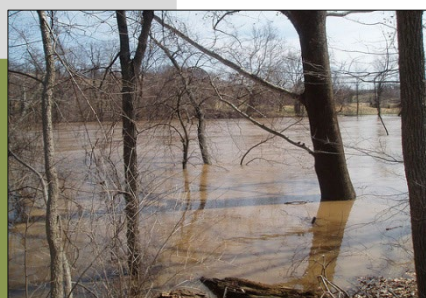




Osage County Multi-Jurisdiction Natural Hazard Mitigation Plan



Meramec Regional Planning Commission • December 2022



CONTRIBUTORS

Osage County Hazard Mitigation Planning Committee

The individuals who participated in the Osage County hazard mitigation planning committee are as follows:

Jurisdictional Representatives

Name	Title	Department	Jurisdiction/Agency/Organization
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Larry Kliethermes	Associate Commissioner	County Commission	Osage County
John Trenshaw	Associate Commissioner	County Commission	Osage County
Ron Hoffman	Emergency Management Director	Office of Emergency Mgt.	Osage County
Mike Bonham	Sheriff	Osage County Sheriff's Department	Osage County
Andrea Rice	Floodplain Manager	Osage County Sheriff's Department	Osage County
Travis Shaffer	Deputy	Osage County Sheriff's Department	Osage County
Janice Frann	Osage County Clerk	County Clerk's Office	Osage County
Ron Kempker	Foreman	Road and Bridge	Osage County
Lori Clenney	Administrator	Road and Bridge	Osage County
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Lukefahr Probst	Officer	Linn Police Department	City of Linn
Larry Fredrich	Director	Public Works	City of Linn
Lyle Best	Superintendent	Administration	Osage County R-I
Dena Smith	Superintendent	Administration	Osage County R-II
Melissa Wright	Principal	Administration	Maries County R-II

*Sign in sheets from planning meetings are included in Appendix B.

The individuals who represented stakeholders on the Osage County hazard mitigation planning committee are as follows:

Participating Stakeholder Representatives

Name	Title	Agency/Organization
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Name	Title	Agency/Organization
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EXECUTIVE SUMMARY

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. Osage County and participating cities and school districts developed this multi-jurisdictional local hazard mitigation plan update to reduce future losses to the county and its communities and schools resulting from hazard events. The plan is an update of a plan that was approved on June 8, 2018. The original plan was approved in April of 2005. The plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 and to achieve eligibility for the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance Grant Programs.

The county Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that covers the following 12 jurisdictions that participated in the planning process:

- Osage County
- City of Argyle
- City of Chamois
- City of Freeburg
- City of Linn
- City of Meta
- City of Westphalia
- Osage County R-I School District
- Osage County R-II School District
- Osage County R-III School District

Osage County and the jurisdictions listed above have developed a multi-jurisdictional Hazard Mitigation Plan that was originally approved by FEMA in 2005 with an update approved by FEMA on June 8, 2018. This current planning effort serves as an update (hereafter referred to as the 2022 Hazard Mitigation Plan.)

The plan update process followed a methodology prescribed by FEMA, which began with the formation of a Mitigation Planning Committee (MPC) comprised of representative from Osage County and participating jurisdictions. The MPC updated the risk assessment that identified and profiled hazards that pose a risk to Osage County and analyzed the vulnerability to these hazards. The MPC also examined the capabilities in place to mitigate them. The MPC determined that the planning area is vulnerable to several hazards that are identified, profiled and analyzed in this plan. Riverine and flash flooding, winter storms, severe thunderstorms/hail/lightening/high winds and tornadoes are among the hazards that historically have had a significant impact.

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

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Goal 2: Reduce the potential impact of natural disasters to [property, infrastructure, and the local economy.

Goal 3: Reduce the potential impact of natural disasters on the continuity of government and essential services.

To meet the identified goals, the MPC developed recommended mitigation actions, which are detailed in Chapter 4 of this plan. The MPC developed an implementation plan for each action, which identifies priority level, responsible agency, timeline, cost estimate, potential funding sources and progress to date.

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 by and adopted with resolutions or other documentation of adoption by all participating jurisdictions and school districts. The documentation of adoptions is included in Appendix D.

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

- Osage County
- City of Argyle
- City of Chamois
- City of Freeburg
- City of Linn
- City of Meta
- City of Westphalia
- Osage County R-I School District
- Osage County R-II School District
- Osage County R-III School District

Model Resolution

RESOLUTION NO. _____

A RESOLUTION TO ADOPT THE OSAGE COUNTY MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN

WHEREAS, (Government/District) recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Multi-Jurisdiction Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre-and post-disaster mitigation grant programs; and

WHEREAS, (Government/District) fully participated in the FEMA prescribed mitigation planning process to prepare this Mitigation Plan; and

WHEREAS, the Missouri State Emergency Management Agency and Federal Emergency Management Agency officials have reviewed the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan and approved it contingent upon this official adoption of the participating governing body; and

WHEREAS, (Government/District) desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Osage County Multi-Jurisdiction Natural Hazards Mitigation Plan; and

WHEREAS, adoption by the governing body of (Government/District) demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

NOW, THEREFORE BE IT RESOLVED, that (Government/District) adopts the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.

Certifying Official

Date

Witness

Date

1 Introduction and Planning Process

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1.1 Purpose

Osage County and nine other jurisdictions prepared this local hazard mitigation plan to guide hazard mitigation planning for the purpose of better protecting the people and property of the county from the effects of natural hazard events. Hazard mitigation is defined by FEMA as “any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event.” Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set and appropriate strategies to lessen impacts are determined, prioritized and implemented.

The mission of the Osage County Hazard Mitigation Plan is to substantially and permanently reduce the county’s vulnerability to natural hazards. This plan demonstrates the communities’ commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources for the next five years. The plan is intended to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property and the natural environment. This can be achieved by increasing public awareness, documenting resources for risk reduction and loss prevention and identifying activities to guide the community towards the development of a safer, more sustainable community.

This plan was also developed to make Osage County and participating cities and school districts eligible for certain federal disaster assistance as required by the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). Those programs include the Federal Emergency Management Agency’s (FEMA) Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program and Flood Mitigation Assistance Program. The plan has been prepared in accordance with the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and developed and organized within the rules and regulations established under 44 CFR 201.6 published in the *Federal Register* on February 26, 2002 and finalized in October 31, 2007. Guidance for the development of this plan includes FEMA’s Local Mitigation Planning

Handbook, March 2013 and FEMA's Local Mitigation Plan review Guide, October 1, 2011. Those jurisdictions within Osage County that do not adopt the 2021 plan will not be eligible for funding through these grant programs.

Neither Osage County, nor any cities in Osage County participate in the NFIP Community Rating System (CRS).

1.2 Background and Scope

The 2022 Osage County Hazard Mitigation Plan is an update of the original plan developed and approved in April 2005. The first update of the 2005 plan was approved by FEMA on March 22, 2013. The second update of the plan was approved on June 8, 2018. The revised document will be valid for five years from approval by FEMA. It is a multi-jurisdictional plan that covers the participating jurisdictions within the county's borders, all of whom adopted both the 2013 and 2018 plan:

- Osage County
- City of Argyle
- City of Chamois
- City of Freeburg
- City of Linn
- City of Meta
- City of Westphalia
- Osage County R-I School District
- Osage County R-II School District
- Osage County R-III School District

The information and guidance in this plan document will be used to help guide and coordinate mitigation activities and decisions for local jurisdictions and organizations. Proactive mitigation planning will help reduce the cost of disaster response and recover to local communities and residents by protecting critical infrastructure, reducing liability exposure and minimizing overall community impacts and disruptions. Osage County has been affected by natural disasters in the past and participating jurisdictions and organizations are committed to reducing the impacts of future incidents and becoming eligible for hazard mitigation-related funding opportunities.

1.3 Plan Organization

The plan contains a mitigation action listing, a discussion of the purpose and methodology used to develop the plan, a profile on Osage County, as well as the hazard identification and vulnerability assessment of natural hazards. In addition, the plan offers a discussion of the community's current capability to implement the goals, objectives and strategies identified through the planning process.

The plan is organized as follows:

- Executive Summary

- 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

Changes made to the 2021 plan are detailed in Table 1.1.

Table 1.1. Changes Made in Plan Update

Plan Section	Summary of Updates
Chapter 1 – Introduction and Planning Process	Updated members of the Mitigation Planning Committee (MPC) and participating jurisdictions formally adopted the MPC.
Chapter 2 – Planning Area Profile and Capabilities	Noted new GIS capabilities for participating jurisdictions, updated demographics and information provided in jurisdictional questionnaires, updated jurisdictional capabilities.
Chapter 3 – Risk Assessment	Combined extreme heat and extreme cold into one hazard: extreme temperatures. Updated data on hazards, updated demographic data.
Chapter 4 – Mitigation Strategy	The mitigation category of each action was added to the action worksheets. The goals and action items were reviewed and updated, and progress made updated in the action worksheets.
Chapter 5 – Plan Implementation and Maintenance	Updated MPC meetings for evaluating and updating the plan quarterly.

To assist in the explanation of the above identified contents, there are several appendices included which provide more detail on specific subjects. This plan is intended to improve the ability of Osage County and the jurisdictions within to handle disasters and will document valuable local knowledge on the most efficient and effective ways to reduce loss.

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.

The Osage County Hazard Mitigation Planning Committee first organized in 2020 when the Missouri State Emergency Management Agency (SEMA) provided grant funds and contracted with the Meramec Regional Planning Commission (MRPC) to develop a hazard mitigation plan for the county. MRPC is a council of local governments in south central Missouri serving Crawford, Dent, Gasconade, Maries, Osage, Osage, Pulaski and Osage counties.

MRPC's role in developing and updating the Osage County Hazard Mitigation plan included assisting in the formation of the mitigation planning committee (MPC) and facilitating the planning meetings; soliciting public input; and producing the draft and final plan for review by the MPC, SEMA and FEMA. Staff carried out the research and documentation necessary for the

planning process. In addition, MRPC compiled and presented the data for the plan, helped the MPC with the prioritization process and insured that the final document met the DMA requirements established by federal regulations and the most current planning guidance.

In 2020, SEMA secured a grant to develop the Osage County Multi-Hazard Mitigation Plan and contracted with MRPC to facilitate the planning process for the plan development. MRPC staff has followed the most current planning guidance provided by FEMA for the purpose of insuring that the plan meets all of the requirements of the Disaster Mitigation Act as established by federal regulations.

The Osage County Multi-Hazard Mitigation Plan was developed as the result of a collaborative effort among Osage County, the City of Argyle, City of Chamois, Village of Freeburg, City of Linn, City of Meta, City of Westphalia, Osage County R-I School District, Osage County R-II School District, Osage County R-III School District, , public agencies, non-profit organizations, the private sector as well as regional, state and federal agencies. MRPC contacted and asked for volunteers to serve on the planning committee from the county and local city governments, school districts, the county health department, local businesses and utility companies. The mailing list is included in **Appendix B: Planning Process**. This cross-section of local representatives was chosen for their experience and expertise in emergency planning and community planning in Osage County. Staff worked with the Osage County MPC to collect and analyze information on hazards and disasters that have impacted the county as well as document mitigation activities that have occurred during the past five years.

Due to time and duty constraints, not all the jurisdictions that were invited to participate in the MPC were able to attend meetings. However, all of the jurisdictions provided information to develop the document, submitted questionnaires, reviewed the plan and provided input. Interviews were conducted with stakeholders from the community and several planning meetings were conducted during the plan development.

The 2022 planning process began with a meeting held at the Osage County Administration Building on November 16, 2021. MRPC staff provided an overview of the hazard mitigation planning process and review of the existing hazard mitigation plan. The group reviewed and discussed hazard mitigation goals and what progress had been made on hazard mitigation action items over the past four years. The second meeting was held on February 8, 2022. The MPC reviewed the revised list of goals and action items, then applied the STAPLEE method (Social, Technical, Administrative, Political, Legal, Economic; Environmental) and a cost benefit analysis to best determine priorities. A full description of the prioritization process is included in Chapter 4. The group agreed to review plan chapters as they were completed through email or postings on the MRPC website. The third meeting of the MPC was held on September 22, 2022. The MPC reviewed participation requirements and status of participation of jurisdictions; reviewed and discussed draft chapters; reviewed plan maintenance and the adoption process.

The final list of prioritized action items was emailed out to all jurisdictions and entities that had been invited to participate on the MPC. Recipients were asked to review and provide feedback if they had concerns about how any of the projects were ranked. The draft plan was made available on-line and MPC members were notified on where to find the document and asked to review and provide feedback.

All planning committee members were provided drafts of sections of the plan as they became available. Members of the planning committee reviewed the draft chapters and provided valuable input to MRPC staff. Additionally, through public committee meetings, press releases

and draft plan posting on MRPC's website, ample opportunity was provided for public participation. An internet survey was provided for the public to provide input into the process. The results of that survey are included in the appendices. Jurisdictions in surrounding counties were also notified of where to view the revised plan and encouraged to provide input. Any comments, questions and discussions resulting from these activities were given strong consideration in the development of this plan.

Osage County further assisted in the planning process by issuing public notice of the planning meetings as well as scheduling meeting times at the County Administration Building in Linn. County officials attended and participated in meetings.

The MPC contributed to the planning process by:

- Attending and participating in meetings;
- Collecting data for the plan;
- Making decisions on plan content;
- Reviewing drafts of the plan document;
- Developing a list of needs;
- Prioritizing needs and potential mitigation projects; and
- Assisting with public participation and plan adoption

The MPC did not formally meet on a regular basis as recommended in the plan. However, mitigation has become a regular topic of discussion among the majority of jurisdictions included in the plan. A number of hazard mitigation projects have been completed in the county and hazard mitigation concepts are being incorporated into other planning projects

Table 1.2 provides information on who actively participated in the planning process and who they represented:

Kym Brunnert, Meghan Birmingham, Danny Kirsch, Elise Brochue, Nicki Bax, Emily Sommer, Deidra Buechter, and Tammy Massman all participated indirectly by providing information, completing the jurisdictional questionnaire, participating in phone calls and email discussions and assisting with adoption of the plan.

Table 1.2 Jurisdictional Representatives Osage County Mitigation Planning Committee

Name	Title	Department	Jurisdiction/Agency/ Organization	Direct Participation	Indirect Participation
Darryl Griffin	Presiding Commissioner	County Commission	Osage County	X	
Larry Kliethermes	Associate Commissioner	County Commission	Osage County	X	
John Trenshaw	Associate Commissioner	County Commission	Osage County	X	
Ron Hoffman	Emergency Management Director	Office of Emergency Mgt.	Osage County	X	
Mike Bonham	Sheriff	Osage County Sheriff's Department	Osage County	X	
Andrea Rice	Floodplain Manager	Osage County Sheriff's Department	Osage County	X	

Name	Title	Department	Jurisdiction/Agency/ Organization	Direct Participation	Indirect Participation
Travis Shaffer	Deputy	Osage County Sheriff's Department	Osage County	X	
Janice Frank	Interim Clerk to Commission	County Clerk's Office	Osage County	X	
Brooke Dudenhoeffer	Commission Clerk	County Clerk's Office	Osage County	X	
Ron Kempker	Foreman	Road and Bridge	Osage County	X	
Kim Sallin	Director	Osage County Health Department	Osage County	X	
Kym Brunnert	City Clerk	Administration	City of Argyle		X
Meghan Birmingham	City Clerk	Administration	City of Chamois		X
Danny Kirsch	Supervisor	City Water and Sewer	City of Chamois		X
Elise Brochue	Mayor	Administration	City of Chamois		X
Nicki Bax	City Clerk	Administration	City of Freeburg		X
Michael Bickell	Police Chief	Linn Police Department	City of Linn	X	
Lukefahr Probst	Officer	Linn Police Department	City of Linn	X	
Larry Fredrich	Director	Public Works	City of Linn	X	
Carrie Grellner	City Clerk	Administration	City of Linn	X	
Emily Sommer	Mayor	Administration	City of Meta		X
Deidra Buechter	City Clerk	Administration	City of Meta		X
Tammy Massman	Mayor	Administration	City of Westphalia		X
Lyle Best	Superintendent	Administration	Osage County R-I	X	
Dena Smith	Superintendent	Administration	Osage County R-II	X	
Melissa Wright	Principal	Administration	Osage County R-II	X	

The expertise of MPC members in the six mitigation categories (Preventive Measures, Property Protection, Natural Resource Protection, Emergency Services, Structural Flood Control Projects and Public Information) is outlined in Table 1.3 MPC Capability with Six Mitigation Categories.

Table 1.3 MPC Capability with Six Mitigation Categories

Community Department/Office	Preventive Measures	Structure and Infrastructure Projects		Natural Resource Protection	Public Information	Emergency Services
		Property Protection	Structural Flood Control Projects			
County Commission	✓	✓	✓	✓	✓	
County Clerk's Office	✓	✓	✓	✓	✓	
County Office of Emergency Management	✓				✓	✓
Sheriff's Department	✓	✓			✓	✓
County Road and Bridge	✓	✓	✓	✓		
County Health Department				✓	✓	
City of Argyle Administration	✓	✓	✓	✓	✓	
City of Chamois Administration	✓	✓	✓	✓	✓	
City of Chamois Water and Sewer	✓	✓	✓	✓		
City of Freeburg Administration	✓	✓	✓	✓	✓	
City of Linn Administration	✓	✓	✓	✓	✓	
City of Linn Police Department	✓	✓			✓	✓
City of Linn Public Works	✓	✓	✓	✓	✓	
City of Meta Administration	✓	✓	✓	✓	✓	
City of Westphalia Administration	✓	✓	✓	✓	✓	
Osage Co. R-I School Admin.	✓	✓	✓		✓	
Osage Co. R-II School Admin.	✓	✓	✓		✓	
Osage Co. R-III School Admin.	✓	✓	✓		✓	

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.

Osage County invited incorporated cities, school districts, utility companies, medical facilities, nursing facilities, county health department, and not-for-profits to participate in the hazard mitigation planning process. Press releases were sent to media. Letters and/or emails were sent to each of the following:

- Osage County
- City of Argyle
- City of Chamois
- Village of Freeburg
- City of Linn
- City of Meta
- City of Westphalia
- Osage County R-I School District
- Osage County R-II School District
- Osage County R-III School District
- Osage Co. Health Dept.
- Charter Cable
- Media Comm. Corp.
- Socket Internet Services
- Ameren UE
- Three Rivers Electric Cooperative
- Crawford Electric Cooperative
- State Technical College of Missouri
- Community Health Center
- Capital Region Medical Clinic
- Linn Oak Rehabilitation Center
- Stonebridge Westphalia
- Harbor Place - Linn
- American Red Cross
- Missouri Department of Conservation
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- MO SEMA
- FEMA
- Unterrified Democrat
- USDA NRCS

A copy of the mailing list and invitation letters are included in Appendix B: Planning Process.

The Disaster Mitigation Act requires that each jurisdiction must participate in the planning process and formally adopt the plan. There were a number of criteria established for participation. In order to be considered participating in the planning process, jurisdictions needed to do at least one of the following as well as adopt the plan:

- Providing a representative to serve on the planning committee;
- Participating in at least one or more meetings of the planning committee;
- Providing data for plan development through surveys and/or interviews;
- Identify goals and mitigation actions for the plan;
- Prioritize mitigation actions/projects for the plan;
- Review and comment on the draft plan document;
- Informing the public, local officials and other interested parties about the planning process and providing opportunities for them to comment on the plan;
- Provide in-kind match documentation; and
- Formally adopt the plan prior to submittal of the final draft to SEMA and FEMA for final approval.

Not all jurisdictions were able to attend the MPC meetings. Most communities and school districts in Osage County are small and understaffed. It was not always feasible for representatives to travel to the meetings. However, all jurisdictions met at least one of the participation criteria. All jurisdictions were contacted by phone and asked to complete the data collection questionnaire. In some cases, staff assisted jurisdictions with completion of the questionnaire. All jurisdictions were also contacted via email and phone regarding completion of in-kind match forms and if there were any questions regarding the information on the data collection questionnaires. The jurisdictions that participated in the process, as well as their level of participation in the process are shown in Table 1.3. Documentation of meetings, including sign-in sheets are included in Appendix B: Planning Process.

Table 1.4 Jurisdictional Participation in the Planning Process

Jurisdiction	Meet- ing #1	Meet- ing #2	Meet- ing #3	Interviews	Data Collection Questionnaire/Call	Update/Develop/ Prioritize Mitigation Actions	Review/ Comment on Plan
Osage County	X	X	X	X	X	X	X
City of Argyle				X	X		X
City of Chamois				X	X		X
Village of Freeburg				X	X		X
City of Linn	X	X		X	X	X	X
City of Meta				X	X		X
City of Westphalia				X	X		X
Osage Co. R- I	X			X	X		X
Osage Co. R- II	X			X	X		X
Osage Co. R- III	X			X	X		X

1.4.2 The Planning Steps

Osage County and MRPC worked together to develop the plan and based the planning process in FEMA's *Local Mitigation Planning Handbook (March 2013)*, the *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 process has included organizing the county's resources, assessing the risks to the county, developing the mitigation plan and implementing the plan and monitoring the progress of plan implementation.

The planning committee based their activities on the 10-step planning process adapted from FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs. By following the 10-step planning process, the plan met funding eligibility requirements of the Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities Grant

Program, Pre-Disaster Mitigation Program, Community Rating System and Flood Mitigation Assistance Program.

Table 1.5 Osage County Planning 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)(2) & (3)
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)(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)

The planning area was determined by the boundaries of Osage County. MRPC staff provided general information on the hazard mitigation plan review process at regular MRPC board meetings – providing both written and oral reports on the review process, schedules for the various plans; which ones had been funded; described match requirements; and asked mayors and commissioners to think about who should be included on the planning committees for each respective county.

The planning team was selected by contacting the leadership of each jurisdiction, explaining the process, and asking them to send appropriate representation to the planning meetings. In addition, they were asked to provide input on who they wanted to include on the planning committee. Stakeholders such as electric cooperatives and sewer districts were also contacted and invited. In addition, it was suggested that representatives of some of the local critical facilities be included on the planning committee, such as medical clinics and nursing homes. All meetings were also publicized to allow additional interested parties to attend and participate. Osage County Commission offered to host the meetings at the county administration building and the first meeting was held there on November 16, 2021.

At the first meeting on November 16, 2021, MRPC staff made introductions and provided an overview of the Osage County Hazard Mitigation plan. The group reviewed and discussed the goals and objectives. A good deal of the meeting was spent sharing information on what progress had been made in five years and discussing current and future needs and adding new

mitigation actions to the existing list. Staff offered to help those jurisdictions present with completion of their data collection surveys. The group started working on reviewing and prioritizing the action items – using both the STAPLEE method and analyzing the cost benefit.

At the second meeting on June 25, 2020, the group reviewed, revised, and combine the existing plan goals to remove redundancy. The group then reviewed complete list of action items; determined which had been completed; which should be combined; which were no longer a high or medium priority; and determined if any needed to be added. The MPC then provided input on prioritizing each of the action items. Staff took those recommendations and developed a matrix of the action items with the STAPLEE and cost benefit scores. This matrix was emailed out to all of the individuals and organizations on the mailing list for the MPC with a request for feedback. All suggestions for changes were incorporated into the plan. MRPC staff shared the results of the public survey. The group also reviewed the list of critical facilities in the plan and provided feedback on any changes or additions to that list. It was decided that staff would share plan chapters with the MPC as they were completed.

At the third meeting on September 22, 2022, the group reviewed participation requirements and the status of all jurisdictions; reviewed and discuss those draft chapters that were completed; discussed plan maintenance and the adoption process.

Table 1.5 Schedule of MPC Meetings outlines the dates that meetings were held and topics covered. Documentation of the planning process can be found in Appendix B: Planning Process.

Table 1.6 Schedule of MPC Meetings

Meeting	Topics	Date
Planning Meeting #1	Overview of hazard mitigation planning purpose and Osage County plan; grant programs linked to approved plan; participation requirements and public involvement; data collection questionnaires; discussion of hazards; critical facilities	November 16, 2021
Planning Meeting #2	Overview of hazard mitigation planning and Osage Co. HMP; discussion of goals and action items for the next 5 years; prioritization of action items; road and bridge projects; integration of other data, reports, studies, and plans	February 8, 2022
Planning Meeting #3	Reviewed participation requirements and status of jurisdictions, review and discussion of draft chapters, plan maintenance and adoption process and next steps for the planning process and completion of the plan.	September 22, 2022

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.

The MPC followed the same process for public involvement and input as suggested by SEMA and FEMA and as was followed during earlier planning processes. The first MPC meeting was held at the Osage County Courthouse. Public notices were placed at the courthouse, and press releases were done prior to the meeting to make the public aware. Meetings were also posted on the MRPC webpage. The public was notified each time the plan or sections of the plan were presented for review and discussion. A public survey was conducted, and the results shared with the MPC. A sample of the survey and the results of the survey are included in Appendix C: Public Survey. MPC members and public officials within the county as well as in surrounding counties were contacted, directed to the MRPC website (www.meramecregion.org) where a copy of the draft plan could be viewed or downloaded. The document was made available on the website on October 6, 2022. Hard copies of the final draft were placed at the Osage County Courthouse. A hard copy of the draft could be obtained directly from MRPC by request. Members of the local media were invited to attend planning meetings. Information was shared by these media outlets with the public on the planning process and where to find draft copies of the plan. Copies of public notices and press release are included in Appendix B. Results of the public survey are included in Appendix C: Public Survey.

No comments were received from the public other than what was found in the public survey. Which are included in the Appendices.

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.

Every effort was made to encourage input from stakeholders whose goals and interests interface with hazard mitigation in Osage County including:

- Neighboring communities
- Local and regional agencies involved in hazard mitigation activities
- Agencies with the authority to regulate development
- Businesses
- Academia
- Other private and non-profit interests

Stakeholders involved in the hazard mitigation planning process included State technical College of Missouri, Missouri University Extension, General Baptist Nursing Home, and the Unterrified Democrat. No federal stakeholders were involved during the planning process. Lists of the people from the jurisdictions and stakeholders who were invited to participate in the planning process follows.

Jurisdictional Representatives Invited to Participate in the Planning Process

Name	Title	Department	Jurisdiction/Agency/Organization
Darryl Griffin	Presiding Commissioner	County	Osage County
John Trenshaw	Associate Commissioner	County	Osage County
Larry Kleithermes	Associate Commissioner	County	Osage County
Nicci Kammerich	Clerk	County	Osage County
Michael Bonham	Sherriff	Sherriff's Dept.	Osage County
Ron Hoffman	EMD	Emergency Management	Osage County
Ron Kempker	Foreman	Road and Bridge	Osage County
Kim Sallin	Administrator	Health	Osage County
Ryan Davis	Chairperson	Admin.	City of Argyle
Kym Brunnert	City Clerk	Admin.	City of Argyle
Derek Schwartz	Director	Emergency Management	City of Argyle
Ruben Wieberg	Chief	Fire	Argyle Vol. Fire Department
Elise Brochue	Mayor	Admin.	City of Chamois
Michelle Stanley	Clerk	Admin.	City of Chamois
Danny Kirsch	Director	Public Works	City of Chamois
Rodney Frey	Director	Emergency Management	City of Chamois
Riley Lewis	Marshal	Police	City of Chamois
Joe Rost	Chief	Fire	Chamois Vol. Fire Department
Darryl Haller	Chairperson	Admin.	City of Freeburg
Allen Gradel	City Clerk	Admin.	City of Freeburg
Darryl Haller	Chief	Fire	Freeburg Comm. Fire Association
Todd Feeler	Superintendent	Water and Sewer	City of Freeburg
Dwight Massey	Mayor	Admin.	City of Linn
Carrie Grellner	City Clerk	Admin.	City of Linn
Larry Fredrich	Superintendent	Water, Street & Utilities	City of Linn
Richard Bray	Chief	Police	City of Linn
Ron Hoffman	Chief	Fire	Linn Fire Protection District
Emily Sommerer	Mayor	Admin.	City of Meta
Diedra Buechter	Clerk	Admin.	City of Meta
Kenneth Helton	Chief	Fire	Meta Fire & Rescue
Tammy Massman	Mayor	Admin.	City of Westphalia
Kerry Bax	Clerk	Admin.	City of Westphalia
Jim Roark	Chief	Fire	Westphalia Fire Protection District

Name	Title	Department	Jurisdiction/Agency/Organization
Lyle Best	Superintendent	Admin	Osage Co. R-I School District
Dena Smith	Superintendent	Admin	Osage Co. R-II School District
Chuck Woody	Superintendent	Admin	Osage Co. R-III School District

Stakeholder Invited to Participate in the Planning Process

Name	Title	Agency/Organization
-	-	Ameren UE
-	-	Three Rivers Electric Cooperative
-	-	Socket Internet Services
-	-	Media Comm. Corp.
-	-	Charter Communications
-	-	Capital Region Medical Clinic
-	-	Community Health Center
-	-	Unterrified Democrat
Corey J. Schoeneberg	Captain	MO. Highway Patrol
-	-	MO Dept. of Transportation
-	-	Missouri Dept. of Conservation
Brenda Gerlach	Area Coordinator	MO SEMA
Shawn Strong	President	State Technical College of Missouri
Matt Shively	-	U.S. Army Corp. of Engineers
Ken Sessa	-	U.S. FEMA
Karen Herrington	Field Supervisor	U.S. Fish & Wildlife Services
-	-	U.S. Department of Agriculture, NRCS
Melissa Wilding	-	American Red Cross
Laci Tambke	Administrator	Linn Oak Rehabilitation Center
Julie Heckman	Administrator	Stonebridge Westphalia
Gina Huckstep	Administrator	Harbor Place - Linn

Jurisdictional representatives on the MPC were asked to share and solicit information from within and outside of their jurisdictions. A broad spectrum of entities other than the jurisdictions named in the plan, were invited to participate in the planning process.

The questionnaire provided to every jurisdiction asked how mitigation actions were being incorporated into other planning documents. The county road and bridge department does a good job of incorporating mitigation projects into their regular maintenance program. Those projects have been incorporated into the plan document. Hazard mitigation goals and action items have also been incorporated, where applicable, in the Community Economic Development Strategy (CEDS).

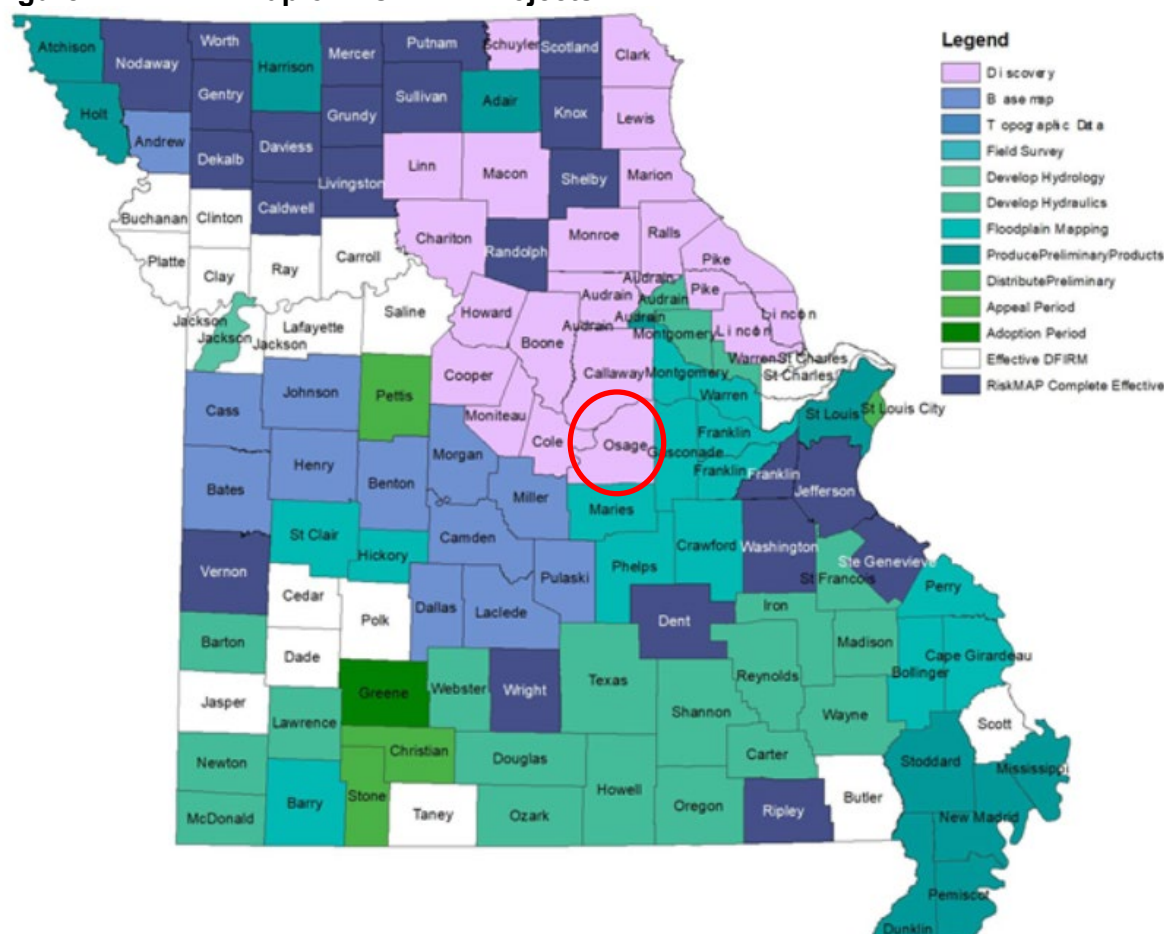
Coordination with FEMA Risk MAP Project

The Risk MAP project has begun in Osage County. The discovery process began in January 2020. Discovery is the process where it is determined what each county in the watershed needs to have the best flood risk data possible with the funds available. The county currently has DFIRM maps. Once completed, Risk MAP will provide mitigation planning support in a variety of ways including helping in the assessment of risks and identifying action items to reduce

vulnerability. In addition, this project will provide tools to improve the understanding of risk by local officials and the general public.

Figure 1.1 illustrates the current status of Missouri counties in regard to RiskMap projects

Figure 1.1. Map of RiskMAP Projects



Integration of Other Data, Reports, Studies and Plans

The MPC researched available plans, studies, reports and technical information during development of the Update. The intent was to identify existing data and information, shared objectives and past and ongoing activities that would add to the Update. The goal was to identify the existing capabilities and planning mechanisms to implement the mitigation strategy. Osage County is a rural area with the largest community's population at approximately 1,350. Not all of the participating communities have planning or zoning, subdivision regulations or other mechanisms for controlling the development of land. Some of the jurisdictions do have ordinances and planning documents. Following is a list of the documents that were reviewed:

- Local planning and zoning ordinances
- County EOP
- Crisis Plans (school districts)
- Comprehensive plans

- Economic development plans
- Capital improvement plans
- Regional Transportation Plan
- Floodplain management ordinances and flood Insurance Risk Maps (FIRMs)

In addition to information available from local jurisdictions, a number of data sources, reports, studies and plans were used in updating the plan. Every attempt was made to gather the best available data to develop the vulnerability assessment and identify assets in the county. The Missouri State Hazard Mitigation Plan (2018) was reviewed and referenced throughout the document. Other data sources included dam information from the Missouri Department of Natural Resources and National Inventory of Dams (NID); fire reports from state agencies; Wildland/Urban Interface and Intermix data from the SILVIS Lab – Department of Forest Ecology and Management – University of Wisconsin; the Community Economic Development Strategy (CEDS); capital improvement plans from the participating jurisdictions; historic weather data and damage estimates from the National Oceanic and Atmospheric Administration; the critical facilities inventory conducted by MRPC; and road and bridge department plans/budgets.

All documents were reviewed so that the MPC would have a broad foundation of data upon which to base the planning area's risk assessment. Information from these documents and data sources are incorporated into the plan as indicated throughout the document.

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

The MPC reviewed the hazards that affected Osage County at the first planning meeting on November 16, 2021 including discussions of any hazard events that occurred during the last twenty years and all of the hazards included in the Missouri Hazard Mitigation plan. A variety of sources were used to identify and profile hazards. These included U.S. Census data, GIS data, HAZUS, the Missouri Spatial Data Information Service (MSDIS), statewide datasets compiled by state and federal agencies, existing plans and reports, personal interviews with MPC members and the questionnaire completed by each jurisdiction. Every effort was made to use the most current and best data available. Additional information on the risk assessment and the conclusions drawn from the available data can be found in Chapter 3.

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

Assets for each jurisdiction were identified based on responses to the data collection questionnaire distributed to all jurisdictions, interviews with MPC members and the critical facilities inventory conducted by MRPC. Additional sources included U.S. Census, GIS data, MSDIS and HAZUS.

Losses were calculated using HAZUS and the Missouri State Hazard Mitigation plan data and the most recent U.S. census data available. Values reflected in the plan are on structures only and do not include land values.

Jurisdictions provided information on their regulatory, personnel, fiscal and technical abilities by completing the data collection questionnaire. The vulnerability assessment was completed using estimates from the 2018 State plan. For more information on planning area profiles and capabilities, please see Chapter 2.

Step 6: Set Goals (Handbook Task 6)

The goals from the initial hazard mitigation plan were reviewed at the first planning meeting on November 16, 2021. At the second planning meeting on February 8, 2022 the MPC discussed revision of the original goals to remove redundancy and improve coverage. The revised goals are as follows:

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Goal 2: Reduce the potential impact of natural disasters to [property, infrastructure, and the local economy.

Goal 3: Reduce the potential impact of natural disasters on the continuity of government and essential services.

Step 7: Review Possible Mitigation Actions and Activities

Mitigation strategy and specific action items were discussed at the first and second MPC meetings. At the first MPC meeting the group reviewed the list in the existing plan and decided which actions could be eliminated; what could be combined; what needed to remain on the list; and what needed to be added. It was emphasized that any mitigation actions in the plan that were not likely to be accomplished, due to cost factors or that did not address the risks identified in the risk assessment, should be removed from the list.

Discussions also included mitigation activities that had been completed or were in process that had not been in the original plan document. Each jurisdiction and stakeholder group was asked to provide information about mitigation activities that were needed as well as those that had been accomplished over the past five years. Meeting facilitators offered to share ideas for mitigation projects from the FEMA publication *Mitigation Ideas: As Resource for Reducing Risk to Natural Hazards (January 2013)* to help stimulate ideas and discussion.

Staff received proposed road and bridge mitigation projects that needed to be addressed from the County Associate Commissioners on February 08, 2022.

In order to prioritize action items, the MPC was asked to use the STAPLEE method as well as assign a cost benefit to each activity. This allowed the group to consider a broad range of issues in order to decide which actions should be considered high, moderate or low priority. The prioritization process used by the MPC is explained as follows:

STAPLEE stands for the following:

- **Social:** Will the action be acceptable to the community? Could it have an unfair effect on a particular segment of the population?
- **Technical:** is the action technically feasible? Are there secondary impacts? Does it offer a long-term solution?
- **Administrative:** Are there adequate staffing, funding and maintenance capabilities to implement the project?
- **Political:** Will there be adequate political and public support for the project?
- **Legal:** Does your jurisdiction have the legal authority to implement the action?

- **Economic:** is the action cost-beneficial? Is there funding available: Will the action contribute to the local economy?
- **Environmental:** Will there be negative environmental consequences from the action? Does it comply with environmental regulations? Is it consistent with community environmental goals?

Each question was scored based on a 0 to 3 point value system:

- 3 = Definitely YES
- 2 = Maybe YES
- 1 = Probably NO
- 0 = Definitely NO

For the Benefit/Cost Review portion of the prioritization process, these two aspects were scored as follows:

Benefit – two (2) points were added for each of the following avoided damages (8 points maximum = highest benefit)

- Injuries and/or casualties
- Property damages
- Loss-of-function/displacement impacts
- Emergency management costs/community costs

Cost – points were subtracted according to the following cost scale (-5 points maximum = highest cost)

- (-1) = Minimal – little cost to the jurisdiction involved
- (-3) = Moderate – definite cost involved but could likely be worked into operating budget
- (-5) = Significant – cost above and beyond most operating budgets; would require extra appropriations to finance or to meet matching funds for a grant

Note: For the Benefit/Cost Review, the benefit and cost of actions which used the word “encourage” were evaluated as if the action or strategy being encouraged was actually to be carried out.

Total Score – The scores for the STAPLEE Review and Benefit/Cost Review were added to determine a Total Score for each action.

Priority Scale – To achieve an understanding of how a Total Score might be translated into a Priority Rating, a sample matrix was filled out for the possible range of ratings an action might receive on both the STAPLEE and Benefit/Cost Review. The possible ratings tested ranged between:

- A hypothetical action with “Half probably NO and half maybe YES” answers on STAPLEE (i.e. poor STAPLEE score) and Low Benefit/High Cost: Total Score = 7
- A hypothetical action with “All definitely YES” on STAPLEE and High Benefit/Little Cost: Total Score = 28

An inspection of the possible scores within this range led to the development of the following Priority Scale based on the Total Score in the STAPLEE- Benefit/Cost Review process:

20 – 28 points = High Priority
14-19 points = Medium Priority
13 points and below = Low Priority

The benefit portion of the prioritization process helped the MPC focus on long-term mitigation solutions that demonstrated the future cost savings that could be realized by completing mitigation projects that safeguard lives and protect property.

Finally, action items were reviewed to determine if they met the SMART criteria as provided by SEMA and FEMA: **S**pecific, **M**easurable, **A**chievable, **R**elevant, **T**ime-bound.

Step 8: Draft an Action Plan

The MPC reviewed the final list of action items and completed the prioritization process at the February 8, 2022 meeting. The final list was then mailed out to all jurisdictions and members of the MPC for review and approval as everyone was not able to attend the meeting. Staff was directed by the MPC to take the finalized list after allowing time for comments and draft an action plan.

Step 9: Adopt the Plan (Handbook Task 8)

When the first draft of the plan was completed, staff posted the document on the MRPC website and provided a hard copy to the county courthouse. All MPC members, jurisdictions and surrounding jurisdictions were notified on where to find a copy of the plan to review. If requested, additional hard copies of the plan document were provided. After allowing time for comments, a letter was mailed out to all jurisdictions asking them to formally adopt the plan and providing a sample adoption resolution. A deadline was provided in order to ensure receipt of adoption resolutions prior to submitting a final draft to FEMA for approval.

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

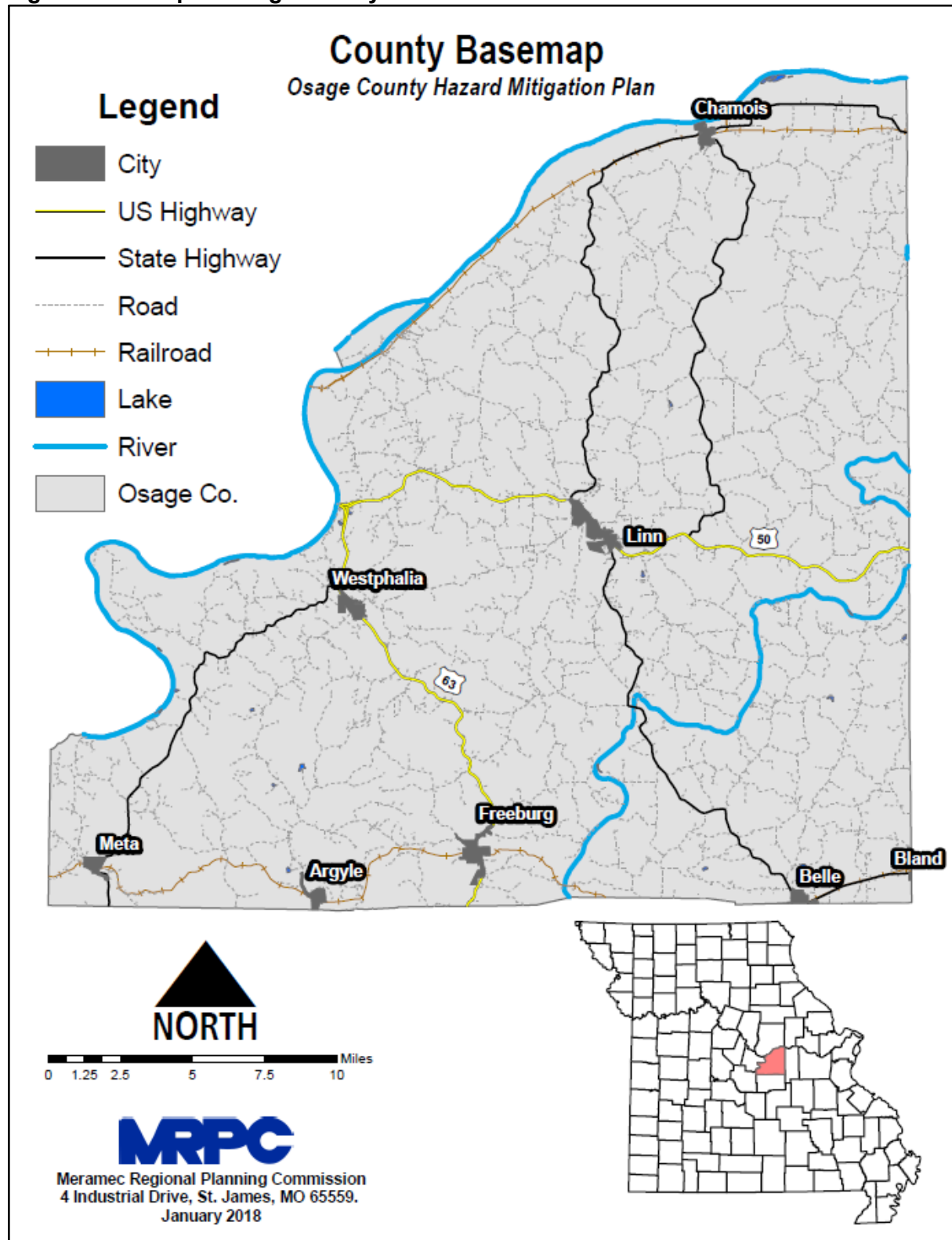
At all three planning meetings (November 16, 2021, February 8, 2022 and September 22, 2022) MRPC staff advised the MPC and participating jurisdictions of the importance of continuing to meet periodically to discuss implementation of the plan as well as monitoring and maintaining the plan into the future. Chapter 5 provides details on Osage County's strategy for implementation, evaluation and revising the plan.

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2.1 Osage County Planning Area Profile

Figure 2.1. Map of Osage County



Osage County has a population of approximately 13,274 according to the most recent census data¹. **Table 2.1** illustrates the percentage population growth since 2010 as compared to the statewide and national population growth. The median household income and percentage growth since 2010, as compared to statewide and national figures can be found in **Table 2.2**. Furthermore, median house value percentage growth for Osage County, Missouri, and the United States is provided in **Table 2.3**.

Table 2.1. Percent Population Growth for County, State, and Nation 2010 - 2020

Demographic Region	Total Population		Change Over Period	
	2010	2020	Change	Percent
Missouri	5,814,785	6,154,913	340,128	5.85
United States	300,758,215	331,449,281	30,691,066	10.2
Osage County	13,473	13,274	-199	-1.48

Source: U.S. Census Bureau, Census 2010 Summary File 1; U.S. Census Bureau, Census 2020 Redistricting Data

Table 2.2. Median Household Income and Percentage Growth for County, State, and Nation 2010 - 2020

Demographic Region	Median Household Income (USD)		Change Over Period	
	2010	2020	Change	Percent
United States	\$51,914	\$64,994	\$13,080	20.1
Missouri	\$46,262	\$57,290	\$20,972	19.2
Osage County	\$45,746	\$62,087	\$16,341	35.7

Source: U.S. Census Bureau, 2006-2010 and 2016-2020 5-Year American Community Survey

Table 2.3. Median House Value Percentage Growth for County, State, and Nation 2010 - 2020

Demographic Region	Median House Value (USD)		Change Over Period	
	2010	2020	Change	Percent
United States	\$188,400	\$229,800	\$41,400	18.02
Missouri	\$137,700	\$163,600	\$25,900	15.8
Osage County	\$120,400	\$159,000	\$20,300	32.1

Source: U.S. Census Bureau, 2006-2010 and 2016-2020 5-Year American Community Survey

2.1.2 Geography, Geology and Topography

Osage County has a total land area of 611 square miles with 6.1 square miles of water. Between 31 and 60 percent of the county is covered by forest land. Eight percent of the land cover within the county is cropland. The area has karst terrain, which is characterized by springs, caves, losing streams, and sinkholes. Incorporated jurisdictions within the county include the City of Argyle, City of Chamois, Village of Freeburg, City of Linn, City of Meta, and City of Westphalia.

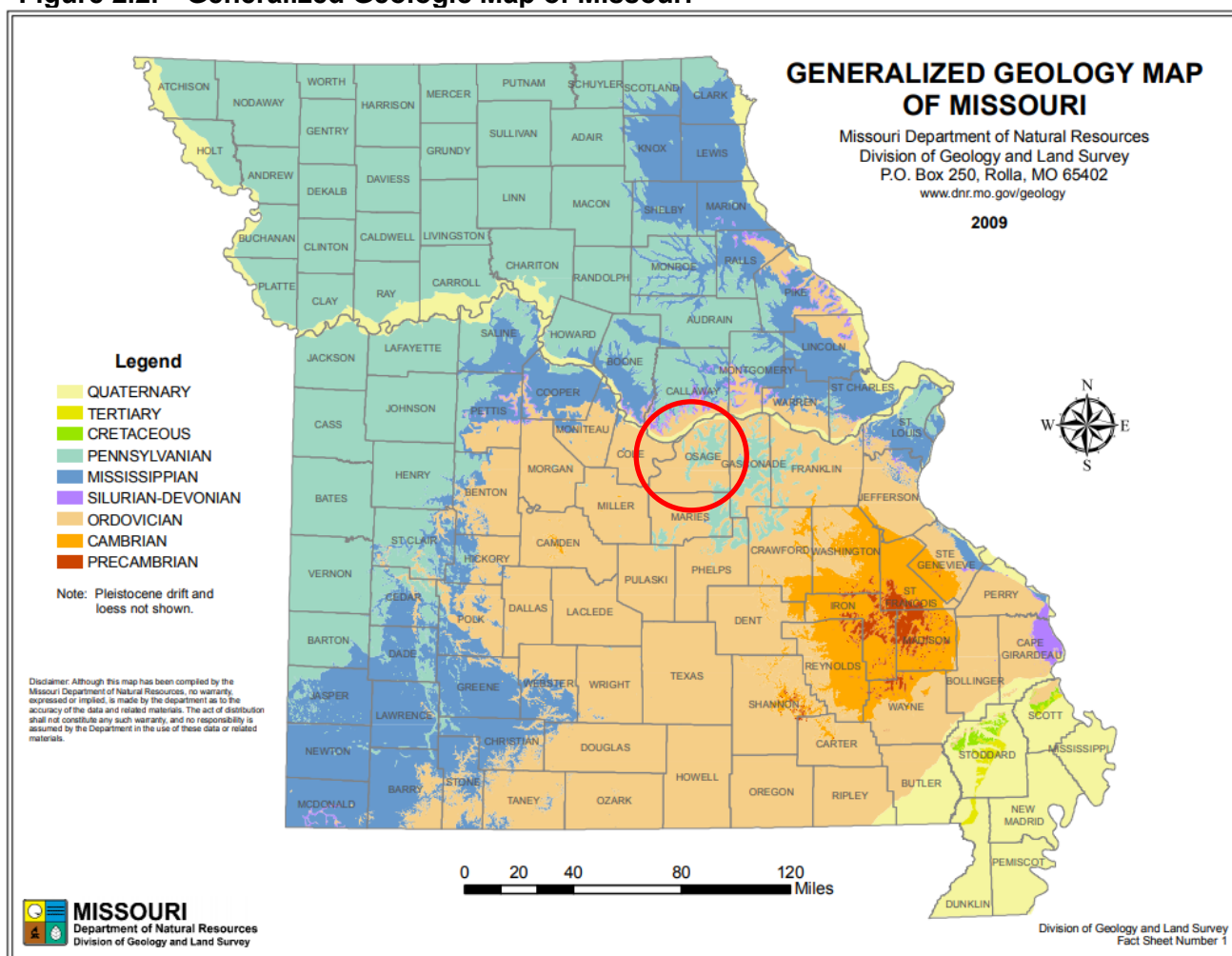
The county seat, Linn, is located in central portion of the county, approximately 21 miles

¹ U.S. Census Bureau, 2015-2019 American Community Survey 5-Year Estimates

southeast of the state capital of Jefferson City, approximately 45 miles north of Rolla, Mo. and approximately 105 miles east of St. Louis, Mo. The county is bordered on the north by Callaway County. On the east side the county is bordered Cole and Miller Counties. To the south the county is bordered by Maries County. Gasconade County shares a border with Osage to the west.

The county is located in the Ozark Plateau – the largest outcrop area of Ordovician-age rocks in the United States. This rock is 505 to 441 million years old and made up primarily of carbonates and thin shales with three distinctive sandstone layers; the Gunter at the base of the column, the red and white Roubidoux which is often used as a building stone, and the St. Peter glass sand. This stone is the result of a time period when Missouri was covered by a shallow sea and the stone frequently produces aquatic fossils from that time period. Portions of this formation contain rock that dissolves and fractures over time from rainwater, thus resulting in the karst features found throughout the Ozarks. **Figure 2.2** depicts a generalized geologic map of Missouri and its counties.

Figure 2.2. Generalized Geologic Map of Missouri



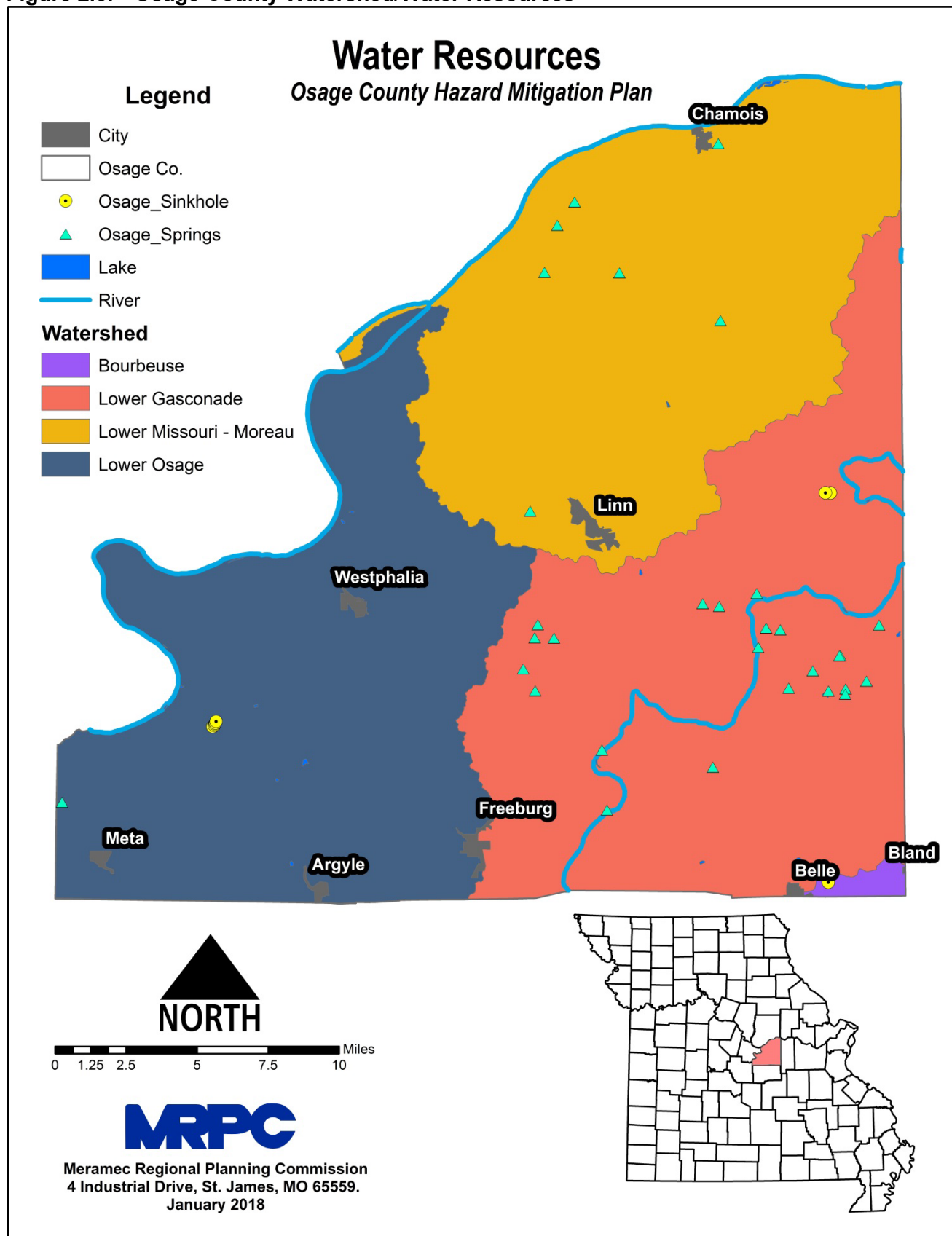
Source: <https://dnr.mo.gov/document-search/generalized-geologic-map-missouri-pub2514/pub2514> *Red circle indicates Osage County

The topography of Osage County is nearly uniform, consisting of narrow ridges and steep sided valleys. Elevations rise from an average of about 600 feet along the stream valleys to near 1,000 feet along the ridge crests. Generally, the land in the county slopes very gradually towards the Osage and Missouri Rivers.

According to the Soil Survey of Osage County, Missouri, published by the Natural Resources Conservation Service (NRCS), there are eight different soil types found in Osage County. However, 55 percent of the county is dominated by two of those soil types – the Wrengart-Gatewood Association and the Gatewood-Gravois Association. The Wrengart-Gatewood Association accounts for an estimated 25 percent of the soil type in the county. This soil type is found on narrow ridge tops and is made up of loess and residuum. The Gatewood-Gravois Association makes up an estimated 30 percent of the soil type in the county. This soil type can be found on side slopes and is also made of loess and residuum. Other soil types found in Osage County include the Menfro-Gatewood Association, Haynie-Leta-Blake Association, Jamesfin-Racoon-Kaintuck Association, Swiss-Plato-Union Association, Rueter-Plato-Gravois Association, and Wrengart-Swiss-Gatewood Association.

Osage County is comprised of four HUC8 watersheds which include the Bourbeuse River, Lower Osage River, Lower Gasconade River, and Lower Missouri-Moreau rivers. The major streams are the Missouri River, with its large tributaries, Loose Creek and Bailey's Creek; the Osage River, with the Big and Little Maries Creeks; and the Gasconade River, with Pointer's, Brush, Swan, Owen's and Lesser Creeks. The watersheds located in Osage County can be seen in **Figure 2.3**.

Figure 2.3. Osage County Watershed/Water Resources



The Bourbeuse River watershed is located within the northeastern quarter of the Ozark Highlands. The main stem of the Bourbeuse River winds northeasterly through Phelps, Gasconade, and Franklin counties to join the Meramec River, and its watershed additionally encompasses portions of Maries, Osage, and Crawford counties. The Bourbeuse River is 147 miles from mouth to headwaters, and the lower 132 miles have permanent flow. The Bourbeuse River watershed drains 843 square miles and is composed of a number of smaller watersheds including Spring Creek, Boone Creek, Brush Creek, Red Oak Creek, Dry Fork, Little Bourbeuse River, and the Lower Bourbeuse River. The gradient of the main stem is low compared to other streams of the Ozark Highlands, and gradients of the tributaries are slightly higher in the lower watershed compared to the upper watershed.

The Gasconade River watershed is located within the Ozark Plateau of the Interior Ozark Highlands. The river meanders north to northeast through Webster, Texas, Laclede, Pulaski, Dent, Maries, Osage, Phelps, and Gasconade counties to join the Missouri River. The Gasconade River is 271 miles long from mouth to headwaters with 263 miles having permanent flow. The Upper and Lower Gasconade River watersheds drain 2,806 square miles. The Upper Gasconade River watershed has an average gradient of 27.6 feet/mile, and the Lower Gasconade River watershed has an average of 3.9 feet/mile. A number of springs within the middle Gasconade River portions are due to the karst geology of the Roubidoux and Gasconade Dolomite Formation and losing stream segments. The karst topography causes losing portions in the Osage Fork, Roubidoux, North Cobb, Little Piney, Spring, and Mill creeks, and Gasconade River. The entire Gasconade River watershed is reported to have 76 springs and the largest concentration of big springs in the state.

The Lower Osage River watershed is found in central Missouri in the Missouri counties of Osage, Maries, Cole, Pulaski, Miller, Camden, Morgan, Benton, and Hickory and encompasses 2,474 square miles. The Lake of the Ozarks was formed in 1931 in the western half of the East Osage River Basin. This basin lies within a dissected plateau known as the Salem Plateau and is represented by four of Missouri's natural divisions. Karst features are common and soils are generally acidic with moderate to low fertility. Erosion rates are generally low although new housing developments, road construction, intensive confinement of livestock and overgrazing have denuded land causing locally-increased erosion and sediment pollution. Truman Dam and Bagnell Dam on the Osage River have significantly impacted the hydrology of the region. Bagnell Dam has significantly changed the timing of water quantity discharged down the Osage River channel. This change in discharge rates and volume may have negatively affected the fish community found in the lower Osage River and its tributaries.

The Missouri River drains one-sixth of the United States and encompasses 529,350 square miles. It flows 2,341 miles from its headwaters at the confluence of the Gallatin, Madison, and Jefferson Rivers in the Rocky Mountains at Three Forks, Montana, to its confluence with the Mississippi River at St. Louis, Missouri. Historically, the "Big Muddy" changed course. The channel relocated over 2,000 feet or more a year in some places and deposited huge amounts of silt in other places. It is estimated that 11 billion cubic feet of sediment were carried past St. Charles, Missouri in 1879 — enough to cover a square mile of ground 200 feet deep. Banks along the river would erode 200 to 300 feet during a single rise of the river. It was the movement of this sediment that created braided channels in the meandering river, hampering navigation and the permanency of bottomland farms and river towns. From bluff to bluff, the river-floodplain below Sioux City, Iowa, covers 1.9 million acres. Historically, the river meandered across more

than one-fourth of this floodplain acreage. This "meander belt" contained a variety of fish and wildlife habitats including wetlands, sandbars, wet prairies, and bottomland forests. Seasonal floods provided the water needed to replenish shallow-water habitats used for fish and wildlife breeding and growth.

During the last 100 years, stream channels in the Ozarks have become wider and shallower and deep-water fish habitat has been lost. Historical data indicate that channel disturbances have resulted most directly from clearing of vegetation along stream channels, which decreases bank strength. Historical and stratigraphic data show that after 1830, Ozarks streams responded to land-use changes by depositing more gravel and less muddy sediment, compared to pre-settlement conditions. Because less muddy sediment is being deposited on flood plains, many stream banks now lack cohesive sediments, and therefore, no longer support steep banks. Land use statistics indicate that the present trend in the rural Ozarks is toward increased populations of cattle and increased grazing density; this trend has the potential to continue the historical stream-channel disturbance by increasing storm-water runoff and sediment supply.

Physiographic features, such as river basins and watersheds, play an important role in the development of any given area. Practical planning and engineering methods take advantage of the topography in planning and designing sewer and water facilities. The individual watersheds should form the basis for sewer and water districts, while several contiguous watersheds within the same drainage basin may be combined to form a sewer or water district.

2.1.3 Climate

Snow occurs between November and April, both inclusive, but most of the snow falls in December, January and February. An average of about 14 inches of snow occurs annually in the Meramec Region. It is unusual for snow to stay on the ground for more than a week or two before it melts. Winter precipitation usually is in the form of rain, snow or both. Conditions sometimes borderline between rain and snow, and in these situations freezing drizzle or freezing rain occurs. Spring, summer and early fall precipitation comes largely in the form of showers or thunderstorms. Thunderstorms are most frequent from April to July. The average annual precipitation is 45.82 inches, which occurs on the average of less than 100 days per year. About half of these will be days with thunderstorms.

Because of its inland location, Missouri and Osage County are subject to frequent changes in temperature. The average annual temperature is 54.04°F. The average annual high temperature is 65.3°F with the average annual low at 42.8°F. The average high and low in January is 40°F and 20°F, respectively. In July the average high and low are 87°F and 66°F, respectively. A heat index of 115°F has been observed in Osage Co.

While winters are cold and summers are hot, prolonged periods of very hot weather are unusual. Occasional periods of mild, above freezing temperatures are noted almost every winter. Conversely, during the peak of the summer season occasional periods of dry, cool weather break up stretches of hot, humid weather. About half of the days in July and August will have temperatures of 90°F or above, but it is not unusual for the temperature to drop into the 50s by the evening. In winter, there is an average of about 100 days with temperatures below 32°F. Temperatures below 0°F are infrequent with only about three days per year reaching this low temperature. The first frost occurs in mid-October, and the last frost occurs about mid-April.

2.1.4 Population/Demographics

Table 2.4 provides population/demographic data for Osage County between 2000 and 2020 by jurisdiction. The unincorporated area of Osage County was determined by subtracting the populations of the incorporated areas from the overall county population.

Table 2.4. Osage County Population 2010-2020 by Jurisdiction

Jurisdiction	2000 Population	2010 Population	2020 Population	2010-2020 # Change	2010-2020 % Change
Unincorporated Osage County	10,096	10,467	10,436	31	-0.3%
Argyle	164	162	144	-18	-11.11%
Chamois	456	396	377	-19	-4.8%
Freeburg	423	437	409	-28	-6.41%
Linn	1,354	1,459	1,350	-109	-7.47%
Meta	249	225	180	-45	-20%
Westphalia	320	327	378	51	15.6%

Source: U.S. Census Bureau, Census 2000 Summary File 1; Census 2010 Summary File 1; Census 2020 Redistricting Data

Table 2.5 provides information in regard to the percent of individuals under the age of 5, and over 65 for the county, State, and Nation. In addition, average household size is illustrated in **Table 2.6** including figures for Osage County, Missouri, and the U.S. In 2020 there were an estimated 6,492 households within the county².

Table 2.5. Percent of Individuals Under the Age of 5, and Over 65 for County, State, and Nation (2020)

Location	% Under Age of 5	% Over Age of 65
Osage County	5.5	17.4
Missouri	6.1	16.9
United States	6.0	16.0

Source: U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates

Table 2.6. 2020 Average Household Size for County, State, and Nation

Location	Average Household Size
Osage County	2.54
Missouri	2.44
United States	2.60

Source: U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates

² U.S. Census Bureau, 2020 Decennial Redistricting Data

Social Vulnerability Index (SoVI ®)

The University of South Carolina developed the Social Vulnerability Index to evaluate and rank the ability to respond to, cope with, recover from, and adapt to natural disasters. The index synthesizes 30 socioeconomic variables which are primarily derived from the United States Census Bureau. **Table 2.7** depicts the Social Vulnerability Index for Osage County along with its national percentile.

Table 2.7. Social Vulnerability Index (SoVI ®)

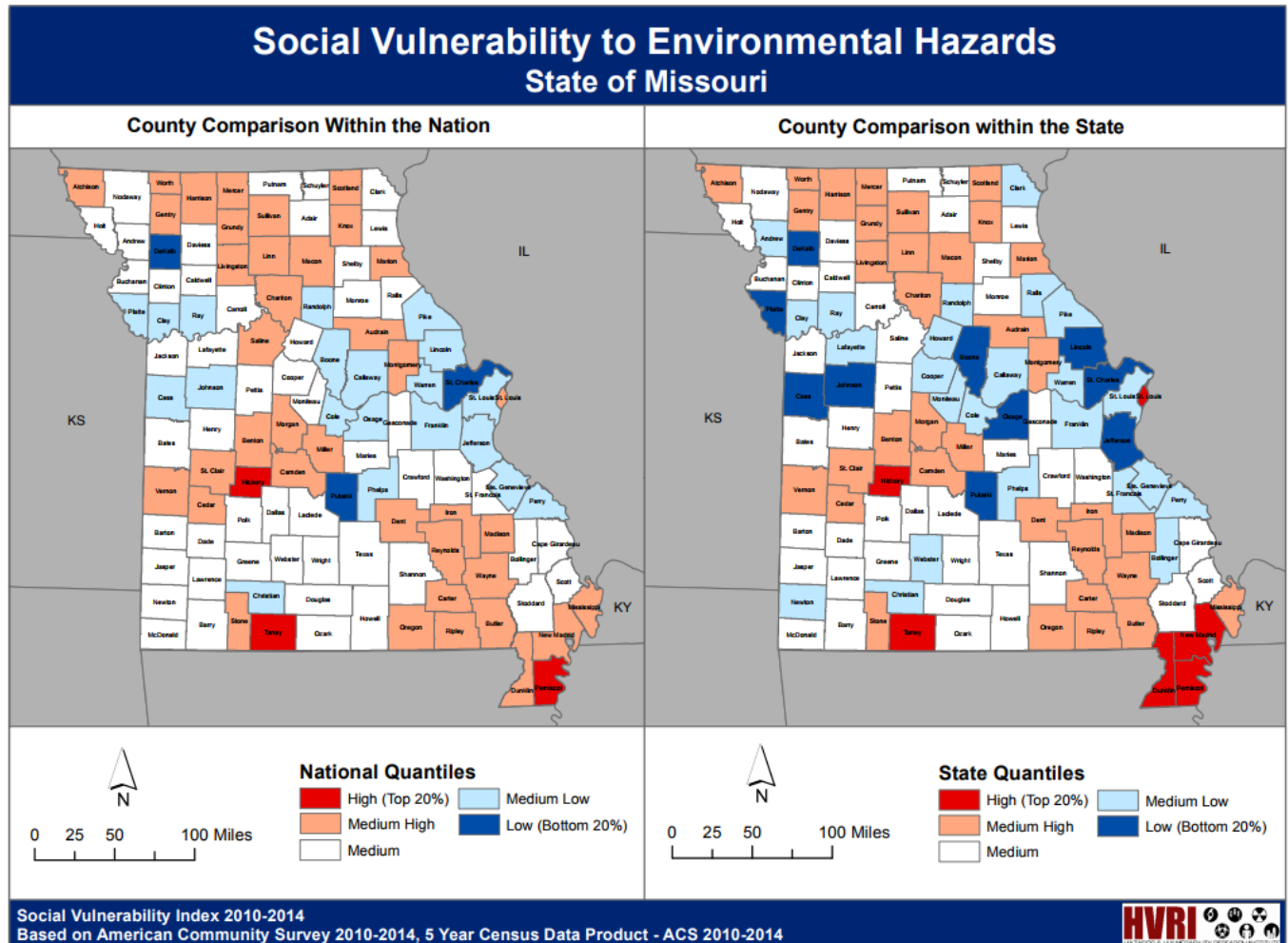
State	County	SoVI Score (10 - 14)	National Percentile (10 - 14)
Missouri	Osage County	-4.079999924	6.2%

Source: <http://artsandsciences.sc.edu/geog/hvri/sovi-data>

The analysis of 30 socioeconomic variables includes the standardization of data, and reduction of variables into a condensed set of statistically optimized components; positive component loadings (+) are linked with amplified vulnerability, and negative component loadings (-) are linked with diminished vulnerability. Scores are represented as a numeric value but have no inherent mathematical properties. To simplify the metrics of the SoVI ® Score, a negative number illustrates a county's resiliency to hazard events, and a positive number illustrates a decrease in resiliency³. Osage County's SoVI ® Score illustrates a diminished vulnerability to cope with natural disasters. Additionally, Osage County is ranked 6.2 percent nationally, for counties most vulnerable to environmental hazards. **Figure 2.4** depicts Missouri's SoVI ® to environmental hazards between 2010 and 2014. Furthermore, **Figure 2.5** depicts the Nation's SoVI ® to environmental hazards between 2010 and 2014.

