1	0	0	0	0	1	1	0	1	0	0	0	1	10
Unincorporated Carter County	0	0	0	1	1	0	0	2	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	7

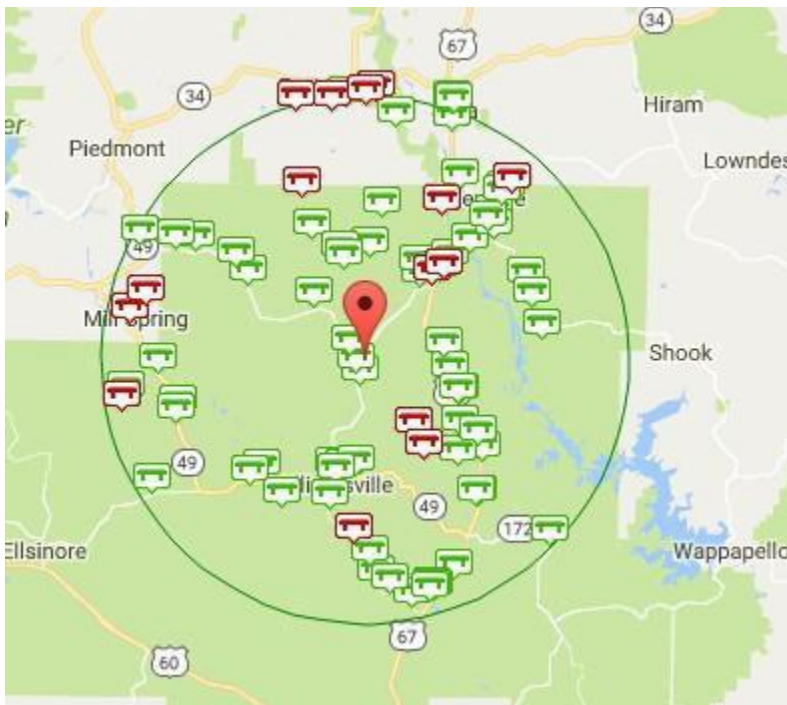
Bridges: The map below shows the locations of bridges in the planning area included in the National Bridge Inventory data set. The blue dots on the map identify which bridges are “scour critical.” The term “scour critical” refers to one of the database elements in the National Bridge Inventory. This element is quantified using a “scour index”, which is a number indicating the vulnerability of a bridge to scour during a flood. Bridges with a scour index between 1 and 3 are considered “scour critical”, or a bridge with a foundation determined to be unstable for the observed or elevated scour condition. There are no scour critical bridges identified in Carter County.

Figure 3.1. Scour Critical Bridges



Source: *National Bridge Inventory, 2019*

Figure 3.2. County Bridges



According to the National Bridge Inventory there are 47 bridges located within Carter County. Three bridges are in poor condition, 32 are in fair condition, and the remainder are in good condition.

3.2.3 Other Assets

Assessing the vulnerability of the planning area to disaster also requires data on the natural, historic, cultural, and economic assets of the area. This information is important for many reasons.

- These types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- Knowing about these resources in advance allows for consideration immediately following a hazard event, which is when the potential for damages is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- The presence of natural resources can reduce the impacts of future natural hazards, such as wetlands and riparian habitats which help absorb floodwaters.
- Losses to economic assets like these (e.g., major employers or primary economic sectors) could have severe impacts on a community and its ability to recover from disaster.

Threatened and Endangered Species: Table 3.8 below shows federally threatened and endangered species within the planning area.

Table 3.8. Threatened and Endangered Species in Carter County

Common Name	Scientific Name	Status
Gray Bat	Myotis Grisescens	Endangered
Indian Bat	Myotis Sodalis	Endangered
Northern Long Eared Bat	Myotis Septentrionalis	Threatened
Ozark Hellbender	Cryptobranchus Alleganiensis Bishopi	Endangered
Curtis Pearlymussel	Epioblasma Florentina Curtisi	Endangered
Pink Mucket	Lampsilis Abrupta	Endangered
Snuffbox	Epioblasma Triquetra	Endangered

Source: U.S. Fish and Wildlife Service, <https://ecos.fws.gov/ipac/location/FPP2Q5A5MFBK7HPQPLDUBVYFJM/resources>

Natural Resources: The Missouri Department of Conservation (MDC) provides a database of lands the MDC owns, leases, or manages for public use. **Table 3.9** below provides the names and locations of parks and conservation areas in the planning area.

Table 3.9. Parks in Carter County

Area Name	Address	City/Community
Carter Creek CA	County Road 21-306	Van Buren
Hunter Towersite	County Road 0-251	Hunter
Miller CL	Highway 21 North	Van Buren
Peck Ranch CA	Highway H	Fremont
Van Buren Riverfront Park	Main Street	Van Buren

Source: https://nature.mdc.mo.gov/discover-nature/find/places?area_name=&counties=5689&location%5Bdistance%5D=50&location%5Borigin%5D=

Historic Resources: The National Register of Historic Places is the official list of registered cultural resources worthy of preservation. It was authorized under the National Historic Preservation Act of 1966 as part of a national program. The purpose of the program is to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources. The National Register is administered by the National Park Service under the Secretary of the Interior. Properties listed in the National Register include districts, sites, buildings, structures and objects that are significant in American history, architecture, archeology, engineering, and culture.

Properties in Carter County that are listed upon the National Register of Historic Places are shown in **Table 3.10** below.

Table 3.10. Carter County Properties on the National Register of Historic Places

Property	Address	City	Date Listed
Mrs. Louis Bedell House	3 rd and Maple Streets	Grandin	10/14/81
Earl Boyer House	5 th Street	Grandin	10/14/81
Big Spring Historic District	MO 103	Van Buren	1/18/90
J.W. Gibson House	6 th and Pine Streets	Grandin	10/14/81
Gooseneck Site	Address restricted	Restricted	1/18/90
Delia Greensfelder House	4 th and Cherry Streets	Grandin	10/14/81
Loretta Herrington House	5 th Street	Grandin	10/14/81
James Hinton House	Walnut Street	Grandin	10/14/81
Nettie Jacobson House	6 th and Oak Streets	Grandin	10/14/81
Issac Kelley Site	Address restricted	Restricted	2/4/88

Nola Kitterman House	6 th Street	Grandin	10/14/81
Wallace Knapp House	6 th and S. Elm Streets	Grandin	10/14/81
Buford Lawhorn House	6 th Street	Grandin	10/14/81
Iva Lewis House	6 th Street	Grandin	10/14/81
Masonic Lodge	5 th and Elm Streets	Grandin	10/14/81
Terry Mays House	6 th and S. Plum Streets	Grandin	10/14/81
Thornton NcNew House	6 th and Spruce Streets	Grandin	10/14/81
Mill Pond	MO 21	Grandin	10/14/81
Della Nance House	6 th Street	Grandin	10/14/81
Hazel Owens House	5 th Street	Grandin	10/14/81
Sixth Street Historic District	6 th Street	Grandin	10/14/81
James Smith House	6 th Street	Grandin	10/14/81
Lawrence Smith House	3 rd Street	Grandin	10/14/81
William F. Smith House	6 th Street	Grandin	10/14/81
Lee Tucker House	3 rd Street	Grandin	10/14/81

Source: Missouri Department of natural Resources – Missouri National Register Listings by County <http://dnr.mo.gov/shpo/mnrlist.htm>

The table below list the major non-government employers that reside within Carter County.

Table 3.11. Major Non-Government Employers in Carter County

Employer Name	Main Locations	Product or Service	Employees
Van Buren School District	Van Buren	Education	55
East Carter County School District	Ellsinore	Education	80

Source: Data Collection Questionnaires; local Economic Development Commissions

Agriculture

Agriculture plays an important role in Carter County and consists primarily of livestock farming. According to the United States Department of Agriculture 2012 Census of Agriculture, there were 196 farms in Carter County and 73,642 acres of land in farms. The market value of agricultural products sold that were produced within Carter County in 2012 was \$4,610,000. 23% of this total was crop sales at \$1,046,000 and 77% was livestock sales at \$3,564,000.

Table 3.12. Agriculture-Related Jobs in Carter County

Workers per Farm	Number of Farms	Total
1	13	13
2	7	14
3 or 4	10	30
5 to 9	3	15
10 workers or more	0	0
Total		72

Source: https://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Missouri/

3.3 Land Use and Development

3.3.1 Development Since Previous Plan Update

Table 3.13 provides the population growth statistics for all cities in Carter County as well as the unincorporated portion of the county.

Table 3.13. Carter County Population Growth, 2000-2017

Jurisdiction	Total Population 2017 estimate	Total population 2000	2000-2017 # Change	2000-2017 % Change
Unincorporated Carter County	4,667	4,497	+170	3.6%
City of Van Buren	821	845	-24	-3.2%
City of Ellsinore	443	363	+80	23%
City of Grandin	238	236	+2	0.8%

Source: U.S. Bureau of the Census, Decennial Census; Population Statistics are for entire incorporated areas as reported by the Census bureau

Population growth or decline is generally accompanied by increases or decreases in the number of housing units. **Table 3.14** provides the change in numbers of housing units in the planning area from 2000 to 2017.

Table 3.14. Change in Housing Units, 2000-2017

Jurisdiction	Housing Units 2017	Housing Units 2000	2000-2017 # Change	2000-2017 % change
Unincorporated Carter County	3,260	3,028	+232	7.5%
City Van Buren	455	440	+15	-2.1%
City of Ellsinore	274	184	+90	22.5%
City of Grandin	116	119	-3	-2.6%

Source: U.S. Bureau of the Census, Decennial Census; Population Statistics are for entire incorporated areas as reported by the U.S. Census Bureau

The 2017 American Community Survey estimates that Carter County population decreased by 10 people. As the previous data figure shows the decrease is attributed to a population decline within the City of Van Buren. The population increases in the other jurisdictions are likely created by net migration and natural births occurring in the communities.

Since the 2013 Carter County Hazard Mitigation Plan was approved, the primary change in land development has been related to the 2017 flood event (DR-4317). The changes have been due to significant infrastructure damage and the flood buyouts. Specific changes are identified below.

City of Van Buren

Van Buren is in the process of purchasing up to 10 homes in a residential buyout due to the 2017 disaster. This will alter land use and prohibit development in the buyout areas.

City of Ellsinore

Ellsinore has not experienced changes in development since the last plan update.

City of Grandin

Grandin has not experienced changes in development since the last plan update.

Unincorporated Carter County

Carter County is in the process of purchasing up to 12 homes in a residential buyout due to the 2017 disaster. This will alter land use and prohibit development in the buyout areas, located in the town of Fremont, MO.

3.3.2 Future Land Use and Development

Future Development

Plans are currently in existence for future development within the county and cities of Van Buren and Ellsinore. The previous county government offices were destroyed by the 2017 flood event. The City of Van Buren experienced similar devastation with their city governments. While they did not lose their City Hall, they did lose their Public Safety Facility.

City of Van Buren

Van Buren expects construction of a new public safety (police, fire, and ambulance) facility to begin in Spring of 2020.

City of Ellsinore

Ellsinore plans new construction of a fire house in Spring of 2020 to replace their current, deteriorating structure.

City of Grandin

Grandin is not anticipating any future development. The population in Grandin has remained flat, with little change in economic conditions.

Unincorporated Carter County

Construction of a new Justice Center, which will house a new courthouse, sheriff's office, and jail is underway.

School District's Future Development

Little future development is expected in each school district. The population of students is expected to stay the same or only show a slight increase. The facilities and classrooms currently in use will be sufficient for the planned future student population.

3.4 Hazard Profiles, Vulnerability, and Problem Statements

Each hazard has been analyzed individually in a hazard profile. The profile consists of a general hazard description, location, severity/magnitude/extent, previous events, future probability, a discussion of risk variations between jurisdictions, and how anticipated development could impact risk. At the end of each hazard profile is a vulnerability assessment, followed by a summary problem statement.

Hazard Profiles

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

Each hazard identified in Section 3.1.4 has been profiled individually in this section in alphabetical order. The level of information presented in the profiles varies by hazard based on the information available. With each update of this plan, new information will be incorporated to provide better evaluation and prioritization of the hazards that affect the planning area. Detailed profiles for each of the identified hazards include information categorized as follows:

Hazard Description: This section consists of a general description of the hazard and the types of impacts it may have on a community or school/special district.

Geographic Location: This section describes the geographic location of the hazard in the planning area. For some hazards, the entire planning area is at risk.

Strength/Magnitude/Extent: This includes information about the strength, magnitude, and extent of a hazard. For some hazards, this is accomplished with description of a value on an established scientific scale or measurement system, such as an EF2 tornado on the Enhanced Fujita Scale. Strength, magnitude, and extent can also include the speed of onset and the duration of hazard events. Describing the strength/magnitude/extent of a hazard is not the same as describing its potential impacts on a community. Strength/magnitude/extent defines the characteristics of the hazard regardless of the people and property it affects.

Previous Occurrences: This section includes available information on historic incidents and their impacts. Historic event records form a solid basis for probability calculations.

Probability of Future Occurrence: The frequency of recorded past events is used to estimate the likelihood of future occurrences. Probability was determined by dividing the number of recorded events by the number of years and multiplying by 100. This gives the percent chance of the event happening in any given year. For events occurring more than once annually, the probability will be reported 100% in any given year, with a statement of the average number of events annually.

Changing Future Conditions Considerations: In addition to the probability of future occurrence, changing future conditions should also be considered, including the effects of long-term changes in weather patterns and climate on the identified hazards. NOAA has a new tool that can provide useful information for this purpose. NOAA Climate Explorer, <https://toolkit.climate.gov/tools/climate-explorer>.

Vulnerability Assessments

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

Requirement §201.6©(2)(ii)(A) :The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

Requirement §201.6©(2)(ii)(B) :[The plan should describe vulnerability in terms of an]

estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Requirement §201.6©(2)(ii)©: [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Requirement §201.6©(2)(ii): (As of October 1, 2008) [The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged in floods.

Following the hazard profile for each hazard will be the vulnerability assessment. The vulnerability assessment further defines and quantifies populations, buildings, critical facilities, and other community assets at risk to damages from natural hazards. The vulnerability assessments will be based on the best available data. The vulnerability assessments can also be based on data that was collected for the 2018 State Hazard Mitigation Plan Update. With the 2018 Hazard Mitigation Plan Update, SEMA is pleased to provide online access to the risk assessment data and associated mapping for the 114 counties in the State, including the independent City of St. Louis. Through the web-based Missouri Hazard Mitigation Viewer, local planners and other interested parties can obtain all State Plan datasets. This effort removes from local mitigation planners a barrier to performing all the needed local risk assessments by providing the data developed during the 2018 State Plan Update.

The Missouri Hazard Mitigation Viewer includes a Map Viewer with a legend of clearly labeled features, a north arrow, a base map that is either aerial imagery or a street map, risk assessment data symbolized the same as in the 2018 State Plan for easy reference, search and query capabilities, ability to zoom to county level data and capability to download PDF format maps. The Missouri Hazard Mitigation Viewer can be found at this link:

<http://bit.ly/MoHazardMitigationPlanViewer2018>.

The vulnerability assessments in the Carter County Hazard Mitigation Plan will also be based on:

- Written descriptions of assets and risks provided by participating jurisdictions;
- Existing plans and reports;
- Personal interviews with planning committee members and other stakeholders; and
- Other sources as cited.

Within the Vulnerability Assessment, the following sub-headings will be addressed:

- **Vulnerability Overview:** The plan will provide an overall summary of each jurisdiction's vulnerability to the identified hazards. The overall summary of vulnerability identifies structures, systems, populations or other community assets as defined by the community that are susceptible to damage and loss for hazard events.
- **Potential Losses to Existing Development:** This section will examine the types and numbers, of buildings, critical facilities, etc. currently existing for each jurisdiction, and the potential impacts of each hazard. Impact means the consequences of effect of the hazard on the jurisdiction and its assets. Assets are determined by the community and include people, structures, facilities, systems, capabilities, and/or activities that have value to the

community.

- **Previous and Future Development:** This section will include information on how changes in development have impacted the community's vulnerability to this hazard. Changes in development in known hazard prone areas since the previous plan and how those changes have increased or decreased the community's vulnerability. Anticipated future developments in the county will be described and how that impacts hazard risk.
- **Hazard Summary by Jurisdiction:** For hazard risks that vary by jurisdiction, this section will provide an overview of the variation and the factual basis for that variation.

Problem Statements

Each hazard analysis will conclude with a brief summary of the problems created by the hazard in the planning area, and possible ways to resolve those problems. Jurisdiction-specific information will be included in those cases where the risk varies across the planning area. The focus of the problem statements sub-section is to synthesize the "problems" revealed through the risk assessment and then through the process of updating the mitigation strategy, develop mitigation actions that are aimed at "solving" the identified problems.

3.4.1 Flooding (Riverine and Flash)

Hazard Profile

Hazard Description

A flood is partial or complete inundation of normally dry land areas. Riverine flooding is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt, or ice. There are several types of riverine floods, including headwater, backwater, interior drainage, and flash flooding. Riverine flooding is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt or ice melt. The areas adjacent to rivers and stream banks that carry excess floodwater during rapid runoff are called floodplains. A floodplain is defined as the lowland and relatively flat area adjoining a river or stream. The terms "base flood" and "100-year flood" refer to the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year. Floodplains are part of a larger entity called a basin, which is defined as all the land drained by a river and its branches.

Flooding caused by dam failure is discussed in Section 3.4.2 and will not be addressed in this section. A flash flood occurs when water levels rise at an extremely fast rate as a result of intense rainfall over a brief period, sometimes combined with rapid snowmelt, ice jam release, frozen ground, saturated soil, or impermeable surfaces. Flash flooding can happen in Special Flood Hazard Areas (SFHAs) as delineated by the National Flood Insurance Program (NFIP), and can also happen in areas not associated with floodplains.

Ice jam flooding is a form of flash flooding that occurs when ice breaks up in moving waterways, and then stacks on itself where channels narrow. This creates a natural dam, often causing flooding within minutes of the dam formation.

In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations – areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow.

Most flash flooding is caused by slow-moving thunderstorms or thunderstorms repeatedly moving over the same area. Flash flooding is a dangerous form of flooding which can reach full peak in only a few minutes. Rapid onset allows little or no time for protective measures. Flash flood waters move at very fast speeds and can move boulders, tear out trees, scour channels, destroy buildings, and obliterate bridges. Flash flooding can result in higher loss of life, both human and animal, than slower developing river and stream flooding.

In certain areas, aging storm sewer systems are not designed to carry the capacity currently needed to handle the increased storm runoff. Typically, the result is water backing into basements, which damages mechanical systems and can create serious public health and safety concerns. This combined with rainfall trends and rainfall extremes all demonstrate the high probability, yet generally unpredictable nature of flash flooding in the planning area.

Although flash floods are somewhat unpredictable, there are factors that can point to the likelihood of flash floods occurring. Weather surveillance radar is being used to improve monitoring capabilities of intense rainfall. This, along with knowledge of the watershed characteristics, modeling techniques, monitoring, and advanced warning systems has increased the warning time for flash floods.

Geographic Location

Riverine flooding is most likely to occur in SFHAs. Historically there are three sources of common flooding within Carter County; Current River near Van Buren, Eleven Point River, and the Pike Creek near Fremont. The riverine flooding history below was gathered from the National Centers for Environmental Information (NCEI), for a twenty year period of January 1, 1998 to October 1, 2018. Table 3.15 shows Carter County flood event history.

Table 3.15. Carter County NCEI Flood Events by Location, 1998-2018

Location	# of Events
Unincorporated Carter County	17
-Unincorporated Carter County (unspecified)- 14 flood events	
-Unincorporated Carter County (Fremont)- 2 flood events	
-Unincorporated Carter County (Chicopee)-1 flood events	
City of Van Buren	5
City of Ellsinore	3
City of Grandin	1

Source: National Centers for Environmental Information

Flash flooding occurs in SFHAs and those locations in the planning area that are low-lying. They also occur in areas without adequate drainage to carry away the amount of water that falls during intense rainfall events. Inside city limits are more streets and impervious areas that often lead to causing of flash flooding. Areas such as streets, sidewalks, parking lots, and driveways prevent rain water from

being absorbed by the ground and create runoff water that can lead to flash flooding, especially in low lying areas of the city. In reviewing incidents reported by the NCEI database for the time period January 1, 1998-October 1, 2018 there were 17 flash flood events in Carter County, with these events impacting multiple locations within the county. Table 3.16 provides the number of flash flood events by location recorded in NCEI for the 20-year period.

Table 3.16. Carter County NCEI Flash Flood Events by Location, 1998-2018

Location	# of Events
Unincorporated Carter County	13
-Unincorporated County (unspecified)- 13 flood events	
City of Van Buren	4
City of Ellsinore	3
City of Grandin	2

Source: National Centers for Environmental Information

Strength/Magnitude/Extent

Missouri has a long and active history of flooding over the past century, according to the 2018 State Hazard Mitigation Plan. Flooding along Missouri’s major rivers generally results in slow-moving disasters. River crest levels are forecast several days in advance, allowing community’s downstream sufficient time to take protective measures, such as sandbagging and evacuations. Nevertheless, floods exact a heavy toll in terms of human suffering and losses to public and private property. By contrast, flash flood events in recent years have caused a higher number of deaths and major property damage in many areas of Missouri.

According to the U.S. Geological Survey, two critical factors affect flooding due to rainfall: rainfall duration and rainfall intensity – the rate at which it rains. These factors contribute to a flood’s height, water velocity and other properties that reveal its magnitude.

National Flood Insurance Program (NFIP) Participation

Table 3.17 provides details on NFIP participation for the communities in the planning area. Table 3.18 shows the number of policies in force, amount of insurance in force, number of closed losses, and total payments for each jurisdiction, where applicable. The second table provides data as of July 31, 2017.

Table 3.17. NFIP Participation in Carter County

CommunityID #	CommunityName	NFIP Participant (Y/N)	Current Effective Map Date	Regular-Emergency Program Entry Date
290472	City of Van Buren	Y	9/1/86	9/1/86
290466	City of Ellsinore	Y	8/19/86	8/19/86
290460	City of Grandin	Sanctioned	11/8/74	11/8/75
290060	Carter County	Y	2/4/87	2/4/87

Source: NFIP Community Status Book, 9/24/2019; BureauNet, <http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book>; M= No elevation determined – all Zone A, C, and X NSFHA = No Special Flood Hazard Area; E=Emergency Program

The City of Grandin does not participate in the NFIP. Current city officials are exploring participation in the future; however, Grandin has not sustained significant flood damage in past flood events.

Table 3.18. NFIP Policy and Claim Statistics as of July 31,2019

Community Name	Policies in Force	Closed Losses	Total Payments
City of Van Buren	22	55	\$2,044,496
City of Ellsinore	6	0	\$0
City of Grandin	0	0	\$0
Carter County	57	68	\$3,538,790

Source: NFIP Community Status Book, 7/31/2019; BureauNet, <http://bsa.nfipstat.fema.gov/reports/reports.html>; *Closed Losses are those flood insurance claims that resulted in payment. Loss statistics are for the period from [date] to [date].

Carter County had the most closed losses with 68 total payments for such claims totaling \$3,538,790.

Repetitive Loss/Severe Repetitive Loss Properties

Repetitive Loss Properties are those properties with at least two flood insurance payments of \$5,000 or more in a 10-year period. According to the Flood Insurance Administration, jurisdictions included in the planning area have a combined total of 12 residential repetitive loss properties. As of November 15, 2019, 0 properties had been mitigated.

Table 3.19 lists the repetitive loss properties within Carter County.

Table 3.19. Carter County Repetitive Loss Properties

Jurisdiction	# of Properties	Building Payments (\$)	Content Payments (\$)	Total Payments (\$)	# of Losses
City of Van Buren	4	159,813.65	0	159,813.65	11
City of Ellsinore	0	0	0	0	0
City of Grandin	0	0	0	0	0
Unincorporated Carter County	8	964,347.88	109,455.55	1,073,803.43	22

Source: Flood Insurance Administration as of 2019

Severe Repetitive Loss (SRL): An SRL property is defined it as a single-family property (consisting of one-to-four residences) that is covered under flood insurance by the NFIP; and has (1) incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage with the amount of each claim payment exceeding \$5,000 and with cumulative amounts of such claims payments exceeding \$20,000; or (2) for which at least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property. According to the Flood Insurance Administration, there are zero mitigated Severe Repetitive Loss properties in each jurisdiction in Carter County.

Previous Occurrences

Following is Table 3.20 showing presidential flooding disaster declarations in the past twenty years, Jan-1998 through Aug-2018, which included the planning area and their impact. Dollar amounts of individual and public assistance are statewide totals, not just for Carter County.

Table 3.20. Flooding Disaster Declarations January 1998 to August 2018

Disaster Number	Description	Declaration Date Incident Period	Individual Assistance (IA) Public Assistance (PA)
DR-4317	Severe Storms, Tornadoes, Straight Line Winds, Flooding	6/2/2017 4/28/2017 – 5/11/2017	IA-\$12,527,583.31 PA-\$64,268,021.45
EM-3374	Severe Storms, Tornadoes, Straight Line Winds, Flooding	1/2/2016 12/22/2018 – 1/9/2016	N/A
DR-1980	Severe Storms, Flooding, Tornado	5/9/2011 4/19/2011 – 6/6/2011	IA - \$37,062,310.48 PA-\$160,170,851.47
DR-1809	Severe Storm, Flooding, Tornadoes	11/13/2008 9/11/2008 – 9/24/2008	IA - \$6,869,983.55 PA - \$8,529,243.13
DR-1749	Flooding, Severe Storm	3/19/2008 3/17/2008 – 5/9/2008	IA - \$13,924,227.09 PA - \$26,045,574.54
DR-1748	Severe Winter Storms, Flooding	3/12/2008 2/10/2008 – 2/14/2008	PA-\$10,068,998.77
DR-1412	Severe Storms, Tornadoes, and Flooding	5/6/2002 4/24/2002 – 6/10/2002	PA - \$35,299,777.93
DR-1006	Severe Storms, Tornadoes, and Flooding	12/1/1993 11/13/1993 – 11/19/1993	N/A

The following tables (Tables 3.21 and 3.22) provide annual flash flooding and riverine flooding for Carter County. The data was obtained through the NOAA National Centers for Environmental Information using the data for events occurring January 1, 1998 - August 31, 2018.

Table 3.21 NCEI Carter County Flash Flood Events Summary, 1998 to 2018

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
1998	0	0	0	0	0
1999	0	0	0	0	0
2000	0	0	0	0	0
2001	0	0	0	0	0
2002	3	0	0	25,000	0
2003	1	0	0	0	0
2004	0	0	0	0	0
2005	1	0	0	0	0
2006	2	1	0	27,000	0
2007	2	0	0	0	0
2008	0	0	0	0	0
2009	1	0	0	0	0
2010	0	0	0	0	0
2011	2	0	0	60,000	0
2012	0	0	0	0	0
2013	0	0	0	0	0
2014	1	0	0	300,000	0

2015	0	0	0	0	0
2016	1	0	0	40,000	0
2017	1	0	0	50,000	0
2018	0	0	0	0	0

Source: NCEI, Date Accessed: 11/5/2019

Table 3.22 NCEI Carter County Riverine Flood Events Summary, 1998 to 2018

Year	# of Events	# of Deaths	# of Injuries	Property Damages (\$)	Crop Damages (\$)
1998	0	0	0	0	0
1999	0	0	0	0	0
2000	0	0	0	0	0
2001	1	0	0	0	0
2002	1	0	0	25,000	0
2003	0	0	0	0	0
2004	0	0	0	0	0
2005	0	0	0	0	0
2006	0	0	0	0	0
2007	0	0	0	0	0
2008	3	0	0	1,000,000	0
2009	3	0	0	0	0
2010	0	0	0	0	0
2011	3	0	0	35,000	0
2012	0	0	0	0	0
2013	2	0	0	0	0
2014	0	0	0	0	0
2015	2	0	0	25,000	0
2016	3	0	0	0	0
2017	3	0	0	10,000,000	0
2018	0	0	0	0	0

Source: NCEI, Date Accessed: 11/5/2019

Probability of Future Occurrence

The historical data presented above demonstrates that there has been 36 flooding events over a 20-year time period, 15 flash flood events and 21 riverine flood events. The probability of a flash flood or riverine flooding occurring in any given year somewhere in the planning area is 100%. The average number of flooding events based on this data is 1.8 per year.

Changing Future Conditions Considerations

If departure from normal with respect to increased precipitation intensity continues, frequency of floods in Missouri is likely to increase as well. Over the last half century, average annual precipitation in most of the Midwest has increased by 5 to 10 percent. Rainfall during the four wettest days of the year has increased about 35 percent, and the amount of water flowing in most streams during the worst flood of

the year has increased by more than 20 percent.

It is likely (66-100% probability) that the frequency of heavy precipitation or the proportion of total rainfall from heavy falls will increase in the 21st century across the globe. More specifically, it is “very likely” (90- 100% probability) that most areas of the United States will exhibit an increase of at least 5% in the maximum 5-day precipitation by late 21st century. As the number of heavy rain events increase, more flooding and pooling water can be expected.

Flooding occasionally threatens riverfront communities, and greater river flows could increase these threats. In April and May 2017, heavy rainfall caused a flood of historic proportions in the region’s river communities of Van Buren and Doniphan, MO. Carter County lost all government offices and the City of Van Buren lost their public safety facility. Nearly 280 homes were impacted along with all local, state, and federal parks and tourist destinations.

The expected increases in rainfall frequency and intensity are likely to put additional stress on natural hydrological systems and community stormwater systems. Heavier snowfalls in the winter will lead to intensified spring flooding, and groundwater levels will remain high even in non-floodplain areas. Such changes in climate patterns can lead to the development of compounding events that interact to create extreme conditions. Flooding caused by high groundwater levels typically recedes more slowly than riverine flooding, slowing the response and recovery process. Groundwater-fed rivers and streams are also likely to experience heightened flooding when groundwater levels are high.

Jurisdictions updating or installing stormwater management systems should consider potentially larger future discharge amounts when sizing culverts and drainage ways; storage capacity can also be increased by building retention basins to hold excess stormwater. Communities already prone to flooding should be prepared for a potential increase in facility closures and/or damages, as well as an increase in public demand for flood response and assistance. Natural features that experience repeated flooding may manifest changes in the form of stream bank instability and changing shoreline, floodplain, and wetland boundaries. Communities may also wish to plan for the potential loss of cropland and damage to both private property and public infrastructure such as bridges.

The environmental impacts of flooding include erosion, surface and groundwater contamination, and reduced water quality. The threat of more frequent flood events may thus be a concern particularly for communities who depend on lakes, rivers, or trout streams for tourism. Rural communities may experience increases in well contamination and road washouts, while urban areas may be particularly vulnerable to flash flooding as heavy rain events quickly overwhelm the ability of a more impermeable environment to absorb excess stormwater.

Vulnerability

Vulnerability Overview

The vulnerability overview for Carter County comes primarily from HAZUS data included in the 2018 Missouri State Hazard Mitigation Plan. HAZUS uses GIS technology to estimate the impacts of disasters. HAZUS-MH produces a flood polygon and flood depth grid that represents the base flood. Data for Carter County utilized HAZUS flood data. The 2012 state plan includes Level 2 HAZUS flood analysis for all 114 Missouri counties, this data is coupled with DFIRM depth grids and enhanced building inventory.

DFIRM data is not available for Carter County, and impact estimates in counties where DFIRM data was integrated typically increases the losses when compared to counties such as Carter County where only

HAZUS-generated flood data was utilized. The damage building counts generated by HAZUS are susceptible to rounding errors and are likely the weakest output of the model due to the use of HAZUS census blocks for analysis.