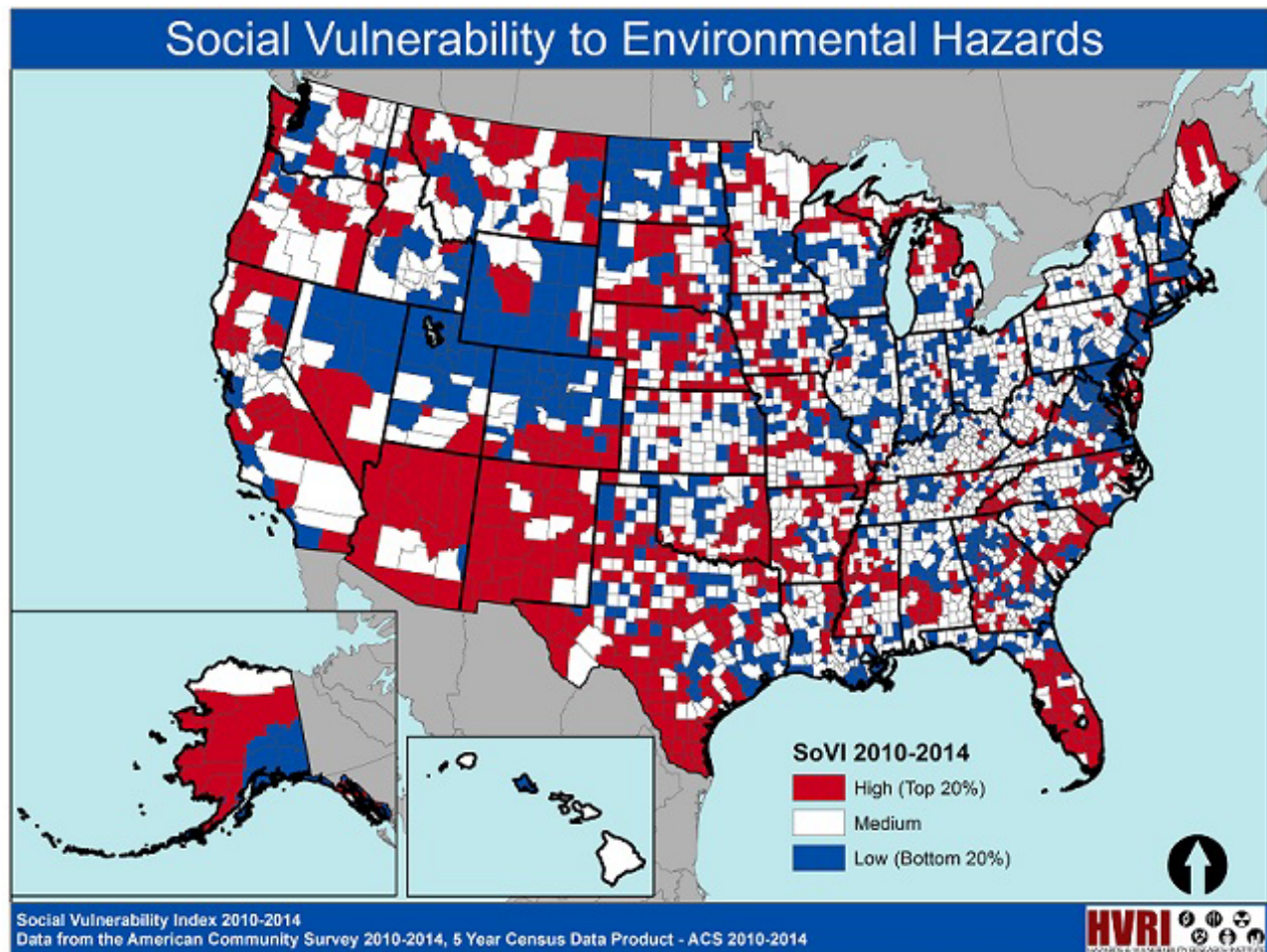
³ <http://webra.cas.sc.edu/hvri/products/sovifaq.aspx>

Figure 2.4. 2010 – 2014 Missouri Social Vulnerability to Environmental Hazards (SoVI ®)



Source: http://artsandsciences.sc.edu/geog/hvri/sites/sc.edu.geog.hvri/files/attachments/MO_1014.pdf

Figure 2.5. 2010 – 2014 U.S. Social Vulnerability to Environmental Hazards (SoVI ®)



Source: <http://artsandsciences.sc.edu/geog/hvri/sovi%C2%AE-0>

Table 2.8 provides additional demographic and economic indicators for Osage County.

Table 2.8. 2020 Unemployment, Poverty, Education, and Language Percentage Demographics, Osage County, Missouri

Jurisdiction	% in Labor Force	% of Population Unemployed	% of Families Below the Poverty Level	High School Diploma ONLY, ages 25+ (%)	Bachelor's degree or higher, ages 25+ (%)	% of population language spoken at home other than English
Osage County	62.3	1.7	3.6	43.9	20.4	1.2
Argyle	81.3	0.0	0	34.1	14.6	1.9
Chamois	46.9	5.8	14.4	52.8	17.4	1.0
Freeburg	55.4	7.5	3.2	50.4	4.0	0
Linn	57.5	2.4	10.5	36.8	22.7	2.8

Jurisdiction	% in Labor Force	% of Population Unemployed	% of Families Below the Poverty Level	High School Diploma ONLY, ages 25+ (%)	Bachelor's degree or higher, ages 25+ (%)	% of population language spoken at home other than English
Meta	49.3	6.7	12.5	50.7	7.1	0
Westphalia	52.4	0.0	2.3	48.6	27.4	1.4

Source: U.S. Census Bureau, 2016-2020 American Community Survey, 5-Year American Community Survey

2.1.5 History

The first settlers came into Osage county in the early 1800s and were predominantly French and second-generation Americans from the East. Starting in the early 1830s, there was a large influx of German settlers, which continued for several decades. The county was formally organized in January 1841 and named after the Osage River. For the first two years after the county's formal organization, county business, including court business, was conducted in various homes throughout the county. The first courthouses were log homes of Thomas Robinson, Elijah White, Adolphus Mengese, and Eli McJilton. The first temporary building constructed for the express purpose of holding court was built by Eli McJilton. The first permanent courthouse was erected in 1843 at a cost of \$3,420.79 in the county seat of Linn. Completed in 1844, this building served the county until 1874 when it was sold to make way for a new courthouse. The new courthouse was damaged by fire in 1880, and then burned to the ground in 1922. In 1923, the building, which still serves as the county courthouse, was constructed along Route 50 in Linn at a cost of \$85,000.

In 1844 the first log jail was constructed in Osage county, popularly called the "dog house" and many of the inmates found the dirt floor to their advantage in tunneling out. A limestone and cotton-rock jail was erected in 1858 at a cost of \$2,560 and was torn down when the new jail in the basement of the present day court house was completed in 1924.

The first newspaper published in Linn was the *Osage County Advocate*, a non-partisan local newspaper edited by C.W. Crutsinger. Two years later, Col. L. Zevely purchased the paper and called it the *Unterrified Democrat*. Peter B. Stratton, Jr. purchased the paper in 1875 and called it *Osage County News*. J.W. Zevely purchased the paper again in 1882 and renamed it the *Unterrified Democrat*, which it still holds.

The early economy of the area was based almost entirely upon agriculture. In 1898, exports from Osage County included cattle, hogs, wheat, corn, flour, sheep, clover seed, wine, poultry, eggs, butter, cross ties, hides and furs. The county is part of the steep, hilly and rocky Missouri Ozarks and the soil is not conducive to crop production, thus, agriculture has always been strongest in livestock production. Agriculture in the county has always been primarily at the subsistence level. As agriculture became more and more mechanized following WWI, the economic viability of the small subsistence farm dwindled, resulting in great out-migration from the area. Although the existence of four navigable rivers in or on the borders of the county were historically an asset for transportation of exports and imports, the location and topography of the county prohibits it from becoming a major transportation or trade center. Natural resources of economic importance include timber and fire clay.

Cities in Osage County included Argyle, Chamois, Freeburg, Linn, Meta and Westphalia. Argyle is located in the southwestern part of Osage county. Argyle experienced its greatest building boom

when the Rock Island Railroad built tracks near the city. Petitioned for incorporation was filed February 3, 1908. In 1906, the first school building was constructed. The school was remodeled in 1937 when a high school was added to the structure.

Chamois is located about seven miles west of the northeast corner of the county on the Missouri River and the Missouri Pacific railroad. The town was given its name by Morgan Harbor, who was one of the first settlers to locate in the vicinity of the city. The city received electricity in the fall of 1914. The city water works and sewage system was installed in 1923. The Chamois high school was accredited and approved as a first class four-year high school in 1920.

Freeburg is located about 20 miles southeast of Linn, on Highway 63. The Rock Island Railroad intersects the town. Most of the land upon which the town is located was homesteaded by Adam Wieberg. The village experienced the greatest “boom” when the St. Louis and Colorado Railroad built its tracks near the city and dug a tunnel under the outlying district. Petition for incorporation of the town of Freeburg was filed November 2, 1909.

The City of Linn stretches for a mile along Highway 50 in the center of Osage County. The County Court of Osage County chose the site of the permanent seat of justice in 1842, creating the town of Linn. The town was named for Lewis Fields Linn, the only Missourian unanimously elected to the US Senate and who is claimed as the state’s “Model Senator.” On October 3, 1899, Linn was incorporated as a village and on October 11, 1911 it was incorporated as a city of the fourth class.

Meta is located on the Rock Island Railroad, in the southwest corner of the county. The city for the most part is located at the foot of a high hill at the edge of a valley. The location of the city and the progressiveness of its people had encouraged many businesses to locate there, including Roller Mills, cheese factory, farmer exchange, lumber yard, depot with stock pens, and charcoal kilns. Petition for incorporation was filed on Nov. 14, 1904.

Westphalia is located along Highway 63, about 11 miles southwest of Linn. In 1830 a group of Catholic immigrants from Westphalia, Germany, came up the “breaks of the Osage” and located in the bend of the Maries River, near the present site of Westphalia.

2.1.6 Occupations

Table 2.9 provides occupation statistics for the incorporated jurisdictions and incorporated county.

Table 2.9. Occupation Statistics, Osage County, Missouri

Place	% in Management, Business, Science, and Arts Occupations	% in Service Occupations	% in Sales and Office Occupations	% in Natural Resources, Construction, and Maintenance Occupations	% in Production, Transportation, and Material Moving Occupations
Osage County	32.6	13.2	20.6	13.8	19.8
Argyle	19.3	5.5	23.9	7.3	44.0
Chamois	30.7	18.4	21.5	9.2	20.2
Freeburg	18.1	13.1	13.8	30.0	25.0
Linn	29.3	25.5	16.6	9.8	18.7
Meta	11.4	24.3	2.9	11.4	50.0
Westphalia	48.9	13.8	8.0	16.7	12.6

Source: U.S. Census, 2016-2020 American Community Survey, 5-year Estimates.

2.1.7 Agriculture

Due to the rural nature of the area, agriculture and timber are significant factors in the local economy. According to the 2012 Census of Agriculture, the number of farms in the County was 1,115 encompassing 283,342 total acres⁴. In addition, the average farm was 254 acres. According to the 2017 Census of Agriculture, Osage County had increased to 1,277 farms encompassing 320,084 acres, with an average farm size of 251 acres⁵. Furthermore, there are only approximately 43 farms with 1,000 or more acres in the County. Due to the rugged nature of the region, row crop farming is for the most part limited to the river valleys. In 2017, 53,233 acres of cropland were harvested, with forage (hay, haylage, grass silage, and greenchop) being the top crop in the County. Moreover, 539,673 turkeys were raised⁶. The average sale per farm was \$63,187. Lastly, the total number of hired workers in the County was 515⁷ individuals comprising 7.39%⁸ of the total workforce.

The Ozarks region of Missouri is the focal point of several converging ranges of plant associations. Eastern hardwoods, southern pines and western prairies and the wildlife each supports, all reach the outward limits of their range in this area. As a result, various types of forest lands and animal habitats co-exist within a limited area. Several sawmills operate in the area and the large amount of National Forest Lands in the region also contribute to the importance of timber production and logging to the local economy.

2.1.8 FEMA Hazard Mitigation Assistance Grants in Planning Area

FEMA's Hazard Mitigation Assistance (HMA) grant program provides funding for mitigation activities which have the potential to reduce disaster losses and protect life and property from future disaster damages⁹. Previous FEMA HMA Grants issued in the planning area can be found in **Table 2.10**.

Table 2.10. FEMA HMA Grants in County from 1993-2019

Project Type	Sub applicant	Award Date	Project Total (\$)
206.2: Safe Room (Tornado and Severe Wind Shelter) - Public	Linn State Technical College	05/06/2006	1,386,000
Total			1,386,000

Source: Missouri SEMA, <https://www.fema.gov/openfema-dataset-hazard-mitigation-grants-v1>

2.1.9 FEMA Public Assistance (PA) Grants in Planning Area

The purpose of the Public Assistance (PA) Grant Program is to support communities' recovery from major disasters by providing them with grant assistance for debris removal, life-saving emergency protective measures, and restoring public infrastructure. Local governments, states, tribes, territories and certain private nonprofit organizations are eligible to apply. Public Assistance

⁴ 2012 Census of Agriculture, USDA, National Agriculture Statistics Service

⁵ Source: 2012 Census of Agriculture – County Data, USDA, National Agriculture Statistics Service

⁶ 2012 Census of Agriculture, Missouri Farm Commodity Sales, USDA, National Agriculture Statistics Service

⁷ http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_County_Level/Missouri/st29_2_007_007.pdf

⁸ U.S. Census Bureau, 2016-2020 American Community Survey

⁹ <https://www.fema.gov/media-library/assets/documents/103279>

is FEMA's largest grant program. **Table 2.11** below gives information about all Public Assistance Grant for the Planning area. It gives the Declaration number, project type and size, the applicant, and the project total. Total PA grants is \$1,659,925.95.

Table 2.11. FEMA PA Grants in Osage County from 2000-2020

Disaster Declaration	Project Type	Project Size	Applicant	Project Total
1412	ROAD WASHOUT	Small	OSAGE COUNTY	\$10,576.80
1412	ROAD DAMAGE	Small	OSAGE COUNTY	\$2,306.50
1412	ROADWAY SURFACE REPAIR	Small	OSAGE COUNTY	\$6,074.64
1412	ROAD DAMAGE	Large	OSAGE COUNTY	\$125,241.83
1463	4.2 CULVERT & AGGREGATE SURFACING REPAIR	Small	OSAGE COUNTY	\$6,679.17
1463	1.2 COURTHOUSE ROOF REPAIR	Small	OSAGE COUNTY	\$1,000.00
1463	DEBRIS REMOVAL	Small	OSAGE COUNTY	\$1,719.32
1463	DONATED RESOURCES	Small	OSAGE COUNTY	\$489.80
1676	EMERGENCY PROTECTIVE MEASURES	Small	FREEBURG, VILLAGE OF	\$2,585.77
1676	DEBRIS REMOVAL	Small	FREEBURG, VILLAGE OF	\$16,975.20
1676	EMERGENCY PROTECTIVE MEASURES	Small	OSAGE COUNTY	\$7,502.51
1676	DEBRIS REMOVAL	Small	OSAGE COUNTY	\$2,722.93
1736	EMERGENCY PROTECTIVE MEASURES	Small	CHAMOIS, CITY OF	\$2,571.86
1736	PA PILOT - DEBRIS REMOVAL	Small	CHAMOIS, CITY OF	\$9,002.25
1736	EMERGENCY PROTECTIVE MEASURES	Small	FREEBURG, VILLAGE OF	\$2,503.40
1736	EMERGENCY PROTECTIVE MEASURES	Small	WESTPHALIA, CITY OF	\$1,496.60
1736	EMERGENCY PROTECTIVE MEASURES	Small	OSAGE COUNTY	\$15,788.26
1736	PA PILOT -DEBRIS REMOVAL	Small	OSAGE COUNTY	\$10,695.81
1749	EMERGENCY PROTECTIVE MEASURES	Small	OSAGE COUNTY	\$10,047.36
1749	ROAD WASHOUT	Small	OSAGE COUNTY	\$16,131.95
1749	ROADS WASHOUT	Small	OSAGE COUNTY	\$28,516.67
1749	ROAD WASHOUT	Small	OSAGE COUNTY	\$18,638.61
1749	ROAD WASHOUT EROSION	Small	OSAGE COUNTY	\$24,623.59
1749	ROAD/DITCH WASHOUTS	Small	OSAGE COUNTY	\$29,706.89
1749	ROAD WASHOUT EROSION	Small	OSAGE COUNTY	\$7,027.78
1749	ROADS WASHOUT/EROSION	Small	OSAGE COUNTY	\$20,275.14
1749	ROAD WASHOUT EROSION	Small	OSAGE COUNTY	\$22,910.11
1749	DONATED RESOURCES	Small	OSAGE COUNTY	\$2,167.30
1749	LOW WATER CROSSING WASHOUT	Small	OSAGE COUNTY	\$29,906.00

1961	OSRB-05-Emergency Protective Measures- 48 Hour Snow Rem	Small	CHAMMOIS, CITY OF	\$2,808.20
1961	OSMG-01-Emergency Protective Measures-48 Hour Snow Remo	Small	FREEBURG, VILLAGE OF	\$2,020.47
1961	OSRH-01 - EPM- 48 Hr Snow Removal	Small	LINN	\$11,831.03
1961	OSRB-02 - OSAGE COUNTY	Small	OSAGE COUNTY	\$19,749.16
1961	OSRB-01- Emergency Protective Measures - 48 Hour Snow R	Small	OSAGE COUNTY SCHOOL DISTRICT R-2	\$2,961.73
1961	OSRL-03 - OSAGE AMBULANCE DISTRICT	Small	OSAGE AMBULANCE DISTRICT	\$1,328.95
4130	OCOC01C - gravel roads washout - 14 sites.	Small	OSAGE COUNTY	\$14,035.40
4130	OCOC02C - Gravel Road Washout -9 sites	Small	OSAGE COUNTY	\$6,590.37
4130	OCOC03C - Gravel Road Washout - 11 Sites	Small	OSAGE COUNTY	\$19,050.83
4130	OCOC01B - Temporary Bridge replacement -1 site	Small	OSAGE COUNTY	\$19,957.40
4130	OCOC04C Gravel Washouts - 14 Sites	Small	OSAGE COUNTY	\$23,176.43
4130	OCOC05C- Gravel Washouts- 6 sites	Small	OSAGE COUNTY	\$11,478.61
4130	OCOC06C - gravel roads washout - 26 sites.	Small	OSAGE COUNTY	\$25,787.21
4130	OCOC09C - Culverts (4 Sites)	Small	OSAGE COUNTY	\$3,048.69
4130	OCOC10C - Osage County Roads & Bridges (22 sites)	Small	OSAGE COUNTY	\$43,361.42
4130	OCOC11C - Flowable Concrete (3 Sites)	Small	OSAGE COUNTY	\$3,905.83
4130	OCOC12C - Low water crossings (4 Sites)	Small	OSAGE COUNTY	\$16,857.35
4130	OCOC01A Debris Removal	Small	OSAGE COUNTY	\$9,167.11
4130	OCOC08C - CR 610 Bridge Replacement	Large	OSAGE COUNTY	\$291,537.89
4144	OCOC02C-Gravel Washouts-5 sites	Small	OSAGE COUNTY	\$14,975.67
4144	OCOC01C-Gravel Washouts-30 sites	Large	OSAGE COUNTY	\$64,287.72
4144	OCOC03C-Gravel Washouts-6 sites	Small	OSAGE COUNTY	\$17,418.33
4144	OCOC02A Debris Removal	Small	OSAGE COUNTY	\$8,132.32
4238	EBM004G - PARKS	Small	META	\$7,498.55
4238	DHD006C - Osage County CR200-CR400 Roads	Small	OSAGE COUNTY	\$69,735.95
4238	DHD009C - Osage County CR600 Roads	Small	OSAGE COUNTY	\$27,090.55
4238	DHD008C - Osage County CR500 Roads	Large	OSAGE COUNTY	\$126,373.20

4238	DHD010C - Osage County CR700-800 Roads	Small	OSAGE COUNTY	\$82,222.94
4317	CP01425 - District 200 Roads and Culverts	Small	OSAGE COUNTY	\$10,381.65
4317	CP01571 - District 700, 800 & Engineers Roads and Culve	Small	OSAGE COUNTY	\$18,006.17
4317	CP01570 - District 300, 400, 500, 600 Roads and Culvert	Small	OSAGE COUNTY	\$40,869.13
4490	145685 - OAD Covid-19 2020	Small	OSAGE AMBULANCE DISTRICT	\$73,206.05
4490	155973 - OADCovid19 Vents	Small	OSAGE AMBULANCE DISTRICT	\$99,538.75
4490	182045 - Medical Supplies	Small	OSAGE AMBULANCE DISTRICT	\$17,756.93
4490	661763 - OCAD Medical Supplies	Small	OZARK CENTRAL AMBULANCE DISTRICT	\$17,893.91
			TOTAL	\$1,659,925.95

Source: Federal Emergency Management Agency, 06/09/2022

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, the special districts, and the public school districts.

2.2.1 Unincorporated Osage County

Overview

The jurisdiction of Osage County includes all unincorporated areas within the county boundaries. Osage County is governed by a three-member County Commission. The Commission is composed of a Presiding Commissioner, representing all of the county's population. The Presiding Commissioner is elected to a four-year term. Two Associate Commissioners are also elected to four year terms. The Associate Commissioners each represent half of the county's population each, are elected for four-year terms. Other elected officials include the County Clerk, Prosecuting Attorney, Sheriff, Circuit Clerk, Recorder of Deeds, Collector of Revenue, Treasurer, Assessor, County Surveyor, Coroner, and Public Administrator.

Other county officials include the 911/Emergency Management Director/NFIP Floodplain Administrator, Health Dept. Administrator, Road and Bridge Supervisor, and Mapping Specialist.

Technical and Fiscal Resources

Osage County operates as a third-class county. The county government has the authority to administer county structures, infrastructures, and finances as well as floodplain regulations. Third class counties do not have building regulations.

There are six fire departments located in the county. All are volunteer departments. Those departments include Argyle Volunteer Fire Dept., Chamois Fire Protection District., Freeburg Volunteer Fire Department, Linn Fire Protection District, Meta Fire & Rescue, and Westphalia Fire Protection District. Osage Co. is served by the Osage Co. Sheriff's Office. The county has a 911 Central Dispatch Center located at 205 East Main, Linn, MO. The county is served by three ambulance districts – Ozark Central Ambulance District, Maries-Osage Ambulance District, and Osage Ambulance District. The closest hospitals are located in Jefferson City, in adjoining Cole County; and Hermann, in Gasconade County. Within the county there are 13 outdoor warning sirens. Additional warning systems include Reverse 911, IPAWS, and the county also utilizes Facebook. The county also possesses 2 fixed generators (Courthouse and Admin. Building), and multiple portable generators. There is one designated public tornado shelter, constructed in accordance with FEMA standards, located at 1 Technology Drive, Linn, MO 65051.

Fiscal tools or resources that the county could potentially use to help fund mitigation activities include Community Development Block Grants, Capital Improvements project funding, levy taxes for specific purposes, incur debt through general obligation bonds, and incur debt through special tax bonds.

Existing Plans and Policies

The county has a County Emergency Operations Plan, Economic Development Plan, Regional Transportation Plan, Critical Facilities Plan, and Floodplain Ordinance. Osage County also participates in the National Flood Insurance Program. The County Emergency Management Director serves as the floodplain manager.

Other Mitigation Activities

The Office of Emergency Management, local fire departments, Sheriff's Office, and the Osage County Health Department have conducted public education campaigns to raise awareness and increase preparedness among the county's population. Those programs have included flood recovery awareness and Floodplain Ordinance, fire safety, storm preparedness, heat wave preparedness, and general press releases/social media outreach regarding hazards, preparedness, and mitigation. Bicycle and car seat safety education is provided by the Coalition for Roadway Safety.

Table 2.12. Demographic and Structure Risk Parameters For Unincorporated Osage County

Jurisdiction	Total Population	People With a Disability	Non-English Speaking Populations	People Below Poverty Level	Population Under 5 Yrs.	Population 65 Yrs. and Over	Residences Built Prior to 1939	Mobile Homes
Unincorporated Osage County	10,498	1,122	109	596	533	1,785	455	234

Source: U.S. Census Bureau, 2016-2020 5-Years American Community Survey

Table 2.13. Unincorporated Osage County Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	N/A
County Emergency Operations Plan	Yes – 10/2017
Local Recovery Plan	No
County Recovery Plan	No
City Mitigation Plan	N/A
County Mitigation Plan	Yes – 2017
Debris Management Plan	No
Economic Development Plan	Yes – Regional CEDS 2018
Transportation Plan	Yes – Regional 2019
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
Firewise or other fire mitigation plan	No
Critical Facilities Plan (Mitigation/Response/Recovery)	Yes – Update in Progress
Policies/Ordinance	
Zoning Ordinance	No

Capabilities	Status Including Date of Document or Policy
Building Code	No
Floodplain Ordinance	Yes – 9/2012
Subdivision Ordinance	No
Tree Trimming Ordinance	No
Nuisance Ordinance	No
Storm Water Ordinance	No
Drainage Ordinance	No
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Landscape Ordinance	No
Program	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
Hazard Awareness Program	No
National Flood Insurance Program	Yes
NFIP Community Rating System (CRS) Participating Community	No
National Weather Service (NWS) Storm Ready	No
FireWise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	Varies
Economic Development Program	MRPC
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	No
Hazard Analysis/Risk Assessment (County)	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Evacuation Route Map	Yes
Critical Facilities Inventory	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	Yes
Engineer	No
Development Planner	No
Public Works Official	No
Emergency Management Director	Yes
NFIP Floodplain Administrator	Yes
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	Yes – MLEPD
County Emergency Management Commission	No

Capabilities	Status Including Date of Document or Policy
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	Yes – Mid Missouri PHA
Regional Planning Agencies	Yes - MRPC
Historic Preservation	No
Non-Governmental Organizations (NGOs)	
American Red Cross	Yes
Salvation Army	Yes
Veterans Groups	Yes
Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.)	Yes
Local Funding Availability	
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	No
Impact fees for new development	No
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	No
Ability to withhold spending in hazard prone areas	No

Source: Data Collection Questionnaire, 2022

2.2.2 Village of Argyle

Overview

Argyle is located in the southwest portion of Osage County. Argyle is located where Highways T and AA merge. Argyle has a four-member board of alderman and a mayor. The city population from the 2020 5-year ACS data is 168, in 2010 it was 162, which shows a stable population.

Technical and Fiscal Resources

Argyle is a participating community in the National Flood Insurance Program. The Village of Argyle is covered by the Osage County Sheriff's Department. The Osage County 911 Communications Center is located in Linn to provide 911 dispatching throughout the county. The office is staffed 24 hours a day. There is one outdoor warning sirens that is activated by the Argyle Volunteer Fire Department. The community does not have a FEMA tornado shelter or any portable or fixed generators.

The Maries Osage Ambulance District covers the southern portion of the county, including the Village of Argyle. There is also a Rural Fire Protection District located in Argyle.

Public education programs are provided regionally by the Coalition for Roadway Safety and Osage Emergency Management.

Over 44 percent of housing units in Caledonia were built prior to 1939, this is the highest percentage pre-1939 homes in the county. A greater percent of older homes increases the village's risk to damages from several hazards.

Table 2.14 below shows the demographic and structure statistics, and **Table 2.15** describes the mitigation capabilities of the village.

Table 2.14. Demographic and Structure Risk Parameters For Argyle

Jurisdiction	Total Population	With a disability	Non-English Speaking Populations	People Below Poverty Level	Population Under 5 Yrs.	Population 65 Yrs. and Over	Residences Built Prior to 1939	Mobile Homes
Argyle	168	19	3	0	7	32	30	0

Source: U.S. Census Bureau, 2016-2020 5-Years American Community Survey

Table 2.15. Village of Argyle Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	Yes – 02/01/2022
Builder's Plan	No
Capital Improvement Plan	Yes – 02/01/2022
City Emergency Operations Plan	No
County Emergency Operations Plan	Yes – 10/2017
Local Recovery Plan	No
County Recovery Plan	No
City Mitigation Plan	No
County Mitigation Plan	Yes – 2017
Debris Management Plan	No
Economic Development Plan	Yes – Regional CEDS 2018
Transportation Plan	Yes – Regional 2021
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
FireWise or other fire mitigation plan	No
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	No
Building Code	No
Floodplain Ordinance	Yes – 8/14/2012
Subdivision Ordinance	No
Tree Trimming Ordinance	No
Nuisance Ordinance	Yes
Storm Water Ordinance	No
Drainage Ordinance	No
Site Plan Review Requirements	No

Capabilities	Status Including Date of Document or Policy
Historic Preservation Ordinance	No
Landscape Ordinance	No
Program	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
Hazard Awareness Program	No
National Flood Insurance Program	Yes
NFIP Community Rating System (CRS) Participating Community	No
National Weather Service (NWS) Storm Ready	No
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	7
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	No
Hazard Analysis/Risk Assessment (County)	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Evacuation Route Map	No
Critical Facilities Inventory	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	No
Emergency Management Director	No
NFIP Floodplain Administrator	Yes
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	Yes – regional MLEPD
County Emergency Management Commission	No
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	Yes – Mid Missouri PHA
Regional Planning Agencies	Yes - MRPC
Historic Preservation	No
Non-Governmental Organizations (NGOs)	
American Red Cross	No

Capabilities	Status Including Date of Document or Policy
Salvation Army	No
Veterans Groups	Yes
Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.)	Yes
Local Funding Availability	
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	No
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	Yes
Ability to withhold spending in hazard prone areas	No

Source: Data Collection Questionnaire, 2022

2.2.3 City of Chamois

Overview

Chamois is located in the northern portion of Osage County on Highway 100 running along the Missouri River. There is a four member Board of Aldermen and a Mayor. The city personnel include a City Clerk, Public Works Official, Fire Chief, and City Attorney. The city population from the 2020 5-year ACS data is 431, in 2010 it was 396, which shows a population growth of almost nine percent.

Technical and Fiscal Resources

Chamois is a participating community in the National Flood Insurance Program. Law enforcement in the community is provided by the Osage County Sheriff's Office. The Osage Ambulance District provides ambulance service for the city and surrounding area. There is a Rural Fire Protection District located in Chamois, which serves the city and the surrounding area as well. The city has one warning siren; activated by the county and also has Smart 911. The city possesses one portable generator.

Fiscal tools or resources that the city could potentially use to help fund mitigation activities include Community Development Block Grants, Capital Improvements project funding, taxes for specific purposes, fees for water, sewer, gas, and electric services, impact fees for new development, debt through general obligation bonds, debt through special tax bonds, debt through private activities, and withholding spending in hazard prone areas.

Public education programs are provided regionally by the Coalition for Roadway Safety and Osage Emergency Management.

Chamois has the highest percentage of population with a disability at almost 15 percent. Higher percentages of vulnerable populations increase the risk of injury or death during hazard events.

Table 2.16 below shows the demographic and structure statistics, and **Table 2.17** describes the mitigation capabilities of the city.

Table 2.16. Demographic and Structure Risk Parameters For Chamois

Jurisdiction	Total Population	With a disability	Non-English Speaking Populations	People Below Poverty Level	Population Under 5 Yrs.	Population 65 Yrs. and Over	Residences Built Prior to 1939	Mobile Homes
Chamois	431	64	4	82	24	90	49	12

Source: U.S. Census Bureau, 2016-2020 5-Years American Community Survey

Table 2.17. City of Chamois Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	No
County Emergency Operations Plan	Yes – 10/2017
Local Recovery Plan	No
County Recovery Plan	No
City Mitigation Plan	No
County Mitigation Plan	Yes – 2017
Debris Management Plan	No
Economic Development Plan	Yes – Regional CEDS 2018
Transportation Plan	Yes – Regional 2021
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
FireWise or other fire mitigation plan	No
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	No
Building Code	No
Floodplain Ordinance	Yes – 1/14/2021
Subdivision Ordinance	No
Tree Trimming Ordinance	Yes
Nuisance Ordinance	Yes
Storm Water Ordinance	No
Drainage Ordinance	No
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Landscape Ordinance	Yes

Capabilities	Status Including Date of Document or Policy
Program	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
Hazard Awareness Program	Yes
National Flood Insurance Program	Yes
NFIP Community Rating System (CRS) Participating Community	No
National Weather Service (NWS) Storm Ready	No
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	10
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	Yes
Property Acquisition	Yes
Planning/Zoning Boards	No
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	Yes
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	No
Hazard Analysis/Risk Assessment (County)	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Evacuation Route Map	Yes
Critical Facilities Inventory	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	Yes
Emergency Management Director	Yes
NFIP Floodplain Administrator	Yes
Bomb and/or Arson Squad	No
Emergency Response Team	Yes
Hazardous Materials Expert	Yes
Local Emergency Planning Committee	Yes – regional MLEPD
County Emergency Management Commission	No
Sanitation Department	Yes
Transportation Department	No
Economic Development Department	No
Housing Department	Yes – Mid Missouri PHA
Regional Planning Agencies	Yes - MRPC
Historic Preservation	Independent
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	Yes – American Legion

Capabilities	Status Including Date of Document or Policy
Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.)	Yes - Lions
Local Funding Availability	
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	Yes
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	Yes
Ability to withhold spending in hazard prone areas	Yes

Source: Data Collection Questionnaire, 2022

2.2.4 Village of Freeburg

Overview

Irondale is located in the south central portion of Osage County where state highways 63 and P intersect. There is a four member Board of Trustees and a Mayor. The village personnel include a Clerk, Water Clerk, Water/Sewer/Road Superintendent, and one part-time personnel. The village population from the 2020 5-year ACS data is 426, in 2010 it was 437, which shows a population decline of over two percent.

Technical and Fiscal Resources

Freeburg does not participate in the National Flood Insurance Program or have a Floodplain Ordinance. Law enforcement in the community is provided by the Osage County Sheriff's Office. The Osage Ambulance District and Maries-Osage Ambulance District provides ambulance service for the city and surrounding area. The Freeburg Volunteer Fire Department provides fire protection. The village has one fixed generator and two warning sirens which are controlled by the county.

Fiscal tools or resources that the Village could potentially use to help fund mitigation activities include Capital Improvements funding, authority to levy taxes for specific purposes, fees for water, sewer, gas, or electric services, and incur debt through special tax bonds.

Public education programs are provided regionally by the Coalition for Roadway Safety and Osage Emergency Management.

The Village of Freeburg has the highest percent of manufactured homes, with almost fourteen percent. Higher percentages of mobile homes increase the risk of damages during natural disasters.

Table 2.18 below shows the demographic and structure statistics, and **Table 2.19** describes the mitigation capabilities of the city.

Table 2.18. Demographic and Structure Risk Parameters For Freeburg

Jurisdiction	Total Population	With a disability	Non-English Speaking Populations	People Below Poverty Level	Population Under 5 Yrs.	Population 65 Yrs. and Over	Residences Built Prior to 1939	Mobile Homes
Freeburg	426	38	0	48	36	95	28	25

Source: U.S. Census Bureau, 2016-2020 5-Years American Community Survey

Table 2.19. Village of Freeburg Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	No
County Emergency Operations Plan	Yes – 10/2017
Local Recovery Plan	No
County Recovery Plan	No
City Mitigation Plan	No
County Mitigation Plan	Yes – 2017
Debris Management Plan	No
Economic Development Plan	Yes – Regional CEDS 2018
Transportation Plan	Yes – Regional 2021
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
FireWise or other fire mitigation plan	No
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	No
Building Code	No
Floodplain Ordinance	No
Subdivision Ordinance	No
Tree Trimming Ordinance	No
Nuisance Ordinance	Yes
Storm Water Ordinance	No
Drainage Ordinance	No
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Landscape Ordinance	No
Program	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
Hazard Awareness Program	No
National Flood Insurance Program	No

Capabilities	Status Including Date of Document or Policy
NFIP Community Rating System (CRS) Participating Community	No
National Weather Service (NWS) Storm Ready	No
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	6
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Stream Maintenance Program	No
Tree Trimming Program	Yes
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	No
Hazard Analysis/Risk Assessment (County)	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Evacuation Route Map	No
Critical Facilities Inventory	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	No
Emergency Management Director	No
NFIP Floodplain Administrator	No
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	Yes – MLEPD
County Emergency Management Commission	No
Sanitation Department	Yes
Transportation Department	No
Economic Development Department	No
Housing Department	Yes – Mid Missouri PHA
Regional Planning Agencies	Yes - MRPC
Historic Preservation	No
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	Yes
Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.)	Yes
Local Funding Availability	

Capabilities	Status Including Date of Document or Policy
Ability to apply for Community Development Block Grants	No
Ability to fund projects through Capital Improvements funding	No
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	No
Ability to incur debt through general obligation bonds	No
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	No
Ability to withhold spending in hazard prone areas	No

Source: Data Collection Questionnaire, 2022

2.2.5 City of Linn

Overview

Linn is located in central Osage County where Highways 50, 89, and 100 intersect, about 20 miles east of Jefferson City. Linn is the county seat and a fourth class city. There is a four member Board of Aldermen and a Mayor. The city employs a City Clerk, Treasurer, Police Chief, Utilities Superintendent, and City Attorney. The city population from the 2020 5-year ACS data is 1,507, in 2010 it was 1,459, which shows a population growth of just over three percent.

Technical and Fiscal Resources

Linn is a participating community in the National Flood Insurance Program. Law enforcement in the community is provided by the Linn City Police Department, located at 1200 East Main Street, Linn, Mo 65051. There is a City/Rural Fire Protection District located in Linn, which serves the city and the surrounding area. The Osage Ambulance District provides ambulance service for the city and surrounding area as well. The city has two warning sirens. The warning sirens are controlled by the Osage County 911 Center. The city employs an Emergency Management Coordinator (Police Chief) and NFIP Floodplain Administrator. The city has two generators.

Fiscal tools or resources that the city could potentially use to help fund mitigation activities include Community Development Block Grants, Capital Improvements project funding, taxes for specific purposes, fees for water, sewer, gas or electric services, impact fees for new development, debt through general obligation bonds, and debt through special tax bonds.

Public education programs are provided regionally by the Coalition for Roadway Safety and Osage Emergency Management.

Linn has the highest percent of non-English speaking population (2.6 percent) and people living below the poverty line (22.1 percent). A large percent of vulnerable populations increases the risk of injury or death due to hazards.

Table 2.20 below shows the demographic and structure statistics, and **Table 2.21** describes the mitigation capabilities of the city.

Table 2.20. Demographic and Structure Risk Parameters For Linn

Jurisdiction	Total Population	With a Disability	Non-English Speaking Populations	People Below Poverty Level	Population Under 5 Yrs.	Population 65 Yrs. and Over	Residences Built Prior to 1939	Mobile Homes
Linn	1,507	221	39	333	108	202	49	0

Source: U.S. Census Bureau, 2016-2020 5-Years American Community Survey

Table 2.21. City of Linn Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	No
County Emergency Operations Plan	Yes, 10/2017
Local Recovery Plan	No
County Recovery Plan	No
City Mitigation Plan	No
County Mitigation Plan	Yes - 2017
Debris Management Plan	No
Economic Development Plan	Yes – Regional CEDS 2018
Transportation Plan	Yes – Regional 2021
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
FireWise or other fire mitigation plan	No
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	Yes
Building Code	Yes – IBC 2012
Floodplain Ordinance	Yes – 2012
Subdivision Ordinance	Yes
Tree Trimming Ordinance	No
Nuisance Ordinance	Yes
Storm Water Ordinance	No
Drainage Ordinance	No
Site Plan Review Requirements	Yes
Historic Preservation Ordinance	No
Landscape Ordinance	No
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	No
Hazard Awareness Program	No
National Flood Insurance Program	Yes
NFIP Community Rating System (CRS) Participating Community	No
National Weather Service (NWS) Storm Ready	No

Capabilities	Status Including Date of Document or Policy
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	5
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	Yes
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	No
Hazard Analysis/Risk Assessment (County)	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Evacuation Route Map	No
Critical Facilities Inventory	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Vulnerable Population Inventory	No
Land Use Map	Yes
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	Yes
Emergency Management Director	No
NFIP Floodplain Administrator	Yes
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	Yes - MLEPD
County Emergency Management Commission	No
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	Yes – Mid Missouri PHA
Regional Planning Agencies	Yes - MRPC
Historic Preservation	No
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	Yes
Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.)	Yes
Local Funding Availability	
Ability to apply for Community Development Block Grants	Yes

Capabilities	Status Including Date of Document or Policy
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	yes
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	No
Ability to withhold spending in hazard prone areas	No

Source: Data Collection Questionnaire, 2022

2.2.6 City of Meta

Overview

Meta is located in the southwest corner of Osage County on Highway 133. There is a four member Board of Aldermen and a Mayor. The city employs a City Clerk/Water Clerk, City Treasurer, Chief Water Operator and three City Maintenance staff. The city population from the 2020 5-year ACS data is 172, in 2010 it was 225, which shows a population decline of over 23 percent.

Technical and Fiscal Resources

Meta participates in the National Flood Insurance Program. Law enforcement in the community is provided by the Osage County Sheriff's Office. Central Communications for the community is provided by Osage County. Ambulance service for Meta is provided by the Osage County Ambulance District, Maries County Ambulance District, and Miller County Ambulance District. The community is also served by Meta Fire & Rescue. There is one outdoor warning siren within the community. The Mayor also acts as the Emergency Management Coordinator.

Fiscal tools or resources that the city could potentially use to help fund mitigation activities include Community Development Block Grants, Capital Improvements project funding, taxes for specific purposes, and fees for water services.

Public education programs are provided regionally by the Coalition for Roadway Safety and Osage Emergency Management.

Table 2.22 below shows the demographic and structure statistics, and **Table 2.23** describes the mitigation capabilities of the city.

Table 2.22. Demographic and Structure Risk Parameters For Meta

Jurisdiction	Total Population	With a Disability	Non-English Speaking Populations	People Below Poverty Level	Population Under 5 Yrs.	Population 65 Yrs. and Over	Residences Built Prior to 1939	Mobile Homes
Meta	172	20	0	22	4	42	28	0

Source: U.S. Census Bureau, 2016-2020 5-Years American Community Survey

Table 2.23. City of Meta Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	Yes – June 2014
County Emergency Operations Plan	Yes – 10/2017
Local Recovery Plan	No
County Recovery Plan	No
City Mitigation Plan	No
County Mitigation Plan	Yes – 2017
Debris Management Plan	No
Economic Development Plan	Yes – Regional CEDS 2018
Transportation Plan	Yes – Regional 2021
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
FireWise or other fire mitigation plan	No
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	No
Building Code	No
Floodplain Ordinance	Yes – 4/11/2012
Subdivision Ordinance	No
Tree Trimming Ordinance	No
Nuisance Ordinance	Yes
Storm Water Ordinance	No
Drainage Ordinance	No
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Landscape Ordinance	No
Program	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
Hazard Awareness Program	No
National Flood Insurance Program	Yes
NFIP Community Rating System (CRS) Participating Community	No
National Weather Service (NWS) Storm Ready	No
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No

Capabilities	Status Including Date of Document or Policy
ISO Fire Rating	7
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	No
Hazard Analysis/Risk Assessment (County)	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Evacuation Route Map	No
Critical Facilities Inventory	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	Yes
Development Planner	No
Public Works Official	No
Emergency Management Director	Yes
NFIP Floodplain Administrator	Yes
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	Yes – MLEPD
County Emergency Management Commission	No
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	Yes – Mid Missouri PHA
Regional Planning Agencies	Yes - MRPC
Historic Preservation	No
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	No
Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.)	Yes
Local Funding Availability	
Ability to apply for Community Development Block Grants	Yes
Ability to fund projects through Capital Improvements funding	Yes

Capabilities	Status Including Date of Document or Policy
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	No
Ability to incur debt through general obligation bonds	No
Ability to incur debt through special tax bonds	No
Ability to incur debt through private activities	No
Ability to withhold spending in hazard prone areas	No

Source: Data Collection Questionnaire, 2022

2.2.7 City of Westphalia

Overview

Westphalia is located in the west central portion of Osage County on Highway 63. There is a four member Board of Aldermen and a Mayor. The city employs a City Clerk. The city population from the 2020 5-year ACS data is 411, in 2010 it was 327, which shows a population growth of over 25 percent.

Technical and Fiscal Resources

Westphalia participates in the National Flood Insurance Program. Law enforcement in the community is provided by the Osage County Sheriff's Office. Central Communications for the community is provided by Osage County. Ambulance service for Westphalia is provided by the Osage County Ambulance District. Westphalia Fire Protection District serves the community and surrounding area. There is one outdoor warning siren within the city. The city's sewer plant houses one portable generator.

Fiscal tools or resources that the city could potentially use to help fund mitigation activities include Community Development Block Grants, Capital Improvements project funding, taxes for specific purposes, fees for water, sewer, gas or electric services, impact fees for new development, debt through general obligation bonds, debt through special tax bonds, debt through private activities, and withholding spending in hazard prone areas.

Westphalia has the highest percentage of population under the age of 5 (10.5 percent) and over the age of 65 (30.4 percent). High percentages of vulnerable populations increases the risk of injury and death during natural disasters.

Mitigation Actions

The city recently completed raising the elevation of a commercial structure that is located within the floodplain.

Table 2.24 below shows the demographic and structure statistics, and **Table 2.25** describes the mitigation capabilities of the city.

Table 2.24. Demographic and Structure Risk Parameters For Westphalia

Jurisdiction	Total Population	With a Disability	Non-English Speaking Populations	People Below Poverty Level	Population Under 5 Yrs.	Population 65 Yrs. and Over	Residences Built Prior to 1939	Mobile Homes
Westphalia	411	54	2	21	43	125	53	0

Source: U.S. Census Bureau, 2016-2020 5-Years American Community Survey

Table 2.25. City of Westphalia Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	No
County Emergency Operations Plan	Yes – 10/2017
Local Recovery Plan	No
County Recovery Plan	No
City Mitigation Plan	No
County Mitigation Plan	Yes – 20167
Debris Management Plan	No
Economic Development Plan	Yes – Regional CEDS 2018
Transportation Plan	Yes – Regional 2021
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
FireWise or other fire mitigation plan	No
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	Yes – 2002
Building Code	No
Floodplain Ordinance	Yes – 6/2020
Subdivision Ordinance	No
Tree Trimming Ordinance	No
Nuisance Ordinance	No
Storm Water Ordinance	No
Drainage Ordinance	No
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Landscape Ordinance	Yes
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	No
Hazard Awareness Program	No
National Flood Insurance Program	Yes
NFIP Community Rating System (CRS) Participating Community	No
National Weather Service (NWS) Storm Ready	No
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No

Capabilities	Status Including Date of Document or Policy
ISO Fire Rating	7
Economic Development Program	No
Land Use Program	Yes
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	Yes
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	No
Hazard Analysis/Risk Assessment (County)	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Evacuation Route Map	No
Critical Facilities Inventory	Yes – Hazard Mitigation (2017) & Hazardous Materials (annual) Plans
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	No
Emergency Management Director	No
NFIP Floodplain Administrator	Yes
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	Yes – MLEPD
County Emergency Management Commission	No
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	Yes – Mid Missouri PHA
Regional Planning Agencies	Yes - MRPC
Historic Preservation	No
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	Yes – American Legion
Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.)	Yes – Lions, Knights of Columbus
Local Funding Availability	
Ability to apply for Community Development Block Grants	Yes
Ability to fund projects through Capital Improvements funding	Yes

Capabilities	Status Including Date of Document or Policy
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	Yes
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	Yes
Ability to withhold spending in hazard prone areas	Yes

Source: Data Collection Questionnaire, 2022

Table 2.26 summarizes the mitigation capabilities of Osage County and its jurisdictions.

Table 2.26. Mitigation Capabilities Summary Table

CAPABILITIES	Unincorporated Osage County	Argyle	Chamois	Freeburg	Linn	Meta	Westphalia
Planning Capabilities							
Comprehensive Plan	No	Yes – 02/01/2022	No	No	No	No	No
Builder's Plan	No	No	No	No	No	No	No
Capital Improvement Plan	No	Yes – 02/01/2022	No	No	No	No	No
City Emergency Operations Plan	N/A	No	No	No	No	Yes – 6/2014	No
County Emergency Operations Plan	Yes – 10/2017	Yes – 10/2017	Yes – 10/2017	Yes – 10/2017	Yes – 10/2017	Yes – 10/2017	Yes – 10/2017
Local Recovery Plan	No	No	No	No	No	No	No
County Recovery Plan	No	No	No	No	No	N/A	No
City Mitigation Plan	N/A	No	No	No	No	No	No
County Mitigation Plan	Yes – 2017	Yes – 2017	Yes – 2017	Yes – 2017	Yes – 2017	Yes – 2017	Yes – 2017
Debris Management Plan	No	No	No	No	No	No	No
Economic Development Plan	Yes – CEDS 2018	Yes – CEDS 2018	Yes – CEDS 2018	Yes – CEDS 2018	Yes – CEDS 2018	Yes – CEDS 2018	Yes – CEDS 2018
Transportation Plan	Yes – Regional 2021	Yes – Regional 2021	Yes – Regional 2021	Yes – Regional 2021	Yes – Regional 2021	Yes – Regional 2021	Yes – Regional 2021
Land-use Plan	No	No	No	No	No	No	No
Flood Mitigation Assistance (FMA) Plan	No	No	No	No	No	No	No
Watershed Plan	No	No	No	No	No	No	No
Firewise or other fire mitigation plan	No	No	No	No	No	No	No
Critical Facilities Plan (Mitigation/Response/Recovery)	Yes	No	No	No	No	No	No
Policies/Ordinances							
Zoning Ordinance	No	No	No	No	Yes	No	Yes – 2002

CAPABILITIES	Unincorporated Osage County	Argyle	Chamois	Freeburg	Linn	Meta	Westphalia
Building Code	No	No	No	No	Yes – IBC	No	No
Floodplain Ordinance	Yes – 9/2012	Yes – 8/14/2012	Yes – 1/14/2021	No	Yes – 2012	Yes – 4/11/2012	Yes – 6/2020
Subdivision Ordinance	No	No	No	No	Yes	No	Yes
Tree Trimming Ordinance	No	No	Yes	No	No	No	No
Nuisance Ordinance	No	Yes	Yes	Yes	Yes	Yes	No
Storm Water Ordinance	No	No	No	No	No	No	No
Drainage Ordinance	No	No	No	No	No	No	No
Site Plan Review Requirements	No	No	No	No	Yes	No	No
Historic Preservation Ordinance	No	No	No	No	No	No	No
Landscape Ordinance	No	No	Yes	No	No	No	Yes
Program							
Zoning/Land Use Restrictions	No	No	No	No	Yes	No	Yes
Codes Building Site/Design	No	No	No	No	No	No	No
Hazard Awareness Program	No	No	Yes	No	No	No	No
National Flood Insurance Program	Yes	Yes	Yes	No	Yes	Yes	Yes
NFIP Community Rating System (CRS) Participating Community	No	No	No	No	No	No	No
National Weather Service (NWS) Storm Ready	No	No	No	No	No	No	No
Firewise Community Certification	No	No	No	No	No	No	No
Building Code Effectiveness Grading (BCEGs)	No	No	No	No	No	No	No
ISO Fire Rating	Varies	7	10	6	5	7	7
Economic Development Program	No	No	No	No	No	No	No
Land Use Program	No	No	No	No	No	No	Yes
Public Education/Awareness	No	No	Yes	No	No	No	No
Property Acquisition	No	No	Yes	No	No	No	No
Planning/Zoning Boards	No	No	No	No	Yes	No	Yes

CAPABILITIES	Unincorporated Osage County	Argyle	Chamois	Freeburg	Linn	Meta	Westphalia
Stream Maintenance Program	No	No	No	No	No	No	No
Tree Trimming Program	No	No	No	Yes	No	No	No
Engineering Studies for Streams (Local/County/Regional)	No	No	Yes	No	No	No	No
Mutual Aid Agreements	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Studies/Reports/Maps							
Hazard Analysis/Risk Assessment (City)	No	No	No	No	No	No	No
Hazard Analysis/Risk Assessment (County)	Yes – 2017, 2021	Yes – 2017, 2021	Yes – 2017, 2021	Yes – 2017, 2021	Yes – 2017, 2021	Yes – 2017, 2021	Yes – 2017, 2021
Evacuation Route Map	No	No	Yes	No	No	No	No
Critical Facilities Inventory	Yes – 2017, 2021	Yes – 2017, 2021	Yes – 2017, 2021	Yes – 2017, 2021	Yes – 2017, 2021	Yes – 2017, 2021	Yes – 2017, 2021
Vulnerable Population Inventory	No	No	No	No	No	No	No
Land Use Map	No	No	No	No	Yes	No	No
Staff/Department							
Building Code Official	No	No	No	No	No	No	No
Building Inspector	No	No	No	No	No	No	No
Mapping Specialist (GIS)	Yes	No	No	No	No	No	No
Engineer	No	No	No	No	No	Yes	No
Development Planner	No	No	No	No	No	No	No
Public Works Official	Yes	No	Yes	No	Yes	No	No
Emergency Management Director	Yes	Yes	Yes	No	No	Yes	No
NFIP Floodplain Administrator	Yes	Yes	Yes	No	Yes	Yes	Yes
Bomb and/or Arson Squad	No	No	No	No	No	No	No
Emergency Response Team	No	No	Yes	No	No	No	No
Hazardous Materials Expert	No	No	Yes	No	No	No	No
Local Emergency Planning Committee	Yes - MLEPD	Yes - MLEPD	Yes - MLEPD	Yes - MLEPD	Yes - MLEPD	Yes - MLEPD	Yes - MLEPD
County Emergency Management Commission	No	No	No	No	No	No	No
Sanitation Department	No	No	Yes	Yes	No	No	No

CAPABILITIES	Unincorporated Osage County	Argyle	Chamois	Freeburg	Linn	Meta	Westphalia
Transportation Department	No	No	No	No	No	No	No
Economic Development Department	No	No	No	No	No	No	No
Housing Department	Yes – Mid Missouri PHA	Yes – Mid Missouri PHA	Yes – Mid Missouri PHA	Yes – Mid Missouri PHA	Yes – Mid Missouri PHA	Yes – Mid Missouri PHA	Yes – Mid Missouri PHA
Regional Planning Agencies	Yes - MRPC	Yes - MRPC	Yes - MRPC	Yes - MRPC	Yes - MRPC	Yes - MRPC	Yes - MRPC
Historic Preservation	No	No	No	No	No	No	No
Non-Governmental Organizations (NGOs)							
American Red Cross	Yes	No	No	No	No	No	No
Salvation Army	Yes	No	No	No	No	No	No
Veterans Groups	Yes	Yes	Yes	Yes	Yes	No	Yes
Environmental Organization	No	No	No	No	No	No	No
Homeowner Associations	No	No	No	No	No	No	No
Neighborhood Associations	No	No	No	No	No	No	No
Chamber of Commerce	No	No	No	No	No	No	No
Community Organizations (Lions, Kiwanis, etc.)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Resources							
Ability to apply for Community Development Block Grants	Yes	Yes	Yes	No	Yes	Yes	Yes
Ability to fund projects through Capital Improvements funding	Yes	Yes	Yes	No	Yes	Yes	Yes
Authority to levy taxes for a specific purpose	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fees for water, sewer, gas, or electric services	No	Yes	Yes	Yes	Yes	Yes	Yes
Impact fees for new development	No	No	Yes	No	Yes	No	Yes
Ability to incur debt through general obligation bonds	Yes	Yes	Yes	No	Yes	No	Yes

CAPABILITIES	Unincorporated Osage County	Argyle	Chamois	Freeburg	Linn	Meta	Westphalia
Ability to incur debt through special tax bonds	Yes	Yes	Yes	Yes	Yes	No	Yes
Ability to incur debt through private activities	No	Yes	Yes	No	No	No	Yes
Ability to withhold spending in hazard prone areas	No	No	Yes	No	No	No	Yes

Source: Data Collection Questionnaires, 2022

2.2.8 Public School District Profiles and Mitigation Capabilities

The following school districts are participating jurisdictions in this plan: Osage County R-I, Osage County R-II, and Osage County R-III. As public institutions responsible for the care and education of the county's children, these school districts share an interest with Osage County in public safety and hazard mitigation planning. **Figure 2.6** provides the boundaries of the school districts participating in this planning process.

Technical and Fiscal Resources

Osage County R-I and R-II both have NOAA all hazard radios on site to provide early warning of hazard events. Each school district has fire alarms and intercom systems capable of providing specific instructions in the event of an emergency.

Existing Plans and Policies

All three school districts have an emergency management plan and weapons policy.

Other Mitigation Activities

All schools participating in the plan conduct regular fire, earthquake, tornado drills, and lock-down security training at varying frequencies from quarterly to once an academic year. None of the districts have a designated safe area for tornados that meets FEMA standards.

New Construction

Osage County R-I purchased a new modular for the preschool since the last plan update. In the next five years they hope to start additions to buildings to take the place of the modular units.

Osage County R-II has not done any construction since the last plan update and does not have plans for any additions or construction in the next five years.

Osage County R-III completed a remodel of the entire upstairs of the elementary school since the last plan revision. The district does not have specific plans for additions in the next five years.

Table 2.27. School District Buildings and Enrollment Data, 2022

District Name	Building Name	Enrollment
Osage County R-I		
	Osage County Elementary	75
	Chamois High School	65
Osage County R-II		
	Osage County Elementary	295
	Linn High School	324
Osage County R-III		
	Fatima Elementary	278
	Fatima High School	520

Source: <https://dese.mo.gov/directory>

Figure 2.6. Osage County School Districts

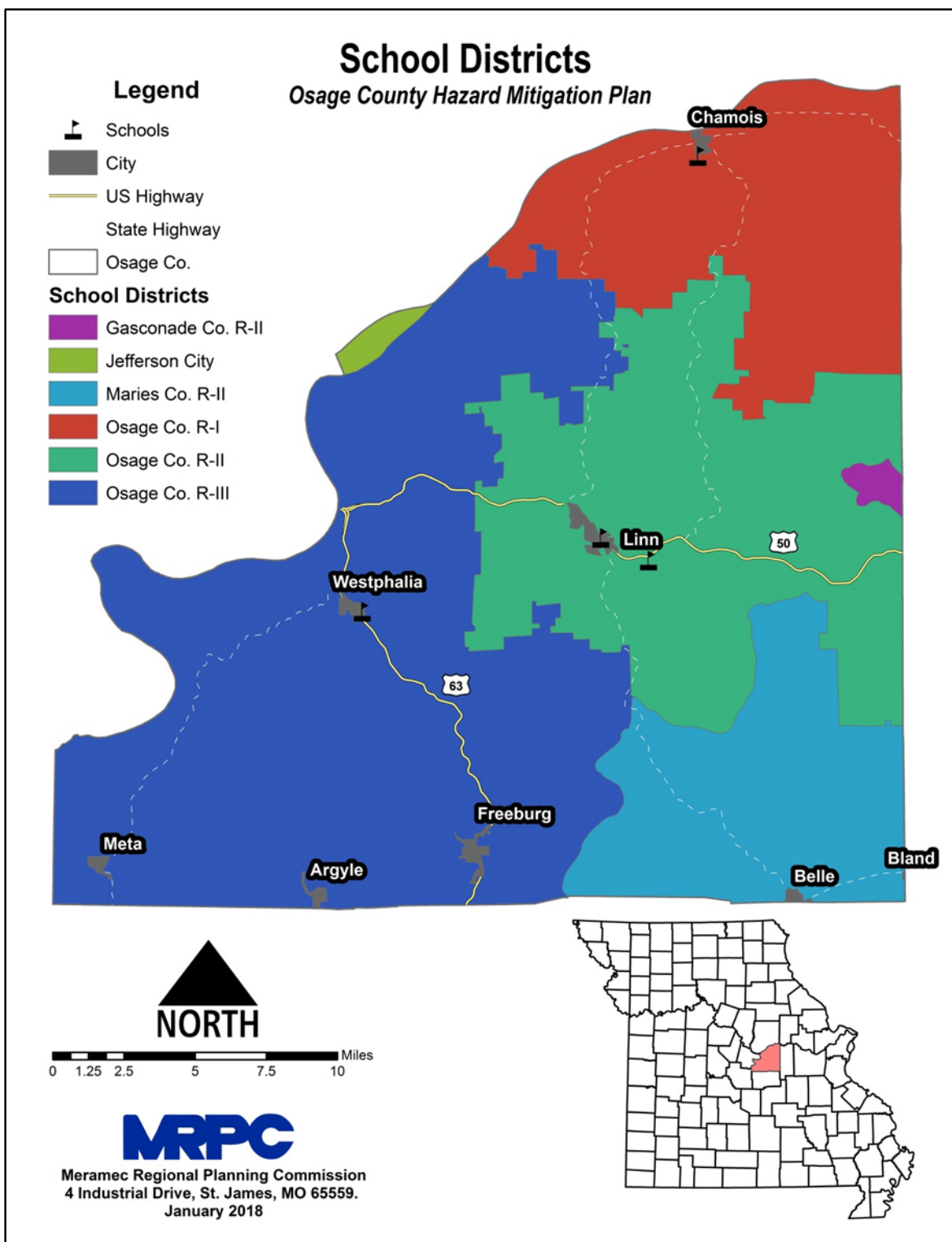


Table 2.28. Summary of Mitigation Capabilities for School Districts

Capability	Osage Co. R-I	Osage Co. R-II	Osage Co. R-III
Planning Elements			
Master Plan/Date	Yes – 11/2020	No	No
Capital Improvement	No	Yes - 2019	Yes – May 2021
School Emergency Plan/Date	Yes – 8/2021	Yes - 2020	Yes – 7/2021
Weapons Policy/Date	Yes – 8/2021	Yes - 2010	Yes – 7/20/2005
Personnel Resources			
Full-Time Building Official (Principle)	Yes	Yes	Yes
Emergency Manager	No	No	Yes
Grant Writer	No	No	Yes
Public Information Officer	No	No	Yes
Financial Resources			
Capital Improvements Project Funding	Yes	Yes	No
Local Funds	Yes	Yes	Yes
General Obligation	Yes	Yes	Yes
Special Tax Bonds	No	Yes	No
Private Activities/Donations	Yes	Yes	Yes
State and Federal Funds/Grants	Yes	Yes	Yes
Other			
Privately or Self-Insured?	MUSIC	Privately	MUSIC
Fire Evacuation Training	Annual	Quarterly	Biannually
Tornado Sheltering Exercises	Annual	Quarterly	Biannually
Public Address/Emergency Alert System	PA System	PA System	PA System
NOAA Weather Radios	Yes	No	No
Lock-Down Security Training	Annual	Quarterly	Biannually
Mitigation Programs	No	No	No
Tornado Shelter/Safe-room	No	No	Designated areas - not FEMA
Campus Police	No	No	No

Source: Data Collection Questionnaires, 2022

State Technical College of Missouri is located in Linn, MO and is the only post-secondary schools in Osage County (**Table 2.29**).

Table 2.29. Osage County Colleges/Universities

College/University	Location	Description	Enrollment
State Technical College of Missouri	One Technology Drive, Linn, MO 65051	Associates Degree and Certificates	2,037

3 RISK ASSESSMENT

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Hazard Profile	3.45
Vulnerability.....	3.54
Problem Statement.....	3.59
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Hazard Profile	3.60
Vulnerability.....	3.72
Problem Statement.....	3.74
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Hazard Profile	3.75
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Problem Statement.....	3.92
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	3.1

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Hazard Profile	3.182
Vulnerability.....	3.186
Problem Statement.....	3.194

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

The goal of the risk assessment is to estimate the 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.

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 Future Land Use and Development** discusses areas of planned future development
- **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 primary phase in the development of a hazard mitigation plan is to identify specific hazards which may impact the planning area. To initiate this process, the Hazard Mitigation Planning Committee (HMPC) reviewed a list of natural hazards provided by the Federal Emergency Management Agency (FEMA). From that list, the HMPC selected pertinent natural hazards of concern that have the potential to impact Osage County. These selected natural hazards are further profiled and analyzed in this plan.

3.1.1 Review of Existing Mitigation Plans

Within the State of Missouri, local hazard mitigation plans customarily include only natural hazards, as only natural hazards are required by federal regulations. Nevertheless, there is an opportunity to include man made or technical hazards within the plan. However, it was decided that only natural hazards were appropriate for the purpose of this plan. Based on past history and future probability, the Hazard Mitigation Planning Committee (HMPC) determined that the following potential hazards would be included in the Osage County Hazard Mitigation Plan:

- Dam Failure
- Drought
- Earthquake
- Extreme Temperatures
- Wildfires
- Flooding (Riverine and Flash)
- Land Subsidence/Sinkholes
- Levee Failure
- Severe Thunderstorms Including High Winds, Lightning, and Hail
- Tornado
- Severe Winter Weather

Hazards not occurring in the planning area or considered insignificant were eliminated from this plan. **Table 3.1** outlines the hazards eliminated from the plan and the reasons for doing so. Additionally, some hazards were combined in the Osage County Plan to match the hazards listed in the Missouri State Hazard Mitigation Plan.

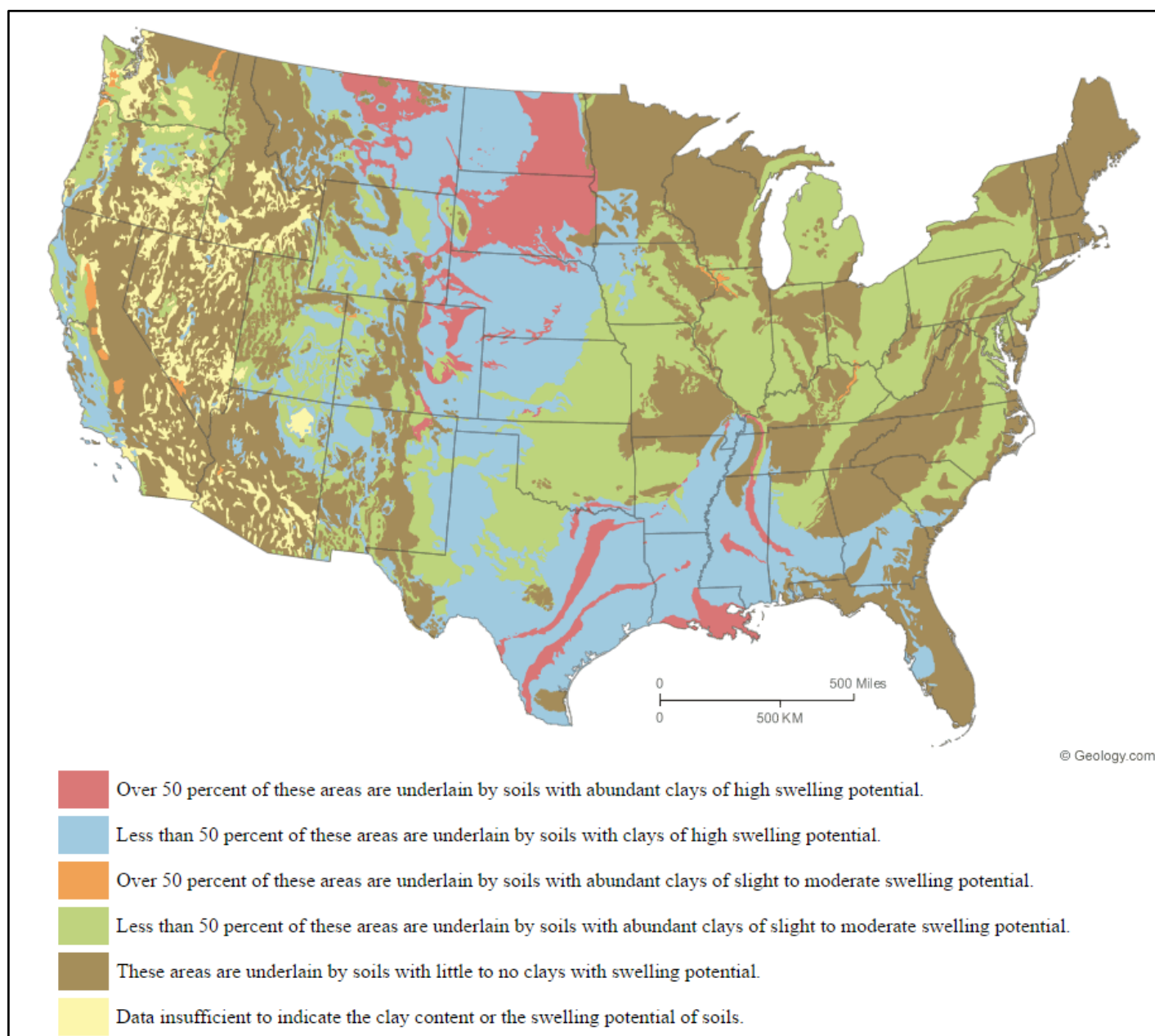
Table 3.1. Hazards Not Profiled in the Plan

Hazard	Reason for Omission
Avalanche	No mountains in the planning area.
Coastal Erosion	Planning area is located in the Midwest, not on any coast.
Coastal Storm	Planning area is located in the Midwest, not on any coast.
Debris Flow	There are no mountainous areas in the planning area where this type of event occurs.

Hazard	Reason for Omission
Expansive Soils	No expansive soils exist within the planning area. According to the USGS National Geologic Map Database ¹ , the planning area is underlain by soils with little to no clays with swelling potential (Figure 3.1).
Hurricane	Planning area is located in the Midwest, not on any coast.
Volcano	There are no volcanic areas in the county.

¹ http://ngmdb.usgs.gov/Prodesc/proddesc_10014.htm

Figure 3.1. Swelling clays map of the conterminous United States



Source: http://ngmdb.usgs.gov/Prodesc/proddesc_10014.htm

3.1.2 Review Disaster Declaration History

In order to assess risk, it was logical to review the disaster declaration history for the State of Missouri and specifically for Osage County. Federal and State disaster declarations are granted when the severity and magnitude of a hazard event surpasses the ability of local government to respond and recover. Disaster assistance is initiated when the local government's response and recovery capabilities have been exhausted. In this type of situation, the state may declare a disaster and provide resources from the state level. If the disaster is so great that state resources are also overwhelmed, a federal disaster may be declared in order to allow for federal assistance.

There are three agencies through which a federal disaster declaration can be issued – FEMA, the U.S. Department of Agriculture (USDA) and/or the Small Business Administration. A federally declared disaster generally includes long-term federal recovery programs. The type of declaration is determined by the type of damage sustained during a disaster and what types of institutions or industries are affected.

A declaration issued by USDA indicates that the affected area has suffered at least a 30 percent loss in one or more crops or livestock industries. This type of declaration provides those farmers affected with access to low-interest loans and other programs to assist with disaster recovery and mitigation.

Missouri has been especially hard hit by natural disasters in the recent past. The state has had 72 federally declared disasters since 1953. Of those, 35 have occurred since 2002. Most of these disasters have been weather related – severe wind and rain storms, tornadoes, flooding, hail, ice storms and winter storms. **Table 3.2** lists the federal disaster declarations for Osage County from 2001 to 2020.

Table 3.2. FEMA Disaster Declarations that included Osage County, Missouri, 2001-2020

Disaster Number	Description	Incident Period & Declaration Date	Individual Assistance (IA) Public Assistance (PA)
DR-1412	Missouri Severe Storms & Tornadoes	Incident Period: April 24, 2002-June 10, 2002 Declaration Date: May 06, 2002	IA
DR-1463	Missouri Severe Storms, Tornadoes and Flooding	Incident Period: May 04, 2003-May 30, 2003 Declaration Date: May 06, 2003	IA, PA
EM-3232	Missouri Hurricane Katrina Evacuation	Incident Period: August 29, 2005-October 1, 2005 Declaration Date: September 10, 2005	PA
DR-1676	Missouri Severe Winter Storms and Flooding	Incident Period: January 12, 2007 – January 22, 2007 Declaration Date: January 15, 2007	PA

Disaster Number	Description	Incident Period & Declaration Date	Individual Assistance (IA) Public Assistance (PA)
DR-1708	Missouri Severe Storms & Flooding	Incident Period: May 05, 2007-May 18, 2007 Declaration Date: June 11, 2007	IA
DR-1736	Missouri Severe Winter Storms	Incident Period: December 06, 2007-December 17, 2007 Declaration Date: December 27, 2007	PA
EM-3281	Missouri Severe Winter Storms	Incident Period: December 08, 2007-December 15, 2007 Declaration Date: December 12, 2007	PA
DR-1749	Missouri Severe Storms & Flooding	Incident Period: March 17, 2008-May 09, 2008 Declaration Date: March 19, 2008	IA, PA
DR-1809	Missouri Severe Storms, Flooding, and a Tornado	Incident Period: September 11, 2008-September 24, 2008 Declaration Date: November 13, 2008	IA
EM-3303	Missouri Severe Winter Storm	Incident Period: January 26, 2009-January 28, 2009 Declaration Date: January 30, 2009	PA
EM-3325	Missouri Flooding	Incident Period: June 01, 2011-August 01, 2011 Declaration Date: June 30, 2011	PA
EM-3317	Missouri Severe Winter Storm	Incident Period: January 31, 2011-February 05, 2011 Declaration Date: February 03, 2011	PA
DR-1961	Missouri Severe Winter Storm & Snowstorm	Incident Period: January 31, 2011-February 05, 2011 Declaration Date: March 23, 2011	PA
DR-4130	Missouri Severe Storms, Straight-line Winds, Tornadoes, and Flooding	Incident Period: May 29, 2013-June 11, 2013 Declaration Date: July 18, 2013	PA
DR-4144	Missouri Severe Storms, Straight-line Winds, and Flooding	Incident Period: August 02, 2013-August 14, 2013 Declaration Date: September 06, 2013	PA

Disaster Number	Description	Incident Period & Declaration Date	Individual Assistance (IA) Public Assistance (PA)
DR-4238	Missouri Severe Storms, Tornadoes, Straight-line Winds, and Flooding	Incident Period: May 15, 2015-July 27, 2015 Declaration Date: August 07, 2015	PA
EM-3374	Missouri Severe Storms, Tornadoes, Straight-line Winds, and Flooding	Incident Period: December 22, 2015-January 09, 2016 Declaration Date: January 02, 2016	PA
DR-4250	Missouri Severe Storms, Tornadoes, Straight-line Winds, and Flooding	Incident Period: December 23, 2015-January 09, 2016 Declaration Date: January 21, 2016	IA
DR-4317	Missouri Severe Storms, Tornadoes, Straight-line Winds, and Flooding	Incident Period: April 28, 2017-May 11, 2017 Declaration Date: June 02, 2017	IA, PA
DR-4451	Missouri Severe Storms, Tornadoes, and Flooding	Declaration Date: July 9, 2019 Incident Period: April 29, 2019 to July 6, 2019	IA
EM-3482	Missouri COVID-19	Declaration Date: March 13, 2020 Incident Period: January 20, 2020, and continuing	PA
DR-4490	Missouri COVID-19 Pandemic	Declaration Date: March 26, 2020 Incident Period: January 20, 2020, and continuing	IA, PA

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

3.1.3 Research Additional Sources

List of the additional sources of data on locations and past impacts of hazards in the planning area:

- Missouri Hazard Mitigation Plans (2013, 2018)
- 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
 - Missouri Public Service Commission
 - National Fire Incident Reporting System (NFIRS)
 - National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI);
 - Pipeline and Hazardous Materials Safety Administration
 - County and local Comprehensive Plans to the extent available
 - County Emergency Management
 - 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 (sources are cited in the body of the Plan)

Remarkably, 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. Those using information from NCEI should be cautious as the NWS does not guarantee the accuracy or validity of the information.

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. They do not represent current dollar values.

The database currently contains data from January 1950 to present, 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.

3.1.4 Hazards Identified

Table 3.3 lists the hazards that significantly impact each jurisdiction within the planning area and were chosen for further analysis in alphabetical order. However, not all hazards impact every jurisdiction such as dam failure. “X” indicates the jurisdiction is impacted by the hazard, and a “-” indicates the hazard is not applicable to that jurisdiction. As Osage County is predominately rural, limited variations occur across the county. However, jurisdictions with a high percentage of housing comprised of mobile homes, for example, could be more at risk to damages from a tornado.

Table 3.3. Hazards Identified for Each Jurisdiction

Jurisdiction	Dam Failure	Drought	Earthquake	Extreme Heat	Fires (Urban/Structural and wild)	Flooding (River and Flash)	Land Subsidence/Sinkholes	Levee Failure	Thunderstorms/High Winds/ Lightning/Hail	Tornado	Severe Winter Weather
Osage Co.	x	x	x	x	x	x	x	x	x	x	x
Argyle	x	x	x	x	x	x	x	-	x	x	x
Chamois	x	x	x	x	x	x	x	x	x	x	x
Freeburg	x	x	x	x	x	x	x	-	x	x	x
Linn	x	x	x	x	x	x	x	-	x	x	x
Meta	x	x	x	x	x	x	x	-	x	x	x
Westphalia	x	x	x	x	x	x	x	-	x	x	x
School Districts											
Osage Co. R-I	x	x	x	x	x	x	x	x	x	x	x
Osage Co. R-II	x	x	x	x	x	x	x	-	x	x	x
Osage Co. R-III	x	x	x	x	x	x	x	-	x	x	x

3.1.5 Multi-Jurisdictional Risk Assessment

For this multi-jurisdictional hazard mitigation plan, each hazard is profiled in which the risks are assessed on a planning area wide basis. Some hazards, such as dam failure, vary in risk across the county. If variations exist within the planning area, discussion is included in each profile. Osage County is uniform across the county in terms of climate, topography, and building construction characteristics. Weather-related hazards will impact the entire county in much the same fashion, as do topographical/geological related hazards such as earthquake. Sinkholes are widespread in the county, but more localized in their effects. Areas of urbanization include Chamois, Freeburg, Linn, Meta, and Westphalia. These urbanized areas have more assets at a greater density, and therefore have greater vulnerability to weather-related hazards. Rural areas include agricultural assets (livestock/crops) that are also vulnerable to damages. Differences among jurisdictions for each hazard will be discussed in greater detail in the vulnerability section of each hazard.

3.2 Assets at Risk

This section assesses the planning area's population, structures, critical facilities, infrastructure, and other important assets that may be at risk to hazards.

3.2.1 Total Exposure of Population and Structures

Unincorporated County and Incorporated Cities

In the following three tables, population data is based on 2020 Census Bureau data. Building counts values are based on parcel data provided by the 2018 Missouri State Hazard Mitigation Plan, which can be found at the following website,

https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf.

Table 3.4. Maximum Population and Building Exposure by Jurisdiction

Jurisdiction	2020 Population	Building Count	Building Exposure (\$)	Contents Exposure (\$)	*Total Exposure (\$)
Argyle	144	108	\$13,923,000	\$7,641,000	\$21,564,000
Chamois	377	207	\$54,117,000	\$23,964,000	\$78,081,000
Freeburg	409	280	\$42,706,000	\$24,470,000	\$67,175,000
Linn	1,350	525	\$95,294,000	\$51,818,000	\$147,112,000
Meta	180	170	\$34,985,000	\$30,298,000	\$65,175,000
Westphalia	378	185	\$31,964,000	\$15,981,000	\$47,945,000
Unincorporated Osage County	10,436	12,538	\$771,522,000	\$400,093,000	\$1,171,615,000
Total	13,274	14,100	\$1,044,511,000	\$554,265,000	\$1,598,776,000

Sources: U.S. Census Bureau, 2020 DEC Redistricting Data, 2018 Missouri State Hazard Mitigation Plan, 2021 Questionnaire

Table 3.5. Building Value/Exposure by Usage Type

Jurisdiction	Agriculture	Commercial	Education	Government	Industrial	Residential	Total
Argyle	\$54	\$2,352	\$0	\$476	\$0	\$18,682	\$21,564
Chamois	\$0	\$6,047	\$18,264	\$952	\$10,720	\$42,098	\$78,081
Freeburg	\$52	\$12,095	\$0	\$476	\$0	\$54,553	\$67,175
Linn	\$2	\$18,478	\$6,849	\$3,332	\$5,360	\$113,091	\$147,112
Meta	\$0	\$7,391	\$0	\$952	\$26,799	\$30,141	\$65,283
Westphalia	\$41	\$8,735	\$4,566	\$476	\$0	\$34,127	\$47,945
Osage County	\$18,206	\$57,785	\$36,529	\$4,760	\$64,318	\$967,999	\$1,149,596
Total	\$18,356	\$114,226	\$66,208	\$11,425	\$107,196	\$1,281,365	\$1,598,776

Source: FEMA HAZUS, Missouri State Hazard Mitigation Plan

* All values in 1,000s of dollars.

Table 3.6. Building Counts by Usage Type

Jurisdiction	Residential Counts	Commercial Counts	Industrial Counts	Agricultural Counts	Other (Govt./ Education)	Total
Argyle	75	7	0	25	1	108
Chamois	169	18	10	0	10	207
Freeburg	219	36	0	24	1	280
Linn	454	55	5	1	10	525
Meta	121	22	25	0	2	170
Westphalia	137	26	0	19	3	185
Unincorporated	3,969	176	60	8,394	26	12,538
Total	5,144	340	100	8,463	53	14,100

Source: Missouri GIS Database, SEMA Mitigation Management Section

Table 3.7 below, provides additional information for school districts, including the number of 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 3.7. Population and Building Exposure by Jurisdiction-Public School Districts

Public School District	Enrollment	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
Osage Co. R-I	140	10	9,578,952	1,463, 940	11,149,134
Osage Co. R-II	619	6	18,667,704	3,225,127	21,892,531
Osage Co. R-III	858	5	32,660,000	2,115,000	34,775,000

Source: <https://apps.dese.mo.gov/MCDS/home.aspx?categoryid=1&view=2>; 2021 Data Collection Questionnaire

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.

The table below (**Table 3.8**) provides information for critical facilities in the planning area. Specific information includes a Hazus ID if applicable, jurisdiction, building name/owner, and address. Facilities addressed include emergency, fire departments, law enforcement, medical and schools.

Table 3.8 Osage County Critical Facilities by Type and Jurisdiction

HazusID	Jurisdiction	Building Name	Address	City	State	Zip
Emergency Facilities						
	Osage Co.	Osage Co. E-911	205 E. Main St.	Linn	MO	65051
	Osage Co.	Emergency Management Director	205 E. Main St.	Linn	MO	65051
Fire Department Facilities						
	Argyle	Argyle Volun. Fire Dept. #1	223 3 rd St.	Argyle	MO	65001
	Chamois	Chamois Volunteer Fire Dept.	200 S Main St.	Chamois	MO	65024
	Chamois	Chamois Volunteer Fire Dept.	338 E Missouri Ave.	Chamois	MO	65024
	Freeburg	Freeburg Comm. Fire Assoc. #1	600 Hwy. 63	Freeburg	MO	65035
	Freeburg	Freeburg Comm. Fire Assoc. #2	4339 HWY U	Rich Fountain	MO	65035
	Linn	Linn Fire Prot. Dist. #1	210 W. Main St.	Linn	MO	65051
MO000400	Linn	Linn Fire Prot. Dist. #2	1986 HWY A	Bonnots Mill	MO	65051
MO000679	Linn	Linn Fire Prot. Dist. #3	633 HWY 89 N	Linn	MO	65051
MO000401	Linn	Linn Fire Prot. Dist. #4	1200 E. Main St.	Linn	MO	65051
	Linn	Linn Fire Prot. Dist. #5	100 S. Clay St.	Linn	MO	65051
MO000402	Meta	Meta Fire & Rescue	112 E Third St.	Meta	MO	65058
	Westphalia	Westphalia Fire Prot. Dist.	3388 County Road 503	Westphalia	MO	65085
	Westphalia	Westphalia Fire Prot. Dist.	1926 HWY 63	Westphalia	MO	65085
Law Enforcement Facilities						
MO000165	Linn	Linn Police Dept.	1200 E Main St.	Linn	MO	65051
MO000015	Osage Co.	Osage County Sheriff's Office	106 Main St.	Linn	MO	65051
Medical Facilities						
	Linn	Capital Region Physicians - Linn	916 E. Main St.	Linn	MO	65051
	Linn	Community Health Center of Central Missouri	1016 E Main St.	Linn	MO	65051
	Linn	JCMG Family Care Clinic - Linn	1306 E Main St.	Linn	MO	65051
	Linn	Osage Ambulance District	119 MO-89	Linn	MO	65051
	Meta	Comm-Unity Ambulance Service	PO Box 132, Locust Street	Meta	MO	65058
	Belle	Osage Ambulance District	1001 E. First St.	Belle	MO	65013
	Osage County	Osage Co. Health Dept	205 E Main St.	Linn	MO	65051
School Facilities						

HazusID	Jurisdiction	Building Name	Address	City	State	Zip
HazusID	Jurisdiction	Building Name	Address	City	State	Zip
MO001582	Bonnotes Mill	St. Mary's School	1641 HWY C	Bonnotes Mill	MO	65016
MO002940	Chamois	Chamois Elem.	614 S Poplar St.	Chamois	MO	65024
MO002941	Chamois	Chamois High	614 S Poplar St.	Chamois	MO	65024
MO001256	Freeburg	Holy Family School	110 W Oliver St.	Freeburg	MO	65035
MO002942	Linn	Linn Elem.	141 Wildcat Dr.	Linn	MO	65051
MO000710	Linn	Linn High	141 Wildcat Dr.	Linn	MO	65051
MO001253	Linn	St. George Elem. School	601 E Main St.	Linn	MO	65051
MO001581	Loose Creek	Immaculate Conception School	147 County Road 402	Loose Creek	MO	65054
MO001255	Rich Fountain	Sacred Heart School	4309 HWY U	Rich Fountain	MO	65035
MO001093	Westphalia	Fatima Elem.	143 E Main	Westphalia	MO	65085
MO001796	Westphalia	Fatima High	143 E Main	Westphalia	MO	65085
MO001254	Westphalia	St. Joseph Catholic School	123 E Main St.	Westphalia	MO	65085
Childcare Facilities						
	Belle	Doodlebugs Learning Center LLC	501 E First St.	Belle	MO	65013
	Bonnotes Mill	Blauvelt, Whitney Ann	93 Vosholl Ln.	Bonnotes Mill	MO	65016
	Bonnotes Mill	Jansen, Kim D	71 Cote Dessein Ln.	Bonnotes Mill	MO	65016
	Chamois	Osage County R-I School District	614 S Poplar St.	Chamois	MO	65024
	Chamois	The Sunflower Patch	59 Sunflower Ln.	Chamois	MO	65024
	Freeburg	Roberson, Megan	23 County Road 521	Freeburg	MO	65035
	Jefferson City	Little Sprout's Clubhouse LLC	332 County Road 501	Jefferson City	MO	65101
	Jefferson City	Miss Kathy's Preschool LLC	62 Playtime Ln.	Jefferson City	MO	65101
	Linn	Central Missouri Community Action	1315 E Main St. # b	Linn	MO	65051
	Linn	Bartlett, Nicky and Hoffman, Kim	3785 Highway U	Linn	MO	65051
	Linn	Dudenhoeffer, Judy A	371 Highway 100	Linn	MO	65051
	Linn	Jacobs, Erin Lucero	13 County Road 804	Linn	MO	65051
	Linn	Scheulen, Deidre Anne	657 County Road 606	Linn	MO	65051
	Linn	Mimi's Playschool	24 Boonedocks Trail	Linn	MO	65051
	Linn	The Schoolhouse Childcare LLC	1214 E Lee St. Ste. E	Linn	MO	65051
	Loose Creek	Bailey's Learn & Play, LLC	191 County Road 402	Loose Creek	MO	65054
	Loose Creek	Creative Kids Learning Center, LLC	564 Loose Creek Highway	Loose Creek	MO	65054
	Loose Creek	Lisa's Little Ones	149 Rosetrail	Loose Creek	MO	65054
	St Thomas	Hoffman, Erica	400 N Olive St.	St Thomas	MO	65076
	Westphalia	Osage County R-III School District	1927 Highway 63	Westphalia	MO	65085

HazusID	Jurisdiction	Building Name	Address	City	State	Zip
Nursing Homes						
	Linn	Harbor Place – Linn	24 Trenshaw Trail	Linn	MO	65051
	Westphalia	Westphalia Hill Nursing Home	1899 Highway 63	Westphalia	MO	65085

Source: Hazard Mitigation Plan Data Collection Questionnaire (2020-2021); Missouri Department of Health and Senior Services website-health.mo.gov

Table 3.9 Includes a summary of the inventory of critical and essential facilities and infrastructure in the planning area. The list was compiled from the 2020 Data Collection questionnaire, the Meramec Regional Hazardous Materials Emergency Response Plan and the National Bridge Inventory.

Table 3.9. Inventory of Critical/Essential Facilities and Infrastructure by Jurisdiction

	Airport Facility	Bus Facility	Childcare Facility	Communications Tower	Electric Power Facility	Emergency Operations	Fire Service	Government	Housing	Shelters	State & Non-State Structures (Bridge)	Hospital/Health Care	Military	Natural Gas Facility	Pipeline/Pump Station	Nursing Homes	Police Station	Potable Water Facility	Rail	Sanitary Pump Stations	School Facilities	Stormwater Pump Stations	Tier II Chemical Facility	Wastewater Facility	Total
Unincorporated Osage County	1	-	9	22	1	-	2	1	4973	-	96	1	-	-	-	-	-	-	1	-	5	-	5	-	5,117
Town of Argyle	-	-	-	-	-	-	1	1	80	-	1	-	-	-	-	-	-	-	-	-	-	-	3	1	87
City of Chamois	0	0	2	1	0	0	2	1	300	0	1	0	0	0	0	0	0	0	1	2	2	-	2	1	315
Village of Freeburg	-	-	1	1	-	-	1	1	214	1	-	-	-	-	-	-	-	-	-	3	1	-	10	1	234
City of Linn	-	-	7	-	-	-	-	1	751	-	1	5	-	-	-	1	1	2	-	4	1	-	20	1	795
City of Meta	-	-	-	-	-	-	1	1	88	-	2	1	-	-	-	-	-	1	-	-	0	-	5	1	100
City of Westphalia	-	-	1	-	-	-	1	1	175	-	-	-	-	-	-	1	-	-	-	-	2	-	3	1	185
Totals	1	0	20	24	1	0	8	7	6581	1	101	7	0	0	0	2	1	3	2	9	11	-	48	6	6,833

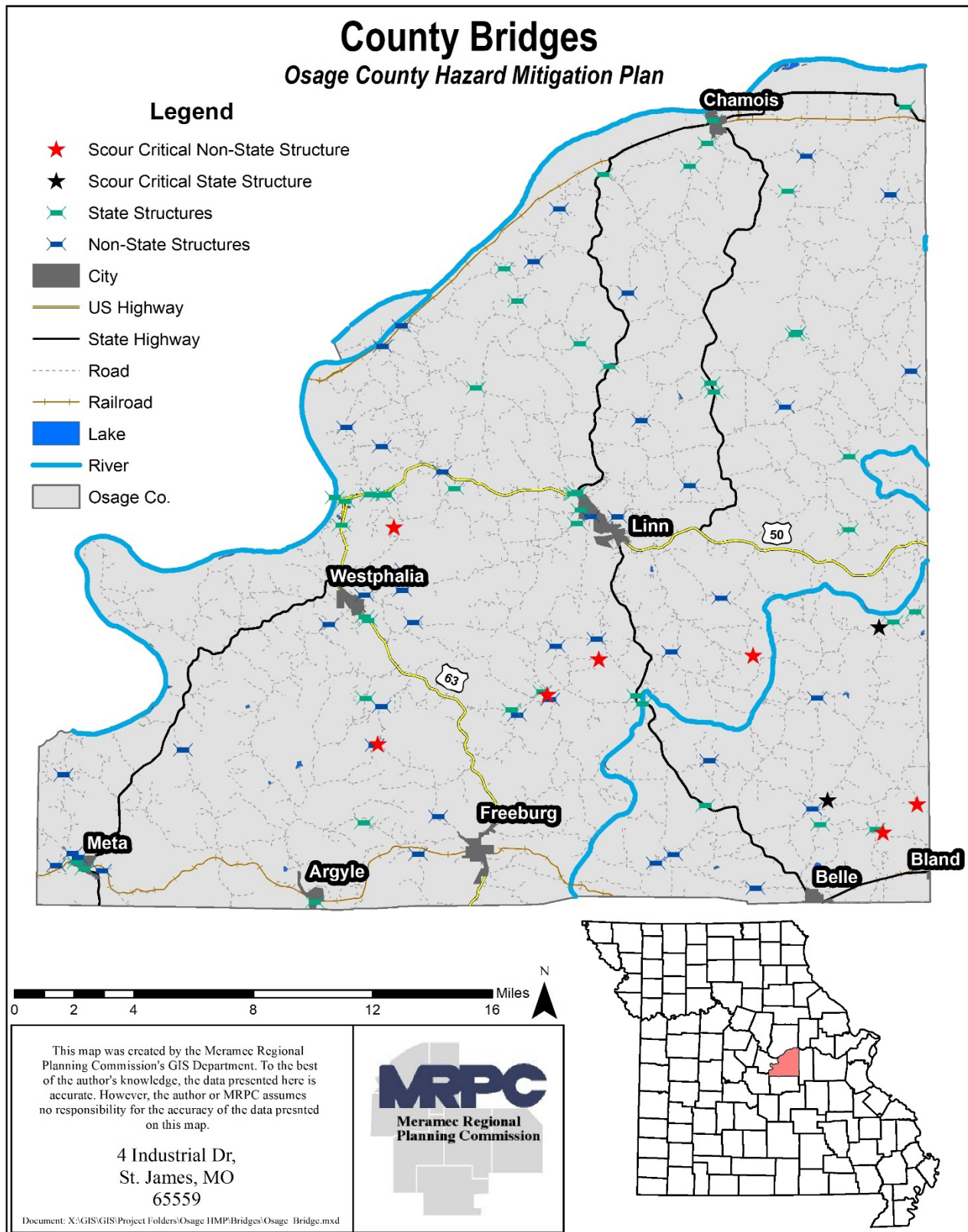
Source: 2020 Data Collection Questionnaires, National Bridge Inventory, Missouri Department of Health and Senior Services, Meramec Local Emergency Planning District, MPC, 2020

According to the National Bridge Inventory there are a total of 101 bridges in Osage County². **Figure 3.2** shows the locations of State regulated bridges and non-State bridges in the planning area. Scour critical bridges were also examined. 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 evaluated scour condition. There are nine scour critical bridge within Osage County. The County Rd 741 bridge crossing the Crider Creek, the County Rd 742 bridge crossing Crider Creek, the County Rd 625 bridge crossing Swan Creek, the County Rd. 806 bridge crossing Owens Creek, the County Rd 631 bridge crossing a branch of Brush Creek, the MO 89 South bridge over the Gasconade River, the Route HH East bridge crossing Baileys Creek, the County Rd 608 bridge crossing the Maries River, and County Rd 522 bridge crossing a branch of the Maries River all have a scour index of 3.³

² <http://www.fhwa.dot.gov/bridge/nbi/no10/county.cfm>

³ <https://infobridge.fhwa.dot.gov/Data/SelectedBridges#!/#OverviewTab>

Figure 3.2. Osage County Bridges



Source: MSDIS, MoDOT, MRPC

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 3.10** depicts Federally Threatened, Endangered, Proposed and Candidate Species in the county.

Table 3.10. Threatened and Endangered Species in Osage County

Common Name	Scientific Name	Status
Fish		
Niangua Darter	<i>Etheostoma nianguae</i>	Threatened (F) Endangered (S)
Pallid Sturgeon	<i>Scaphirhynchus albus</i>	Endangered (F) (S)
Lake Sturgeon	<i>Acipenser fulvescens</i>	Endangered (S)
Topeka Shiner	<i>Notropis topeka</i>	Endangered (S) (F)
Flathead Chub	<i>Platygobio gracilis</i>	Endangered (S)
Mammal		
Gray bat	<i>Myotis grisescens</i>	Endangered (F) (S)
Indiana bat	<i>Myotis sodalis</i>	Endangered (F) (S)
Eastern Spotted Skunk	<i>Spilogale putorius</i>	Endangered (S)
Northern long-eared bat	<i>Myotis septentrionalis</i>	Threatened (F)
Mollusk		
Ebonyshell	<i>Fusconaia ebena</i>	Endangered (S)
Elephantear	<i>Elliptio crassidens</i>	Endangered (S)
Pink mucket	<i>Lampsilis abrupta</i>	Endangered (F) (S)
Scaleshell	<i>Leptoea leptodon</i>	Endangered (F) (S)
Spectaclecase	<i>Cumberlandia monodonta</i>	Endangered (F)
Birds		
Northern Harrier	<i>Circus hudsonius</i>	Endangered (S)
Amphibian		
Eastern Hellbender	<i>Cryptobranchus alleganiensis</i>	Endangered (F) (S)
Flowering Plants		
Western Prairie Fringed Orchid	<i>Platanthera praeclara</i>	Threatened (F) Endangered (S)

Note: S = State, F = Federal

Source: U.S. Fish and Wildlife Service, <https://ecos.fws.gov/ecp/>;

MDC Endangered Field Guide, <https://nature.mdc.mo.gov/status/endangered>

Natural Resources: The Missouri Department of Conservation (MDC) provides a database of lands owned, leased, or managed for public use. **Table 3.11** provides the names and locations of parks and

conservation areas in Osage County.

Table 3.11. Conservation Areas in Osage County

Area Name	Address	Nearest City
Ben Branch Lake CA	From Linn, take Highway 89 northeast 10 miles, then County Road 314 west to the area.	Linn
Bonnot's Mill Access	From Bonnots Mill, take Riverview Drive west proceeding under the RR tracks, then County Road 416 west 0.50 mile to the access. Access is located 2.20 river miles above the mouth of the Osage River.	Bonnot's Mill
Bruns (Dr Bernard) Access	From Westphalia, take Highway 63 north, then County Road 609 east to the area.	Westphalia
Chamois Access	From Chamois, take Highway 100 west 0.10 miles.	Chamois
Cooper Hill CA	From Mt. Sterling, take Route A south 2.50 miles, then Route D west 2.75 miles to the village of Cooper	Mt. Sterling
Painted Rock CA	From Westphalia, take Highway 63 north, then Highway 133 west 7 miles to the area.	Westphalia
Pointers Creek Access	From Linn, take Route CC southeast 8 miles, then Route RA east to the access. (Route RA is impassable	Linn
Rollins Ferry Access	From Linn, take Highway 89 south 7 miles to the access.	Linn
Smoky Waters CA	From Osage City, take Engineer Road east 2 miles.	Osage City

Source: <https://nature.mdc.mo.gov/discover-nature/places>

Table 3.11 provides information pertaining to community owned/operated parks within Osage County.

Table 3.12. Community Owned Parks in Osage County

Park Name	Address	City
Chamois City Park	N City Park Rd.	Chamois
Freeburg City Park		Freeburg
Linn City Park	E Lee St	Linn
McGuire Park	McGuire Park Trail	Linn
Meta Community Park	Highway 133	Meta
Westphalia City Park	Highway 63	Westphalia

Source: Google Search

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. **Table 3.13** provides information regarding properties on the National Register of Historic Places in Osage County.

Table 3.13. Osage County Properties on the National Register of Historic Places

Property	Address	City	Date Listed
Bonnots Mill Historic District	Roughly Old Mill Rd., Riverside Dr., Highwater Rd., Iris Ave., Wildwood Ln., Hwy A and Main, Short and Church Hill St., Bonnots Mill	Bonnot's Mill	1/21/93
Chamois Public School	402 S. Main St.	Chamois	6/26/03
Dauphine Hotel	100 Iris St.	Bonnot's Mill	11/14/80
Huber's Ferry Farmstead Historic District	Jct. US 50 and US 63	-	1/15/99
Osage County Poorhouse	MO 621, 0.5 mi. S of Linn	Linn	2/13/98
St. Joseph Church	Main St.	Westphalia	4/11/72
Sacred Heart Catholic Church and Parsonage	SR U	Rich Fountain	9/09/82
Townley, Alvah Washington, Farmstead Historic District	304 S Market St.	Chamois	8/5/99
Zewicki, Dr. Enoch T. and Amy, House	402 E. Main St.	Linn	2/27/02

Source: Missouri Department of Natural Resources – Missouri National Register Listings by County
<https://mostateparks.com/page/84821/osage-county-national-register-listings>

Economic Resources: **Table 3.14** provides major non-government employers in the planning area. There are approximately 268 employer establishments within the county, employing on average 16 individuals each⁴.

Table 3.14. Major Non-Government Employers in Osage County

Employer Name	Product or Service	Employees
Lakeside	Distribution Center	125
Diamond Dog Food (Meta)	Manufacturer & Distribution	150
Osage Co. R-I	School	50
Osage Co. R-II	School	100
Osage Co. R-III	School	124
Play Mor Trailers	Manufacturer	80
Quaker Windows (Freeburg)	Manufacturing	900
Osage Industries	Ambulance Manufacturer	100-249
Jim Butler Linn Chevrolet	Automobile Dealer	50-99
Westphalia Hill Nursing Home	Nursing & Convalescent Homes	50-99
54 Foods Inc	Restaurants	50-99
Stonehearth Inn	Hotels & Motels	50-99
State Technical College of Missouri	Higher Education	230

Source: <https://meric.mo.gov/industry/business-locator>, 2021 Data Collection Questionnaires

Agriculture plays an important role in Osage County. However, the Agribusiness Employment Location Quotient for the county is 1.14, meaning that there is a slightly higher share of agribusiness employment than is the case nationwide⁵. In addition, there were 89 individuals working in the agriculture industry, comprising 1.28% of the total workforce in 2019⁶. Furthermore, the market value of products sold in 2017 was \$80,689,000; 78% from livestock sales and 22% from crop sales.⁷

3.3 Land Use and Development

3.3.1 Development Since Previous Plan

Table 3.15 provides population growth statistics for Osage County.

⁴ <https://www.census.gov/quickfacts/fact/table/osagecountymissouri,US/PST045219>

⁵ MERIC Department of Higher Education and Workforce Development

⁶ https://data.census.gov/cedsci/table?q=United%20States&t=Occupation&q=0400000US29_0500000US29151&tid=ACSST5Y2019.S2401&hidePreview=true

⁷ https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/2/table/1/state/MO/county/073/year/2017

Table 3.15. Osage County Population Growth, 2010-2020

Jurisdiction	Total Population 2010	Total population 2020	2010-2020 # Change	2010-2020 % Change
Unincorporated Osage County	10,806	10,436	-370	-3.4
Argyle	162	144	-18	-11.1
Chamois	396	377	-19	-5.3
Freeburg	437	409	-28	-6.4
Linn	1,459	1,350	-109	-7.5
Meta	229	180	-49	-21.4
Westphalia	389	378	-11	-2.8

Source: U.S. Bureau of Census, Census 2020 DEC Redistricting Data, Census 2010 DEC Redistricting Data

Typically, population growth or decline is generally accompanied by an increase or decrease in the number of housing units. **Table 3.16** provides the change in numbers of housing units in the planning area from 2010-2020.

Table 3.16. Change in Housing Units, 2010-2020

Jurisdiction	Housing Units 2010	Housing Units 2020	2010-2019 # Change	2010-2019 % change
Unincorporated Osage County	4,938	4973	35	0.7
Argyle	81	80	-1	-1.2
Chamois	230	211	-19	-8.3
Freeburg	227	214	-13	-5.7
Linn	758	751	-7	-0.9
Meta	115	88	-27	-23.5
Westphalia	184	175	-9	-4.9

Source: U.S. Census Bureau, 2020 DEC Redistricting Data; U.S. Bureau of the Census, Census 2010 DEC Redistricting Data

3.3.2 Future Land Use and Development

Jurisdictions reported anticipated future developments within the next five years (2023-2028). Osage County reported some improvement projects planned for the Osage County Fairgrounds and a new fire station constructed for the Linn Fire Protection District. Most of the cities did not anticipate any major future developments within the next five years however, the city of Meta is planning on completing some

stormwater drainage improvements, constructing a new maintenance building, and doing some sewer and park projects.

Osage County R-I School District will be constructing some building additions in order to remove some modular units. Osage County R-II and Osage County R-III School Districts indicated that they did not have any major development or construction planned for the next five years. None of the three school districts have FEMA certified tornado shelters but would be interested in adding a FEMA certified tornado saferoom in the near future if adequate resources can be garnered.

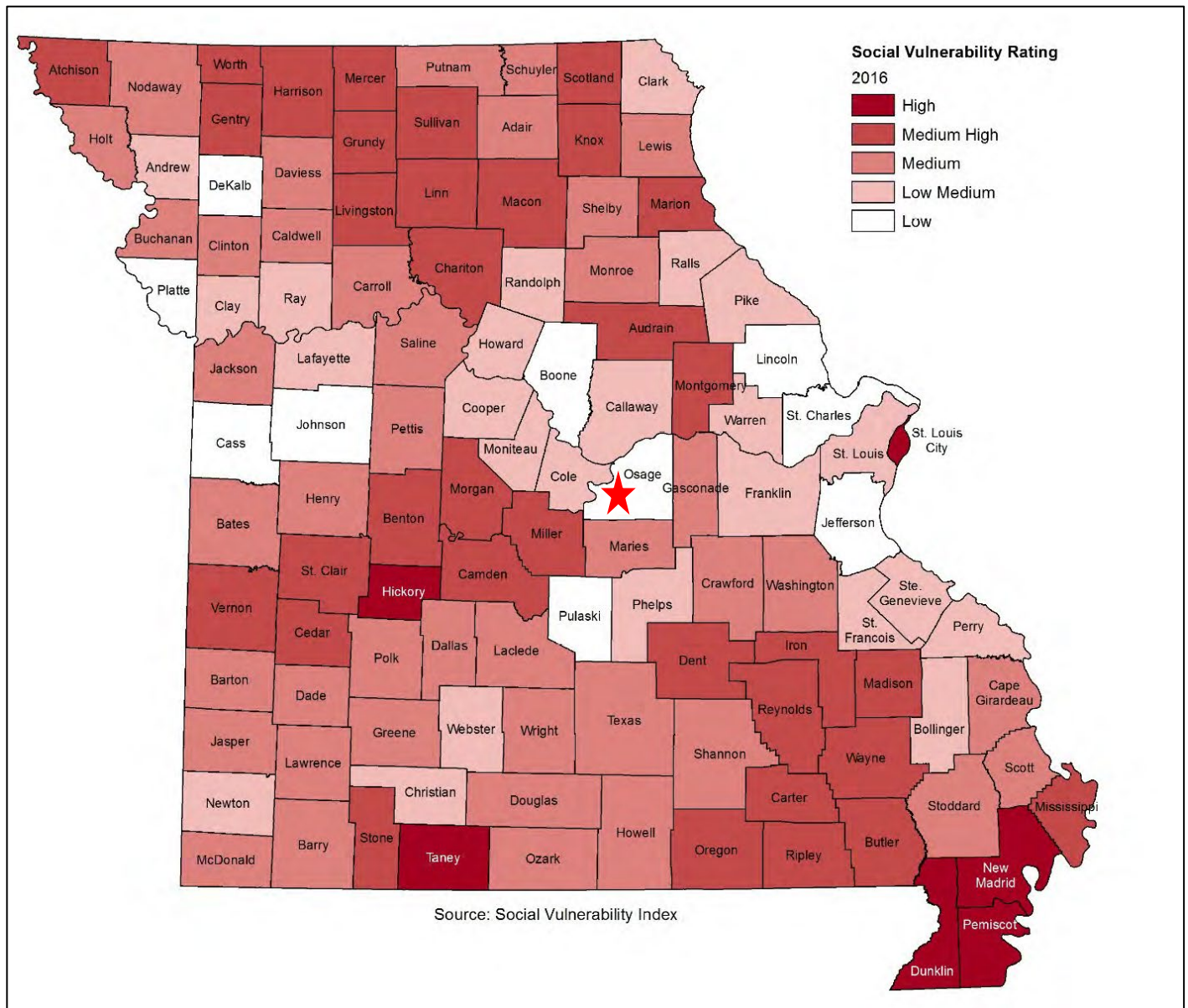
New development can impact a jurisdiction's vulnerability to natural hazards. As the number of buildings, critical facilities, and assets increase, vulnerability increases as well. For example, real estate development can increase storm water runoff, which often increases localized flooding. However, some development such as infrastructure improvements can help reduce vulnerability risks. Unfortunately, quantitative data is not available to further examine each jurisdiction's new development and its correlation to natural hazard vulnerabilities.

Socioeconomic Profile

The Missouri State Hazard Mitigation Plan provides ratings for social vulnerability for each of the counties in the state based on 42 socioeconomic and built environment variables, that research suggests, contribute to a community's ability to prepare for, respond to and recover from hazards. Based on that data, Osage County has a "low" social vulnerability rating (**Figure 3.3**). Furthermore, business incentives are available in the County including Missouri Works, a program for qualified job creators which enables the retention of withholding tax or tax credits that can be transferrable, refundable and/or saleable; BUILD, a financial incentive for the location or expansion of large business projects; sales tax exemptions exist for qualified manufacturers; and industrial infrastructure grants are available up to \$2 million or \$20,000 per job created⁸.

⁸ <https://ded.mo.gov/programs/business/missouri-works>

Figure 3.3. Social Vulnerability Rating for Osage County



Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

3.4 Hazard Profiles, Vulnerability, and Problem Statements

Each hazard that has been determined to be a potential risk to Osage County is profiled individually in this section of the plan document. The profile will consist 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 will be a vulnerability assessment, followed by a summary problem statement.

Hazard Profiles

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

Each hazard identified in Section 3.1.4 will be profiled individually in this section in alphabetical order. The level of information presented in the profiles will vary 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. Where available, use maps to indicate the specific locations of the planning area that are vulnerable to the subject hazard. 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. For hazards such as drought that may have gradual onset and extended duration, probability can be based on the number of months in drought in a given time-period and expressed as the probability for any given month to be in drought.

Changing Future Conditions Considerations: The discussion on the probability of future occurrence should also consider changing future conditions, 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://crt-climate-explorer.nemac.org/>

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 (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Requirement §201.6(c)(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(c)(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(c)(2)(ii)(C): [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(c)(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 county-level data, which is in the Missouri Hazard Mitigation Plan (2018). 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. Through the web-based Missouri hazard Mitigation Viewer, local planners or 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 can be found at this link: <http://bit.ly/MoHazardMitigationPlanViewer2018>.

The county-level assessments in the State Plan were also based on the following additional sources:

- Statewide GIS data sets compiled by state and federal agencies; and
- FEMA's HAZUS-MH loss estimation software.

The vulnerability assessments in the Osage County 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: This section will include a brief review of the vulnerability of each hazard.

Potential Losses to Existing Development: This section will describe the potential impacts of each hazard – the consequences of the effect of the hazard on the jurisdiction and its assets (including types and numbers, of buildings, critical facilities, etc.).

Previous and Future Development: This section will include information on how changes in development have impacted the community's vulnerability to this hazard. Describe how any changes in development that occurred in known hazard prone areas since the previous plan have increased or decreased the community's vulnerability. Describe any anticipated future development in the county, and how that would impact hazard risk in the planning area.

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 must conclude with a brief summary of the problems created by the hazard in the planning area, and possible ways to resolve those problems. Additionally, variations in risk between geographic areas will be included.

3.4.1 Dam Failure

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.3, Page 3.148
https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- Missouri Department of Natural Resources, Dam and Reservoir Safety, <https://dnr.mo.gov/land-geology/dam-reservoir-safety>
- Stanford University's National Performance of Dams Program; <http://npdp.stanford.edu/>
- National Inventory of Dams, <https://nid.usace.army.mil/#/>
- National Resources Conservation Service <http://www.nrcs.usda.gov>
- Missouri Spatial Data Information Service, <http://msdis.missouri.edu>
- Missouri Hazard Mitigation Viewer
<http://bit.ly/MoHazardMitigationPlanViewer2018> - Website
<https://drive.google.com/file/d/1bPkc0jgF9ofwQLnTL9N0u-oPFWi9hkst/view> - User Guide
 - Total number of Missouri NID dams by County
 - Total number of High, Significant, and Low Hazard dams by County
 - Total number of State Regulated dams by County
 - Total number of Class 1, Class 2, and Class 3 dams by County
 - Total number of structures impacted by USACE dams by County
 - Total number of structures impacted by State dams by County
 - Total value of structures impacted by USACE dams by County
 - Total value of structures impacted by State dams by County
 - Total population impacted by USACE dams by County
 - Total population impacted by State dams by County

Hazard Profile

Hazard Description

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.

Information regarding dam classification systems under both the Missouri Department of Natural Resources (MDNR) and the National Inventory of Dams (NID), which differ, are provided in **Table 3.17** and **Table 3.18**, respectively.

Table 3.17. MDNR Dam Hazard Classification Definitions

Hazard Class	Definition
Class I	Contains 10 or more permanent dwellings or any public building
Class II	Contains 1 to 9 permanent dwellings or 1 or more campgrounds with permanent water, sewer, and electrical services or 1 or more industrial buildings
Class III	Everything else

Source: Missouri Department of Natural Resources, Missouri Geological Survey Rolla Office

Table 3.18. NID Dam Hazard Classification Definitions

Hazard Class	Definition
Low Hazard	A dam located in an area where failure could damage only farm or other uninhabited buildings, agricultural or undeveloped land including hiking trails, or traffic on low volume roads that meet the requirements for low hazard dams.
Significant Hazard	A dam located in an area where failure could endanger a few lives, damage an isolated home, damage traffic on moderate volume roads that meet certain requirements, damage low-volume railroad tracks, interrupt the use or service of a utility serving a small number of customers, or inundate recreation facilities, including campground areas intermittently used for sleeping and serving a relatively small number of persons.
High Hazard	A dam located in an area where failure could result in any of the following: extensive loss of life, damage to more than one home, damage to industrial or commercial facilities, interruption of a public utility serving a large number of customers, damage to traffic on high-volume roads that meet the requirements for hazard class C dams or a high-volume railroad line, inundation of a frequently used recreation facility serving a relatively large number of persons, or two or more individual hazards described for significant hazard dams.

Source: National Inventory of Dams

Geographic Location

Dams in Planning Area

According to the Missouri Department of Natural Resources Dam Safety Program, there are 21 recorded dams in Osage County, including Class 1 (3), Class 2 (9), Class 3 (9) dams (**Table 3.19**). In addition, the state regulates 1 of the 21 dams. The NID hazard class dams are high (12), significant (1), and low (8). None of the dams are owned or operated by the United States Army Corps of Engineers (USACE). County dams are privately or commercially owned. **Table 3.20** provides the names, locations, and other pertinent information for all NID High Hazard Dams in the planning area.

Table 3.19. Osage County Dams Hazard Risk

Name of Dam	DNR Hazard Class	NID Hazard Class
Argyle Lake Dam	2	High
Baker Dam	2	High
Baumhoer Lake Dam	3	Low
Ben Branch Dam	1	High
Byington Lake Dam	1	High
College Hill Dam	3	Low
Dill, Lee Dam	3	Low
Franken Lake Dam	3	Low
Hug Dam	3	Low
J G F Farms Dam	3	Low
Kuper-Scott Ranch Dam	2	High
Lake Acres Dam	2	High
Lake Isabell Dam	3	Low
Luecke Lake Dam	3	Low
Muenks Dam	2	High
Patterson Lake Dam	2	High
Pinnell Lake Dam	2	High
Rohlfing Ram - Mononame 408	1	High
Scott Lake Dam	3	Significant
Welschmeyer's Dam	2	High
Willibrand Lake Dam	2	High

Source: MDNR Dam and Safety Program

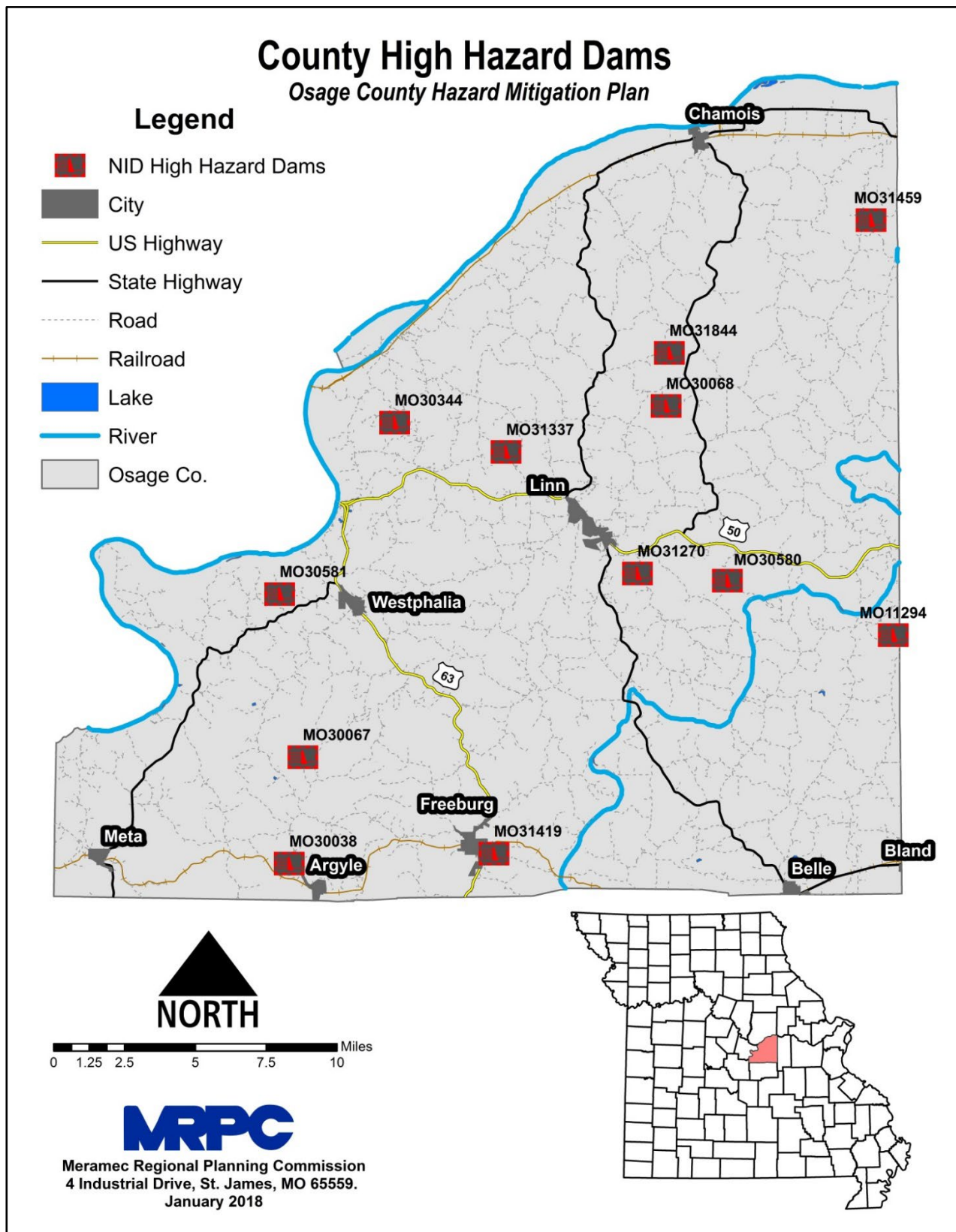
Table 3.20. NID High Hazard Class Dams in the Osage County Planning Area

Dam Name	NIDID	Hazard Potential *	NID Height (Ft.)	NID Storage	River	Nearest City *	Distance To City (Mi.) *
Argyle Lake Dam	MO30038	High	25	160	Tr-Loose Creek	ARGYLE	2
Baker Dam	MO31459	High	25	54	Tr-Baileys Creek	MORRISON	2
Ben Branch Dam	MO31844	High	51	1,210	Ben Branch	LUYSTOWN	3
Byington Lake Dam	MO31270	High	33	159	Owens Creek	Linn	1
Kuper-Scott Ranch Dam	MO30344	High	25	67	Jaeger Creek	Taos	3
Lake Acres Dam	MO30068	High	30	144	Tr-Indian Creek	Luystown	2
Muenks Dam	MO31337	High	29	78	Tr-Maasen Creek-Loose Creek	Loose Creek	3
Patterson Lake Dam	MO11294	High	31	166	Tr-Third Creek	COOPER HILL	1
Pinnell Lake Dam	MO30581	High	25	107	Tr-Osage River	Westphalia	2
Rohlfing Dam - Mononame 408	MO30580	High	23	74	Tr-Pointers Creek	Linn	4
Welschmeyer's Dam	MO31419	High	28	75	Tr-Gasconade River	Freeburg	<1
Willibrand Lake Dam	MO30067	High	25	334	Tr-Maries River	Koeltztown	3

Figure 3.4 depicts locations of NID high hazard dams located in the planning area. If a dam failure were to occur in Osage County, depending upon dam and location, the severity would range between negligible to life threatening. Road infrastructure, residential structures, commercial buildings, and public buildings are all vulnerable to losses. There are areas of assembly in dam inundation zones, specifically retail stores in Hermann, MO.

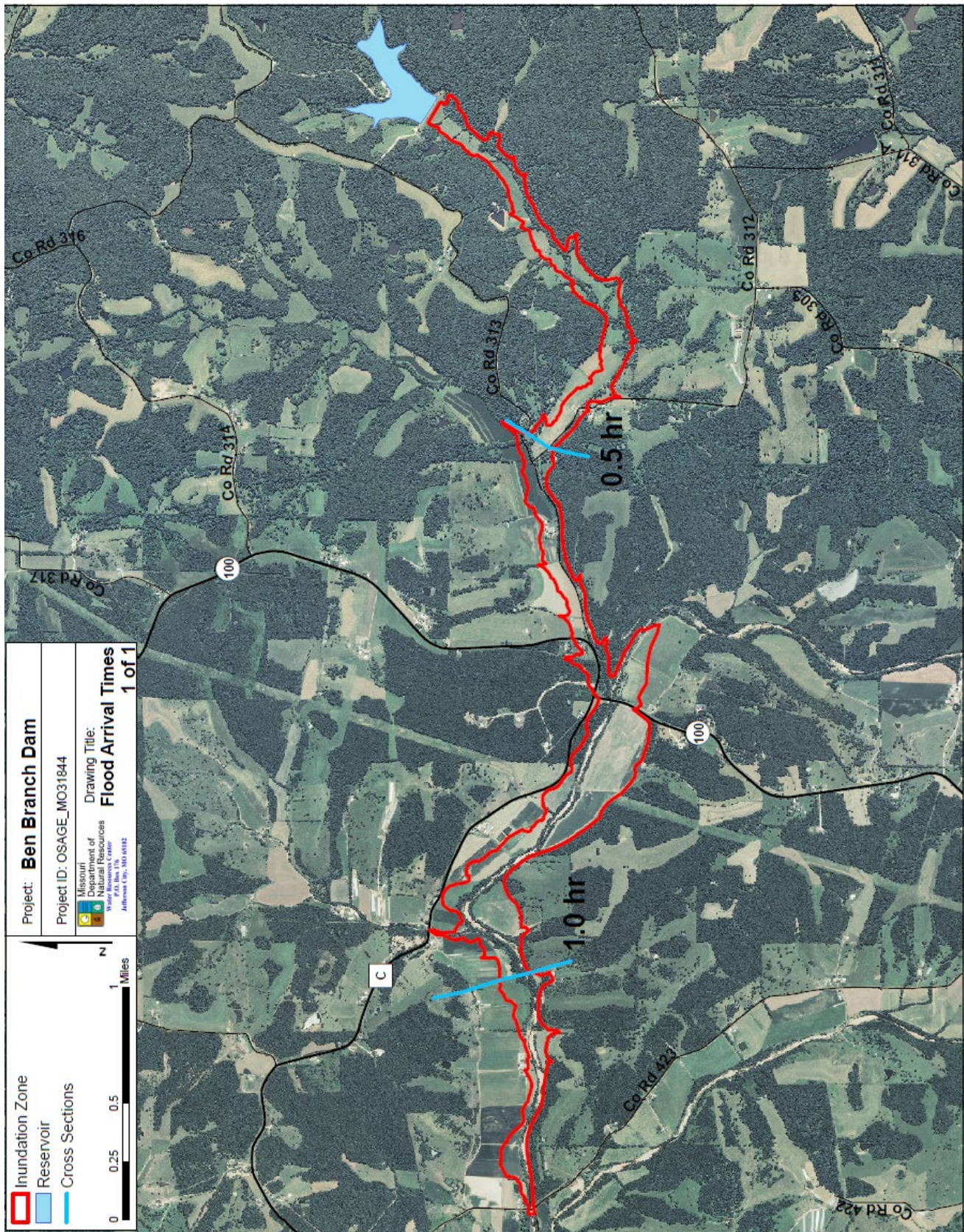
One dam inundation map, Ben Branch Dam, was available from the Missouri Department of Natural Resources (**Figure 3.5**). No other dam inundation maps were available for the remaining NID High Hazard Dams in the county.

Figure 3.4. NID High Hazard Dam Locations in Osage County



Source: MSDIS, MRPC

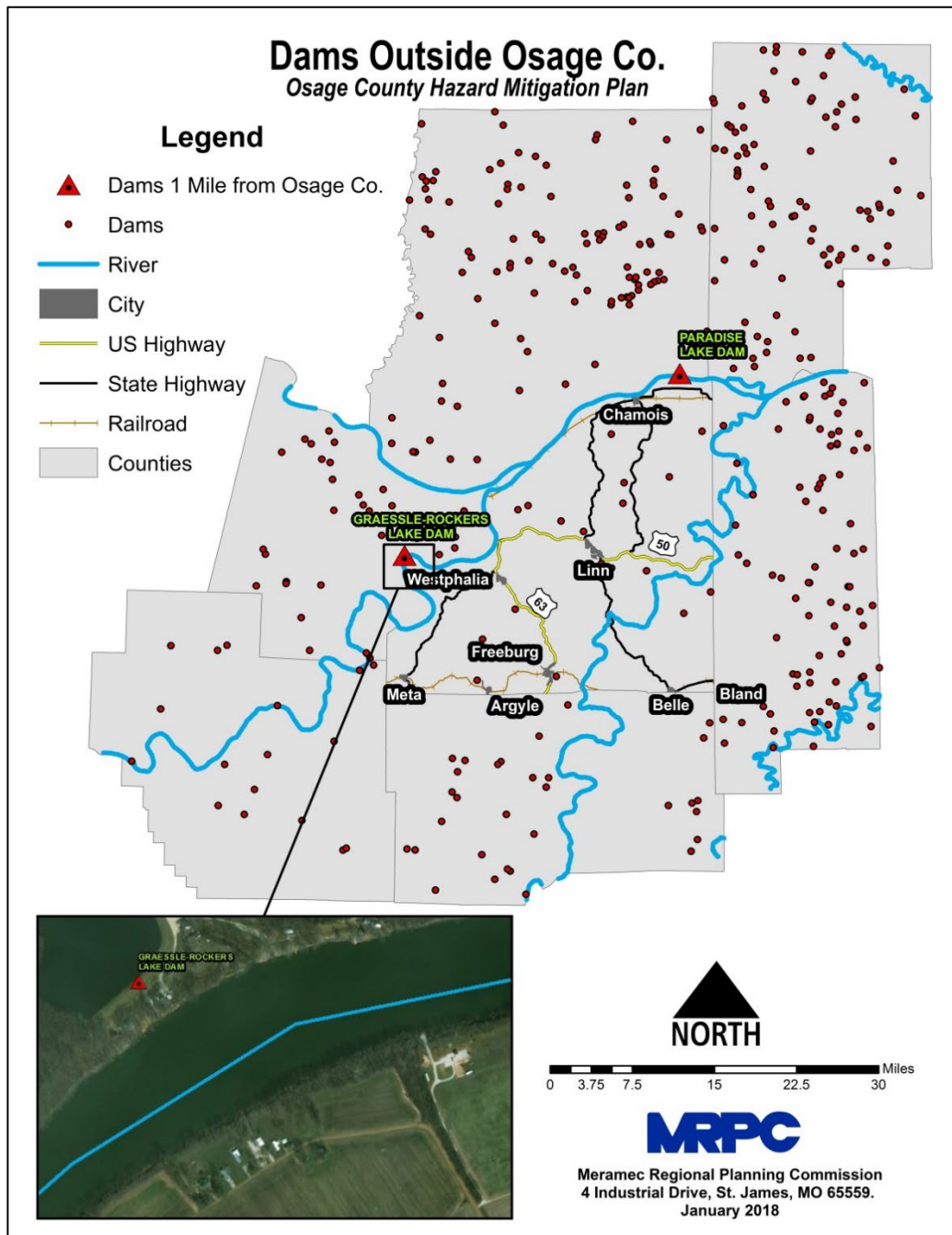
Figure 3.5. Ben Branch Dam Inundation Zone



Upstream Dams Outside the Planning Area

According to the Missouri Department of Natural Resources' Dam and Reservoir Safety Program, there are no regulated high hazard dams that would flow into Osage County from surrounding counties during a failure event. However, Graessle-Rockers Lake Dam in Cole County (Unregulated, High Hazard, Class 2) is located approximately 200 yards from Osage Co., across the Osage River. As seen in **Figure 3.6**, there are numerous structures in close proximity to the dam. During a failure event, loss of life and property damage are possible dependent upon severity of failure.

Figure 3.6. Upstream Dams Outside Osage County



Source: MSDIS, MRPC

Strength/Magnitude/Extent

The strength/magnitude of dam failure would be similar in some cases to the impacts associated with flood events (see the flood hazard vulnerability analysis and discussion). Based on the hazard class definitions, failure of any of the High Hazard/Class I dams could result in a serious threat of loss of human life, serious damage to residential, industrial or commercial areas, public utilities, public buildings, or major transportation facilities. Catastrophic failure of any high hazard dams has the potential to result in greater destruction due to the potential speed of onset and greater depth, extent, and velocity of flooding. Worst case scenario would be a catastrophic failure at any of the high hazard class dams designated in **Figure 3.4**.

Previous Occurrences

According to Stanford University's National Performance of Dams Program and the Missouri State Emergency Management Agency, there were 86 recorded dam incidents in Missouri between 1917 and 2016. For the 42-year period from 1975 to 2016 for which dam failure statistics are available, 19 dam failures and 68 incidents are recorded. Fortunately, only one drowning has been associated with a dam failure in the state. The problem of unsafe dams in Missouri was underscored by dam failures at Lawrenceton in 1968, Washington County in 1975, Fredricktown in 1977, and a near failure in Franklin County in 1979. A severe rainstorm and flash flooding in October 1998 compromised about a dozen small, unregulated dams in the Kansas City area. But perhaps the most spectacular and widely publicized dam failure in recent years was the failure of the Taum Sauk Hydroelectric Power Plant Reservoir atop Profitt Mountain in Reynolds County, MO.

In the early morning hours of December 14, 2005, a combination of human and mechanical error in the pump station resulted in the reservoir being overfilled. The manmade dam around the reservoir failed and dumped over a billion gallons of water down the side of Profitt Mountain, into and through Johnson's Shut-Ins State Park and into the East Fork of the Black River. The massive wall of water scoured a channel down the side of the mountain that was over 6000 feet wide and 7,000 feet long that carried a mix of trees, rebar, concrete, boulders and sand downhill and into the park⁹. The deluge destroyed Johnson's Shut-Ins State Park facilities, including the campground, and deposited sediment, boulders and debris into the park. The flood of debris diverted the East Fork of the Black River into an older channel and turned the river chocolate brown. Fortunately, the breach occurred in mid-winter. Five people were injured when the park superintendent's home was swept away by the flood, but all were rescued and eventually recovered. Had it been summer, and the campground filled with park visitors, the death toll could have been very high¹⁰. This catastrophe has focused the public's attention on the dangers of dam failures and the need to adequately monitor dams to protect the vulnerable.

Despite the significance of the immediate damage done by the Taum Sauk Reservoir dam failure, the incident also highlights the long-term environmental and economic impacts of an event of this magnitude. Four years later, the toll of the flooding and sediment on aquatic life in the park and Black River is still being investigated. Even after the removal of thousands of dump truck loads of debris and mud, the river is still being affected by several feet of sediment left in the park. The local economy, heavily reliant upon the tourism from the park and Black River, has also been hit hard¹¹.

⁹ United States Geological Survey. Damage Evaluation of the Taum Sauk Reservoir Failure using LiDAR.

https://www.researchgate.net/publication/268325451_Damage_Evaluation_of_the_Taum_Sauk_Reservoir_Failure_using_LiDAR

¹⁰ The Alert. Spring 2006. After the Deluge...What's Ahead for Taum Sauk? By Dan Sherburne.

¹¹ The Alert. Spring 2006. After the Deluge...What's Ahead for Taum Sauk? By Dan Sherburne.

Event Description

According to Stanford University's National Performance of Dams Program, no dam incidents have been recorded for Osage County¹².

Probability of Future Occurrence

Since it is unknown which dams, if any might fail at any given time, determining the probability of future occurrence is not possible¹³. In addition, dam failure within the county has not occurred according to available data.

Changing Future Conditions Considerations

According to the Missouri State Hazard Mitigation Plan, 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 the likelihood of flooding. Projections of changes in future conditions suggest that precipitation may increase and occur in more extreme events, which may increase risk the flooding, putting stress on dams and increasing the likelihood of dam failure.¹⁴

The safety of dams in the future 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. 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.¹⁵

Vulnerability

Vulnerability Overview

Data was obtained from the 2018 Missouri State Hazard Mitigation Plan for the vulnerability analysis of dam failure for Osage County. There are however data limitations regarding dams unregulated by the State of Missouri due to height requirements. These limitations hinder vulnerability analysis; nonetheless, failure potential still exists. **Table 3.21** provides vulnerability analysis data for the failure of State-regulated dams in Missouri.

¹² http://npdp.stanford.edu/dam_incidents

¹³ 2018 Missouri State Hazard Mitigation Plan

¹⁴ 2018 Missouri State Hazard Mitigation Plan

¹⁵ 2018 Missouri State Hazard Mitigation Plan

Table 3.21. Vulnerability Analysis for Failure of State-Regulated Dams in Missouri

County	Class 1	Class 2	Class 3	Total	Estimated # of Buildings Vulnerable	Average Exposure Value per Structure (\$)	Estimated Total Potential Building Exposure (\$)	Estimated Total Population Exposure	Estimated Building Losses (\$)
Osage	1	0	0	1	36	621,032	22,357,152	3	175,947,457

For the vulnerability analysis of State regulated dams, the State developed the following assumptions for overview.

- Class 1 dams: the number of structures in the inundation area was estimated to be 10 or more permanent dwellings or any public building. Inspection of these dams must occur every two years.
- Class 2 dams: the area downstream from the dam that would be affected by inundation contains one to nine permanent dwellings, or one or more campgrounds with permanent water, sewer and electrical services or one or more industrial buildings. Inspection of these dams must occur once every three years.
- Class 3 dams: the area downstream from the dam that would be affected by inundation does not contain any of the structures identified for Class 1 or Class 2 dams. Inspection of these dams must occur once every five years.

According to the 2018 Missouri State Hazard Mitigation Plan, there are 36 buildings vulnerable to failure of State-regulated dams (**Figure 3.7**) in Osage County. Furthermore, the state quantified potential loss estimates in terms of property damages. To execute the analysis, the following assumptions were utilized.

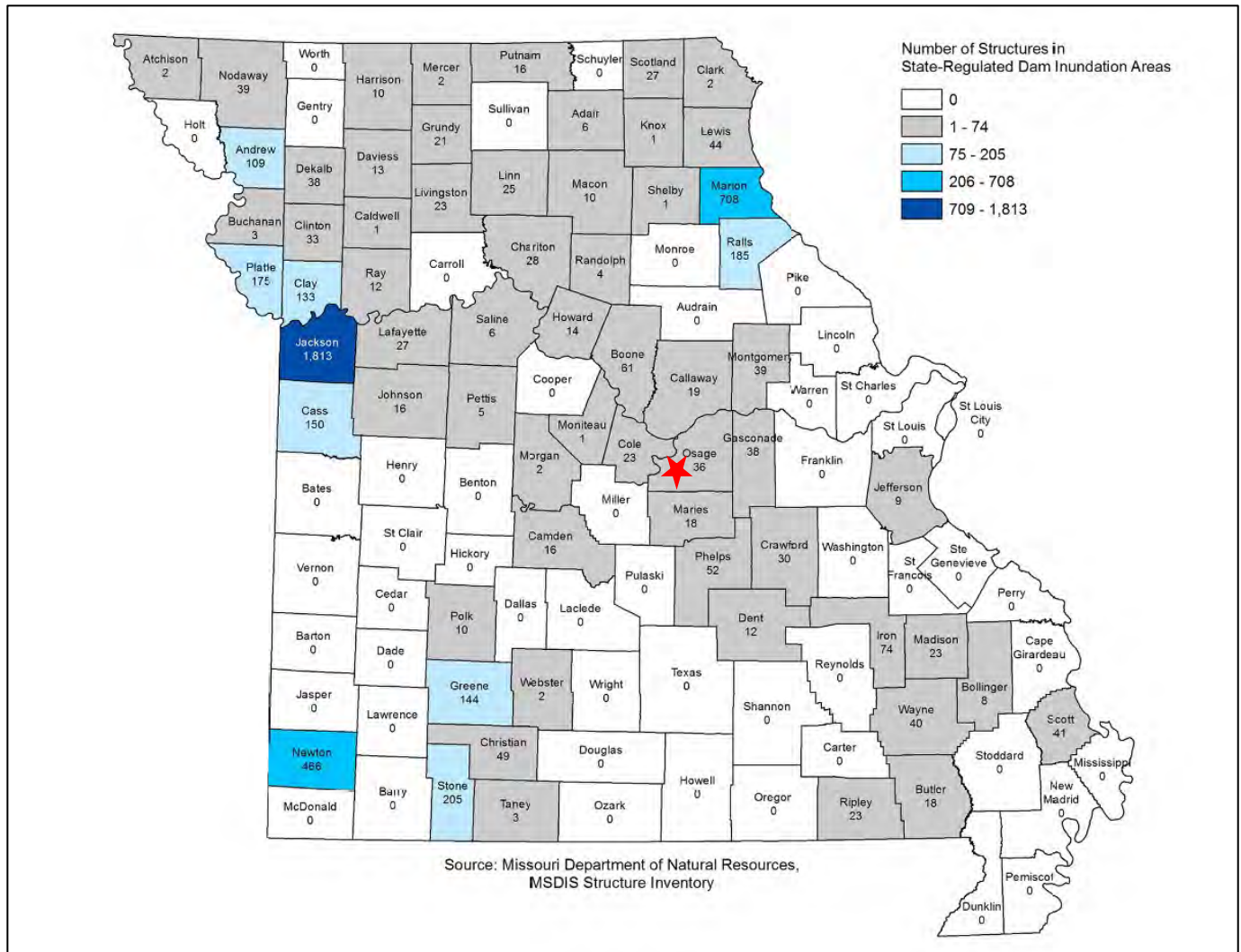
- For State-regulated Class 1 and Class 2 dams that have available inundation maps as well as USACE dams for which inundation maps were made available, GIS comparative analysis was accomplished against the building exposure data to determine the types, numbers and estimated values of buildings at risk to dam failure.
- The building exposure data was based on the structure inventory data layer available from the Missouri Spatial Data Inventory Service (MSDIS). The available dam inundation areas were compared against the structure inventory to determine the numbers and types of structures at risk to dam failure.
- To calculate estimated values of buildings at risk, buildings values available in the HAZUS census block data were used to determine an average value for each property type. This average value per property type was then applied to the number of structures in dam inundation areas by type to calculate an overall estimated value of buildings at risk by type.¹⁶

Figure 3.7 and **Figure 3.8** depict the total estimated building losses and population exposure by

¹⁶ 2018 Missouri State Hazard Mitigation Plan

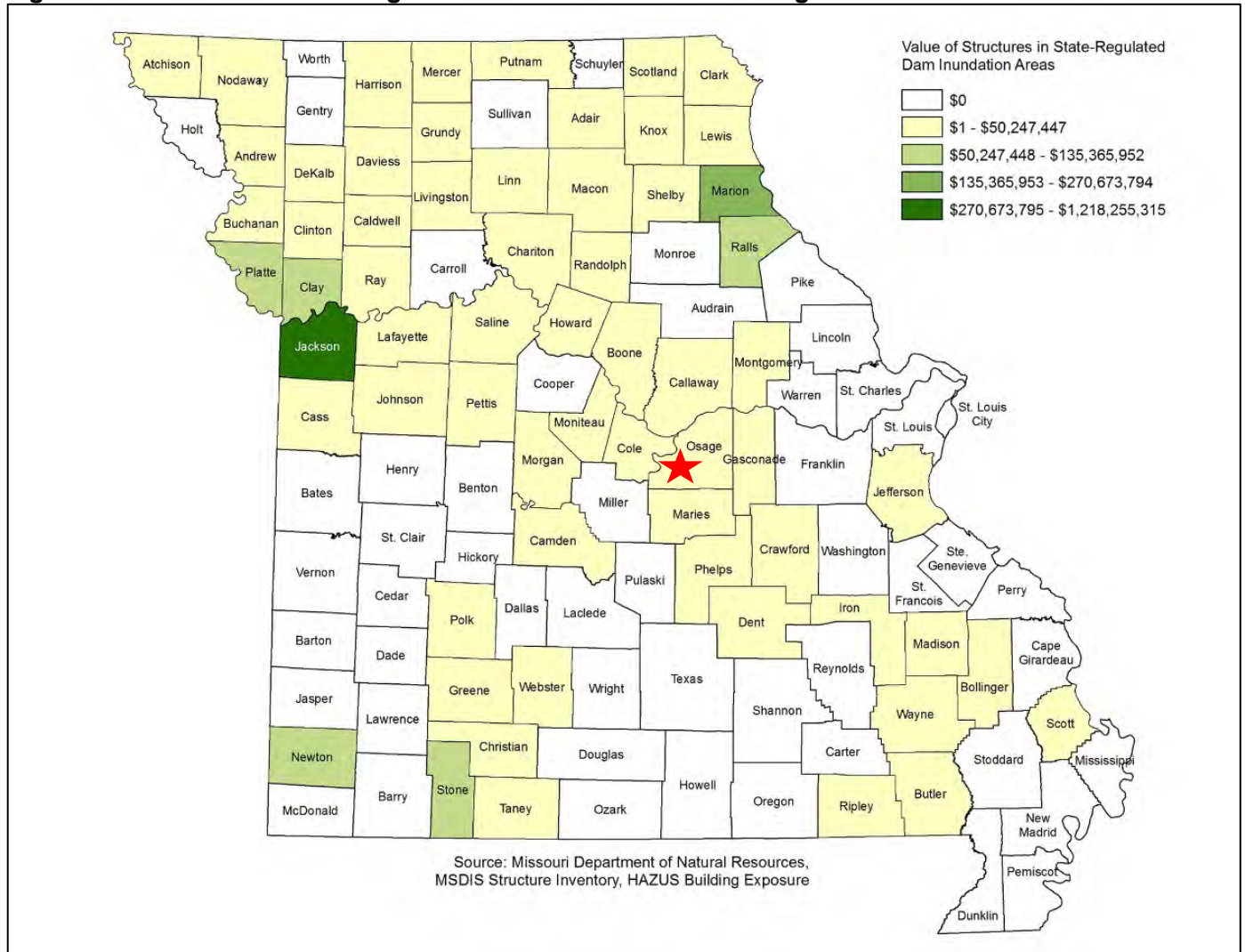
county, respectively. The estimated building losses from failure of State-regulated dams are \$1 – \$50,247,447. The estimated population exposure to failure of State-regulated dams, shown in **Figure 3.9**, ranges between 1 and 104.