Flooding presents a danger to life and property, often resulting in injuries, and in some cases, fatalities. Floodwaters themselves can interact with hazardous materials. Hazardous materials stored in large containers could break loose or puncture as a result of flood activity. Examples are bulk propane tanks. When this happens evacuation of citizens is necessary.

Public health concerns may result from flooding, requiring disease and injury surveillance. Community sanitation to evaluate flood-affected food supplies may also be necessary. Private water and sewage sanitation could be impacted, and vector control (for mosquitoes and other entomology concerns) may be necessary.

When roads and bridges are inundated by water, damage can occur as the water scours materials around bridge abutments and gravel roads. Floodwaters can also cause erosion undermining road beds. In some instances, steep slopes that are saturated with water may cause mud or rock slides onto roadways. These damages can cause costly repairs for state, county, and city road and bridge maintenance departments. When sewer back-up occurs, this can result in costly clean-up for home and business owners as well as present a health hazard. There are no scour bridges identified in Carter County.

Potential Losses to Existing Development

In reviewing the data presented in the 2018 State Plan, Table 3.34, provides potential loss estimates at risk to the 100-year flood, the data includes building loss, loss ratio, and displaced populations. The data used for Carter County estimates the following:

- \$21,012,000 in structural damage
- \$16,606,000 in contents damage
- \$207,000 in inventory loss
- \$34,825,000 in total direct loss
- \$144,000 in total income loss
- Loss Ratio of the County: 4.05%
- Displaced households: 513
- Population requiring shelter: 122

In reviewing available data and discussing with school districts, there are no school district assets located in flood plains. The Van Buren R-1 School District does report prior damage to school buildings from the 2017 flood event. In discussion with county personnel and local residents, significant damage to critical facilities also occurred during the 2017 flood event. Carter County lost all of their government offices and Van Buren lost their public safety facility. Critical facilities that sustained damage include the Carter County Courthouse, Jail, and Sheriff's Office, the Van Buren R-1 Gymnasium and the Van Buren Public Safety Building. Van Buren would be the community with the highest risk of loss factors due to the infrastructure present, such as the courthouse.

Risk mapping, Assessment, and Planning (RiskMAP) is a new FEMA program that provides communities with flood information and tools they can use to enhance their mitigation plans and better protect citizens. Through more accurate flood maps, risk assessment tools, and outreach RiskMap builds on Map Modernization and strengthens local ability to make informed decisions

about reducing risk. There currently is not activity regarding RiskMap in Carter County.

Impact Future Development

As there is little future development anticipated in Carter County the impact of flash and riverine flooding is not anticipated to increase in the county. The only future development planned is the construction of a new Carter County Justice Center and Courthouse, Van Buren Public Safety Facility, and residential housing, all located outside of the floodplain. The Van Buren Public Safety Facility will be located near a stream, but will be outside of the floodplain and elevated above the 2017 flood level. These future developments could also increase impervious surfaces causing additional water run-off and drainage problems during heavy rainfall events.

EMAP Consequence Analysis

Carter County has no communities with emergency management programs seeking EMAP accreditation.

Hazard Summary by Jurisdiction

Vulnerability varies greatly across the county. Areas near the Current River and Pike Creek are the areas most prone to flooding, leaving Van Buren and unincorporated Carter County most vulnerable. The Van Buren R-1 School District, serving western Carter County is also located near the Current River flood source. Ellsinore and Grandin are situated farther away from this flood source and are not as susceptible to flood damage. According to tables 3.14 and 3.15, there have been a total of 39 flood events in Van Buren and unincorporated Carter County, as compared to 9 total events for Ellsinore and Grandin combined.

- **Carter County** - All county offices are located in Van Buren, leaving the county government, justice system, and associated structures susceptible to impact.
- **City of Van Buren** – City Hall and the city’s public safety facility are near the Current River flood source and susceptible to impact.
- **Van Buren R-1 School District** – Sustained damage in the 2017 flood event and vulnerable to future impact.
- **East Carter County R-2 School District** – Not susceptible to flood damage as the district is not near a flood source. Slight vulnerability to flash flooding as some infrastructure is located in the valleys in Ellsinore, MO.
- **City of Ellsinore** - Slight vulnerability to flash flooding as some infrastructure is located in the valleys of the city.
- **City of Grandin** - Slight vulnerability to flash flooding as some infrastructure is located in the valleys of the city.

Problem Statement

Carter County is home to the Current River and Pike Creek flood sources. Both have the ability to overtop or flood. The entire county is susceptible to both types of flooding, riverine, and flash flooding. Both types of flooding have caused damage to the county in previous events. Within the jurisdiction of Van Buren for example, the local, state, and federal parks experience extreme flood damage during flood events. Retail buildings also experience the impacts of flooding, which impact tourism dollars received during the tourism season.

Critical facilities vulnerable to flooding include all county offices, city offices, and justice systems within Carter County and Van Buren. The Van Buren R-1 School District is also at risk. Due to the risk involved in flooding the MPC included actions in this plan to mitigate loss during future events. Carter County, for example, is constructing a new justice center complex outside of the floodplain. In addition, the Van Buren Public Safety Facility is being elevated out of the floodplain.

Older, residential homes are located in the floodplain in Van Buren and unincorporated Carter County. While flood buyouts are ongoing, there are still people living in the floodplain in the county. Possible solutions include the continued relocation of persons out of the floodplain and into safe areas.

3.4.2 Dam Failure

Hazard Profile

Hazard Description

According to the State of Missouri's Hazard Mitigation Plan, the National Dam Safety Act defines a dam as an artificial barrier impounding and/or diverting water and having the following characteristics:

1. Height in excess of six feet and storage capacity of fifty acre-feet or more.
2. Height at least twenty-five feet and storage capacity more than fifteen acre-feet.

Levees are not considered dams by definition.

Dams can be owned and overseen by either private residents or public institutions. The responsibility for the safe operation and regular maintenance of dams falls to the owner of the property. In some states, the State may regulate the construction, modification, maintenance, and operations of any dam. In Missouri, according to the Department of Natural Resources, the State regulates "all non-agricultural, non-federal dams more than thirty-five feet in height" and provides technical assistance and informational resources to all dam owners.

A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams are typically constructed of earth, rock, concrete, or mine tailings. Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, affecting both life and property. Dam failure can be caused by any of the following:

1. Overtopping - inadequate spillway design, debris blockage of spillways or settlement of the dam crest.
2. Piping: internal erosion caused by embankment leakage, foundation leakage and deterioration of pertinent structures appended to the dam.
3. Erosion: inadequate spillway capacity causing overtopping of the dam, flow erosion, and inadequate slope protection.
4. Structural Failure: caused by an earthquake, slope instability or faulty construction.

Table 3.23. MDNR Dam Hazard Classification Definitions

Hazard Class	Definition
Class I	The area downstream from the dam that would be affected by inundation contains ten (10) or more permanent dwellings or any public building. Inspection of these dams must occur every two years
Class II	The area downstream from the dam that would be affected by inundation contains one (1) to nine (9) permanent dwellings, or one (1) or more campgrounds with permanent water, sewer, and electrical services or one (1) or more industrial buildings. Inspection of these dams must occur every three years
Class III	The area downstream from the dam that would be affected by inundation does not contain any of the structures identified for Class I or Class II dams. Inspection of these dams must occur once every five years.

Source: Missouri Department of Natural Resources, http://dnr.mo.gov/env/wrc/docs/rules_req_94.pdf

Table 3.24. NID Dam Hazard Classification Definitions

Hazard Class	Definition
Low Hazard	Equal or exceed 25 feet in height and which exceed 15 acre-feet in storage, or Equal of exceed 50 acre-feet and exceed 6 feet in height
Significant Hazard	Possible loss of human life and likely significant property or environmental destruction
High Hazard	Loss of one human life is likely if the dam fails

Source: National Inventory of Dams

Geographic Location

Dams Located Within the Planning Area

The Missouri Department of Natural Resources (DNR) lists 13 dams in Carter County, 1 of which is regulated by the DNR. Only one is federally regulated. Structures located below these dams are most susceptible to dam failure events.

Table 3.25 provides a list of the names, locations, and hazard class for all high hazard dams in the planning area.

Table 3.25. High Hazard Dams in the Carter County Planning Area

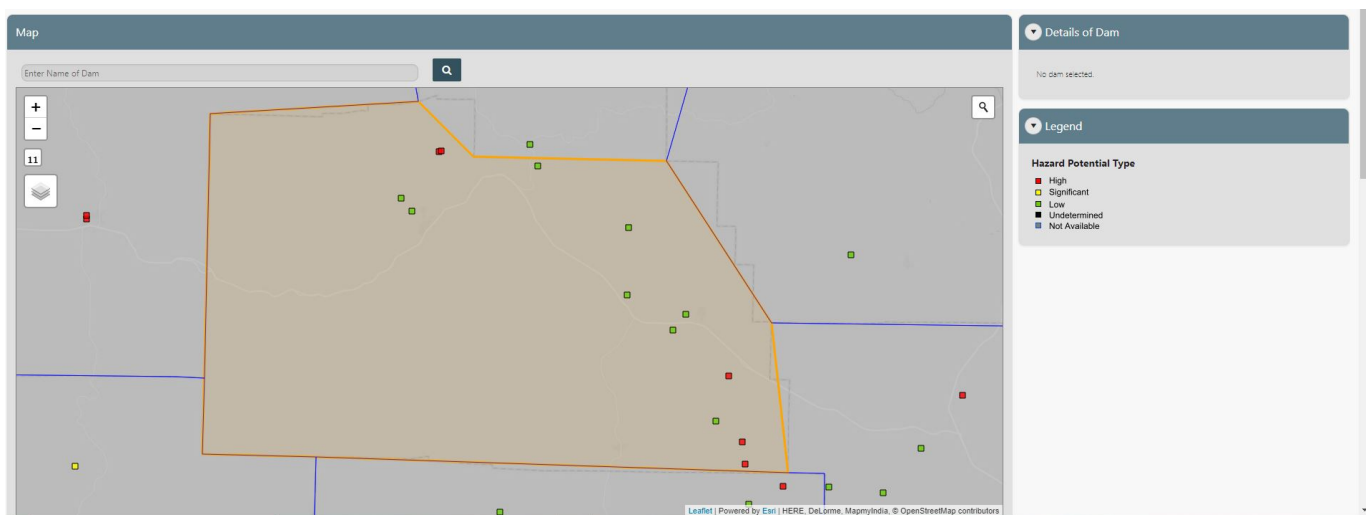
Dam Name	Emergency Action Plan	Dam Height (Ft)	Normal Storage (Acre-Ft)	River	Nearest Downstream City	Hazard Class	NID Class
Lakeview Tree Farm Dam	No	20	86	TR Tenmile Creek	Harviell	1	High
Lake Hogan Dam	No	24	167	TR North Prong Beaverdam Creek	Naylor	1	High
Ed Baker #1 Lake Dam	Yes	61	2,162	TR to N. Prong Beaverdam Creek	Fairdealing	1	High

Hill and Dale Dam East	No	22	118	TR Pine Valley Creek	Van Buren	1	High
Hill and Dale Dam West	No	25	80	TR Pine Valley Creek	Van Buren	1	High

Sources: Missouri Department of Natural Resources, <http://dnr.mo.gov/env/wrc/dam-safety/statemap.htm> and National Inventory of Dams, http://nid.usace.army.mil/cm_apex/f?p=838:12

The map following, Figure 3.3, provides the location of the dams within Carter County. The map, provided by the Missouri Department of Natural Resource displays the location of all thirteen (13) dams; the low hazards dams are indicted with a green dot while the high lazard dams are marked with a red dot on the map. There are five (5) high hazard dams within the boundaries of Carter County. The vulnerability assessment on the pages following will discuss in greater detail, the assets that would be impacted by a dam failure.

Figure 3.3 High Hazard Dam Locations in Carter County & Areas Impacted in the Event of Breach



Source: U.S. Army Corps of Engineers, Missouri Department of Natural Resources

Upstream Dams Outside the Planning Area

In reviewing information from the Missouri Department of Natural Resources, the United States Army Corps of Engineers, and the National Inventory of Dams, the planning committee has determined that there are no dams that are upstream of Carter County that have the potential to impact Carter County if they were to fail.

Strength/Magnitude/Extent

All thirteen of the Carter County dams are Class I dams under the Missouri DNR classification system. This is a relatively low number compared to other counties in the state. The USACE also maintains the National Inventory of Dams (NID). The NID categorizes dams according to downstream hazard potential, and the definitions are different from the DNR's definitions. The NID definitions are as follows:

- Low Hazard Potential: Dams assigned the low hazard potential classification are those where failure or disoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the property owners.
- Significant Hazard Potential: Dams assigned the significant hazard potential classification are those dams where failure or disoperation results in no probable loss of human life but can cause economic loss, environmental change, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominately rural or agricultural areas but could be located in areas with population and significant infrastructure.
- High Hazard Potential: Dams assigned the high hazard potential classification are those where failure or disoperation will probably cause loss of human life.

The NID lists 13 dams in the county, with 5 of them classified as "high hazard," or ones which could cause the loss of human life in the event of failure. The last two columns in Table 3.24 above include, for each dam, the NID classification, and the nearest community. A review of the columns show no high hazard dams located in close proximity to communities. However, dam breach inundation area maps were not available for the dams impacting the planning area. The Planning Committee will try to obtain this information for the next plan update.

Previous Occurrences

There have been no reports of dam failure or overtopping in Carter County.

Probability of Future Occurrence

According to data offered by the Water Resources Program of the Missouri DNR, there have been no significant dam failures within Carter County. This data, however, should not be understood to mean that there will be no dam failures in Carter County's future. Understandably as dams age the likelihood that one may fail increases.

Any NID High Hazard dams that are not regulated by MDNR or a federal agency may not be regularly inspected and could result in loss of life. Any lack of inspection on these high hazard dams may impact future probability of occurrence.

Changing Future Conditions Considerations

Studies have been conducted to investigate the impact of climate change scenarios on dam safety. Dam failure is already tied to flooding and the increased pressure flooding places on dams. The impacts of changing future conditions on dam failure will most likely be those related to changes in precipitation and flood likelihood. Changing future conditions projections suggest that precipitation may increase and occur in more extreme events, which may increase risk of flooding, putting stress on dams and increasing likelihood of dam failure.

The safety of dams for the future climate can be based on an evaluation of changes in design floods and the freeboard available to accommodate an increase in flood levels. The results from the studies indicate that the design floods with the corresponding outflow floods and flood water levels will increase in the future, and this increase will affect the safety of the dams in the future. Studies concluded that the total hydrological failure probability of a dam will increase in the future climate and that the extent and depth of flood waters will increase by the future dam break scenario.

Vulnerability

Vulnerability Overview

As stated above, The Missouri Department of Natural Resources lists 13 dams in Carter County, 1 of which are regulated by the DNR. One is federally regulated. Structures located below these dams are most susceptible to dam failure events. Of the dams in Carter County, 5 are rated as High Hazard Dams. All 5 are rated a Class 1, meaning the area downstream contains 10 or more permanent dwellings. Loss of one human life is likely if the dams fail. There are no school district facilities or critical facilities that are located within the inundation area of any dam in Carter County. Dams fail on an individual basis, when one dam fails, not all dams fail. Any vulnerability will be limited to those persons and structures that are within the inundation zone of a failed dam. Therefore, the vulnerability of the county to one dam breaking is minimal.

Potential Losses to Existing Development

Currently in Carter County there is no major development in progress. Should a dam failure event occur, the most vulnerable would be agricultural land, with the smaller communities of Fairdealing, Harviell, Van Buren and Naylor the most vulnerable. These communities are many miles away in a neighboring county. The likelihood of those communities sustaining damage from these 5 dams is minimal.

Impact of Previous and Future Development

Carter County is very rural and sparsely populated. There is little to no development anticipated within the inundation areas of any of the dams located in the county.

EMAP Consequence Analysis

Carter County does not have emergency management program seeking EMAP accreditation.

Hazard Summary by Jurisdiction

The communities in the neighboring county are at a higher risk of damage in the event dam failure occurs in Carter County. No school districts or special interest districts will be harmed in the event of dam failure; due to the fact they are not immediately located within the flooding area. County roads are at the highest risk of being damaged, like in previous events, in the event of dam failure in Carter County.

- **Carter County** – Low vulnerability, with the exception of county road damage.
- **City of Van Buren** – Low vulnerability.
- **City of Ellsinore** – Low vulnerability.
- **City of Grandin** – Low vulnerability.
- **Van Buren R-1 School District** – Low vulnerability.

-
- **East Carter County R-2 School District – Low vulnerability.**

Problem Statement

The failure of a dam in the planning area can cause significant damage to structures nearby. The committee has created actions to lessen the impact such as educational materials, relocating residents, and regular maintenance of dams.

3.4.3 Earthquakes

Hazard Profile

Hazard Description

An earthquake is a sudden motion or trembling that is caused by a release of energy accumulated within or along the edge of the earth's tectonic plates. Earthquakes occur primarily along fault zones and tears in the earth's crust. Along these faults and tears in the crust, stresses can build until one side of the fault slips, generating compressive and shear energy that produces the shaking and damage to the built environment. Heaviest damage generally occurs nearest the earthquake epicenter, which is that point on the earth's surface directly above the point of fault movement. The composition of geologic materials between these points is a major factor in transmitting the energy to buildings and other structures on the earth's surface.

In the United States, there are several thousand earthquakes annually. The State of California experiences the most damaging earthquakes, while Alaska experiences the highest number of earthquakes. According to an article by the United States Geological Survey, however, earthquakes occurring in the New Madrid seismic zone affect a much larger area than that which is affected by activity along other fault lines. In fact, the New Madrid seismic "region has more earthquakes than any other part of the United States east of the Rocky Mountains," according to the article.

Earthquakes occur primarily along fault zones and tears in the earth's crust. Along these faults and tears in the crust, stresses can build until one side of the fault slips, generating compressive and shear energy that produces the shaking and damage to the built environment. Heaviest damage generally occurs nearest the earthquake epicenter, which is that point on the earth's surface directly above the point of fault movement. The composition of geologic materials between these points is a major factor in transmitting the energy to buildings and other structures on the earth's surface.

As explained by the Federal Emergency Management Agency, major earthquakes and their accompanying foreshocks and aftershocks can be measured in two different ways. In 1935, the Richter Scale was developed by Charles F. Richter to measure the amount of energy released by an earthquake. The Modified Mercalli Intensity Scale was also developed as a tool to measure the severity of a quake using damage observations. The Mercalli Scale uses Roman numerals I to XII to rate an earthquake's intensity. A description of various Richter Scale and Modified Mercalli Scale intensities is offered below.

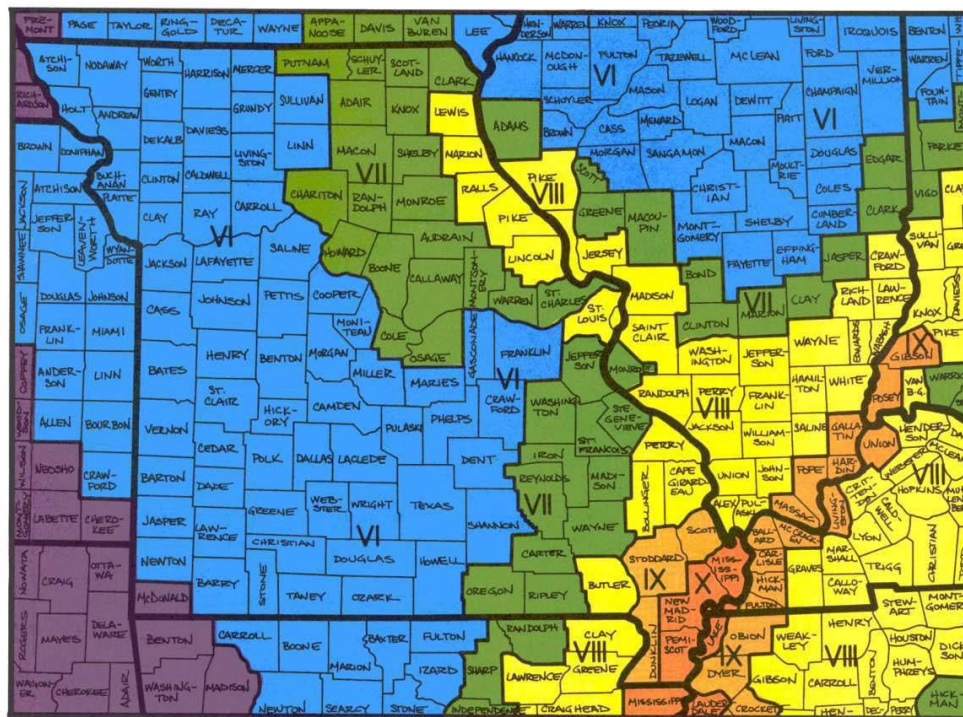
The most severe earthquakes in the New Madrid Seismic Zone (NMSZ) from December 16, 1811 through March 12, 1812, with the most severe occurring on December 16, 1811 and February 7, 1812. These quakes rank seventh and ninth respectively among the largest earthquakes recorded in the United States.

Geographic Location

The New Madrid Seismic Zone is made up of several thrust faults that stretch throughout Southeast Missouri. The effects of a large earthquake will impact the entire county indiscriminately. All jurisdictions are expected to experience the same intensity across the planning area. Carter County is at risk for strong ground movements and has a high potential for soil liquefaction due to the presence of loose, sandy consolidated sediments and a high water table. The immediate vicinity of the Ozarks is also at risk from the earthquakes in the New Madrid Seismic Zone because, like in the Bootheel, subsurface conditions of the Mississippi and Missouri River Valleys can amplify earthquakes.

The map below shows the highest projected Modified Mercalli intensities by county from a potential magnitude 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid Seismic Zone. The secondary maps in Figure 3.5 on page 3.43 show the same regional intensities for 6.7 and 8.6 earthquake, respectively.

Figure 3.4 Impact Zones for Earthquake Along the New Madrid Fault

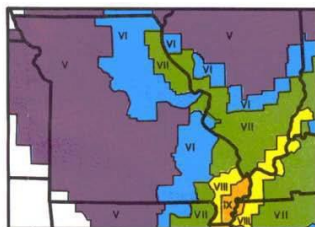


This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.

6.7

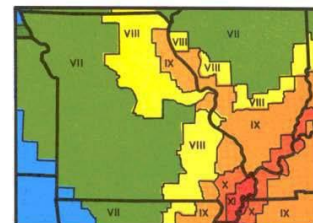
7.6

8.6



This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 6.7 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.

This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 8.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



Source: https://sema.dps.mo.gov/docs/EQ_Map.pdf

Figure 3.5 Projected Earthquake Intensities

MODIFIED MERCALLI INTENSITY SCALE

- People do not feel any Earth movement.
- II A few people might notice movement.
- III Many people indoors feel movement. Hanging objects swing.
- IV Most people indoors feel movement. Dishes, windows and doors rattle. Walls and frames of structures creak. Liquids in open vessels are slightly disturbed. Parked cars rock.
- Almost everyone feels movement. Most people are awakened. Doors swing open or closed. Dishes are broken. Pictures on the wall move. Windows crack in some cases. Small objects move or are turned over. Liquids might spill out of open containers.
- Everyone feels movement. Poorly built buildings are damaged slightly. Considerable quantities of dishes and glassware, and some windows are broken. People have trouble walking. Pictures fall off walls. Objects fall from shelves. Plaster in walls might crack. Some furniture is overturned. Small bells in churches, chapels and schools ring.
- People have difficulty standing. Considerable damage in poorly built or badly designed buildings, adobe houses, old walls, spires and others. Damage is slight to moderate in well-built buildings. Numerous windows are broken. Weak chimneys break at roof lines. Cornices from towers and high buildings fall. Loose bricks fall from buildings. Heavy furniture is overturned and damaged. Some sand and gravel stream banks cave in.
- Drivers have trouble steering. Poorly built structures suffer severe damage. Ordinary substantial buildings partially collapse. Damage slight in structures especially built to withstand earthquakes. Tree branches break. Houses not bolted down might shift on their foundations. Tall structures such as towers and chimneys might twist and fall. Temporary or permanent changes in springs and wells. Sand and mud is ejected in small amounts.

O Most buildings suffer damage. Houses that are not bolted down move off their foundations. Some underground pipes are broken. The ground cracks conspicuously. Reservoirs suffer severe damage.

Well-built wooden structures are severely damaged and some destroyed. Most masonry and frame structures are destroyed, including their foundations. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, and lakes. Railroad tracks are bent slightly. Cracks are opened in cement pavements and asphalt road surfaces.

Few if any masonry structures remain standing. Large, well-built bridges are destroyed. Wood frame structures are severely damaged, especially near epicenters. Buried pipelines are rendered completely useless. Railroad tracks are badly bent. Water mixed with sand, and mud is ejected in large amounts.

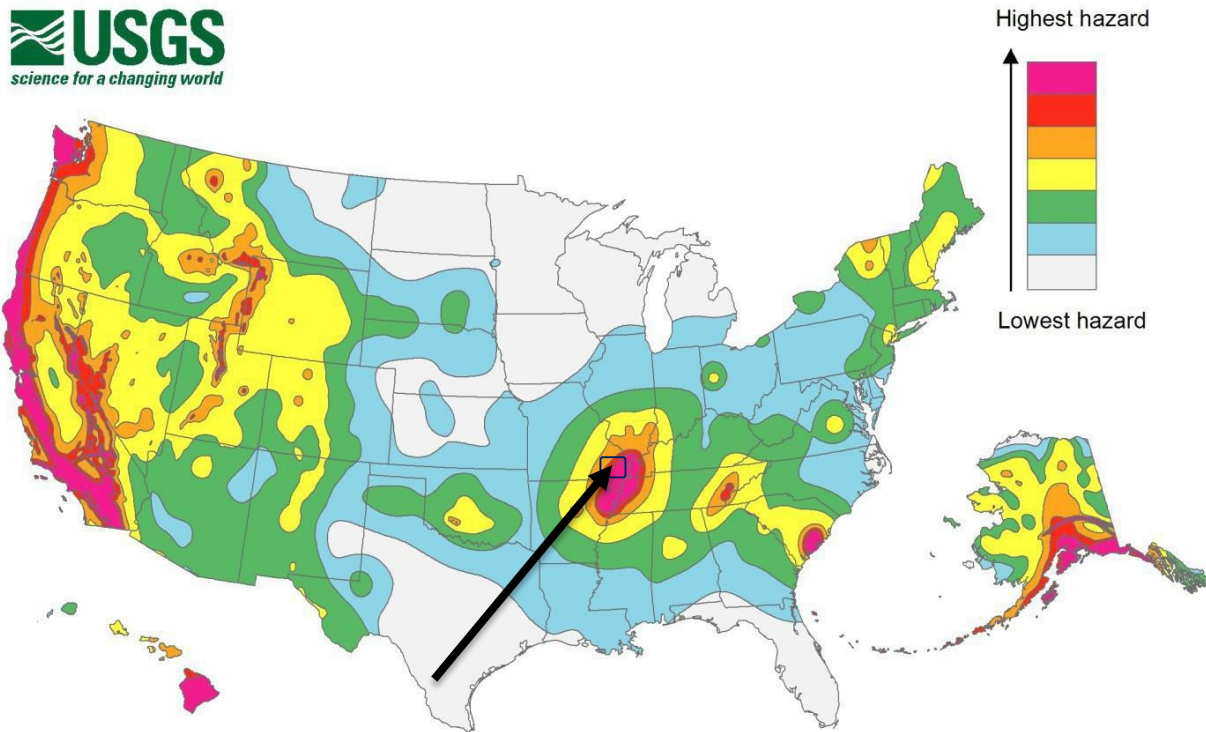
- XLI Damage is total, and nearly all works of construction are damaged greatly or destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move. Lakes are dammed, waterfalls formed and rivers are deflected.

Intensity is a numerical index describing the effects of an earthquake on the surface of the Earth, on man, and on structures built by man. The intensities shown in these maps are the highest likely under the most adverse geologic conditions. There will actually be a range in intensities within any small area such as a town or county, with the highest intensity generally occurring at only a few sites. Earthquakes of all three magnitudes represented in these maps occurred during the 1811-1812 "New Madrid earthquakes." The isoseismal patterns shown here, however, were simulated based on actual patterns of somewhat smaller but damaging earthquakes that occurred in the New Madrid seismic zone in 1843 and 1895.

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JEFFERSON CITY, MO 65102
Telephone: 571.526-9100

Figure 3.6 illustrates seismicity in the United States. Carter County is located near the New Madrid Seismic Zone, this places the County in a higher hazard area.

Figure 3.6. United States Seismic Hazard Map



Source: United States Geological Survey at http://earthquake.usgs.gov/hazards/products/conteminois/2014/HazardMap2014_lg.jpg

Strength/Magnitude/Extent

The extent or severity of earthquakes is generally measured in two ways: 1) the Richter Magnitude Scale is a measure of earthquake magnitude; and 2) the Modified Mercalli Intensity Scale is a measure of earthquake severity. The two scales are defined as follows.

Richter Magnitude Scale

The Richter Magnitude Scale was developed in 1935 as a device to compare the size of earthquakes. The magnitude of an earthquake is measured using a logarithm of the maximum extent of waves recorded by seismographs. Adjustments are made to reflect the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, comparing a 5.3 and a 6.3 earthquake shows that the 6.3 quake is ten times bigger in magnitude. Each whole number increase in magnitude represents a tenfold increase in measured amplitude because of the logarithm. Each whole number step in the magnitude scale represents a release of approximately 31 times more energy.

Modified Mercalli Intensity Scale

The intensity of an earthquake is measured by the effect of the earthquake on the earth's surface. The intensity scale is based on the responses to the quake, such as people awakening, movement of furniture, damage to chimneys, etc. The intensity scale currently used in the United States is the Modified Mercalli (MM) Intensity Scale. It was developed in 1931 and is composed of 12 increasing levels of intensity. They range from imperceptible shaking to catastrophic destruction, and each of the twelve levels is denoted by a Roman numeral. The scale does not have a mathematical basis, but is based on observed effects. Its use gives the laymen a more meaningful idea of the severity.

Previous Occurrences

According to the Missouri Department of Natural Resources there were 236 earthquakes that ranged between Magnitude 2.0 and Magnitude 4.9 that shook southeast Missouri from 2000-2010. In reviewing the specific incidents, during that time period none of these earthquakes had an epicenter in Carter County.

The largest earthquakes ever felt in the United States occurred along the New Madrid fault line during the winter of 1811-1812. During the course of three months, three earthquakes registering above 8.0 on the Richter Scale were felt by nearly the entire eastern half of the United States. According to the United States Geological Survey, church bells in Boston, Massachusetts rang as a result of the tremendous shaking. In fact, the New Madrid quakes were two to three times stronger than the 1964 Alaska earthquake and ten times more powerful than the 1906 San Francisco quake.

Probability of Future Occurrence

The probability of a magnitude 2.0 through 4.9 earthquakes impacting the area is nearly certain in any given year based on the historical data that 236 occurred in southeast Missouri in 10 years. The probability of an earthquake having an epicenter in Carter County is at 30% based on the data provided by USGS.

The two-percent probability of exceedance in 50 years of peak ground acceleration for Carter County is in the .4 range of standard gravity according to the USGS.

Changing Future Conditions Consideration

Scientists are beginning to believe there may be a connection between changing climate conditions and earthquakes. Changing ice caps and sea-level redistribute weight over fault lines, which could potentially have an influence on earthquake occurrences. However, currently no studies quantify the relationship to a high level of detail, so recent earthquakes should not be linked with climate change. While not conclusive, early research suggests that more intense earthquakes and tsunamis may eventually be added to the adverse consequences that are caused by changing future conditions.

Vulnerability

Vulnerability Overview

The impacts and severity of earthquakes on Missouri can be significant. The New Madrid earthquakes of 1811–1812 are among the largest that have happened on the North American continent. Although

losses were limited because of the sparse population of the time, many Native Americans died and property was damaged to the point that resettlement became a national policy.

The most important direct earthquake hazard is ground shaking. Ground shaking affects structures close to the earthquake epicenter but can also affect those at great distances, particularly where thick clay-rich soils can amplify ground motions. Certain types of buildings are more vulnerable to ground shaking than others. Unreinforced masonry structures, tall structures without adequate lateral resistance, and poorly maintained structures are specifically susceptible to large earthquakes.

The Missouri Department of Insurance, Financial Institutions & Professional Registration (DIFP) prepared a report in August 2015 on the state of earthquake coverage in Missouri presenting the market trends over the past 15 years. The report notes that earthquake coverage has become less available and less affordable over the last 15 years. Insurance coverage rates for Carter County experienced a 189.5% increase from 2000 – 2014. Those rates seem to be stabilizing, with rates decreasing 14.2% between 2013 and 2014 according to the 2015 “The State of Earthquake Coverage Report”.

Potential Losses to Existing Development

HAZUS 2.1 was used to analyze vulnerability and estimate losses due to earthquakes. All HAZUS analyses were run using an enhanced Level 2 inventory database comprised of updated demographic and aggregated data using the 2010 US Census. The information and data for this vulnerability overview and potential loss were gathered from the 2018 Missouri State Hazard Mitigation Plan.

The updated annualized loss scenario presented here shows the economic losses to buildings annualized over eight earthquake return periods (100, 200, 500, 1,000, 2,000, and 2,500 years). HAZUS defines annualized loss as the expected value of loss in any one year. The software develops annualized loss estimates by aggregating the losses and their exceedance probabilities from the eight return periods. Annualized loss is the maximum potential annual dollar loss resulting from various return periods averaged on a ‘per year’ basis.

Reported in Table 3.60 in the 2018 Missouri State Hazard Mitigation Plan is that the building loss in Carter County would be \$157,000 or a loss ratio of \$302,000,000. Loss per capita would be approximately \$25.10. Carter County ranks 43rd in the state for its total losses, whereas St. Louis County, which borders the Mississippi River, is ranked first.

A second scenario, based on an event with a 2% probability of exceedance in 50 years was also done to model a worst case scenario. The methodology is based on a probabilistic seismic hazard shaking grids developed by the USGS. The maps provide estimates of peak ground acceleration and spectral acceleration at periods of 0.3 second and 1.0 second, respectively, which have a 2% probability of exceedance in the next 5 years. This scenario used a 7.7 driving magnitude, which is typical New Madrid fault planning scenario.

As reported in Table 3.63 in the 2018 Missouri State hazard Mitigation Plan, structural damage would amount to \$19,483, with non-structural damage estimated at \$63,654. Also contents damage and inventory loss are estimated at \$22,578. Total economic loss to buildings in Carter County is estimated at \$130,244. The loss ratio for the county is estimated at 16.01% which would rank thirty-seventh in the state.

Impact of Previous and Future Development

Future development is not expected to increase the risk other than contributing to the overall exposure of what could become damaged as a result of an earthquake event.

EMAP Consequence Analysis

No emergency management programs seeking EMAP accreditation exist in Carter County.

Hazard Summary by Jurisdiction

The earthquake intensity is not likely to vary greatly throughout the planning area; therefore, the risk will be the same throughout. The original county courthouse is more vulnerable to damages from the earthquake due to its age. No specific area of Carter County is more susceptible to earthquakes than another area.

- **Carter County** – Historic county courthouse building is more vulnerable due to age. No other specific area of Carter County is more susceptible to earthquakes than another area.
- **City of Van Buren** – Not anymore susceptible to earthquakes that another area.
- **City of Ellsinore** - Not anymore susceptible to earthquakes that another area.
- **City of Grandin** - Not anymore susceptible to earthquakes that another area.
- **Van Buren R-1 School District** - Not anymore susceptible to earthquakes that another area.
- **East Carter County R-2 School District** - Not anymore susceptible to earthquakes that another area.

Problem Statement

Carter County is very near the New Madrid Seismic Zone, enough that substantial damage would result in Carter County from a severe earthquake. The estimated loss data provided above demonstrates the level of loss the county would experience In both scenarios presented above, Carter County ranks in the top 50 counties in the state in regards to loss ratio.

The only area that has a higher potential for damage, as discussed above is the historic Carter County Courthouse, located in the City of Van Buren. The greatest concern of the MPC was the lives of local residents. To address this concern, the MPC developed the goal to continue earthquake education and participation in practice events.

3.4.4 Land Subsidence/Sinkholes

Hazard Profile

Hazard Description

Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that naturally can be dissolved by ground water circulating through them. As the rock dissolves, spaces and caverns develop underground. The sudden collapse of the land surface above them can be dramatic and range in size from broad, regional lowering of the land surface to localized collapse. However, the primary causes of most subsidence are human activities: underground mining of coal, groundwater or petroleum withdrawal, and drainage of organic soils. In addition, sinkholes can develop as a result of subsurface void spaces created over time due to the erosion of subsurface limestone (karst).

Land subsidence occurs slowly and continuously over time, as a general rule. On occasion, it can

occur abruptly, as in the sudden formation of sinkholes. Sinkhole formation can be aggravated by flooding.

In the case of sinkholes, the rock below the surface is rock that has been dissolving by circulating groundwater. As the rock dissolves, spaces and caverns form, and ultimately the land above the spaces collapse. In Missouri, sinkhole problems are usually a result of surface materials above openings into bedrock caves eroding and collapsing into the cave opening. These collapses are called “cover collapses” and geologic information can be applied to predict the general regions where collapse will occur. Sinkholes range in size from several square yards to hundreds of acres and may be quite shallow or hundreds of feet deep.

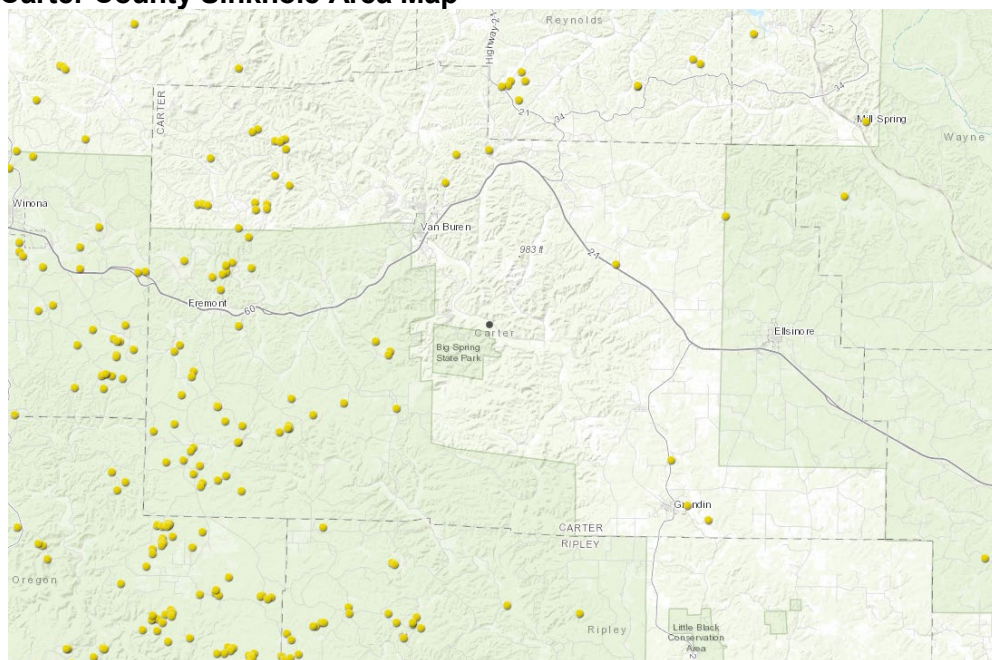
According to the U.S. Geological Survey (USGS), the most damage from sinkholes tends to occur in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania. Fifty-nine percent of Missouri is underlain by thick, carbonate rock that makes Missouri vulnerable to sinkholes. Sinkholes occur in Missouri on a fairly frequent basis. Most of Missouri’s sinkholes occur naturally in the State’s karst regions (areas with soluble bedrock). They are a common geologic hazard in southern Missouri, but also occur in the central and northeastern parts of the State. Missouri sinkholes have varied from a few feet to hundreds of acres and from less than one to more than 100 feet deep. The largest known sinkhole in Missouri encompasses about 700 acres in western Boone County southeast of where Interstate 70 crosses the Missouri River. Sinkholes can also vary in shape like shallow bowls or saucers whereas others have vertical walls. Some hold water and form natural ponds.

Mining activities that have occurred in Carter County include iron and copper.

Geographic Location

The map below shows the location of sinkholes in the planning area. The primary area of Carter County that has sinkholes is Grandin at the southern part of the County.

Figure 3.7 Carter County Sinkhole Area Map



Source: www.dnr.mo.gov/geology/geoserv/envgeo/sinkholes.htm

Strength/Magnitude/Extent

Sinkholes vary in size and location, and these variances will determine the impact of the hazard. A sinkhole could result in the loss of a personal vehicle, a building collapse, or damage to infrastructure such as roads, water, or sewer lines. Groundwater contamination is also possible from a sinkhole. Because of the relationship of sinkholes to groundwater, pollutants captured or dumped in sinkholes could affect a community's groundwater system. Sinkhole collapse could be triggered by large earthquakes. Sinkholes located in floodplains can absorb floodwaters but make detailed flood hazard studies difficult to model.

The 2018 State Plan included only seven documented sinkhole "notable events". The plan stated that sinkholes are common to Missouri and the probability is high that they will occur in the future. To date, Missouri sinkholes have historically not had major impacts on development nor have they caused serious damage. Thus, the severity of future events is likely to be low.

Previous Occurrences

According to the 2018 State Plan sinkholes are a regular occurrence in Missouri, but that there are rarely events of any significance. There have been no damage reports resulting from sinkholes in Carter County and few from around the State of Missouri. In the 2018 State Plan on page 3.225 recent events are described from around the state. The first event occurred in 2012 when a sinkhole caused a road to collapse near the Springfield-Branson National Airport. A water main broke as a result of the collapsed roadway, and the sinkhole likely formed as a result of heavy rains. No sinkholes in Carter County were noted.

Probability of Future Occurrence

The probability of future occurrences of sinkholes is high; however the severity is likely low. The map above depicts the general location of sinkholes that are known in the county. Other sinkholes may be found later that are not currently identified. No sinkhole events of record are located in Carter County; therefore, the probability of a future even cannot be calculated. The MPC felt like a more accurate map of sinkholes in the county could prevent future development near the sites and help mitigate future damages.

Changing Future Conditions Considerations

Direct effects from changing climate conditions such as an increase in droughts and could contribute to an increase in sinkholes. These changes raise the likelihood of extreme weather, meaning the torrential rain and flooding conditions which often lead to the exposure of sinkholes are likely to become increasingly common. Certain events such as a heavy precipitation following a period of drought can trigger a sinkhole due to low levels of groundwater combined with a heavy influx of rain.

Vulnerability

Vulnerability Overview

Sinkholes are a common feature in Missouri, however in Carter County there are only 72 documented sinkholes. There have been no reports of damages resulting from these sinkholes. Many of these sinkholes in Carter County have occurred in areas of very low population density.

Potential Losses to Existing Development

All known sinkholes are in remote and very rural areas of the county, there have been no reported sinkholes near populations or developments. Therefore, the potential loss to existing development

is very low and not expected.

Impact Future Development

All known sinkholes are in remote and very rural areas that are at risk of sinkhole formation are in extremely rural areas that are not anticipated for any type of future development. Therefore, there is not expected to be any impacts on future development from sinkholes.

EMAP Consequence Analysis

No emergency management programs seeking EMAP accreditation exist in Carter County.

Hazard Summary by Jurisdiction

No reported sinkholes are in the vicinity of critical facilities or school district assets. Documented sinkholes are located in the rural area of the county.

- **Carter County** – No vulnerability.
- **City of Van Buren** – No vulnerability.
- **City of Ellsinore** - No vulnerability.
- **City of Grandin** - No vulnerability.
- **Van Buren R-1 School District** - No vulnerability.
- **East Carter County R-2 School District** - No vulnerability.

Problem Statement

The risk for damages due to sinkholes is limited and unlikely. However, the MPC felt that having more accurate mapping of existing sinkholes could help militate against future damages if the county and city officials were more aware of the locations.

3.4.5 Drought

Hazard Profile

Hazard Description

Drought is generally defined as a condition of moisture levels significantly below normal for an extended period of time over a large area that adversely affects plants, animal life, and humans. A drought period can last for months, years, or even decades. There are four types of drought conditions relevant to Missouri, according to the State Plan, which are as follows:

- Meteorological drought is defined in terms of the basis of the degree of dryness (in comparison to some “normal” or average amount) and the duration of the dry period. A meteorological drought must be considered as region-specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region.
- Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (e.g., streamflow, reservoir and lake levels, ground water). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system. Hydrological droughts are usually out of phase with or lag the occurrence of

meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and ground water and reservoir levels. As a result, these impacts also are out of phase with impacts in other economic sectors.

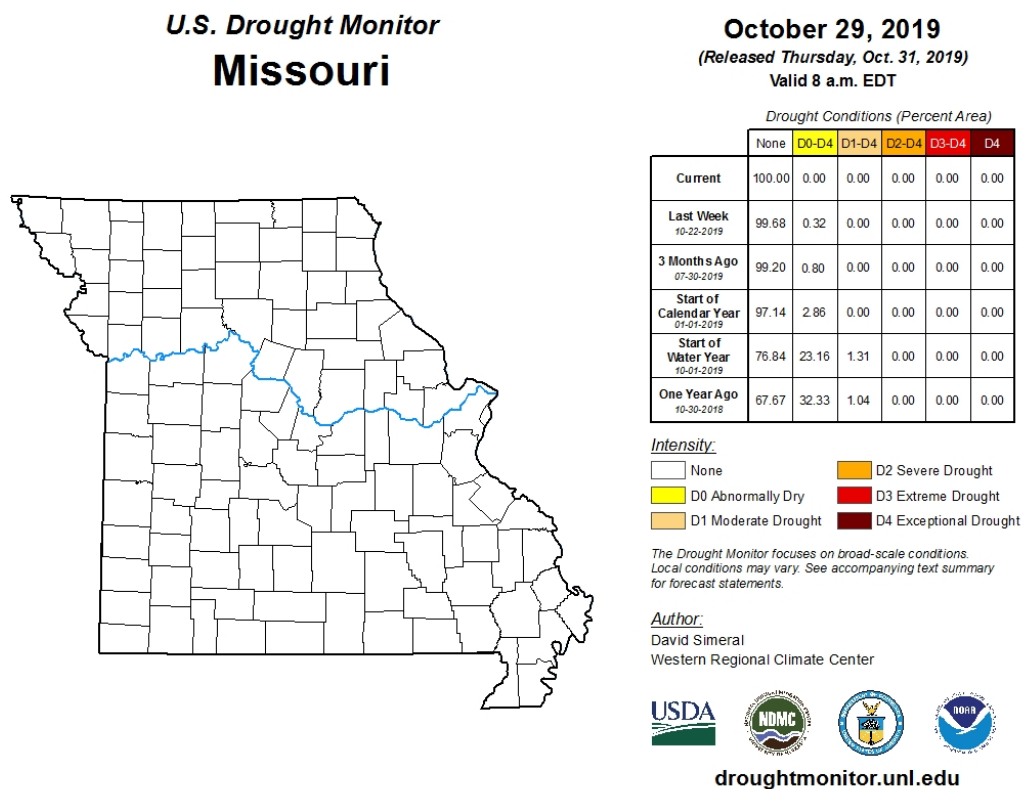
- Agricultural drought focus is on soil moisture deficiencies, differences between actual and potential evaporation, reduced ground water or reservoir levels, etc. Plant demand for water depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil.
- Socioeconomic drought refers to when physical water shortage begins to affect people.

Geographic Location

The entire planning area of Carter County is vulnerable to the effects of drought. Although all jurisdictions in the county are at risk, droughts most directly impact the agriculture sector. According to the United States Department of Agriculture, Ag Census 2012 there are 196 farms in Carter County and 73,642 acres of the county are used for agriculture. All agriculture in Carter County is livestock farms with the average farm size being 376 acres. No conversion of farmland to development is occurring in Carter County.

See figure 3.8 for a recent U.S. Drought Monitor as an example of the geographic area that could be in drought at any given moment in time. This is only a snapshot of conditions.

Figure 3.8. U.S. Drought Monitor Map of Missouri on October 29, 2019



Source: U.S. Drought Monitor, <http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?MO>

Strength/Magnitude/Extent

The Palmer Drought Indices measure dryness based on recent precipitation and temperature. The indices are based on a “supply-and-demand model” of soil moisture. Calculation of supply is relatively straightforward, using temperature and the amount of moisture in the soil. However, demand is more complicated as it depends on a variety of factors, such as evapotranspiration and recharge rates. These rates are harder to calculate. Palmer tried to overcome these difficulties by developing an algorithm that approximated these rates and based the algorithm on the most readily available data – precipitation and temperature.

The Palmer Index has proven most effective in identifying long-term drought of more than several months. However, the Palmer Index has been less effective in determining conditions over a matter of weeks. It uses a “0” as normal, and drought is shown in terms of negative numbers; for example, negative 2 is moderate drought, negative 3 is severe drought, and negative 4 is extreme drought. Palmer’s algorithm also is used to describe wet spells, using corresponding positive numbers.

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 Palmer Index can therefore be applied to any site for which sufficient precipitation and temperature data is available.

Previous Occurrences

According to the USDA Risk Management Agency’s data that identifies insured crop loss payments by county as a result of drought, no droughts impacted Carter County from 1999–2019. The Drought Impact Reporter noted 21 previous droughts for Carter County since 1999. Previous droughts include:

- 10/11/2018 – no end date - Missouri farmers were warned to test baled cornstalks before feeding them to cattle because the droughty summer may have left them high in nitrates, according to University of Missouri Extension livestock specialist Gene Schmitz. Some stalks contained nearly four times the acceptable level of nitrates. Warrensburg Daily Star-Journal (Mo.), Oct. 11, 2018
- 8/20/2018 – no end date - Missouri Gov. Mike Parson announced a new relief program for farmers, allowing them to hay and pump water from some state land as intense drought gripped the state. Farmers can access water from 28 conservation areas and five state parks in the northern and middle parts of the state, where drought was the worst. Up to 5,000 gallons of water can be pumped daily per farm. A state lottery will allow 16 farmers an opportunity to hay nearly 900 acres of Missouri State Parks land with haying taking place between Aug. 27 and Nov. 27. Fort Worth Star-Telegram (Texas), Aug. 20, 2018
- 7/26/2018 – no end date - Missouri U.S. Senators Claire McCaskill and Roy Blunt sought drought assistance from the U.S. Department of Agriculture to release Conservation Reserve Program (CRP) acreage for haying and grazing. The senators would also like approval of the Missouri Farm Service Agency’s request for special authority to release CRP acreage covered by additional conservation practices for haying and grazing. Missouri Net (Jefferson City, Mo.), July 26, 2018
- 7/18/2018 – no end date - Missouri farmers who responded to a Missouri Farm Bureau survey reported that the drought was severely hitting hay production and will likely force many producers to sell livestock. Ninety-eight percent of respondents reported that their first cutting of hay was of poorer quality or quantity than usual, averaging 43 percent below normal production. In northwest Missouri, more than 86 percent anticipated needing to purchase hay to get them through until spring, but just 13 percent said hay was available for purchase in their area. Producers expected to travel at least 110 miles to find suitable hay. In addition, hay prices have risen about 106 percent, and reaching as high as 130 percent in northwest Missouri. Seventy-two percent of respondents expect to have to sell some of their herds, due to drought. Of that 72

percent, more than 60 percent felt they would have to sell at least 20 percent of their herd. Montrose Daily Press (Colo.), July 18, 2018. Sold calves early so we would not have to feed hay. Ponds are drying up CoCoRaHS Report from Station #Alton 7.3 W on 7/16/2018 we live just south of Nixa MO. Hot, little and spotty rain. Grass isn't growing. Most of our cattle are in Reeds Spring south of here. Even less rain, no grass growing, ponds dangerously low. We will have to move the cattle here where we can water with a well and feed hay IN JULY. Can't find more hay so if we don't get rain we will have to sell off cattle. CoCoRaHS Report from Station #Nixa 2.7 SSW on 7/16/2018.

- 7/16/2018 – no end date - Hay prices in the Ozarks were more than double, nearly triple what hay cost in 2017, according to an Ozarks farmer. Grass hay cost as much as \$200 per ton when it can be found, but hay was scarce. Farmers expect to have to sell their cattle. Four States Homepage (KODE-TV, KSNF-TV) (Joplin, Mo.), July 16, 2018.
- 6/25/2018 – 9/1/2018 - The Missouri Soil and Water Districts Commission granted a statewide variance, allowing grazing in livestock-excluded areas that were under maintenance of a state cost-share contract. KDKD-FM 95.3 (Clinton, Mo.), June 25, 2018
- 6/1/2018 – 3/25/2019 - Nearly 300 Missouri cattle deaths have been attributed to high nitrate levels in hay and drought-stunted corn. Most instances were seen in southwest and south central Missouri. Boonville Daily News (Mo.), March 7, 2019. Drought in Missouri during 2017 and through the summer of 2018 reduced available hay and grass supplies, leaving farmers to feed hay of questionable quality to their livestock. Some of the poorer quality hay was high in nitrate and resulted in the deaths of 150 cattle in the past month. In southwest Missouri, one farmer lost 40 of his 70 cattle, while another farmer lost 20 cows. Hay & Forage Grower (Fort Atkinson, Wis.), Feb. 18, 2019
- 7/1/2017 – 3/2/2018 - The drought has affected this cow/calf farm with an established rotational grazing system. Rainfall was a negative 11.55" from the norm between July 2017 - January 2018 and a positive 4.9" in the month of February. Nitrogen added in August to build up stockpiles of grass for winter strip grazing was ineffective due to lack of rain. Hay will be needed to maintain herd through to spring. Increased soil erosion was noticed during February flooding due to lack of forage cover due to drought. From Carter County, Missouri, on March 2, 2018
- 4/16/2017 – no end date - Missouri farmers were warned that forages under stress from the winter drought and warm spring might set seed heads early this year. If the rain continues and the temperatures are good, forages may respond well. If rains cease to fall, pastures may be all stems and seeds rather than leaves. While grass stems are not particularly nourishing for grazing herds, Kentucky 31 tall fescue stems can produce toxic alkaloid concentrate in stems and seeds. High Plains Journal (Kan.), April 16, 2017
- 8/30/2012 – no end date - Cattle sales in southern Missouri from Joplin to Farmington were higher than usual as ranchers held out as long as they could before selling cattle. Observers noted that cattle were 10 to 15 percent lighter than usual because the countryside held no grass or much in the way of water for the livestock. The landscape in central Missouri was tan as drought dried up everything. Raleigh News & Observer (N.C.), Aug. 30, 2012
- 7/23/2012 – 7/24/2012 - Off the top of my head I know of several farmers hauling water to livestock because ponds and creeks have dried up. All the corn in our area is being chopped for silage or baled for hay. At least 50% of producers are feeding hay and have been since July 1. Trees are turning brown on hillsides in Madison County (see included picture). Iron and Madison Counties have had sizable fires. Areas included in these observations include Ripley, Reynolds, Carter, Butler, Iron, Madison, Wayne, St. Francois and Perry counties. From Pat Guinan, Missouri State Climatologist, on behalf of Kendra Graham, livestock specialist in Wayne County, Missouri, on July 24, 2012.
- 7/12/2012 – no end date - Agriculture Secretary Tom Vilsack July 11 announced a package of program improvements that will deliver faster and more flexible assistance to farmers and ranchers devastated by natural disasters. Vilsack announced three significant improvements to decades-old USDA programs and processes related to Secretarial disaster designations: a final

rule that simplifies the process for Secretarial disaster designations and will result in a 40 percent reduction in processing time for most counties affected by disasters; a reduced interest rate for emergency loans that effectively lowers the current rate from 3.75 percent to 2.25 percent; and a payment reduction on Conservation Reserve Program (CRP) lands qualified for emergency haying and grazing in 2012, from 25 to 10 percent. The final rule for Secretarial disaster designations is amended as follows: 1) Nearly automatically qualifies a disaster county once it is categorized by the U.S. Drought Monitor as a severe drought for eight consecutive weeks during the growing season. Effective July 12, 1,016 primary counties in 26 states will be designated as natural disaster areas, making all qualified farm operators in the designated areas eligible for low interest emergency loans from USDA's Farm Service Agency (FSA), provided eligibility requirements are met. 2) Streamlines the USDA Secretarial designation process, which is expected to provide better service to farmers and ranchers by reducing by approximately 40 percent the amount of time required for designating a disaster area. 3) Removes the requirement that a request for a disaster designation be initiated by a state governor or Indian tribal council, increasing the likelihood that counties will be covered. Indian tribal councils and governors may still submit a request for a designation, but it will not be required in order to initiate a disaster declaration. <http://www.usda.gov/documents/disaster-fast-track-2012.pdf>
http://www.fsa.usda.gov/Internet/FSA_File/fast_trk_primary_contig_cos.pdf USDA FSA press release, July 12, 2011

- 6/29/2012 – no end date - The Missouri Department of Conservation issued a statewide fire ban effective immediately in all conservation areas. Campfires and all sources of open flames, such as charcoal grills and the use of firewood in cooking fires, was prohibited. Columbia Missourian (Mo.), June 29, 2012
- 6/1/2012 – 7/17/2012 - Mark Twain National Forest authorities stated that the number of forest fires was "setting a record pace." During June and July, there were more than 50 wildfires that charred more than 4,000 acres. The 20-year average is 174 fires that scorch 5,145 acres. Since the start of 2012, more than 6,000 acres were burned by 117 fires. Heat and drought contributed to the increased number of fires. Springfield News-Leader (Mo.), July 17, 2012
- 4/1/2012 – no end date - The U.S. Department of Agriculture (USDA) on July 17, 2012, designated 97 counties in Missouri as primary natural disaster areas due to damage and losses caused by drought and excessive heat that began in April 1, 2012, and continues. Contiguous counties in other states are also eligible. The counties declared primary disaster areas are: Adair, Cole, Iron, Monroe, Andrew, Cooper, Jackson, Montgomery, Atchison, Crawford, Jasper, Morgan, Audrain, Dade, Jefferson, Newton, Barry, Dallas, Johnson, Nodaway, Barton, Daviess, Knox, Oregon, Benton, De Kalb, Laclede, Osage, Boone, Dent, Lafayette, Pettis, Buchanan, Douglas, Lawrence, Phelps, Caldwell, Franklin, Lewis, Pike, Callaway, Gasconade, Lincoln, Platte, Camden, Gentry, Linn, Polk, Carroll, Greene, Livingston, Pulaski, Cass, Grundy, McDonald, Putnam, Cedar, Harrison, Macon, Ralls, Chariton, Henry, Maries, Randolph, Christian, Hickory, Marion, Ray, Clark, Holt, Mercer, Reynolds, Clay, Howard, Miller, St. Charles, Clinton, Howell, Moniteau, St. Clair, Ste. Genevieve, St. Francois, St. Louis, and Saline. USDA FSA press release No. 0074.12, July 17, 2012
- 7/1/2011 – no end date - All but three counties in Missouri were declared to be natural disaster areas by the U.S. Department of Agriculture due to drought from July 1 through August 30. The only counties not included in the declaration were Atchison, Holt and Mississippi counties. This declaration permits affected farmers, ranchers, and other agricultural producers to apply for low-interest emergency loans from the Farm Service Agency. Columbia Missourian (Mo.), Oct. 18, 2011
- 6/15/2010 – 10/24/2010 - The following report was submitted. The severity of the drought of 2010 has worsened within the past month. The last significant rainfall was around September 8th, and was very spotty. Since mid May, Carter, Ripley, and surrounding counties have received approximately 45-50% of normal rainfall, and temperatures have been extremely warm, record setting to be exact, which has added to crop and pasture drought problems. Producers have fed hay off and on since late June and steadily since mid August. We just missed another rain

- forecast. Water supplies for livestock are also a major issue now. Impact Source: Government
- 6/5/2010 – 9/30/2010 - The following report was submitted. Livestock producers in Ripley and Carter Counties have been feeding hay for 3 weeks. Pastures are burned up, by not having significant rainfall for 6 weeks, plus we have been well above average in temps, too. Livestock water is also becoming a concern for some producers. Non-irrigated crops are a complete failure. Impact Source: Government
 - 11/2/2007 – 11/2/2007 - Twenty-two Missouri counties have been declared a natural disaster area by the U.S. Department of Agriculture, due to drought. The counties affected by the declaration include Bollinger, Butler, Cape Girardeau, Carter, Dunklin, Howell, Iron, Jefferson, Madison, Mississippi, New Madrid, Oregon, Pemiscot, Perry, Reynolds, Ripley, Scott, St. Francois, Ste. Genevieve, Stoddard, Washington, and Wayne counties. Neighboring counties that are also eligible for low-interest loans include Crawford, Dent, Douglas, Franklin, Ozark, Shannon, St. Louis and Texas. Impact Source: MediaMore Information: <http://www.semissourian.com/story/1288259.html>
 - 10/18/2007 – 10/18/2007 - Representative Emerson of Missouri wrote to Acting U.S. Secretary of Agriculture to urge him to consider the request sent by the governor seeking an agricultural disaster declaration for 22 counties in southeastern Missouri. The twenty-two counties are Bollinger, Butler, Cape Girardeau, Carter, Dunklin, Howell, Iron, Jefferson, Madison, Mississippi, New Madrid, Oregon, Pemiscot, Perry, Reynolds, Ripley, St. Francois, Ste. Genevieve, Scott, Stoddard, Washington and Wayne. Impact Source: MediaMore Information: <http://www.houstonherald.com/articles/2007/10/18/news/doc471628f032db3080631191.txt>
 - 9/15/2006 – 9/15/2006 - Due to agricultural losses incurred from drought, Missouri Governor Blunt has formally requested that the U.S. Department of Agriculture declare the following 96 state counties agricultural disaster areas: Adair, Andrew, Atchison, Audrain, Barry, Barton, Bates, Benton, Boone, Buchanan, Caldwell, Callaway, Camden, Carter, Carroll, Cass, Cedar, Christian, Clark, Clay, Clinton, Cole, Cooper, Crawford, Dade, Dallas, Daviess, DeKalb, Dent, Douglas, Franklin, Gasconade, Gentry, Greene, Grundy, Harrison, Henry, Hickory, Holt, Howard, Iron, Jackson, Jasper, Jefferson, Johnson, Knox, Laclede, Lafayette, Lawrence, Lewis, Lincoln, Linn, Livingston, McDonald, Madison, Maries, Marion, Mercer, Miller, Moniteau, Monroe, Montgomery, Morgan, Newton, Nodaway, Osage, Ozark, Pettis, Phelps, Pike, Platte, Polk, Pulaski, Putnam, Ralls, Randolph, Ray, Reynolds, St. Charles, St. Clair, St. Francois, St. Louis, Ste. Genevieve, Schuyler, Scotland, Shannon, Stone, Sullivan, Taney, Texas, Vernon, Warren, Washington, Webster, Worth, and Wright. Impact Source: MediaMore Information: <http://www.brownfieldnetwork.com/gestalt/go.cfm?objectid=B2E36DA9-FA38-8910-93111863925C6F5A>

Probability of Future Occurrence

The twenty-one incidents reported above span over twenty years of data, or 240 months. This means Carter County experience 21 events over 20 years, 21/20. This shows that in the future there is a 100% chance that another drought event could occur in Carter County. The timing and duration of drought is not predictable, but long-range outlooks and predicted impacts of climate change could indicate an increased chance of drought.