Figure 3.7. Estimated Number of Buildings Vulnerable to Failure of State-regulated Dams



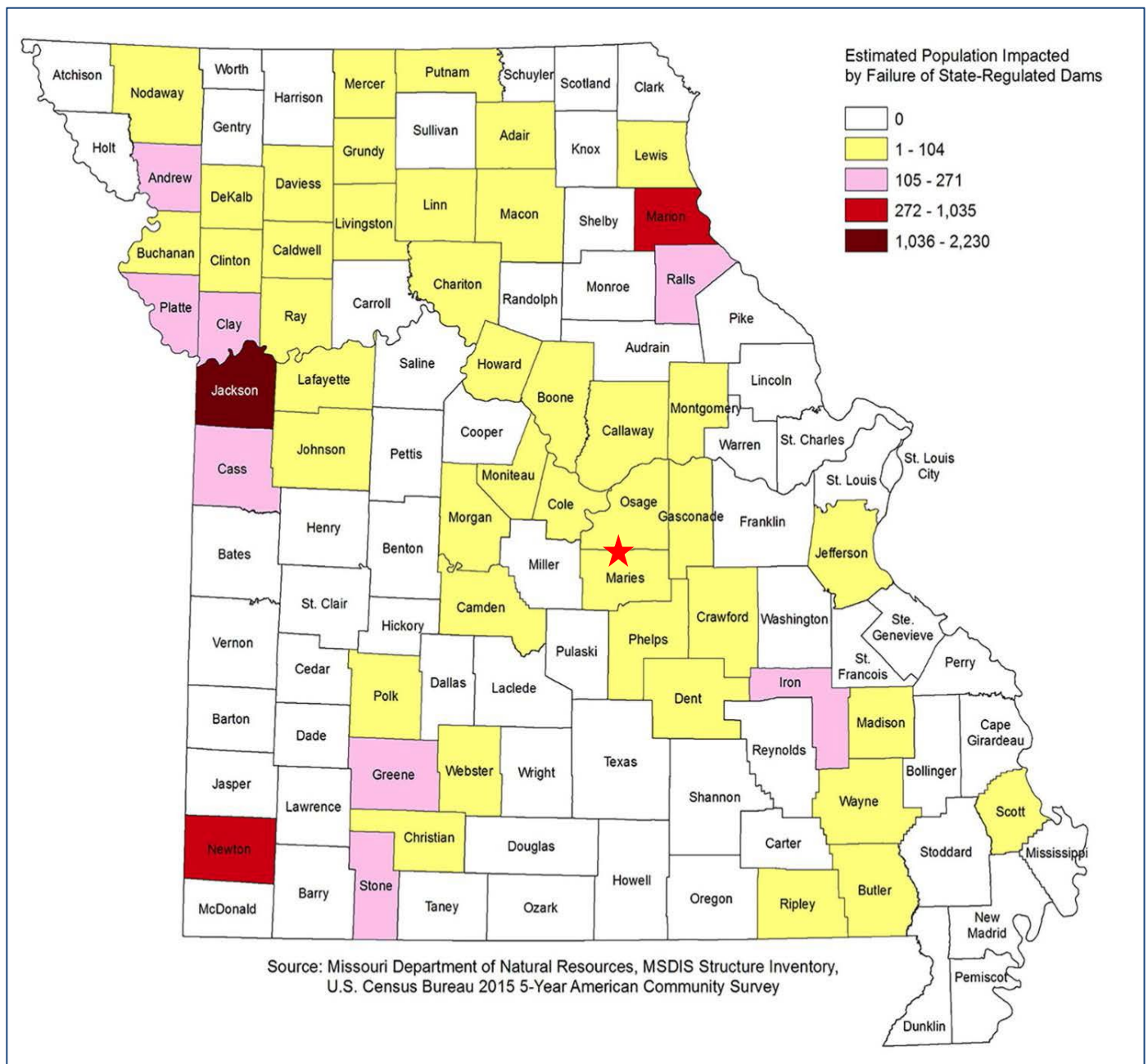
Source: 2018 Missouri State Hazard Mitigation Plan
 *Red star indicates Osage County

Figure 3.8. Estimated Building Losses from Failure of State-regulated Dams



Source: 2018 Missouri State Hazard Mitigation Plan
 *Red star indicates Osage County

Figure 3.9. Estimated Population Exposure to Failure of State-regulated Dams



Source: 2018 Missouri State Hazard Mitigation Plan
 *Red star indicates Osage County

Potential Losses to Existing Development: (including types and numbers, of buildings, critical facilities, etc.)

The worst case dam failure event at any high hazard dam in the county could lead to serious loss to road infrastructure, commercial and residential structures, and human life. However, all high hazard dams located within the county are rural in nature.

Impact of Previous and Future Development

Future development within the county that has potential to be influenced by dam failure includes any

areas downstream of a dam within the 100 Year Floodplain. No development is planned in any floodplain or areas downstream of dams in the county or cities.

Hazard Summary by Jurisdiction

Variations in vulnerability across the planning area depend upon multiple variables. Nonetheless, Osage County school districts and special districts do not have assets located in dam breach inundation areas. The only state regulated dam in the county has an estimated building loss of \$22,357,152. The estimated population exposure to failure of Ben Branch Dam is 3.

Problem Statement

In summary, the hazard risk for dam failure in Osage County ranges between high and low, dependent upon the dam. If a dam does fail, the expected impacts could vary from negligible to critical, and could potentially affect road infrastructure, residential structures, commercial buildings, public structures, and human life. It is recommended to encourage land use management practices to decrease the potential for damage from a dam collapse, including the discouragement of development in areas with the potential for sustaining damage from a dam failure. Installation of education programs to inform the public of dam safety measures and preparedness activities would be beneficial. In addition, the availability of training programs to encourage landowners how to properly inspect their dams and develop emergency action plans would be advantageous.

3.4.2 Drought

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.6, Page 3.235
- Maps of effects of drought, National Drought Mitigation Center (NDMC) located at the University of Nebraska in Lincoln; <http://www.drought.unl.edu/>.
- Historical drought impacts, National Drought Mitigation Center (NDMC) located at the University of Nebraska in Lincoln; at <http://droughtreporter.unl.edu/>.
- Recorded low precipitation, NOAA Regional Climate Center, (<http://www.hprcc.unl.edu>).
- Water shortages, Missouri's Drought Response Plan, Missouri Department of Natural Resources, <https://dnr.mo.gov/water/how-water/state-water/drought>
- Populations served by groundwater by county, USGS-NWIS, <http://maps.waterdata.usgs.gov/mapper/index.html>
- Census of Agriculture, https://agcensus.library.cornell.edu/census_parts/2012-missouri/
- USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/en/Information-Tools/Summary-of-Business/Cause-of-Loss>
- Natural Resources Defense Council, <http://www.nrdc.org/globalWarming/watersustainability/>
- Missouri Department of natural Resources (MDNR), Drought News, Conditions and Resources
- Missouri Hazard Mitigation Viewer
<http://bit.ly/MoHazardMitigationPlanViewer2018> - Website
<https://drive.google.com/file/d/1bPkc0jqF9ofwQLnTL9N0u-oPFWi9hkst/view> - User Guide
 - Vulnerability to drought by County
 - Crop insurance claims due to drought by County

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 2018 Missouri State Hazard Mitigation 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 people¹⁷ - which impacts supply and demand of some economic commodity.

Geographic Location

All areas and jurisdictions in Osage County are susceptible to drought, but particularly cities where thousands of residents are served by the same source of water. These cities use deep hard rock wells that are 1,100 to 1,800 feet deep and can experience drought when recharge of these wells is low. The majority of individuals living in Osage County rely on groundwater resources for drinking water. Approximately 82% of the land in the county is utilized for agricultural purposes. Furthermore, livestock sales comprise 78% of the market of agricultural products sold in Osage County. A drought would directly impact livestock production and the agriculture economy in Osage County¹⁸.

Strength/Magnitude/Extent

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 mortality¹⁹.

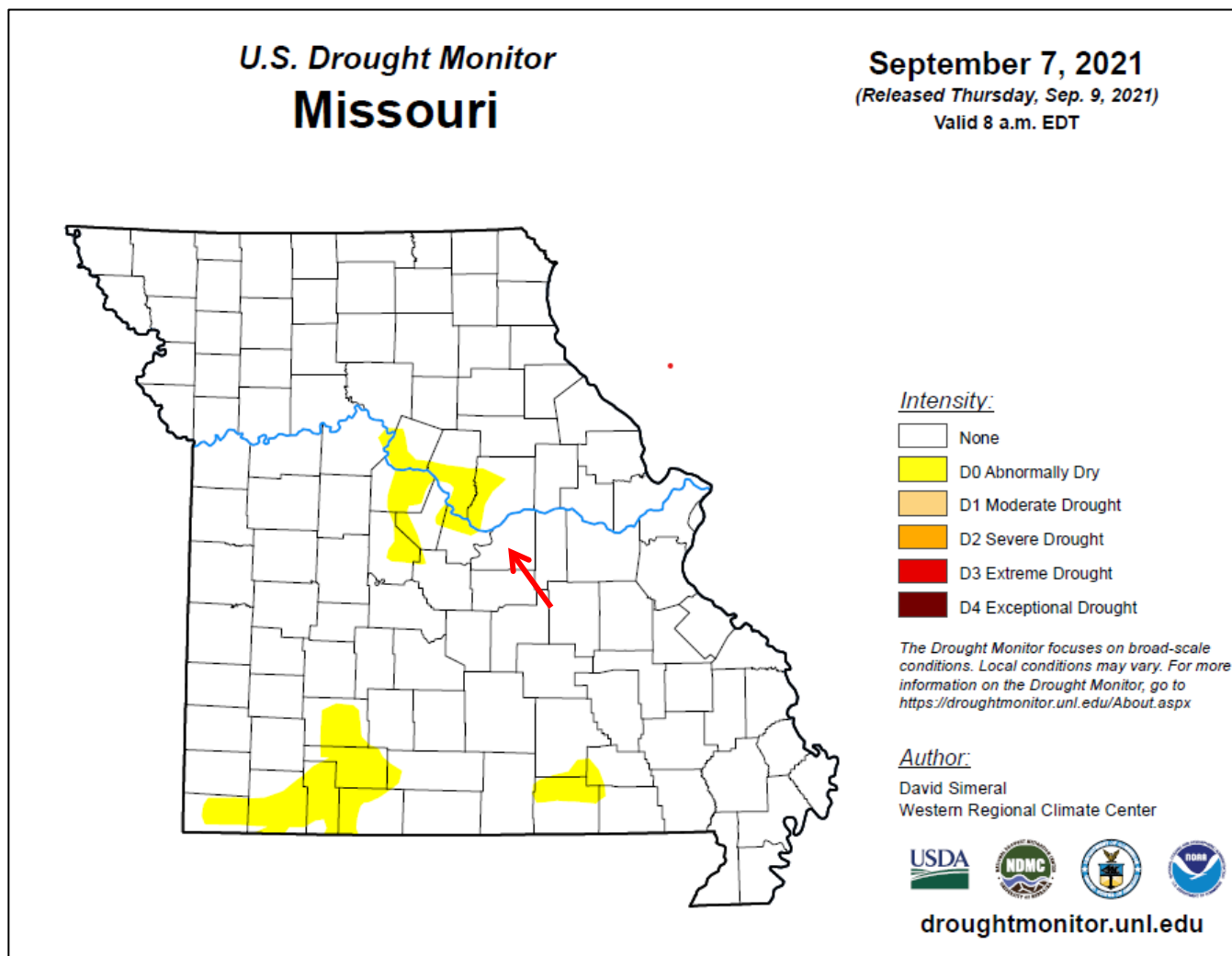
Figure 3.10 depicts a U.S. Drought Monitor map of Missouri on October 27, 2020. This map illustrates the planning area, which could be in drought at any given moment in time. A red arrow indicates the location of the planning area (Osage County).

¹⁷ <http://www.drought.unl.edu/> <http://droughtreporter.unl.edu/>

¹⁸ https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/index.php

¹⁹ https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/index.php

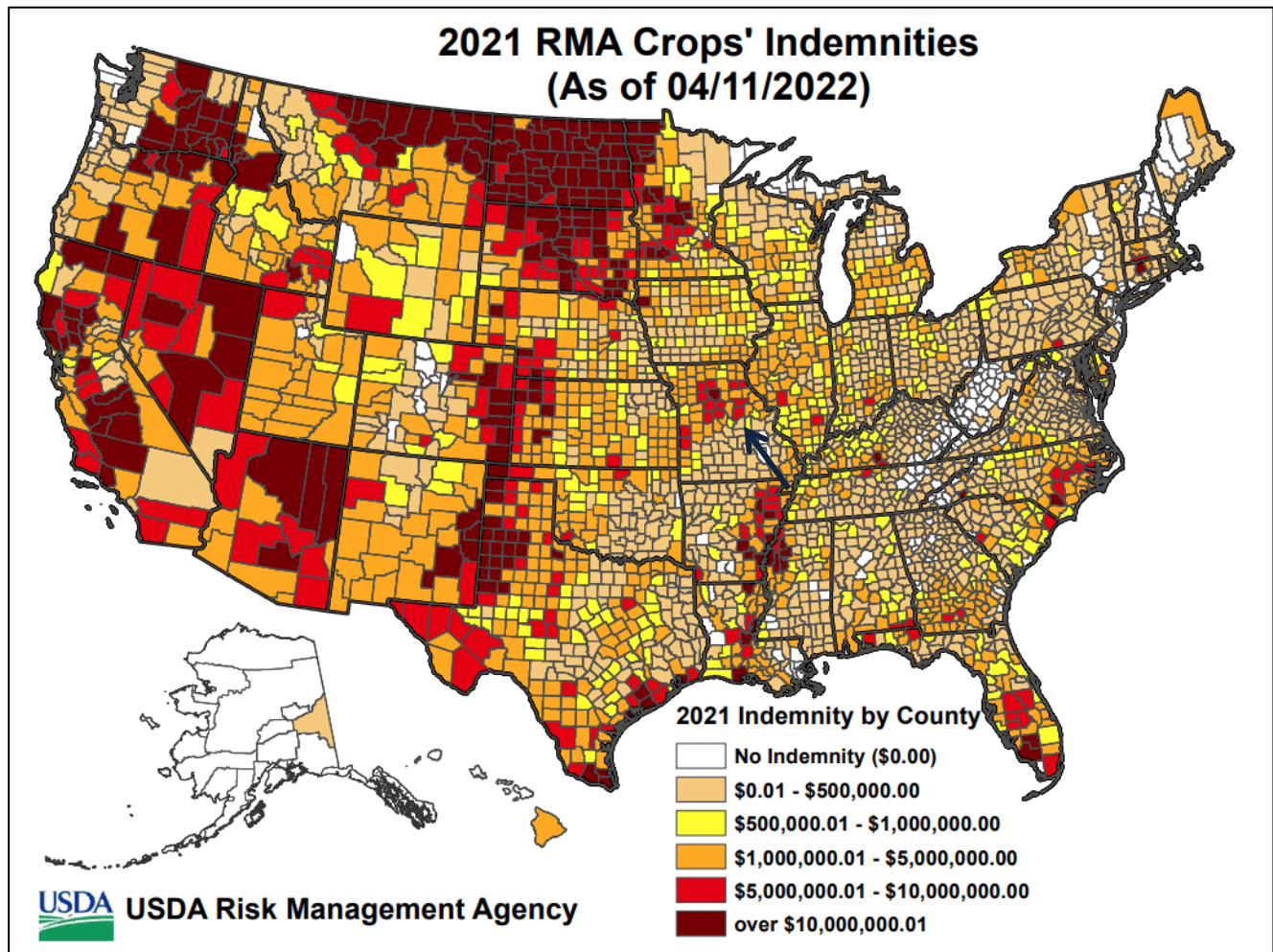
Figure 3.10. U.S. Drought Monitor Map of Missouri on October 27, 2020



Source: U.S. Drought Monitor, <http://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?MO>
*Red arrow indicates Osage County

Figure 3.11 illustrates RMA crop indemnities for 2021 across the United States. Osage County fell in the range of \$0.01 to \$500,000 for crop indemnities.

Figure 3.11. 2021 RMA Crop Indemnities for the United States



Source: <https://www.rma.usda.gov/-/media/RMA/Maps/Total-Crop-Indemnity-Maps/Crop-Year-2021/041122map.ashx>

*Black arrow indicates Osage County

According to the USDA's Risk Management Agency, there have been 199 crop insurance payments due to drought in Osage County since 2001, totaling \$3.692.970. **Table 3.22** illustrates the year, number of payments, and total amount of crop insurance payments.

Table 3.22. Osage County Crop Indemnity Payments (2000-2020)

Year	Number of Payments	Total
2001	2	\$1,512
2002	3	\$44,997
2003	4	\$44,201
2004	0	0
2005	7	\$38,134
2006	5	\$28,752
2007	6	\$38,134
2008	0	0

Year	Number of Payments	Total
2009	0	0
2010	0	0
2011	5	\$64,099
2012	15	\$1,096,113.08
2013	5	\$32,760
2014	3	\$11,337
2015	0	0
2016	3	\$2,085
2017	4	\$8,648
2018	36	\$111,284
2019	70	\$1,968,298
2020	31	\$202,616
TOTAL	199	\$3,692,970

Source: <https://www.rma.usda.gov/Information-Tools/Summary-of-Business/Cause-of-Loss>

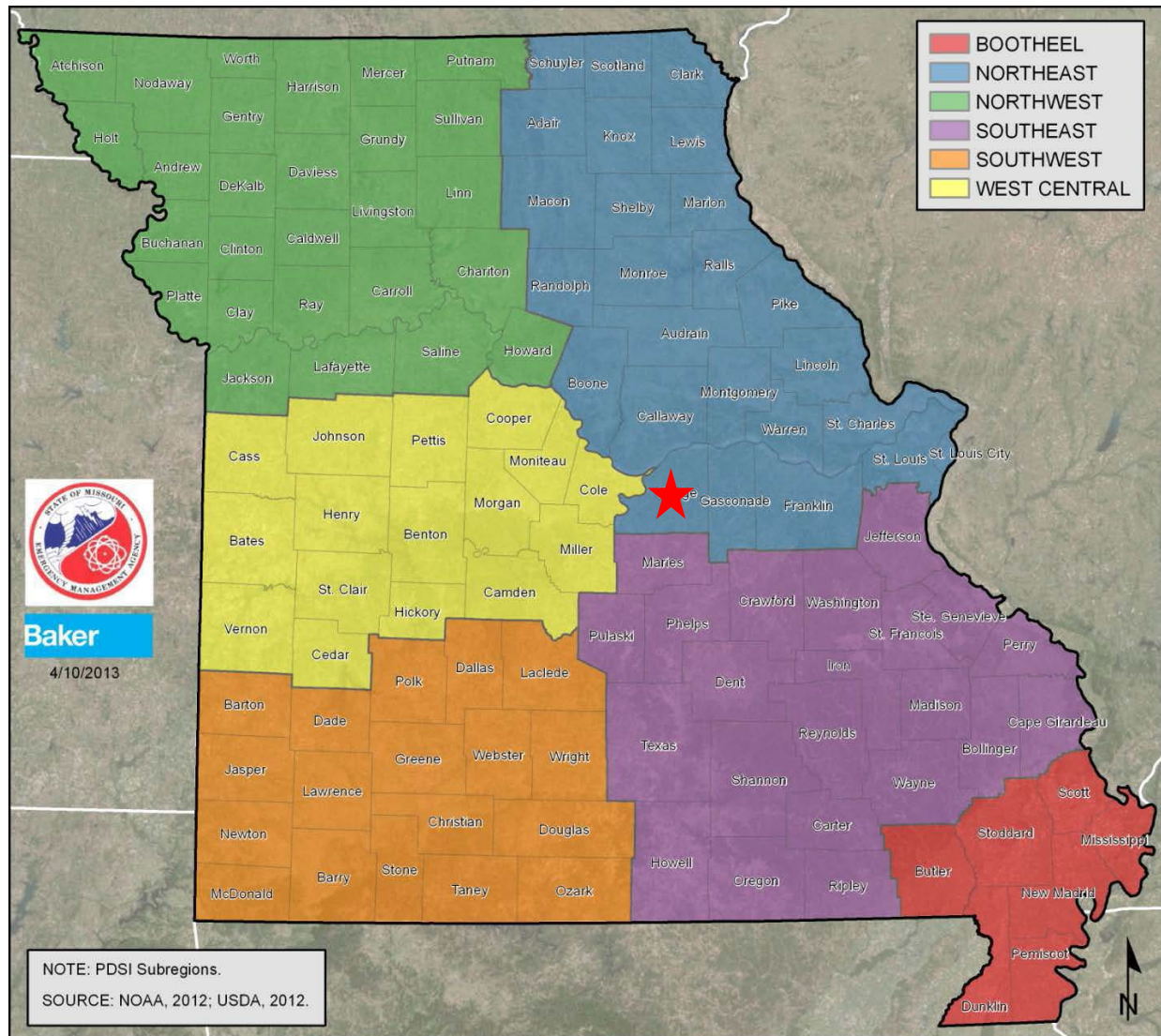
The Palmer Drought Indices measure dryness based on recent precipitation and temperature. The indices are based on a “supply-and-demand model” of soil moisture. Calculation of supply is relatively straightforward, using temperature and the amount of moisture in the soil. However, demand is more complicated 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.

Figure 3.12 illustrates the Palmer Drought Severity Index sub-regions of Missouri. Osage County is categorized under the Northeast sub-region.

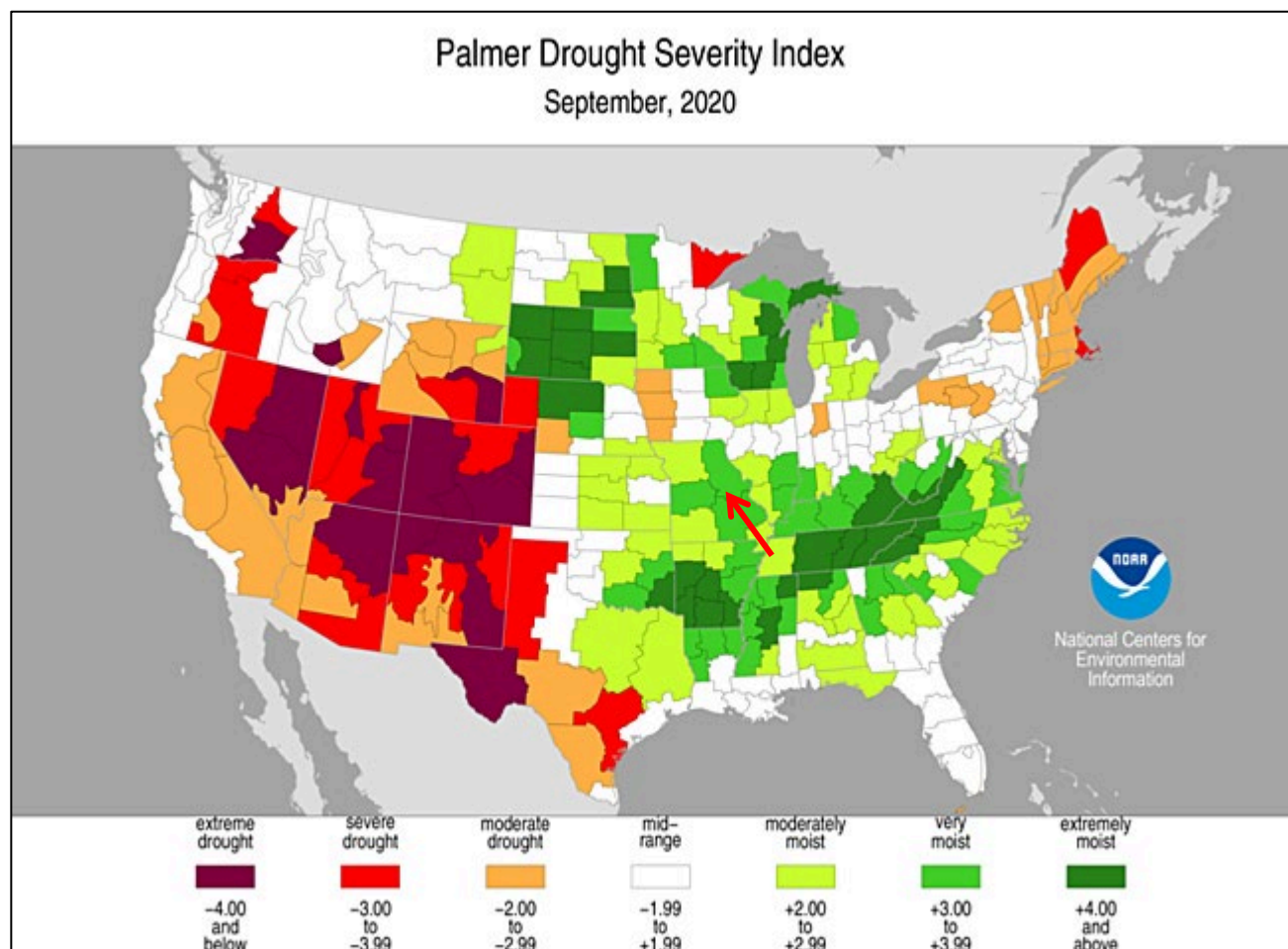
Figure 3.12. Palmer Drought Severity Index: Missouri Sub-regions



Source: 2018 Missouri State Hazard Mitigation Plan; *Red star indicates Osage County

Figure 3.13 is an example of the Palmer Modified Drought Index for the United States for September 2020.

Figure 3.13. Palmer Modified Drought Index National Map September 2020



Source: <http://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/>; *Red arrow indicates Osage County

Data was collected from the Missouri Department of Natural Resources (2020 Census of Missouri Public Water Systems) to determine water source by jurisdiction. Each of the participating communities within Osage County utilizes well water as the primary source of water. These communities could experience hardship in the event of a long-term drought. **Table 3.23** provides information in regard to the percent of source that is groundwater for each jurisdiction in the county.

Table 3.23. 2018 Water Source by Jurisdiction

Jurisdiction	% of source that is groundwater
Argyle	100
Chamois	100
Freeburg	100
Linn	100
Meta	100
Westphalia	100

Source: Missouri Dept. of Natural Resources, 2020 Census of Missouri Public Water Systems

Previous Occurrences

Table 3.24 offers Palmer Drought Severity Index data for Osage County between 2011 and 2020. This information exemplifies drought conditions on a monthly basis for Missouri's Northeast sub-region within the United States.

Table 3.24. Palmer Drought Severity Index for Osage County, MO (2011 – 2020)

	Year									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Jan.	Extremely moist	Mid-range	Mid-range	Moderate Drought	Moderately moist	Extremely moist	Mid-range	Moderate drought	Mid-range	Extremely moist
Feb.	Extremely moist	Mid-range	Mid-range	Moderate Drought	Moderately moist	Very moist	Mid-range	Mid-range	Moderately moist	Very moist
March	Extremely moist	Mid-range	Mid-range	Moderate Drought	Mid-range	Very moist	Mid-range	Mid-range	Moderately moist	Very moist
April	Very moist	Mid-range	Moderately moist	Mid-range	Mid-range	Moderately moist	Mid-range	Mid-range	Moderately moist	Very moist
May	Very moist	Mid-range	Very moist	Mid-range	Mid-range	Moderately moist	Mid-range	Mid-range	Very moist	Very moist
June	Very moist	Moderate drought	Very moist	Mid-range	Very moist	Mid-range	Mid-range	Mid-range	Very moist	Very moist
July	Mid-range	Severe drought	Mid-range	Mid-range	Extremely moist	Mid-range	Mid-range	Moderate drought	Very moist	Very moist
Aug.	Mid-range	Extreme drought	Mid-range	Mid-range	Extremely moist	Very moist	Mid-range	Mid-range	Extremely moist	Very moist
Sept.	Mid-range	Severe drought	Mid-range	Moderately moist	Very moist	Very moist	Mid-range	Mid-range	Very moist	Very moist
Oct.	Moderate drought	Severe drought	Mid-range	Very moist	Moderately moist	Moderately moist	Mid-range	Mid-range	Very moist	Moderately moist
Nov.	Mid-range	Severe drought	Mid-range	Very moist	Very moist	Mid-range	Mid-range	Mid-range	Very moist	Moderately moist
Dec.	Mid-range	Severe drought	Moderate drought	Moderately moist	Extremely moist	Mid-range	Moderate drought	Mid-range	Very moist	Mid-range

Source: <https://www.ncei.noaa.gov/access/monitoring/historical-palmers/maps/psi/201101-202012>

Probability of Future Occurrence

To calculate the probability of future occurrence of drought in Osage County, historical climate data was analyzed. There were 32 months of recorded drought (**Table 3.25**) over a 20-year span (January, 2001 to December, 2020). The number of months in drought (32) was divided by the total number of months (240) and multiplied by 100 for the annual average percentage probability of drought (**Table 3.26**). Although drought is not predictable, long-range outlooks and predicted impacts of climate change could indicate an increase change of drought.

Table 3.25. Palmer Drought Severity Index for Osage County, MO (2001 – 2020)

Month	Year											
	January	February	March	April	May	June	July	August	September	October	November	December
2001												
2002												
2003	x	x	x									
2004												
2005							x				x	x
2006	x	x	x	x	x	x	x	x	x			
2007										x	x	
2008												
2009												
2010												
2011										x		
2012						x	x	x	x	x	x	x
2013												x
2014	x	x	x									
2015												
2016												
2017												x
2018	x						x					
2019												
2020												

Source: <https://www.ncei.noaa.gov/access/monitoring/historical-palmers/maps/psi/200101-202012>

*x indicates drought

Table 3.26. Annual Average Percentage Probability of Drought in Osage County, MO

Location	Annual Avg. % P of Drought
Osage County	13.3%

Source: NOAA National Centers for Environmental Information, Historical Palmer Drought Indices

*P = probability; see page 3.44 for definition.

Changing Future Conditions Considerations

According to the 2018 Missouri Hazard Mitigation Plan, severe drought is a natural part of Missouri's climate and is a risk to agriculture. Future increases in evaporation rates due to higher temperatures may increase the intensity of naturally occurring droughts. Although it is believed that springs will be wetter, summer droughts are likely to be more severe. Higher evaporation and lower summer rainfall are likely to reduce river flows. The number of heavy rainfall events is predicted to increase, with the overall total rainfall amounts to remain the same. This indicates that there will be periods of heavy rainfall followed by longer periods of dry days. Higher temperatures and increased evapotranspiration increase the likelihood of drought and its negative impact on agriculture.²⁰

Vulnerability

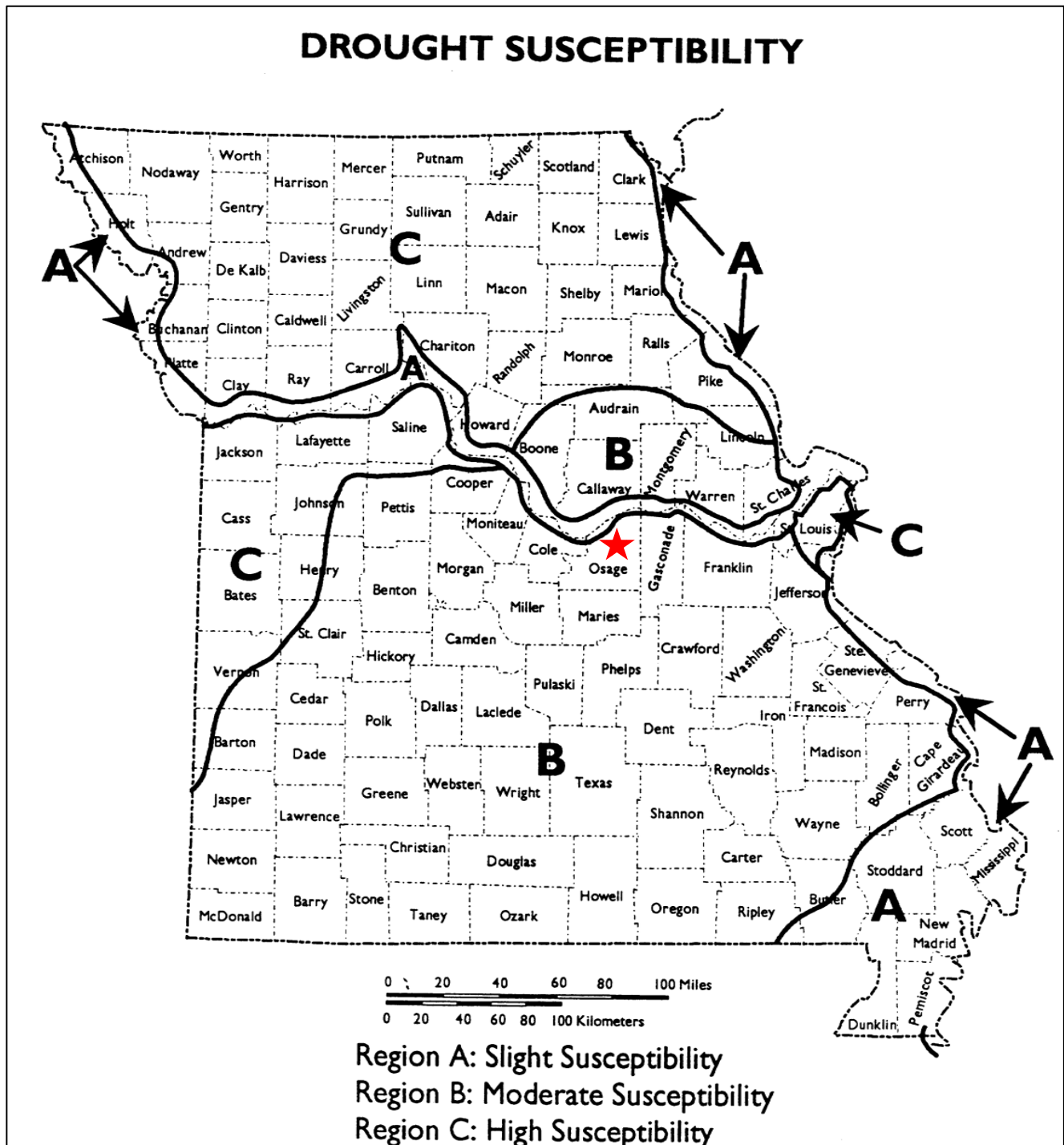
Vulnerability Overview

Data was obtained from the 2018 Missouri State Hazard Mitigation Plan for the drought vulnerability analysis. **Table 3.27** depicts the ranges for drought vulnerability factor ratings created by SEMA. The array ranges between 1 (low) and 5 (high). The factors considered include social vulnerability, crop exposure ratio, annualized crop claims paid and likelihood of occurrence. Once the ranges were determined and applied to all factors considered in the analysis, the ratings were combined to determine an overall vulnerability rating for drought. Osage County is determined as having medium vulnerability to crop loss (**Table 3.28**) as a result of a drought. Additionally, SEMA has divided the State into 3 regions in regards to drought susceptibility (**Figure 3.14**). Osage County is included in Region B (Moderate Susceptibility). Region B is described as having groundwater sources that are suitable in meeting domestic and municipal water needs, but due to required well depths, irrigation wells are very expensive. Also, the topography is commonly unsuitable for row-crop irrigation²¹.

²⁰ 2018 Missouri State Hazard Mitigation Plan

²¹ 2018 Missouri State Hazard Mitigation Plan

Figure 3.14. Drought Susceptibility in Missouri



Source: 2018 Missouri State Hazard Mitigation Plan; *Red star indicates Osage County

Table 3.27. Ranges for Drought Vulnerability Factor Ratings

Factors Considered	Low (1)	Medium-low (2)	Medium (3)	Medium-high (4)	High (5)
Social Vulnerability Index	1	2	3	4	5
Crop Exposure Ratio Rating	\$866,000 - \$10,669,000	\$10,669,001 - \$33,252,000	\$33,252,001 - \$73,277,000	\$73,277,001 - \$155,369,000	\$155,369,001 - \$256,080,000
Annualized USDA Crop Claims Paid	<\$340,000	\$340,000 - \$669,999	\$670,000 - \$999,999	\$1M - \$1,299,999	>\$1,300,000
Likelihood of Occurrence of Severe or Extreme Drought	1-1.9%	2-3.9%	4-5.9%	6-8.9%	9-10.72%
Total Drought Vulnerability Rating	7-8	9-10	11-12	13-14	15-17

Source: 2018 Missouri State Hazard Mitigation Plan

Table 3.28. Vulnerability of Osage County to Drought

SOVI index rating	USDA RMA Total Drought Crop Claims	Avg Annualized Crop Claims	USDA Claims Rating	2012 Crop Exposure	Crop Exposure Rating	Likelihood of severe drought %	Drought occurrence rating	Total Rating	Total rating (text) drought
3	\$1,244,528	\$138,281	1	\$13,940,000	2	10.72	5	11	Medium

Source: 2018 Missouri State Hazard Mitigation Plan

Potential Losses to Existing Development

Drought is not limited to a hazard that affects just agriculture, but can extend to encompass the nation's whole economy. Its impact can adversely affect a small town's water supply, the corner grocery store, commodity markets, or tourism. Additionally, extreme droughts have the ability to damage roads, water mains, and building foundations. On average, drought costs the U.S. economy about \$6 billion to \$8 billion a year, according to the National Drought Mitigation Center²². Moreover, drought prone regions are also prone to increased fire hazards.

Impact of Future Development

Impacts of drought on future development within Osage County would be negligible. Population projections as provided by the Missouri Office of Administration suggest that Osage County will increase by approximately 96 individuals within the next 10 years²³. Moreover, with an increasing population, water use and demand would be expected to increase as well; potentially straining the water supply systems. However, long term drought could expose vulnerabilities during construction/upgrades of water distribution and sewer infrastructures. Furthermore, any agriculture related development in terms of crop or livestock production would also be at risk.

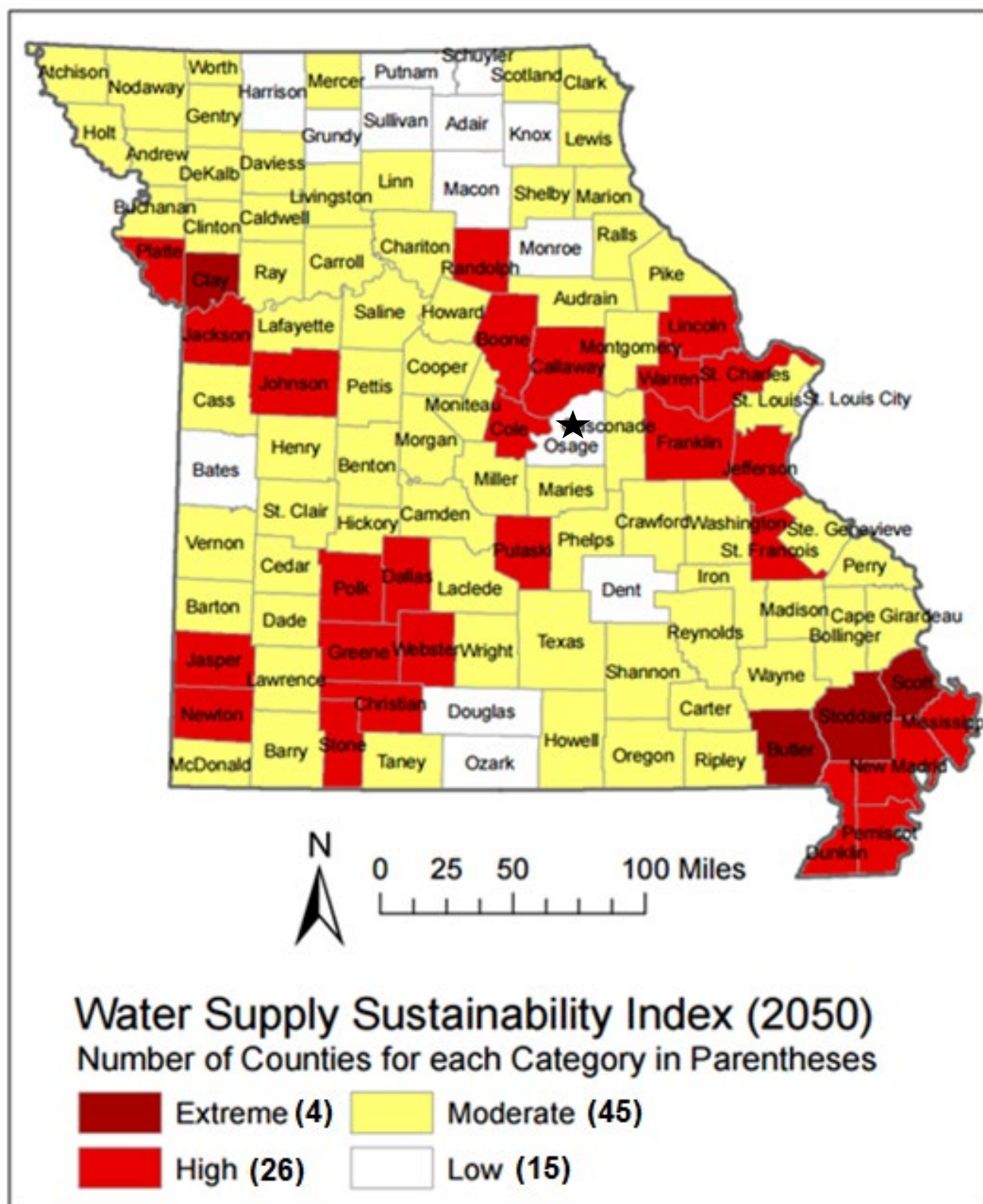
²² <https://drought.unl.edu/>

²³ Missouri Office of Administration <http://oa.mo.gov/budget-planning/demographic-information/population-projections/2000-2030-projections>

Impact of Climate Change

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. Osage County is predicted to experience low amounts of water shortages as a result of global warming (**Figure 3.15**) by the year 2050.

Figure 3.15. Water Supply Sustainability Index (2050) with Climate Change Impacts



Source: Natural Resources Defense Council (NRDC), Climate Change, Water, and Risk

*Black star indicates Osage County

Hazard Summary by Jurisdiction

The variations between jurisdictions are non-existent to minimal. Osage County and the communities of Argyle, Chamois, Freeburg, Linn, Meta, and Westphalia utilize ground/well water as their water source. In all cities, drought conditions would be the same as those experienced in rural areas, but the magnitude would be different with only lawns and local gardens impacted. Long term drought, spanning months at a time, could negatively impact the amount of potable drinking water available.

Problem Statement

In summary, drought within Osage County is considered low risk. Climate change predictions also suggest low risks by the year 2050. Osage County has a strong agricultural economy. Drought would impact commodities, specifically livestock and crops. Potential impacts to local economies and infrastructures are foreseeable in the event of a long-term drought.

The county and all cities should develop water monitoring plans as an early warning system. Each sector should inventory and review their groundwater operation plans. A water conservation awareness program should be presented to the public either through pamphlets, workshops or a drought information center. Voluntary water conservation should be encouraged to the public. The county and both cities should continually look for and fund water system improvements, new systems, and new wells.

3.4.3 Earthquakes

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.4, Page 3.192
- U.S. Seismic Hazard Map, United States Geological Survey, <https://www.usgs.gov/programs/earthquake-hazards/maps>;
- Impact of Earthquakes on the Central USA
http://www.cusec.org/documents/aar/NMSZ_CAT_PLANNING_SCENARIO.pdf
- Missouri Hazard Mitigation Viewer
<http://bit.ly/MoHazardMitigationPlanViewer2018> - Website
<https://drive.google.com/file/d/1bPkc0JgF9ofwQLnTL9N0u-oPFWi9hkst/view> - User Guide
 - Total population impacted by earthquakes by County
 - Total number of structures impacted by earthquakes by County
 - Total value of structures impacted by earthquakes by County
 - Property loss ratio to earthquakes by County
- 6.5 Richter Magnitude Earthquake Scenario, New Madrid Fault Zone map, <https://iowageologicalsurvey.org/>;
- Facts about the New Madrid Seismic Zone, <https://dnr.mo.gov/land-geology/hazards/earthquakes/science/facts-new-madrid-seismic-zone>

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.

The closest fault to Osage County is the New Madrid Seismic Zone (NMSZ). The NMSZ is the most active seismic area in the United States east of the Rocky Mountains. Unfortunately, the faults in the NMSZ are poorly understood due to concealment by alluvium deposits. Moreover, the NMSZ is estimated to be 30 years overdue for a 6.3 magnitude earthquake²⁴.

Geographic Location

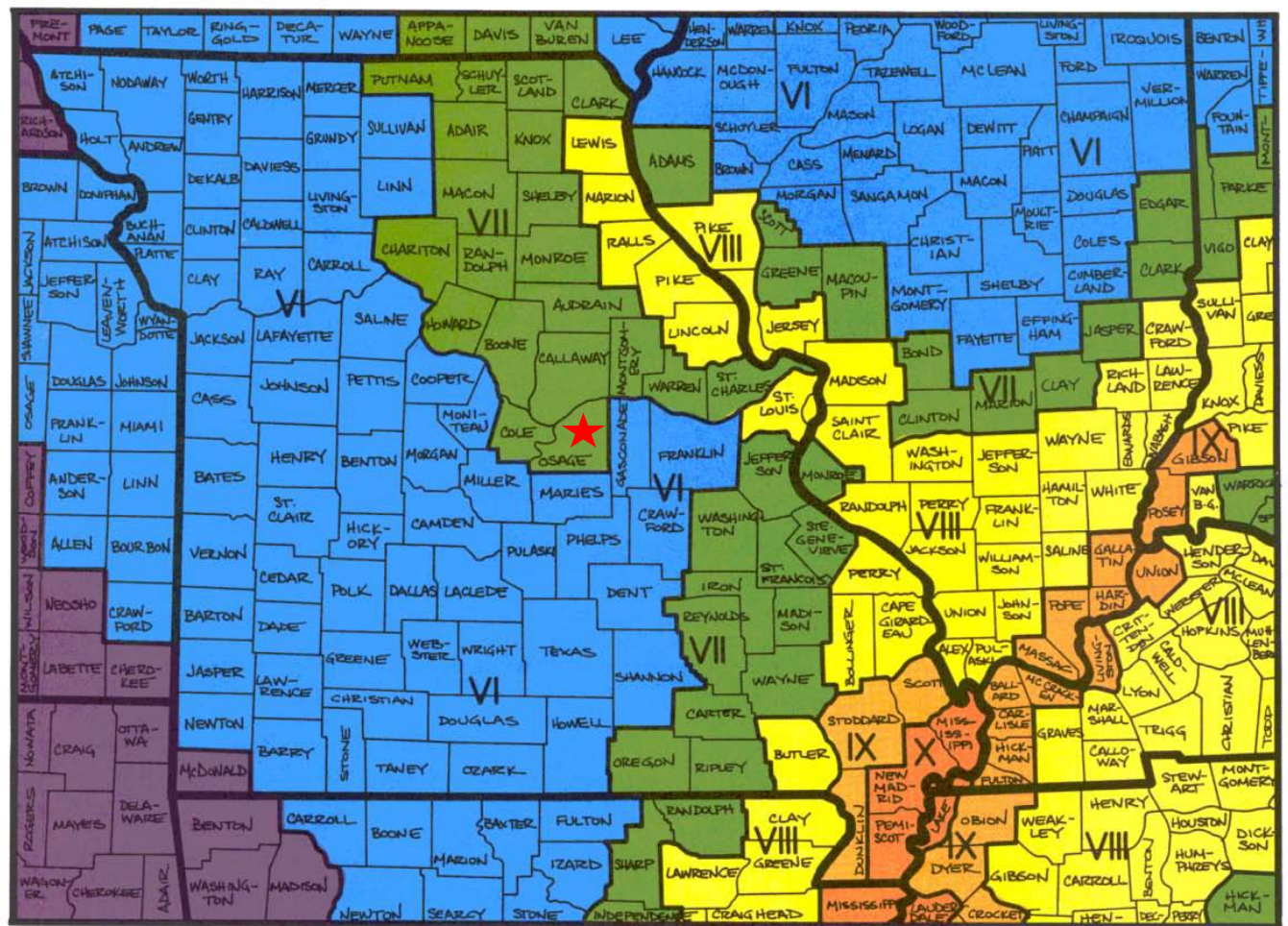
There are eight earthquake source zones in the Central United States, one of which is located within the state of Missouri—the New Madrid Fault. Other seismic zones, because of their proximity, also affect Missourians. These are the Wabash Valley Fault, Illinois Basin, and the Nemaha Uplift. The most active zone is the New Madrid Fault, which runs from Northern Arkansas through Southeast Missouri and Western Tennessee and Kentucky to the Illinois side of the Ohio River Valley.

Figure 3.16 depicts impact zones for a magnitude 7.6 earthquake along the New Madrid Fault along with associated Modified Mercalli Intensities. Osage County is indicated by a red star. Furthermore, the

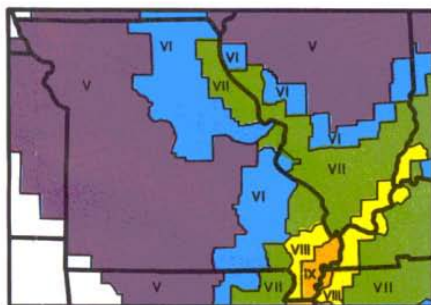
²⁴ Missouri Department of Natural Resources, Facts about the New Madrid Seismic Zone

Modified Mercalli Intensities for potential 6.7 and 8.6 magnitude earthquakes are illustrated. In the event of a 6.7 magnitude earthquake, Osage County would experience a Modified Mercalli Intensity of V (**Figure 3.17**). This intensity is categorized as being almost felt by everyone. 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. Additionally, in the occurrence of 7.6 and 8.6 magnitude earthquakes; the county would experience Modified Mercalli Intensities of VII. There will 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. **Figure 3.17** and **Table 3.29** further define Richter Scale intensities.

Figure 3.16. Impact Zones for Earthquake Along the New Madrid Fault

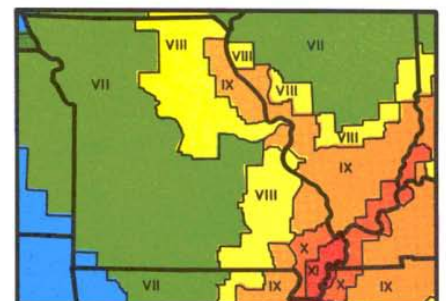


This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



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: sema.dps.mo.gov; *Red star indicates Osage County

Figure 3.17. Projected Earthquake Intensities

MODIFIED MERCALLI INTENSITY SCALE	
I 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.	
V 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.	IX 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.
VI 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.	X 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.
VII 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.	XI 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.
VIII 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.	XII 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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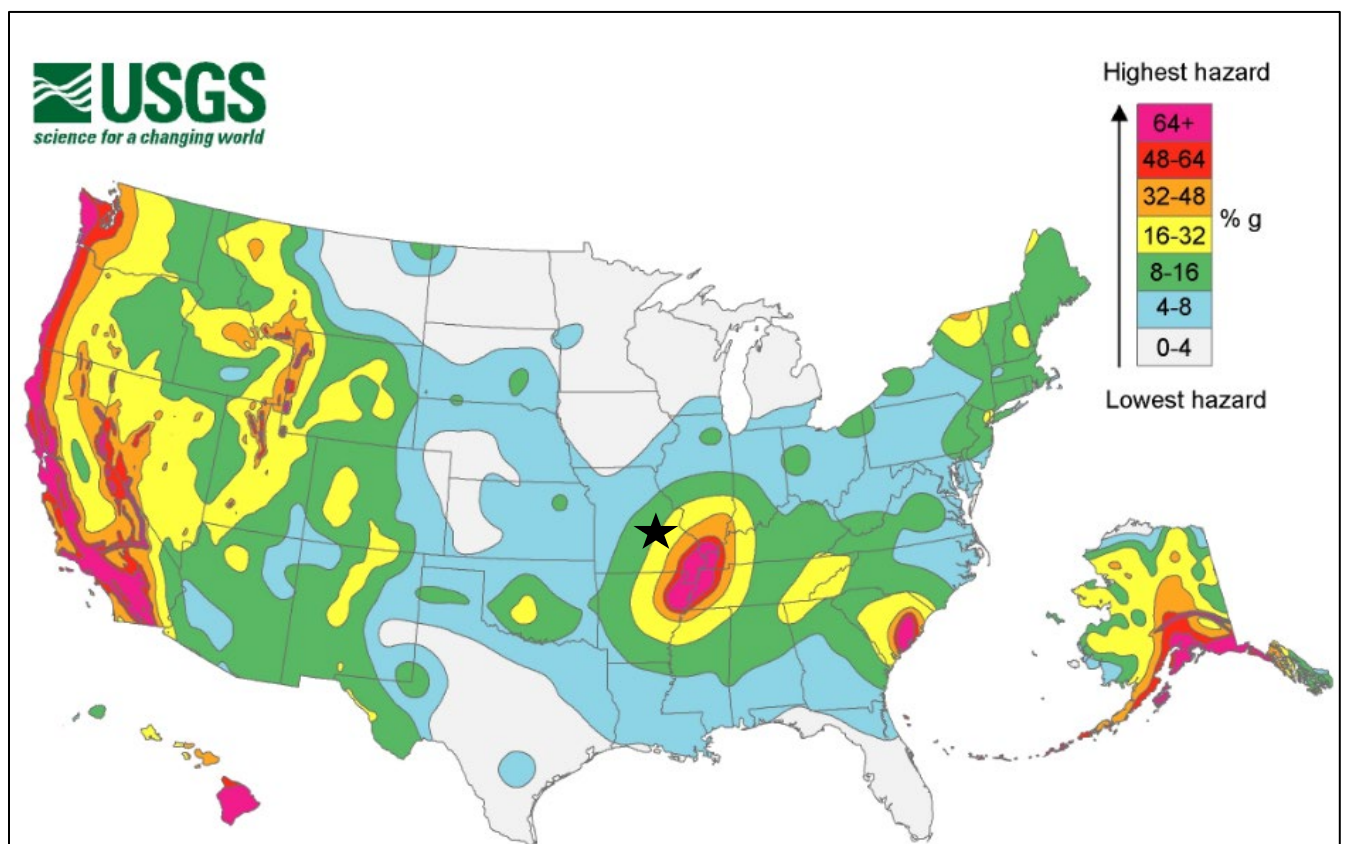
Source: sema.dps.mo.gov

Table 3.29. Richter Scale of Earthquake Magnitude

Magnitude Level	Category	Effects	Earthquake per Year
Less than 1.0 to 2.9	Micro	Generally not felt by people, though recorded on local instruments	More than 100,000
3.0-3.9	Minor	Felt by many people; no damage	12,000-100,000
4.0-4.9	Light	Felt by all; minor breakage of objects	2,000-12,000
5.0-5.9	Moderate	Some damage to weak structures	200-2,000
6.0-6.9	Strong	Moderate damage in populated areas	20-200
7.0-7.9	Major	Serious damage over large areas; loss of life	3-20
8.0 and higher	Great	Severe destruction and loss of life over large areas	Fewer than 3

Figure 3.18 illustrates the seismicity in the United States. A black star indicates the location of Osage County. The seismic hazard map displays earthquake peak ground acceleration (PGA) that has a 2% chance of being exceeded in 50 years, which has a value between 16-32% g.

Figure 3.18. United States Seismic Hazard Map



Source: USGS, <http://earthquake.usgs.gov>; *Black star indicates Osage County

Strength/Magnitude/Extent

The extent or strength 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. Each whole number increase in magnitude represents a tenfold increase in measured amplitude; an estimate of energy. For example, comparing a 5.3 and a 6.3 earthquake shows that a 6.3 earthquake is ten times bigger than a magnitude 5.3 earthquake on a seismogram, but is 31.622 times stronger (energy release)²⁵.

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

Most of Missouri's earthquake activity has been concentrated in the southeast corner of the state, which lies within the New Madrid seismic zone. The written record of earthquakes in Missouri prior to the nineteenth century is virtually nonexistent; however, there is geologic evidence that the New Madrid seismic zone has had a long history of activity. The first written account of an earthquake in the region was by a French missionary on a voyage down the Mississippi River. He reported feeling a distinct tremor on Christmas Day 1699 while camped in the area of what is now Memphis, TN.

Whatever the seismic history of the region may have been before the first Europeans arrived, after Dec. 16, 1811, there could be no doubt about the area's potential to generate severe earthquakes. On that date, shortly after 2 a.m., the first tremor of the most violent series of earthquakes in the United States history struck southeast Missouri. In the small town of New Madrid, about 290 kilometers south of St. Louis, residents were aroused from their sleep by the rocking of their cabins, the cracking of timbers, the clatter of breaking dishes and tumbling furniture, the rattling of falling chimneys, and the crashing of falling trees. A terrifying roaring noise was created as the earthquake waves swept across the ground. Large fissures suddenly opened and swallowed large quantities of river and marsh water. As the fissures closed again, great volumes of mud and sand were ejected along with the water.

The earthquake generated great waves on the Mississippi River that overwhelmed many boats and washed others high upon the shore. The waves broke off thousands of trees and carried them into the river. High riverbanks caved in, sand bars gave way, and entire islands disappeared. The violence of

²⁵ Measuring the Size of an Earthquake, https://www.usgs.gov/facts/how-are-earthquakes-recorded-how-are-earthquakes-measured-how-magnitude-earthquake-determined?qt-news_science_products=0#qt-news_science_products

the earthquake was manifested by great topographic changes that affected an area of 78,000 to 130,000 square kilometers.

On Jan. 23, 1812, a second major shock, seemingly more violent than the first, occurred. A third great earthquake, perhaps the most severe of the series, struck on Feb. 7, 1812.

The three main shocks probably reached intensity XII, the maximum on the Modified Mercalli scale, although it is difficult to assign intensities, due to the scarcity of settlements at the time. Aftershocks continued to be felt for several years after the initial tremor. Later evidence indicates that the epicenter of the first earthquake (Dec. 16, 1811) was probably in northeast Arkansas. Based on historical accounts, the epicenter of the Feb. 7, 1812, shocks was probably close to the town of New Madrid.

Although the death toll from the 1811-12 series of earthquakes has never been tabulated, the loss of life was very slight. It is likely that if at the time of the earthquakes the New Madrid area had been as heavily populated as at present, thousands of persons would have perished. The main shocks were felt over an area covering at least 5,180,000 square kilometers. Chimneys were knocked down in Cincinnati, Ohio, and bricks were reported to have fallen from chimneys in Georgia and South Carolina. The first shock was felt distinctly in Washington, D.C., 700 miles away, and people there were frightened badly. Other points that reported feeling this earthquake included New Orleans, 804 kilometers away; Detroit, 965 kilometers away; and Boston, 1,769 kilometers away.

The New Madrid seismic zone has experienced numerous earthquakes since the 1811-12 series, and at least 35 shocks of intensity V or greater have been recorded in Missouri since 1811. Numerous earthquakes originating outside of the state's boundaries have also affected Missouri. Five of the strongest earthquakes that have affected Missouri since the 1811-12 series are described below.

On Jan. 4, 1843, a severe earthquake in the New Madrid area cracked chimneys and walls at Memphis, Tennessee. One building reportedly collapsed. The earth sank at some places near New Madrid; there was an unverified report that two hunters were drowned during the formation of a lake. The total felt area included at least 1,036,000 square kilometers.

The Oct. 31, 1895, earthquake near Charleston, MO probably ranks second in intensity to the 1811-12 series. Every building in the commercial area of Charleston was damaged. Cairo, Illinois, and Memphis, Tennessee, also suffered significant damage. Four acres of ground sank near Charleston and a lake was formed. The shock was felt over all or portions of 23 states and at some places in Canada.

A moderate earthquake on April 9, 1917, in the Ste. Genevieve/St. Mary's area was reportedly felt over a 518,000 square kilometer area from Kansas to Ohio and Wisconsin to Mississippi. In the epicentral area people ran into the street, windows were broken, and plaster cracked. A second shock of lesser intensity was felt in the southern part of the area.

The small railroad town of Rodney, MO experienced a strong earthquake on Aug. 19, 1934. At nearby Charleston, windows were broken, chimneys were overthrown or damaged, and articles were knocked from shelves. Similar effects were observed at Cairo Mounds and Mound City, IL, and at Wickliff, KY. The area of destructive intensity included more than 596 square kilometers.

The Nov. 9, 1968, earthquake centered in southern Illinois was the strongest in the central United States since 1895. The magnitude 5.5 shock caused moderate damage to chimneys and walls at Hermann, St. Charles, St. Louis, and Sikeston, Missouri. The felt areas include all or portions of 23 statesⁱⁱ.

Small earthquakes continue to occur frequently in Missouri. Averages of 200 earthquakes are detected every year in the New Madrid Seismic Zone alone. Most are detectable only with sensitive instruments, but on an average of every 18 months, southeast Missouri experiences an earthquake strong enough to crack plaster in buildings²⁶.

Probability of Future Occurrence

Osage County has reported a total of zero earthquakes since 1931. The County, located in east central Missouri, a good distance from the southeast corner of the state that has the potential for moderate damage should a significant earthquake occur.

The 2018 Missouri Hazard Mitigation Plan states that there have been 31 recorded earthquake events greater than or equal to M 4.0 in the 43-year period from 1973 to 2018. According to this data, annual probability calculates to 72 percent. Additionally, the USGS estimated in 2006 that the probability of a repeat of the 1811-1812 earthquakes (magnitude 7.5 – 8.0) was seven to ten percent in a 50-year time period (Source: <http://pubs.usgs.gov/fs/2006/3125>). Given the historical frequency of earthquake events, this hazard is determined to have a high probability of occurrence within the State.

SEMA utilized Hazus V 3.2 to analyze vulnerability and estimate losses to earthquakes. Hazus is a program developed by FEMA which is a nationally applicable standardized methodology that encompasses models for assessing potential losses from earthquakes, floods, and hurricanes. All Hazus analyses were run using Level 1 building inventory database comprised of updated demographic and aggregated data based on the 2010 census. An annualized loss scenario that enabled an “apples to apples” comparison of earthquake risk for each county was synthesized from a FEMA nationwide annualized loss study (FEMA 366 Hazus Estimated Annualized Earthquake Losses for the United States, April 2017). A second scenario, based on an event with a two percent probability of exceedance in 50 years, was done to model a worst-case earthquake using a level of ground shaking recognized in earthquake-resistant design.

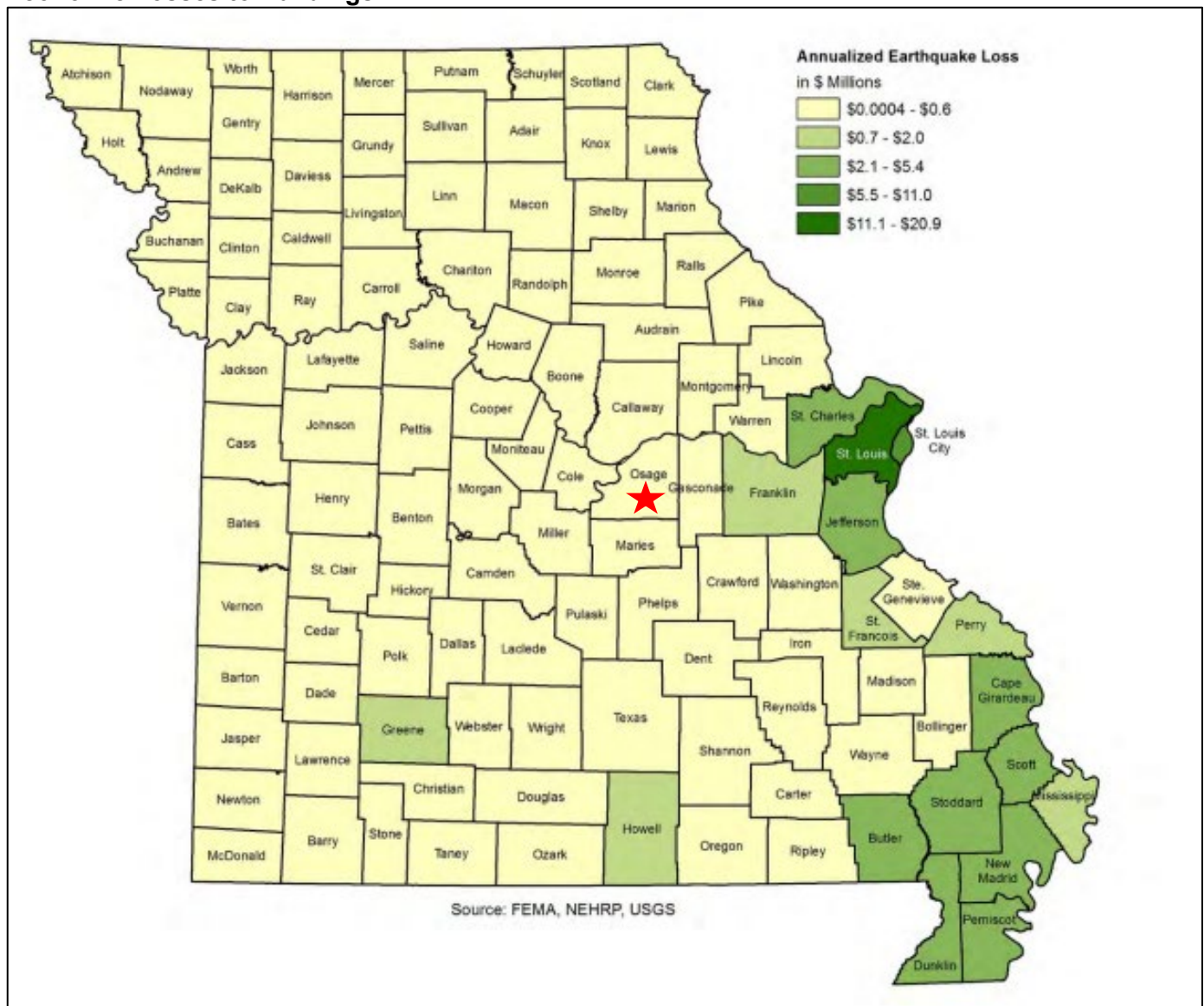
Annualized loss is the maximum potential annual dollar loss resulting from eight return periods (100, 200, 500, 750, 1,000, 1,500, 2,000, and 2,500 years) averaged on a ‘per year’ basis²⁷. This is the scenario that FEMA uses to compare relative risk from earthquakes and other hazards at the county level nationwide. The Hazus earthquake loss estimation is depicted in **0** which shows annualized loss scenario direct economic losses to buildings. In this scenario, the annualized earthquake loss for buildings in Osage County in any one year is estimated to be \$4,000 to \$600,000. **Table 3.30** provides information on total estimated losses, estimated losses per capita and loss ratio. This results in the county being ranked 64th in the state for expected loss with low vulnerability for this hazard. This loss ratio indicates impacts on local economies in the event of an earthquake, and the difficulty for jurisdictions to recover from said event.²⁸

²⁶ Missouri State Hazard Mitigation Plan 2018

²⁷ 2018 Missouri State Hazard Mitigation Plan

²⁸ 2018 Missouri State Hazard Mitigation Plan

Figure 3.19. HAZUS-MH Earthquake Loss Estimation: Annualized Loss Scenario –Direct Economic Losses to Buildings.