Changing Future Conditions Considerations

Severe drought, a natural part of Missouri's climate, is a risk to this agriculture-dependent state. Future increases in evaporation rates due to higher temperatures may increase the intensity of naturally-occurring droughts.

Although springtime in Missouri is likely to be wetter, summer droughts are likely to be more severe. Higher evaporation and lower summer rainfall are likely to reduce river flows. The drought of 2012 narrowed navigation channels, forced lock closures, and caused dozens of barges to run aground on

the Mississippi River along the Missouri shoreline. The resulting impact on navigation cost the region more than \$275 million. The drought of 2012–2013 also threatened municipal and industrial water users along the Missouri River.

The number of heavy rainfall events is predicted to increase, yet researchers currently expect little change in total rainfall amounts, indicating that the periods between heavy rainfalls will be marked by an increasing number of dry days. Higher temperatures and increased evapotranspiration increase the likelihood of drought. This could lead to agricultural drought and suppressed crop yields.

Vulnerability

Vulnerability Overview

According to the 2018 Missouri State Hazard Mitigation Plan, Carter County has a moderate susceptibility to droughts. Groundwater resources are adequate to meet domestic and municipal water needs, but due to required well depths, irrigation wells are very expensive. The topography is generally unsuitable for row-crop irrigation.

Potential Losses to Existing Development

The National Drought Monitor Center at the University of Nebraska at Lincoln summarized the potential severity of drought as follows. Drought can create economic impacts on agriculture and related sectors, including forestry and fisheries, because of the reliance of these sectors on surface and subsurface water supplies. In addition to losses in yields in crop and livestock production, drought is associated with increases in insect infestations, plant disease, and wind erosion. Droughts also bring increased problems with insects and disease to forests and reduce growth. The incidence of forest and range fires increases substantially during extended droughts, which in turn place both human and wildlife populations at higher levels of risk. Income loss is another indicator used in assessing the impacts of drought because so many sectors are affected. Finally, while drought is rarely a direct cause of death, the associated heat, dust and stress can all contribute to increased mortality.

Anticipated potential losses are limited to agriculture damage, particularly with impacts to livestock. Droughts impact hay production, which is a necessary commodity for livestock farmers in Carter County. According to the USDA Risk Management Agency's data that identifies insured crop loss payments by county as a result of drought, no insurance losses were claimed in Carter County from 1999–2019. Therefore, there is no data from which to utilize to determine potential future monetary losses.

Impact of Previous and Future Development

Little future development is anticipated within Carter County due to the rural nature of the county. Any future development will not result in increased impacts from droughts. All of the public water supply districts have ample capacity to meet all foreseen future development. No significant increase is anticipated in the number of acres farmed.

Changing Future Conditions Considerations

A new analysis, performed for the Natural Resources Defense Council, examined the effects of climate change on water supply and demand in the contiguous United States. The study found that more than 1,100 counties will face higher risks of water shortages by mid-century as a result of climate change. Two of the principal reasons for the projected water constraints are shifts in precipitation and potential

evapotranspiration (PET). Climate models project decreases in precipitation in many regions of the U.S., including areas that may currently be described as experiencing water shortages of some degree.

EMAP Consequence Analysis

No emergency management programs seeking EMAP accreditation exist in Carter County.

Hazard Summary by Jurisdiction

Groundwater is a valuable commodity that is readily available in Carter County. Even when creeks, streams, and rivers may be at low levels, groundwater is readily available. Although the drought conditions are typically constant across the county, in the incorporated cities the magnitude will be different from that experienced by farmers. Where farmers potentially experience crop loss or damage, in cities only lawns and gardens would be impacted. The capacity of the organized public water supply districts is sufficient to provide ample water to local residents. However, there are many local residents that rely on private wells for water supply that could potentially be impacted by a severe drought. In severe drought conditions, there is the possibility for building foundations to be weakened due to shrinking and expanding soils.

- **Carter County** – Agriculture production and farmland could be negatively impacted through loss of livestock and feed source.
- **City of Van Buren** – Primarily contained to damage to lawns and gardens.
- **City of Ellsimore** - Primarily contained to damage to lawns and gardens.
- **City of Grandin** - Primarily contained to damage to lawns and gardens.
- **Van Buren R-1 School District** - Primarily contained to damage to lawns and gardens.
- **East Carter County R-2 School District** – Primarily contained to damage to lawns and gardens.

Problem Statement

Drought is a hazard that impacts large geographic regions of the country. The sector that is most impacted in Carter County is the acres that are used for farming. Drought causes damages to crops and can negatively impact the yield of crops depending on the time the drought occurs. Carter County has experienced twenty-one droughts in the last twenty years, placing extra strain on livestock, feed sources, lawns and gardens, forcing ag producers and residents to utilize external water sources more frequently. While the water supply is not in danger in Carter County, costs for residents on public water systems are impacted.

3.4.6 Extreme Temperatures

Hazard Profile

Hazard Description

Extreme temperature events, both hot and cold, can impact human health and mortality, natural ecosystems, agriculture and other economic sectors. According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index chart shown in **Figure 3.9** uses both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

Extreme cold often accompanies severe winter storms and can lead to hypothermia and frostbite in people without adequate clothing protection. Cold can cause fuel to congeal in storage tanks and supply lines, stopping electric generators. Cold temperatures can also overpower a building's heating system and cause water and sewer pipes to freeze and rupture. Extreme cold also increases the likelihood for ice jams on flat rivers or streams. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is hazardous to health and safety.

The National Institute on Aging estimates that more than 2.5 million Americans are elderly and especially vulnerable to hypothermia, with the isolated elders being more at risk. About 10 percent of people over the age of 65 have some kind of bodily temperature-regulating defect, and 3-4 percent of all hospital patients over 65 are hypothermic.

Also at risk, are those without shelter, those who are stranded, or who live in a home that is poorly insulated or without heat. Other impacts of extreme cold include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters; household fires, which can be caused by fireplaces and emergency heaters; and frozen/burst pipes.

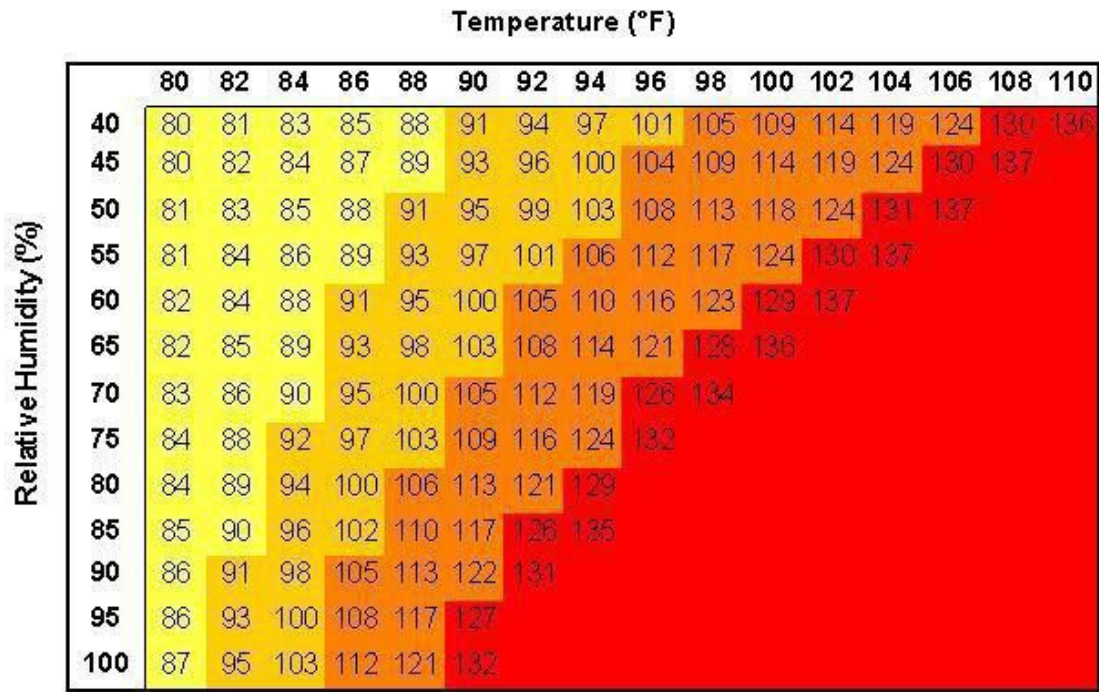
Geographic Location

Extreme heat and extreme cold hazards are area-wide hazard events, and the risk of extreme heat or cold does not vary across the planning area. All areas are equally susceptible to the impacts of extreme heat and cold. Extreme heat and cold events are typically regional in nature and impact multiple counties, and even multiple states.

Strength/Magnitude/Extent

The National Weather Service (NWS) has an alert system in place (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for issuing excessive heat alerts is when for two or more consecutive days: (1) when the maximum daytime Heat Index is expected to equal or exceed 105 degrees Fahrenheit (F); and the night time minimum Heat Index is 80 degrees F or above. A heat advisory is issued when temperatures reach 105 degrees and a warning is issued at 115 degrees.

Figure 3.9. Heat Index (HI) Chart



Source: National Weather Service (NWS)

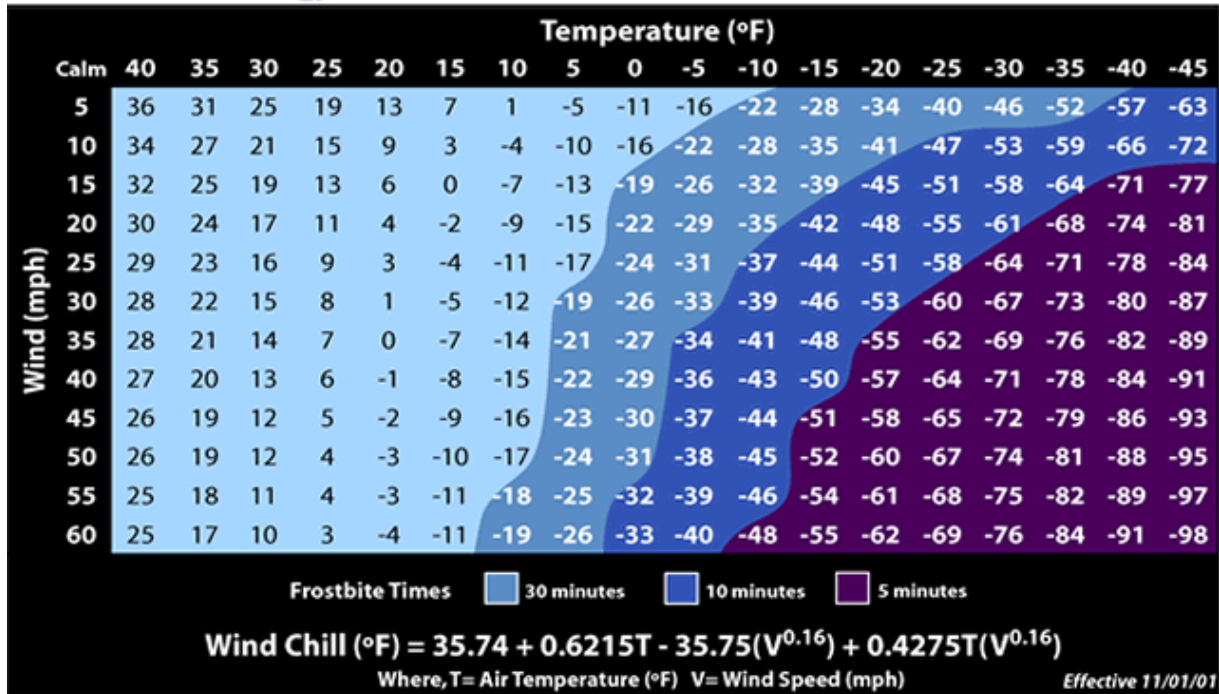
Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. The shaded zone above 105°F corresponds to a HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

The NWS Wind Chill Temperature (WCT) index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from winter winds and freezing temperatures. The figure below presents wind chill temperatures which are based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperatures and eventually the internal body temperature.

Figure 3.10. Wind Chill Chart



Wind Chill Chart



Source: <https://www.weather.gov/safety/cold-wind-chill-chart>

Previous Occurrences

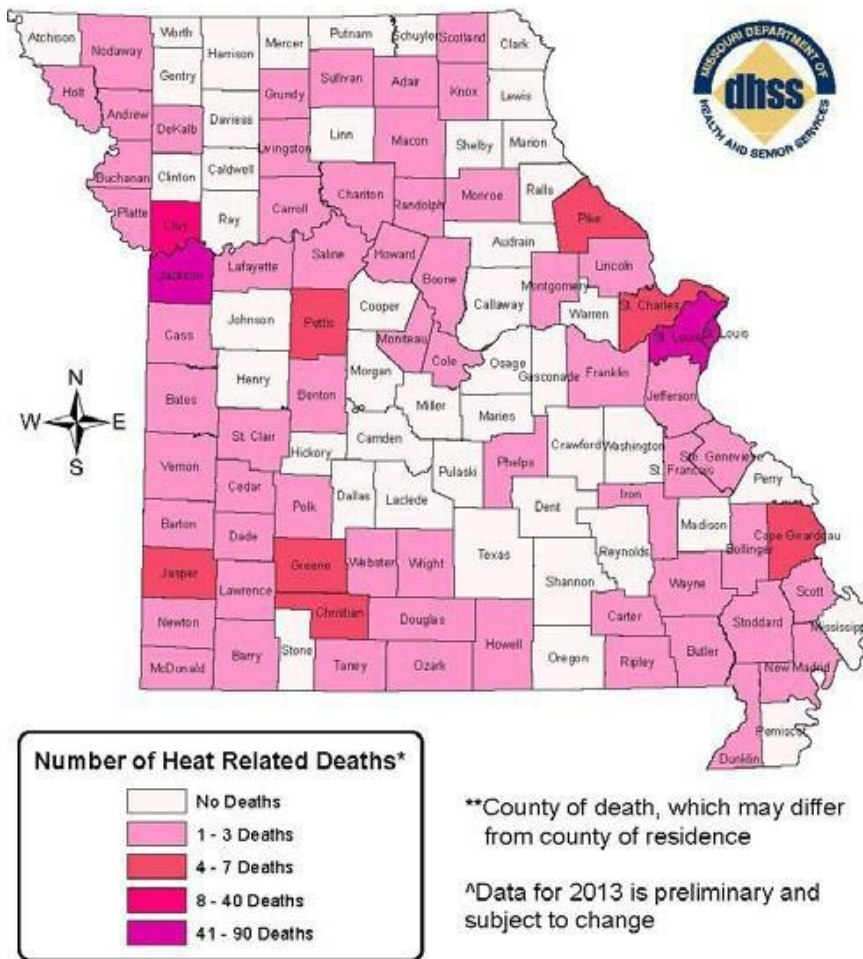
According to the National Centers for Environmental Information (NCEI) database, from August 1, 2010 through August 1, 2015 there were nine reported excessive heat events. These nine events included, thirty-eight days of excessive heat. In reviewing the reports provided by the NCEI there were two deaths reported within Carter County and surrounding counties.

From the time period of January 1, 2009 and July 31, 2019, there were five occurrences of extreme cold/wind chill and cold/wind chill events in Carter County. There were no deaths or property damage from these occurrences.

The following map (Figure 3.11), depicts the number of heath related deaths by county from 2000-2013. Carter County falls within the same colored category as many of its neighbors that have experienced 1-3 deaths during this time period.

Figure 3.11. Heat Related Deaths in Missouri 2000 - 2013

Number of Heat Related Deaths in Missouri by County** for 2000 - 2013^



*Source: Bureau of Environmental Epidemiology

Date: 6/5/2014

Extreme heat can cause stress to crops and animals. According to USDA Risk Management Agency, there were no losses to insurable crops during a 10-year time period from January 1, 2009 – October 31, 2019. Extreme heat can also strain electricity delivery infrastructure overloaded during peak use of air conditioning during extreme heat events. Another type of infrastructure damage from extreme heat is road damage. When asphalt is exposed to prolonged extreme heat, it can cause buckling of asphalt-paved roads, driveways, and parking lots.

From 1988-2011, there were 3,496 fatalities in the U.S. attributed to summer heat. This translates to an annual national average of 146 deaths. During the same period, two deaths were recorded in the planning area, according to NCEI data. The National Weather Service stated that among natural hazards, no other natural disaster—not lightning, hurricanes, tornadoes, floods, or earthquakes—causes more deaths.

Probability of Future Occurrence

The probability of future occurrence can be calculated by dividing the number of extreme heat events by the number of years, in this case nine events divided by five years is equal to a sum greater than 100% probability that an extreme heat event will occur in any given year. The average number of

events per year would be approximately two. Extreme heat events are often underreported any this data is based on those events reported by NOAA through its NCEI.

Cold, extreme cold, and wind chill events is also calculated by dividing the number of events over the number of years, in this case five events divided by ten years is equal to a 50% probability that a cold event will occur in any given year.

Changing Future Conditions

Under a higher emissions pathway, historically unprecedented warming is projected by the end of the century. Even under a pathway of lower greenhouse gas emissions, average annual temperatures are projected to most likely exceed historical record levels by the middle of the 21st century. For example, in southern Missouri, the annual maximum number of consecutive days with temperatures exceeding 95 degrees F is projected to increase by up to 20 days. Temperature increases will cause future heat waves to be more intense, a concern for this region which already experiences hot and humid conditions. If the warming trend conditions, future heat waves are likely to be more intense, and cold wave intensity is projected to decrease.

The impacts of extreme heat events are experienced most acutely by the elderly and other vulnerable populations. High temperatures are exacerbated in urban environments, a phenomenon known as the urban heat island effect, which in turn tend to have higher concentrations of vulnerable populations. Higher demand for electricity as people try to keep cool amplifies stress on power systems and may lead to an increase in the number of power outages. Atmospheric concentrations of ozone occur at higher air temperatures, resulting in poorer air quality, while harmful algal blooms flourish in warmer water temperatures, resulting in poorer water quality.

Mitigation against the impacts of future temperature increase may include increasing education on heat stress prevention, organizing cooling centers, allocating additional funding to repair and maintain roads damaged by buckling and potholes, and reducing nutrient runoff that contributes to algal blooms. Local governments should also prepare for increased demand on public recreational facilities, utility systems, and healthcare centers. Improving energy efficiency in public buildings will also present an increasingly valuable savings potential.

Vulnerability

Vulnerability Overview

Those at greatest risk for heat-related illness include infants and children up to five years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather. In agricultural areas, the exposure of farm workers, as well as livestock, to extreme temperatures is a major concern.

From the statistical data collected in the 2018 State Plan, four factors were considered in determining overall vulnerability to extreme temperatures as follows: total population, percentage of population over 65, likelihood of 3.264 3 Risk Assessment occurrence, and social vulnerability. Based on natural breaks in the statistical data, a rating value of 1 through 5 was assigned to each factor. These rating values correspond to the following descriptive terms: 1) Low 2) Low-medium 3) Medium 4) Medium-high 5) High.

In Carter County, 17.4% of the population is over the age of 65 according to the 2018 State Plan, which represents a medium SOVI ranking. The likelihood of extreme heat occurrence is 2.43 and 1.71 for extreme cold. The overall vulnerability rating for extreme heat is medium and medium high for extreme cold.

Table 3.26 lists typical symptoms and health impacts due to exposure to extreme heat.

Table 3.26. Typical Health Impacts of Extreme Heat

Heat Index (HI)	Disorder
80-90° F (HI)	Fatigue possible with prolonged exposure and/or physical activity
90-105° F (HI)	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity
105-130° F (HI)	Heatstroke/sunstroke highly likely with continued exposure

Source: National Weather Service Heat Index Program, www.weather.gov/os/heat/index.shtml

Potential Losses to Existing Development

The historical amount paid for crop insurance damage is \$0, so it can be assumed that during future events little to no monetary damage will occur. Extreme temperatures can impact the entire Carter County planning area. Areas with crops are more susceptible to costly damage.

Impact of Previous and Future Development

Population growth can result in increases in the age-groups that are most vulnerable to extreme heat. Population growth also increases the strain on electricity infrastructure, as more electricity is needed to accommodate the growing population. There has been a 23% increase in population overall in Carter County from 2000 – 2010 Census data. Growth has primarily been in the small communities of Ellsinore and Grandin and unincorporated Carter County.

EMAP Consequence Analysis

No emergency management programs seeking EMAP accreditation exist in Carter County.

Hazard Summary by Jurisdiction

Those at greatest risk for heat-related illness and deaths include children up to five years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. To determine jurisdictions within the planning area with populations more vulnerable to extreme heat, demographic data was obtained from the 2010 census on population percentages in each jurisdiction comprised of those under age 5 and over age 65. Data was not available for overweight individuals and those on medications vulnerable to extreme heat. Table 3.27 below summarizes vulnerable populations in the participating jurisdictions. Note that school and special districts are not included in the table because students and those working for the special districts are not customarily in these age groups.

Table 3.27. County Population Under Age 5 and Over Age 65, 2010 Census Data

Jurisdiction	Population Under 5 ys	Population 65 ys and over
Unincorporated Carter County	441	1,040
City of Van Buren	56	202
City of Ellsinore	41	95
City of Grandin	22	37

Source: U.S. Census Bureau, (*) includes entire population of each city or county

- **Carter County** – Those under five years of age and over 65 years of age, people who are overweight, and people on medications are most vulnerable to extreme

temperatures. All other strategic buildings and critical facilities within the county are air conditioned and heated with no increased susceptibility to damages from extreme heat or cold.

- **City of Van Buren** – Those under five years of age and over 65 years of age, people who are overweight, and people on medications are most vulnerable to extreme temperatures.
- **City of Ellsinore** - Those under five years of age and over 65 years of age, people who are overweight, and people on medications are most vulnerable to extreme temperatures.
- **City of Grandin** - Those under five years of age and over 65 years of age, people who are overweight, and people on medications are most vulnerable to extreme temperatures.
- **Van Buren R-1 School District** – Very few children under 5 years of age attend school and all district buildings have air conditioners and heaters. School is typically not in session during the hottest time of the year which is typically the month of July. All school districts in the county remain open regardless of temperature. However, accommodations are made for extreme heat or cold events such as keeping children indoors during recess times to reduce potential exposure to extreme heat or cold. Additionally, all schools in the county comply with the Missouri State High School Activities Association guidelines for avoiding heat-related problems during practice and sporting events.
- **East Carter County R-2 School District** – Very few children under 5 years of age attend school and all district buildings have air conditioners and heaters. School is typically not in session during the hottest time of the year which is typically the month of July. All school districts in the county remain open regardless of temperature. However, accommodations are made for extreme heat and cold events such as keeping children indoors during recess times to reduce potential exposure to extreme heat and cold. Additionally, all schools in the county comply with the Missouri State High School Activities Association guidelines for avoiding heat-related problems during practice and sporting events.

Problem Statement

The risks presented in this section resulting from extreme temperatures include heat-related illness and death, cold-related illness and death, and damage to crops in Carter County. To address the problem of extreme heat and cold the MPC have included the action to educate residents on heat and cold-related illnesses.

3.4.7 Severe Thunderstorms Including High Winds, Hail, and Lightning

Hazard Profile

Hazard Description

Thunderstorms

A thunderstorm is defined as a storm that contains lightning and thunder which is caused by unstable atmospheric conditions. When cold upper air sinks and warm moist air rises, storm clouds or ‘thunderheads’ develop resulting in thunderstorms. This can occur singularly, as well as in clusters or lines. The National Weather Service defines a thunderstorm as “severe” if it includes hail that is one inch or more, or wind gusts that are at 58 miles per hour or higher. At any given moment across the world, there are about 1,800 thunderstorms occurring. Severe thunderstorms most often occur in Missouri in the spring and summer, during the afternoon and evenings, but can occur at any time. Other hazards associated with thunderstorms are heavy rains resulting in flooding (discussed separately in **Section 3.4.1**) and tornadoes (discussed separately

in **Section 3.4.9**).

High Winds

A severe thunderstorm can produce winds causing as much damage as a weak tornado. The damaging winds of thunderstorms include downbursts, microbursts, and straight-line winds. Downbursts are localized currents of air blasting down from a thunderstorm, which induce an outward burst of damaging wind on or near the ground. Microbursts are minimized downbursts covering an area of less than 2.5 miles across. They include a strong wind shear (a rapid change in the direction of wind over a short distance) near the surface. Microbursts may or may not include precipitation and can produce winds at speeds of more than 150 miles per hour. Damaging straight-line winds are high winds across a wide area that can reach speeds of 140 miles per hour.

Lightning

All thunderstorms produce lightning which can strike outside of the area where it is raining and is has been known to fall more than 10 miles away from the rainfall area. Thunder is simply the sound that lightning makes. Lightning is a huge discharge of electricity that shoots through the air causing vibrations and creating the sound of thunder.

Hail

According to the National Oceanic and Atmospheric Administration (NOAA), hail is precipitation that is formed when thunderstorm updrafts carry raindrops upward into extremely cold atmosphere causing them to freeze. The raindrops form into small frozen droplets. They continue to grow as they come into contact with super-cooled water which will freeze on contact with the frozen rain droplet. This frozen droplet can continue to grow and form hail. As long as the updraft forces can support or suspend the weight of the hailstone, hail can continue to grow before it hits the earth.

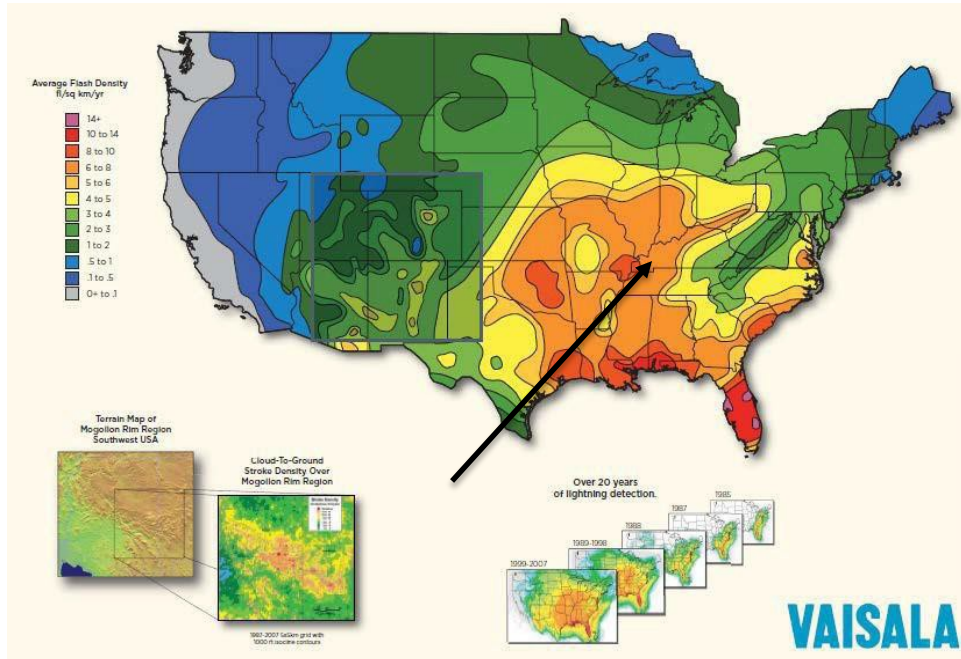
At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a $\frac{1}{4}$ " diameter or pea sized hail requires updrafts of 24 miles per hour, while a $2\frac{3}{4}$ " diameter or baseball sized hail requires an updraft of 81 miles per hour. According to the NOAA, the largest hailstone in diameter recorded in the United States was found in Vivian, South Dakota on July 23, 2010. It was eight inches in diameter, almost the size of a soccer ball. Soccer-ball-sized hail is the exception, but even small pea-sized hail can do damage.

Geographic Location

Thunderstorms/ high winds/hail/lightning events are an area-wide hazard that can happen anywhere in the county. Although these events occur similarly throughout the planning area, they are more frequently reported in more urbanized areas. In addition, damages are more likely to occur in more densely developed urban areas.

The map below (Figure 3.12) shows lightning frequency in the country. From viewing the map and legend, it can be determined that the average flash density for Carter County is 10-14 ft./sq. km/yr. This indicates the number of lightning flashes to the ground per kilometer squared per year.

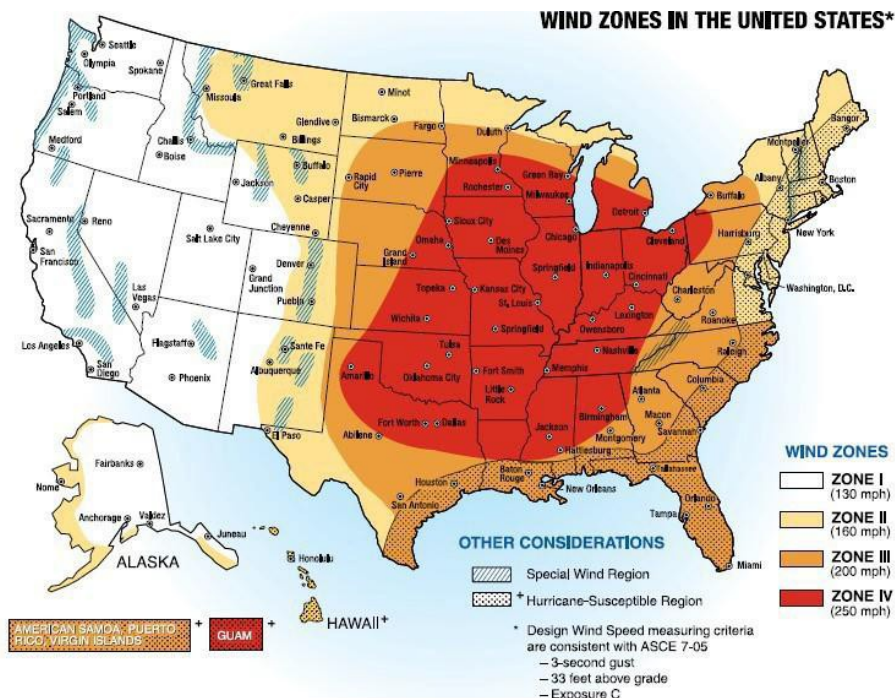
Figure 3.12. Location and Frequency of Lightning in Missouri



Source: National Weather Service, http://www.lightningsafety.noaa.gov/stats/08_Vaisala_NLDN_Poster.pdf. Note: indicate location of planning area with a colored square or arrow.

The map below (Figure 3.13) depicts wind zones in the United States. Carter County is located in zone IV.

Figure 3.13. Wind Zones in the United States



Source: FEMA 320, Taking Shelter from the Storm, 3rd edition, http://www.weather.gov/media/bis/FEMA_SafeRoom.pdf

Strength/Magnitude/Extent

Based on information provided by the Tornado and Storm Research Organization (TORRO), **Table 3.28** below describes typical damage impacts of the various sizes of hail.

Table 3.28. Tornado and Storm Research Organization Hailstorm Intensity Scale

Intensity Category	Diameter (mm)	Diameter (inches)	Size Description	Typical Damage Impacts
Hard Hail	5-9	0.2-0.4	Pea	No damage
Potentially Damaging	10-15	0.4-0.6	Mothball	Slight general damage to plants, crops
Significant	16-20	0.6-0.8	Marble, grape	Significant damage to fruit, crops, vegetation
Severe	21-30	0.8-1.2	Walnut	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
Severe	31-40	1.2-1.6	Pigeon's egg > squash ball	Widespread glass damage, vehicle bodywork damage
Destructive	41-50	1.6-2.0	Golf ball > Pullet's egg	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
Destructive	51-60	2.0-2.4	Hen's egg	Bodywork of grounded aircraft dented, brick walls pitted
Destructive	61-75	2.4-3.0	Tennis ball > cricket ball	Severe roof damage, risk of serious injuries
Destructive	76-90	3.0-3.5	Large orange > Soft ball	Severe damage to aircraft bodywork
Super Hailstorms	91-100	3.6-3.9	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Super Hailstorms	>100	4.0+	Melon	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Source: Tornado and Storm Research Organization (TORRO), Department of Geography, Oxford Brookes University

Notes: In addition to hail diameter, factors including number and density of hailstones, hail fall speed and surface wind speeds affect severity. <http://www.torro.org.uk/site/hyscale.php>

Straight-line winds are defined as any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 miles per hour, which represent the most common type of severe weather. They are responsible for most wind damage related to thunderstorms. Since thunderstorms do not have narrow tracks like tornadoes, the associated wind damage can be extensive and affect entire (and multiple) counties. Objects like trees, barns, outbuildings, high-profile vehicles, and power lines/poles can be toppled or destroyed, and roofs, windows, and homes can be damaged as wind speeds increase.

The onset of thunderstorms with lightning, high wind, and hail is generally rapid. Duration is less than six hours and warning time is generally six to twelve hours. Nationwide, lightning kills 75 to 100 people each year. Lightning strikes can also start structural and wildland fires, as well as damage electrical systems and equipment.

Previous Occurrences

The following tables provide previous occurrences for January 1,2009-December 31,2018 based on data from the NCEI. The high wind events include all wind events with winds reported above 50 knots during this time period. Hail events listed below include hail events in which hail of 1" or greater was reported. Thunderstorm events list all storms which include thunderstorm winds. "Limitations to the use of NCEI reported lightning events include the fact that only lightning events that result in fatality, injury and/or property and crop damage are in the NCEI."

Table 3.29 Hail Events, Diameter 1” or greater-Jan 1, 2009-December 31, 2018

Date	Size	Property Damage	Location
4/9/2011	1.25	0	Ellsinore
4/19/2011	1.00	0	Van Buren
4/22/2011	1.00	0	Grandin
5/25/2011	1.75	0	Ellsinore
2/29/2012	1.50	0	Ellsinore
3/9/2017	1.75	0	Ellsinore
5/27/2017	2.00	0	Eastwood
4/3/2018	1.00	0	Ellsinore
5/31/2018	1.00	0	Fremont
6/26/2018	1.50	0	Van Buren

Table 3.30 Thunderstorm Events-Jan 1, 2009-December 31, 2018

Date	Injury	Property Damage	Location
5/8/2009	0	\$20,000	Van Buren Airport
4/30/2010	0	\$3,000	Fremont
10/26/2010	0	\$5,000	Van Buren
10/26/2010	0	\$5,000	Ellsinore
4/19/2011	0	\$5,000	Ellsinore
4/25/2011	0	\$0	Grandin
4/27/2011	0	\$0	Ellsinore
5/12/2011	0	\$3,000	Ellsinore
6/26/2011	0	\$10,000	Van Buren
8/6/2011	0	\$2,000	Ellsinore
8/7/2011	0	\$10,000	Fremont
8/7/2011	0	\$25,000	Van Buren
9/6/2012	0	\$10,000	Van Buren
1/29/2013	0	\$50,000	Chilton
6/28/2013	0	\$10,000	Van Buren
2/20/2014	0	\$50,000	Hunter
7/9/2015	0	\$1,000	Hunter
5/9/2016	0	\$5,000	Van Buren
5/9/2016	0	\$0	Ellsinore
7/8/2016	0	\$40,000	Fremont
7/8/2016	0	\$5,000	Ellsinore
5/27/2017	0	\$5,000	Van Buren
7/1/2018	0	\$3,000	Fremont
7/20/2018	0	\$5,000	Van Buren
8/16/2018	0	\$5,000	Van Buren

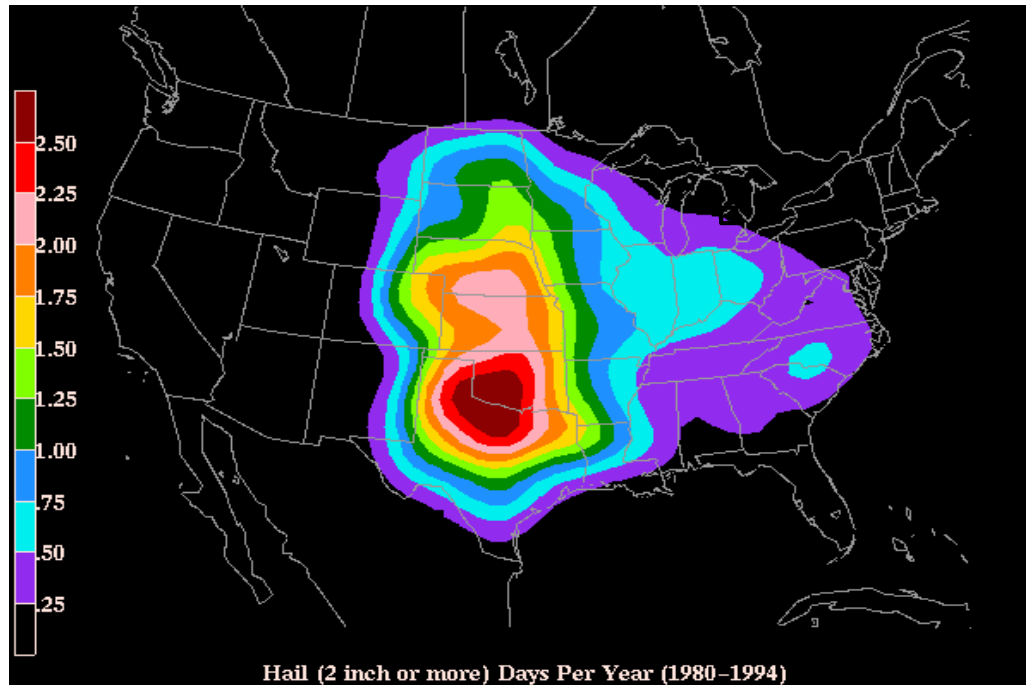
In the past five years of reported crop loss to insurance claims, no claims were reported in Carter County due to thunderstorms, high winds, hail, or lightning.

Probability of Future Occurrence

In reviewing the ten-year history presented above, the probability of a high wind event with winds greater than 50 knots is 100% in the planning area in any given year. In fact, a review of this data shows that there is an average of one high wind event each year, within any area of the county.

Figure 3.14 is a map showing the annual probability of a hailstorm, that would produce 2" hail or greater. Carter County falls in the area of .5-.75 chance per year.

Figure 3.14. Annual Hailstorm Probability(2" diameter or larger), U 1980- 1994



Source: NSSL, http://www.nssl.noaa.gov/users/brooks/public_html/bighail.gif Note:

Changing Future Conditions Considerations

NASA's Earth Observatory provides an analysis on how climate change could, theoretically, increase potential storm energy by warming the surface and putting more moisture in the air through evaporation. The presence of warm, moist air near the surface is a key ingredient for summer storms that meteorologists have termed "convective available potential energy," or CAPE. With an increase in CAPE, there is greater potential for cumulus clouds to form. The study also counters this theory with the theory that warming in the Arctic could lead to less wind shear in the mid-latitude areas prone to summer storms, making the storms less likely.

Predicted increases in temperature could help create atmospheric conditions that are fertile breeding grounds for severe thunderstorms and tornadoes in Missouri. Possible impacts include an increased risk to life and property in both the public and private sectors. Public utilities and manufactured housing developments will be especially prone to damages. Jurisdictions already affected should be prepared for more of these events, and should thus prioritize mitigation actions such as construction of safe rooms for vulnerable populations, retrofitting and/or hardening existing structures, improving warning systems and public education, and reinforcing utilities and additional critical infrastructure.

Vulnerability

Vulnerability Overview

Severe thunderstorm losses are usually attributed to the associated hazards of hail, downburst winds, lightning and heavy rains. Losses due to hail and high wind are typically insured losses

that are localized and do not result in presidential disaster declarations. However, in some cases, impacts are severe and widespread and assistance outside state capabilities is necessary. Hail and wind also can have devastating impacts on crops. Severe thunderstorms/heavy rains that lead to flooding are discussed in the flooding hazard profile. Hailstorms cause damage to property, crops, and the environment, and can injure and even kill livestock. In the United States, hail causes more than \$1 billion in damage to property and crops each year. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are also commonly damaged by hail. Hail has been known to cause injury to humans, occasionally fatal injury.

In general, assets in the County vulnerable to thunderstorms with lightning, high winds, and hail include people, crops, vehicles, and built structures. Although this hazard results in high annual losses, private property insurance and crop insurance usually cover the majority of losses. Considering insurance coverage as a recovery capability, the overall impact on jurisdictions is reduced.

Most lightning damages occur to electronic equipment located inside buildings. But structural damage can also occur when a lightning strike causes a building fire. In addition, lightning strikes can cause damages to crops if fields or forested lands are set on fire. Communications equipment and warning transmitters and receivers can also be knocked out by lightning strikes.

Severe thunderstorms are common in Missouri and Carter County. These events include winds, hail, and lightning, which are all contributing elements of severe thunderstorms. The MPC has researched wind speeds over 50 knots, lightning events, thunderstorm events, and hail events 1” and larger in diameter. In reviewing the 2018 State Plan, data was gathered from several sources including the National Centers for Environmental Information, USDA Crop Insurance Claims, the US Census, and the calculated Social Vulnerability Index from the Hazards and Vulnerability Research Institute in the Department of Geography at the University of South Carolina. The table below provides the housing density building exposure, percentage of mobile homes, and social vulnerability index for Carter County as reported in Table 3.9.1 of the 2018 State Plan.

Table 3.31 Housing Density, Building Exposure, Mobile Home Data, and SOVI

Housing Units/sq Mile	Total Building Exposure \$	Percentage of Mobile Homes	Social Vulnerability Index (-5)
6.38	\$519,266,000	22.3%	4

Additional data was obtained from the 2018 Missouri State Hazard Mitigation Plan to complete the overall vulnerability analysis. From this statistical data collected, five factors were considered in determining overall vulnerability such as, housing density, likelihood of occurrence, building exposure, average annual property loss ratio, and social vulnerability. For hail and wind, the two additional factors of crop exposure and average annual crop insurance claims as a result of these hazards were considered.

To complete the vulnerability analysis utilizing the factors described above, a rating value of 1-5 was assigned to the data obtained for each factor. These values correspond to the follow descriptive terms:

1. Low
2. Medium-low
3. Medium
4. Medium-high
5. High

Carter County has a high probability of experiencing an episode of high winds, thunderstorms, hail, or tornadoes within the next five years if not annually. Due to their geographical location and the historical events within the area. There has been a total of 48 high wind events with a 2.286 likelihood of occurrence; 45 hail events with a 2.143 likelihood of occurrence; and 1 lightning event with a .0048 likelihood of occurrence in the planning area according to the 2018 State Plan.

Potential Losses to Existing Development

Based on prior events and the vulnerability assessment, it can be determined that the potential losses to existing development will be, and has been, minimal when compared to the potential exposure. Annualized property losses are \$117,000 for high wind, \$4,000 for hail, and \$0 for lightning according to Table 3.93 of the 2018 State Plan.

Previous and Future Development

With little future development expected in Carter County, the exposure and losses associated with thunderstorm, wind, hail, and lightning = events are not expected to change.

EMAP Consequence Analysis

No emergency management programs seeking EMAP accreditation exist in Carter County.

Hazard Summary by Jurisdiction

Although thunderstorms/high winds/lightning/hail events are area-wide, places with a large concentration of population is at greater risk for greater damage. These areas include trailer parks, subdivisions, and assisted living facilities.

- **Carter County** – Over 22% of county residents live in mobile homes. These residents have a high vulnerability to thunderstorm events.
- **City of Van Buren** – In addition to a percentage of residents living in mobile homes, Van Buren is home to many historic structures that are more vulnerable to thunderstorm events.
- **City of Ellsinore** – Residents living in mobile homes and historic structures.
- **City of Grandin** - Residents living in mobile homes and historic structures.
- **Van Buren R-1 School District** – Children attending school could be vulnerable to thunderstorm events while waiting for school transportation, walking between buildings, or being outside of school buildings during school hours.
- **East Carter County R-2 School District** – Children attending school could be vulnerable to thunderstorm events while waiting for school transportation, walking between buildings, or being outside of school buildings during school hours.

Problem Statement

Thunderstorms and the associated risks of high winds, lightning, and hail can result in property and crop damage and have the potential to cause injuries or death to residents. These storms are common occurrences within the county; however, due to in large part to the sparse population density of the county, the damages resulting from these events is relatively limited. The NCEI Storm Events Database notes 35 thunderstorm and hail events in the county with \$277,000 in damages. Some of the recommendations of the MPC were to seek out funding for emergency generators for critical facilities that are not equipped with generators. Also, to ensure that critical facilities were equipped with some form of lightning protection for assets located at the facility such as communication equipment.

3.4.8 Severe Winter Weather

Hazard Profile

Hazard Description

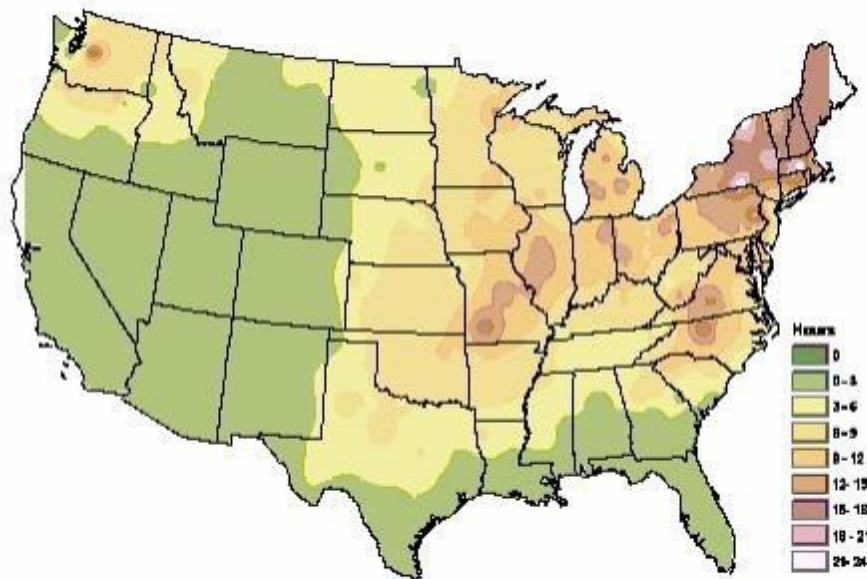
A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. The National Weather Service describes different types of winter storm events as follows.

- **Blizzard**—Winds of 35 miles per hour or more with snow and blowing snow reducing visibility to less than $\frac{1}{4}$ mile for at least three hours.
- **Blowing Snow** —Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- **Snow Squalls**—Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- **Snow Showers**—Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- **Freezing Rain**—Measurable rain that falls onto a surface with a temperature below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing-rain events are short lived and occur near sunrise between the months of December and March.
- **Sleet**—Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects.

Geographic Location

All jurisdictions within the county are at risk for severe winter weather including heavy snow, ice, extreme cold temperatures, and freezing rain. According to the map below, Figure 3.15, Carter County is on the border of the area that receives 8-9 and 9-12 hours of freezing rain per year.

Figure 3.15. NWS Statewide Average Number of Hours per Year with Freezing Rain



Source: American Meteorological Society. "Freezing Rain Events in the United States." <http://ams.confex.com/ams/pdfpapers/71872.pdf>

Strength/Magnitude/Extent

Severe winter storms include heavy snowfall, ice, and strong winds which can push the wind chill well below zero degrees in the planning area.

For severe weather conditions, the National Weather Service issues some or all of the following products as conditions warrant across the State of Missouri. NWS local offices in Missouri may collaborate with local partners to determine when an alert should be issued for a local area.

- Winter Weather Advisory — Winter weather conditions are expected to cause significant inconveniences and may be hazardous. If caution is exercised, these situations should not become life threatening. Often the greatest hazard is to motorists.
- Winter Storm Watch — Severe winter conditions, such as heavy snow and/or ice are possible within the next day or two.
- Winter Storm Warning — Severe winter conditions have begun or are about to begin.
- Blizzard Warning — Snow and strong winds will combine to produce a blinding snow (near zero visibility), deep drifts, and life-threatening wind chill.
- Ice Storm Warning -- Dangerous accumulations of ice are expected with generally over one quarter inch of ice on exposed surfaces. Travel is impacted, and widespread downed trees and power lines often result.
- Wind Chill Advisory -- Combination of low temperatures and strong winds will result in wind chill readings of -20 degrees F or lower.

- Wind Chill Warning -- Wind chill temperatures of -35 degrees F or lower are expected. This is a life-threatening situation.

Previous Occurrences

Table 3.32 below provides previous occurrences and damages as reported by the NCEI for January 1, 2009 through December 31, 2018. These events and damages are for blizzard, cold/wind chill, extreme cold/wind chill, heavy snow, ice storm, sleet, winter storm, and winter weather.

Table 3.32 NCEI Carter County Winter Weather Events Summary, January 1, 2009-December 31, 2018

Date	Event Type	Deaths	Injuries	Property Damage \$	Crop Damage \$
1/5/2009	Winter Weather	0	0	0	0
1/15/2009	Extreme Cold/Wind Chill	0	0	0	0
1/26/2009	Winter Storm	0	0	\$300,000	0
2/28/2009	Heavy Snow	0	0	0	0
1/6/2010	Winter Weather	0	0	0	0
1/29/2010	Heavy Snow	0	0	0	0
2/8/2010	Winter Weather	0	0	0	0
12/15/2010	Winter Weather	0	0	0	0
1/17/2011	Winter Weather	0	0	0	0
1/20/2011	Winter Storm	0	0	0	0
2/4/2011	Winter Weather	0	0	0	0
2/9/2011	Winter Weather	0	0	0	0
11/28/2011	Winter Weather	0	0	0	0
2/13/2012	Winter Weather	0	0	0	0
12/25/2012	Winter Storm	0	0	0	0
12/28/2012	Winter Weather	0	0	0	0
2/21/2013	Ice Storm	0	0	\$100,000	0
3/21/2013	Winter Weather	0	0	0	0
12/5/2013	Winter Storm	0	0	0	0
1/5/2014	Cold/Wind Chill	0	0	0	0
1/5/2014	Winter Weather	0	0	0	0
2/2/2014	Winter Weather	0	0	0	0

2/4/2014	Winter Storm	0	0	0	0
2/10/2014	Winter Weather	0	0	0	0
3/2/2014	Winter Storm	0	0	0	0
11/16/2014	Winter Weather	0	0	0	0
12/01/2014	Winter Weather	0	0	0	0
1/11/2015	Winter Weather	0	0	0	0
2/15/2015	Heavy Snow	0	0	0	0
2/17/2015	Winter Weather	0	0	0	0
2/19/2015	Cold/Wind Chill	0	0	0	0
2/20/2015	Winter Storm	0	0	0	0
2/28/2015	Winter Weather	0	0	0	0
3/1/2015	Winter Weather	0	0	0	0
3/4/2015	Winter Storm	0	0	0	0
1/19/2016	Winter Weather	0	0	0	0
2/14/2016	Winter Weather	0	0	0	0
1/5/2017	Winter Weather	0	0	0	0
1/13/2017	Winter Weather	0	0	0	0
1/1/2018	Cold/Wind Chill	0	0	0	0
1/11/2018	Winter Weather	0	0	0	0
1/15/2018	Winter Weather	0	0	0	0
1/16/2018	Cold/Wind Chill	0	0	0	0
2/6/2018	Winter Weather	0	0	0	0
2/11/2018	Winter Weather	0	0	0	0
4/7/2018	Winter Weather	0	0	0	0
11/14/2018	Winter Weather	0	0	0	0

Source: NCEI, data accessed 11/6/2019

Notable winter weather events include a winter storm on January 26, 2009, causing \$300,000 in property damage, and an ice storm on February 21, 2013, causing \$100,000 in property damage. No injuries, deaths, or crop damage to report. There have been 3 disaster declarations for severe winter storms, in 2007, 2009, and 2011. No public assistance dollars were provided in 2007 and 2011. In 2009, \$135,879,596.08 in public assistance dollars were provided for DR-1822. The most significant winter weather event in recent memory is included in the table above as a Winter Storm

on January 26, 2009. The storm resulted in \$300,000 dollars in property damage in Carter County. Households were without electricity for days and remote households for weeks. It is reported that in southeast Missouri the property damages were \$120.450 million. The storm included heavy snow to the north; however, the largest problem was the ice that caused overhead power lines to fall as the weight of the ice broke utility poles, sometimes for miles in a stretch.

Winter storms, cold, frost and freeze take a toll on crop production in the planning area. The table below, Table 3.33, lists the USDA's Risk Management Agency payments for insured crop losses in the planning area as a result of cold conditions and snow 2010-2015. Illustrated in the table below there was no crops lost due to winter weather in the planning area.

Table 3.33. Crop Insurance Claims Paid in Carter County as a Result of Cold Conditions and Snow 01/01/2010-12/31/2015

Crop Year	Crop Name	Cause of Loss Description	Insurance Paid
0	0	0	0

Source: USDA Risk Management Agency, <http://www.rma.usda.gov/data/cause.htm>

Probability of Future Occurrence

The probability of a future occurrence of severe winter weather is greater than 100% chance to occur somewhere in the county in any given year. According to the 10 years of incidents reported above, the average year sees four winter weather events ranging from extreme cold temperatures to snow and ice.

Changing Future Conditions Considerations

A shorter overall winter season and fewer days of extreme cold may have both positive and negative indirect impacts. Warmer winter temperatures may result in changing distributions of native plant and animal species and/or an increase in pests and non-native species. Warmer winter temperatures will result in a reduction of lake ice cover. Reduced lake ice cover impacts aquatic ecosystems by raising water temperatures. Water temperature is linked to dissolved oxygen levels and many other environmental parameters that affect fish, plant, and other animal populations. A lack of ice cover also leaves lakes exposed to wind and evaporation during a time of year when they are normally protected. As both temperature and precipitation increase during the winter months, freezing rain will be more likely. Additional wintertime precipitation in any form will contribute to saturation and increase the risk and/or severity of spring flooding. A greater proportion of wintertime precipitation may fall as rain rather than snow.

Vulnerability

Vulnerability Overview

In reviewing the 2018 Missouri State Hazard Mitigation Plan the vulnerability for winter storms to impact Carter County can be determined. The method used to determine this vulnerability in the 2018 State Plan was statistical analysis of data from several sources: the NCEI storm events database from 1993-December 2012, FEMA's Public Assistance funds from DR-1672, DR-1736, DR-1748, DR-1822, and DR-1961, Crop Insurance Claims data from the USDA Risk Management Agency (1998-2012), total building exposure from HAZUS, US Census Data, and the USDA Census of Agriculture.

Additional data was obtained from the National Centers for Environmental Information to complete

the overall vulnerability analysis and the total overall vulnerability rating for severe winter weather. The total number of winter weather events includes blizzard, heavy snow, ice storm, winter storm, and winter weather events was also calculated. Using all of the available data, Carter County has a 3.4286 likelihood of occurrence of winter weather and an overall vulnerability rating of medium.

Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. Ice can also become a problem on roadways if the air temperature is high enough that precipitation falls as freezing rain rather than snow.

Buildings with overhanging tree limbs are more vulnerable to damage during winter storms when limbs fall. Businesses experience loss of income as a result of closure during power outages. In general, heavy winter storms increase wear and tear on roadways though the cost of such damages is difficult to determine. Businesses can experience loss of income as a result of closure during winter storms.

Overhead power lines and infrastructure are also vulnerable to damages from winter storms. In particular ice accumulation during winter storm events damage to power lines due to the ice weight on the lines and equipment. Damages also occur to lines and equipment from falling trees and tree limbs weighted down by ice. Potential losses could include cost of repair or replacement of damaged facilities, and lost economic opportunities for businesses.

Secondary effects from loss of power could include burst water pipes in homes without electricity during winter storms. Public safety hazards include risk of electrocution from downed power lines. Specific amounts of estimated losses are not available due to the complexity and multiple variables associated with this hazard. Standard values for loss of service for utilities reported in FEMA's 2009 BCA Reference Guide, the economic impact as a result of loss of power is \$126 per person per day of lost service.

Potential Losses to Existing Development

As discussed above historical loss data was obtained from the NCEI Storm Event Database for Blizzard, Heavy Storm Ice Storm, Winter Storm and Winter Weather for the period from 2009 to December 2018. The total property damage was \$400,000 which results in approximately \$40,000 in property loss per year.

Previous and Future Development

Anticipated development in Carter County is limited to reconstruction of facilities damaged or destroyed by the 2017 flood event, including the county courthouse and justice center and the Van Buren public safety building. Generators are expected to be installed in the new construction facilities to minimize impacts of utility interruptions.

Preliminary discussions regarding the construction of low-income housing has been initiated, which could result in an increase in population if eventually constructed. However, the complex will be a new construction with adequate insulation and will be located in the center of town, close to shopping and other services. Winter weather impacts to these residents are expected to be minimal.

EMAP Consequence Analysis

No emergency management programs seeking EMAP accreditation exist in Carter County.

Hazard Summary by Jurisdiction

All jurisdictions within Carter County are equally vulnerable to winter weather events. However, the incorporated cities are at a higher risk of damages resulted in an event to properties. This is due to the higher concentration of population, or more vulnerable population such as senior citizens in the nursing homes.

- **Carter County** – There is a high concentration of elderly persons in Carter County, and 22% of residents live in mobile homes. These residents have a high vulnerability to winter weather events.
- **City of Van Buren** – In addition to a percentage of elderly residents, Van Buren is home to many historic structures that are more vulnerable to the impacts of winter weather events. Generators are not available to emergency personnel in Van Buren.
- **City of Ellsinore** – High population of elderly residents. Generators are not available to emergency personnel in Van Buren.
- **City of Grandin** – High population of elderly residents. Generators are not available to emergency personnel in Van Buren.
- **Van Buren R-1 School District** – Children attending school could be vulnerable to winter weather events while waiting for school transportation, walking between buildings, or being outside of school buildings during school hours.
- **East Carter County R-2 School District** – Children attending school could be vulnerable to winter weather events while waiting for school transportation, walking between buildings, or being outside of school buildings during school hours.

Problem Statement

Winter weather comes with a myriad of impacts that start with health concerns from extreme cold temperatures, to falling and motor vehicle accidents caused by icy surfaces, to power outages caused by ice accumulating on overhead powerlines. The MPC was concerned about the availability of emergency power generators at critical facilities and has proposed an action to continue to increase the availability of generators.

3.4.9 Tornado

Hazard Profile

Hazard Description

Essentially, tornadoes are a vortex storm with two components of winds. The first is the rotational winds that can measure up to 500 miles per hour, and the second is an uplifting current of great strength. The dynamic strength of both these currents can cause vacuums that can overpressure structures from the inside.

Although tornadoes have been documented in all 50 states, most of them occur in the central United States due to its unique geography and presence of the jet stream. The jet stream is a high-velocity stream of air that separates the cold air of the north from the warm air of the south. During the winter, the jet stream flows west to east from Texas to the Carolina coast. As the sun moves north, so does the jet stream, which at summer solstice flows from Canada across Lake Superior to Maine. During its move northward in the spring and its recession south during the fall, the jet stream crosses Missouri, causing the large thunderstorms that breed tornadoes.

Tornadoes spawn from the largest thunderstorms. The associated cumulonimbus clouds can reach

heights of up to 55,000 feet above ground level and are commonly formed when Gulf air is warmed by solar heating. The moist, warm air is overridden by the dry cool air provided by the jet stream. This cold air presses down on the warm air, preventing it from rising, but only temporarily. Soon, the warm air forces its way through the cool air and the cool air moves downward past the rising warm air. This air movement, along with the deflection of the earth's surface, can cause the air masses to start rotating. This rotational movement around the location of the breakthrough forms a vortex, or funnel. If the newly created funnel stays in the sky, it is referred to as a funnel cloud. However, if it touches the ground, the funnel officially becomes a tornado.

A typical tornado can be described as a funnel-shaped cloud in contact with the earth's surface that is "anchored" to a cloud, usually a cumulonimbus. This contact on average lasts 30 minutes and covers an average distance of 15 miles. The width of the tornado (and its path of destruction) is usually about 300 yards. However, tornadoes can stay on the ground for upward of 300 miles and can be up to a mile wide. The National Weather Service, in reviewing tornadoes occurring in Missouri between 1950 and 1996, calculated the mean path length at 2.27 miles and the mean path area at 0.14 square mile.

The average forward speed of a tornado is 30 miles per hour but may vary from nearly stationary to 70 miles per hour. The average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. Tornadoes are most likely to occur in the afternoon and evening, but have been known to occur at all hours of the day and night.

Geographic Location

As with the previous hazard of thunderstorms, tornadoes can occur anywhere in Carter County and impact all jurisdictions in the county.

Strength/Magnitude/Extent

Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 miles per hour and damage paths can be more than one-mile wide and 50 miles long. Tornadoes have been known to lift and move objects weighing more than 300 tons a distance of 30 feet, toss homes more than 300 feet from their foundations, and siphon millions of tons of water from water bodies. Tornadoes also can generate a tremendous amount of flying debris or "missiles," which often become airborne shrapnel that causes additional damage. If wind speeds are high enough, missiles can be thrown at a building with enough force to penetrate windows, roofs, and walls. However, the less spectacular damage is much more common.

Tornado magnitude is classified according to the EF- Scale (or the Enhance Fujita Scale, based on the original Fujita Scale developed by Dr. Theodore Fujita, a renowned severe storm researcher). The EF- Scale (see **Table 3.34**) attempt to rank tornadoes according to wind speed based on the damage caused. This update to the original F Scale was implemented in the U.S. on February 1, 2007.

Table 3.34. Enhanced F Scale for Tornado Damage

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest ¼-mile (mph)	3 Second Gust (mph)	EF Nu	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165

4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Source: The National Weather Service, www.spc.noaa.gov/faq/tornado/ef-scale.html

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center as listed in **Table 3.35**. The damage descriptions are summaries. For the actual EF scale it is necessary to look up the damage indicator (type of structure damaged) and refer to the degrees of damage associated with that indicator. Information on the Enhanced Fujita Scale's damage indicators and degrees of damage is located online at www.spc.noaa.gov/ef-scale/ef-scale.html.

Table 3.35. Enhanced Fujita Scale with Potential Damage

Enhanced Fujita Scale			
Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF0	65-85	53.5%	Light. Peels surface off some roofs; some damage to gutters siding; branches broken off trees; shallow-rooted trees push over. Confirmed tornadoes with no reported damage (i.e. those that remain in open fields) are always rated EF0).
EF1	86-110	31.6%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	Considerable. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes complete destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
EF3	136-165	3.4%	Severe. Entire stores 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
EF4	166-200	0.7%	Devastating. Well-constructed houses and whole frame houses completely levelled; cars thrown and small missiles generated.
EF5	>200	<0.1%	Explosive. Strong frame houses levelled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur.