Source: 2018 Missouri State Hazard Mitigation Plan; *Red star indicates Osage County

Table 3.30. HAZUS-MH Earthquake Loss Estimation-Osage County: Annualized Loss Scenario

Total Losses in \$ Thousands	Loss Per Capita, In \$ Thousands	Loss Ratio in \$ Per Million	Statewide Ranking for Expected Losses
\$58	\$0.0042	\$36	64th

Source: Hazus 2.1

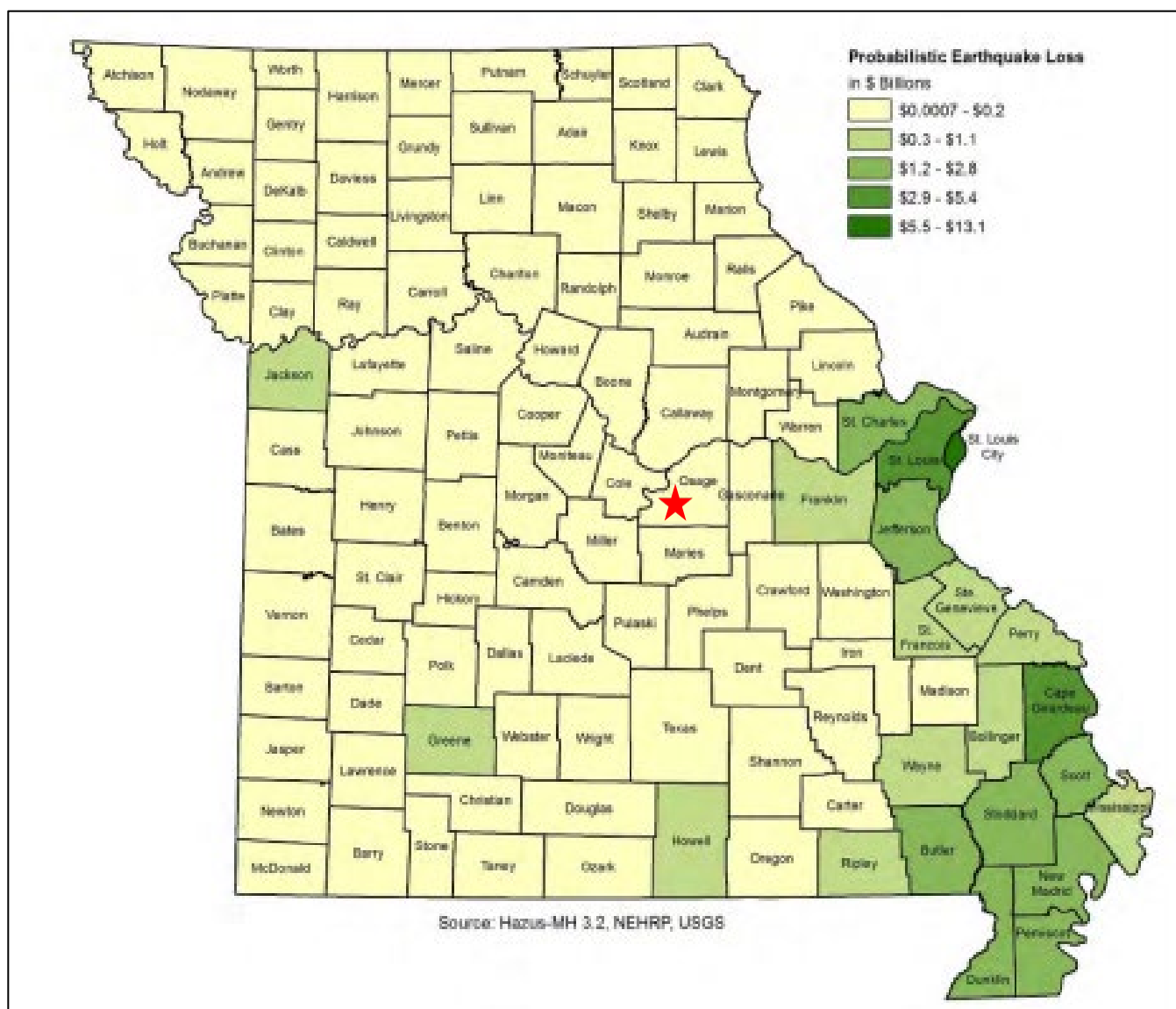
*All \$values are in thousands

**Loss ratio is the sum of structural and nonstructural damage divided by the entire building inventory value within a county

Likewise, SEMA developed a second scenario which incorporated a 2% probability of exceedance in 50 years. This model was to demonstrate a worst-case scenario. This scenario is equivalent to the 2,500-year earthquake scenario in HAZUS-MH. The methodology is based on probabilistic seismic

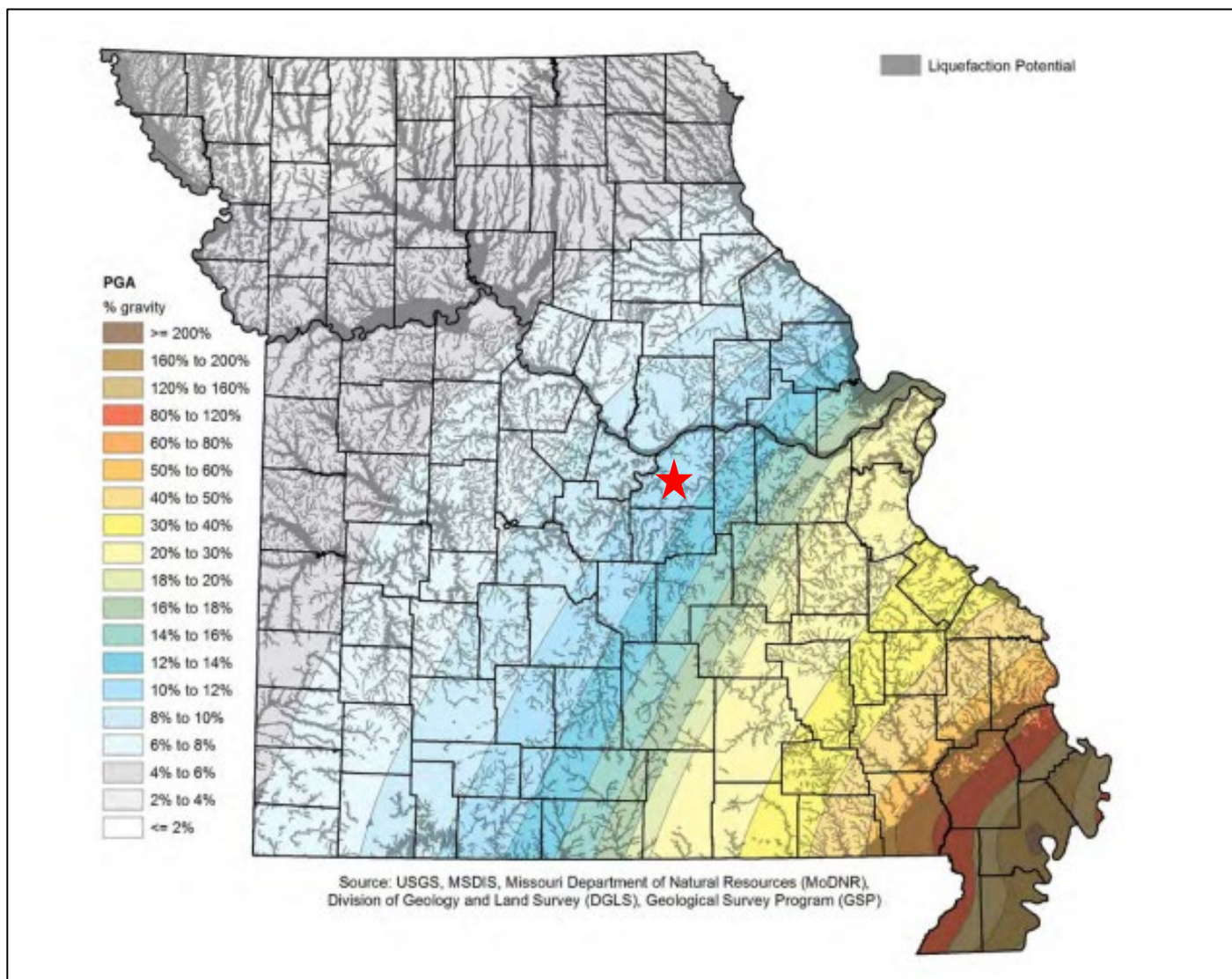
hazard shaking grids developed by the U.S. Geological Survey (USGS) for the National Seismic Hazard Maps that are included with HAZUS-MH. The USGS updated this mapping in 2014. **Figure 3.20** illustrates direct economic loss to buildings. Osage County is anticipated to lose between \$700,000 and \$200,000,000 in a 50-year scenario. **Figure 3.21** provides estimates of peak ground acceleration and spectral acceleration (ground shaking potential) at intervals of 0.3 and 1.0 seconds, respectively which have a two percent probability of exceedance in the next 50 years. These acceleration events have a 2% probability of exceedance in the next 50 years. A 7.7 magnitude earthquake was utilized in this scenario, which is typically utilized for New Madrid fault planning scenarios in Missouri. Furthermore, this pattern of shaking can be seen in with corresponding potential for damage and areas with soils potentially susceptible to liquefaction. Osage County is estimated to have peak ground acceleration between 8 percent and 14 percent.

Figure 3.20. HAZUS-MH Earthquake Loss Estimation with a 2% Probability of Exceedance in 50 Years Scenario – Total Building Loss



Source: 2018 Missouri State Hazard Mitigation Plan; *Red star indicates Osage County

Figure 3.21. Hazus Earthquake 2% Probability of Exceedance in 50 Years – Ground Shaking and Liquefaction Potential



Source: 2018 Missouri State Hazard Mitigation Plan; *Red star indicates Osage County

Table 3.31 provides information on estimated direct economic losses for Osage County, including structural, nonstructural, inventory, contents, relocation costs, capital related loss, wages, and rental income loss. According to the 2018 Missouri Hazard Mitigation Plan, Osage County's loss ratio is 3.35 percent. Osage County ranks 57th in the state for direct economic losses in this scenario. **Figure 3.22** depicts loss ratio by county, which is the ratio of the building structure and nonstructural damage to the value of the entire building inventory. The loss ratio is a measure of the disaster impact to community sustainability, which is generally considered at risk when losses exceed 10 percent of the built environment (FEMA). Osage County shows a loss ratio of 0.2 percent to 3.4 percent.

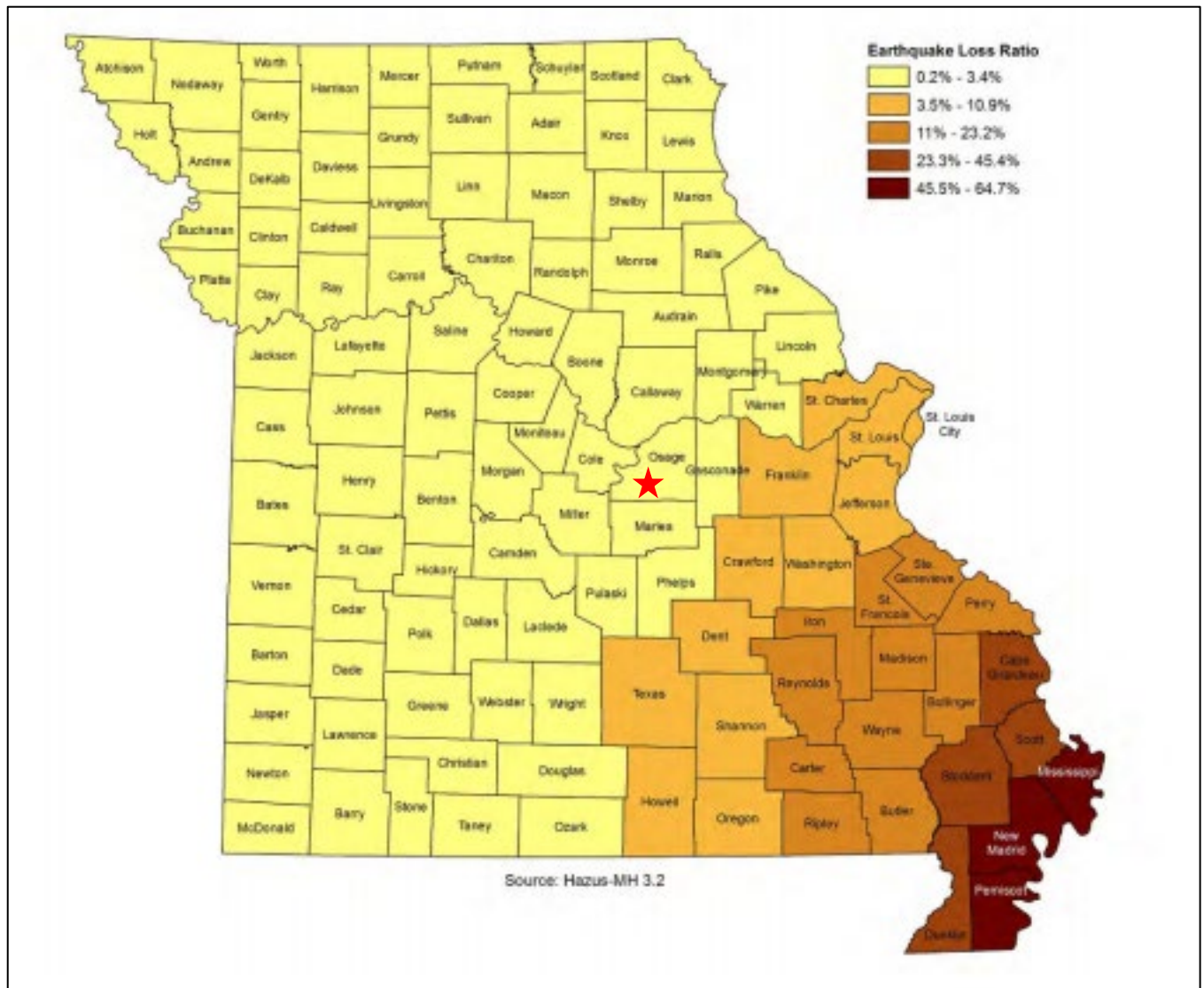
Table 3.31. HAZUS-MH Earthquake Loss Estimation 2% Probability of Exceedance in 50 Years Scenario Direct Economic Losses Results Summary for Osage County*

Cost Structural Damage	Cost Non-Structural Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
\$8,178	\$22,834	\$7,801	\$190	3.35	\$5,651	\$836	\$1,368	\$1,921	\$48,779

Source: 2018 Missouri Hazard Mitigation Plan

*All values in thousands

Figure 3.22. Hazus Earthquake Loss Estimation with a 2% Probability of Exceedance in 50 Years Scenario – Loss Ratio



Source: 2018 Missouri State Hazard Mitigation Plan; *Red star indicates Osage County

Changing Future Conditions Considerations

Scientists are beginning to believe that there may be a correlation 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.²⁹

Vulnerability

Vulnerability Overview

As stated in the 2018 Missouri Hazard Mitigation Plan, 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. Losses at the time were limited due to low population and little development. However, a similar quake at this time would result in devastating damage.

The most important direct earthquake hazard is ground shaking, which affects structures close to the earthquake epicenter. However, ground shaking can also affect structures located great distances from epicenters, 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.

According to MDNR's Missouri Geological Survey, damage from earthquakes in the New Madrid Seismic Zone will vary depending on the earthquake magnitude, the character of the land and the degree of urbanization. Infrastructure in the region such as highways, bridges, pipelines, communication lines and railroads might suffer damage, which would adversely affect Osage County, even if the county itself did not suffer heavy damage. Infrastructure could take a significant time to repair.

An important tool for homeowners to address the risk of earthquake damage to property is the purchase of earthquake insurance coverage. The Missouri Department of Insurance, Financial Institutions and Professional Registration (DIFP) prepared a report in 2020 on the state of earthquake insurance coverage in Missouri. The report notes that earthquake coverage has become less available and less affordable over the last 15 years. The cost of earthquake insurance has increased from an average of \$50 per year to \$209 per year. In high-risk counties the increases have been more substantial – from \$57 per year in 2000 to \$490 per year in 2020. The number of residences covered by earthquake insurance has dropped over the last 15 years – likely due to the increased cost of premiums. In 2020 the percentage of residential policies with earthquake coverage in Osage County was 16.8 percent with the average cost of coverage at \$150 per year.³⁰

Potential Losses to Existing Development

Osage County's buildings are suggested to lose between \$4,000 and \$600,000 in any one year, thus ranking the County as being ranked as 45th in the state for total expected losses. In the HAZUS

²⁹ Missouri State Hazard Mitigation Plan 2018

³⁰ The State of Earthquake Coverage Report,

<https://insurance.mo.gov/earthquake/documents/OverviewofResidentialEarthquakeInsurancein2020.pdf>

scenario illustrated in Figure 3.28, Osage County has a loss ratio of .2 percent to 3.4 percent. The loss ratio indicates impacts on local economies in the event of an earthquake, and the difficulty for jurisdictions to recover from said event. According to the 2018 Missouri State Hazard Mitigation Plan, Osage would suffer total building losses of \$700,000 - \$200,000,000 in a two percent HAZUS-MH 50-year scenario.

Impact of Previous and Future Development

Future development at risk includes new fire station and residential development in Linn, and building expansions planned at Osage County R-I school district. Future development will not increase the risk of an earthquake, rather contributing to the overall exposure of damaged property. As new development arises, minimum standards of building codes should be established in all jurisdictions to decrease the potential damage/loss should an earthquake occur.

The Revised Statutes of MO, Section 160.451 require that: The governing body of each school district which can be expected to experience an intensity of ground shaking equivalent to a Modified Mercalli Intensity of VII or above from an earthquake occurring along the New Madrid Fault with a potential magnitude of 7.6 on the Richter Scale shall establish an earthquake emergency procedure system in every school building under its jurisdiction³¹.

Hazard Summary by Jurisdiction

Since earthquake intensity is not likely to vary greatly throughout the planning area, the risk will be the same throughout. Osage County is not near the New Madrid Shock Zone, but it will most likely endure mild secondary effects from the earthquake, such as fire, structure damage, utility disruption, environmental impacts, and economic disruptions/losses. However, damages could differ if there are structural variations in the planning area's built environment. For example, if one community has a higher percentage of residences built prior to 1939 than the other participants, that community is likely to experience higher damages. **Table 3.32** depicts the percent of residences built prior to 1939 in Osage County. In addition, if school districts have buildings built prior to 1939, those facilities may be at higher risk of damage should an earthquake occur. Argyle (44.1%), Meta (32.2%), and Westphalia (29.9%) have the most residences susceptible to damage in the event of an earthquake. If a major earthquake should occur, Osage County would likely be impacted by the number of refugees traveling through the area seeking safety and assistance.

Table 3.32. Percent of Osage County Residences Built Prior to 1939

Jurisdiction	Number of Residences Built Prior to 1939	% of Residences Built Prior to 1939
Unincorporated Osage County	455	11.4%
Argyle	30	44.1%
Chamois	49	27.4%
Freeburg	28	15.5%
Linn	49	8.4%
Meta	28	32.2%
Westphalia	53	29.9%

Source: U.S. Census Bureau, 2016-2020 5-Year American Community Survey

³¹ 2015 Boone County Hazard Mitigation Plan

Problem Statement

In a worst-case scenario, the county is expected to encounter \$47,663,000 in total economic losses to buildings. Meta has a higher risk of damage to buildings due to over 42 percent of the homes having been built prior to 1939.

Jurisdictions should encourage the purchase of earthquake hazard insurance. As well as establishing structurally sound emergency shelters in several parts of the county. In addition, stringent minimum standards of building codes should be established. Lastly, outreach and education should be utilized more frequently to prepare citizens for the next occurrence.

3.4.4 Extreme Temperatures

Some specific sources for this hazard are:

- 2018 Missouri State hazard Mitigation Plan, Chapter 3, Section 3.3.7, Page 3.253
https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- National Centers for Environmental Information, Storm Events Database,
<http://www.ncdc.noaa.gov/stormevents/>
- Heat Index Chart & typical health impacts from heat, National Weather Service; National Weather Service Heat Index Program, <https://www.weather.gov/safety/heat-index>;
- Wind Chill chart, National Weather Service, http://www.nws.noaa.gov/om/cold/wind_chill.shtml;
- Daily temperatures averages and extremes, High Plains Regional Climate Summary, https://hprcc.unl.edu/climate_extremes.php, <http://climod.unl.edu/>;
- Hyperthermia mortality, Missouri; Missouri Department of Health and Senior Service, <http://health.mo.gov/living/healthcondiseases/hyperthermia/pdf/hyper1.pdf>;
- Hyperthermia mortality by Geographic area, Missouri Department of Health and Senior Services, <http://health.mo.gov/living/healthcondiseases/hyperthermia/pdf/hyper2.pdf>;
- Missouri Hazard Mitigation Viewer
<http://bit.ly/MoHazardMitigationPlanViewer2018> - Website
<https://drive.google.com/file/d/1bPkc0jqF9ofwQLnTL9N0u-oPFWi9hkst/view> - User Guide
 - Average annual occurrence for extreme heat by County
 - Vulnerability to extreme heat by County
 - Average annual occurrence for extreme cold by County
 - Vulnerability to extreme cold by County

Hazard Profile

Hazard Description

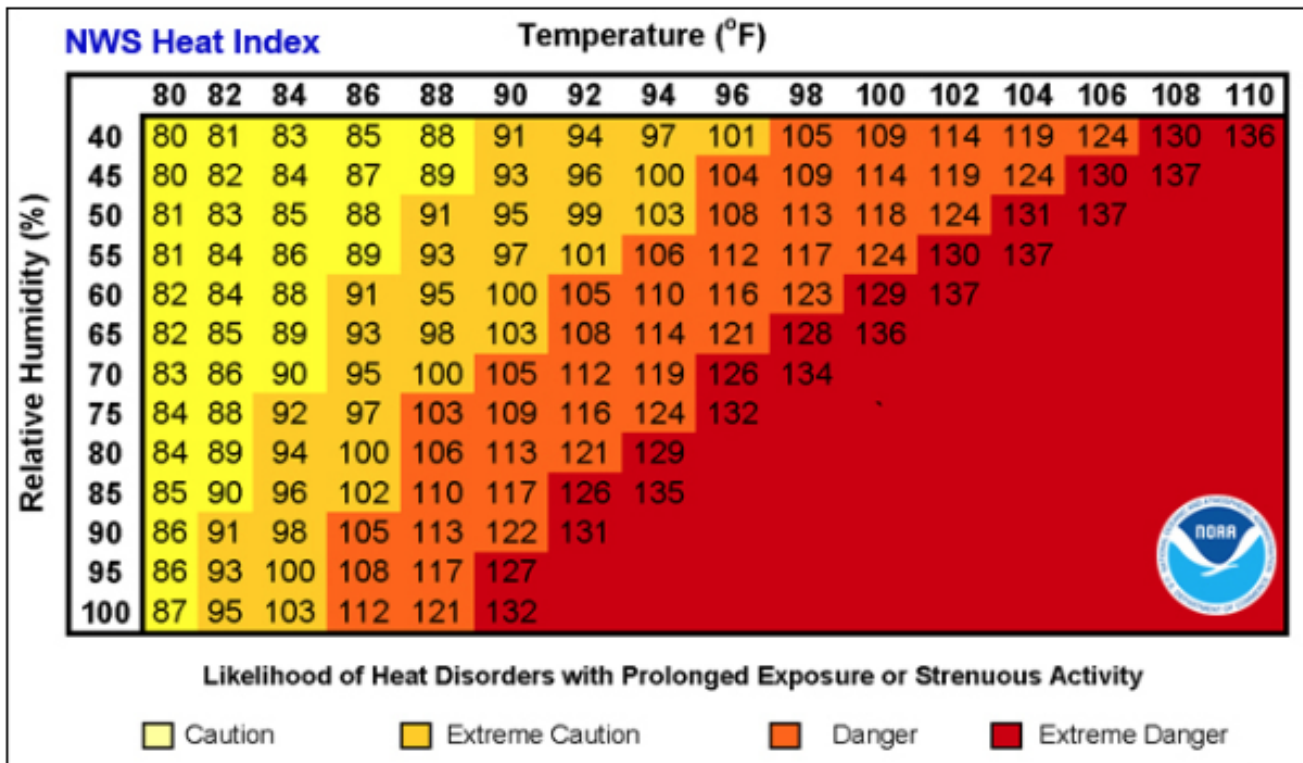
Extreme temperature events, both hot and cold, can impact human health and mortality, natural ecosystems, agriculture and other economic sectors. According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several days. 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 3.23** uses both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions. Other factors that should be taken into account include duration of exposure to high temperatures, wind and activity.

The NWS has increased its efforts to more effectively alert the general public and local authorities on the hazards of heat waves. The Heat Index (HI) is an effective tool in helping people understand the dangers of high temperatures and how temperature and relative humidity together provide a more accurate gauge of heat intensity. The HI, provided in degrees Fahrenheit, is an accurate measure of how hot it actually feels when the relative humidity is added to the air temperature. For example – using the Heat Index Chart in **Figure 3.23** - if the air temperature is 96 degrees Fahrenheit, (found in the top of the table), and the relative humidity is 55 percent (found on the left of the table), the Heat Index is 112 degrees Fahrenheit (the intersection of the 96 degree row and the 55 percent column). Because HI values were devised for shady, light wind conditions, exposure to full sunshine can increase HI values by up to 15 degrees Fahrenheit. Also, strong winds, particularly with very hot, dry air, can be

extremely dangerous.

High humidity, a common factor in Missouri, can magnify the effects of extreme heat. While heat-related illness and death can occur from exposure to intense heat in just one afternoon, heat stress on the body has a cumulative effect. The persistence of a heat wave increases the threat to public health.

Figure 3.23. Heat Index (HI) Chart



Source: National Weather Service (NWS); <https://www.weather.gov/safety/heat-index>

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.

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 and furnaces. Cold temperatures can also overpower a building's heating system and cause water and sewer lines to freeze and rupture. Extreme cold also increases the likelihood for ice jams on flat rivers and streams. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is hazardous to health and safety.

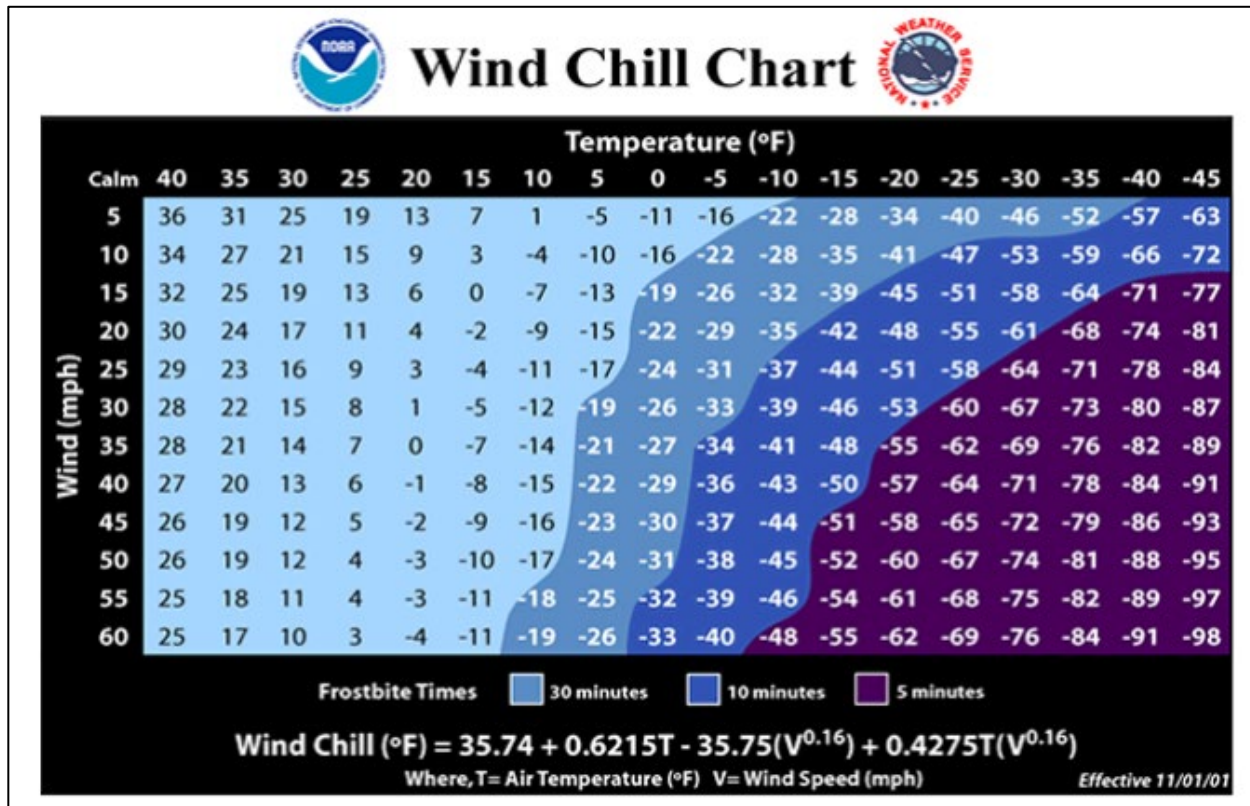
The National Institute on Aging estimates that more than 2.5 million Americans are elderly and especially vulnerable to hypothermia, with those who are isolated being most at risk. About 10 percent of people over the age of 65 have some kind of bodily temperature-regulating defect, and three to four 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 fire, which can be caused by fireplaces and emergency heaters; and frozen/burst pipes.

The NWS Wind Chill Temperature (WCT) index, shown in **Figure 3.24**, 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 temperature and eventually the internal body temperature.

Figure 3.24. Wind Chill Chart



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

Geographic Location

Extreme temperature is considered to be an area-wide hazard event. In such a case, the chance of variation in temperatures across Osage County is minimal to nonexistent.

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°F or above. A heat advisory is issued when temperatures reach 105 degrees and a warning is issued at 115 degrees.

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. **Figure 3.24** 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 temperature and eventually the internal body temperature.

Extreme heat can cause stress to crops and animals. However, according to the NOAA Storm Events Data Base, there were no reported agricultural losses for Osage County in the twenty year span between 2001 and 2020. **Table 3.33** displays data specifically on agricultural losses due to extreme heat from the USDA Risk Management website. 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.

Table 3.33. Osage County Heat Related Crop Indemnity Payments (2001-2020)

Year	Number of Payments	Total
2005	1	\$2,509.00
2006	1	\$1,794.00
2007	2	\$1,647.20
2011	1	\$817.00
2012	3	\$8,676.00
2014	2	\$15,035.00
2017	1	\$2,081.00
TOTAL	11	\$34,640.20

Source: <https://www.rma.usda.gov/Information-Tools/Summary-of-Business/Cause-of-Loss>

From 1988 through 2011, there were 3,496 fatalities in the U.S. attributed to summer heat. This translates to an annual average of 146 deaths. During the same time period, zero deaths were recorded in Osage County, according to NOAA Storm Events Data Base. The national Weather Service stated that among natural hazards, no other natural disaster – not lightning, hurricanes, tornadoes, floods or earthquakes – causes more deaths.

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.

Table 3.34 lists typical symptoms and health impacts due to exposure to extreme heat.

Table 3.34. 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, <https://www.weather.gov/safety/heat-index>

The National Weather Service 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°F or above. A heat advisory is issued when temperatures reach 105 degrees and a warning is issued at 115 degrees.

Previous Occurrences

Table 3.35 provides data in relation to record heat events between 2001 and 2020 in Osage County. Maximum heat index values and temperatures are shown for each extreme temperature event. Fortunately, there was only one injury and zero fatalities recorded during this time. In addition, **Figure 3.25** illustrates heat related deaths by county in Missouri between 1980 and 2016.

Table 3.35. NCEI Osage County Heat Events Summary (2001 – 2020)

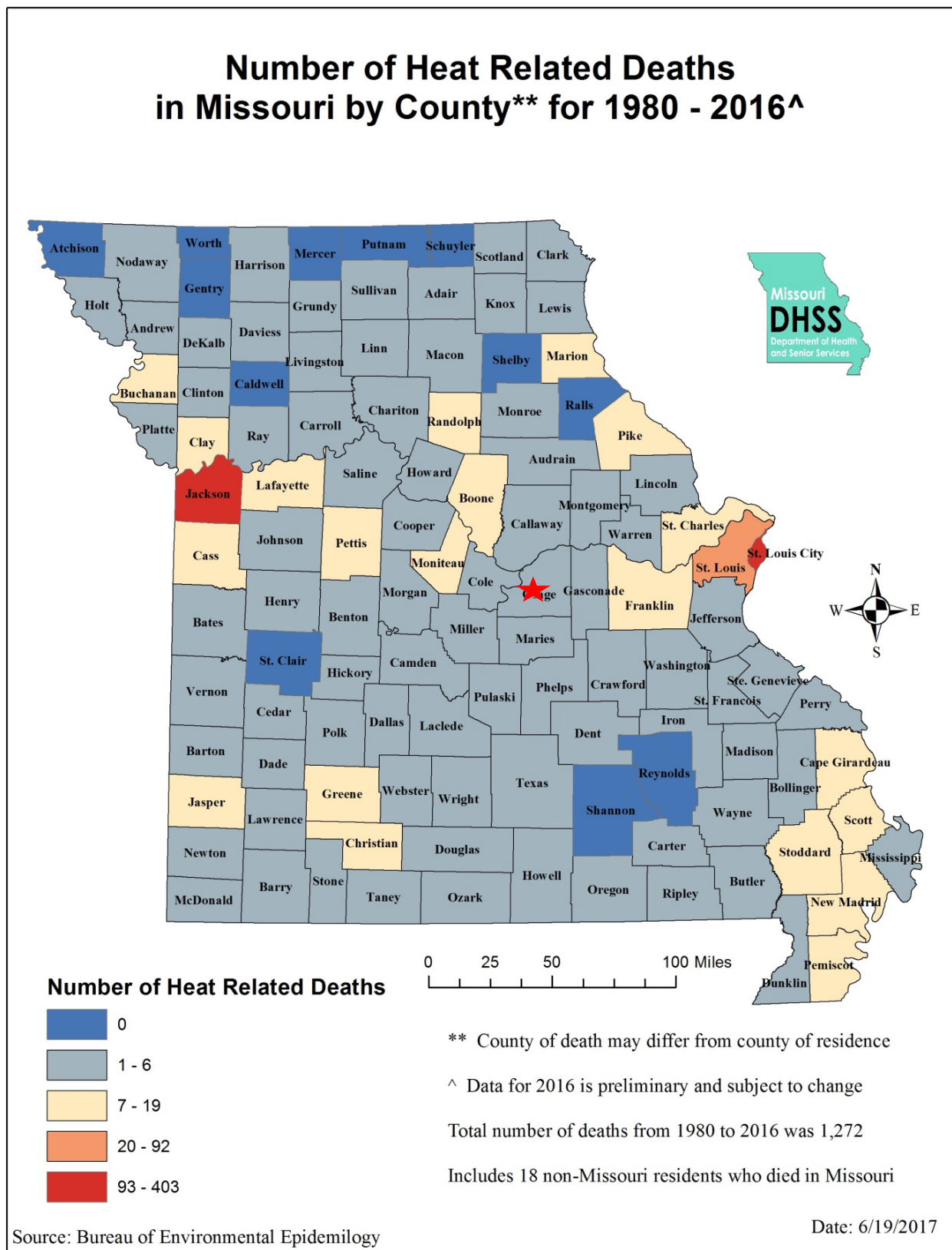
Month, Year	# of Event Days	Fatalities	Injuries	Temperature (F°)	Heat Index Values (F°)
7/7/2001	3	0	0	90s	105-110
7/17/2001	1	0	0	95-99	110-115
7/21/2001	3	0	0	95-99	105-115
7/29/2001	2	0	0	90s	105-110
8/1/2001	2	0	0	95-99	105
8/7/2001	2	0	0	95-99	102-110
8/21/2001	1	0	0	90-100	105-110

Month, Year	# of Event Days	Fatalities	Injuries	Temperature (F°)	Heat Index Values (F°)
7/8/2002	2	0	0	95-99	105-110
7/20/2002	2	0	0	95-99	105-115
7/26/2002	5	0	0	95-99	105-115
8/1/2002	5	0	0	101	-
8/15/2003	6	0	0	95-105	-
8/24/2003	4	0	0	95-100	105-110
7/20/2004	2	0	0	95	105-110
7/20/2005	6	0	0	110-105	105-120
7/17/2006	6	0	0	110-105	105-120
7/29/2006	2	0	0	100	105-110
8/1/2006	2	0	0	100	-
8/5/2007	9	0	0	100+	-
6/21/2009	6	0	0	90-99	100-107
6/18/2010	5	0	0	95	100-105
7/14/2010	1	0	0	90+	105-110
7/17/2010	1	0	0	95	105
7/22/2010	2	0	0	95-99	105-110
8/2/2010	2	0	0	101+	110
8/8/2010	6	0	0	100	110-115
7/1/2011	2	0	0	90s	105
7/10/2011	2	0	0	100+	-
7/17/2011	4	0	0	90+	105-110
8/1/2011	2	0	0	100	105-115
8/6/2011	2	0	0	95-99	105-110

Month, Year	# of Event Days	Fatalities	Injuries	Temperature (F°)	Heat Index Values (F°)
8/31/2011	1	0	0	103	105-110
9/1/2011	3	0	0	100+	105
6/27/2012	3	0	0	100-108	-
7/1/2012	7	0	0	100-107	-
7/16/2012	3	0	0	100-106	-
7/22/2012	5	0	0	106-108	-
7/31/2012	1	0	0	105	105-110
8/1/2012	1	0	0	105	105-110
8/31/2013	1	0	0	100	105-110
9/1/2013	1	0	0	100	105-110
8/20/2014	7	0	0	95-99	105-110
7/12/2015	2	0	0	95-99	110
7/17/2015	2	0	0	95-99	105-110
7/25/2015	4	0	0	95-99	110
6/15/2016	2	0	0	95-99	105
6/22/2016	1	0	0	95	105
7/18/2016	7	0	0	95-99	110
7/18/2017	6	0	0	95-108	-
Total	170	0	0	-	-

Source: <http://www.ncdc.noaa.gov/stormevents/>

Figure 3.25. Heat Related Deaths in Missouri 2000 - 2016

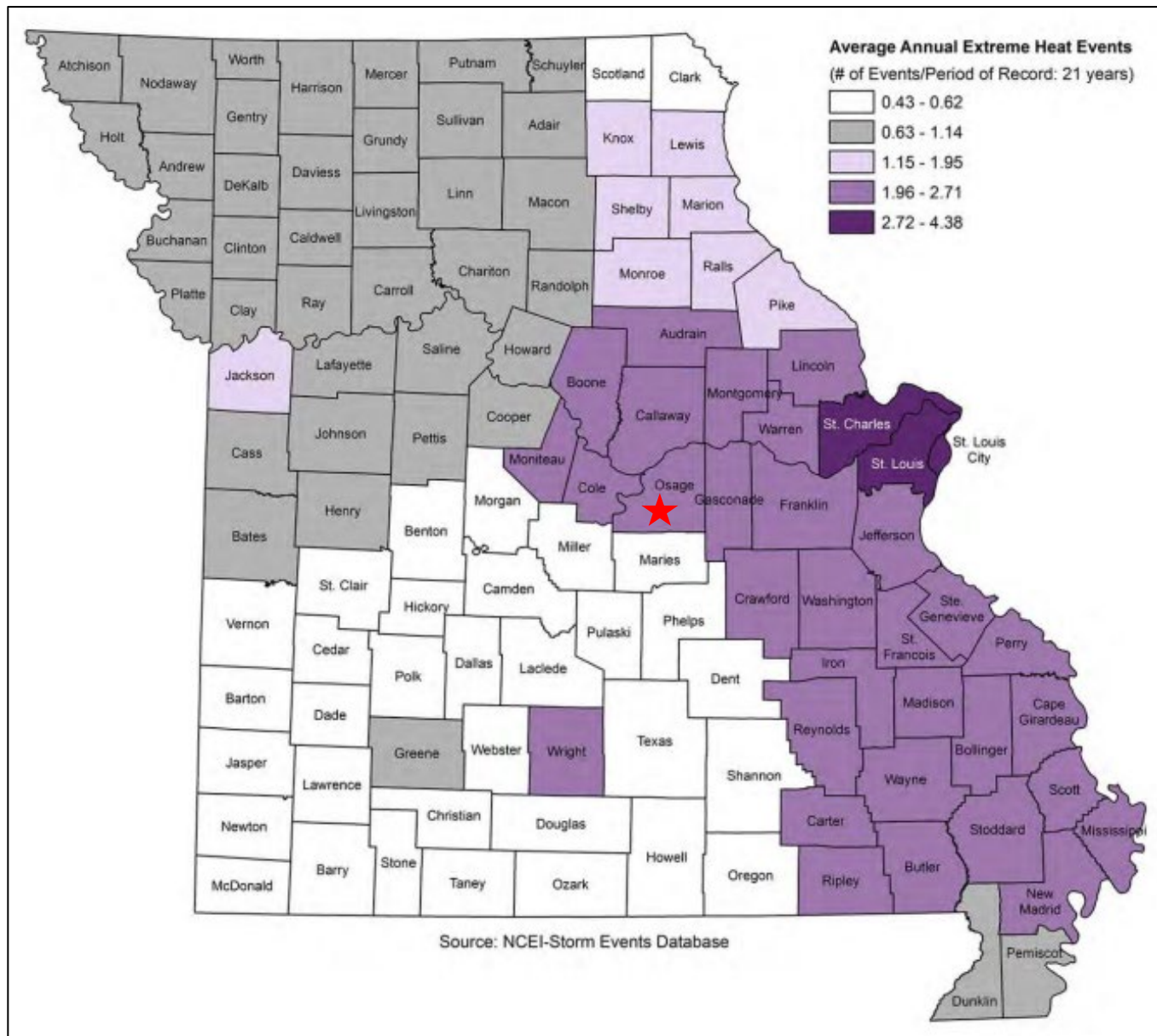


Source: <https://health.mo.gov/living/healthcondiseases/hyperthermia/pdf/stat-report.pdf> *Red star indicates Osage County

Probability of Future Occurrence

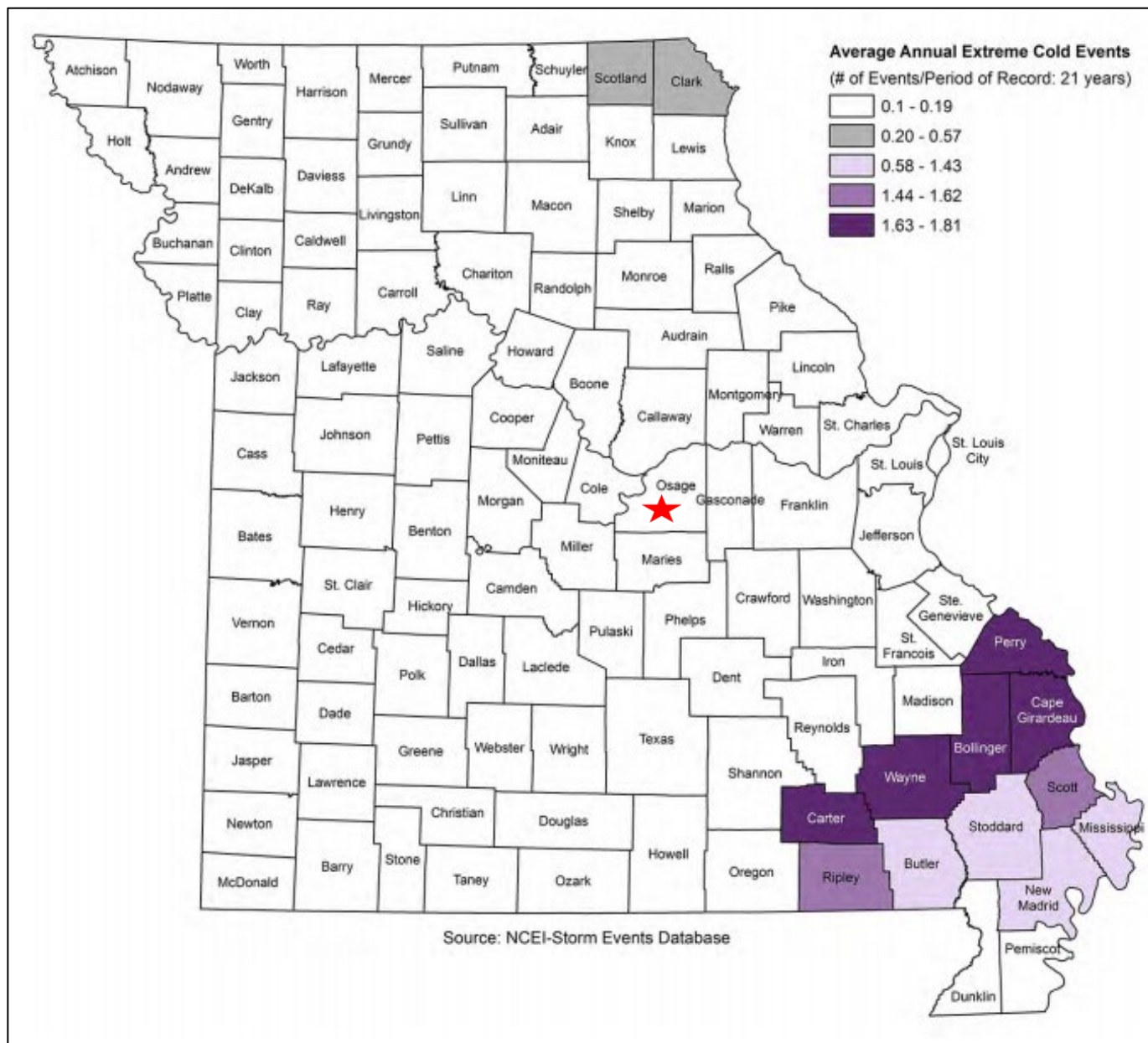
Figure 3.26 illustrates the average annual occurrence for extreme heat statewide. Based on information provided in the 2018 Missouri State Hazard Mitigation Plan, Osage County has an average of 1.96 to 2.71 events per year based on data from 21 years. **Figure 3.27** illustrates the average annual occurrence for extreme cold statewide. Osage County has an average of 0.1 to 0.19 events per year based on data from 21 years. It should be noted that there are data limitations due to underreporting of extreme heat and cold events.

Figure 3.26. Average Annual Occurrence for Extreme Heat



Source: 2018 Missouri State Hazard Mitigation Plan; *Red star indicates Osage County

Figure 3.27. Average Annual Occurrence for Extreme Cold



Source: 2018 Missouri Hazard Mitigation Plan, *Red star indicates Osage County

Changing Future Conditions Considerations

According to the 2018 Missouri Hazard Mitigation Plan, 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 continues, future heat waves are likely to be more intense and cold spells are

projected to decrease.

Furthermore, higher temperatures are experienced more acutely by vulnerable populations such as the elderly, the very young, the homeless, the ill and disabled, and those living in poverty. Higher demands and costs for electricity to run air conditioners can stress power systems. Higher temperatures can also cause harmful algal blooms in warmer water – resulting in poor water quality.

Mitigation against the impacts of future temperature increases 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 utility systems. Improving energy efficiency in public buildings will also present an increasingly valuable savings potential.

Vulnerability

Vulnerability Overview

Osage County, along with the rest of the state of Missouri is vulnerable to extreme heat and cold events. **Table 3.36** shows the typical health impacts of extreme heat. Jurisdictions with higher percentages of individuals below the age of 5, and above the age of 65 tend to be more at risk for extreme heat (**Table 3.41**). People who are overweight, ill or on certain medication can also be more vulnerable to high temperatures. The city of Westphalia has an estimated 38.6 percent of individuals who are 65 or older. The city of Linn had the lowest number of older residents with 12.9 percent aged 65 and over. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather. The exposure to extreme temperatures of farm workers and livestock is also a major concern.

Table 3.36. 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, <https://www.weather.gov/safety/heat-index>

The method used by state planners to determine vulnerability to extreme temperatures across Missouri was a statistical analysis of data from several sources: National Centers for Environmental Information (NCEI) storm events data (1996- December 31, 2016), percentage of population over 65 data from the U.S. Census (2015 ACS) and 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. Four factors were considered in determining overall vulnerability to extreme temperatures – total population, percentage of population over 65, likelihood of occurrence and social vulnerability. Based on natural breaks in the data, a rating value of one through five was assigned with one being low, two being low-medium, three being medium, four being medium-high and five being high.

Table 3.37 shows the population, percent of population over 65 and social vulnerability index data for

Osage County overall.

Table 3.37. Population, Percent of Population Over 65 and SOVI Data for Osage County

County	Total Population Rating	Percentage of Population Over 65	Percent of Population Over 65 Rating	SOVI Ranking	SOVI Rating
Osage	1	16.1	2	Medium	3

Source: 2018 Missouri Hazard Mitigation Plan

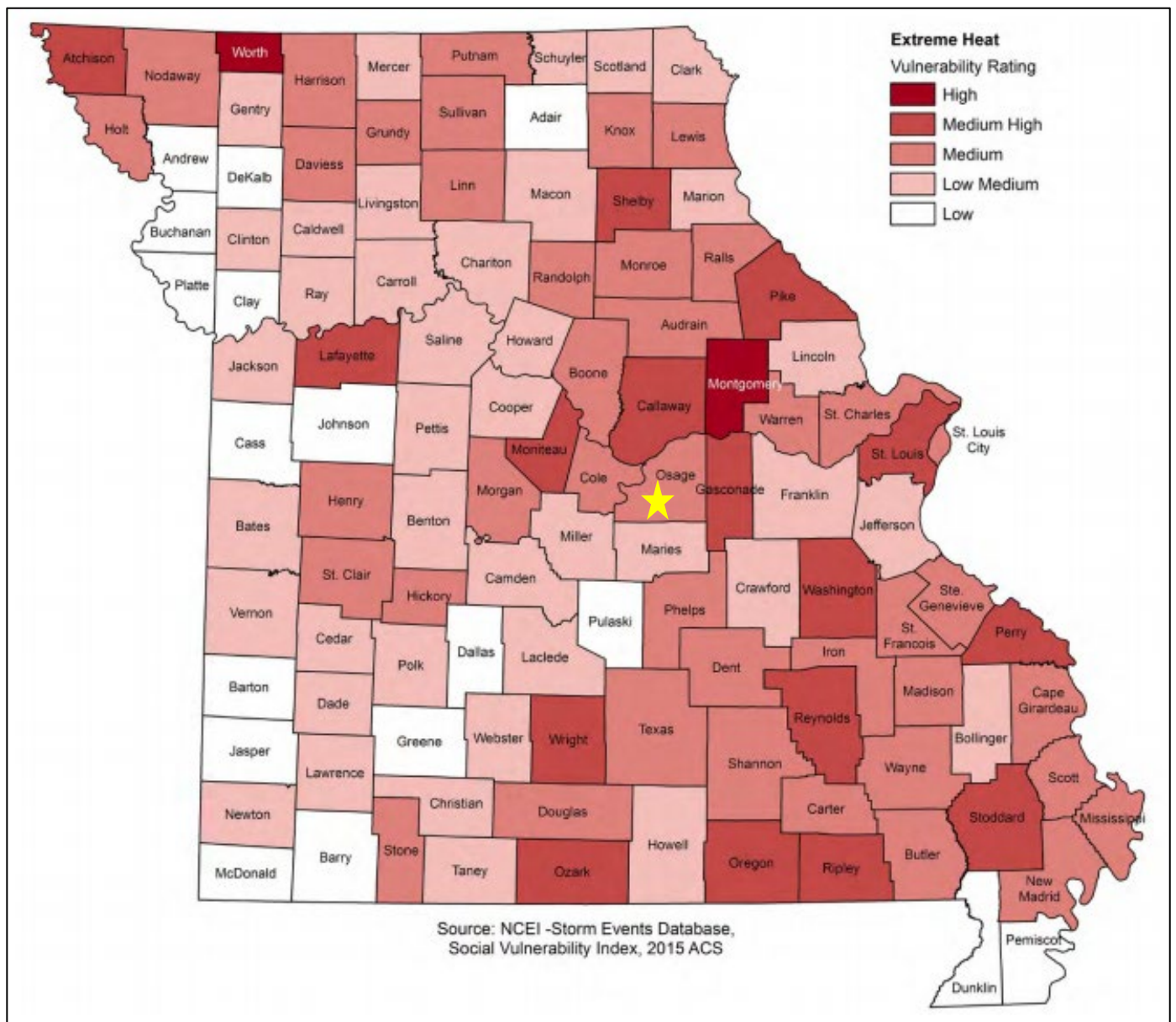
Table 3.38 illustrates the likelihood of occurrence and overall vulnerability rating for extreme temperatures for Osage County. **Figure 3.28** and **Figure 3.29** provide a vulnerability summary for extreme heat and extreme cold, respectively. Osage County has Medium vulnerability for extreme heat and Low Medium vulnerability for extreme cold.

Table 3.38. Osage County Likelihood of Occurrence and Overall Vulnerability Rating for Extreme Temperatures

Heat					Cold				
Total Events	Likelihood of Occurrence	Likelihood Rating	Total Vulnerability	Total Vulnerability Description	Total Events	Likelihood of Occurrence	Likelihood Rating	Total Vulnerability	Total Vulnerability Description
50	2.38	4	10	Medium	2	0.10	1	7	Low Medium

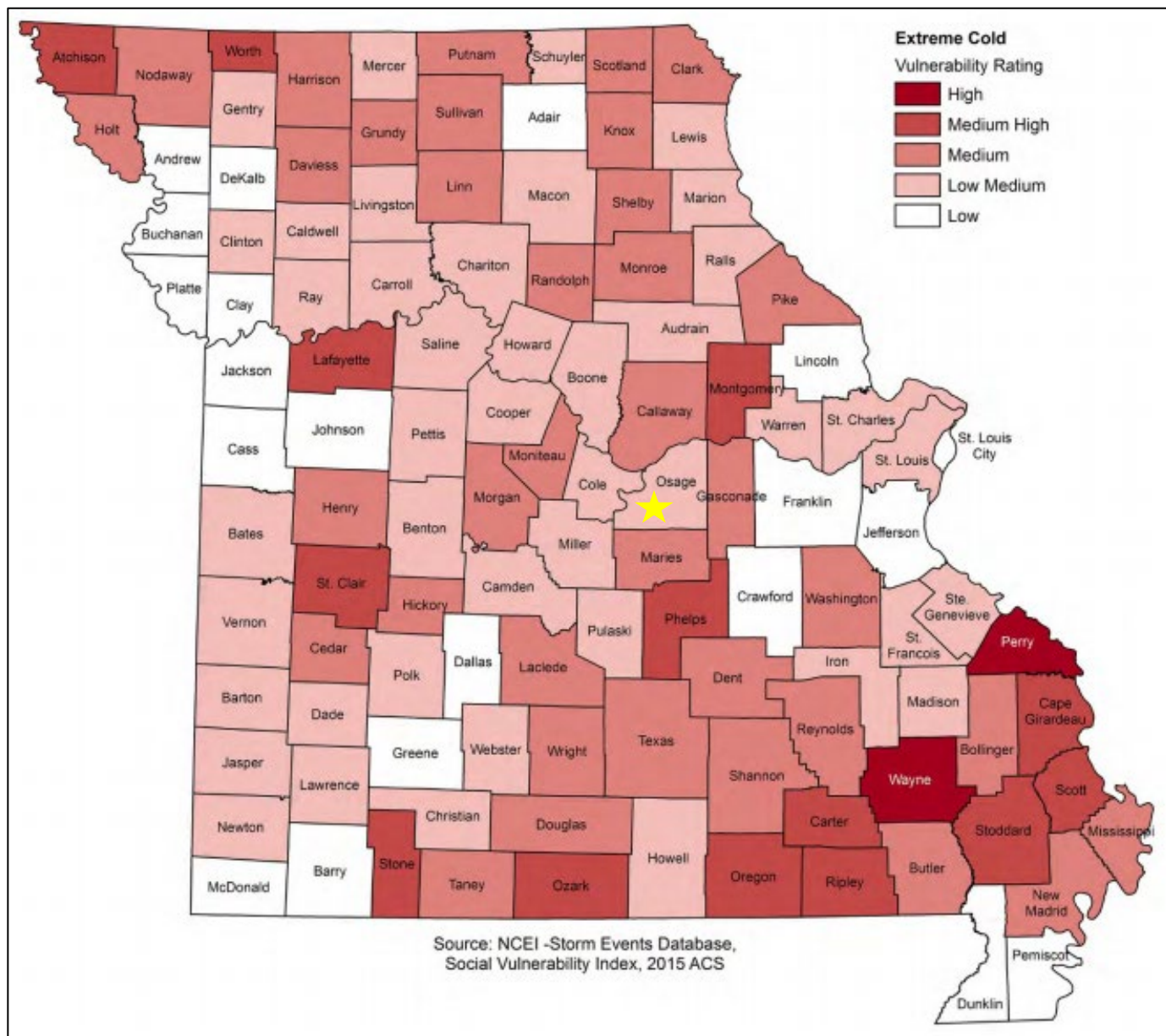
Source: 2018 Missouri Hazard Mitigation Plan

Figure 3.28. Vulnerability Summary for Extreme Heat



Source: 2018 Missouri Hazard Mitigation Plan, *Yellow star indicates Osage County

Figure 3.29. Vulnerability Summary for Extreme Cold



Source: 2018 Missouri Hazard Mitigation Plan, *Yellow star indicates Osage County

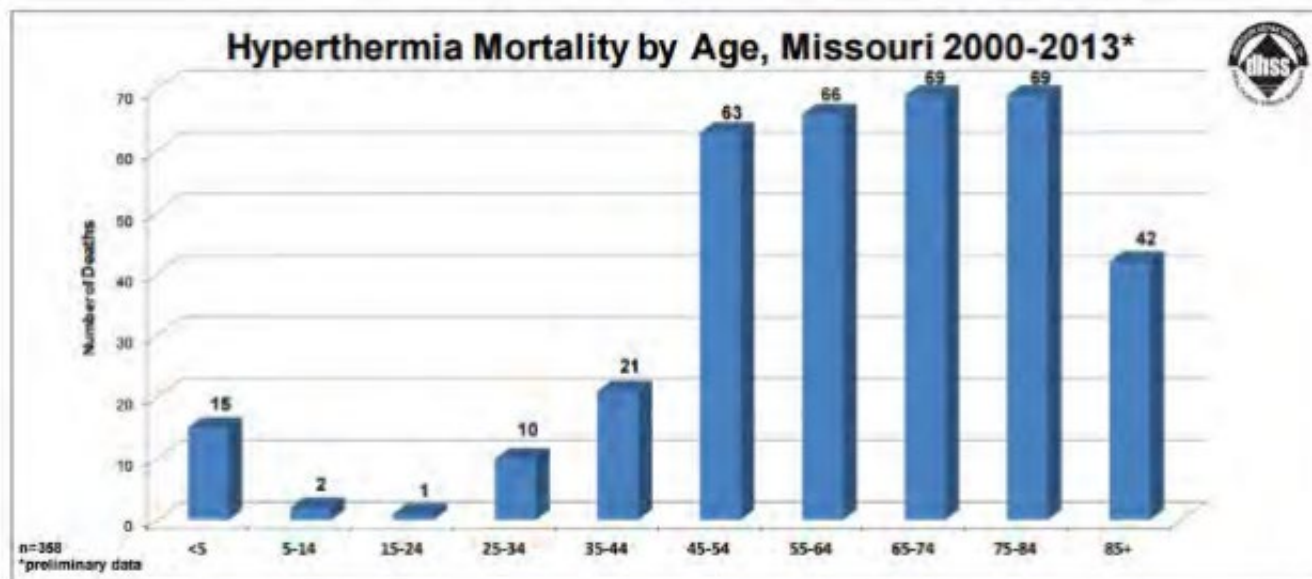
Potential Losses to Existing Development

Extreme Heat/Heat Wave

Of greatest concern during extreme heat events are hyperthermia injuries and deaths. The 2018 Missouri Hazard Mitigation plan states that there were 358 heat-related deaths reported in Missouri from 2000 through 2013. There were 217 (61%) deaths in the metropolitan areas of Kansas City and St. Louis and 141 (39%) deaths in rural parts of the state. Half of the deaths were age 65 or older. People in this demographic group are more vulnerable to this hazard for a number of reasons. Many live alone and have medical conditions that put them at higher risk. The lack of air conditioning or the refusal to use it for fear of higher utility bills further increases their risk. Deaths among children under the age of five are often linked to being left in vehicles during hot weather. Between 2000 and 2013

there were 15 (4%) heat-related deaths of children less than five years old. In the age group between 5 years and 65 years deaths are generally due to over exertion at work or in sports activities, complicating medical conditions or substance abuse. **Figure 3.30** shows the hyperthermia mortality rate by age for the 2000-2013 timeframe.

Figure 3.30. Hyperthermia Mortality of Age, Missouri 2000-2013



Source: Missouri DHSS, <http://health.mo.gov/living/healthcondiseases/hyperthermia/pdf/hyper4.pdf>

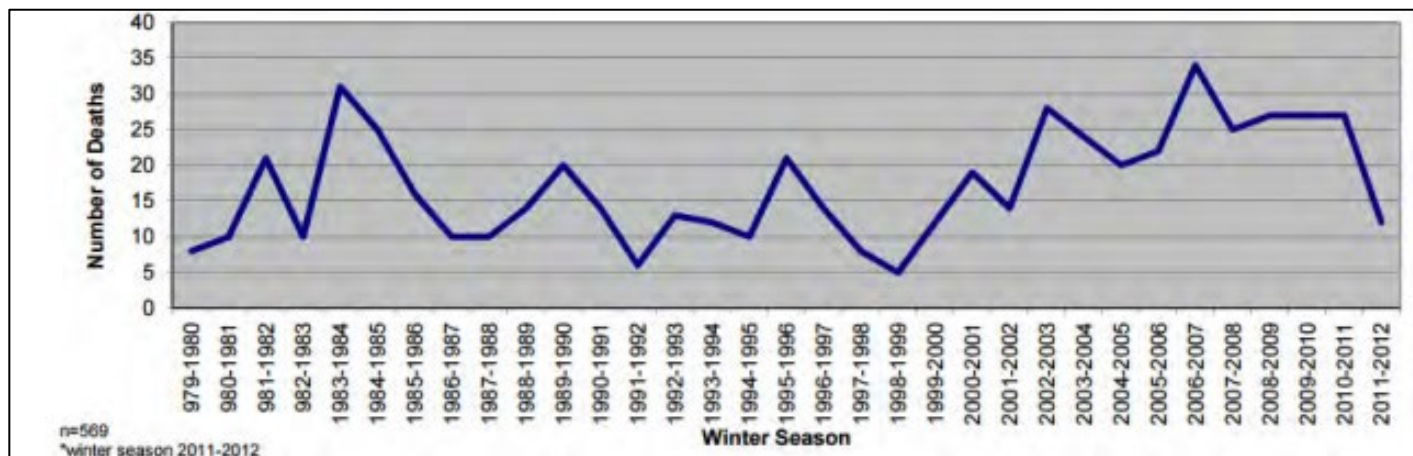
During extreme heat events structural, road, and electrical infrastructure are vulnerable to damages. Depending upon temperatures and duration of extreme heat, losses will vary.

Extreme Cold

According to the Missouri Department of Health and Senior Services, 569 people died in Missouri due to extreme cold conditions between 1979 and 2012, see **Figure 3.31**. As with extreme heat, the elderly are more vulnerable to cold-related deaths. Elderly or disabled individuals fall outside their homes and are not able to call for help or reach the safety of shelter during periods of extreme cold. According to the 2018 Missouri State Hazard Mitigation plan, during the winters of 1989-2012, a total of 414 hypothermia deaths occurred, with 186 (44.9%) being 65 years of age or older. As with extreme heat, substance abuse can be a contributing factor for people between the ages of 25 and 64. Between 1989 and 2012, substance abuse factored into the hypothermia deaths of 107 of the 208 (51.4%) deaths in this age group. Fortunately, hypothermia deaths in people under the age of 25 are rare in Missouri, accounting for only 19 (4.6%) of the total extreme cold related deaths during this timeframe. There were two (0.5%) deaths of children under the age of five. Over 72 percent of hypothermia deaths are among males – 299 of the total 414. The remaining 115 (27.8%) were female.

In regards urban versus rural, hypothermia deaths tend to be higher in rural areas than in urban communities. There were 183 (44.2%) cold related deaths in the Kansas City and St. Louis metropolitan areas, while 231 (55.8%) occurred in other parts of the state.

Figure 3.31. Hypothermia Deaths, Missouri: Winter Seasons 1979-2012



Source: Missouri DHSS, <http://health.mo.gov/living/healthcondiseases/hypothermia/pdf/hypo1.pdf>

Extreme cold can also cause stress to crops and animals. However, according to the NOAA Storm Events Data Base, there were no reported agricultural losses for Osage County during that 20-year time period. **Table 3.39** displays data specifically on agricultural losses due to extreme cold from the USDA Risk Management website.

Table 3.39. Osage County Cold/Freeze Related Crop Indemnity Payments (2001-2020)

Year	Number of Payments	Total
2001	1	\$1,460.00
2007	2	\$337.00
2013	2	\$10,764.00
2015	1	\$11,564
TOTAL	6	\$24,125.00

Source: <https://www.rma.usda.gov/Information-Tools/Summary-of-Business/Cause-of-Loss>

Table 3.40 provides data in relation to record cold, wind chill, and freeze events between 2001 and 2020 in Osage County. Minimum temperatures are shown for each extreme temperature event where available. Fortunately, there were no recorded injuries and fatalities during this time.

Table 3.40. NCEI Osage County Cold/Wind Chill/Freeze Events Summary (2001-2020)

Month, Year	# of Event Days	Fatalities	Injuries	Temperature (F°)
4/4/2007	7	0	0	NA
1/1/2010	12	0	0	-16
1/6/2014	2	0	0	-26
Total	21	0	0	-

Source: <http://www.ncdc.noaa.gov/stormevents/>

Impact of Previous and Future Development

Population trends from 2010 to 2019 for Osage County indicate that the population in unincorporated areas has fallen by an estimated 0.4 percent. The city of Chamois population has increased by a significant 25 percent. Overall, the county population has decreased by 1.9 percent. Population growth can result in increased age groups that are more susceptible to extreme heat and cold. Additionally, as populations increase, so does the strain on each jurisdiction's electricity and road infrastructure. Local government and local emergency management should take extreme heat and cold in consideration when upgrades occur to the local power grid.

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 or have medical conditions that make them more vulnerable. To determine jurisdictions within the planning area with populations more vulnerable to extreme heat, demographic data was obtained from the 2016-2020 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 or with medical conditions that made them more vulnerable. **Table 3.41** 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 3.41. County Population Under Age 5 and Over Age 65 (2016-2020)

Jurisdiction	Population Under 5 Years	Population 65 Years and over
Unincorporated Osage County	5.1%	17.0%
Argyle	4.2%	19.0%
Chamois	5.6%	20.9%
Freeburg	8.5%	22.3%
Linn	7.2%	13.4%
Meta	2.3%	24.4%
Westphalia	10.5%	30.4%

Source: U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates

Due to lack of data, strategic buildings that lack air-conditioning could not be analyzed for this report. Additionally, school policy data in regard to extreme heat or cold were not available.

In summary, the risks of extreme heat or cold can impact the health/lives of citizens within the county, specifically the young and elderly. The city of Westphalia has a high percentage of individuals 65 and over with 30.4 percent.

Many people do not realize how deadly a heat wave can be. Extreme heat is a natural disaster that is not as dramatic as floods or tornadoes. Working with the Osage County Health Department and EMD, local governments should encourage residents to:

- Stay indoors as much as possible and limit exposure to the sun;
- Stay on the lowest floor out of the sunshine if air conditioning is not available;
- Consider spending the warmest part of the day in public buildings such as libraries or other public or community buildings. Circulating air can cool the body by increasing the evaporation

-
- rate of perspiration;
 - Eat light, well-balanced meals at regular intervals and avoid using salt tablets unless directed by a physician;
 - Hydrate by drinking plenty of water. Individuals with epilepsy or heart, kidney or liver disease who are on fluid restricted diets or have problems with fluid retention should consult their physicians on liquid intake;
 - Limit consumption of alcoholic beverages;
 - Dress in loose-fitting, lightweight and light colored clothes that cover as much skin as possible;
 - Protect your face and head by wearing a wide-brimmed hat. Wear sunscreen;
 - Check on family, friends and neighbors who do not have air conditioning and are generally alone;
 - Never leave children or pets in closed vehicles;
 - Avoid strenuous work during the warmest part of the day and use the buddy system when working in extreme heat and take frequent breaks.

People who work outdoors should be educated about the dangers and warning signs of heat disorders. Buildings, ranging from homes (particularly those of the elderly) to factories, should be equipped with properly installed, working air conditioning units, or have fans that can be used to generate adequate ventilation. However, although fans are less expensive to operate than air conditioning, they may not be effective, and may even be harmful when temperatures are very high. As the air temperature rises, air flow is increasingly ineffective in cooling the body. At temperatures above 100° F, the fan may be delivering overheated air to the skin at a rate that exceeds the capacity of the body to get rid of this heat – even with perspiring – and the net effect is to add heat rather than to cool the body. An air conditioner is a much better option. Charitable organizations and the health department should work together to provide fans, when appropriate, to at-risk residents during times of critical heat. When temperatures are too high, however, these groups should work to get at-risk populations into cooling shelters.

Extreme Cold

Extreme cold can also be life-threatening and the following precautions should be taken when someone is suffering from hypothermia:

- Call 9-1-1 for immediate medical assistance;
- Move the victim to a warm place;
- Monitor the victim's blood pressure and breathing;
- If necessary, provide rescue breathing and CPR;
- Remove wet clothing;
- Dry off the victim;
- Take the victim's temperature;
- Warm the body core first, NOT the extremities. Warming the extremities first can cause the victim to go into shock and can also drive cold blood toward the heart and lead to heart failure;
- Do not warm the victim too fast – rapid warming may cause heart arrhythmias

Problem Statement

In summary, the risks of extreme heat and cold can impact the health/lives of citizens within the county, specifically the young and elderly. Based on the vulnerability analysis, the city of Westphalia has the highest risk because of a large population of people aged 65 and over (**Table 3.41**).

All jurisdictions should make sure they have plans in place to provide both cooling and warming shelters during times of extreme temperatures. School districts should have policies in place to minimize strenuous exercise outdoors during heat waves and to consider policies for delaying or cancelling school during times of extreme cold to reduce risk to students waiting for buses.