Source: NOAA Storm Prediction Center, <http://www.spc.noaa.gov/efscale/ef-scale.html>

Enhanced weather forecasting has provided the ability to predict severe weather likely to produce tornadoes days in advance. Tornado watches can be delivered to those in the path of these storms several hours in advance. Lead time for actual tornado warnings is about 30 minutes. Tornadoes have been known to change paths very rapidly, thus limiting the time in which to take shelter. Tornadoes may not be visible on the ground if they occur after sundown or due to blowing dust or driving rain and hail.

Previous Occurrences

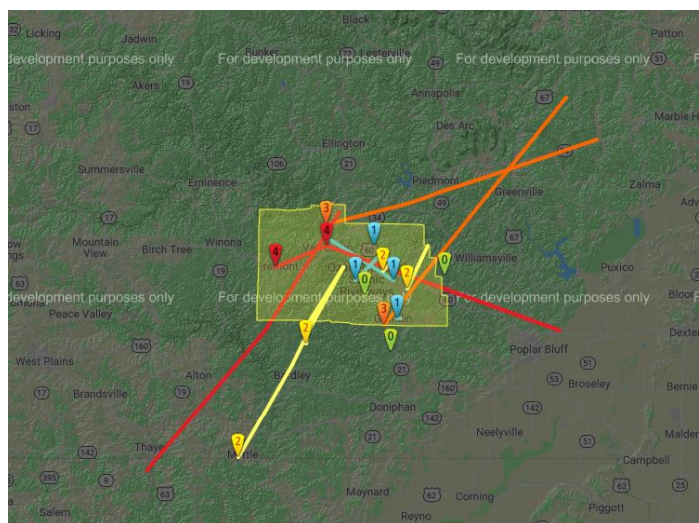
Table 3.36 includes NCEI reported tornado events and damages since 1993 in the planning area. Prior to that date, only really destructive tornadoes were recorded. It is necessary to go back as far as possible because of the random and intermittent nature of tornado events. There are limitations to the use of NCEI tornado data that must be noted. For example, one tornado may contain multiple segments as it moves geographically. A tornado that crosses a county line or state line is considered a separate segment for the purposes of reporting to the NCEI. Also, a tornado that lifts off the ground for less than 5 minutes or 2.5 miles is considered a separate segment. If the tornado lifts off the ground for greater than 5 minutes or 2.5 miles, it is considered a separate tornado. Tornadoes reported in Storm Data and the Storm Events Database is in segments.

Table 3.36. Recorded Tornadoes in Carter County, 1993 –2018

Date	Beginning Location	Ending Location	Length (miles)	Width (yards)	F/EF Rating	Death	Injury	Property Damage	Crop Damage
6/7/1995	Ellsinore	Ellsinore	1.5	300	F0	0	0	\$40,000	\$0
4/24/2002	Van Buren	Ellsinore	20.5	300	F4	0	2	\$15,000,000	\$0
4/24/2004	E. Carter County	Ellsinore	7.6	200	F2	0	5	\$600,000	\$0
6/13/2008	S. Carter County	Grandin	0.62	125	EF1	0	0	\$50,000	\$0
12/31/2010	Chilton	Ellsinore	2.63	200	EF2	0	0	\$200,000	\$0
05/25/2011	Grandin	Ellsinore	11.4	550	EF3	0	0	\$300,000	\$0
05/25/2011	Hunter	Hunter	.49	50	EF0	0	0	\$2,000	\$0
12/23/2015	Chilton	Chilton	6	100	EF1	0	0	\$90,000	\$0

As can be seen from the table above, From January 1, 1993 to December 31, 2018 there were a total of eight reported tornadoes in Carter County. The resulting damage was \$16,282,000 to property, no deaths and 7 injuries resulted from these events. Figure 3.16 provides a map of tornadoes to strike Carter County and their associated paths.

Figure 3.16. Carter County Map of Historic Tornado Events



Source: Tornado History Project, 11/12/2019

Probability of Future Occurrence

There is a 28% chance that a tornado could strike somewhere in the county in any given year (7 tornadoes/25 years). Based on past occurrences from 1993-2018, there has been an average of one tornado every four years.

Changing Future Conditions Considerations

Scientists do not know how the frequency and severity of tornadoes will change. Research published in 2015 suggests that changes in heat and moisture content in the atmosphere, brought on by a warming world, could be playing a role in making tornado outbreaks more common and

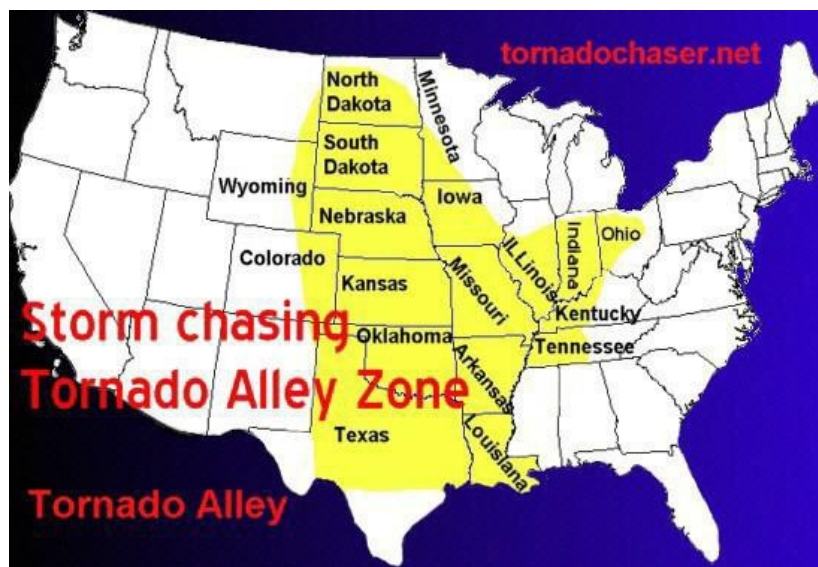
severe in the U.S. The research concluded that the number of days with large outbreaks have been increasing since the 1950s and that densely concentrated tornado outbreaks are on the rise. It is notable that the research shows that the area of tornado activity is not expanding, but rather the areas already subject to tornado activity are seeing the more densely packed tornadoes. Because Missouri experiences on average around 39.6 tornadoes a year, such research is closely followed by meteorologists in the state.

Vulnerability

Vulnerability Overview

Carter County is located in the eastern side of Tornado Alley. This is a region in the U.S with high frequency of dangerous and destructive tornadoes. Figure 3.17 illustrates the area where historically dangerous tornadoes have occurred.

Figure 3.17. Tornado Alley in the U.S.



Source:

<http://www.tornadochaser.net/tornalley.html>

The 2018 Missouri State Hazard Mitigation Plan was reviewed to determine further vulnerability of the county to tornadoes. The method used to determine vulnerability to tornadoes across Missouri was statistical analysis of data from several sources: HAZUS building exposure value data, population density and mobile home data from the U.S. Census (2015 ACS), the calculated Social Vulnerability Index for Missouri Counties from the Hazards and Vulnerability Research Institute in the Department of Geography at the University of South Carolina, and storm events data (1950 to December 31, 2016) from the National Centers for Environmental Information (NCEI). It is important to realize that one limitation to the NCEI data is that many tornadoes that might have occurred in uninhabited areas, as well as some in inhabited areas, may not have been reported. The incompleteness of the data suggests that it is not appropriate for use in parametric modeling. In addition, NOAA data cannot show a realistic frequency distribution of different Fujita scale tornado events, except for recent years. Thus a parametric model based on a combination of many physical aspects of the tornado to predict future expected losses was not used. The statistical model used for this analysis was probabilistic based purely on tornado frequency and historic losses. It is based on past experience and forecasts the expected results for the immediate or extended future.

From the statistical data collected, six factors were considered in determining overall vulnerability to

tornadoes as follows: building exposure, population density, social vulnerability, percentage of mobile homes, likelihood of occurrence, and annual property loss. Based on natural breaks in the statistical data, a rating value of 1 through 5 was assigned to each factor. These rating values correspond to the following descriptive terms: 1) Low 2) Low-medium 3) Medium 4) Medium-high 5) High

Table 3.37 Risk Factors for Tornado Vulnerability in Carter County

# Of Tornadoes	Likelihood of Occurrence	Probability Rating	Annualized Historic Property Loss	Loss Ratio Rating	Overall Vulnerability Rating	Total Vulnerability
17	.0254	2	\$364,507	2	15	Medium High

Potential Losses to Existing Development

In reviewing tornado history data provided from the NCEI covering the dates January 1, 1993 through December 31, 2018. There is a 28% chance that a tornado could strike somewhere in the county in any given year (7 tornadoes/25 years). Based on past occurrences from 1993-2018, there has been an average of one tornado every four years. It can be assumed that with this historical data one tornado will occur at least every four years, with the potential to cause damage to property in its path.

Previous and Future Development

Little future development is anticipated in Carter County, therefore, the vulnerability to tornadoes and the resulting damages are not expected to increase.

EMAP Consequence Analysis

No emergency management programs seeking EMAP accreditation exist in Carter County.

Hazard Summary by Jurisdiction

As with thunderstorm hazards, higher population concentration has the potential to result in greater risk and loss to individual jurisdictions. The cities of Van Buren and Ellsinore have a higher concentration of people and housing than other rural areas of Carter County, therefore the risk for damages and injuries and deaths are higher. The Van Buren R-1 and East Carter County R-2 school districts both have safe rooms available. These safe rooms will reduce the risk of death and injury for those who seek shelter during a tornado event. A tornado event could occur anywhere in the planning area, but some jurisdictions would suffer heavier damages because of the age of the housing or the high concentration of mobile homes. There has not been any damage to school buildings from previous tornado occurrences.

- **Carter County** – There is a high concentration of elderly persons in Carter County, and 22% of residents live in mobile homes. These residents have a high vulnerability to tornadoes.
- **City of Van Buren** – In addition to a percentage of elderly residents, Van Buren is home to many historic structures that are more vulnerable to the impacts of tornadoes. A community safe room is available at the Van Buren R-1 School

District.

- **City of Ellsinore** – High population of elderly residents. A tornado safe room is available at the East Carter County R-2 School District.
- **City of Grandin** – High population of elderly residents.
- **Van Buren R-1 School District** – Children attending school could be vulnerable to tornadoes while waiting for school transportation, walking between buildings, or being outside of school buildings during school hours. A community safe room is available at the Van Buren R-1 School District.
- **East Carter County R-2 School District** – Children attending school could be vulnerable to tornado events while waiting for school transportation, walking between buildings, or being outside of school buildings during school hours. A tornado safe room is available at the East Carter County R-2 School District.

Problem Statement

Tornadoes are destructive and can impact any area of the county with very short notice. Tornadoes are capable of causing injury, loss of life, damage to property and to crops. One of the priorities set forth by the MPC was to continue education and practice events should a tornado occur.

3.4.10 Wildfires

Hazard Profile

Hazard Description

Due to the rural nature of Carter County urban and structural fires are not discussed within this plan. The greater hazard in Carter County is wildfires. The fire incident types for wildfires include: 1) natural vegetation fire, 2) outside rubbish fire, 3) special outside fire, and 4) cultivated vegetation, crop fire.

The Missouri Division of Fire Safety (MDFS) indicates that approximately 80 percent of the fire departments in Missouri are staffed with volunteers. Whether paid or volunteer, these departments are often limited by lack of resources and financial assistance. The impact of a fire to a single-story building in a small community may be as great as that of a larger fire to a multi-story building in a large city.

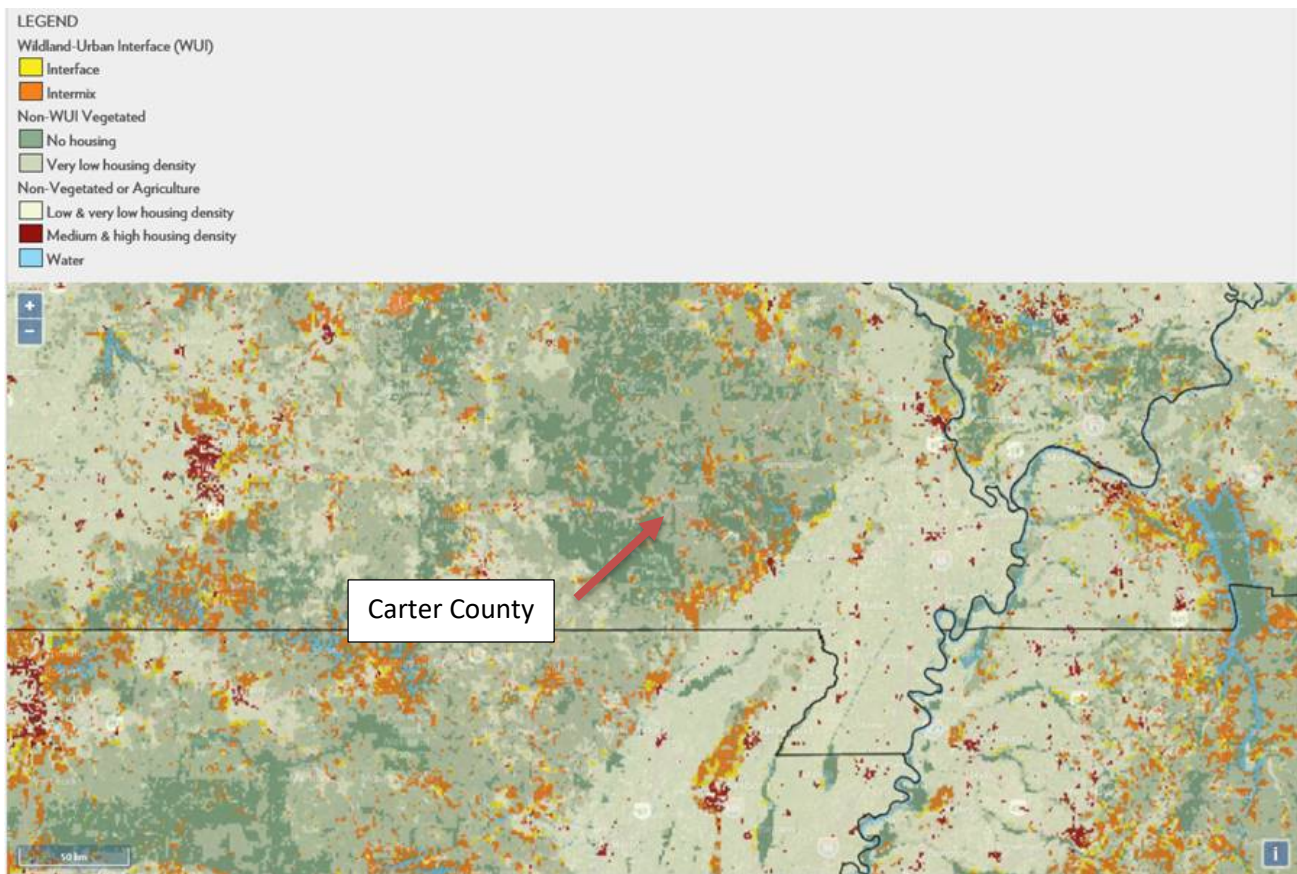
The Forestry Division of the Missouri Department of Conservation (MDC) is responsible for protecting privately owned and state-owned forests and grasslands from wildfires. To accomplish this task, eight forestry regions have been established in Missouri for fire suppression. The Forestry Division works closely with volunteer fire departments and federal partners to assist with fire suppression activities. Currently, more than 900 rural fire departments in Missouri have mutual aid agreements with the Forestry Division to obtain assistance in wildfire protection if needed.

Most of Missouri fires occur during the spring season between February and May. The length and severity of both structural and wildland fires depend largely on weather conditions. Spring in Missouri is usually characterized by low humidity and high winds. These conditions result in higher fire danger. In addition, due to the recent lack of moisture throughout many areas of the state, conditions are likely to increase the risk of wildfires. Drought conditions can also hamper firefighting efforts, as decreasing water supplies may not prove adequate for firefighting. It is common for rural residents burn their garden spots, brush piles, and other areas in the spring. Some landowners also believe it is necessary to burn their forests in the spring to promote grass growth, kill ticks, and reduce brush. Therefore, spring months are the most dangerous for wildf

ires. The second most critical period of the year is fall. Depending on the weather conditions, a sizeable number of fires may occur between mid-October and late November.

Geographic Location

Damages due to wildf fires would be higher in communities with more wildland–urban interface (WUI) areas. The term refers to the zone of transition between unoccupied land and human development and needs to be defined in the plan. Within the WUI, there are two specific areas identified: 1) Interface and 2) Intermix. The interface areas are those areas that abut wildland vegetation and the Intermix areas are those areas that intermingle with wildland areas.



Strength/Magnitude/Extent

Wildfires damage the environment, killing some plants and occasionally animals. Firefighters have been injured or killed, and structures can be damaged or destroyed. The loss of plants can heighten the risk of soil erosion and landslides. Although Missouri wildfires are not the size and intensity of those in the Western United States, they could impact recreation and tourism in and near the fires.

Wildland fires in Missouri have been mostly a result of human activity rather than lightning or someother natural event. Wildf fires in Missouri are usually surface fires, burning the dead leaves on the ground or dried grasses. They do sometimes “torch” or “crown” out in certain dense evergreen stands like eastern red cedar and shortleaf pine. However, Missouri does not have the extensive stands of evergreens found in the western US that fuel the large fire storms seen on television news stories.

While very unusual, crown fires can and do occur in Missouri native hardwood forests during

prolonged periods of drought combined with extreme heat, low relative humidity, and high wind. Tornadoes, high winds, wet snow and ice storms in recent years have placed a large amount of woody material on the forest floor that causes wildfires to burn hotter and longer. These conditions also make it more difficult for fire fighters suppress fires safely.

Often wildfires in Missouri go unnoticed by the general public because the sensational fire behavior that captures the attention of television viewers is rare in the state. Yet, from the standpoint of destroying homes and other property, Missouri wildfires can be quite destructive. There is no recent information about notable structural and wildland fires in the planning area.

Previous Occurrences

According to the Missouri Department of Conservation Wildfire Data Search, there have 113 reported fires in Carter County from January 1, 2009 through December 31, 2018. According to the Missouri Department of Conservation, 6,742 acres have burned in Carter County during the 10 year reporting period. Most notable, 1,500 acres burned due to arson in 2011.

Probability of Future Occurrence

To calculate the probability of future occurrences of wildland fires: (113 number of reported wildland fires in 10 years equals 100% probability in any given year). Therefore, it can be predicted that approximately 11 fires occur each year within Carter County. From interviews with local fire fighters and the county emergency management director this probability seems to be accurate from past experiences, articles, or other sources.

Changing Future Conditions Considerations

Higher temperatures and changes in rainfall are unlikely to substantially reduce forest cover in Missouri, although the composition of trees in the forests may change. More droughts would reduce forest productivity, and changing future conditions are also likely to increase the damage from insects and diseases. But longer growing seasons and increased carbon dioxide concentrations could more than offset the losses from those factors. Forests cover about one-third of the state, dominated by oak and hickory trees. As the climate changes, the abundance of pines in Missouri's forests is likely to increase, while the population of hickory trees is likely to decrease 0.

Higher temperatures will also reduce the number of days prescribed burning can be performed. Reduction of prescribed burning will allow for growth of understory vegetation – providing fuel for destructive wildfires. Drought is also anticipated to increase in frequency and intensity during summer months under projected future scenarios. Drought can lead to dead or dying vegetation and landscaping material close to structures which creates fodder for wildfires within both the urban and rural settings.

Vulnerability

Vulnerability Overview

A large portion of Carter County is either farmland or National or State Forest. Nearly 65% of the southeastern portion of the county is pasture and farmland, while the northeastern corner of the county consists almost entirely of forests. These circumstances render the county somewhat susceptible to wildfires, especially during periods of prolonged dryness. As presented in the data above, it is certain that a wildland fire will occur, with an historical average of 11 per year. However, most of these fires are medium in size, with the average fire burning 55 acres. In reviewing the data from the reported fires, available in the 2018 Missouri State

Hazard Mitigation Plan beginning on page 3.395, it can be seen that average annual acres burned is 481.

The greatest areas of vulnerability are in areas of Wildland/Urban Interfaces (WUI). These areas are defined as zones of transition between unoccupied land and human development. Communities that are within 0.5 miles of the zone may also be included. These lands and communities adjacent to and surrounded by wildlands are at risk of wildfires.

Potential Losses to Existing Development

Although dollar values are not assigned to prior losses, it can be determined that over the 10 years of data available from the Missouri Department of Conservation, there have been 6,742 acres burned in wildfires.

Impact of Previous and Future Development

Future development is not anticipated to increase the potential impact of wildland fires in Carter County.

EMAP Consequence Analysis

No emergency management programs seeking EMAP accreditation exist in Carter County.

Hazard Summary by Jurisdiction

All of the communities within Carter County are in WUI areas resulting in a greater risk of wildland fires. Absent demographic factors or other variations in housing construction, risk of structural fire probably does not vary greatly across the planning area.

- **Carter County** – In WUI area with risk of vulnerability.
- **City of Van Buren** – In WUI area with risk of vulnerability.
- **City of Ellsinore** – In WUI area with risk of vulnerability.
- **City of Grandin** – In WUI area with risk of vulnerability.
- **Van Buren R-1 School District** – In WUI area with risk of vulnerability.
- **East Carter County R-2 School District** – In WUI area with risk of vulnerability.

Problem Statement

With the rural nature of Carter County and the large areas of farmland and forest wildland fires are inevitable. The greatest risk to property damages occur in the Wildland/Urban Interface areas where residential areas intersect with the wildland areas. In reviewing the risk of wildland fires and the historical data related to wildland fires, the Mitigation Planning Committee continued with the action to develop fire safety awareness for all types of fires.

4 MITIGATION STRATEGY

4 MITIGATION STRATEGY **4.1**

4.1 *Goals*.....4.1

4.2 *Identification and Analysis of Mitigation Actions*.....4.2

4.3 *Implementation of Mitigation Actions*4.6

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

This section presents the mitigation strategy updated by the Mitigation Planning Committee (MPC) based on the updated risk assessment. The mitigation strategy was developed through a collaborative group process. The process included review of [updated] general goal statements to guide the jurisdictions in lessening disaster impacts as well as specific mitigation actions to directly reduce vulnerability to hazards and losses. The following definitions are taken from FEMA’s *Local Hazard Mitigation Review Guide (October 1, 2012)*.

- **Mitigation Goals** are general guidelines that explain what you want to achieve. Goals are long-term policy statements and global visions that support the mitigation strategy. The goals address the risk of hazards as included in the plan.
- **Mitigation Actions** are specific actions, projects, activities, or processes taken to reduce or eliminate long-term risk to people and property from hazards and their impacts. Implementing mitigation actions helps achieve the plan’s mission and goals.

4.1 Goals

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

This planning effort is an update to Carter County’s existing hazard mitigation plan approved by FEMA in April 2013. Therefore, the goals from the 2013 Carter County Hazard Mitigation Plan were reviewed to see if they were still valid, feasible, practical, and applicable to the defined hazard impacts. The MPC conducted a discussion session during their fourth meeting to review and update the plan goals. To ensure that the goals developed for this update were comprehensive and supported State goals, the 2018 State Hazard Mitigation Plan goals were reviewed. The MPC also reviewed the goals from current surrounding county plans.

The goals for the updated plan are as follows:

1. Implement mitigation actions that improve the protection of human life, health, and safety from the adverse effects of disasters.
2. Implement mitigation actions that improve the continuity of government and essential services from the adverse effects of disasters.
3. Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.

4. Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.

In the planning meeting to set these goals, the MPC reviewed the goals included in the *2018 Missouri State Hazard Mitigation Plan* and decided that the best course of action was to mirror the goals from the statewide plan. The MPC felt that the four goals listed in the state plan conveyed the committee's goals for Carter County and all of the goals from the 2013 Carter County Plan could be combined and better defined by the aforementioned four broader goals.

The 2013 Carter County plan included the following goals:

- 1) Reduce loss of life and property.
- 2) Increase public education and awareness.
- 3) Improve warning systems and timing.
- 4) Eliminate hazard prone areas.
- 5) Promote strategies to protect against damages.
- 6) Decrease negative impacts on business and industry.

The MPC felt that several of these goals were duplicated and by reducing the number of goals and utilizing the goals of the state plan the updated plan would convey the needs of the community in a more concise manner.

4.2 Identification and Analysis of Mitigation Actions

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

During the fourth MPC meeting, the results of the risk assessment update were provided to the MPC members for review and the key issues were identified for specific hazards. Changes in risk since adoption of the previously approved plan were discussed. The fourth meeting concluded with the distribution of a list of possible mitigation actions to prompt discussions within and among the jurisdictions. The discussions occurred during jurisdictional break-out meetings. The list included possible new mitigation actions, as well as actions from the previously approved plan. Actions from the previous plan included completed actions, on-going actions, and actions upon which progress had not been made. The MPC discussed SEMA's identified funding priorities and the types of mitigation actions generally recognized by FEMA.

The MPC determined to include problem statements in the plan update at the end of each hazard profile, which had not been done in the previously approved plan. The problem statements summarize the risk to the planning area presented by each hazard, and include possible methods to reduce that risk. Use of the problem statements allowed the MPC to recognize new and innovative strategies for mitigate risks in the planning area.

The focus of Meeting #4 was update of the mitigation strategy. For a comprehensive range of mitigation actions to consider, the MPC reviewed the following information during Meeting #4:

- A list of actions proposed in the previous mitigation plan, the current State Plan, and approved plans in surrounding counties;
- Key issues from the risk assessments, including the Problem Statements concluding each hazard profile and vulnerability analysis;

- State priorities established for Hazard Mitigation Assistance grants; and
- Public input during meetings, responses to Data Collection Questionnaires, and other efforts to involve the public in the plan development process.

For Meeting #3, individual jurisdictions, including school and special districts, developed final mitigation strategy for submission to the MPC. They were encouraged to review the details of the risk assessment vulnerability analysis specific to their jurisdiction. They were also provided a link to the FEMA’s publication, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013)*. This document was developed by FEMA as a resource for identification of a range of potential mitigation actions for reducing risk to natural hazards and disasters.

The MPC reviewed the actions from the previously approved plan for progress made since the plan had been adopted, using worksheets included in Appendix C of this plan. Prior to Meeting #3, the list of actions for each jurisdiction was emailed to that jurisdiction’s MPC representative along with the worksheets. Each jurisdiction was instructed to provide information regarding the “Action Status” with one of the following status choices:

- Completed, with a description of the progress,
- Ongoing, with a description of progress made to date; or,
- Not Yet Started, with a discussion of the reasons for lack of progress.

Additionally, the future inclusion of each mitigation action in the plan update was identified as either keep, delete, or modify. Based on the status updates, there were 6 completed actions, 16 continuing actions (either ongoing or modified), and 21 deleted actions.

Table 4.1 provides a summary of the action statuses for each jurisdiction:

Table 4.1. Action Status Summary

Jurisdiction	Completed Actions	Continuing Actions (ongoing or modify)	Deleted Actions
Unincorporated Carter County	2	5	7
City of Van Buren	1	3	4
City of Ellsinore	0	2	4
City of Grandin	0	2	4
Van Buren R-1 School District	2	2	1
East Carter County R-2 School District	1	2	1

Table 4.2 provides a summary of the completed and deleted actions from the previous plan.

Table 4.2. Summary of Completed and Deleted Actions from the Previous Plan

Completed Actions	Completion Details (date, amount, funding source)
Tornado Safe Room-Van Buren R-1 School District	\$1,209,525-10/06/2015
Make a copy of the Carter County Hazard Mitigation Plan available for public review	April 2013 – present
Equip all school buses with 2-way radios	\$1,000 – August 2016
Monitor repetitive loss properties and seek funding to participate in flood buyout programs.	Flood Buyouts – 2018 – Carter County \$650,125.05 Van Buren \$476,018.24
Deleted Actions	Reason for Deletion
Develop inundation data for high hazard dams.	Data is available; high hazard dams are not a priority threat.
School district provides training to athletic coaches on dangers of heat.	No longer relevant. Changed to education to school personnel versus coaches.
Provide training to EMA volunteers.	No County-sponsored EMA volunteers at this time.
Continue working with MODOT and their Safe and Sound Bridge Program.	No longer relevant
Support and sponsor fan collection drives within the county.	Other agencies lead this effort.
City street departments and county highway departments continue to work closely with MODOT to use the most effective road construction materials available.	No longer relevant.
Continue to maintain snow and ice removal equipment.	No longer relevant.
Trim trees around overhead utility lines.	Responsibility of the utility companies.

Source: Previously approved County Hazard Mitigation Plan; Data Collection Questionnaires.

The following actions were not completed since the 2013 County Plan was approved, along with the action, the status of the action or reason for not including in the update is below:

- Fan collection drives were deleted as an action as a local nonprofit, not a local jurisdiction organizes the efforts of collecting and distributing fans.
- City street departments and county highway departments no longer work with MoDOT to use the most effective road construction materials available as that it is not an immediate priority of MODOT or the Ozark Foothills Regional Transportation Advisory Committee that sets priorities for local road construction projects.
- Develop inundation data for high hazard dams was not completed as none of the 3 high hazard dams in the county are rated at Hazard Class 3 based on the NID criteria, meaning that the loss of human life should not occur if the dams fail and there should be minimal if any environmental impacts and property damage. There are no school district facilities or critical facilities that are located within the inundation area of any dam in Carter County. Dams fail on an individual basis, when one dam fails, not all dams fail. Any vulnerability will be limited to those persons and structures that are within the inundation zone of a failed dam. Therefore, the vulnerability of the county to one dam breaking is minimal.
- Trim trees around overhead utility lines. This is usually a responsibility assumed by the utility company.
- Continue to maintain snow and ice removal equipment was deleted as this activity is primarily completed by the Missouri Department of Transportation.
- Provide training to EMA volunteers was removed as the County does not have any EMA-sponsored volunteers.
- School districts to provide training to athletic coaches on dangers of heat. The districts

provide education to all staff not just coaches.

The following actions from the 2013 County Plan are carried forward into this plan update:

- Enforce county and city ordinances regarding construction in floodplains.
- Seek funding for community tornado saferooms in Van Buren.
- Continue to work in conjunction with the National Weather Service and MODOT to provide PSAs and educational information regarding the dangers of crossing flooded roadways.
- Educate the public on the dangers of heat related illnesses.
- Expand coverage area of tornado warning sirens.
- Continue to provide weather spotter training.
- School districts will follow Missouri State High School Activities Association (MSHSAA) policies regarding lightning and severe thunderstorms during outdoor athletic events.
- Identify and map travel routes susceptible to flash flooding with signage and PSA's.
- Conduct a campaign regarding the dangers of heat related illnesses.
- Participate in Earthquake Awareness events, providing information to the public.
- Provide Tornado Safety information and drills in schools.
- Distribute fire safety brochures and information.
- Make a copy of the Carter County Hazard Mitigation Plan available to the public.
- Provide satellite phones for emergency communications.
- Increase weather spotting training.
- Continue partnership with MODOT for bridge repairs and inspections.
- Establish alternate/emergency routes.
- Jurisdictions participating in the NFIP will continue to participate and enforce floodplain regulations. Jurisdictions not participating will investigate participation. [this action was added because it is a requirement]
- City and county governments to issue burn bans when needed.
- Continue to promote the need for emergency power generators in critical facilities.
- Seek funding for flood buyouts to remove residents from the floodplain.
- Develop a cleanout schedule for drainage systems.
- Promote the importance of NOAA weather radios.
- Investigate lightning protection measures for water and wastewater equipment within the county.

Included in the 2013 Carter County Plan there was a mitigation action to construct tornado safe rooms at school campuses in the county. Since that time, funding has been secured and construction completed on a safe rooms at the Van Buren R-1 School District. However, in the 2017 flood event, that safe room flooded even though it was constructed outside of the FEMA delineated floodplain. The County has included another goal in the plan to construct a community safe room that will be located out of the 2017 flood inundation zone. Other mitigation projects that have been completed within Carter County are two flood buyouts during 2018, one in unincorporated Carter County and one in Van Buren.

The goals and actions of this updated plan were developed through review and discussions of the mitigation planning committee. All actions were found to be cost effective, environmentally sound and technically feasible. The following set of underlying operating principles will improve fiscal and operational efficiency, help maintain focus on the overall goal of community improvement and well-being and help ensure implementation of the actions. Each action will be implemented according to the following strategies:

1. Incorporate mitigation objectives into existing and future plans, regulations, programs and projects.
2. Promote and encourage collaboration between disparate agencies and departments to create synergy that results in benefits that would not be possible through a single agency.

3. Employ sustainable principles and techniques in the implementation of each objective to attain maximum benefits.
4. Create and implement a prioritization process that includes monetary, environmental, and sociological considerations.

4.3 Implementation of Mitigation Actions

44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include an action strategy describing how the actions identified in paragraph (c)(2)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefits review of the proposed projects and their associated costs.

Jurisdictional MPC members were encouraged to meet with others in their community to finalize the actions to be submitted for the updated mitigation strategy. Throughout the MPC consideration and discussion, emphasis was placed on the importance of a benefit-cost analysis in determining project priority. The Disaster Mitigation Act requires benefit-cost review as the primary method by which mitigation projects should be prioritized. The MPC decided to pursue implementation according to when and where damage occurs, available funding, political will, jurisdictional priority, and priorities identified in the Missouri State Hazard Mitigation Plan. The benefit/cost review at the planning stage primarily consisted of a qualitative analysis, and was not the detailed process required grant funding application. For each action, the plan sets forth a narrative describing the types of benefits that could be realized from action implementation. The cost was estimated as closely as possible, with further refinement to be supplied as project development occurs.

The plan must indicate if the prioritization process and/or methodology have changed since the previous plan's adoption. If the process has changed, describe how it changed and why it changed. If the prioritization process and methodology have not changed, state this here in the plan with a description. Sample text if FEMA's suggested STAPLEE methodology is used follows: FEMA's STAPLEE methodology was used to assess the costs and benefits, overall feasibility of mitigation actions, and other issues impacting project. During the prioritization process, the MPC used worksheets to assign scores. The worksheets posed questions based on the STAPLEE elements as well as the potential mitigation effectiveness of each action. Scores were based on the responses to the questions as follows:

- Definitely yes = 3 points
- Maybe yes = 2 points
- Probably no = 1
- Definitely no = 0

The following questions were asked for each proposed action.

- S: Is the action socially acceptable?
- T: Is the action technically feasible and potentially successful?
- A: Does the jurisdiction have the administrative capability to successfully implement this action?
- P: Is the action politically acceptable?
- L: Does the jurisdiction have the legal authority to implement the action?
- E: Is the action economically beneficial?
- E: Will the project have an environmental impact that is either beneficial or neutral? (score "3" if positive and "2" if neutral)

- Will the implemented action result in lives saved?
- Will the implemented action result in a reduction of disaster damage?

Figure 4.1. Blank STAPLEE Worksheet

STAPLEE Worksheet		
Name of Jurisdiction:		
Action or Project		
Action/Project Number:	Insert a unique action number for this action for future tracking purposes. This can be a combination of the jurisdiction name, followed by the goal number and action number (i.e. Joplin1.1)	
Name of Action or Project:		
Mitigation Category:	Prevention; Structure and Infrastructure Projects; Natural Systems Protection; Education and Outreach; Emergency Services	
STAPLEE Criteria		Score
Evaluation Rating Definitely YES = 3 Maybe YES = 2 Probably NO = 1 Definitely NO = 0		
S: Is it Socially Acceptable		
T: Is it Technically feasible and potentially successful?		
A: Does the jurisdiction have the Administrative capacity to execute this action?		
P: Is it Politically acceptable?		
L: Is there Legal authority to implement?		
E: Is it Economically beneficial?		
E: Will the project have either a neutral or positive impact on the natural Environment ?		
Will historic structures be saved or protected?		
Could it be implemented quickly?		
STAPLEE SCORE		
Mitigation Effectiveness Criteria	Evaluation Rating	Score
Will the implemented action result in lives saved?	Assign from 5-10 points based on the likelihood that lives will be saved.	
Will the implemented action result in a reduction of disaster damages?	Assign from 5-10 points based on the relative reduction of disaster damages.	
MITIGATION EFFECTIVENESS SCORE		
TOTAL SCORE (STAPLEE + Mitigation Effectiveness)		
<input type="checkbox"/> High Priority (30+ points)	<input type="checkbox"/> Medium Priority (25 - 29 points)	<input type="checkbox"/> Low Priority (<25 points)

Completed by
(Name, Title, Phone Number)

Goal 1: Implement mitigation actions that improve the protection of human life, health, and safety from the adverse effects of disaster

Action 1.1: Enforce floodplain ordinances

Action Worksheet	
Name of Jurisdiction:	City of Van Buren
Risk / Vulnerability	
Problem being Mitigated:	Floodplain construction ordinances
Hazard(s) Addressed:	Flooding, Dam Failure, Levee Failure
Action or Project	
Action/Project Number:	Flooding 1
Name of Action or Project:	Adopt and/or enforce floodplain ordinances
Action or Project Description:	Examine city ordinances regarding construction in floodplains
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disaster
Estimated Cost:	n/a
Benefits:	Regulating the type of construction in a flood zone will help prevent future damage. Helps reduce flood insurance rates.
Plan for Implementation	
Responsible Organization/Department:	City Mayor and City Council
Action/Project Priority:	High
Timeline for Completion:	1-3 years
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	City ordinances and Planning and Zoning Boards
Progress Report	
Action Status	This action is continuing.
Report of Progress	Ordinances are adopted. Enforcement is ongoing.

Action 1.1 Enforce floodplain ordinances

Action Worksheet	
Name of Jurisdiction:	City of Ellsinore
Risk / Vulnerability	
Problem being Mitigated:	Floodplain construction ordinances
Hazard(s) Addressed:	Flooding, Dam Failure, Levee Failure
Action or Project	
Action/Project Number:	
Name of Action or Project:	Flooding 1 Adopt and/or enforce floodplain ordinances
Action or Project Description:	Examine city ordinances regarding construction in floodplains
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disaster
Estimated Cost:	n/a
Benefits:	Regulating the type of construction in a flood zone will help prevent future damage. Helps reduce flood insurance rates.
Plan for Implementation	
Responsible Organization/Department:	City Council
Action/Project Priority:	High
Timeline for Completion:	1-3 years
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	City ordinances and Planning and Zoning Boards
Progress Report	
Action Status	
Report of Progress	This action is continuing. Ordinances are adopted. Enforcement is ongoing.

Action 1.1 Participate in the National Flood Insurance Program (NFIP) and adopt floodplain ordinances.

Action Worksheet	
Name of Jurisdiction:	City of Grandin
Risk / Vulnerability	
Problem being Mitigated:	Non-participation in the NFIP. Floodplain construction ordinances
Hazard(s) Addressed:	Flooding, Dam Failure, Levee Failure
Action or Project	
Action/Project Number:	Flooding 1
Name of Action or Project:	Adopt floodplain ordinances. Participate in the NFIP.
Action or Project Description:	Begin participation in the NFIP and develop city ordinances regarding construction in floodplains
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disaster
Estimated Cost:	n/a
Benefits:	Participation in the NFIP and adopting floodplain ordinances will help prevent future damage. Helps reduce flood insurance rates.
Plan for Implementation	
Responsible Organization/Department:	City Council
Action/Project Priority:	High
Timeline for Completion:	1-3 years
Potential Fund Sources:	Local funds
Planning Mechanisms to be Used in Implementation, if any:	City ordinances and Planning and Zoning Boards
Progress Report	
Action Status	This action is continuing. Participation in NFIP begins. Ordinances are adopted. Enforcement is ongoing.
Report of Progress	

Action 1.2 Education of Extreme Heat

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Heat Related illnesses education
Hazard(s) Addressed:	Extreme Heat
Action or Project	
Action/Project Number:	Heat
Name of Action or Project:	Education of Extreme Hear
Action or Project Description:	Provide educational resources to residents on avoiding heat related illnesses and accidents
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disaster
Estimated Cost:	n/a
Benefits:	Reduction in accidents, sicknesses, and death due to heat.
Plan for Implementation	
Responsible Organization/Department:	Director of County Health Department
Action/Project Priority:	M, 28
Timeline for Completion:	1-3 years
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Education and Shelters
Progress Report	
Action Status	Ongoing action as information changes and seasons shift.
Report of Progress	

Action 1.3 Earthquake Awareness

Action Worksheet	
Name of Jurisdiction:	Van Buren R-1 School District
Risk / Vulnerability	
Problem being Mitigated:	Earthquake awareness.
Hazard(s) Addressed:	Earthquake
Action or Project	
Action/Project Number:	Earthquake
Name of Action or Project:	Earthquake Awareness
Action or Project Description:	Provide educational resources to students on earthquake procedure and how to stay safe.
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Reduction in accidents, and deaths due to earthquakes.
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	M,25
Timeline for Completion:	1-3 years
Potential Fund Sources:	Local funds.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to conduct earthquake drills and provide educational materials
Progress Report	
Action Status	Continuing
Report of Progress	Conducted annually in collaboration with Carter County EMD.
Completed by:	

Action 1.3 Earthquake Awareness

Action Worksheet	
Name of Jurisdiction:	East Carter County R-II School District
Risk / Vulnerability	
Problem being Mitigated:	Earthquake awareness.
Hazard(s) Addressed:	Earthquake
Action or Project	
Action/Project Number:	Earthquake 1
Name of Action or Project:	Earthquake Awareness
Action or Project Description:	Provide educational resources to residents on earthquake procedure and how to stay safe.
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Reduction in accidents, and deaths due to earthquakes.
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	M,25
Timeline for Completion:	1-3 years
Potential Fund Sources:	Local funds.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to conduct earthquake drills and provide educational materials
Progress Report	
Action Status	Continuing
Report of Progress	Conducted annually in collaboration with Carter County EMD.
Completed by:	

Action 1.4 Tornado Safety Drills

Action Worksheet	
Name of Jurisdiction:	Van Buren R-I School District
Risk / Vulnerability	
Problem being Mitigated:	Tornado Safety
Hazard(s) Addressed:	Tornado
Action or Project	
Action/Project Number:	Tornado 1
Name of Action or Project:	Tornado Safety Drills
Action or Project Description:	Implement drills into the local schools, nursing homes, and child care facilities for protection of students and staff.
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Reduction in accidents, and deaths due to tornados.
Plan for Implementation	
Responsible Organization/Department:	Superintendent.
Action/Project Priority:	L, 21
Timeline for Completion:	1 year
Potential Fund Sources:	Local funds.
Local Planning Mechanisms to be Used in Implementation, if any:	Education and Tornado Sirens
Progress Report	
Action Status	Continuing
Report of Progress	Conducted 2x per year in collaboration with Carter County EMD.
Completed by:	

Action 1.4 Tornado Safety Drills

Action Worksheet	
Name of Jurisdiction:	East Carter County R-II School District
Risk / Vulnerability	
Problem being Mitigated:	Tornado Safety
Hazard(s) Addressed:	Tornado
Action or Project	
Action/Project Number:	Tornado 1
Name of Action or Project:	Tornado Safety Drills
Action or Project Description:	Implement drills into the local schools, nursing homes, and child care facilities for protection of citizens.
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Reduction in accidents, and deaths due to tornados.
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	L, 21
Timeline for Completion:	1 year
Potential Fund Sources:	Local funds.
Local Planning Mechanisms to be Used in Implementation, if any:	Education and Tornado Sirens
Progress Report	
Action Status	Continuing.
Report of Progress	Conducted 2x per year in collaboration with Carter County EMD
Completed by:	

Action 1.5 Fire Education and Alarms

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Fire Awareness
Hazard(s) Addressed:	Fire
Action or Project	
Action/Project Number:	Fire 1
Name of Action or Project:	Fire Education and Alarms
Action or Project Description:	Provide education for residents. Install smoke detectors throughout the county.
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disasters.
Estimated Cost:	\$70,000
Benefits:	Reduction in accidents, and deaths due to fire or damage from smoke. Protect structures or prevent full destruction.
Plan for Implementation	
Responsible Organization/Department:	County Emergency management Director.
Action/Project Priority:	M, 29
Timeline for Completion:	1 year
Potential Fund Sources:	Local funds, grants, and community matching.
Local Planning Mechanisms to be Used in Implementation, if any:	Education and Training
Progress Report	
Action Status	Continuing
Report of Progress	Provided as funds allow.
Completed by:	

Action 1.5 Provide Satellite phones for emergency communication

Action Worksheet	
Name of Jurisdiction:	Van Buren R-I School District
Risk / Vulnerability	
Problem being Mitigated:	Improved Communications
Hazard(s) Addressed:	All
Action or Project	
Action/Project Number:	All 2
Name of Action or Project:	Satellite Phones
Action or Project Description:	Provide satellite phones on school buses and to first responders
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disasters.
Estimated Cost:	\$100,000
Benefits:	Improved communication within the county due to poor cell phone and radio service
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	M, 29
Timeline for Completion:	1 year
Potential Fund Sources:	Local funds, grants, and community matching.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to seek funding for continuous upgrades
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 1.5 Provide Satellite phones for emergency communication

Action Worksheet	
Name of Jurisdiction:	East Carter County R-II School District
Risk / Vulnerability	
Problem being Mitigated:	Improved Communications
Hazard(s) Addressed:	All
Action or Project	
Action/Project Number:	All 2
Name of Action or Project:	Satellite Phones
Action or Project Description:	Provide satellite phones on school buses and to first responders
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disasters.
Estimated Cost:	\$100,000
Benefits:	Improved communication within the county due to poor cell phone and radio service
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	M, 29
Timeline for Completion:	1 year
Potential Fund Sources:	Local funds, grants, and community matching.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to seek funding for continuous upgrades
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 1.6 Construct earthen dike around critical facility

Action Worksheet	
Name of Jurisdiction:	Van Buren R-1 School District
Risk / Vulnerability	
Problem being Mitigated:	Flooding
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	Flood 1
Name of Action or Project:	Earthen Dike
Action or Project Description:	Construct earthen dike around FEMA saferoom building to protect against future flooding in a critical facility.
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disasters.
Estimated Cost:	\$150,000
Benefits:	Mitigates risk of flood damage to critical facility and improves protection of human life, health and safety.
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	M, 30
Timeline for Completion:	1 year
Potential Fund Sources:	Local funds, grants, and community matching.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to seek funding for continuous upgrades
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 1.7 Install stormwater pumps

Action Worksheet	
Name of Jurisdiction:	East Carter County R-II School District
Risk / Vulnerability	
Problem being Mitigated:	Flooding
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	Flood 1
Name of Action or Project:	Stormwater Pumps
Action or Project Description:	Install stormwater pumps to protect critical FEMA saferoom building from impacts of stormwater runoff.
Applicable Goal Statement:	Improve the protection of human life, health, and safety from adverse effects of disasters.
Estimated Cost:	\$100,000
Benefits:	Mitigates risk of flood damage to critical facility and improves protection of human life, health and safety.
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	M, 31
Timeline for Completion:	1 year
Potential Fund Sources:	Local funds, grants, and community matching.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to seek funding for continuous upgrades
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Goal 2: Implement mitigation actions that improve the continuity of government and essential services from the adverse effects of disasters.

Action 2.1 Making Mitigation Plan Available

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Availability of Mitigation Plan
Hazard(s) Addressed:	All
Action or Project	
Action/Project Number:	HMP 1
Name of Action or Project:	Making Mitigation Plan Available
Action or Project Description:	Make the hazard mitigation plan more easily available to the public. Provide a copy to the city, schools, and local health department.
Applicable Goal Statement:	Implement mitigation actions that improve the continuity of government and essential services from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Improve the awareness of hazard mitigation planning and its benefits.
Plan for Implementation	
Responsible Organization/Department:	County Emergency Management Director
Action/Project Priority:	L, 20
Timeline for Completion:	1 year
Potential Fund Sources:	n/a
Local Planning Mechanisms to be Used in Implementation, if any:	
Progress Report	
Action Status	Continuing
Report of Progress	Completed in 2013.
Completed by:	Carter County

Action 2.2 Warning Siren Expansion

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Tornado Sirens
Hazard(s) Addressed:	Tornado
Action or Project	
Action/Project Number:	Tornado 2
Name of Action or Project:	Warning Siren Expansion
Action or Project Description:	Expand availability of warning sirens and reach for residents and tourists.
Applicable Goal Statement:	Implement mitigation actions that improve the continuity of government and essential services from the adverse effects of disasters.
Estimated Cost:	\$10,000
Benefits:	Improve the warning time of a spotted hazard.
Plan for Implementation	
Responsible Organization/Department:	County Emergency Management Director
Action/Project Priority:	L, 20
Timeline for Completion:	1 -5 years
Potential Fund Sources:	Local
Local Planning Mechanisms to be Used in Implementation, if any:	County Emergency Management Director Continue to seek funding for sirens
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 2.3 Hazard Training for Weather Spotters

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Hazard Training
Hazard(s) Addressed:	All
Action or Project	
Action/Project Number:	HMP 2
Name of Action or Project:	Train interested residents on spotting hazardous weather
Action or Project Description:	Increase available weather spotters
Applicable Goal Statement:	Implement mitigation actions that improve the continuity of government and essential services from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Improve the response time, and knowledge of hazards.
Plan for Implementation	
Responsible Organization/Department:	County Emergency Management Director
Action/Project Priority:	M, 26
Timeline for Completion:	1 -5 years
Potential Fund Sources:	Local, grant matching, educational opportunities.
Local Planning Mechanisms to be Used in Implementation, if any:	
Progress Report	
Action Status	Continuing
Report of Progress	Provided as needed
Completed by:	

Goal 3: Implement mitigation actions that improve the protections of public and private property from the adverse effects of disasters.

Action 3.1 Replace low water crossings with culverts

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Flooding
Hazard(s) Addressed:	Flooding, Dam Failure
Action or Project	
Action/Project Number:	Flooding 2
Name of Action or Project:	Culvert installation
Action or Project Description:	Replace low-water crossings with culverts
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	\$200,000
Benefits:	Protection of roadways, surrounding property, and preventive measure for damages.
Plan for Implementation	
Responsible Organization/Department:	County Emergency Management Director
Action/Project Priority:	L, 20
Timeline for Completion:	1 -5 years
Potential Fund Sources:	Local, grant funds
Local Planning Mechanisms to be Used in Implementation, if any:	County and city street departments Continue improvements
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.1 Replace low water crossings with culverts

Action Worksheet	
Name of Jurisdiction:	City of Van Buren
Risk / Vulnerability	
Problem being Mitigated:	Flooding
Hazard(s) Addressed:	Flooding, Dam Failure
Action or Project	
Action/Project Number:	Flooding 2
Name of Action or Project:	Culvert installation
Action or Project Description:	Replace low-water crossings with culverts
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	\$200,000
Benefits:	Protection of roadways, surrounding property, and preventive measure for damages.
Plan for Implementation	
Responsible Organization/Department:	Public Works Director
Action/Project Priority:	L, 20
Timeline for Completion:	1 -5 years
Potential Fund Sources:	Local, grant funds
Local Planning Mechanisms to be Used in Implementation, if any:	County and city street departments Continue improvements
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.1 Replace low water crossings with culverts

Action Worksheet	
Name of Jurisdiction:	City of Ellsinore
Risk / Vulnerability	
Problem being Mitigated:	Flooding
Hazard(s) Addressed:	Flooding, Dam Failure
Action or Project	
Action/Project Number:	Flooding 2
Name of Action or Project:	Culvert installation
Action or Project Description:	Replace low-water crossings with culverts
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	\$200,000
Benefits:	Protection of roadways, surrounding property, and preventive measure for damages.
Plan for Implementation	
Responsible Organization/Department:	Public Works Director
Action/Project Priority:	L, 20
Timeline for Completion:	1 -5 years
Potential Fund Sources:	Local, grant funds
Local Planning Mechanisms to be Used in Implementation, if any:	County and city street departments Continue improvements
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.1 Replace low water crossings with culverts

Action Worksheet	
Name of Jurisdiction:	City of Grandin
Risk / Vulnerability	
Problem being Mitigated:	Flooding
Hazard(s) Addressed:	Flooding, Dam Failure
Action or Project	
Action/Project Number:	Flooding 2
Name of Action or Project:	Culvert installation
Action or Project Description:	Replace low-water crossings with culverts
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	\$200,000
Benefits:	Protection of roadways, surrounding property, and preventive measure for damages.
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	L, 20
Timeline for Completion:	1 -5 years
Potential Fund Sources:	Local, grant funds
Local Planning Mechanisms to be Used in Implementation, if any:	County and city street departments Continue improvements
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.2 Prioritize work on bridges and roadways that are vulnerable to earthquakes.

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Bridges and Roadways
Hazard(s) Addressed:	Earthquake
Action or Project	
Action/Project Number:	Earthquake 2
Name of Action or Project:	Prioritize work on bridges and roadways that are vulnerable to earthquakes.
Action or Project Description:	Reinforce vulnerable bridges and roadways.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Structural protection.
Plan for Implementation	
Responsible Organization/Department:	County Emergency Management Director
Action/Project Priority:	M, 26
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local, grant funds if needed, and city capital improvement tax.
Local Planning Mechanisms to be Used in Implementation, if any:	
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.3 Relocation of residents from floodways

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Participate in Flood buyout programs
Hazard(s) Addressed:	Property protection
Action or Project	
Action/Project Number:	Flood 3
Name of Action or Project:	Relocation residents from floodways.
Action or Project Description:	Flood buyout
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Structural protection.
Plan for Implementation	
Responsible Organization/Department:	County Emergency Management Director
Action/Project Priority:	M, 26
Timeline for Completion:	Ongoing
Potential Fund Sources:	FEMA/SEMA
Local Planning Mechanisms to be Used in Implementation, if any:	
Progress Report	
Action Status	Continuing
Report of Progress	2018 Flood Buyout in progress
Completed by:	

Action 3.4 Establish Alternate Transportation Routes

Action Worksheet	
Name of Jurisdiction:	City of Van Buren
Risk / Vulnerability	
Problem being Mitigated:	Alternate Routes
Hazard(s) Addressed:	All
Action or Project	
Action/Project Number:	HMP 3
Name of Action or Project:	Establish Alternate Transportation
Action or Project Description:	Establish alternate routes during an emergency.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Safety
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	L, 22
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local Funds, MoDot
Local Planning Mechanisms to be Used in Implementation, if any:	Update maps
Progress Report	
Action Status	Continuing
Report of Progress	
Completed by:	

Action 3.5 Enforce Burn Bans

Action Worksheet	
Name of Jurisdiction:	City of Van Buren
Risk / Vulnerability	
Problem being Mitigated:	Institute safe burn guidelines.
Hazard(s) Addressed:	Fire
Action or Project	
Action/Project Number:	Fire 3
Name of Action or Project:	Burn Bans
Action or Project Description:	Allow fire departments and forest service to identify safe burn periods and issues bans.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Structural protection.
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	L, 23
Timeline for Completion:	Ongoing
Potential Fund Sources:	No funding required
Local Planning Mechanisms to be Used in Implementation, if any:	Monitor situations
Progress Report	
Action Status	Continuing
Report of Progress	
Completed by:	

Action 3.5 Enforce Burn Bans

Action Worksheet	
Name of Jurisdiction:	City of Ellsinore
Risk / Vulnerability	
Problem being Mitigated:	Institute safe burn guidelines.
Hazard(s) Addressed:	Fire
Action or Project	
Action/Project Number:	Fire 3
Name of Action or Project:	Burn Bans
Action or Project Description:	Allow fire departments and forest service to identify safe burn periods and issues bans.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Structural protection.
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	L, 23
Timeline for Completion:	Ongoing
Potential Fund Sources:	No funding required
Local Planning Mechanisms to be Used in Implementation, if any:	Monitor situations
Progress Report	
Action Status	Continuing
Report of Progress	
Completed by:	

Action 3.5 Enforce Burn Bans

Action Worksheet	
Name of Jurisdiction:	City of Grandin
Risk / Vulnerability	
Problem being Mitigated:	Institute safe burn guidelines.
Hazard(s) Addressed:	Fire
Action or Project	
Action/Project Number:	Fire 3
Name of Action or Project:	Burn Bans
Action or Project Description:	Allow fire departments and forest service to identify safe burn periods and issues bans.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Structural protection.
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	L, 23
Timeline for Completion:	Ongoing
Potential Fund Sources:	No funding required
Local Planning Mechanisms to be Used in Implementation, if any:	Monitor situations
Progress Report	
Action Status	Continuing
Report of Progress	
Completed by:	

Action 3.6 Establish emergency generators in critical facilities.

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Power Outage
Hazard(s) Addressed:	Storm, Snow, Ice, Tornado
Action or Project	
Action/Project Number:	Tornado 3
Name of Action or Project:	Emergency generators purchase.
Action or Project Description:	Purchase emergency generators for critical facilities defined as temporary shelters, public safety offices, and medical facilities.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	\$200,000
Benefits:	Continuity of government and private services
Plan for Implementation	
Responsible Organization/Department:	Emergency Management Director, County Health Department
Action/Project Priority:	M, 29
Timeline for Completion:	Ongoing
Potential Fund Sources:	FEMA/SEMA, Public Funds, Grants
Local Planning Mechanisms to be Used in Implementation, if any:	Education and public information
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.7 Upgrade Water Systems

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Water
Hazard(s) Addressed:	Drought
Action or Project	
Action/Project Number:	Flooding 4
Name of Action or Project:	Upgrade water systems.
Action or Project Description:	Seek funding to improve water and sewage throughout the county.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	\$150,000
Benefits:	Improve public water supply
Plan for Implementation	
Responsible	Carter County PWSD's
Organization/Department:	
Action/Project Priority:	L, 19
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds, Grants
Local Planning Mechanisms to be Used in Implementation, if any:	
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.8 Lightning Protection

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Lightning
Hazard(s) Addressed:	Thunder Storm
Action or Project	
Action/Project Number:	Storm 1
Name of Action or Project:	Lightning Protection
Action or Project Description:	Explore needed lightning protection at critical facilities and communication equipment
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disaster
Estimated Cost:	\$8,000
Benefits:	Continuity of services
Plan for Implementation	
Responsible Organization/Department:	County Emergency Management Director, County Health Department
Action/Project Priority:	L, 24
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds, Grants as needed.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to monitor
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.8 Lightning Protection

Action Worksheet	
Name of Jurisdiction:	City of Van Buren
Risk / Vulnerability	
Problem being Mitigated:	Lightning
Hazard(s) Addressed:	Thunder Storm
Action or Project	
Action/Project Number:	Storm 1
Name of Action or Project:	Lightning Protection
Action or Project Description:	Explore needed lightning protection at critical facilities and communication equipment
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disaster
Estimated Cost:	\$8,000
Benefits:	Continuity of services
Plan for Implementation	
Responsible Organization/Department:	Public Works Director
Action/Project Priority:	L, 24
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds, Grants as needed.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to monitor
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.8 Lightning Protection

Action Worksheet	
Name of Jurisdiction:	City of Ellsinore
Risk / Vulnerability	
Problem being Mitigated:	Lightning
Hazard(s) Addressed:	Thunder Storm
Action or Project	
Action/Project Number:	Storm 1
Name of Action or Project:	Lightning Protection
Action or Project Description:	Explore needed lightning protection at critical facilities and communication equipment
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disaster
Estimated Cost:	\$8,000
Benefits:	Continuity of services
Plan for Implementation	
Responsible Organization/Department:	Public Works Director
Action/Project Priority:	L, 24
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds, Grants as needed.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to monitor
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action Worksheet	
Name of Jurisdiction:	City of Grandin
Risk / Vulnerability	
Problem being Mitigated:	Lightning
Hazard(s) Addressed:	Thunder Storm
Action or Project	
Action/Project Number:	Storm 1
Name of Action or Project:	Lightning Protection
Action or Project Description:	Explore needed lightning protection at critical facilities and communication equipment
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disaster
Estimated Cost:	\$8,000
Benefits:	Continuity of services
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	L, 24
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds, Grants as needed.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to monitor
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.8 Lightning Protection

Action Worksheet	
Name of Jurisdiction:	Van Buren R-I School District
Risk / Vulnerability	
Problem being Mitigated:	Lightning
Hazard(s) Addressed:	Thunder Storm
Action or Project	
Action/Project Number:	Storm 1
Name of Action or Project:	Lightning Protection
Action or Project Description:	Explore needed lightning protection at critical facilities and communication equipment
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disaster
Estimated Cost:	\$8,000
Benefits:	Continuity of services
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	L, 24
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds, Grants as needed.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to monitor
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.8 Lightning Protection

Action Worksheet	
Name of Jurisdiction:	East Carter County R-II School District
Risk / Vulnerability	
Problem being Mitigated:	Lightning
Hazard(s) Addressed:	Thunder Storm
Action or Project	
Action/Project Number:	Storm 1
Name of Action or Project:	Lightning Protection
Action or Project Description:	Explore needed lightning protection at critical facilities and communication equipment
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disaster
Estimated Cost:	\$8,000
Benefits:	Continuity of services
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	L, 24
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds, Grants as needed.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to monitor
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.9 Mapping of Sinkholes

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Sink Holes
Hazard(s) Addressed:	Sink Holes, Land Subsidence
Action or Project	
Action/Project Number:	Land Subsidence 2
Name of Action or Project:	Mapping of Sinkholes
Action or Project Description:	Create a county wide map of active, and potential sinkholes.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.
Estimated Cost:	\$8,000
Benefits:	Public information, prevent future accidents.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management Director, Commissioners
Action/Project Priority:	M, 26
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds, Grants as needed.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to monitor
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.10 Integrate Into Other Plans

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Education
Hazard(s) Addressed:	Integration, All
Action or Project	
Action/Project Number:	HMP 6
Name of Action or Project:	Integrate into other plans
Action or Project Description:	Integrate hazard mitigation plan into other community plans, such as the comprehensive plan so all documents work together.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Public information, prevent future accidents.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management Director, Commissioners
Action/Project Priority:	L, 23
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds
Local Planning Mechanisms to be Used in	County, city and school district plans
Implementation, if any:	
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.10 Integrate into other Plans

Action Worksheet	
Name of Jurisdiction:	City of Van Buren
Risk / Vulnerability	
Problem being Mitigated:	Education
Hazard(s) Addressed:	Integration, All
Action or Project	
Action/Project Number:	HMP 6
Name of Action or Project:	Integrate into other plans
Action or Project Description:	Integrate hazard mitigation plan into other community plans, such as the comprehensive plan so all documents work together.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Public information, prevent future accidents.
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	L, 23
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds
Local Planning Mechanisms to be Used in	County, city and school district plans
Implementation, if any:	
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.10 Integrate into other Plans

Action Worksheet	
Name of Jurisdiction:	City of Ellsinore
Risk / Vulnerability	
Problem being Mitigated:	Education
Hazard(s) Addressed:	Integration, All
Action or Project	
Action/Project Number:	HMP 6
Name of Action or Project:	Integrate into other plans
Action or Project Description:	Integrate hazard mitigation plan into other community plans, such as the comprehensive plan so all documents work together.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Public information, prevent future accidents.
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	L, 23
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds
Local Planning Mechanisms to be Used in	County, city and school district plans
Implementation, if any:	
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.10 Integrate into other Plans

Action Worksheet	
Name of Jurisdiction:	City of Grandin
Risk / Vulnerability	
Problem being Mitigated:	Education
Hazard(s) Addressed:	Integration, All
Action or Project	
Action/Project Number:	HMP 6
Name of Action or Project:	Integrate into other plans
Action or Project Description:	Integrate hazard mitigation plan into other community plans, such as the comprehensive plan so all documents work together.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Public information, prevent future accidents.
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	L, 23
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds
Local Planning Mechanisms to be Used in	County, city and school district plans
Implementation, if any:	
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.10 Integrate into other Plans

Action Worksheet	
Name of Jurisdiction:	Van Buren R-I School District
Risk / Vulnerability	
Problem being Mitigated:	Education
Hazard(s) Addressed:	Integration, All
Action or Project	
Action/Project Number:	HMP 6
Name of Action or Project:	Integrate into other plans
Action or Project Description:	Integrate hazard mitigation plan into other community plans, such as the comprehensive plan so all documents work together.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Public information, prevent future accidents.
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	L, 23
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds
Local Planning Mechanisms to be Used in	County, city and school district plans
Implementation, if any:	
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 3.10 Integrate into other Plans

Action Worksheet	
Name of Jurisdiction:	East Carter County R-II School District
Risk / Vulnerability	
Problem being Mitigated:	Education
Hazard(s) Addressed:	Integration, All
Action or Project	
Action/Project Number:	HMP 6
Name of Action or Project:	Integrate into other plans
Action or Project Description:	Integrate hazard mitigation plan into other community plans, such as the comprehensive plan so all documents work together.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Public information, prevent future accidents.
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	L, 23
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds
Local Planning Mechanisms to be Used in	County, city and school district plans
Implementation, if any:	
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Goal 4: Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.