3.4.5 Flooding (Riverine and Flash)

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.1, Page 3.80
https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- Watershed map, Environmental Protection Agency, <https://mywaterway.epa.gov/>
- FEMA Map Service Center, Digital Flood Insurance Rate Maps (DFIRM) for all jurisdictions, if available, <https://msc.fema.gov/portal/home>
- Flood Insurance Administration—Repetitive Loss List (this must be requested from the State Floodplain Management agency or FEMA)
- National Centers for Environmental Information, Storm Events Database, <http://www.ncdc.noaa.gov/stormevents/>
- USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/en/Information-Tools/Summary-of-Business/Cause-of-Loss>
- FEMA Data Visualization Tool, <https://www.fema.gov/data-visualization-floods-data-visualization>
- Missouri Hazard Mitigation Viewer
<http://bit.ly/MoHazardMitigationPlanViewer2018> - Website
<https://drive.google.com/file/d/1bPkc0JgF9ofwQLnTL9N0u-oPFWi9hkst/view> - User Guide
 - Risk MAP, DFIRM, and Hazus based depth grids used in Hazus Analysis
 - Flood losses by County 1978-2018
 - Number of flood insurance claims by County
 - Total building exposure to flooding (1% annual chance) by County
 - Buildings impacted by flooding (1% annual chance) by County
 - Flood insurance coverage by County
 - Number of flood insurance policies by County
 - NFIP participation status by County
 - Number of state facilities impacted by flooding (1% annual chance) by County
 - Critical facilities impacted by flooding (1% annual chance) by County

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. 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 3.4.1**. It 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 Special Flood Hazard Areas (SFHA). **Figure 3.32** Is a map of Osage County showing the floodplain boundaries. Following the county-wide map are FIRMs for Argyle, Chamois, Linn, Meta, and Westphalia. (**Figure 3.32 through 3.36**). Digital data for SFHAs is not available. **Figure 3.37** Shows a map of the school districts in Osage County with an overlay of the SFHA. **Table 3.42** shows Osage County NCEI flood events by location between 2001 and 2020.

Figure 3.32 Map of Osage County with Special Flood Hazard Areas

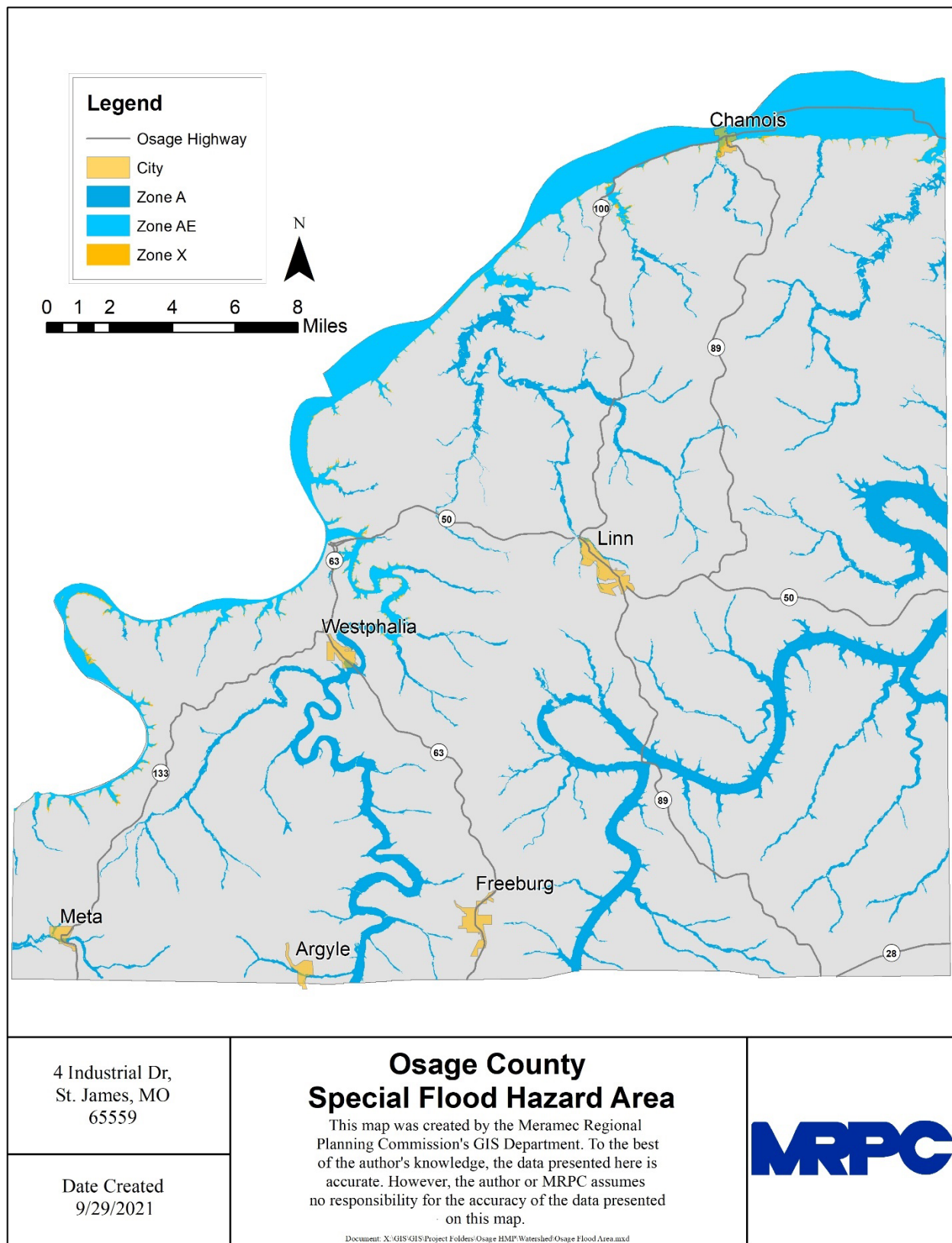
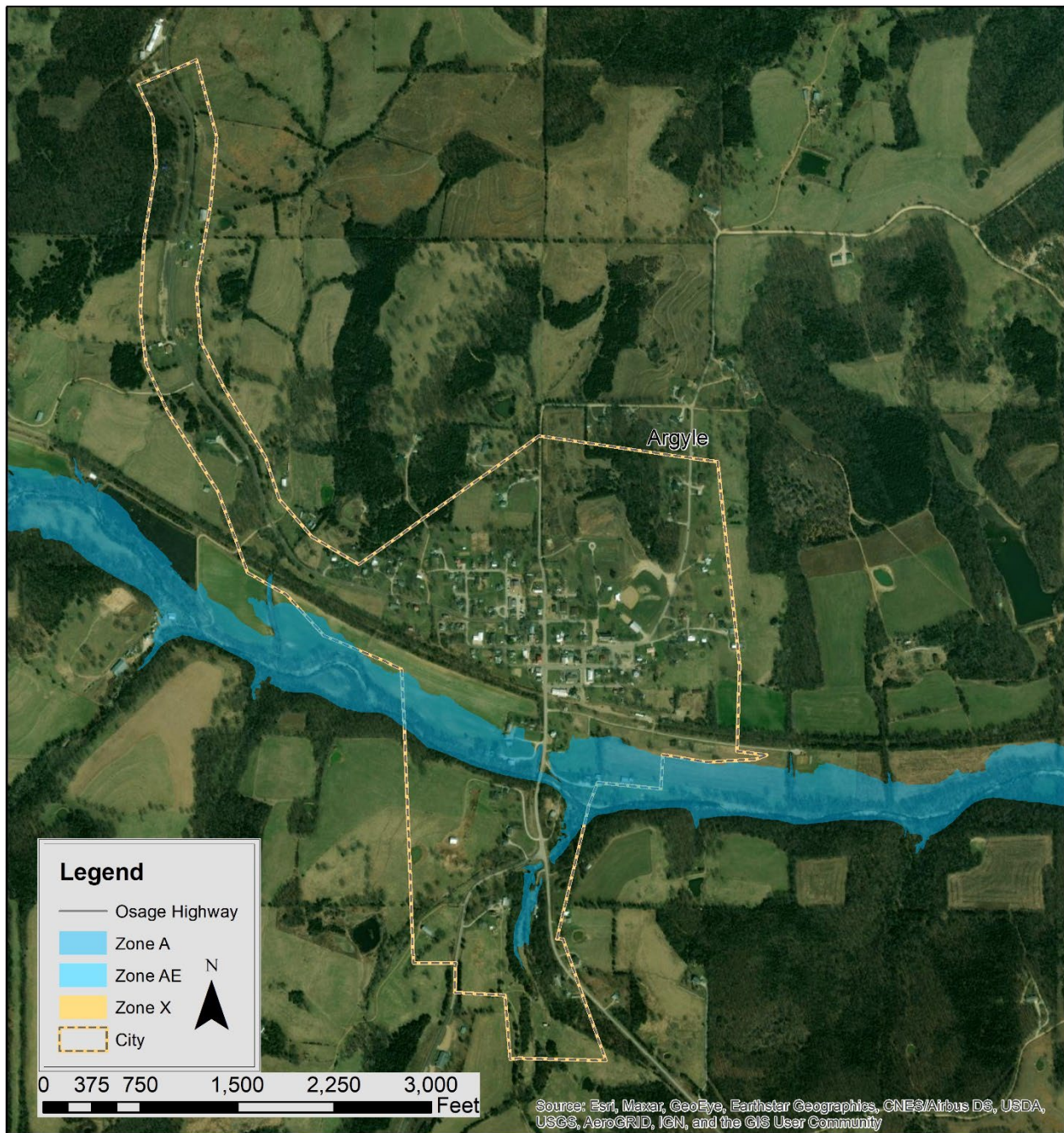



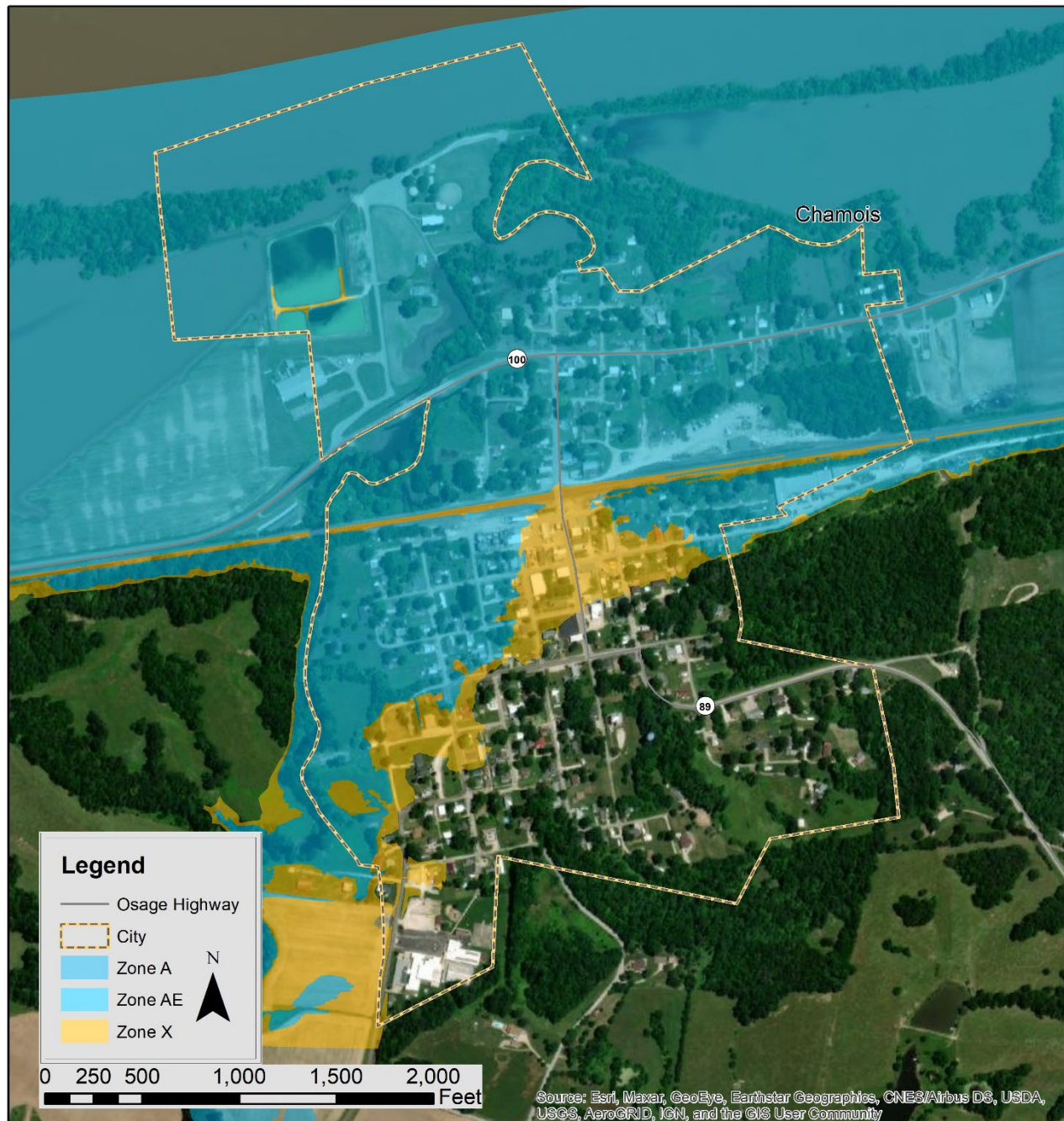
Figure 3.32. City of Argyle, Missouri Special Flood Hazard Areas (SFHAs)




<p>4 Industrial Dr, St. James, MO 65559</p>	<p style="text-align: center;">Argyle Special Flood Hazard Area</p> <p>This map was created by the Meramec Regional Planning Commission's GIS Department. To the best of the author's knowledge, the data presented here is accurate. However, the author or MRPC assumes no responsibility for the accuracy of the data presented on this map.</p> <p style="text-align: center; font-size: small;">Document: X:\GIS\GIS\Project\Folders\Osage HMP\Watershed\Argyle Flood Area.mxd</p>		
<p>Date Created 9/29/2021</p>			

Source: ESRI's ArcGIS

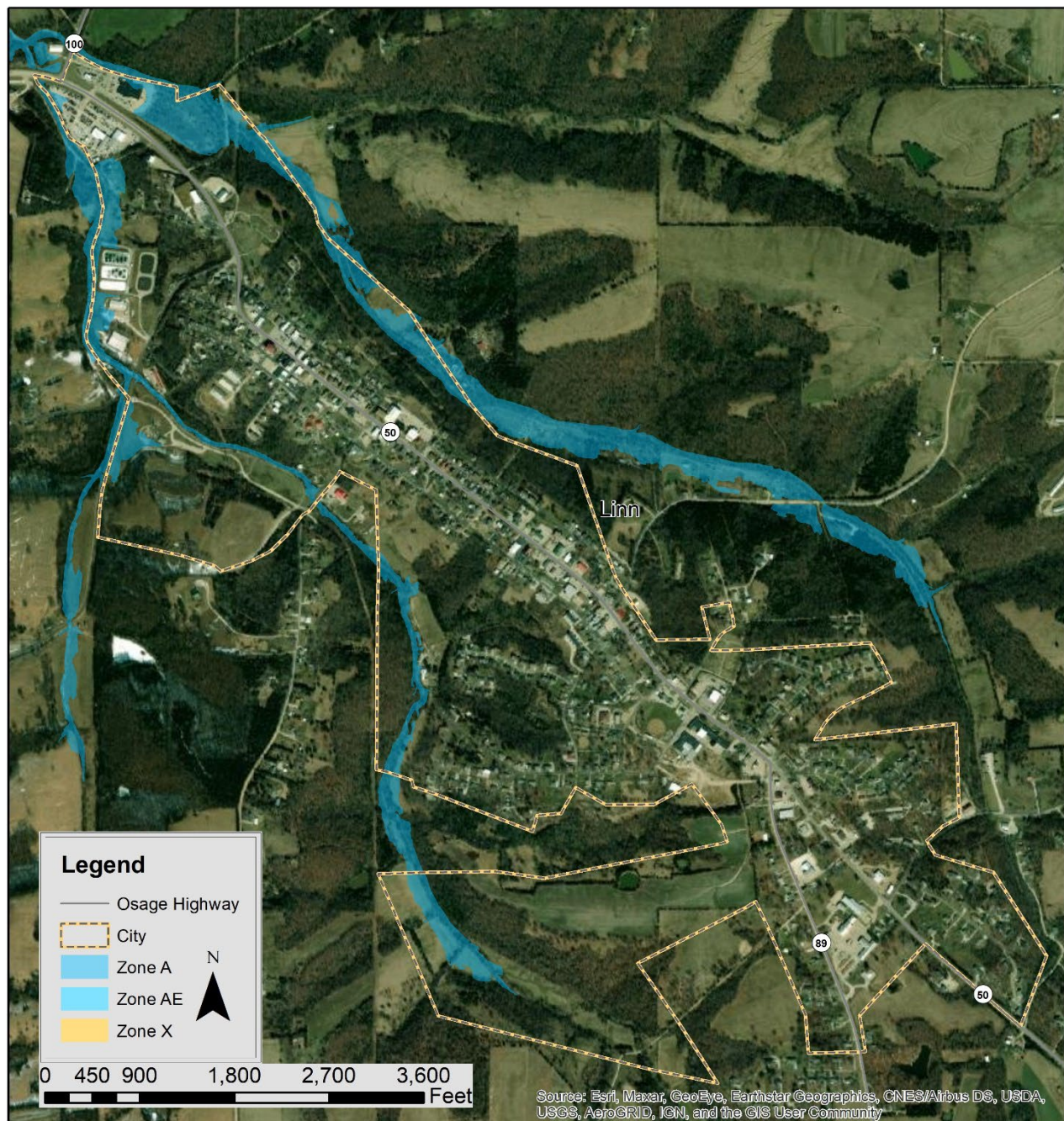
Figure 3.33. City of Chamois, Missouri Special Flood Hazard Areas (SFHAs)




<p>4 Industrial Dr, St. James, MO 65559</p>	<p style="text-align: center;">Chamois Special Flood Hazard Area</p> <p>This map was created by the Meramec Regional Planning Commission's GIS Department. To the best of the author's knowledge, the data presented here is accurate. However, the author or MRPC assumes no responsibility for the accuracy of the data presented on this map.</p> <p style="text-align: center; font-size: small;">Document: X:\GIS\GIS\Project Folders\Osage HMP\Watershed\Chamois Flood Area.mxd</p>	
<p>Date Created 9/29/2021</p>		

Source: ESRI's ArcGIS

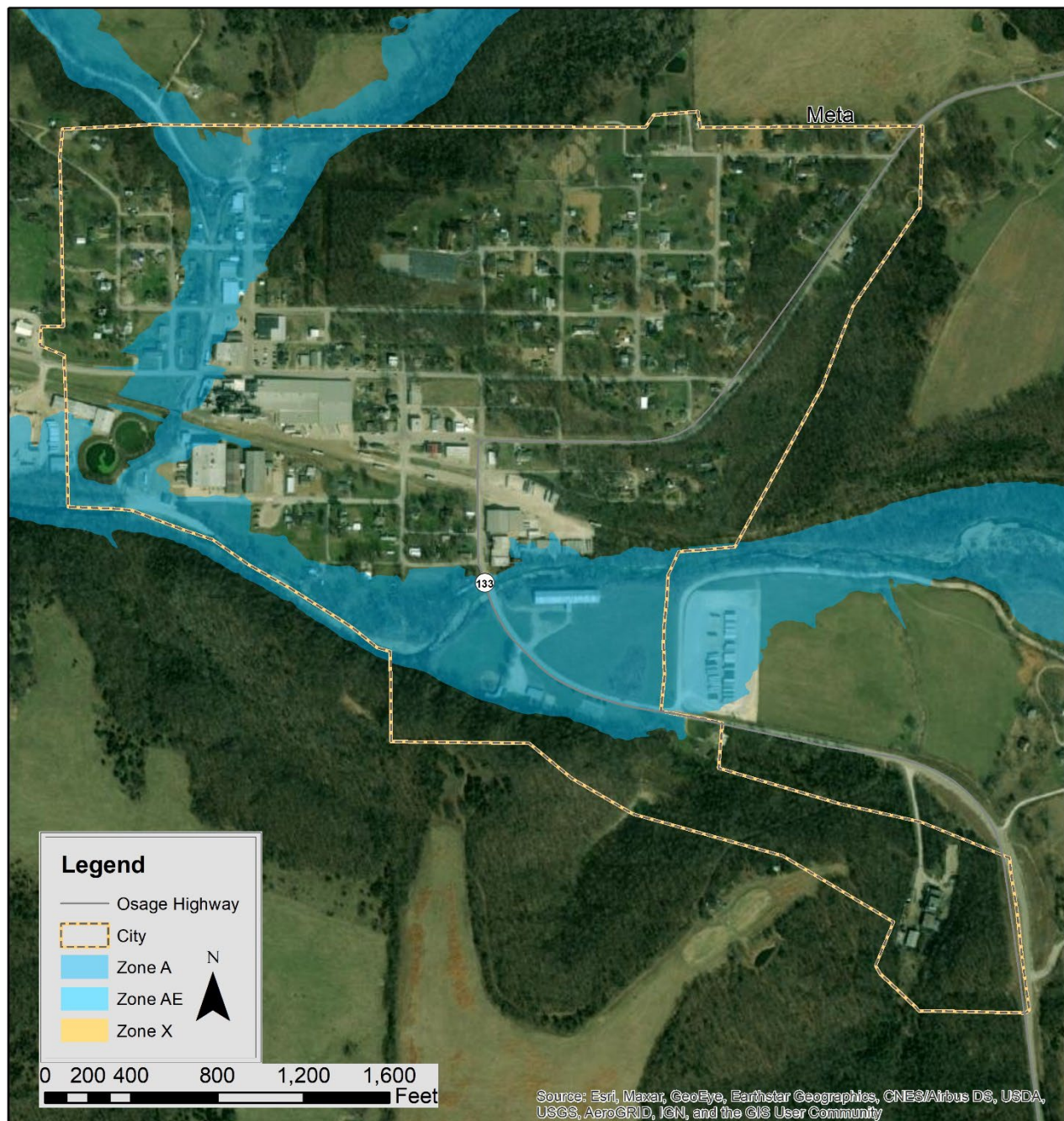
Figure 3.34. City of Linn, Missouri Special Flood Hazard Areas (SFHAs)




<p>4 Industrial Dr, St. James, MO 65559</p>	<div data-bbox="568 1585 1063 1680"> <h2 style="text-align: center;">Linn Special Flood Hazard Area</h2> </div> <div data-bbox="576 1680 1055 1827"> <p style="text-align: center;">This map was created by the Meramec Regional Planning Commission's GIS Department. To the best of the author's knowledge, the data presented here is accurate. However, the author or MRPC assumes no responsibility for the accuracy of the data presented on this map.</p> </div> <div data-bbox="1161 1680 1429 1764">  </div>	
<p>Date Created 9/29/2021</p>	<p style="font-size: small; text-align: center;">Document: X:\GIS\GIS\Project Folders\Osage RMP\Watershed\Linn Flood Area.mxd</p>	

Source: ESRI's ArcGIS

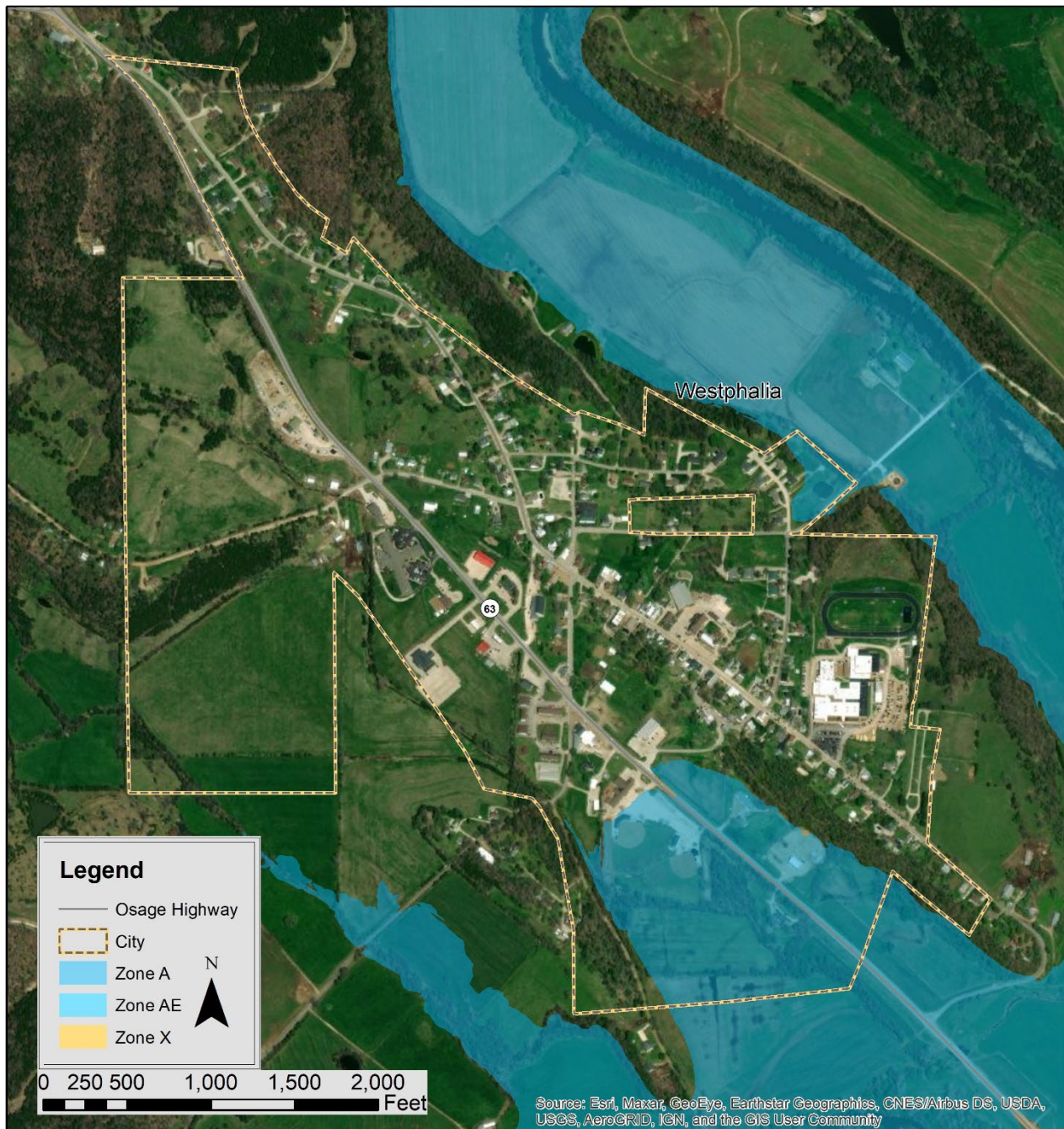
Figure 3.35. City of Meta, Missouri Special Flood Hazard Areas (SFHAs)




<p>4 Industrial Dr, St. James, MO 65559</p>	<p style="text-align: center;">Meta Special Flood Hazard Area</p> <p>This map was created by the Meramec Regional Planning Commission's GIS Department. To the best of the author's knowledge, the data presented here is accurate. However, the author or MRPC assumes no responsibility for the accuracy of the data presented on this map.</p> <p style="text-align: center;"><small>Document: X:\GIS\GIS\Project Folders\Osage TRMP\Watershed\Meta Flood Area.mxd</small></p>	
<p>Date Created 9/29/2021</p>		

Source: ESRI's ArcGIS

Figure 3.36. City of Westphalia, Missouri Special Flood Hazard Areas (SFHAs)



<p>4 Industrial Dr, St. James, MO 65559</p>	<p style="text-align: center;">Westphalia Special Flood Hazard Area</p> <p>This map was created by the Meramec Regional Planning Commission's GIS Department. To the best of the author's knowledge, the data presented here is accurate. However, the author or MRPC assumes no responsibility for the accuracy of the data presented on this map.</p> <p style="text-align: center;"><small>Document: X:\GIS\GIS\Project Folders\Osage HMP\Watershed\Westphalia Flood Area.mxd</small></p>	
<p>Date Created 9/29/2021</p>		

Source: ESRI's ArcGIS

Figure 3.37. Figure 3.37 Osage County School Districts and Special Flood Hazard Areas

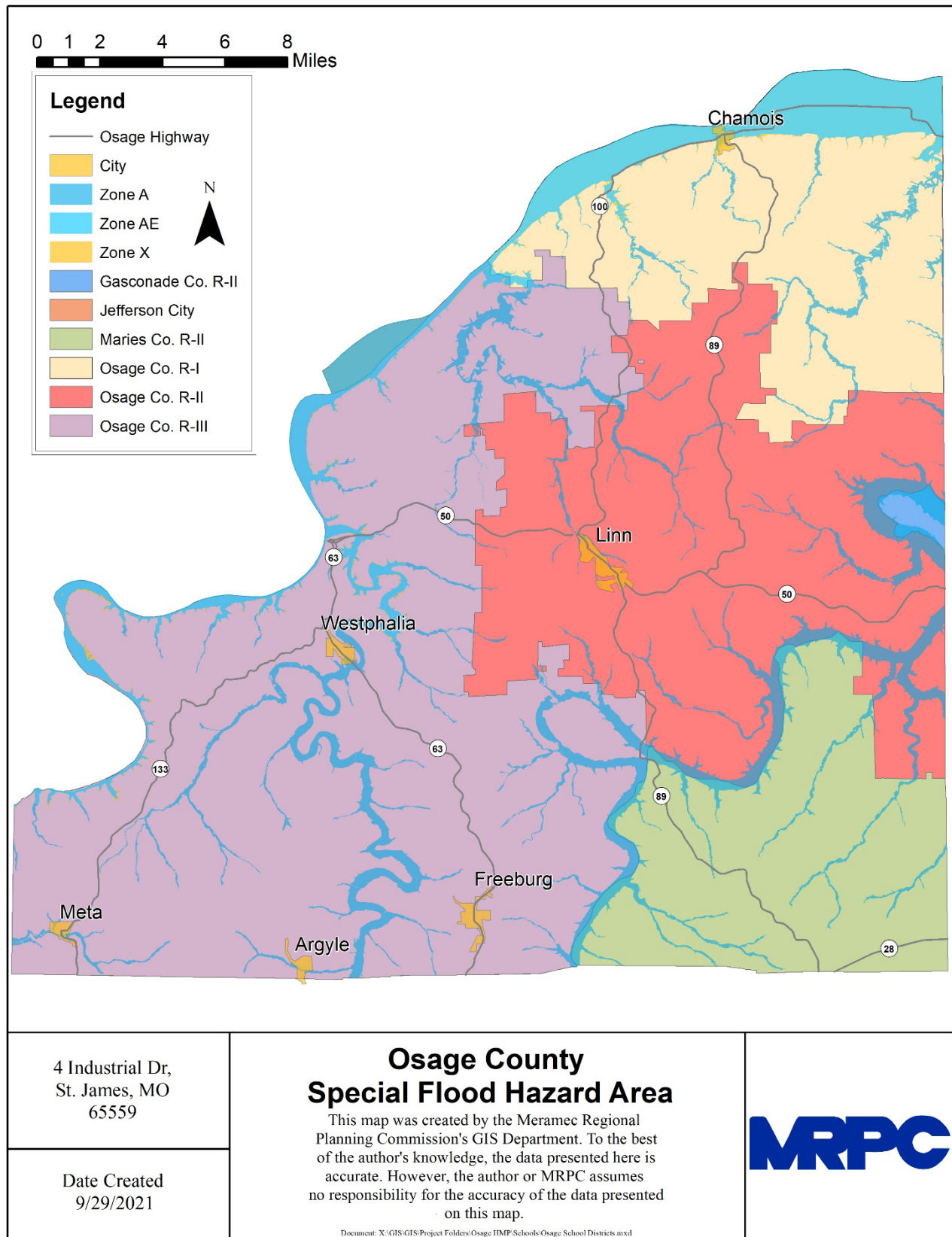


Table 3.42. Summary of Osage County NCEI Flood Events by Location, 2001-2020

Location	# of Events
Osage County	2
Argyle	1
Bonnots Mill	2
Gascondy	1
Meta	1
Rich Fountain	1
Schubert	1

Source: National Centers for Environmental Information Storm Events Database

Flash flooding occurs in SFHAs and 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. After review of NCEI data, Meta is the community most prone to flash flooding events. Unincorporated Osage County also has a high rate of flash flood events. **Table 3.43** provides information in regards to flash flood events between 2001 and 2020.

Table 3.43. Osage County NCEI Flash Flood Events by Location, 2001-2020

Location	# of Events
Osage County - Countywide	3
Osage County – Central Portion	1
Osage County- North Central Portion	1
Argyle	1
Byron	1
Chamois	2
Frankenstein	1
Fredericksburg	2
Freeburg	1
Gascondy	2
Meta	3
Shubert	2
Westphalia	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 communities 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.

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 roadbeds. In some instances, steep slopes that are saturated with water may cause mud or rockslides 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. Further information regarding scour critical bridges can be found in **Section 3.2.2**.

Between 2001 and 2020, there were 206 recorded flood-related crop insurance claims with total losses of \$2,703,593.41 due to flooding within Osage County³². **Table 3.44** shows crop losses for the period 2001 through 2020 (years with no losses are not shown).

Table 3.44. Recorded USDA Crop Insurance Losses (Flood) for Osage County 2001 – 2020

Year	Number of Payments	Total
2001	14	\$95,048.50
2002	12	\$42,951.00
2003	1	\$0.00
2004	1	\$1,869.00
2005	1	\$286.00
2006	1	\$207.00
2007	12	\$80,550.22
2008	32	\$276,880.10
2009	21	\$54,011.00
2010	8	\$24,689.00
2011	15	\$90,382.00
2013	31	\$667,245.90
2015	21	\$507,121.94
2016	5	\$11,562.00
2017	8	\$62,438.50
2019	22	\$786,383.25
2020	1	\$1,968.00
TOTAL	206	\$2,703,593.41

Source: USDA \ Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/en/Information-Tools/Summary-of-Business/Cause-of-Loss>

National Flood Insurance Program (NFIP) Participation

Table 3.45 depicts jurisdictions within the planning area that participate in NFIP. In addition, **Table 3.46** provides the number of policies in force, amount of insurance in force, number of closed losses, and total payments for Osage County and cities.

³² <http://www.rma.usda.gov/data/cause.html>

Table 3.45. NFIP Participation in Osage County

Community ID #	Community Name	NFIP Participant (Y/N)	Current Effective Map Date	Regular-Emergency Program Entry Date
290268	Osage County	Y	09/19/12	02/02/90
290491	Argyle	Y	09/19/12	08/01/86
290270	Chamois	Y	09/19/12	11/15/84
290708	Linn	Y	09/19/12	04/28/06
290271	Meta	Y	09/19/12	04/09/12
290272	Westphalia	Y	09/19/12	09/10/84
-	Freeburg	N	-	-

Source: NFIP Community Status Book,, <https://www.fema.gov/flood-insurance/work-with-nfip/community-status-book>

Table 3.46. NFIP Policy and Claim Statistics as of 06/23/2022

Community Name	Policies in Force	Insurance in Force	Closed Losses	Total Payments
Osage County	36	\$4,530,800	138	\$3,308,141.25
Chamois	35	\$2,130,600	61	\$502,902.39
Meta	2	\$193,600	1	\$21,588.38
Westphalia	1	\$27,100	11	66,381.20

Source: NFIP Community Status Book, [11/05/2020]; SEMA

*Closed Losses are those flood insurance claims that resulted in payment.

Osage County has the highest number of policies, losses, and the highest total payments with \$3,308,141.25.

RiskMAP

Risk mapping, assessment, and planning is a FEMA program which provides communities with flood information and tools to enhance their mitigation plan and take action to better protect their citizens. The project kick-off meeting for RiskMAP in Osage County was held in February 2020.

Repetitive Loss/Severe Repetitive Loss Properties

Repetitive Loss Properties (RL) are those properties with at least two flood insurance payments of \$1,000 or more in a 10-year period.

Severe Repetitive Loss (SRL): A 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 SEMA (**Table 3.47**), as of 09/24/2021, there are 21 repetitive loss properties in Osage County. There have been 61 losses to those properties with total payments of \$1,429,781.94. Unincorporated Osage County has 17 repetitive loss properties which have had 39 losses with total payments of \$1,012,682.50. The city of Chamois has five repetitive loss properties with sixteen losses with total payments of \$363,607.79. There have been 2 mitigated properties, both in Unincorporated Osage County.

Table 3.47. Repetitive Loss Data for Osage County

Jurisdiction	# of Properties	# Mitigated	Building Payments	Content Payments	Total Payments	# of Losses
Osage County	15	2	\$892,392.26	\$120,290.24	\$1,012,682.50	39
Chamois	5	0	\$354,053.21	\$9,554.58	\$363,607.79	16
Westphalia	1	0	\$49,145.78	\$4,345.87	\$53,491.65	6

There are four Severe Repetitive Loss properties in Osage County. One of the properties has been mitigated and the total amount of \$393,849.79 has been paid over a total of 17 NFIP claims.

Table 3.48. Severe Repetitive Loss Data for Osage County

Jurisdiction	# of Properties	# Mitigated	Building Payments	Content Payments	Total Payments	# of Losses
Osage County	1	1	\$43,646.84	\$2,069.92	\$45,716.76	2
Chamois	2	0	\$289,912.42	\$4,728.96	\$294,641.38	9
Westphalia	1	0	\$339,058.20	\$4,345.87	\$348,133.03	6

Previous Occurrences

Table 3.49 provides information regarding Presidential Flooding Disaster Declarations between 2001 and 2020 for Osage County.

Table 3.49. Osage County Presidential Flooding Disaster Declarations 2001 to 2020

Declaration No.	Date	State	Incident Description
DR-1412	2002	MO	Severe Storms, Tornadoes, and Flooding
DR-1463	2003	MO	Severe Storms, Tornadoes, and Flooding
DR-1708	2007	MO	Severe Storms & Flooding
DR-1676	2007	MO	Severe Winter Storms & Flooding
DR-1809	2008	MO	Severe Storms, Flooding, and Tornado
DR-1749	2008	MO	Severe Storms & Flooding
DR-1847	2009	MO	Severe Storms, Tornadoes, and Flooding

Declaration No.	Date	State	Incident Description
DR-3325	2011	MO	Flooding
DR-4144	2013	MO	Severe Storms, Straight-Line Winds, and Flooding
DR-4130	2013	MO	Severe Storms, Straight-Line Winds, Tornadoes, and Flooding
DR-4238	2015	MO	Severe Storms, Straight-Line Winds, Tornadoes, and Flooding
DR-3374	2016	MO	Severe Storms, Straight-Line Winds, Tornadoes, and Flooding
DR-4250	2016	MO	Severe Storms, Straight-Line Winds, Tornadoes, and Flooding
DR-4317	2017	MO	Severe Storms, Straight-Line Winds, Tornadoes, and Flooding
DR-4435	2019	MO	Severe Storms, Straight-Line Winds, and Flooding

Source: FEMA, Disaster Declarations for Missouri, Flooding

Data was obtained from the NCEI regarding flash and river flooding over the last 20 years. **Table 3.50** and **Table 3.51** provide this information. Additionally, narratives available for each event are included.

Table 3.50. NCEI Osage County Riverine Flood Events Summary, 2001 to 2020

Year	# of Events	# of Deaths	# of Injuries	Property Damages (\$)	Crop Damages (\$)
2001	1	0	0	0	0
2002	1	0	0	0	0
2007	1	0	0	5,000	25,000
2008	2	0	0	0	0
2010	1	0	0	0	0
2015	1	0	0	0	0
2017	2	0	0	0	0
Total	9	0	0	5.00K	25.00K

Source: NCEI, data accessed [09/16/21]

Narratives on flood events:

- 06/04/2001:** The Mississippi River flooded in May, and in June the Missouri River took over. Heavy rain across the Missouri River Basin sent the river over its banks to heights in some places not seen since the flooding in 1995. Despite the high river levels, damages were minimal compared to what they could have been. This is because many homes and businesses were relocated out of the flood plain after the devastating flooding of the early and mid-90s. The bulk of the flooding this time occurred in newly established wetlands or in farmhands on the river side of levees. Some towns however were affected.
- 05/08/2002:** Several heavy rain events caused the Missouri River to flood from Central Missouri east to its confluence with the Mississippi River. Most of the flooding started around the 8th and ended by the 20th. The exception being at Gasconade, MO where the river remained in flood until May 28. The river peaked from about 6 to 11 feet over flood stage. Several roads along the river were closed at various times and many acres of farm land went under water. The Katy Trail State Park, a bike and hiking trail that runs along the river from Central Missouri to St.

Charles, was damaged at several locations along the river. Damage to homes and businesses was virtually nonexistent due to relocations and buy outs after the Great Flood of 1993.

3. **05/08/2007:** The Missouri River flooded parts of the northern border of Osage County. Flooding was limited to farmland and roads along the river.
4. **03/19/08:** Heavy rain in March produced major flooding on the Gasconade River in eastern Missouri. The trigger was a four to seven inches of rainfall which produced the flooding from the 19th to the 22nd. The Gasconade River at Rich Fountain crested at 33 feet which was the second highest level ever recorded. Damage along the Gasconade River was mild, mainly to secondary homes or cabins along the river.
5. **09/14/2008:** Up to four inches of rain fell in a short amount of time as the remnants of Hurricane Ike moved through the region causing flooding. Numerous roads were flooded countywide.
6. **06/05/2010:** The Missouri River went into flood early in the month and stay that way into July. Moderate flooding occurred which only affected some roadways and farmland along the river.
7. **12/27/2015:** Between 6 and 8 inches of rain fell across Osage County during a 2 day period. All of this rain caused the creeks and rivers to rise. The Osage River, Gasconade River and Missouri River went into major flood. About 20 structures were either damaged or destroyed from the river flooding.
8. **04/30/2017:** The Maries River rose to major flood levels for a couple of hours due to the heavy rainfall in the basin. A number of county and state roads near the river were flooded. However, no structures were affected by the flooding.
9. **05/01/2017:** The Gasconade River at Rich Fountain went above major flood stage, with a record crest of 37.46 feet on May 2nd, due to very heavy rain over the river basin in late April. A number of secondary roads were closed due to the river flooding.

Table 3.51. NCEI Osage County Flash Flood Events Summary, 2001 to 2020

Year	# of Events	# of Deaths	# of Injuries	Property Damages (\$)	Crop Damages (\$)
2002	4	0	0	0	0
2006	1	0	0	0	0
2008	1	0	0	0	0
2009	2	0	0	0	0
2010	2	0	0	0	0
2012	3	0	0	0	0
2015	2	0	0	0	0
2016	2	0	0	0	0
2017	1	0	0	0	0
2018	1	0	0	0	0
2019	1	0	0	0	0
2020	2	0	0	0	0
Total	22	0	0	0	0

Source: NCEI, data accessed [9/16/21]

Narratives on flash flood events:

1. **05/09/2002:** Another round of 2-4 inches of rain on already saturated ground led to more flash flooding across the area. Numerous roads across the area became impassable due to high water. Many of the small creeks and streams, already high because of previous rain, quickly flooded again.
2. **05/12/2002:** The third heavy rain event of the month brought 3-6 inches of rain over Mother's Day weekend resulting in widespread flash flooding across much of Central and Eastern Missouri. Some weather watchers reported nearly a foot of rain in a 15 day period. Countless creeks and small streams flooded leaving roads underwater. In rural areas, many roads and bridges were severely damaged by floodwater. Urban areas were also overrun by water as storm water drainage systems were quickly overwhelmed. Many people in cities suffered flooded basements. In Centralia, in Boone County, street flooding left people stranded. In Montgomery County, Routes Y, K, J, CC, E and others were flooded and closed. In Franklin County, several roads were closed in Pacific, Robertsville, Catawissa and others. In Gasconade County, Routes N and D were flooded and closed. In Lincoln County, several roads were closed in Troy, Winfield and across the south portion of the county. In St. Louis County, roads were flooded, especially in southern and western areas.
3. **08/18/2002:** Rainfall of 3 to 5 inches fell across Osage County causing flash flooding. The heaviest rain fell across the north central part of the county. Numerous county roads became impassable.
4. **08/20/2002:** Heavy rain flooded and made several roads across central Osage County impassable.
5. **08/26/2006:** Overnight rainfall of a least 3 inches in some locations caused scattered flash flooding across the county. A couple of creeks flooded roads making them impassable.
6. **03/31/2008:** Three to four inches of rain fell over Osage County over a short period of time on already saturated soils. Numerous roads were closed due to flooding including County Roads 508 and 542 near Meta, Highway W northwest of Linn, and Highway P west of Koeltztown.
7. **05/08/2009:** Between 2 and 3 inches of rain fell in a short amount of time causing flash flooding. Highway 89 had two feet of water over it about 4 miles north of Belle.
8. **11/15/2009:** Between 2 and 3 inches of rain fell in a short amount of time on already saturated soils causing flash flooding. Numerous roads were flooded including County Road 412 near Loose Creek and County Road 416 near Bonnots Mill.
9. **06/08/2010:** Up to three inches of rain fell in a short amount of time on already saturated soils, causing flash flooding. Numerous roads were flooded including a secondary road near the intersection of U.S. Highway 50 and State Highway 89, just east of Linn. Also, Highway N in Freedom was closed due to flooding, as well as Highway W just north of Linn.
10. **07/09/2010:** Up to five inches of rain fell in a short amount of time on already saturated soils causing flash flooding. Numerous roads were flooded including Highway CC at the intersection with U.S. Highway 50 and County Road 806 southeast of Highway CC.

-
11. **03/15/2012:** Up to two inches of rain fell in a short amount of time causing flash flooding. Several roads were flooded including U.S. Highway 50 just east of Linn and Highways Y and NN in far southeastern Osage County.
 12. **03/17/2012:** Up to three inches of rain fell in a short amount of time causing flash flooding. Numerous secondary roads were flooded, and several creeks were out of their banks.
 13. **04/14/2012:** Up to four inches of rain fell in a short amount of time causing flash flooding. Several roads were flooded including Highway RA southeast of Linn.
 14. **07/01/2015:** Up to 3 inches of rain fell onto already saturated soils causing flash flooding. Numerous roads were flooded including Route T north of Argyle and Route P west of Freeburg.
 15. **12/26/2015:** Between 3 and 5 inches of rain fell causing flash flooding. Numerous roads were flooded including U.S. Highway 50 at several locations along it. Also, Route RA was closed.
 16. **08/05/2016:** Up to 5 inches of rain fell onto saturated soils causing flash flooding. Numerous roads across southern Osage County were flooded. Highway T near Koeltztown was washed out. Also, Highway P near County Road 524 was washed out. In Freeburg, a water rescue had to be performed after someone drove into a flooded section of roadway and their car stalled.
 17. **08/12/2016:** Up to two inches of rain fell onto already saturated soils causing flash flooding. Several roads were flooded including Highway 100 between Chamois and Morrison.
 18. **04/29/2017:** Between 4 and 6 inches of rain caused flash flooding. Numerous roads were flooded including Route RA southeast of Linn.
 19. **08/29/2018:** Up to four inches of rain fell in a short amount of time causing flash flooding. Several roads were flooded, and numerous creeks were out of their banks in the southeastern portion of Osage County.
 20. **06/22/2019:** Up to three inches of rain caused flash flooding across Osage County. Numerous roads were flooded.
 21. **01/10/2020:** Between 2 and 4 inches of rain, with isolated amounts up to 6 inches, fell in a short amount of time causing flash flooding across Osage County. Numerous roads were flooded including Highways E, W, and 133.
 22. **07/31/2020:** Up to three inches of rain fell in a short amount of time causing flash flooding. Baileys Creek was out of its banks about 3 miles southwest of Morrison, flooding sections of County Road 275.

Probability of Future Occurrence

From the data obtained from the NCEI ³³, there were 9 riverine flood events (**Table 3.50**) over a period of 20 years. This information was utilized to determine the annual average percent probability of riverine flooding (**Table 3.52**). The probability of riverine flooding in Osage County per year is 45.0 percent (9 events/20 years x 100). Furthermore, data was obtained for flash flooding within the county. Osage County endured 22 flash flooding events (**Table 3.51**) over a 20-year period. The probability of flash flooding in Osage County per year is 100% (22 events/20 years x 100) (**Table 3.53**).

³³ <http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=29%2CMISSOURI>

Table 3.52. Annual Average % Probability of Riverine Flooding in Osage County

Location	Annual Avg. % P	Avg. Number of Events
Osage County	45.0%	0.45

*P = probability; see page 3.24 for definition.

Table 3.53. Annual Average % Probability of Flash Flooding in Osage County

Location	Annual Avg. % P	Avg. Number of Events
Osage County	100%	1.1

*P = probability; see page 3.24 for definition.

Changing Future Conditions Considerations

As discussed in the 2018 Missouri Hazard Mitigation Plan, there is a high probability that total rainfall from heavy rainfalls will increase in the 21st century across the globe. As the number of heavy rain events increase, more flooding can be expected.³⁴ Increased development – more roofs and paved areas - can also increase run-off and exacerbate flooding and stormwater issues. These changes will likely result in an increased frequency and severity of floods in Osage County. This change is already being seen in the last 20 years, with heavy rainfall events becoming more severe and occurring more often and severe flooding occurring more frequently. Flood levels on the Gasconade River broke records three times in the past six years.

If rainfall frequency and intensity continue to increase as expected, this will put additional stress on natural hydrological systems and community stormwater systems. Higher groundwater levels can result in more intensive flooding if the ground is already saturated and flood waters typically recede more slowly when groundwater levels are high.³⁵ Other considerations include planning for more expansive stormwater capacity, better drainage and erosion control.³⁶

Vulnerability

Vulnerability Overview

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 can break loose or sustain a puncture as a result of flooding. 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

³⁴ 2018 Missouri State Hazard Mitigation Plan

³⁵ 2018 Missouri State Hazard Mitigation Plan

³⁶ 2018 Missouri State Hazard Mitigation Plan

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. Additional information on scour bridges can be found on page 3.16. Floodwaters can also cause erosion undermining roadbeds. In some instances, steep slopes that are saturated with water may cause mud or rockslides 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.

For the vulnerability analysis of flooding for Osage County, data was obtained from the 2018 Missouri State Hazard Mitigation Plan. The 2018 Plan used the most recent release of Hazus, version 4.0, to model flood vulnerability and estimate flood losses due to the depth of flooding. Additional hazard data inputs were utilized, as available, to perform Hazus Level 2 analyses. This included the extensive use of the FEMA special flood hazard area data and RiskMAP flood risk datasets.

For the Hazus analysis, the flood hazard area and depth of flooding was determined for each county using one of three methods – depending on the data available for that county. Osage County does have digital FIRMS, the regulatory special flood hazard area was utilized. Next, depth grids were generated using cross sections from the FIRM database and/or hydraulic models in combination with the terrain elevation data from which the DFIRM was derived.

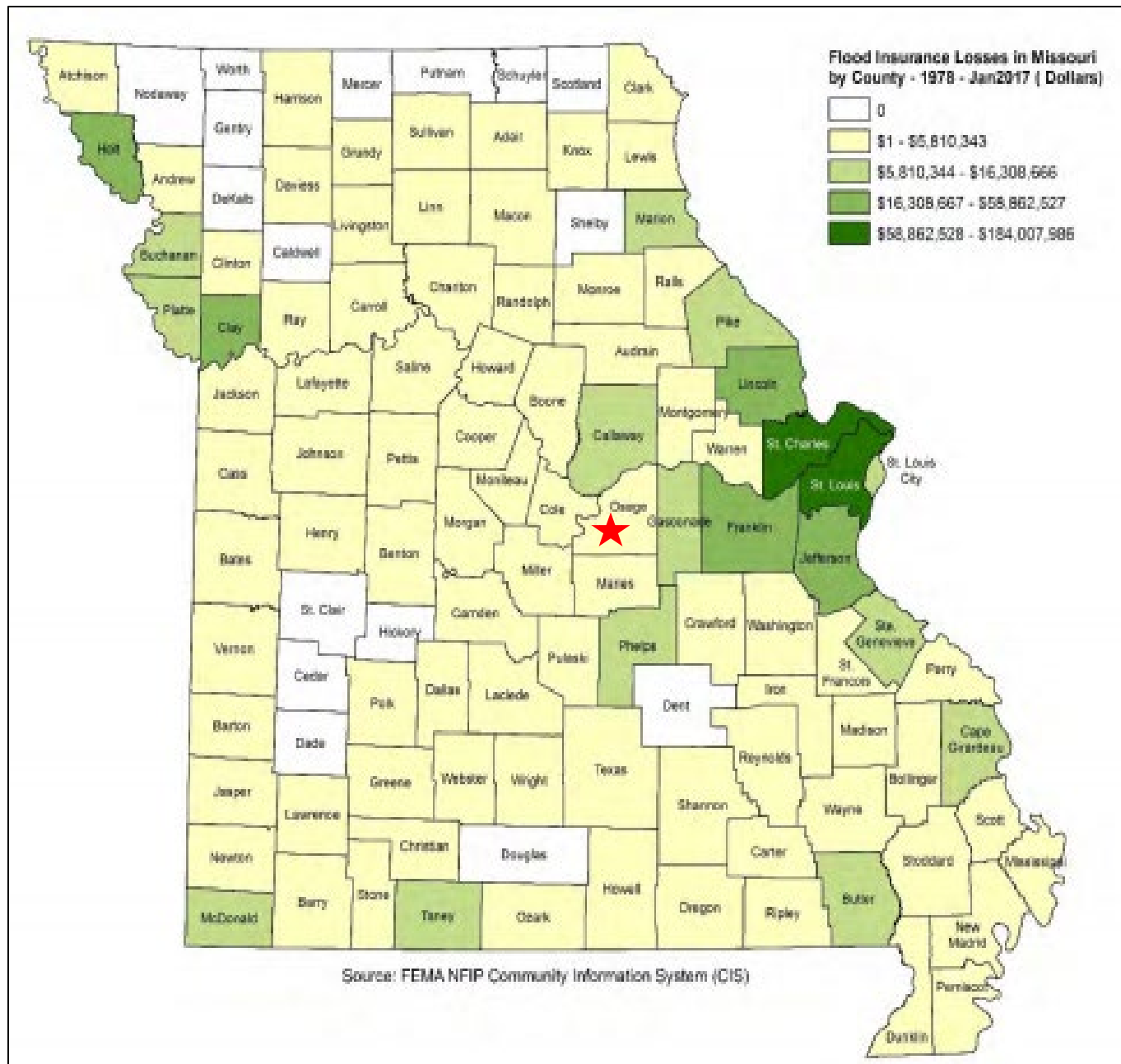
This method was preferred of the three methods, along with RiskMAP flood risk datasets.

In addition to the DFIRM, SEMA analyzed National Flood Insurance Program (NFIP) flood-loss data to determine areas of Missouri with the greatest flood risk. Missouri flood-loss information was obtained from BureauNet which documents losses from 1978 to the present (November 30, 2017 for the State Plan). With this flood-loss data there are limitations noted, including:

- Only losses to participating NFIP communities are represented
- Communities joined the NFIP at various times since 1978
- The number of flood insurance policies in effect may not include all structures at risk to flooding
- Some of the historic loss areas have been mitigated with property buyouts. Two buyouts of repetitive loss properties has occurred in the city of Waynesville and one in unincorporated Osage County.

Figure 3.38 depicts the amount of flood insurance losses in Missouri by county for the period 1978-January 2017. Osage County falls in the \$1 - \$5,810,344 range of payments.

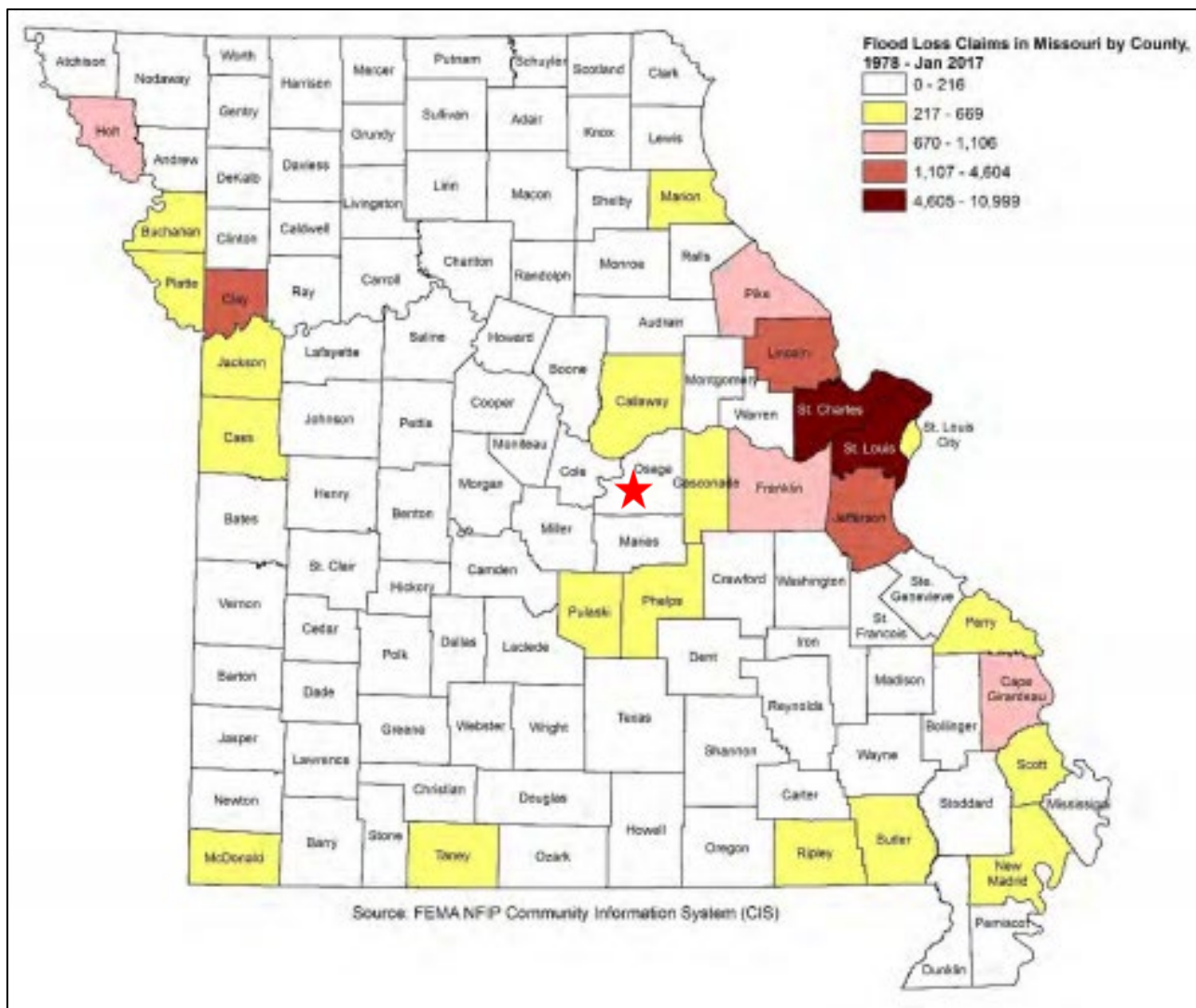
Figure 3.38. Map of Funds Paid Historically for Flood Insurance Losses in Missouri by County 1978 - January 2017



Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Figure 3.39 illustrates the number of flood loss claims made in Missouri during the same time period. Osage County had 0 – 216 claims during that timeframe.

Figure 3.39. Flood Loss Claims in Missouri by County, 1978 – January 2017



Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Furthermore, the state analyzed potential loss estimates to flooding. The purpose of the analysis is to determine where flood losses can occur and the degree of severity using consistent methodology. These results were generated from DFIRM data and Hazus floodplain data. **Table 3.54** provides information regarding total direct building loss and income loss to Osage County. **Table 3.55** provides information on exposure of buildings. According to the Missouri Spatial Data Information Service (MSDIS) there are 1,252 residential structures at risk of flood. Hazus shows the number of building exposed to flood damage at 112, with 63 potentially substantially damaged in a one percent annual chance of a flood.

Table 3.54. Total Direct Building Loss and Income Loss to Osage County

County-wide Building Loss	Structural Damage	Contents Loss	Inventory Loss	Total Direct Loss	Total Income Loss	Total Direct and Income Loss	Calc. Loss Ratio
\$1,611,790,000	\$41,820,000	\$20,504,000	\$103,000	\$62,427,000	\$83,000	\$62,510,000	2.59

Source: 2018 Missouri State Hazard Mitigation Plan

Table 3.55. Osage County Structures Exposure

# MSDIS Residential Structures Exposed	# Hazus Buildings Exposed	# Substantially Damaged
1,252	112	63

Source: 2018 Missouri State Hazard Mitigation Plan

This same analysis indicates that 1,090 people would be displaced in Osage County and 242 would need to be sheltered in the event of a major flood.

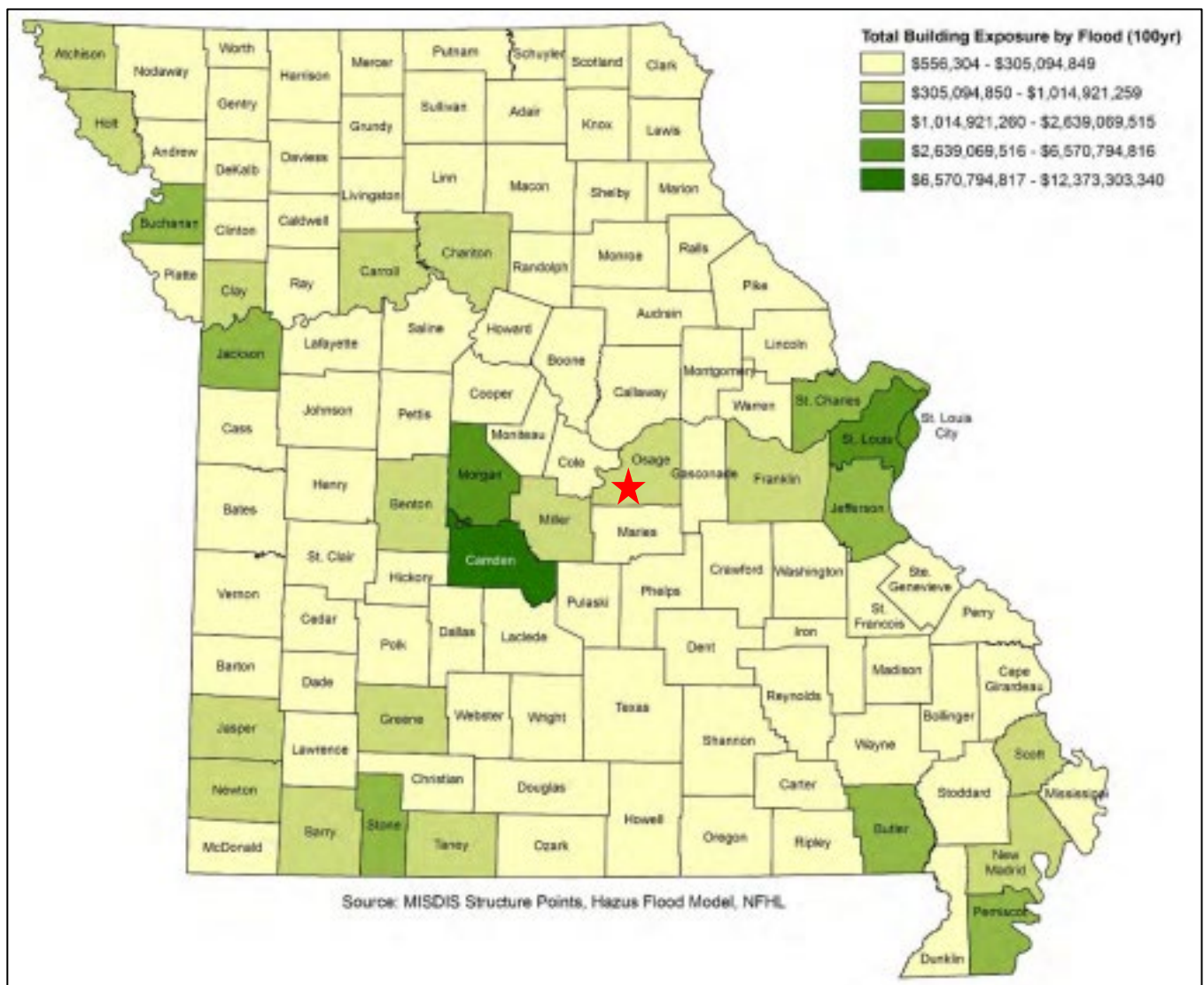
Table 3.56 presents the results of the primary indicators for Osage County – residential, agricultural, commercial, education, government and industrial. This table illustrates the number of affected structures and estimated losses. **Figure 3.40** shows the building exposure for the Hazus Base-Flood Scenario. **Figure 3.41** illustrates the building impacted ratio for a 100-year flood.

Table 3.56. Osage County Total Building Loss and Income Loss

# Residential Structures	Total \$\$ of Loss	# Agriculture Structures	Total \$\$ of Loss	# Commercial Structures	Total \$\$ of Loss	# of Education Structures	Total \$\$ of Loss	# of Government Structures	Total \$\$ of Loss	# of Industrial Structures	Total \$\$ of Loss	Total # Population Affected	Total Loss – Hazus Layer
254	\$51,653,184	468	\$296,277,302	47	\$29,992,302	0	0	1	\$672,059	30	\$46,66,957	665	\$425,152,363

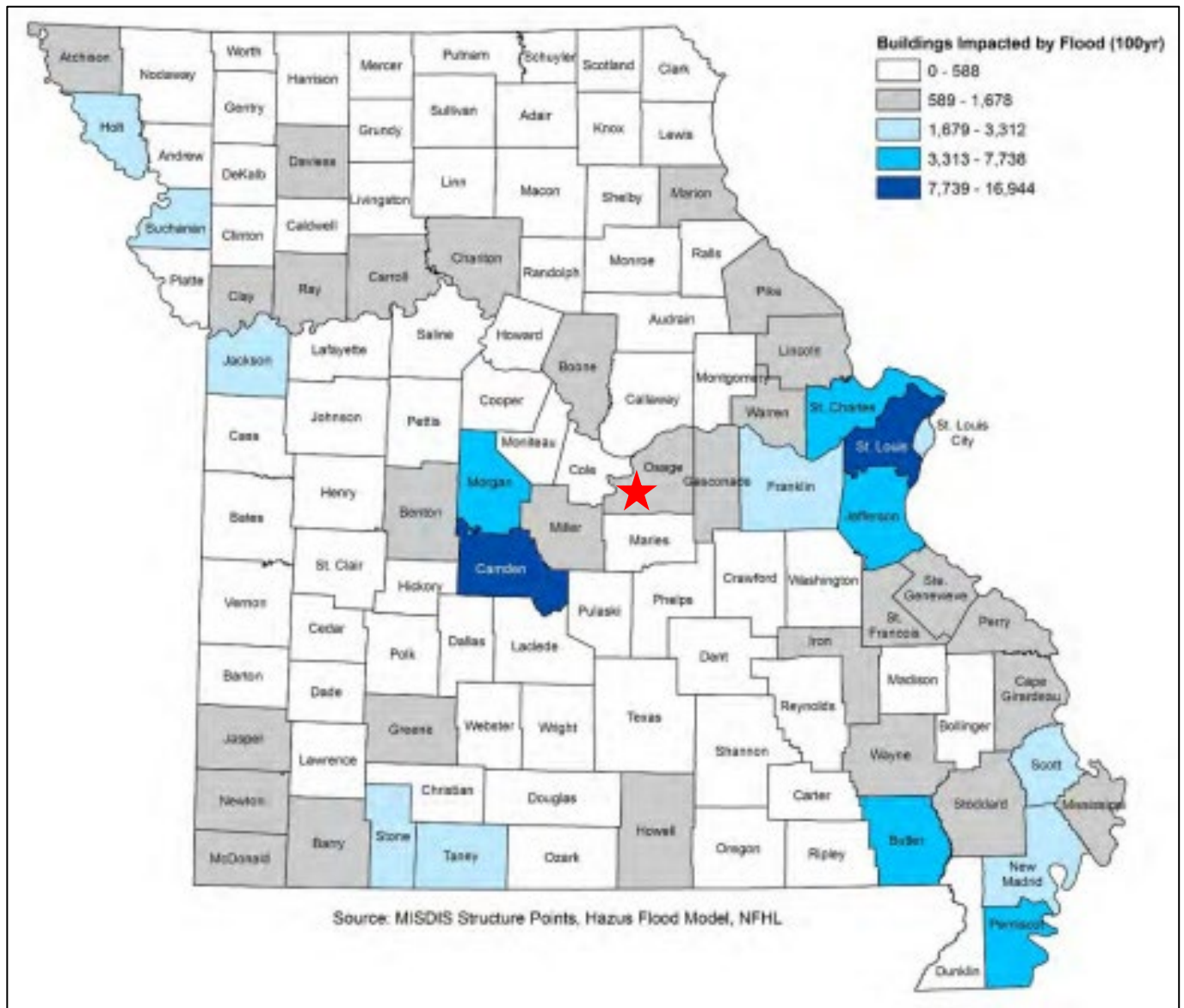
Source: 2018 Missouri State Hazard Mitigation Plan

Figure 3.40. Hazus Countywide Base-Flood Scenarios: Building Exposure



Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Figure 3.41. Hazus Countywide Base-Flood Scenarios: Building Impacted Ratio



Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

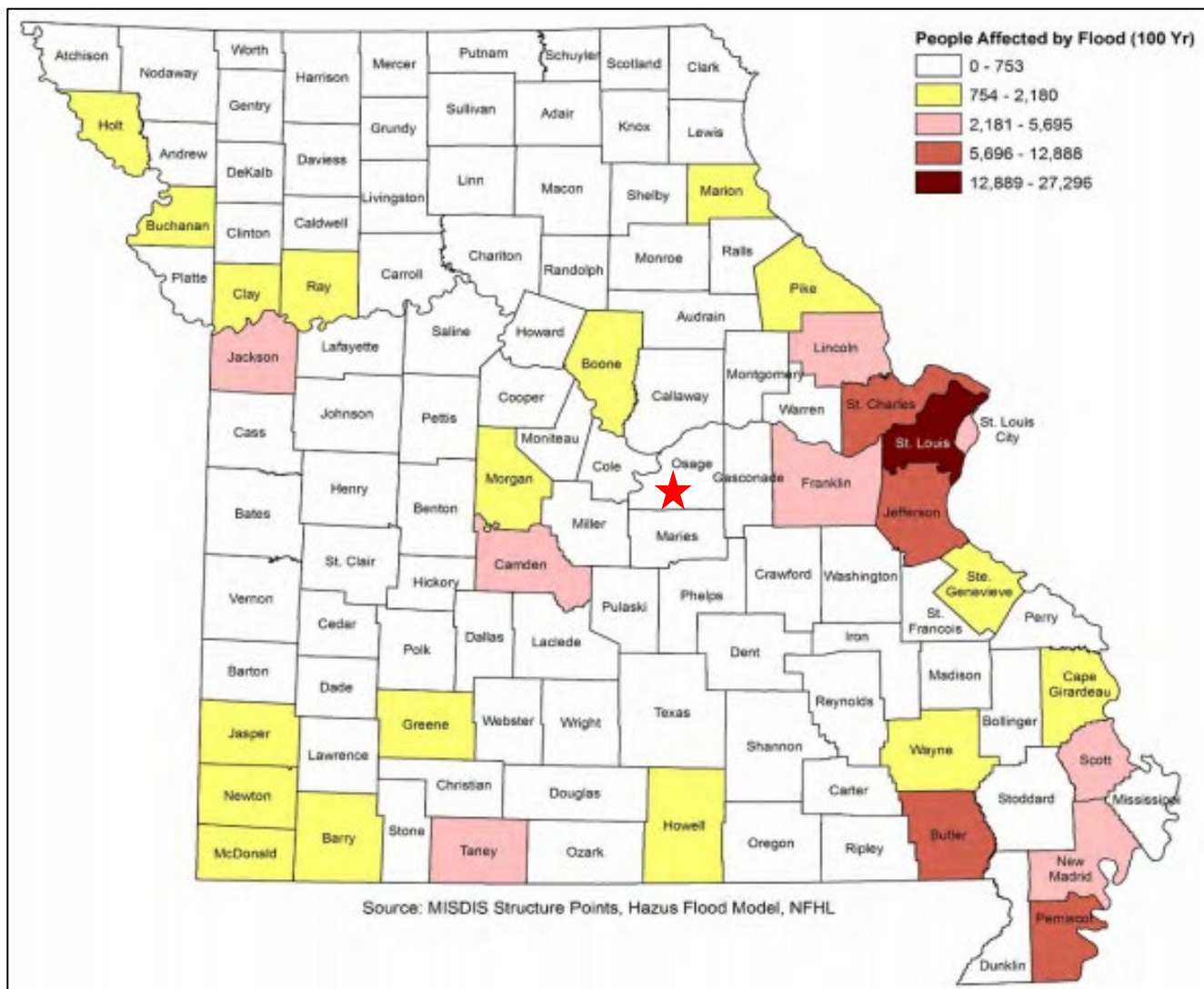
Lastly, the State determined the estimated number of displaced households and need for shelters within Osage County in the event of a 100-year flood. **Table 3.57** and **Figure 3.42** illustrate this information.