Action 4.1 National Flood Insurance Program Community Rating System Implementation

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Public Awareness
Hazard(s) Addressed:	Flooding
Action or Project	
Action/Project Number:	Flood 5
Name of Action or Project:	National Flood Insurance Program
Action or Project Description:	Explore CRS county wide. Receive a community rating.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.
Estimated Cost:	\$8,000
Benefits:	Flood hazard awareness
Plan for Implementation	
Responsible Organization/Department:	Emergency Management Director, County Health Department
Action/Project Priority:	L, 19
Timeline for Completion:	Ongoing
Potential Fund Sources:	Public Funds, Grants as needed.
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to educate
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 4.2 Participate in Flood Insurance Rate Map Identification and Mapping

Action Worksheet	
Name of Jurisdiction:	Carter County
Risk / Vulnerability	
Problem being Mitigated:	Public Awareness
Hazard(s) Addressed:	Flooding
Action or Project	
Action/Project Number:	Flood 5
Name of Action or Project:	Updated floodplain identification and mapping
Action or Project Description:	Demonstrate flood hazard mitigation efforts by the community through NFIP activities and participation in the flood insurance rate map update.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Flood hazard awareness
Plan for Implementation	
Responsible Organization/Department:	Emergency Management Director, County Commission
Action/Project Priority:	L, 19
Timeline for Completion:	Ongoing
Potential Fund Sources:	n/a
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to educate
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 4.2 Participate in Flood Insurance Rate Map Identification and Mapping

Action Worksheet	
Name of Jurisdiction:	City of Van Buren
Risk / Vulnerability	
Problem being Mitigated:	Public Awareness
Hazard(s) Addressed:	Flooding
Action or Project	
Action/Project Number:	Flood 5
Name of Action or Project:	Updated floodplain identification and mapping
Action or Project Description:	Demonstrate flood hazard mitigation efforts by the community through NFIP activities and participation in the flood insurance rate map update.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Flood hazard awareness
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	L, 19
Timeline for Completion:	Ongoing
Potential Fund Sources:	n/a
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to educate
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

Action 4.2 Participate in Flood Insurance Rate Map Identification and Mapping

Action Worksheet	
Name of Jurisdiction:	City of Ellsinore
Risk / Vulnerability	
Problem being Mitigated:	Public Awareness
Hazard(s) Addressed:	Flooding
Action or Project	
Action/Project Number:	Flood 5
Name of Action or Project:	Updated floodplain identification and mapping
Action or Project Description:	Demonstrate flood hazard mitigation efforts by the community through NFIP activities and participation in the flood insurance rate map update.
Applicable Goal Statement:	Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.
Estimated Cost:	n/a
Benefits:	Flood hazard awareness
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	L, 19
Timeline for Completion:	Ongoing
Potential Fund Sources:	n/a
Local Planning Mechanisms to be Used in Implementation, if any:	Continue to educate
Progress Report	
Action Status	New
Report of Progress	
Completed by:	

5 PLAN MAINTENANCE PROCESS

5 PLAN MAINTENANCE PROCESS	5.1
<i>5.1 Monitoring, Evaluating, and Updating the Plan.....</i>	<i>5.1</i>
5.1.1 Responsibility for Plan Maintenance	5.1
5.1.2 Plan Maintenance Schedule	5.2
5.1.3 Plan Maintenance Process.....	5.2
5.2 Incorporation into Existing Planning Mechanisms	5.3
5.3 Continued Public Involvement	5.6

This section provides an overview of the overall strategy for plan maintenance and outlines the method and schedule for monitoring, updating and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

5.1 Monitoring, Evaluating, and Updating the Plan

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

5.1.1 Responsibility for Plan Maintenance

The Mitigation Planning Committee (MPC) will be a standing committee appointed by the Carter County Commission, with oversight provided by the Ozark Foothills Regional Planning Commission. The role of the MPC in regard to implementation monitoring, action evaluation and plan maintenance is described below. The participating jurisdictions, public water supply districts, and school districts commit to conduct the following:

- Meet annually, and after a disaster event, to monitor and evaluate the implementation of the plan;
- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high priority, low- or no-cost recommended actions;
- Maintain vigilant monitoring of multi-objective, cost-share, and other funding opportunities to help the community implement the plan’s recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;

- Report on plan progress and recommended changes to the County Commissioners and governing bodies of participating jurisdictions; and
- Inform and solicit input from the public.

The MPC is an advisory body and can only make recommendations to county, city, town, or district elected officials. Its primary duty is to see the plan successfully carried out and to report to the community governing boards and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, hearing stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information in areas accessible to the public.

5.1.2 Plan Maintenance Schedule

The MPC agrees to meet annually and after a state or federally declared hazard event as appropriate to monitor progress and update the mitigation strategy. The Carter County Emergency Management Director will be responsible for initiating the plan reviews and will invite members of the MPC to the meeting, as well as document all review meetings. The Ozark Foothills Regional Planning Commission will be responsible for beginning the planning and updating of the plan in five years. The plan will be updated every five years via committee meeting and discussion. At the five year mark the committee will take into consideration all notes and reports discussed at each annual review.

In coordination with all participating jurisdictions, a five-year written update of the plan will be submitted to the Missouri State Emergency Management Agency (SEMA) and FEMA Region VII per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule.

5.1.3 Plan Maintenance Process

Progress on the proposed actions can be monitored by evaluating changes in vulnerabilities identified within the plan. The staff at the OFRPC will be responsible for initiating the update process for the Plan. The MPC during the annual meeting should review changes in vulnerability identified as follows:

- Decreased vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions,
- Increased vulnerability due to hazard events, and/or
- Increased vulnerability as a result of new development (and/or annexation).

Future 5-year updates to this plan will include the following activities:

- Consideration of changes in vulnerability due to action implementation,
- Documentation of success stories where mitigation efforts have proven effective,
- Documentation of unsuccessful mitigation actions and why the actions were not effective,
- Documentation of previously overlooked hazard events that may have occurred since the previous plan approval,
- Incorporation of new data or studies with information on hazard risks,
- Incorporation of new capabilities or changes in capabilities,
- Incorporation of growth data and changes to inventories, and

- Incorporation of ideas for new actions and changes in action prioritization.

In order to best evaluate any changes in vulnerability as a result of plan implementation, the participating jurisdictions will adopt the following process:

- Each proposed action in the plan identified an individual, office, or agency responsible for action implementation. This entity will track and report on an annual basis to the jurisdictional MPC member on action status. The entity will provide input on whether the action as implemented meets the defined objectives and is likely to be successful in reducing risk.
- If the action does not meet identified objectives, the jurisdictional MPC member will determine necessary remedial action, making any required modifications to the plan.

Changes will be made to the plan to remedy actions that have failed or are not considered feasible. Feasibility will be determined after a review of action consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring of this plan. Updating of the plan will be accomplished by written changes and submissions, as the MPC deems appropriate and necessary. Changes will be approved by the Carter County Commission and the governing boards of the other participating jurisdictions.

5.2 Incorporation into Existing Planning Mechanisms

44 CFR Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Where possible, plan participants, including school and special districts, will use existing plans and/or programs to implement hazard mitigation actions. Those existing plans and programs were described in Section 2 of this plan. Based on the capability assessments of the participating jurisdictions, communities in Carter County will continue to plan and implement programs to reduce losses to life and property from hazards. The *Carter County Hazard Mitigation Plan* is used to support other plans created within Carter County to support efforts for economic resiliency during a natural disaster such as the Tornado Safe Room constructed in the City of Van Buren. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through the following plans: General or master plans of participating jurisdictions;

- general, master, or comprehensive plans of participating jurisdictions;
- ordinances of participating jurisdictions;
- the Carter County Emergency Operations Plan;
- capital improvement plans and budgets;
- other community plans with the County, such as water conservation plans, storm water management plans, and parks and recreation plans;
- school and special district plans and budgets; and
- other plans and policies outlined in the capability assessment sections for each jurisdiction in Section 2 of this plan.

The MPC members involved in updating these existing planning mechanisms will be responsible for integrating the findings and actions of the mitigation plan, as appropriate. The MPC is also responsible for monitoring this integration and incorporation of the appropriate information into the

five-year update of the multi-jurisdictional hazard mitigation plan.

Additionally, after the annual review of the Hazard Mitigation Plan, the Carter County Emergency Management Director will provide the updated Mitigation Strategy with current status of each mitigation action to the County Commission as well as all Mayors, City Clerks, and School District Superintendents. The Emergency Manager Director will request that the mitigation strategy be incorporated, where appropriate, in other planning mechanisms.

Table 5.1 below lists the planning mechanisms by jurisdiction into which the Hazard Mitigation Plan will be integrated.

Table 5.1 Planning Mechanisms Identified for Integration of Hazard Mitigation Plan

Jurisdiction	Planning Mechanisms	Integration Process for Previous Plan	Integration Process for Current Plan
Unincorporated Carter County	Transportation Plan Emergency Operations Plan Economic Development Plan	County Commissioners responsible for road maintenance attended planning meetings and identified actions related to transportation infrastructure. County EMD is responsible for the county-wide emergency operations plan and attended planning meetings and identified actions related to the current emergency plan.	County Commissioners responsible for road maintenance attended planning meetings and identified new or ongoing actions related to transportation infrastructure. County EMD is responsible for the county-wide emergency operations plan and attended planning meetings and identified actions related to the current emergency plan.
City of Van Buren	Economic Development Plan Transportation Plan	Public works director responsible for road maintenance attended planning meetings and identified actions related to transportation infrastructure. Actions to integrate the regional Comprehensive Economic Development Strategies (CEDS) plan were discussed by Ozark Foothills RPC the City Clerk.	Public works director responsible for road maintenance attended planning meetings and identified new or ongoing actions related to transportation infrastructure. New or ongoing actions to integrate the regional Comprehensive Economic Development Strategies (CEDS) plan were discussed by Ozark Foothills RPC the City Clerk.

<p>City of Ellsinore</p>	<p>Local Emergency Plan Economic Development Plan Transportation Plan</p>	<p>Public works director responsible for road maintenance attended planning meetings and identified actions related to transportation infrastructure. Actions to integrate the regional Comprehensive Economic Development Strategies (CEDS) plan were discussed by Ozark Foothills RPC the City Clerk.</p>	<p>Public works director responsible for road maintenance attended planning meetings and identified new or ongoing actions related to transportation infrastructure. New or ongoing actions to integrate the regional Comprehensive Economic Development Strategies (CEDS) plan were discussed by Ozark Foothills RPC the City Clerk.</p>
<p>City of Grandin</p>	<p>Economic Development Plan Transportation Plan</p>	<p>Mayor responsible for road maintenance attended planning meetings and identified actions related to transportation infrastructure. Actions to integrate the regional Comprehensive Economic Development Strategies (CEDS) plan were discussed by Ozark Foothills RPC the City Clerk.</p>	<p>Mayor responsible for road maintenance attended planning meetings and identified new or ongoing actions related to transportation infrastructure. New or ongoing actions to integrate the regional Comprehensive Economic Development Strategies (CEDS) plan were discussed by Ozark Foothills RPC the City Clerk.</p>
<p>Van Buren R-I</p>	<p>Emergency Operations Plan Annual Budget School Calendar Safety and Security Procedures</p>	<p>Superintendent responsible for emergency operations, annual budget, the district calendar, and safety and security procedures attended planning meetings and identified actions related to each plan.</p>	<p>Superintendent responsible for emergency operations, annual budget, the district calendar, and safety and security procedures attended planning meetings and identified new and ongoing actions related to each plan.</p>

East Carter County R-II	Emergency Operations Plan Annual Budget School Calendar Safety and Security Procedures	Superintendent responsible for emergency operations, annual budget, the district calendar, and safety and security procedures attended planning meetings and identified actions related to each plan.	Superintendent responsible for emergency operations, annual budget, the district calendar, and safety and security procedures attended planning meetings and identified new and ongoing actions related to each plan.
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5.3 Continued Public Involvement

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

The hazard mitigation plan update process provides an opportunity to publicize success stories resulting from the plan’s implementation and seek additional public comment. Information about the annual reviews will be posted in the local newspaper as well as on the Carter County website following each annual review of the mitigation plan. When the MPC reconvenes for the five-year update, it will coordinate with all stakeholders participating in the planning process. Included in this group will be those who joined the MPC after the initial effort, to update and revise the plan. Public notice will be posted and public participation will be actively solicited, at a minimum, through available website postings and press releases to local media outlets, primarily newspapers.

**CARTER COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN UPDATE
MEETING #3—SIGN-IN SHEET**

Project: Carter County, Missouri Multi-Jurisdictional Hazard Mitigation Plan Update **Meeting Date/Time:** 7/16/2018 11:00 AM
Facilitator: Samantha Rodgers Project Coordinator, Ozark Foothills Regional Planning Commission **Place/Room:** Carter County Commission Chambers

Name	Title	Department/Agency	Email	Phone #	Signature
Jeff Davis	Supt.	Van Buren R-I	jedavis@vanburen.mo.us	573-323-4281	
Richard Fuller	Superintendent	East Carter R-2	rsullivan@eastcarter.k12.mo.us	573-322-5625 ext 6	
Carol McNew	City Clerk	City of Gould	gouldrmo@carter.commissioner.com	573-593-4937	
Donald Black	Presiding Commissioner	Carter County	carter.commissioner@carter.com	573-996-6479	
Lynn Murdick	Western Comm.	Carter County	murdickinc@yahoo.com	573-300-0449	
Lepina Stephens	County Clerk	Carter County	carl@carter.com	323-4507	
Amy Steyer	Eastern Comm.	Carter Co		573-666-1666	

OZARK FOOTHILLS REGIONAL PLANNING COMMISSION

3019 FAIR ST.

POPLAR BLUFF, MO 63901

June 14, 2018

SIGN IN SHEET

<u>NAME/PRINT</u>	<u>AFFILIATION</u>
1. Jamie Lanford	OFRPC Recycle
2. Crystal Jones	OFRPC
3. Crystal Mohring	OFRPC
4. Mitchell Courney	
5. Russell Frenk	Some Agency
6. Sarah Frenk	Some Agency
7. Ed DeGaris	City of Poplar Bluff
8. Marshall Cook	Carter County
9. RONDA PEEK	Wayne Co - Secy
10. Cassanova Anastopoulos	OFRPC
11. RODGER LESIT	CITY OF ELLINGTON
12. Carolyn Meeks	OFRPC
13. Stephanie	White Hills Outreach
14. Niki Napp	OFRPC
15. Becky Libke	Carter Co.
16. Wayne EGG	CARTER
17. Wanda KIRKPATRICK	CITY OF TIEDMONT
18. Angela Smith	Williamsville/Wayne
19. Christy Mercer	Senator Claire McClaskill
20. Gwen Brady	Edifying

OZARK FOOTHILLS REGIONAL PLANNING COMMISSION

3019 FAIR ST.

POPLAR BLUFF, MO 63901

June 14, 2018

SIGN IN SHEET

	<u>NAME/PRINT</u>	<u>AFFILIATION</u>
1.	Bennie Cook	Rep Jason Smith office
2.	Arleen Murphy	OFRPC
3.	Jlene Ward	OFRPC
4.	Cornie Teslow	City of Doniphan
5.	PAUL JOHNSON	ELLINGTON
6.	Edward A. Combs	Butler County
7.	William A. Kenner, Jr.	Ripley County
8.	BRYAN PEEK	Wayne Co
9.	Margaret Carter	Butler Co 7th Bank
10.	Heona Ferguson	OFRPC
11.	Vince Lamp	Butler County
12.	Felicity Ray	OFRPC
13.	Camille Donnell	OFRPC
14.	Felicity Ray	
15.		
16.		
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19.		
20.		

OZARK FOOTHILLS REGIONAL PLANNING COMMISSION

SEPTEMBER 13, 2018

CLEARWATER LAKE, PAVILION #2

PIEDMONT, MO

SIGN IN SHEET

<u>NAME/PRINT</u>	<u>AFFILIATION</u>
1. <u>Russell French</u>	<u>SOM Insurance</u>
2. <u>Sarah French</u>	<u>GUEST</u>
3. <u>Reeby Julius</u>	<u>Mayor/Brandin</u>
4. <u>Billy Julius</u>	<u>Guest</u>
5. <u>Mike Brandon</u>	<u>MoDOT</u>
6. <u>PAUL Wood</u>	<u>MAYOR E. HINGTON</u>
7. <u>Kay Wood</u>	<u>Sheriff</u>
8. <u>Crystal Mehery</u>	<u>OFRPC</u>
9. <u>Eugene Schorer</u>	<u>OFRPC</u>
10. <u>David Foster</u>	<u>OFRPC Recycle Center</u>
11. <u>GREGORY KIRK</u>	<u>UARM</u>
12. <u>Timeth KIRK</u>	<u>UARM</u>
13. <u>Carolyn Meeks</u>	<u>ROPNA</u>
14. <u>Uice Hamm</u>	<u>Butler County</u>
15. <u>Cathy Lampe</u>	<u>Butler County</u>
16. <u>Camille Donnell</u>	
17. _____	_____
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19. _____	_____
20. _____	_____

OZARK FOOTHILLS REGIONAL PLANNING COMMISSION
SEPTEMBER 13, 2018
CLEARWATER LAKE, PAVILION #2
PIEDMONT, MO

SIGN IN SHEET

<u>NAME/PRINT</u>	<u>AFFILIATION</u>
1. Babe Mann	Piedmont mo
2. Ronde Polk	West-Wayne Co
3. Randy Finch	West-Wayne Co
4. Dean Finch	Wayne county Sheriff
5. Angus Smith	WC - Williamsville
6. Lynn Schultz	Williamsville
7. Caroline Fielding	Sen Roy Plant
8. Clifford Smith	Williamsville
9. Alexandra Anastopoulos	OFRPC
10. Jeane Ward	OFRPC
11. Mike (Ray)	OFRPC
12. Samie Lanston	OFRPC Recept
13. Bryan Polk	Wayne Co
14. Samantha Rodgers	OFRPC
15. Georgina Ward	City of Piedmont
16. Donal Blake	
17. J. J.	Reynolds
18. Karen White	MO Highlands
19. Gloria Demond	Reynolds Co
20. Anne Hellman	US Rep Jason Smith

OZARK FOOTHILLS REGIONAL PLANNING COMMISSION
 SEPTEMBER 13, 2018
 CLEARWATER LAKE, PAVILION #2
 PIEDMONT, MO

SIGN IN SHEET

<u>NAME/PRINT</u>	<u>AFFILIATION</u>
1. <u>Jeff Glenn</u>	<u>SARASOTA, FL</u>
2. <u>James Dwyer</u>	<u>Reynolds</u>
3. <u>Margaret Carter</u>	<u>Poplar Bluff, MO</u>
4. <u>Earl Johnson</u>	<u>Reynolds Co.</u>
5. <u>Wally Gibbs</u>	<u>Carter Co.</u>
6. <u>Becky Dobb</u>	<u>Carter Co.</u>
7. <u>Kevin Bynum</u>	<u>CITY of NEELYVILLE</u>
8. <u>Bill Kennard</u>	<u>Ripley County</u>
9. <u>Linda Kennel</u>	<u>Guest - Ripley County</u>
10. <u>Crystal Jones</u>	<u>OFRPC</u>
11. <u>Debra Woods</u>	<u>OFRPC</u>
12. <u>J.C. Ray</u>	<u>OFRPC</u>
13. <u>Dianna Ferguson</u>	<u>OFRPC</u>
14. <u>Gene Oakley</u>	<u>Carter Co.</u>
15. _____	_____
16. _____	_____
17. _____	_____
18. _____	_____
19. _____	_____
20. _____	_____

March 8, 2018

OZARK FOOTHILLS REGIONAL PLANNING COMMISSION
Carter County Nutrition Center
#16 Ball Park Road in Van Buren, MO 63965

SIGN IN SHEET

<u>NAME/PRINT</u>	<u>AFFILIATION</u>
1. Matt Winkler	OFRPC
2. [Signature]	
3. James Laugel	OFRPC
4. Doreal Wood	Reynolds Ct.
5. Paul Johnson	Reynolds County
6. Wayne Carbo	Carter
7. David Frencht	Reynolds County
8. Sarah Frencht	Reynolds County
9. Brian Pelt	Wayne Co
10. Sarah French	Kipley County
11. Tami Hale	Ozark Vitality
12. Brockie Maples	Ozark Vitality
13. Curt Majors	Carter County
14. Niki Harp	OFRPC
15. Samantha Rodgers	OFRPC
16. Belona Ferguson	OFRPC
17. Carolyn Mills	OFRPC
18. Elene Ward	OFRPC
19. Felicity Ray	OFRPC
20. Gene Oakley	Carter Co.

OZARK FOOTHILLS REGIONAL PLANNING COMMISSION
Carter County Nutrition Center
#16 Ball Park Road in Van Buren, MO 63965

SIGN IN SHEET

	<u>NAME/PRINT</u>	<u>AFFILIATION</u>
1.	Vince Lampe	Butler County
2.	Greg Kirk	Carter County
3.	Pamela Kirk	Carter County
4.	Tommy Thomas	City of Piedmont
5.	Lyn Schultz	City of Williamsville
6.	Angela Smith	Williamsville / Wayne
7.	Rodda Paul	West-Murray Co
8.	Dorise Vaughn	West-Ozark Vitality
9.	Billy Dompster	AA R P
10.	Elle Jean Keeney	Van Buren YCC
11.	Jan Anderson employee	Recycle
12.	MARY ANDERSON	Recycle
13.	Matt Michel	Ripley Court Prosecutor's Office
14.	Mike Watkins	OFRPC
15.	Andrew M. [unclear]	OTAPC
16.	Brian [unclear]	First First Assembly
17.	Crystal [unclear]	
18.	Heidi Truncore	First A/G
19.	Abigail Truncore	First A/G
20.	Donald Black	Carter Co.

OZARK FOOTHILLS REGIONAL PLANNING COMMISSION
Carter County Nutrition Center
#16 Ball Park Road in Van Buren, MO 63965

SIGN IN SHEET

<u>NAME/PRINT</u>	<u>AFFILIATION</u>
1. Cindy Jenks	
2. Gerra Flatt	
3. Teagan Vaughn	
4. Bechy Gibbs	
5. Mini Grossham	
6.	
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Resolution 2019-103 Carter County, Missouri

A RESOLUTION OF CARTER COUNTY ADOPTING THE 2019 HAZARD MITIGATION PLAN

WHEREAS Carter County recognizes the threat that natural hazards pose to people and property within the Carter County; and

WHEREAS Carter County has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the 2019 Hazard Mitigation Plan, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the *Plan* identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Carter County from the impacts of future hazards and disasters; and

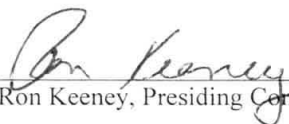
WHEREAS Carter County recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, Carter County will endeavor to integrate the *Plan* into the comprehensive planning process; and

WHEREAS adoption by Carter County demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

NOW THEREFORE, BE IT RESOLVED BY CARTER COUNTY, in the State of Missouri, THAT:

In accordance with the Carter County rule for adopting local resolutions, Carter County adopts the final FEMA-approved *Plan*.

ADOPTED by a vote of 3 in favor and 0 against, and 0 abstaining, this 31st day of October 2019.

By: 
Ron Keeney, Presiding Commissioner

ATTEST:
By: 
Leona Stephens, County Clerk

City of Van Buren- Van Buren, Missouri RESOLUTION NO: 2019-4

A RESOLUTION OF THE CITY OF VAN BUREN ADOPTING THE CARTER COUNTY HAZARD MITIGATION PLAN

WHEREAS the City of Van Buren recognizes the threat that natural hazards pose to people and property within the City of Van Buren; and

WHEREAS the City of Van Buren has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Carter County Hazard Mitigation Plan, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Van Buren from the impacts of future hazards and disasters; and

WHEREAS the City of Van Buren recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the City of Van Buren will endeavor to endeavor to integrate the Plan into the comprehensive planning process; and

WHEREAS adoption by the City of Van Buren demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED BY THE CITY OF VAN BUREN, in the State of Missouri, THAT:

In accordance with the RESOLUTION BEING READ IN FULL, the City of Van Buren adopts the final FEMA-approved Plan.

READ IN FULL BY THE BOARD OF ALDERMAN ON _____ November 04, 2019

Adopted by a vote of 4 in favor and 0 against, and 0 abstaining, this 4th day of November 2019.

BY:

Mayor-Mike Hoerner



Signature

ATTEST:

Tammy Battles-Orchard, City Clerk



APPROVED AS TO FORM:

John Bailiff-Alderman



Signature

City of Grandin, Missouri Resolution No. 11-15-2019

A Resolution of the City of Grandin Adopting the Carter County Hazard Mitigation Plan

Whereas the City of Grandin has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Carter County Hazard Mitigation Plan, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

Whereas the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Grandin from the impacts of future hazards and disasters; and

Whereas the City of Grandin recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the City of Grandin will endeavor to integrate the Plan into the comprehensive planning process; and

Whereas adoption by the City of Grandin demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan.

Now Therefore, Be it Resolved By the City of Grandin, in the State of Missouri, That:

In accordance with City of Grandin Board of Alderman, the City of Grandin adopts the final FEMA-approved Plan.

Adopted by a vote of in favor 3 and 0 against, and 0 abstaining, this day of ~~15th~~ November 15, 2019.

By (Sig): *Rich Julius*
Printed Name: Rich Julius
Mayor

Jim Tucker
Jim Tucker
Alderman

Attest:
By (Sig): *Carol McNew*
Printed Name: Carol McNew
City Clerk

Laura Beth Smith
Laura Beth Smith
Alderman

Approved As to Form:
by (Sig): *Brian Jessop*
Printed Name: Brian Jessop
Alderman

CARTER COUNTY HAZARD MITIGATION RESOLUTION

EAST CARTER COUNTY R-2 SCHOOL, Missouri RESOLUTION NO. 11/21/19

A RESOLUTION OF THE EAST CARTER COUNTY R-2 SCHOOL, ADOPTING THE CARTER COUNTY HAZARD MITIGATION RESOLUTION

WHEREAS the East Carter County R-II Schools recognizes the threat that natural hazards pose to people and property within the EAST CARTER COUNTY R-II SCHOOL; and

WHEREAS the EAST CARTER COUNTY R-2 SCHOOL has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the CARTER COUNTY HAZARD MITIGATION RESOLUTION, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the *Plan* identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the *East Carter County R-II School* from the impacts of future hazards and disasters; and

WHEREAS the East Carter County R-II School recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the East Carter County R-II School will endeavor to integrate the *Plan* into the comprehensive planning process; and

WHEREAS adoption by the East Carter County R-II School demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

NOW THEREFORE, BE IT RESOLVED BY THE EAST CARTER COUNTY R-2 SCHOOL, in the State of Missouri, THAT:

In accordance with MISSOURI SCHOOL BOARD ASSOCIATION (MSBA), the EAST CARTER COUNTY R-2 SCHOOL adopts the final FEMA-approved *Plan*.

ADOPTED by a vote of 7 in favor and 0 against, and 0 abstaining, this 21st day of November, 2019

By (Sig.): *John Gore* *JAMES GORE*
Print name:

ATTEST:
By (Sig.): *Kathey Dalton* *Kathey Dalton*
Print name:

APPROVED AS TO FORM:
By (Sig.): _____
Print name: _____

Carter County Hazard Emergency Mitigation Plan

Van Buren R-1, Missouri RESOLUTION NO.

A RESOLUTION OF THE VAN BUREN R-1 SCHOOL DISTRICT ADOPTING THE CARTER COUNTY EMERGENCY HAZARD MITIGATION PLAN

WHEREAS the Van Buren R-1 recognizes the threat that natural hazards pose to people and property within the Van Buren R-1 School District; and

WHEREAS the Van Buren R-1 School District has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Carter County Hazard Emergency Mitigation Plan, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the *Plan* identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Van Buren R-1 School District from the impacts of future hazards and disasters; and

WHEREAS the Van Buren R-1 School District recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Van Buren R-1 School District will endeavor to integrate the *Plan* into the comprehensive planning process; and

WHEREAS adoption by the Van Buren R-1 School District demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

NOW THEREFORE, BE IT RESOLVED BY THE VAN BUREN R-1 SCHOOL DISTRICT, in the State of Missouri, THAT:

In accordance with The Van Buren R-1 Board of Education, the Van Buren R-1 School District adopts the final *FEMA-approved Plan*.

ADOPTED by a vote of 1 in favor and 0 against, and 0 abstaining, this day of Nov, 26, 2009

By *Cammie Heumann*
(Sig.): Cammie Heumann
Print name:

ATTEST:
By (Sig.): *[Signature]*
Print name:

APPROVED AS TO FORM:
By (Sig.): *[Signature]*
Print name:

Model Resolution

City of Ellsinore, Missouri RESOLUTION NO. 2019-1

A RESOLUTION OF THE CITY OF ELLSINORE ADOPTING THE CARTER COUNTY HAZARD MITIGATION PLAN

WHEREAS the City of Ellsinore recognizes the threat that natural hazards pose to people and property within the City of Ellsinore; and

WHEREAS the City of Ellsinore has participated in the preparation of a multi- jurisdictional local hazard mitigation plan, hereby known as the Carter County Hazard Mitigation Plan, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the *Plan* identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Ellsinore from the impacts of future hazards and disasters; and

WHEREAS the City of Ellsinore recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the City of Ellsinore will endeavor to integrate the *Plan* into the comprehensive planning process; and

WHEREAS adoption by the City of Ellsinore demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

NOW THEREFORE, BE IT RESOLVED BY THE City of Ellsinore, in the State of Missouri, THAT:

In accordance with the City of Ellsinore Board of Aldermen, the City of Ellsinore adopts the final *FEMA-approved Plan*.

ADOPTED by a vote of 4 in favor and 0 against, and 0 abstaining, this 5th day of December, 2019.

By *Luthe W. Ogden*
(Sig): _____
Print name: Luthe W. Ogden

ATTEST:
By (Sig.): _____
Print name: _____

APPROVED AS TO FORM:
By (Sig.): _____
Print name: _____