Table 3.57. Estimated Displaced People and Shelter Needs for Osage County

County	Displaced People	Displaced Population Requiring Shelter
Osage	1,090	242

Source: 2018 Missouri State Hazard Mitigation Plan

Figure 3.42. Hazus Countywide Base-Flood Scenarios: Displaced People



Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Potential Losses to Existing Development

Every jurisdiction in Osage County contains a portion of the 100 Year Floodplain except for Freeburg. According to the HAZUS model, Osage County has a building loss ratio of 2.59% for countywide base-flood scenarios, which is relatively high in relation with other counties in the state. Additionally, the county has a high number of repetitive loss properties. With the annual average probability for flooding at 45% and 100% for flash floods, Osage County's existing development is vulnerable. Especially development located in low-lying areas, near rivers or streams, or where drainage systems are not adequate are all prone to flooding.

According to the 2020 Questionnaire, no school districts within the county have buildings located within the floodplain. Lastly, several buildings damaged historically to flooding have been mitigated, leaving fewer areas of potential destruction.

Impact of Previous and Future Development

Impact of future development is correlated to floodplain management and regulations set forth by the county and jurisdictions³⁷. Future development within low-lying areas near rivers and streams, or where interior drainage systems are not adequate to provide drainage during heavy rainfall events should be avoided. Additionally, future development would also increase impervious surface causing additional water run-off and drainage problems during heavy rainfall events.

Hazard Summary by Jurisdiction

Vulnerability to flooding slightly varies across the planning area. The jurisdiction most vulnerable to flooding is unincorporated Osage County. Unincorporated Osage County has the most recorded NCEI flood events. Since 2001 there have been 20 incidents of flooding or flash flooding in Osage County; (**Table 3.50** and **Table 3.50**). The city of Chamois has 5 repetitive loss properties and 2 severe repetitive loss properties, whereas the county has 15 repetitive loss properties and 1 severe repetitive loss properties.

Those areas at greatest risk to riverine flooding are those populated areas along the Missouri River and Maries River.

A portion of the cities of Westphalia, Meta, and Linn, and the majority of the city of Chamois reside in a SFHA.

The city of Freeburg is not a member of the NFIP and does not have any identified floodplain areas within the city boundaries. But the community is still vulnerable to flash floods and affected by closures to roads around the city.

Problem Statement

The county has already adopted a Floodplain Management Ordinance concerning construction in the floodplain. The county should consider buyouts of properties that are flood prone and have had repetitive losses to mitigate future disasters. Local governments should make a strong effort to further improve warning systems to ensure that future deaths and injuries do not occur. Local governments should consider making improvements to roads and low water crossings that consistently flood by placing them on a hazard mitigation projects list, and actively seek funding to successfully complete the projects.

³⁷ 2015 Boone County Hazard Mitigation Plan

3.4.6 Land Subsidence/Sinkholes

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.5, Page 3.218
https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- <http://www.dnr.mo.gov/geology/geosrv/envgeo/sinkholes.htm>
- <http://www.businessinsider.com/where-youll-be-swallowed-by-a-sinkhole-2013-3>
- <http://water.usgs.gov/edu/sinkholes.html>
- <http://pubs.usgs.gov/fs/2007/3060/>
- Missouri hazard Mitigation Viewer
<http://bit.ly/MoHazardMitigationPlanViewer2018> - Website
<http://drive.google.com/file/d/1bPkc0jgF9ofwQLnTL9NOu-oPFWi9hkst/view> - User Guide
 - Total number of sinkholes by County
 - Vulnerability to sinkholes by County
 - Total number of mines by County
 - Vulnerability to mines by County
 - Total value of structures impacted by sinkholes by County
 - Total population impacted by sinkholes by County

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.

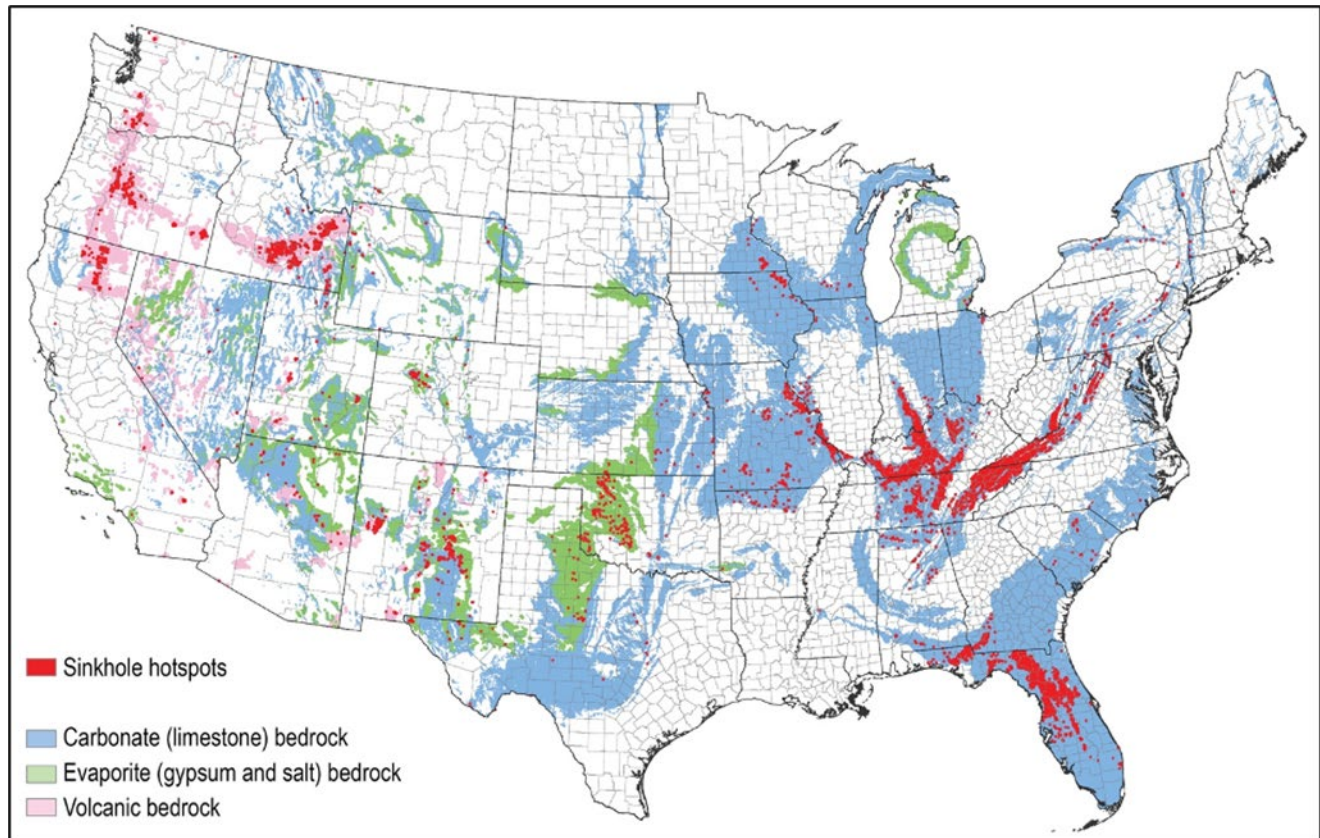
According to the U.S. Geological Survey (USGS), the most damage from sinkholes tends to occur in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania. Fifty-nine percent of Missouri is underlain by thick, carbonate rock that makes Missouri vulnerable to sinkholes. Sinkholes occur 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 other have vertical walls. Some hold water and form natural ponds.

Geographic Location

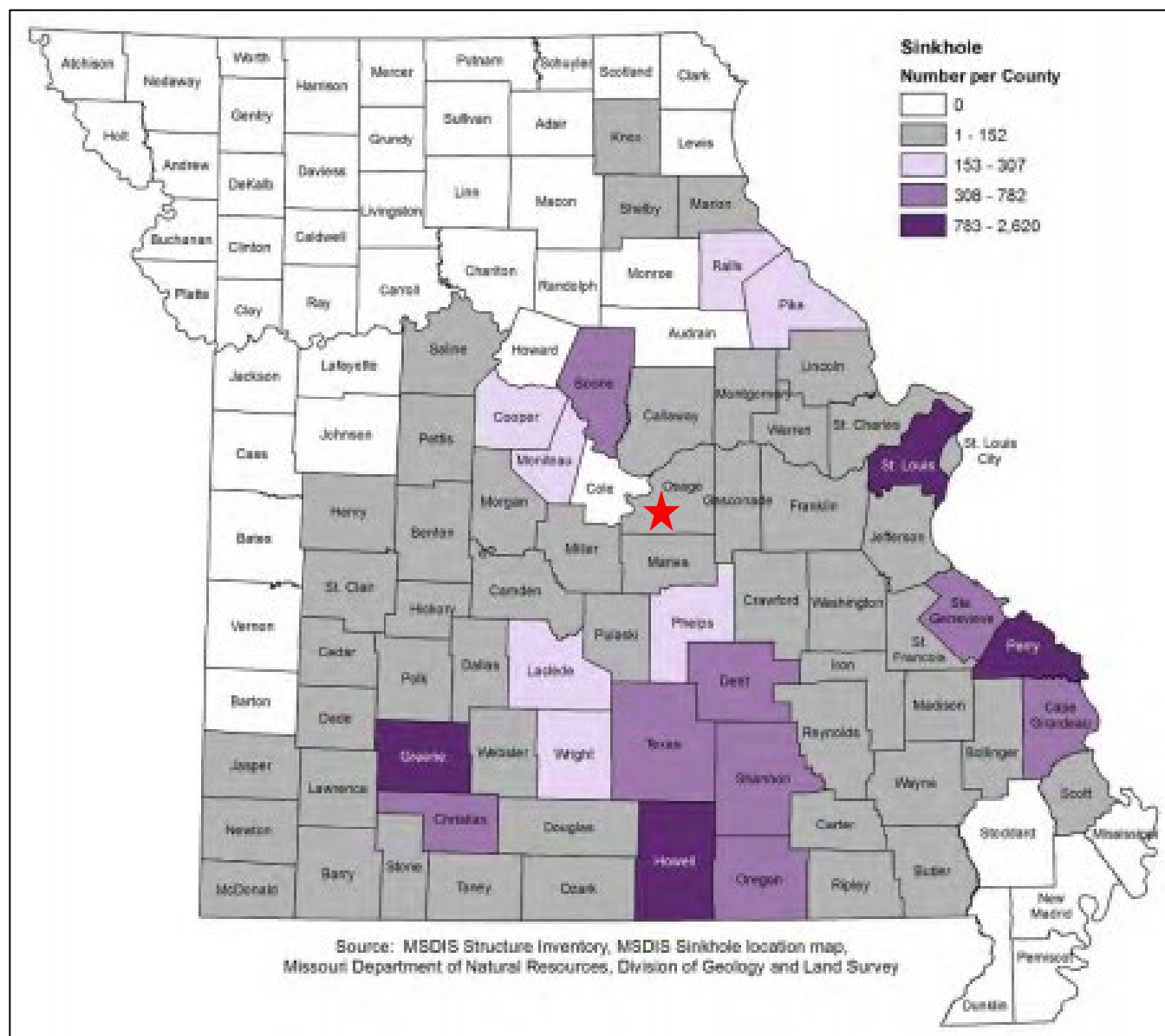
Figure 3.43 depicts karst topography across the United States. Missouri's karst topography is comprised of carbonate rocks such as limestone, dolomite, and marble. Variability in areas prone to sinkholes does not differ greatly across the county. According to the 2018 Missouri State Hazard Mitigation Plan there are one sinkhole that has been recorded within Osage County (**Figure 3.44**). In addition, the Plan states that there are 387 mines in Osage County - as shown in **Figure 3.45**. According to the Missouri Department of Natural Resources, Osage County primarily produces sand, gravel, limestone, and clay. Activities such as mining or drilling are known to be responsible for the formation of sinkholes.

Figure 3.43. Karst Map of the Conterminous United States - 2020



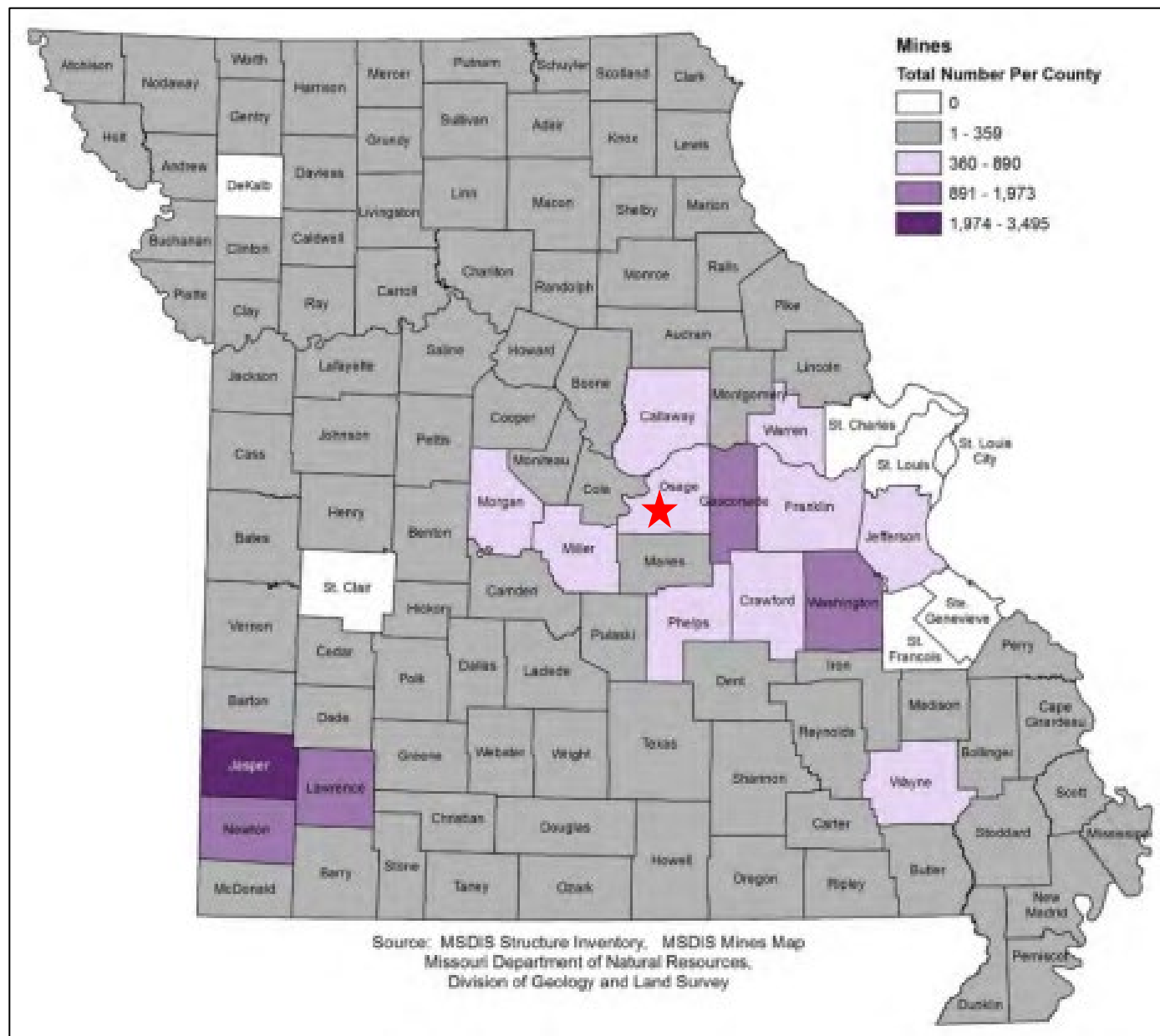
Source: <https://www.usgs.gov/media/images/karst-map-conterminous-united-states-2020>

Figure 3.44. Sinkholes Counts per County



Source: 2018 Missouri Hazard Mitigation Plan; *Red star indicates Osage County

Figure 3.45. Mines Counts Per County



Source: 2018 Missouri Hazard Mitigation Plan; *Red star indicates Osage County

Strength/Magnitude/Extent

Unlike earthquakes or other geologic hazards, there currently is no scale for measuring or determining the severity of sinkholes. However, geological and mining parameters can affect the magnitude and extent of sinkhole subsidence. As previously noted, natural sinkholes develop in areas where the rock below the surface is limestone, carbonate rock, salt beds or any type of rock that can naturally be dissolved by groundwater circulating through it. Artificial sinkholes form due to groundwater pumping, water main and sewer collapses and mine collapses.³⁸

³⁸ 2018 Missouri Hazard Mitigation Plan

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 mentions 18 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 rarely had major impacts on development nor have they caused serious damage.

Previous Occurrences

Although there are few sinkholes and sinkhole areas in Osage County, incidents have occurred in other parts of southern Missouri. Fortunately, there are no recorded incidents of death due to sinkholes in the county. Recorded sinkholes are rural in nature and reside within unincorporated parts of the county.

Probability of Future Occurrence

Due to the lack of data for previous sinkhole events in Osage County, a probability could not be calculated.

Changing Future Conditions Considerations

The Missouri State Hazard Mitigation Plan states that an increase in droughts and extreme weather such as torrential rain and flooding, can result in an increase in sinkholes. Heavy rains often expose or contribute to the development of sinkholes, and periods of drought, with drops in groundwater, can also result in the development of sinkholes. It is expected that future development, coupled with climate change and its corresponding extreme weather events will result in an increase in sinkhole issues in Osage County.

Vulnerability

Vulnerability Overview

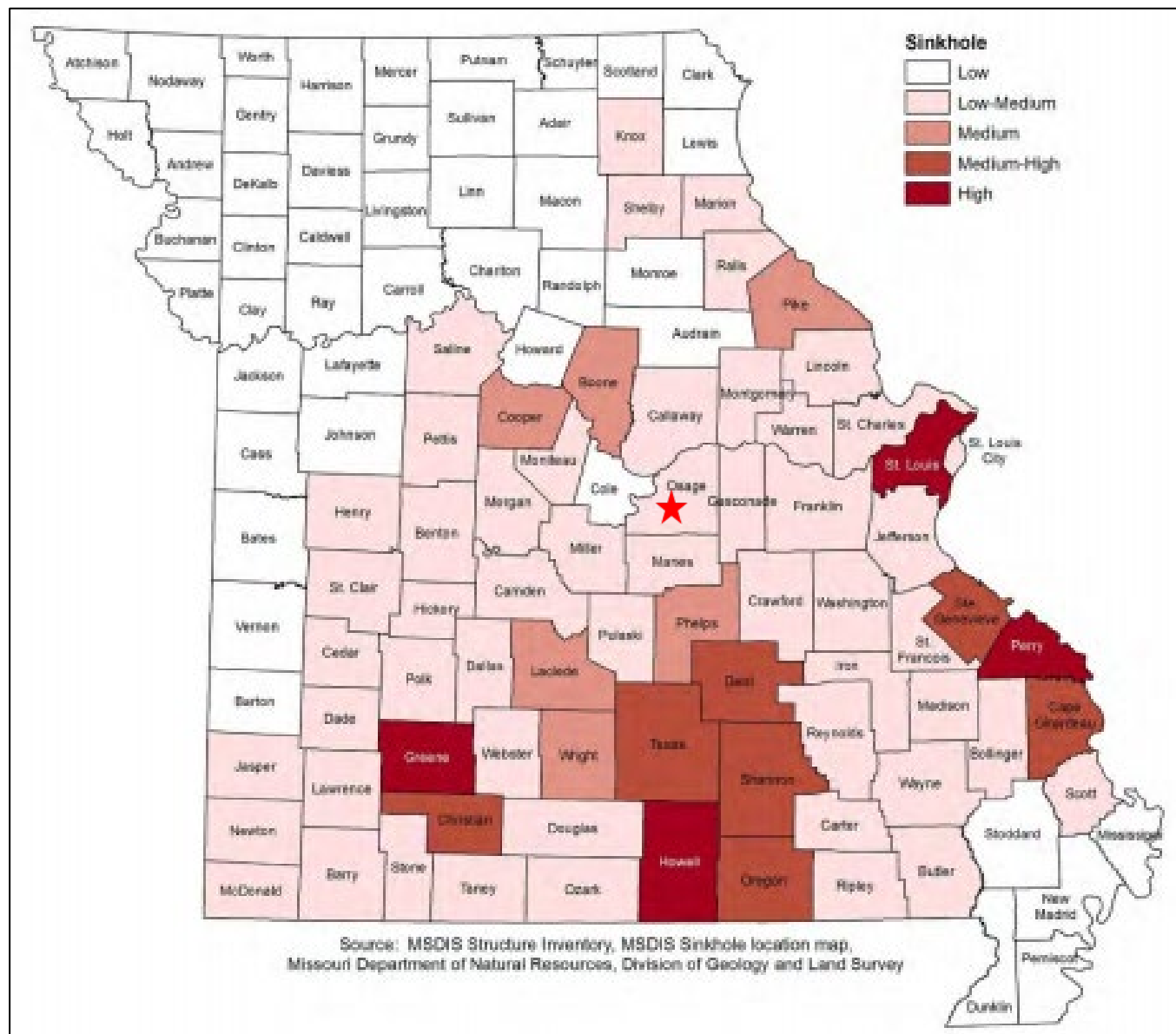
Unfortunately, no statistics are available for the number of subsurface locations that may potentially collapse in the future, forming a sinkhole. According to the state plan, if a county has fewer than 200 sinkholes, the risk is considered 2 - low-medium. For mines, the state plan calculates that Osage County's risk is rated as 3 – Medium. See **Table 3.58**, **Figure 3.46** and **Figure 3.47** further illustrate the sinkhole and mining rating values respectively.

Table 3.58. Sinkhole/Mine Rating Values for Osage County

Factor	1 (Low)	2 (Low-medium)	3(Medium)	4 (Medium-high)	5 (High)
Sinkholes per county	0	1-200	201-400	401-800	801+
Mines per county	0-100	101-250	251-500	501-750	751+

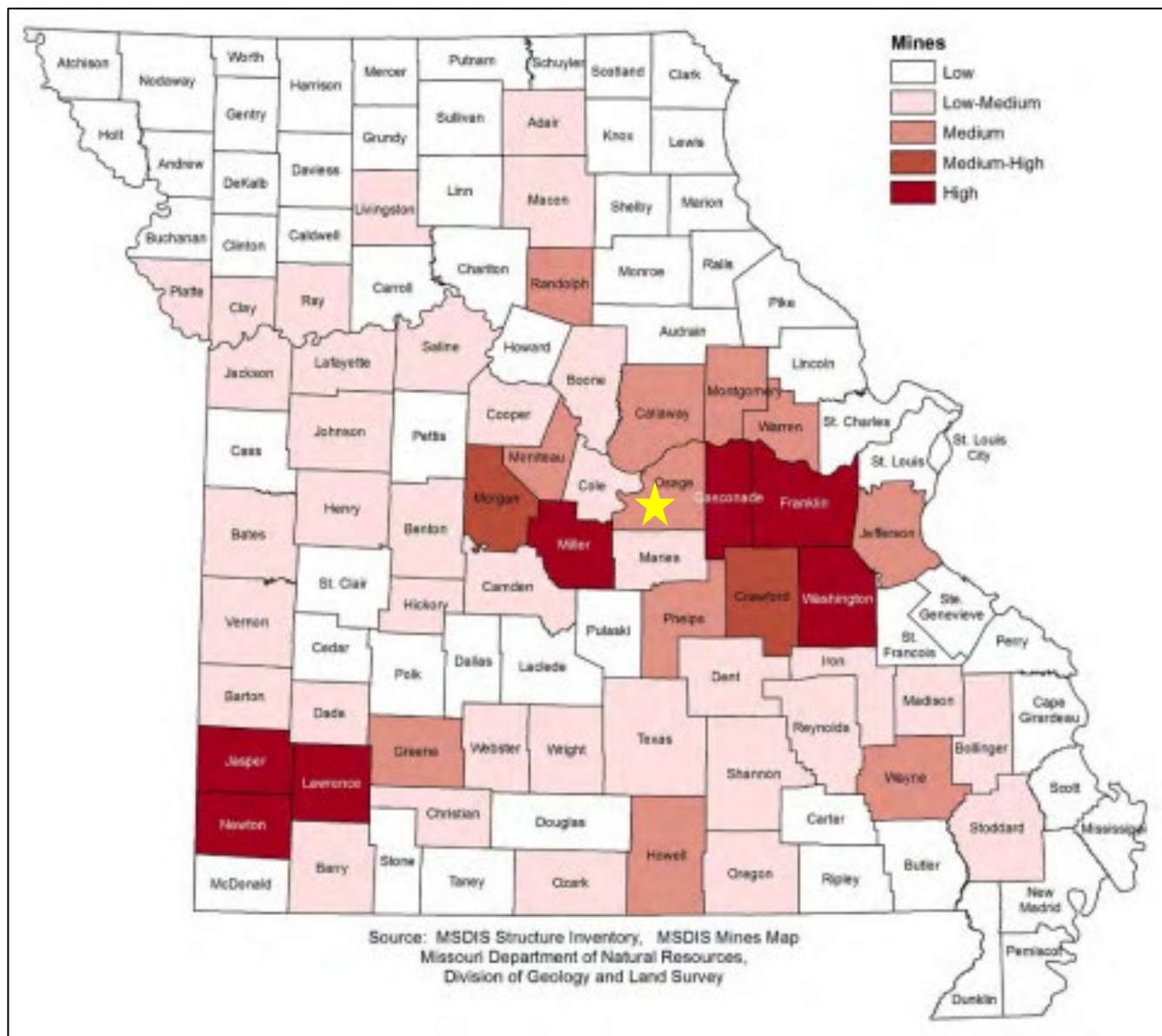
Source: 2018 Missouri Hazard Mitigation Plan, Yellow highlight shows values for Osage County

Figure 3.46. Sinkhole Rating Value by County



Source: 2018 Missouri Hazard Mitigation Plan, *Red star indicates Osage County

Figure 3.47. Mine Rating Value By County



Source: 2018 Missouri Hazard Mitigation Plan, *Yellow star indicates Osage County

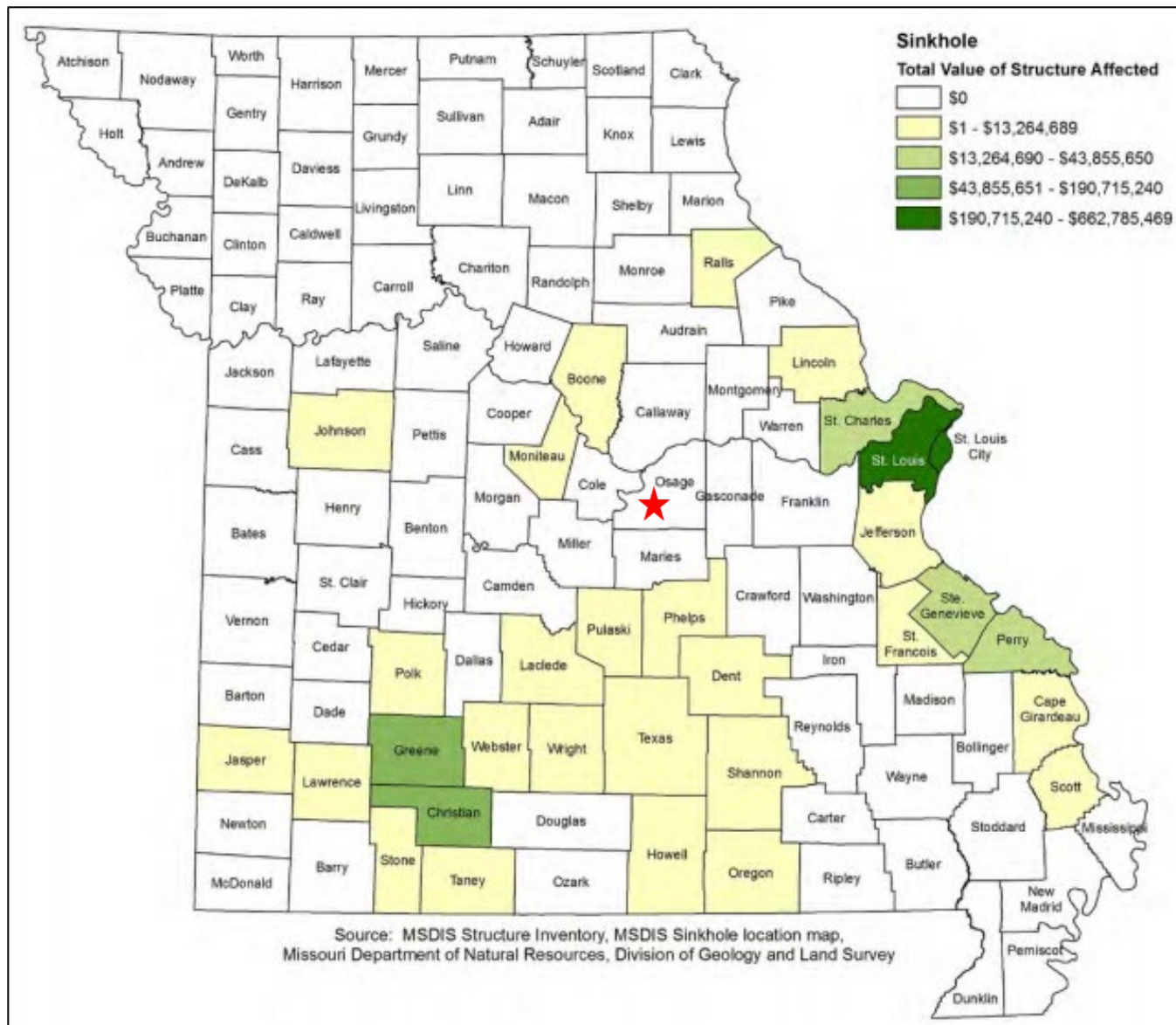
Potential Losses to Existing Development

The most likely type of damage to occur in conjunction with a sinkhole collapse is property damage related to foundation disturbance. Signs include cracks in interior and exterior walls; doors and windows that no longer sit square or open and close properly; depressions forming in the yard; cracks in the street, sidewalk, foundation or driveway; and turbidity in local well water. All of these can be early indicators that a sinkhole is forming in the vicinity³⁹. In the event of a sudden collapse, an open sinkhole can form in a matter of minutes and swallow lawns, automobiles, and homes. This has occurred in some parts of Missouri, particularly in the southwest part of the state, but there have been no dramatic incidents like this in Osage County.

³⁹ <https://ufonline.ufl.edu/infographics/how-to-spot-a-sinkhole/>

The 2018 Missouri Hazard Mitigation Plan devised a method of estimating potential losses using GIS data. **Figure 3.48** shows the ranking of structures that could potentially be impacted by sinkholes by county. This map shows that Osage County has \$0 total value of structures affected.

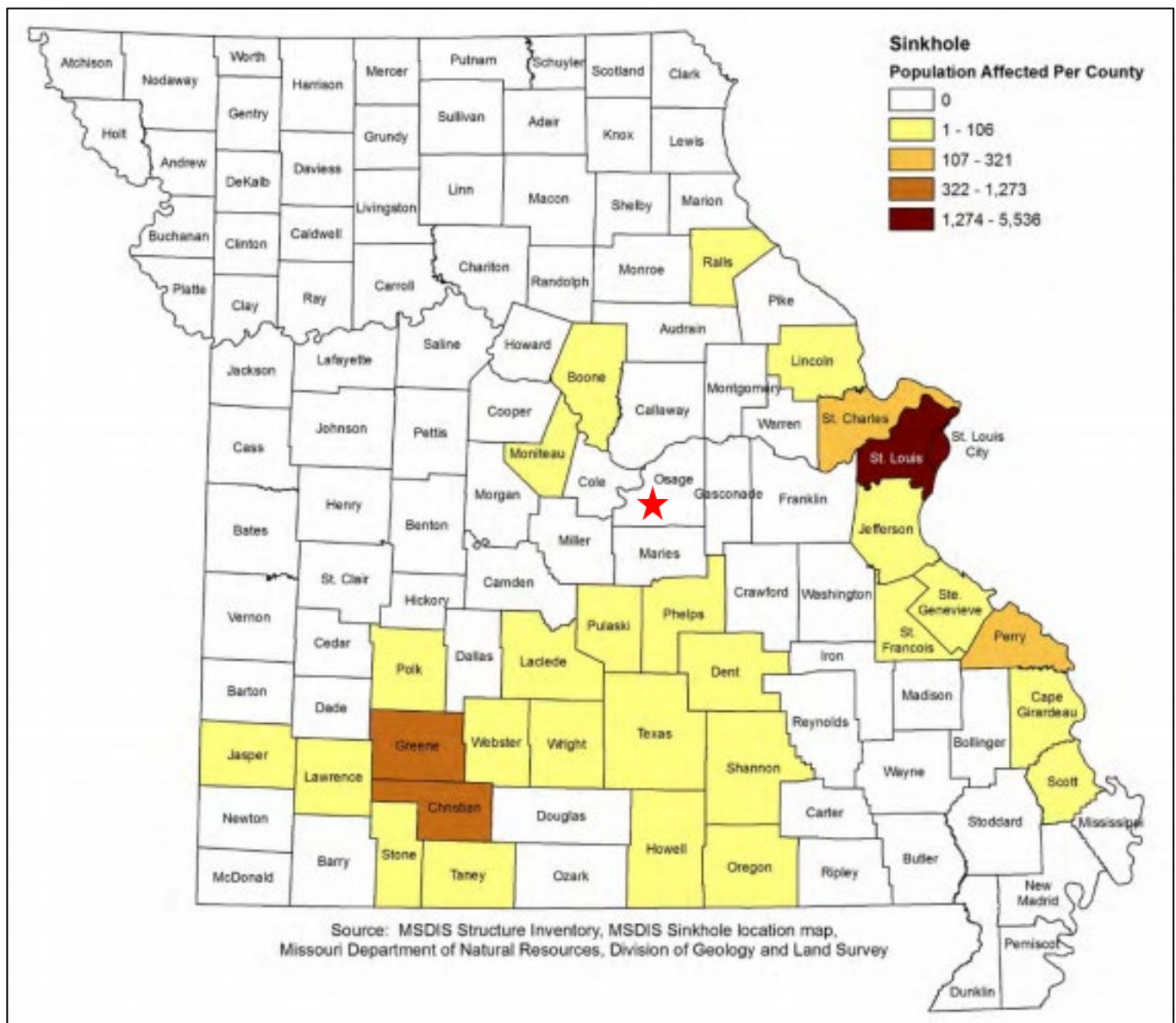
Figure 3.48. Ranking of Structures Potentially Impacted by Sinkholes by County



Source: 2018 Missouri Hazard Mitigation Plan, *Red star indicates Osage County

Figure 3.49 shows the population potentially impacted by sinkholes; Osage County shows that 0 of the county population could be affected by sinkholes.

Figure 3.49. Ranking of Population Potentially Impacted by Sinkholes by County



Source: 2018 Missouri Hazard Mitigation Plan, *Red star indicates Osage County

Impact of Future Development

Future development over or near abandoned mines and in locations at risk of sinkhole formation will increase the hazard vulnerability. Information regarding regulations limiting construction near sinkholes is very limited. According to the state plan, Osage County's risk in regard to these hazards is moderately low.

Hazard Summary by Jurisdiction

According to the state plan, Osage County's risk is low. Based on the location of known sinkholes, the jurisdiction most likely to be impacted by sinkholes is Unincorporated Osage County.

Problem Statement

Sinkholes and sinkhole/mining areas are well documented by both the US Geological Survey and the Missouri Department of Natural Resources Geologic Resources Section. The risk of sinkhole collapse can be lessened by avoiding the construction of structures in these areas and avoiding those activities that significantly alter the local hydrology, such as drilling and mining. In addition, communities should avoid leaking water and sewer lines through appropriate maintenance and monitoring. Local residents should be educated on the risks associated with sinkholes and mines and advised to avoid placing themselves and their property in danger by building in sinkhole/mining areas. Communities with building codes should include prohibitions on building in known sinkhole/mining areas.

3.4.7 Levee Failure

Some sources of data for this hazard include:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.2, Page 3.124
https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- National Levee Database, <https://levees.sec.usace.army.mil/#/>
- FEMA Map Service Center for Flood Insurance Rate Maps and Flood Insurance Studies, [msc.fema.gov/portal; https://www.fema.gov/fema-levee-resources-library](https://www.fema.gov/fema-levee-resources-library)
- Missouri Hazard Mitigation Viewer
<http://bit.ly/MoHazardMitigationPlanViewer2018> - Website
<https://drive.google.com/file/d/1bPkc0jgF9ofwQLnTL9N0u-oPFWi9hkst/view> - User Guide
 - Counties with existing levees
 - Population exposure to levees on the National Inventory of Levees by County
 - Building exposure to levees on the National Inventory of Levees by County
- MSDIS Structure Inventory and All Hazard Risk Dataset
(available in both GIS and Excel format)
<https://drive.google.com/drive/folders/0Bzq99s866kWocFB5Y3hCRIRuWWM>

Hazard Profile

Hazard Description

Levees are earth embankments constructed along rivers and coastlines to protect adjacent lands from flooding. Floodwalls are concrete structures, often components of levee systems, designed for urban areas where there is insufficient room for earthen levees. When levees and floodwalls and their appurtenant structures are stressed beyond their capabilities to withstand floods, levee failure can result in injuries and loss of life, as well as damages to property, the environment, and the economy.

Levees can be small agricultural levees that protect farmland from high-frequency flooding. Levees can also be larger, designed to protect people and property in larger urban areas from less frequent flooding events such as the 100-year and 500-year flood levels. For purposes of this discussion, levee failure will refer to both overtopping and breach as defined in FEMA's Publication "So You Live Behind a Levee" (<http://content.asce.org/ASCELeveeGuide.html>). Following are the FEMA publication descriptions of different kinds of levee failure.

Overtopping: When a Flood Is Too Big

Overtopping occurs when floodwaters exceed the height of a levee and flow over its crown. As the water passes over the top, it may erode the levee, worsening the flooding and potentially causing an opening, or breach, in the levee.

Breaching: When a Levee Gives Way

A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning.

Earthen levees can be damaged in several ways. For instance, strong river currents and waves can erode the surface. Debris and ice carried by floodwaters—and even large objects such as boats or barges—can collide with and gouge the levee. Trees growing on a levee can blow over, leaving a hole

where the root wad and soil used to be. Burrowing animals can create holes that enable water to pass through a levee. If severe enough, any of these situations can lead to a zone of weakness that could cause a levee breach. In seismically active areas, earthquakes and ground shaking can cause a loss of soil strength, weakening a levee and possibly resulting in failure. Seismic activity can also cause levees to slide or slump, both of which can lead to failure.

Geographic Location

Missouri is a state with many levees. Currently, there is no single comprehensive inventory of levee systems in the state. Levees have been constructed across the state by public entities and private entities with varying levels of protection, inspection oversight, and maintenance. The lack of a comprehensive levee inventory is not unique to Missouri.

There are two concurrent nation-wide levee inventory development efforts, one led by the United State Army Corps of Engineers (USACE) and one led by Federal Emergency Management Agency (FEMA). The National Levee Database (NLD), developed by USACE, captures all USACE related levee projects, regardless of design levels of protection. The Midterm Levee Inventory (MLI), developed by FEMA, captures all levee data (USACE and non-USACE) but primarily focuses on levees that provide 1% annual-chance flood protection on FEMA Flood Insurance Rate Maps (FIRMs).

It is known that agricultural levees and other non-regulated levees within the planning area exist that are not inventoried or inspected. These levees that are not designated to provide protection from the 1-percent annual chance flood would overtop or fail in the 1-percent annual chance flood scenario. Therefore, any associated losses would be taken into account in the loss estimates provided in the Flood Hazard Section.

For purposes of the levee failure profile and risk assessment, those levees indicated on the Preliminary DFIRM as providing protection from at least the 1-percent annual chance flood will be discussed and further analyzed. It is noted that increased discharges are being taken into account in revision of the flood maps as part of the RiskMap efforts. This may result in changes to the flood protection level that existing levees are certified as providing.

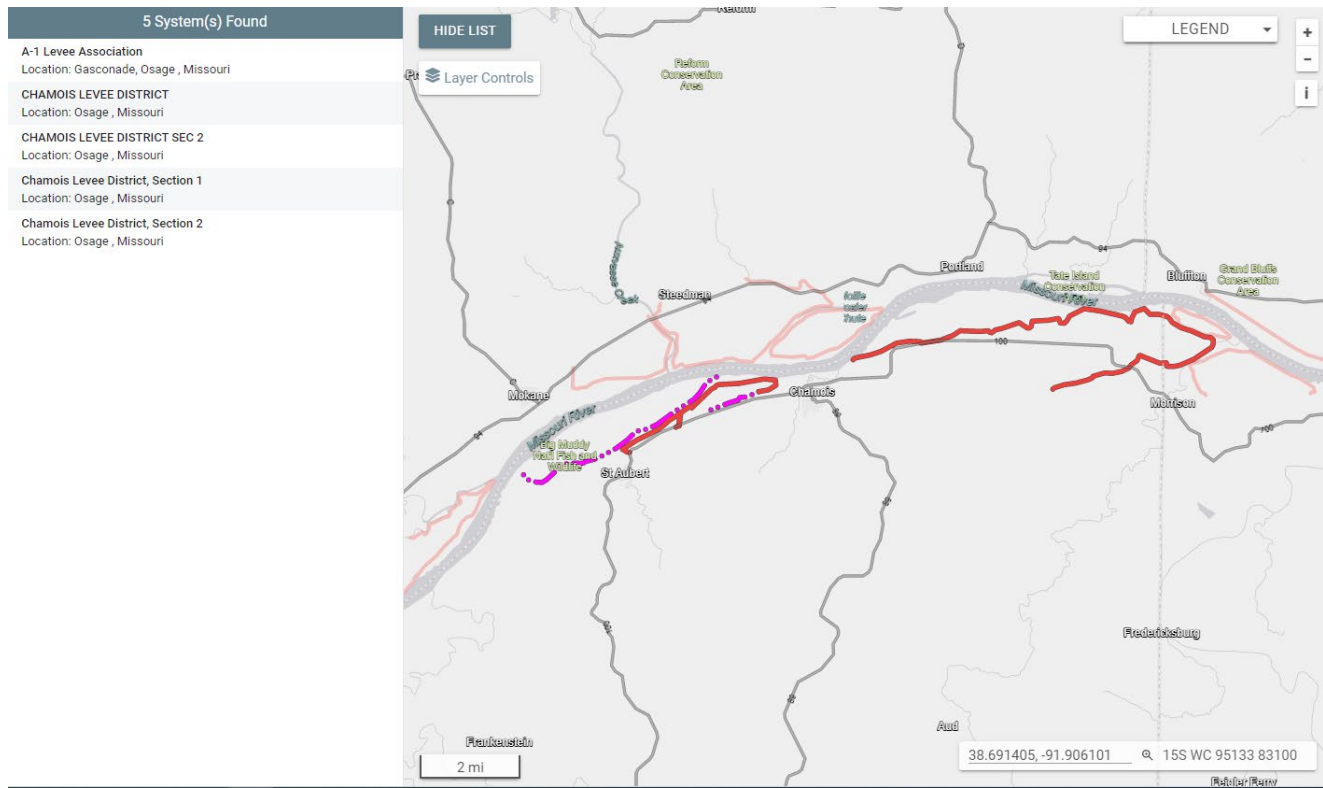
According to the USACE, there are five levees within Osage County. Detailed levee data can be found in **Table 3.59**. Leveed areas can be seen in **Figure 3.50**. None of the levees are certified to protect from the 1-percent annual chance flood event and therefore none of them appear on FIRMs.

Table 3.59. Osage County Levees

County	System Name/Sponsor	Length (miles)	Inspection Date	Inspection Rating	Leveed Area Type	Leveed Area Acreage
Osage	A-1 Levee Association	11.83	6-Aug-2012	Minimally Acceptable	Agricultural	3,565
Osage	CHAMOIS LEVEE DISTRICT	4.64		Under Review	Agricultural	
Osage	CHAMOIS LEVEE DISTRICT SEC 2	1.14		Under Review	Agricultural	
Osage	Chamois Levee District, Section 1	1.81	21-Jan-2014	Minimally Acceptable	Agricultural	100
Osage	Chamois Levee District, Section 2	2.9	21-Jan-2014	Minimally Acceptable	Agricultural	370

Source: <https://levees.sec.usace.army.mil/#/>

Figure 3.50. Osage County Levees - USACE



Source: <https://levees.sec.usace.army.mil/#/>

Strength/Magnitude/Extent

Levee failure is typically an additional or secondary impact of another disaster such as flooding or earthquake. The main difference between levee failure and losses associated with riverine flooding is magnitude. Levee failure often occurs during a flood event, causing destruction in addition to what would have been caused by flooding alone. In addition, there would be an increased potential for loss of life due to the speed of onset and greater depth, extent, and velocity of flooding due to levee breach.

As previously mentioned, agricultural levees and levees that are not designed to provide flood protection from at least the 1-percent annual chance flood likely do exist in the planning area. However, none of these levees are shown on the Preliminary DFIRM, nor are they enrolled in the USACE Levee Safety Program. As a result, an inventory of these types of levees is not available for analysis. Additionally, since these types of levees do not provide protection from the 1-percent annual chance flood, losses associated with overtopping or failure are captured in the Flood Section of this plan.

Previous Occurrences

Table 3.60. USACE Previous Occurrences of Levees in Osage County

System Name/Sponsor	Risk Level	# of Failures	Annual % Risk
A-1 Levee Association	Low	4	10
CHAMMOIS LEEVE DISTRICT	Not Screened	Not Screened	Not Screened
CHAMMOIS LEEVE DISTRECT SEC 2	Not Screened	Not Screened	Not Screened
Chamois Levee District, Section 1	Low	4	20
Chamois Levee Districk, Section 2	Low	4	20

Source: USACE National Levee Database, <https://levees.sec.usace.army.mil/>

A-1 Levee Association levee was overtopped in 1993, 1994, 2013 and 2019. In 1993 and 1995 water flowing over the top of the levee eroded the slope and lead to a breach of the levee. In 2013 and 2019 the levee overtopped without breaching. The 2014 USACE screening level risk assessment estimated the likelihood of a flood overtopping this levee in any given year at approximately 10%, or a one chance in 10. Although the screening found overtopping to be the highest risk driver, it also noted that the condition of drainage pipes in the levee is unknown because they have not been video inspected.

Chamois Levee District, Section 1 levee overtopped but did not breach in 1993, 1995, 2013, and 2019. The 2014 USACE screening level risk assessment estimated the likelihood of a flood overtopping this levee in any given year at approximately 20%, or a 1 chance in 5. Although the screening found overtopping to be the highest risk driver, it also noted that the condition of drainage pipes in the levee is unknown because they have not been video inspected.

Chamois Levee District, Section 2 levee was overtopped in 1993. In 1993 water flowing over the top of the levee eroded the slope and lead to a breach of the levee. In 1995, 2013, and 2019 the levee overtopped without it leading to a breach. The 2014 USACE screening level risk assessment estimated the likelihood of a flood overtopping this levee in any given year at approximately 20%, or a 1 chance in 5. Although the screening found overtopping to be the highest risk driver, it also

noted that the condition of drainage pipes in the levee is unknown because they have not been video inspected.

Probability of Future Occurrence

According to the available data, five levee failures occurred within the last 20 years. This information was utilized to determine the annual average percent probability of levee failure. The probability of levee failure in Osage County per year is 25% (5 event/20 years x 100 = 25%).

Table 3.61. Annual Average % Probability of Levee Failure in Osage County

Location	Annual Avg. % P
Osage County	25%

*P = probability; see page 3.24 for definition.

Changing Future Conditions Considerations

The impact of changing future conditions on levee failure will most likely be related to changes in precipitation and flood likelihood. Climate change projections suggest that precipitation may increase and occur in more extreme events, which may increase risk of flooding, putting stress on levees and increasing likelihood of levee failure. Furthermore, aging levee infrastructure and a lack of regular maintenance (including checking for seepage and removing trees, roots and other vegetation that can weaken a levee) coupled with more extreme weather events may increase risk of future levee failure.

Vulnerability

Vulnerability Overview

The USACE regularly inspects levees within its Levee Safety Program to monitor their overall condition, identify deficiencies, verify that maintenance is taking place, determine eligibility for federal rehabilitation assistance (in accordance with P.L. 4-99), and provide information about the levees on which the public relies. Inspection information also contributes to effective risk assessments and supports levee accreditation decisions for the National Flood Insurance Program administered by the Federal Emergency Management Agency (FEMA).

The USACE now conducts two types of levee inspections. Routine Inspection is a visual inspection to verify and rate levee system operation and maintenance. It is typically conducted each year for all levees in the USACE Levee safety Program. Periodic Inspection is a comprehensive inspection led by a professional engineer and conducted by a USACE multidisciplinary team that includes the levee sponsor. The USACE typically conducts this inspection every five years on the federally authorized levees in the USACE Levee Safety Program.

Both Routine and Periodic Inspections result in a rating for operation and maintenance. Each levee segment receives an overall segment inspection rating of Acceptable, Minimally Acceptable, or Unacceptable. **Figure 3.51** below defines the three ratings.

Figure 3.51. Definitions of the Three Levee System Ratings

Levee System Inspection Ratings	
Acceptable	All inspection items are rated as Acceptable.
Minimally Acceptable	One or more levee segment inspection items are rated as Minimally Acceptable or one or more items are rated as Unacceptable and an engineering determination concludes that the Unacceptable inspection items would not prevent the segment/system from performing as intended during the next flood event.
Unacceptable	One or more levee segment inspection items are rated as Unacceptable and would prevent the segment/system from performing as intended, or a serious deficiency noted in past inspections (previous Unacceptable items in a Minimally Acceptable overall rating) has not been corrected within the established timeframe, not to exceed two years.

None of the levees in the planning area are rated as unacceptable. However, two of the levees are under review and do not have reported data at this time.

Potential Losses to Existing Development

Areas most vulnerable to levee failure are identified in **Figure 3.50**. These areas are in close proximity to the city of Chamois. However, the protected leveed areas are classified as “agricultural” land. Therefore, special districts and assets should not be present. Nonetheless, multiple privately owned levees exist within the county. Unfortunately, these levees tend to be neglected until a failure occurs. **Table 3.62** depicts the risks to peoples and property of the four USACE levees in the County.

Table 3.62. USACE Risk Data for Levee Failure in Osage County

System Name/Sponsor	Risk Level	Population	Structures	Property Value	Agriculture Product Value
A-1 Levee Association	Low	30	60	\$2.6M	\$1.8M
CHAMOIIS LEEVEE DISTRICT	Not Screened	Not Screened	Not Screened	Not Screened	Not Screened
CHAMOIIS LEEVEE DISTRICT SEC 2	Not Screened	Not Screened	Not Screened	Not Screened	Not Screened
Chamois Levee District, Section 1	Low	0	0	\$7.25K	\$55.0K
Chamois Levee District, Section 2	Low	0	0	\$2.85K	\$203K

Source: USACE National Levee Database, <https://levees.sec.usace.army.mil/>

Due to data limitations, potential losses to existing development could not be calculated for uninspected private levee systems. However, any development within leveed areas should anticipate losses during the event of failure.

The city of Chamois has portions of Highway 100, Dooling Creek Bridge, Union Pacific Railroad, and the City Hall Building that could be threatened by potential levee failure.

Impact of Previous and Future Development

Future development in leveed areas would increase the vulnerability for potential losses. Therefore,

development in these areas should be avoided.

Hazard Summary by Jurisdiction

Communities in close proximity to USACE leveed areas include Chamois. However, the leveed areas are considered agricultural. Privately owned levees are present; however, a maintained inventory does not exist.

Problem Statement

There are substantial data limitations for levees within Missouri. Five leveed areas within the county were identified by the USACE. However, none of them are certified to protect in the 1-percent annual flood event. Flooding is the most common hazard associated with levee failure and is area specific. During the event of levee failure, potential loss would be similar to that of flooding.

3.4.8 Severe Thunderstorms Including High Winds, Hail, and Lightning

Some Specific Sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.8, Page 3.280
https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- FEMA 320, Taking Shelter from the Storm, 3rd edition, http://www.weather.gov/media/bis/FEMA_SafeRoom.pdf
- Lightning Map, National Weather Service, <https://www.vaisala.com/sites/default/files/documents/WEA-MET-Annual-Lightning-Report-2020-B212260EN-A.pdf>
- Death and injury statistics from lightning strikes, National Weather Service.
- Wind Zones in the U.S. map, FEMA, https://www.fema.gov/pdf/library/ism2_s1.pdf;
- Annual Windstorm Probability (65+knots) map U.S. 1980-1994, NSSL, http://www.nssl.noaa.gov/users/brooks/public_html/bigwind.gif
- Hailstorm intensity scale, The Tornado and Storm Research Organization (TORRO), <https://www.torro.org.uk/research/hail/hscale>;
- NCEI data;
- USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/Information-Tools/Summary-of-Business/Cause-of-Loss>;
- National Severe Storms Laboratory – hail map, http://www.nssl.noaa.gov/users/brooks/public_html/bighail.gif
- Missouri Hazard Mitigation Viewer
<http://bit.ly/MoHazardMitigationPlanViewer2018> - Website
<http://drive.google.com/file/d/1bPkc0jgF9ofwQLnTL9N0u-oPFWi9hkst/view> - User Guide
 - Average annual high wind events by County
 - Average annual hail events by County
 - Average annual lightning events by County
 - Vulnerability to severe thunderstorm event by County
 - Annualized property loss for high wind events by County
 - Annualized property loss for lightning events by County
 - Annualized property loss ratio for high wind events by County
 - Annualized property loss ratio for hail events by County
 - Annualized property loss ratio for lightning events by County

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 (**Section 3.4.5**) and tornadoes (**Section 3.4.10**)

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 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.

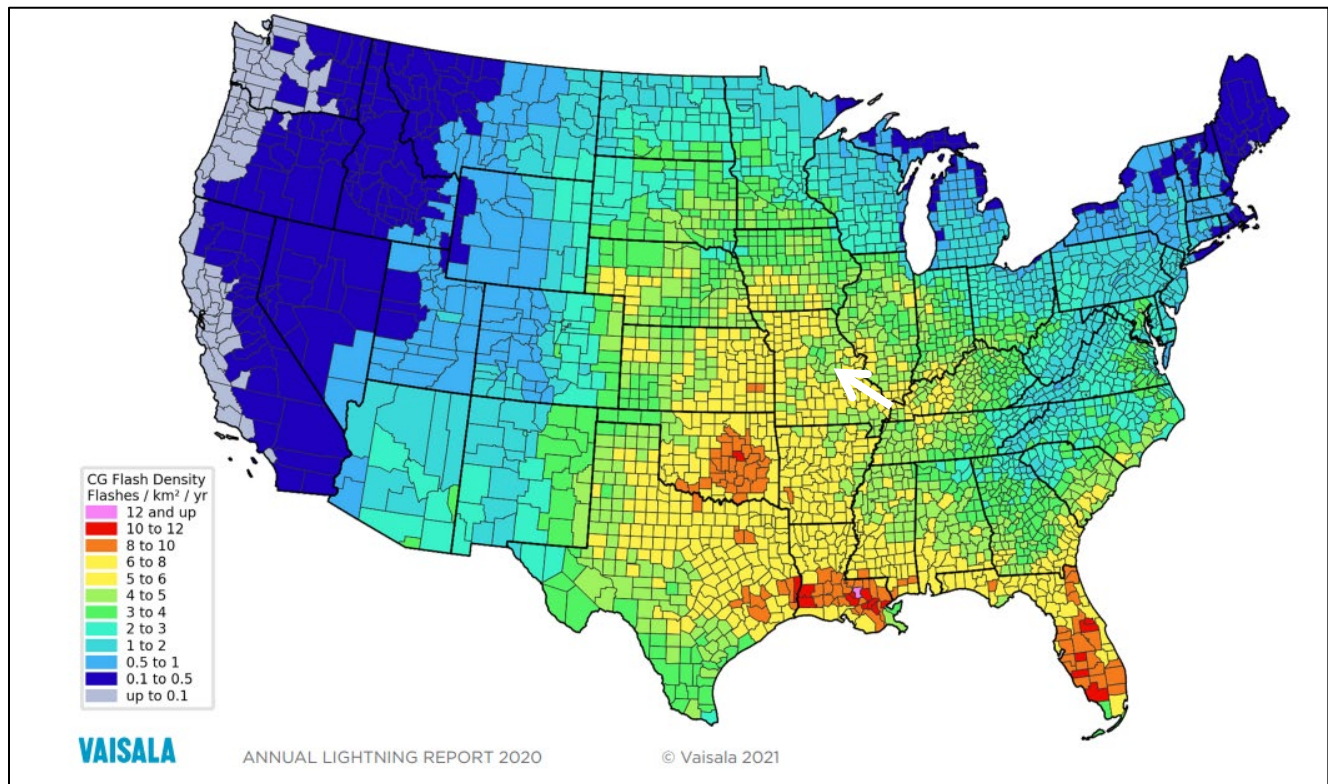
At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a ¼" diameter or pea sized hail requires updrafts of 24 miles per hour, while a 2 ¾" diameter or baseball sized hail requires an updraft of 81 miles per hour. According to the NOAA, the largest 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, and lightning events are an area-wide hazard that can take place anywhere across the United States. Furthermore, these events do not vary greatly across the planning area; they are more frequently reported in urbanized areas. Additionally, densely developed urban areas are more likely to experience damaging events.

Figure 3.52 depicts the location and frequency of lightning in Missouri. Additionally, the map indicates that the flash density of Osage County ranges between 12 and 20 flashes per square kilometer per year.

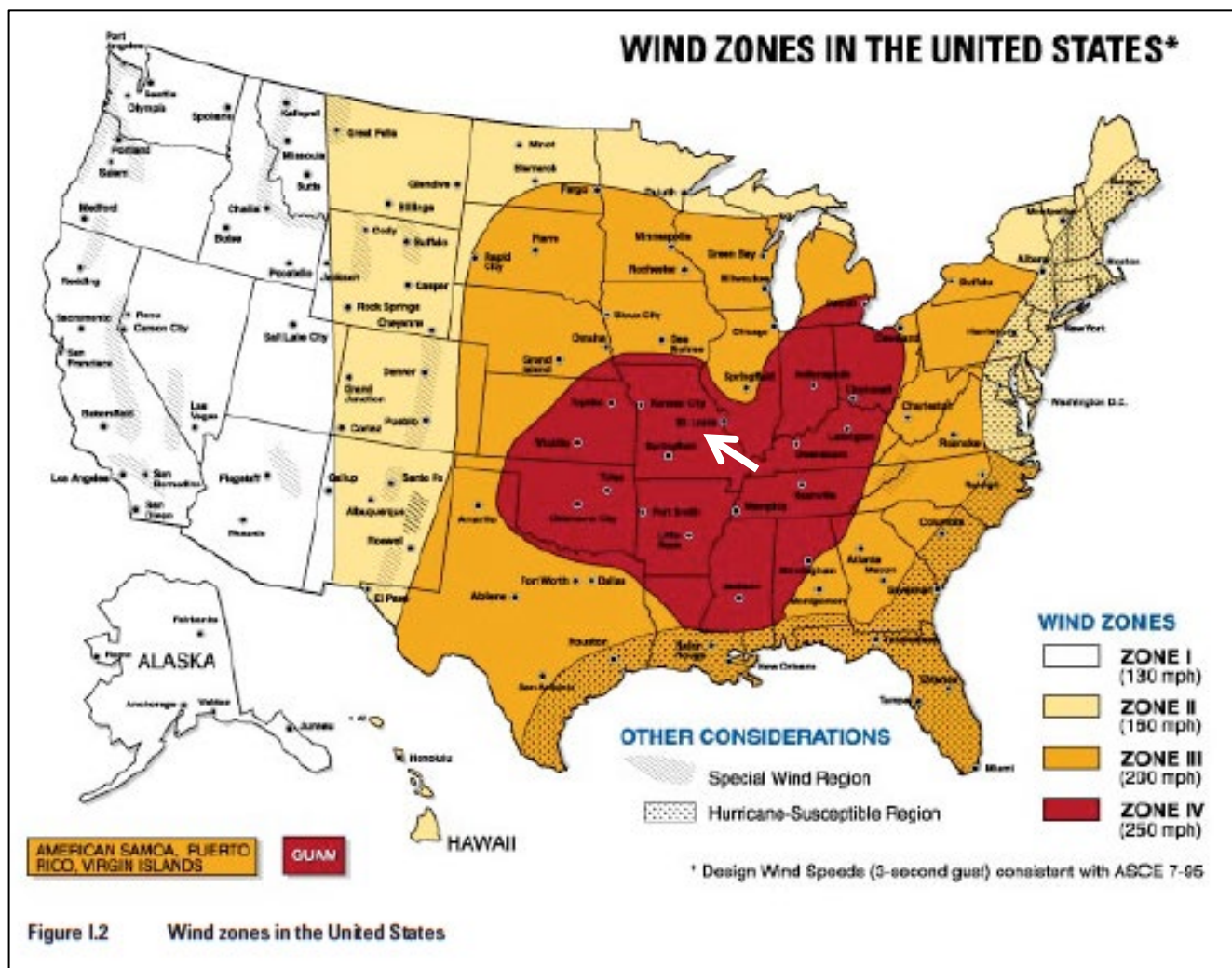
Figure 3.52. Location and Frequency of Lightning in Missouri



Source: National Weather Service, <https://www.vaisala.com/sites/default/files/documents/WEA-MET-Annual-Lightning-Report-2020-B212260EN-A.pdf> * Osage County is indicated by a white arrow.

There are four wind zones that are characterized across the United States. These zones range from Zone I to Zone IV. All of Missouri as well as most of the Midwest fall within Zone IV. Within Zone IV, winds can reach up to 250 mph (**Figure 3.53**).

Figure 3.53. Wind Zones in the United States



Source: FEMA 320, *Taking Shelter from the Storm*, 3rd edition, https://www.fema.gov/pdf/library/ism2_s1.pdf
 *Osage County is indicated by a white arrow.

Strength/Magnitude/Extent

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.

Based on information provided by the Tornado and Storm Research Organization (TORRO), **Table 3.63** below describes typical damage impacts of the various sizes of hail.

Table 3.63. Tornado and Storm Research Organization Hailstorm Intensity Scale

Intensity Category	Diameter (mm)	DiameterSize (inches)	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, 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. <https://www.torro.org.uk/research/hail/hscale>

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.

Between 2001 and 2020, there were 359 recorded crop insurance claims for Thunderstorms, lightning,

high wind, and hail in Osage County.

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

Due to the lack of available parameters, heavy rain is utilized in the place of thunderstorms in **Table 3.64** for events between 2001 and 2020. Moreover, thunderstorm wind and strong wind was included with high winds in **Table 3.65**. NCEI data was obtained for lightning, and hail events between 2001 and 2020 as well (**Table 3.66** and **Table 3.67**). However, 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 3.64. NCEI Osage County Heavy Rain Events Summary, 2001 to 2020

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Max Rainfall (Inch)
2005	1	0	0	0	6
2008	1	0	0	0	4
TOTAL	2	0	0	0	-

Source: NCEI, data accessed [09/17//2021]

Table 3.65. NCEI Osage County Wind Events Summary, 2001 to 2020 (Thunderstorm)

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Max Estimated Gust (kts.)
2001	4	0	0	0	40
2002	1	0	0	0	43
2003	4	0	0	0	43
2005	3	0	0	0	55
2006	1	0	0	0	60
2007	1	0	0	0	52
2008	4	0	0	0	56
2009	1	0	0	1.00K	
2010	2	0	0	0	83
2011	3	0	0	18.00K	70
2012	2	0	0	0	56
2013	2	0	0	0	52
2014	4	0	0	0	56
2015	2	0	0	0	56
2016	2	0	0	0	70

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Max Estimated Gust (kts.)
2017	4	0	0	0	61
2018	2	0	0	0	56
2019	2	0	0	0	61
2020	1	0	0	0	52
Total	45	0	0	19.00K	-

Source: NCEI, data accessed [09/17/2021]

Table 3.66. NCEI Osage County Lightning Events Summary, 2001 to 2020

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damage
Total	0	0	0	0	0

Source: NCEI, data accessed [09/17/2021]

Table 3.67. NCEI Osage County Hail Events Summary, 2001 to 2020

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Max Hail Size (inch)
2001	3	0	0	0	1.50
2002	1	0	0	0	0.75
2003	5	0	0	0	2.75
2004	5	0	0	0	3.00
2005	9	0	0	0	1.75
2006	12	0	0	0	1.75
2008	4	0	0	0	1.00
2009	1	0	0	0	1.00
2011	9	0	0	0	2.50
2012	6	0	0	0	1.25
2013	4	0	0	0	1.75
2015	3	0	0	0	2.50
2016	1	0	0	0	2.00
2017	2	0	0	0	1.75
2018	1	0	0	0	0.75
2020	1	0	0	0	2.75
Total	67	0	0	0	-

Source: NCEI, data accessed [09/17/2021]

Agriculture is an important piece of the economy for Osage County. The table below (**Table 3.68**) summarize past crop damages as indicated by crop insurance claims. The tables illustrate the magnitude of the impact on the planning area's agricultural economy. It should be noted that the USDA Risk Management Agency data does not align directly with the breakdown of hazards listed

here. The claims database only listed “Excessive Moisture/Precipitation/ Rain”, “Hail” and “Wind/Excessive Wind” as three causes of loss categories that align with this hazard. Between 2001 and 2020 a total of 359 insurance claims were paid out for damages due to excessive moisture/precipitation/rain, hail, and wind/excessive wind. The total claims paid for this cause were \$4,491,642.46.

Table 3.68. Crop Insurance Claims Paid In Osage County from Excessive Moisture Precipitation/Rain, Hail, and Wind/Excessive Wind 2001-2020

Crop Year	Crop Name	Cause of Loss Description	Insurance Paid
2001	Corn	Excessive Moisture/Precipitation/Rain	\$7,178.00
	Soybeans		\$1,919.50
	Grain Sorghum		\$882.00
2002	Corn	Excessive Moisture/Precipitation/Rain	\$7,180.00
	Soybeans		\$1,605.00
	Grain Sorghum		\$979.00
	Wheat		\$258.00
2003	Corn	Excessive Moisture/Precipitation/Rain	\$281.00
	Soybeans		\$200.00
2004	Corn	Excessive Moisture/Precipitation/Rain	\$641.00
	Soybeans		\$463.00
2005	Corn	Excessive Moisture/Precipitation/Rain	\$646.00
	Corn	Wind/Excess Wind	\$9770.00
	Wheat	Excessive Moisture/Precipitation/Rain	\$480.00
2006	Soybeans	Excessive Moisture/Precipitation/Rain	\$872.00
2007	Corn	Excessive Moisture/Precipitation/Rain	\$3918.00
	Corn	Wind/Excess Wind	\$3232.00
	Soybeans	Excessive Moisture/Precipitation/Rain	\$56.00
2008	Corn	Excessive Moisture/Precipitation/Rain	\$193,883.00
	Soybeans	Excessive Moisture/Precipitation/Rain	\$101,952.00
	Soybeans	Wind/Excess Wind	\$61.00
	Grain Sorghum	Excessive Moisture/Precipitation/Rain	\$23,226.00
2009	Corn	Excessive Moisture/Precipitation/Rain	\$47,217.00
	Soybeans		\$23,153.00
	Grain Sorghum		\$6,297.00
	Wheat		\$76.00
2010	Corn	Excessive Moisture/Precipitation/Rain	\$185,028.25
	Soybeans		\$53,513.62
	Grain Sorghum		\$5,929.00
2011	Corn	Excessive Moisture/Precipitation/Rain	\$159,194.90
	Soybeans		\$62,206.00
	Grain Sorghum		\$1,521.00
	Wheat		\$9,025.00
2012	Corn	Excessive Moisture/Precipitation/Rain	\$16,343.00
	Soybeans		\$2,933.00
2013	Corn	Excessive Moisture/Precipitation/Rain	\$817,514.60
	Soybeans		\$209,284.00
2014	Soybeans	Excessive Moisture/Precipitation/Rain	\$688.00

Crop Year	Crop Name	Cause of Loss Description	Insurance Paid
2015	Corn	Excessive Moisture/Precipitation/Rain	\$475,587.10
	Soybeans	Excessive Moisture/Precipitation/Rain	\$334,868.59
	Soybeans	Wind/Excess Wind	\$61.00
	Grain Sorghum	Excessive Moisture/Precipitation/Rain	\$59,787.00
	Wheat	Excessive Moisture/Precipitation/Rain	\$10,931.00
2016	Corn	Excessive Moisture/Precipitation/Rain	\$25,308.00
	Soybeans		\$17,713.00
	Grain Sorghum		\$13,085.00
	Wheat		\$247.00
2017	Corn	Excessive Moisture/Precipitation/Rain	\$130,458.00
	Soybeans		\$62,550.50
	Grain Sorghum		\$1,839.00
	Wheat		\$14,431.00
2018	Corn	Excessive Moisture/Precipitation/Rain	4,212.00
	Soybeans		\$31,817.80
	Grain Sorghum		\$10,086.00
2019	Corn	Excessive Moisture/Precipitation/Rain	\$731,305.40
	Soybeans	Excessive Moisture/Precipitation/Rain	\$417,114.70
	Grain Sorghum	Excessive Moisture/Precipitation/Rain	\$10,675.00
	Wheat	Excessive Moisture/Precipitation/Rain	\$31.00
2020	Corn	Excessive Moisture/Precipitation/Rain	\$100,287.00
	Soybeans		\$72,948.00
	Grain Sorghum		\$3,094.00
	Wheat		\$3,599.50
Total	359	-	\$4,491,642.46

Source: USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/Information-Tools/Summary-of-Business/Cause-of-Loss>

Probability of Future Occurrence

From the data obtained from the NCEI ⁴⁰, annual average percent probabilities were calculated for heavy rainfall, high winds, lightning, and hail. Heavy rainfall has a 10.0 percent annual average percent probability of occurrence (2 events/20 years x 100) (**Table 3.69**). Heavy rainfall events can be found in **Table 3.64**.

The annual average percent probability for high winds within the county is 100 percent (45 events/20 years x 100) with an average of 2.25 events per year (**Table 3.70**). High wind events can be found in **Table 3.65**.

Lightning events has a 0 percent annual average percent probability (0 events/20 years x 100). Lightning events can be found in **Table 3.66**. Lastly, the annual average percent probability of hail occurrence is 100% (67 events/20 years) with an average of 3.35 events per year (**Table 3.72**). Hail events can be found in **Table 3.67**.

⁴⁰ <http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=29%2CMISSOURI>

Table 3.69. Annual Average % Probability of Heavy Rain in Osage County

Location	Annual Avg. % P
Osage County	10.0%

*P = probability; see page 3.24 for definition.

Table 3.70. Annual Average % Probability of High Winds in Osage County

Location	Annual Avg. % P	Avg. # of Events
Osage County	100%	2.25

*P = probability; see page 3.24 for definition.

Table 3.71. Annual Average % Probability of Lightning in Osage County

Location	Annual Avg. % P
Osage County	0%

*P = probability; see page 3.24 for definition.

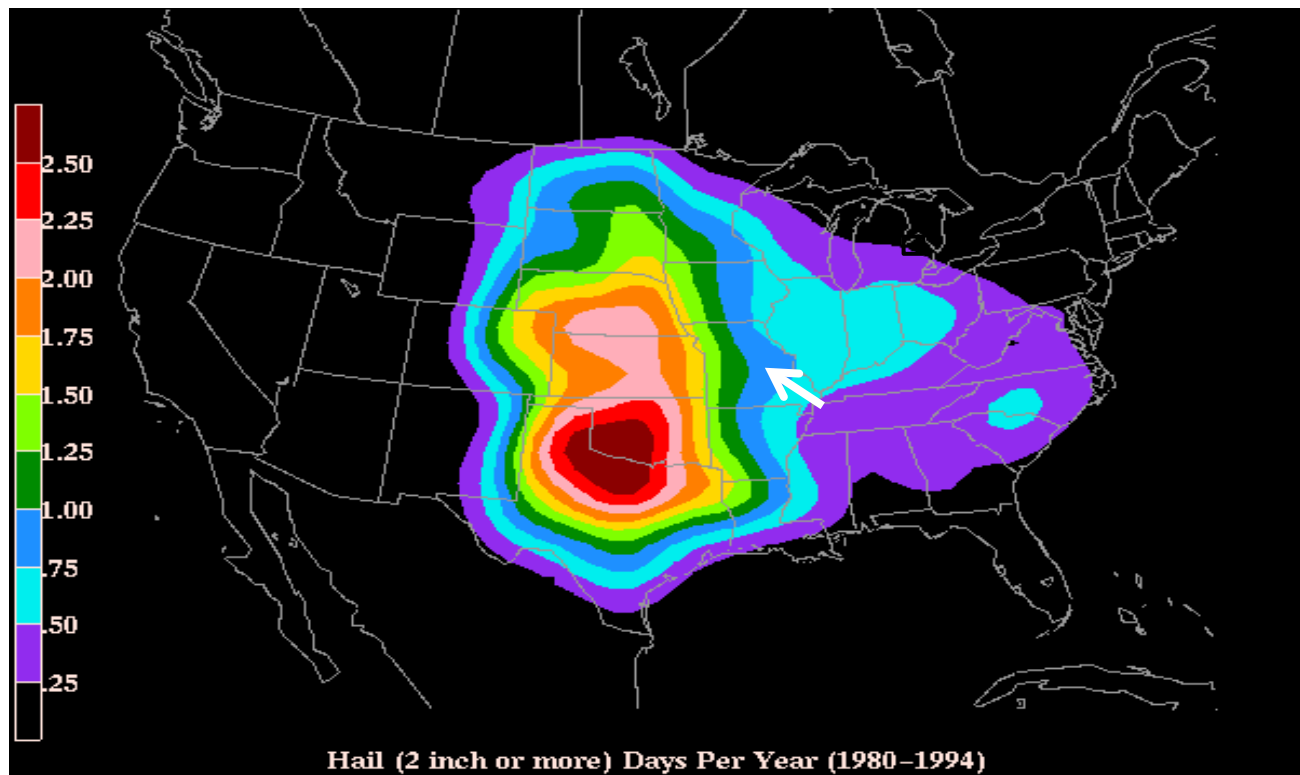
Table 3.72. Annual Average % Probability of Hail in Osage County

Location	Annual Avg. % P	Avg. # of Events
Osage County	100%	3.35

*P = probability; see page 3.24 for definition.

Figure 3.54 depicts a map based on hailstorm data from 1980-1994. It shows the probability of hailstorm occurrence (2" diameter or larger) based on number of days per year. The location of Osage County is identified with a white arrow.

Figure 3.54. Annual Hailstorm Probability (2" diameter or larger), 1980 - 1994



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

* White arrow indicates Osage County

Changing Future Conditions Considerations

Analysis by NASA's Earth Observatory theorizes that the warming surface of the earth, particularly the oceans, puts more moisture into the air through evaporation and could increase potential storm energy. The presence of warm, moist air near the surface is the key component for summer storms called "convective available potential energy" or CAPE. With an increase in CAPE, there is greater potential for cumulus clouds to form and develop into storm systems. The same study provides a counter theory that the warming of the Arctic could result in less wind shear in the mid-latitudes, making powerful storms less likely.⁴¹

Temperatures are predicted to rise, and those rising temperatures could help create atmospheric conditions that are conducive to the development of thunderstorms and tornados in Osage County. Jurisdictions should consider building certified tornado saferooms, improving warning systems, strengthening building codes, reinforcing utilities and other vulnerable infrastructure and increasing public information on storm safety and mitigation activities.⁴²

Vulnerability

Vulnerability Overview

⁴¹ 2018 Missouri State Hazard Mitigation Plan

⁴² 2018 Missouri State Hazard Mitigation Plan

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.⁴³

Data was obtained from the 2018 Missouri State Hazard Mitigation Plan for vulnerability overview and analysis. Since severe thunderstorms occur frequently throughout Missouri, the method used to determine vulnerability to severe thunderstorms was a statistical analysis of data from several sources including: National Centers for Environmental Information (NCEI) storm events data, HAZUS Building Exposure Value data, housing density and mobile home data from the U.S. Census (2015 ACS), and 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.⁴⁴

From the data collected, six factors were considered in determining vulnerability to lightning as follows: housing density, building exposure, percentage of mobile homes, social vulnerability, likelihood of occurrence and average annual property loss. A rating value of one through five was assigned to each factor. Rating values are as follows:

- 1) Low
- 2) Low-medium
- 3) Medium
- 4) Medium-high
- 5) High

Table 3.73 illustrates the factors considered and ranges for the rating values assigned.

Once the ranges were determined and applied to all factors considered in the analysis for wind, hail and lightning, they were rated individually and factored together to determine an overall vulnerability rating for thunderstorms. **Table 3.74** provides the calculated ranges applied to determine overall vulnerability of Missouri counties to severe thunderstorms.

⁴³ <http://www.vaisala.com/en/products/thunderstormandlightningdetectionsystems/Pages/NLDN.aspx>

⁴⁴ 2018 Missouri Hazard Mitigation Plan

Table 3.73. Ranges for Severe Thunderstorm Vulnerability Factor Ratings

Factors Considered	Low (1)	Low Medium (2)	Medium (3)	Medium High (4)	High (5)
Common Factors					
Housing Density (# per sq. mile)	4.11-44.23	44.24-134.91	134.92-259.98	259.99-862.69	862.70-2836.23
Building Exposure (\$)	\$269,532-\$3,224,641	\$3,224,642-\$8,792,829	\$8,792,830-\$22,249,768	\$22,249,769-\$46,880,213	\$46,880,214-\$138,887,850
Percent Mobile Homes	0.2-4.5%	4.6-8.8%	8.9-14%	14.1-21.2%	21.3-33.2%
Social Vulnerability	1	2	3	4	5
Wind					
Likelihood of Occurrence (# of events/ yrs. of data)	0.90 - 2.90	2.91 - 4.57	4.58 - 7.00	7.01 - 12.05	12.06 - 20.86
Average Annual Property Loss (annual property loss/ yrs of data)	\$0.00 – \$81,047.62	\$81,047.63 – \$200,428.57	\$200,428.58 – \$363,500.00	\$363,500.01 – \$837,242.86	\$837,242.87 – \$2,481,809.52
Hail					
Likelihood of Occurrence (# of events/ yrs. of data)	1.19 - 2.76	2.77 - 4.86	4.87 - 7.81	7.82 - 12.38	12.39 - 18.10
Average Annual Property Loss (annual property loss/ yrs. of data)	\$0.00 - \$41,547.62	\$41,547.63 – \$171,980.95	\$171,980.96 – \$467,857.14	\$467,857.15 – \$9,714,523.81	\$9,714,523.82 – \$40,594,285.71
Lightning					
Likelihood of Occurrence (# of events/ yrs. of data)	0-.05	.06-0.14	0.15-0.29	0.30-0.43	0.44-0.67
Average Annual Property Loss (annual property loss/ yrs. Of data)	\$0-\$476.19	\$476.20-\$1,904.76	\$1,904.77-\$7,476.19	\$7,476.20-\$13,142.86	\$13,142.87-\$57,000

Source: 2018 Missouri Hazard Mitigation Plan

Table 3.74. Ranges for Severe Thunderstorm Combined Vulnerability Rating

	Low (1)	Low Medium (2)	Medium (3)	Medium High(4)	High (5)
Severe Thunderstorm Combined Vulnerability	12-16	17-19	20-23	24-29	30-36

Source: 2018 Missouri Hazard Mitigation Plan

According to the Hazus data included in the 2018 state plan, Osage County has total building exposure to severe thunderstorms of \$1,611,790,000. **Table 3.75** shows housing density, building exposure, SOVI and mobile home data for Osage County. The county's building exposure and housing density rating is low, while the percent of mobile homes in the county is rated as low-medium at 8.8 percent of the housing stock. **Table 3.76**, also pulled from the state plan, provides data on the number of events and likelihood of occurrence and occurrence rating for high wind, hail and lightning.

Table 3.75. Osage County Housing Density, Building Exposure, SOVI and Mobile Home Data

Total Building Exposure (Hazus)	Building Exposure Rating	Housing Density	Housing Density Rating	SOVI Ranking	SOVI Ranking Rating	Percent Mobile Homes	Percent Mobile Homes Rating
\$1,611,790,000	1	10.85	1	Low	1	8.8	2

Source: 2018 Missouri Hazard Mitigation Plan

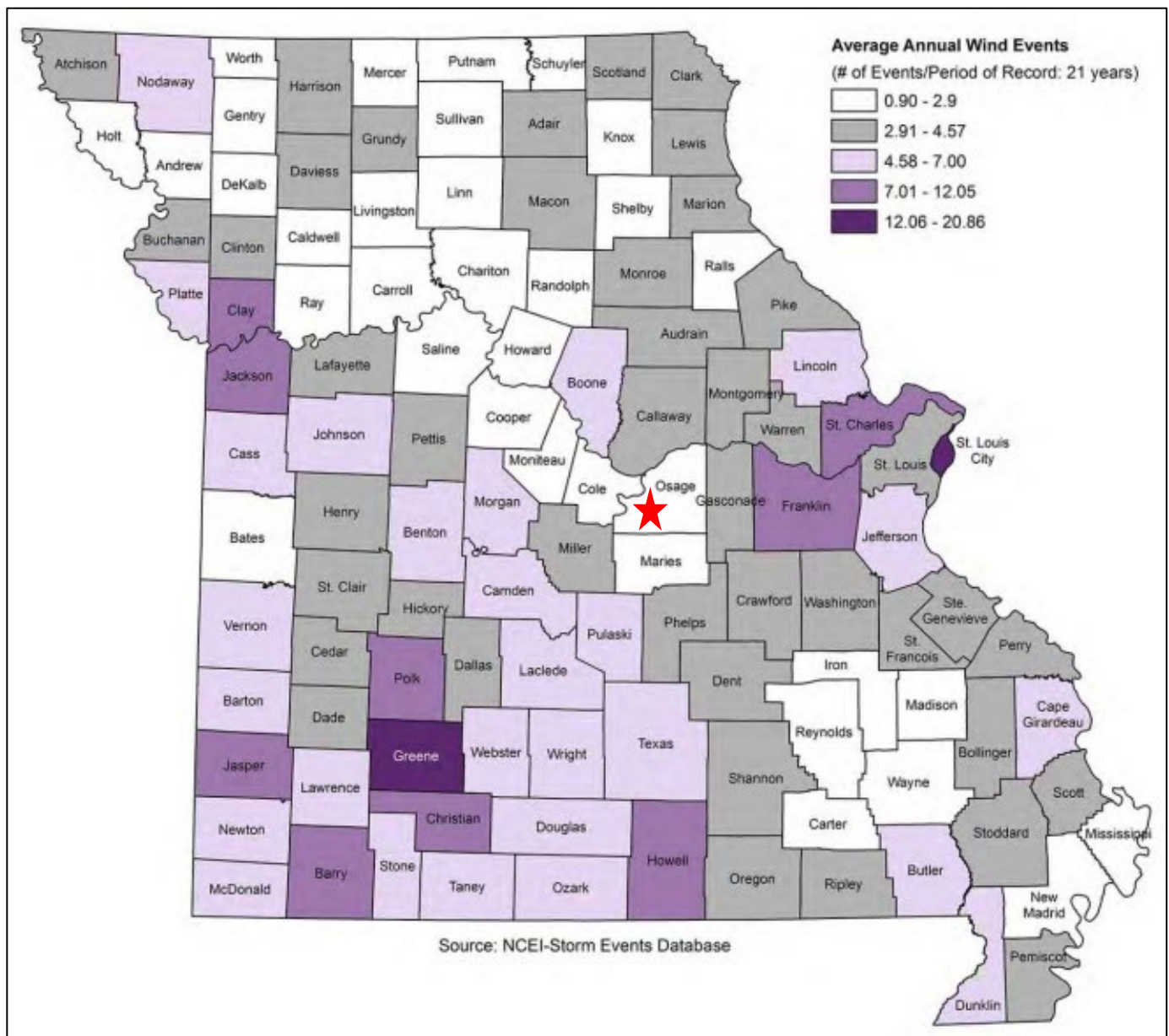
Table 3.76. Number of High Wind, Hail and Lightning Events, Likelihood of Occurrence and Associated Ratings for Osage County

High Wind			Hail			Lightning		
Total Number of Events	Likelihood of Occurrence	Likelihood of Occurrence Rating	Total Number of Events	Likelihood of Occurrence	Likelihood of Occurrence Rating	Total Number of Events	Likelihood of Occurrence	Likelihood of Occurrence Rating
44	2.095	1	72	3.429	2	0	0.000	1

Source: 2018 Missouri Hazard Mitigation Plan

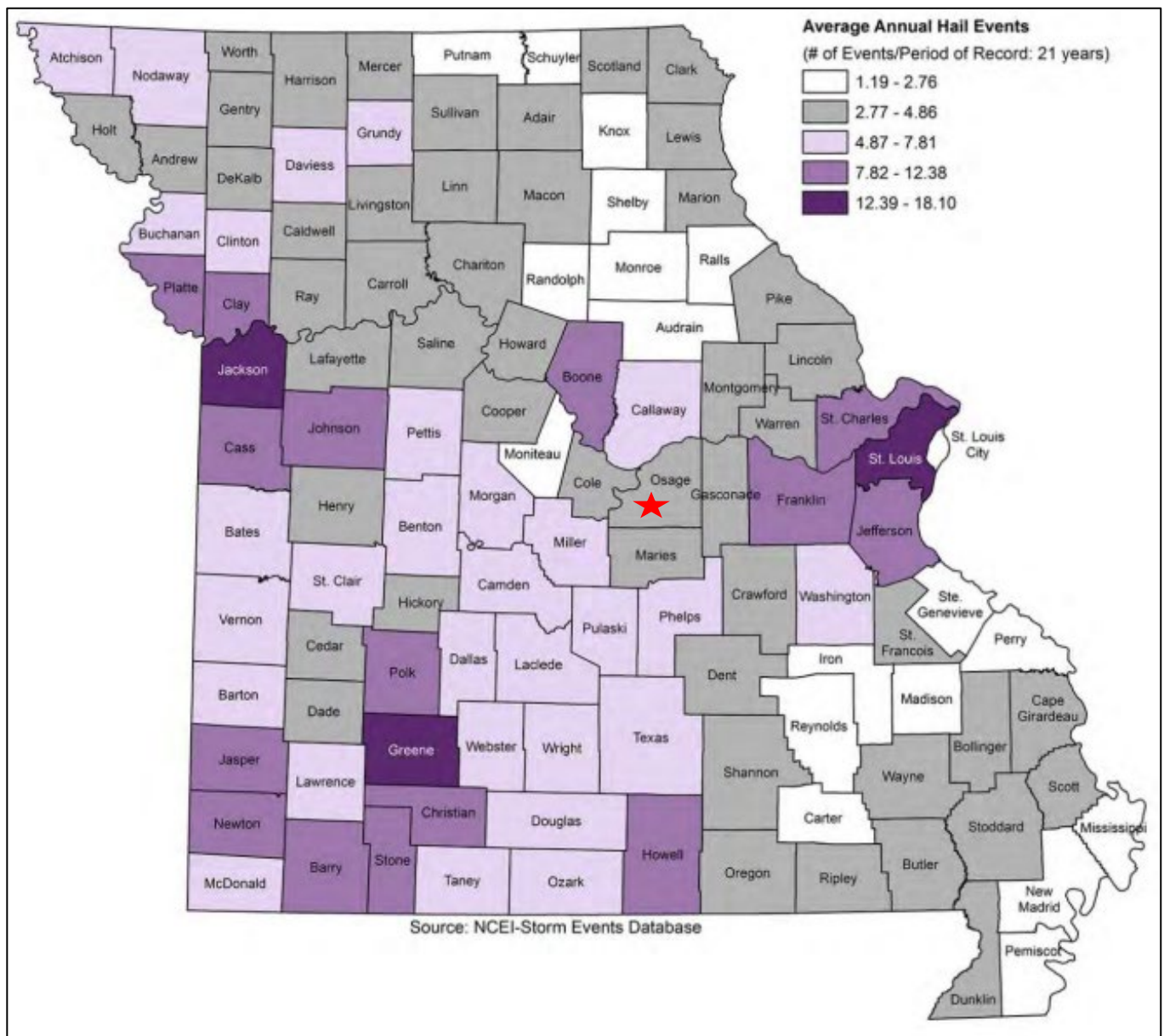
Figure 3.55 through **Figure 3.57** have been pulled from the 2018 Missouri Hazard Mitigation Plan and further depict the average annual likelihood of occurrence of high winds, hail, and lightning events in Missouri.

Figure 3.55. Average Annual High Wind Events (40 MPH and Higher)



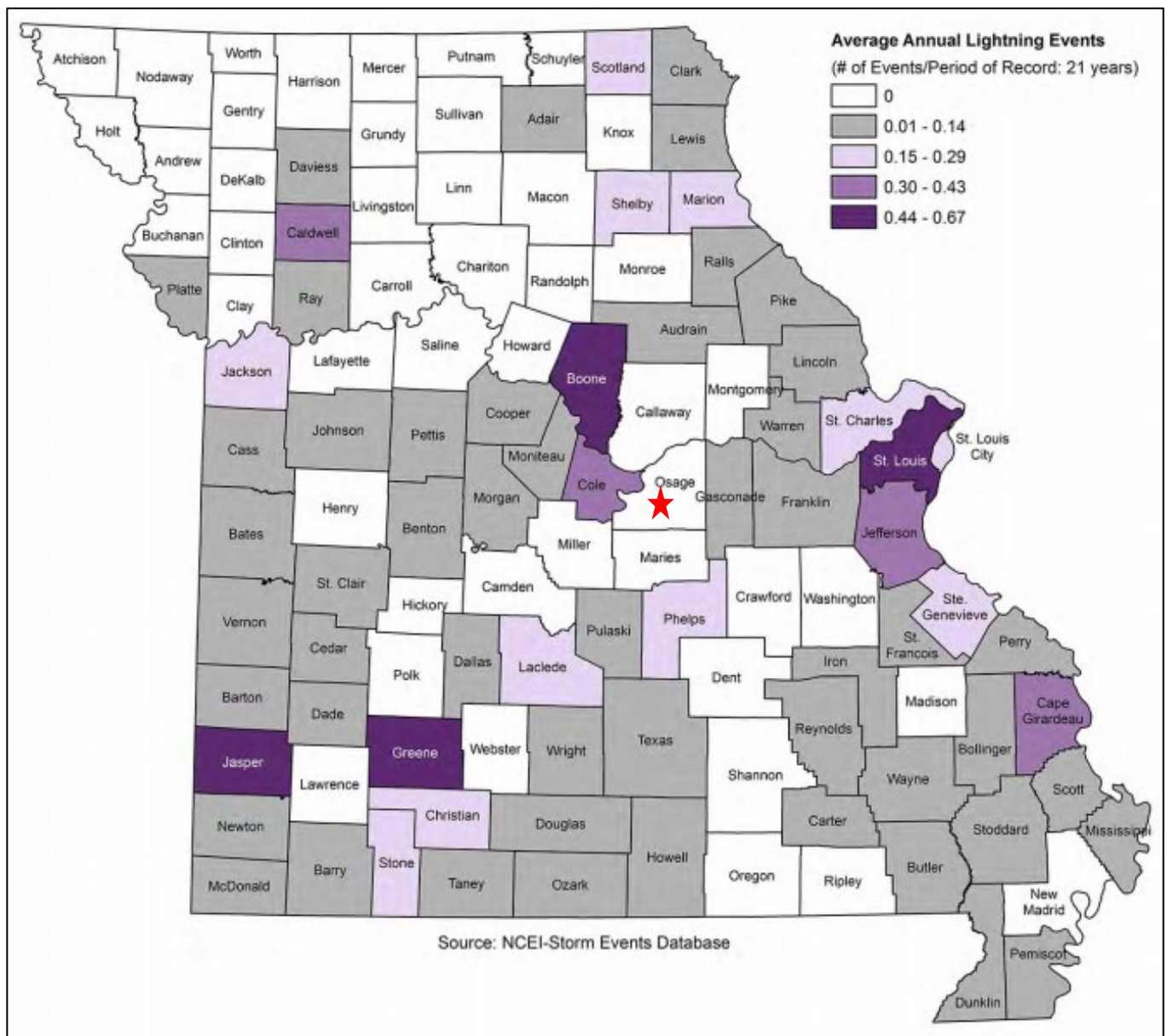
Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Figure 3.56. Average Annual Occurrence of Damaging Hail Events



Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Figure 3.57. Average Annual Occurrence of Lightning Events



Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Table 3.77 provides additional data obtained from the National Centers for Environmental Information for property loss to complete the overall vulnerability analysis.

Table 3.77. Annualized Property Loss and Associated Ratings for Osage County

High Wind		Hail		Lightning	
Total Annualized Property Loss	Total Annualized Property Loss Rating	Total Annualized Property Loss	Total Annualized Property Loss Rating	Total Annualized Property Loss	Total Annualized Property Loss Rating
\$857	1	\$0	1	\$0	1

Source: 2018 Missouri State Hazard Mitigation Plan

After ranges were applied to all factors in the analysis for wind, hail, and lightning, they were weighted equally and factored together to determine an overall vulnerability rating. Following, a combined vulnerability rating was calculated. The calculated ranges applied to determine overall vulnerability of Missouri counties to severe thunderstorms can be found in **Table 3.74**. **Table 3.78** provides the calculated vulnerability rating for the severe thunderstorm hazard. **Figure 3.58** that follows provides the mapped results of this analysis by county⁴⁵.

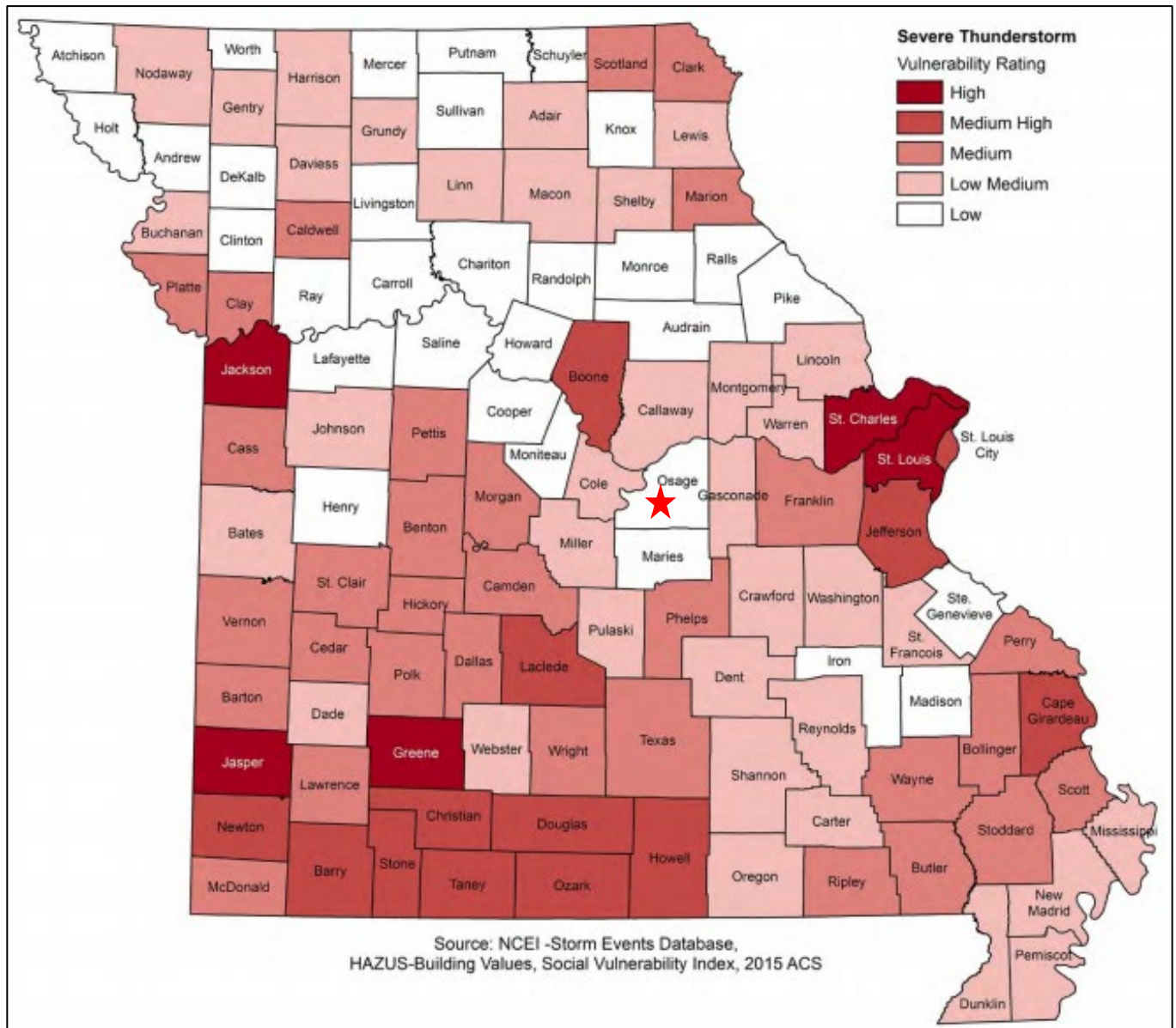
Table 3.78. Severe Thunderstorm Vulnerability Rating for Osage County

Total Sum of All Factor Ratings	Overall Vulnerability Rating for Thunderstorms	Overall Vulnerability Rating for Thunderstorms Description
12	1	Low

Source: 2018 Missouri State Hazard Mitigation Plan

⁴⁵ 2018 Missouri State Hazard Mitigation Plan

Figure 3.58. Vulnerability Summary for Severe Thunderstorms



Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Potential Losses to Existing Development

According to the NCEI Osage County experienced approximately \$19,000 in property damages from severe thunderstorms between 2001 and 2020. This is an average of \$950.00 in losses due to this hazard per year. Most of the property damage caused by storms is covered by private insurance and data is not available. In addition, most damage from severe thunderstorms occurs to vehicles, roofs, siding, and windows. However, there is a variety of impacts from severe thunderstorms. Moreover, secondary effects from hazards, falling trees and debris, can cause destruction within the planning area.

Previous and Future Development

Population trends from 2010 to 2020 for Osage County indicate that the population in unincorporated areas has fallen by an estimated 3.4 percent. The city of Chamois population has decreased by a significant 21.4 percent. The city of Argyle, however, has fallen by 11.1 percent. It is difficult to determine future impacts, however, anticipated development in each jurisdiction will result in increased exposure. Likewise, increased development of residential structures will increase jurisdiction's vulnerability to damages from severe thunderstorms/ high winds/lightning/hail.

Hazard Summary by Jurisdiction

Although thunderstorms/high winds/lightning/hail events are area-wide, there are demographics indicating higher losses in one jurisdiction as compared to another. Jurisdictions with high percentages of housing built before 1939 are more prone to damages from severe thunderstorms. The jurisdiction with the highest percent of houses built before 1939 is the Village of Argyle with 50.6 percent. Additionally, the city of Freeburg has a higher percentage of mobile home, which are more prone to damages.

Problem Statement

The NCEI Storm Events Database notes over 113 thunderstorm and wind events in Osage County since 2001, with over \$19,000.00 in property and crop damages reported. Early warnings are possibly the best hope for residents when severe weather strikes. Cities that do not already possess warning systems – whether that is storm sirens or automated email/text/phone call systems - should plan to invest in such a system. Additional public awareness also includes coverage by local media sources. Storm shelters are another important means of mitigating the effects of severe thunderstorms. A community-wide shelter program should be adopted for residents who may not have adequate shelter in their homes. Residents should also be encouraged to build their own storm shelters to prepare for emergencies. Local governments should encourage residents to purchase weather radios to ensure that everyone has sufficient access to information in times of severe weather.

3.4.9 Severe Winter Weather

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.9, Page 3.321
https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- Wind chill chart, National Weather Service, <http://www.nws.noaa.gov/om/winter/windchill.shtml>;
- Average Number of House per year with Freezing Rain, American Meteorological Society. "Freezing Rain Events in the United States." <http://ams.confex.com/ams/pdfpapers/71872.pdf>;
- USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/Information-Tools/Summary-of-Business/Cause-of-Loss/>;
- Any local Road Department data on the cost of winter storm response efforts.
- National Centers for Environmental Information, Storm Events Database, <http://www.ncdc.noaa.gov/stormevents/>
- Missouri Hazard Mitigation Viewer
<http://bit.ly/MoHazardMitigationPlanViewer2018> - Website
<https://drive.google.com/file/d/1bPkc0jgF9ofwQLnTL9N0u-oPFWi9hkst/view> - User Guide
 - o Average annual severe winter weather events by County
 - o Vulnerability to severe winter weather events by County
 - o Annualized property loss for severe winter weather events by County
 - o Annualized property loss for severe winter weather events by County

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.

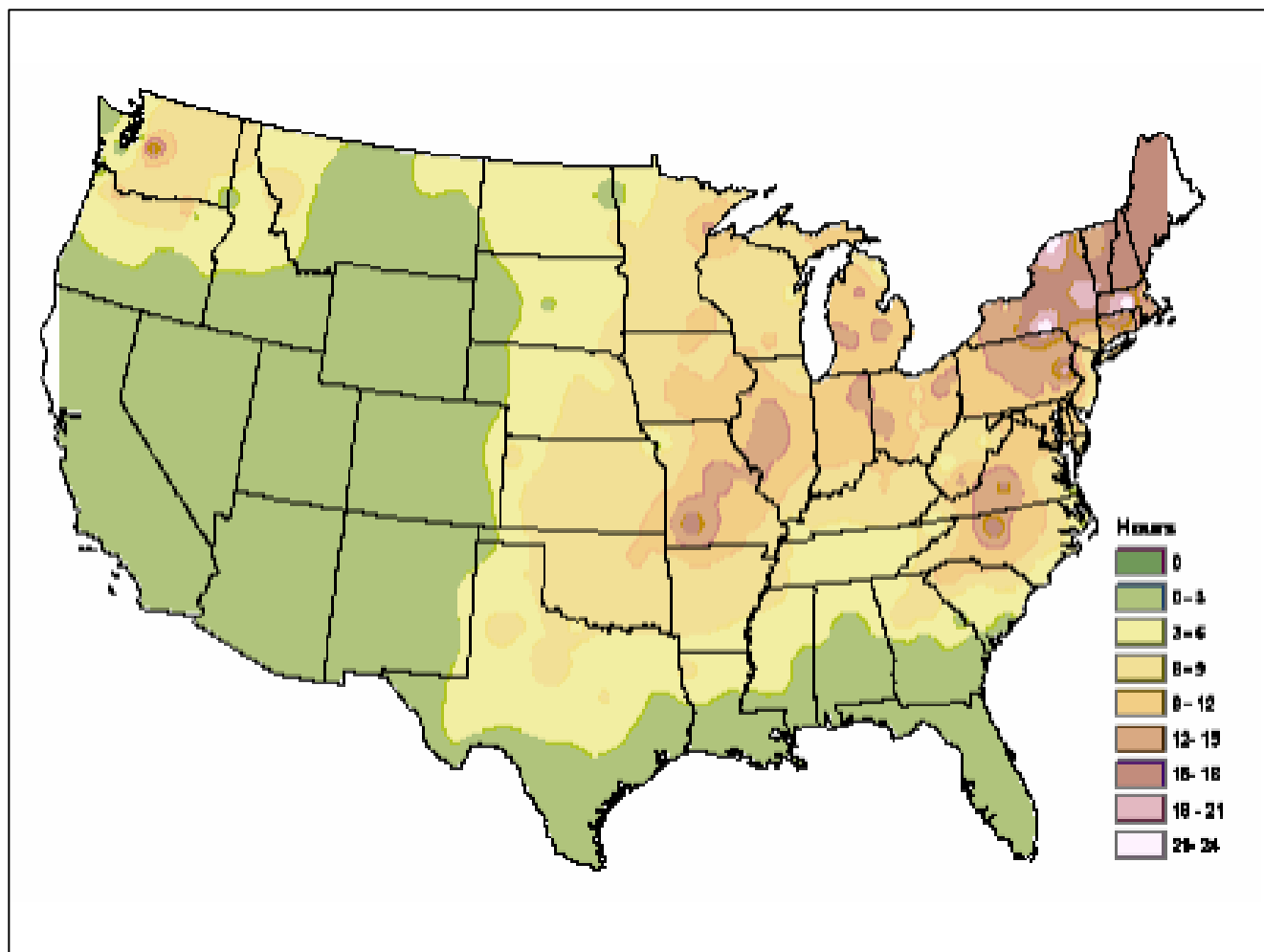
- **Blizzard**—Winds of 35 miles per hour or more with snow and blowing snow reducing visibility to less than ¼ mile for at least three hours.
- **Blowing Snow**—Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- **Snow Squalls**—Brief, 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

Severe winter weather typically strikes Missouri more than once every year. Osage County receives winter weather events from heavy snows to freezing rain annually. Major snowstorms typically occur once each year, causing multiple school closings, as well as suspending business and government

activity. Osage County is vulnerable to heavy snow, ice, extreme cold temperatures and freezing rain. **Figure 3.59** illustrates statewide average number of hours per year with freezing rain. Osage County receives approximately 9 to 12 hours.

Figure 3.59. 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 extreme cold, heavy snowfall, ice, and strong winds which can push the wind chill well below zero degrees in the planning area. 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.

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 most 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.

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.

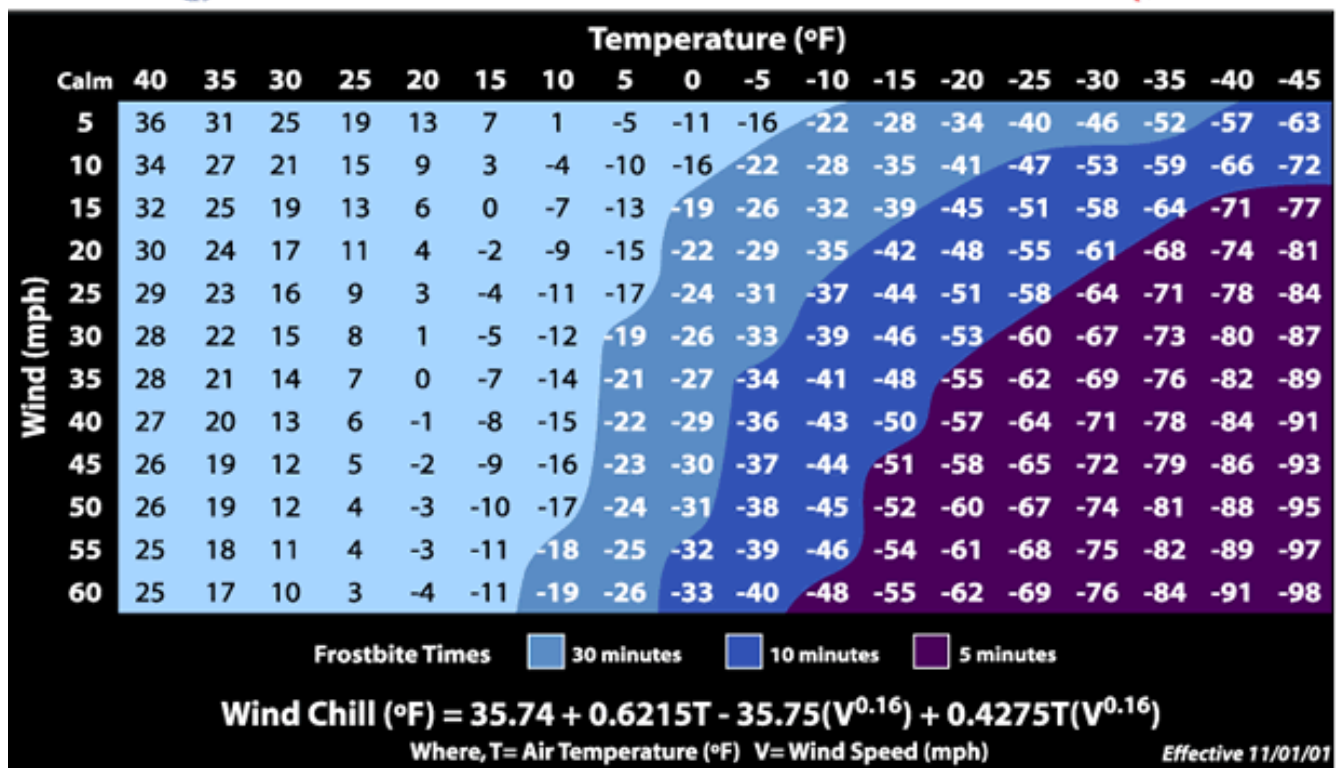
Overhead power lines and infrastructure are also vulnerable to damages from winter storms. In particular, ice accumulation during winter storms can damage power lines and equipment. Damages also occur to lines and equipment from falling trees and tree limbs weighted down by ice. Potential losses could 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.

Wind can greatly amplify the impact of cold ambient air temperatures. Provided by the National Weather Service, **Figure 3.60** below shows the relationship of wind speed to apparent temperature and typical time periods for the onset of frostbite.

Winter storms, cold, frost, and freeze all can influence or negatively impact crop production. However, data obtained from the USDA's Risk Management Agency for insured crop losses indicates that there were no claims paid in Osage County between 2001 and 2020 for severe winter weather.

Figure 3.60. Wind Chill Chart



Source: National Weather Service, <http://www.nws.noaa.gov/om/winter/windchill.shtml>

Previous Occurrences

Data was obtained from the NCEI for winter weather reported events and damages between 2001 and 2020 (Table 3.79). This data includes variables such as blizzard, cold/wind chill, extreme cold/wind chill, heavy snow, ice storm, sleet, winter storm, and winter weather. Additionally, narratives for specific events are listed below.

Table 3.79. NCEI Osage County Winter Weather Events Summary, 2001 - 2020

Type of Event	Inclusive Dates	# of Injuries	Property Damages	Crop Damages
Winter Storm	2/25/2002	0	0	0
Winter Storm	3/2/2002	0	0	0
Winter Storm	3/25/2002	0	0	0
Winter Storm	12/24/2002	0	0	0
Winter Storm	1/1/2003	0	0	0
Winter Storm	2/23/2003	0	0	0
Winter Storm	12/13/2003	0	0	0

Type of Event	Inclusive Dates	# of Injuries	Property Damages	Crop Damages
Winter Storm	1/25/2004	0	0	0
Winter Storm	11/24/2004	0	0	0
Winter Storm	12/8/2005	0	0	0
Winter Storm	11/29/2006	0	0	0
Winter Storm	12/1/2006	0	0	0
Ice Storm	1/12/2007	0	0	0
Ice Storm	12/8/2007	0	102.00K	0
Winter Weather	2/11/2008	0	0	0
Sleet	2/21/2008	0	0	0
Winter Weather	2/23/2008	0	0	0
Cold/wind Chill	1/1/2010	0	0	0
Winter Weather	1/6/2010	0	0	0
Heavy Snow	1/19/2011	0	0	0
Winter Storm	1/31/2011	0	0	0
Winter Storm	2/1/2011	0	0	0
Blizzard	2/1/2011	0	0	0
Winter Storm	2/21/2013	0	0	0
Heavy Snow	3/24/2013	0	0	0
Winter Storm	1/5/2014	0	0	0
Cold/wind Chill	1/6/2014	0	0	0
Winter Storm	3/1/2014	0	0	0
Heavy Snow	1/11/2019	0	0	0
Heavy Snow	2/5/2020	0	0	0
Total	30	0	102.00K	0

Source: NCEI, data accessed [09/20/2021]

Notable Winter Narratives:

1. **1/12/2007:** An arctic boundary settled south of the area on the 12th and 13th of January bringing subfreezing temperatures to the northwestern half of the county warning area. Three rounds of precipitation occurred during this period, with the first being the most destructive of all.

Significant tree and limb damage was reported as a result of this storm, together with widespread power outages. More than 100,000 homes and businesses lost power during this storm. About 1.5 inches of sleet fell and a 1/2 inch of ice accumulation hit parts of Central and Northeast Missouri. From 1/4 to 1/2 inch of ice accumulated from freezing rain across Eastern Missouri and parts of Southwest Illinois. Flooding of low-lying areas and low water crossings occurred across the eastern Ozarks late Friday night and Saturday morning.

Osage County has been included in six federal disaster declarations for ice storms since 2007.⁴⁶ Data obtained from the USDA's Risk Management Agency for insured crop losses indicates that there was one claims paid in Osage County for \$11,564.00 between 2001 and 2020 for severe winter weather.

Probability of Future Occurrence

From the data obtained from the NCEI ⁴⁷, annual average percent probabilities were calculated for winter weather within Osage County (**Table 3.80**). There were 30 recorded events (**Table 3.79**) over a 20-year period. There is 100 percent annual average probability of winter weather occurrence (30 events/20 years), with an average of 1.5 events per year.

Changing Future Conditions Considerations

There are both positive and negative indirect impacts from warming temperatures. Shorter winter seasons and fewer days of extreme cold may result in changes in the distribution of native plant and wildlife. The stress of climate change may cause some native species to become endangered or extinct if that species cannot adapt to changing conditions. There may also be an increase in pests and undesirable non-native species. Warmer winter conditions will result in a deduction of ice lake cover and warmer water temperatures – which can lead to harmful blooms of algae and bacteria. Increased temperatures could also mean increased rainfall in winter months that could increase the risk and severity of spring floods.⁴⁸

Table 3.80. Annual Average % Probability of Winter Weather in Osage County

Location	Annual Avg. % P	Avg. # of Events
Osage County	100%	1.5

*P = probability; see page 3.24 for definition.

Vulnerability

Vulnerability Overview

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

⁴⁶ <https://www.fema.gov/data-visualization-summary-disaster-declarations-and-grants>

⁴⁷ <http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=29%2CMISSOURI>

⁴⁸ 2018 Missouri State Hazard Mitigation Plan

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.

Data was obtained from the 2018 Missouri State Hazard Mitigation Plan for vulnerability information regarding Osage County. Various data sources were utilized for statistical analysis including the following:

- National Centers for Environmental Information (NCEI) storm event data (1999 to December 31, 2019)
- HAZUS Building Exposure Value data
- Housing density data from the U.S. Census (2015 ACS)
- 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

From the statistical data collected, five factors were considered in determining overall vulnerability to severe winter weather as follows: housing density, building exposure, social vulnerability, likelihood of occurrence and average annual property loss. A rating value of one through five was assigned to each factor:

- 1) Low
- 2) Low-medium
- 3) Medium
- 4) Medium-high
- 5) High

Table 3.81 provides the factors considered and the ranges for the rating values assigned. After the individual ratings were determined for the common factors, a combined vulnerability ratings were computed for severe winter weather. Those can be seen in **Table 3.82**. The housing density, building exposure and SOVI data for Osage County can be found in **Table 3.83**.

Table 3.81. Ranges for Severe Winter Weather Vulnerability Factor Ratings

Factors Considered	Low (1)	Low Medium (2)	Medium (3)	Medium High (4)	High (5)
Common Factors					
Housing Density (# per sq. mile)	4.11-44.23	44.24-134.91	134.92-259.98	259.99-862.69	862.70-2836.23
Building Exposure (\$)	\$269,532-\$3,224,641	\$3,224,642-\$8,792,829	\$8,792,830-\$22,249,768	\$22,249,769-\$46,880,213	\$46,880,214-\$138,887,850
Social Vulnerability	1	2	3	4	5
Likelihood of Occurrence (# of events/ yrs. of data)	1.05-1.43	1.44-1.76	1.77-2.10	2.11-2.67	2.68-4.57
Average Annual Property Loss (annual property loss/ yrs. Of data)	\$0-\$143,095.24	\$143,095.25-\$406,666.67	\$406,666.68-\$1,191,000.95	\$1,191,000.96-\$3,184,761.90	\$3,184,761.91-\$5,861,666.67

Source: 2018 Missouri Hazard Mitigation Plan

Table 3.82. Ranges for Severe Winter Weather Combined Vulnerability Rating

	Low (1)	Low-medium (2)	Medium (3)	Medium-high-4	High (5)
Severe Winter Weather Combined Vulnerability	7-8	8-10	10-12	12-15	15-22

Source: 2018 Missouri Hazard Mitigation Plan

Table 3.83. Housing Density, Building Exposure and SOVI Data for Osage County

Total Building Exposure (Hazus)	Building Exposure Rating	Housing Density	Housing Density Rating	SOVI Ranking	SOVI Rating
\$926,358,000	1	7.55	1	Medium	3

Source: 2018 Missouri Hazard Mitigation Plan

0 provides the last piece of the data gathered from NCEI 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. The likelihood of occurrence is 2 or 100 percent per year. The total annualized property loss is \$6,624, which provides a total annualized property loss rating of one and an overall vulnerability rating of nine – which translates to an overall Low-Medium vulnerability rating for the county for severe winter weather.

Table 3.84. Additional Statistical Data Compiled for Vulnerability Analysis for Osage County

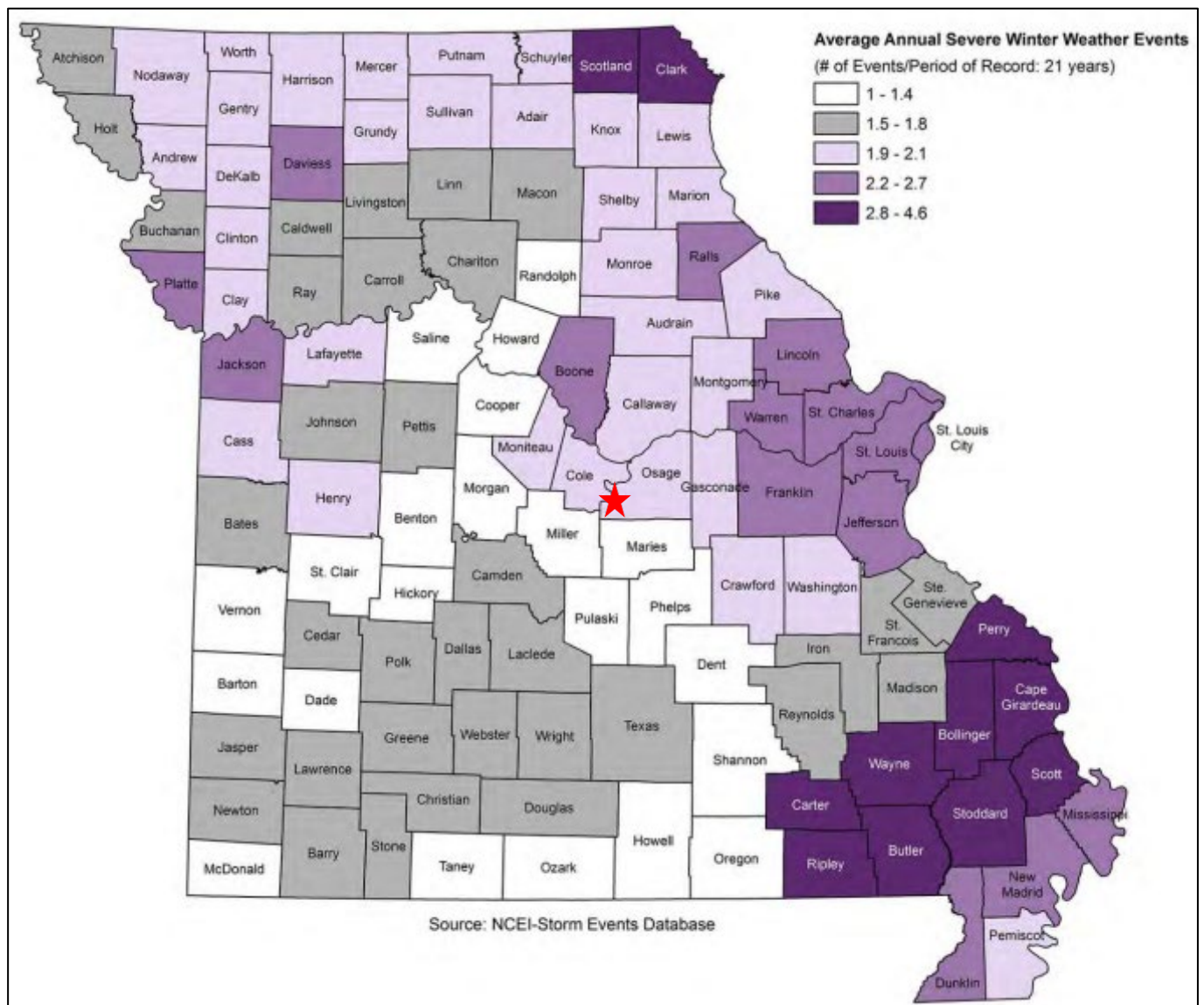
Total number of Winter Weather Events	Likelihood of Occurrence	Likelihood of Occurrence Rating	Total Annualized Property Loss	Total Annualized Property Loss Rating	Overall Vulnerability Rating	Overall Vulnerability Rating Description
40	1.9048	3	\$4,857	1	7	Low

Source: 2018 Missouri Hazard Mitigation Plan

Figure 3.61 illustrates the average annual occurrence of severe winter weather statewide. Osage County falls into the Low category of 1.9 to 2.1 events per year.

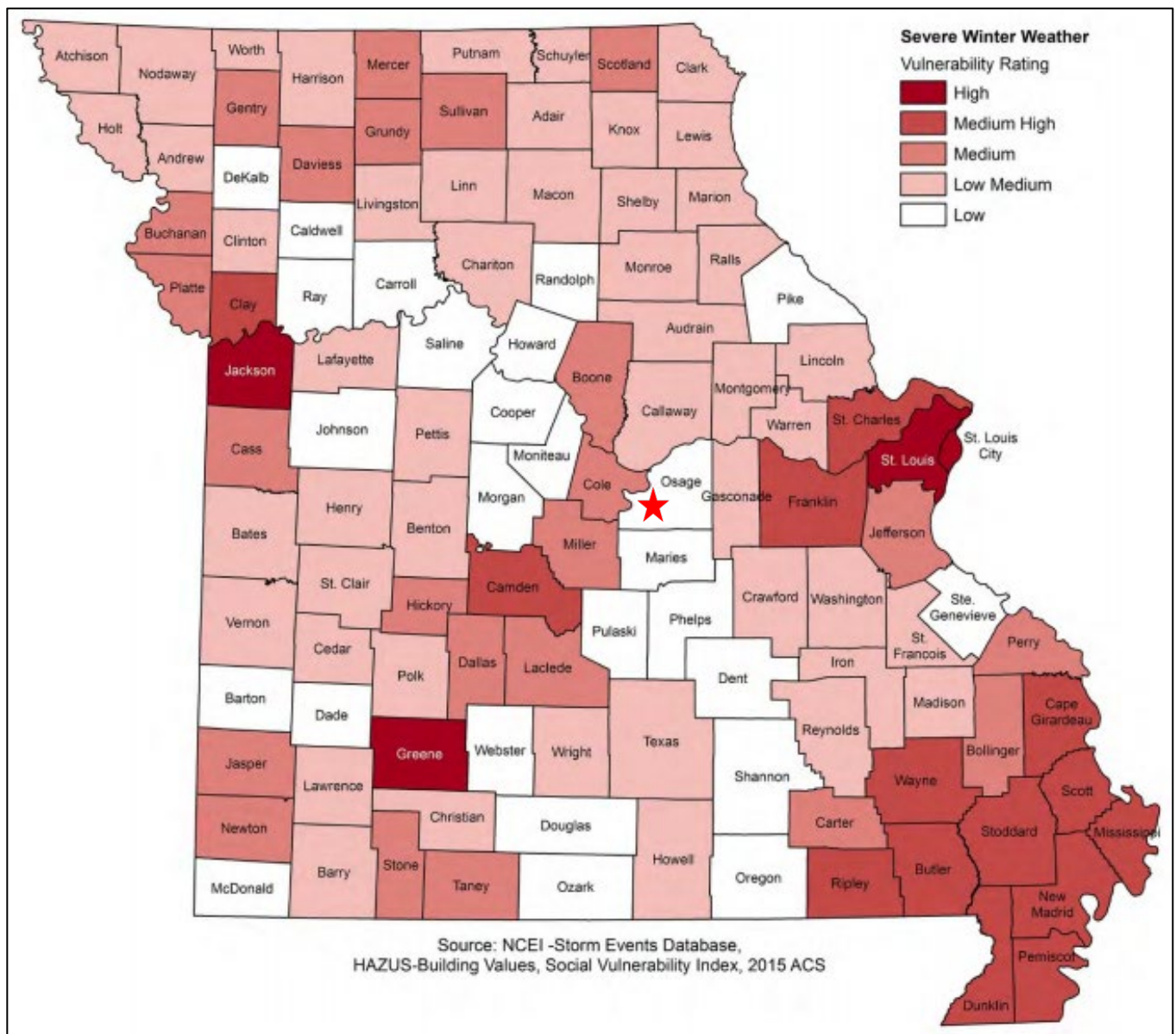
Figure 3.62 provides an illustration of the vulnerability summary of all Missouri counties for severe winter weather. Again, Osage County falls into the Low rating for overall vulnerability.

Figure 3.61. Average Annual Occurrence of Severe Winter Weather Events



Source: 2018 Missouri Hazard Mitigation Plan, *Red star indicates Osage County

Figure 3.62. Vulnerability Summary for Severe Winter Weather



Source: 2018 Missouri Hazard Mitigation Plan, *Red star indicates Osage County

Potential Losses to Existing Development

The next severe winter storm will most likely close schools and businesses for multiple days and make roadways hazardous for travel. Heavy ice accumulation may damage electrical infrastructures, causing prolonged power outages for large portions of the region. In addition, freezing temperatures make water lines vulnerable to freeze/thaw. Fallen tree limbs also pose a threat to various structures/infrastructures across the county. According to the 2018 state plan, Osage County can expect annual property losses of \$4,857 due to severe winter storms.

Impact of Previous and Future Development

Data for future development for the planning area is sparse. However, winter weather will affect the county as a whole. Any future development is at risk to damages and increased exposure. In addition, the county's population within the cities is anticipated to increase, which would increase the number of individuals at risk during a winter weather event.

Hazard Summary by Jurisdiction

Variations in impacts are not anticipated for severe winter weather across the planning area. Yet, areas with high number of mobile homes tend to experience increased damages. The city of Freeburg has the highest abundance of mobile homes, making the area more prone to increase exposure to damage. In addition, rural areas of the county may be more susceptible to power outages due to more power infrastructure being exposed to the risk of damage from winter storms.

Problem Statement

In summary, Osage County is expected to experience at least one severe winter weather event annually; however, the county has a low vulnerability rating. Jurisdictions should enhance their weather monitoring to be better prepared for severe weather hazards. If jurisdictions monitor winter weather, they can dispatch road crews to prepare for the hazard. County and city crews can also trim trees along power lines to minimize the potential for outages due to snow and ice. Citizens should also be educated about the benefits of being proactive to alleviate property damage as well preparing for power outages.

3.4.10 Tornado

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.10, Page 3.355
https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- NWS Enhanced F Scale for Tornado Damage including damage indicators and degrees of damage www.spc.noaa.gov/faq/tornado/ef-scale.html;
- Tornado Activity in the U.S. map (1950-2006), FEMA 320, Taking Shelter from the Storm, 3rd edition;
- Tornado Alley in the U.S. map, <http://tornadochaser.com/education/tornado-alley/>;
- National Centers for Environmental Information, <https://www.ncdc.noaa.gov/stormevents/>;
- Midwest Regional Climate Center, <https://mrcc.purdue.edu/gismaps/cntytnrn.htm>;
- Missouri Hazard Mitigation Viewer
<http://bit.ly/MoHazardMitigationPlanViewer2018> - Website
<https://drive.google.com/file/d/1bPkc0jgF9ofwQLnTL9N0u-oPFWi9hkst/view> - User Guide
 - Number of Tornadoes by County
 - Percentage of Mobile Homes in 2015 by County
 - Average annual tornado events by County
 - Vulnerability to tornado events by County
 - Annualized property loss for tornado events by County
 - Annualized property loss for tornado events by County

Hazard Profile

Hazard Description

The NWS defines a tornado as “a violently rotating column of air extending from a thunderstorm to the ground.” It is usually spawned by a thunderstorm and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. Often, vortices remain suspended in the atmosphere as funnel clouds. When the lower tip of a vortex touches the ground, it becomes a tornado.

High winds not associated with tornadoes are profiled separately in this document in **Section 08**, Severe Thunderstorms Including High Winds, Hail, and Lightning.

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.

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

In Missouri, tornadoes occur most frequently between April and June, with April and May usually producing the most tornadoes. However, tornadoes can arise at any time of the year. While tornadoes can happen at any time of the day or night, they are most likely to occur between 3 p.m. and 9 p.m. Furthermore, tornadoes can occur anywhere across the state of Missouri, including Osage 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 (**Table 3.85**) attempts 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 3.85. Enhanced F Scale for Tornado Damage

Fujita Scale			Derived EF Scale		Operational Scale	
F #	Fastest 1/4 - Mile (mph)	3 Second Gust (mph)	EF #	3 Second Gust (mph)	EF #	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 3.86**. 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.

Table 3.86. Enhanced Fujita Scale with Potential Damage

Enhanced Fujita Scale			
Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF0	65-85	53.5%	<u>Light</u> . Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e. those that remain in open fields) are always rated EF0).
EF1	86-110	31.6%	<u>Moderate</u> . Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	<u>Considerable</u> . 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%	<u>Severe</u> . 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 distance.
EF4	166-200	0.7%	<u>Devastating</u> . Well-constructed houses and whole frame houses completely levelled; cars thrown and small missiles generated.
EF5	>200	<0.1%	<u>Explosive</u> . 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 3.87 illustrates NCEI data reported for tornado events and damages from 2001 to 2020 in the planning area.

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 are in segments.

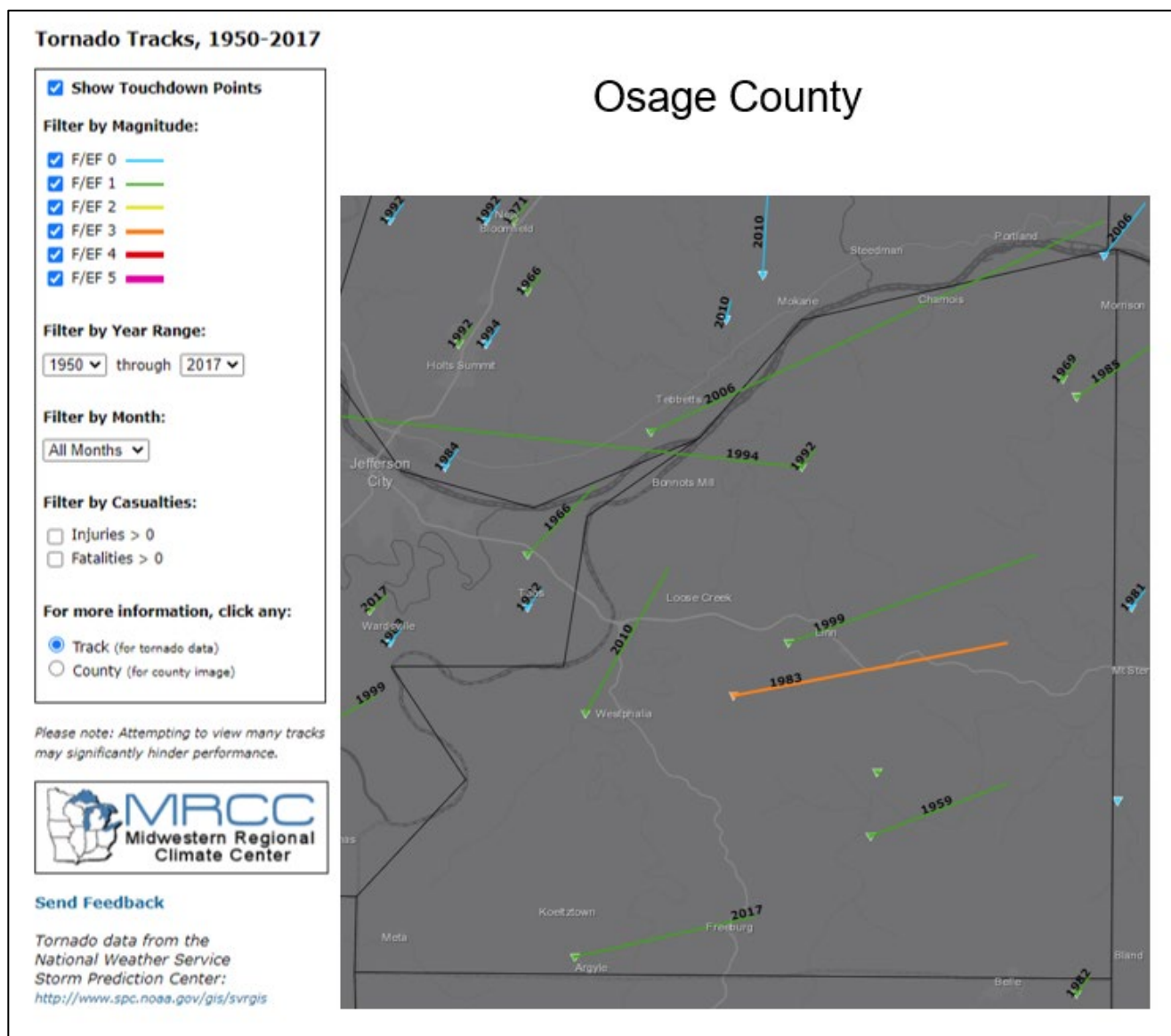
Table 3.87. Recorded Tornadoes in Osage County, 2001 – 2020

Date	Beginning Location	Ending Location	Length (miles)	Width (yards)	F/EF Rating	Death	Injury	Property Damage	Crop Damages
03/12/2006	5SW Chamois	6NE Chamois	8.5	150	F1	0	0	0	0
03/12/2006	7ENE Chamois	8ENE Chamois	.7	50	F0	0	0	0	0
03/10/2010	2WSW Westphalia	1WNW Loose Creek	6.61	60	EF1	0	0	0	0
02/27/2011	2WSW Judge	2WSW Judge	0.24	50	EF1	0	0	0	0
03/06/2017	0W Argyle	1ENE Freeburg	7.26	75	EF1	0	0	0	0
Total	5	-	23.31	385	-	0	0	0	0

Source: National Centers for Environmental Information, <http://www.ncdc.noaa.gov/stormevents/>

Figure 3.63 depicts historic tornado paths across Osage County.

Figure 3.63. Osage County Map of Historic Tornado Paths (1950 – 2017)



Source: Midwest Regional Climate Center, <https://mrcc.purdue.edu/gismaps/cntyorn.htm>

According to the USDA Risk Management Agency's record, there were no insurance payments in Osage County for crop damages as a result of tornadoes between 2001 and 2021.

Probability of Future Occurrence

From the data obtained from the NCEI⁴⁹, an annual average percent probability was calculated for tornadoes within Osage County (**Table 3.88**). There is a 25 percent annual average probability of a tornado occurrence (5 events/20 years x 100). Tornado events can be found in **Table 3.87**. In addition, **Figure 3.64**, obtained from the 2018 Missouri State Hazard Mitigation Plan, also illustrates tornado probabilities across the United States and further shows Osage County's average probability of 1 - 20 percent.

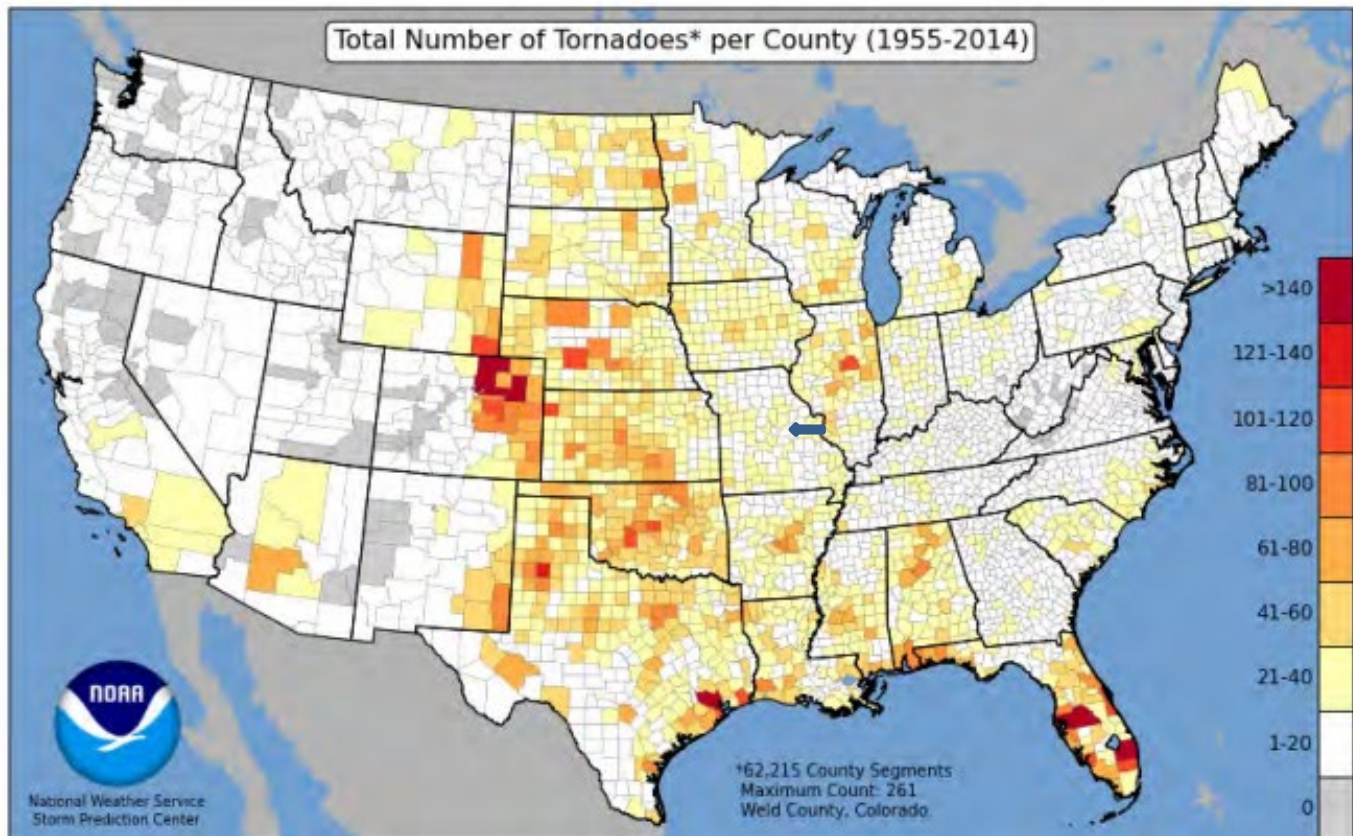
⁴⁹ <http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=29%2CMISSOURI>

Table 3.88. Annual Average % Probability of Tornadoes in Osage County

Location	Annual Avg. % P
Osage County	25%

*P = probability; see page 3.24 for definition.

Figure 3.64. Tornado Activity in the United States



Source: 2018 Missouri State Hazard Mitigation Plan, *Blue arrow indicates Osage County

Changing Future Conditions Considerations

There is still not enough data to know how the frequency and severity of tornadoes will change in a warming world. Research suggests that changes in heat and moisture content in the atmosphere could play a role in making tornado outbreaks more frequent and more severe in the U.S. The research concluded that the number of days with large tornado outbreaks have been increasing for the past 70 years and that densely concentrated tornado outbreaks are increasing as well.⁵⁰

⁵⁰ 2018 Missouri Hazard Mitigation Plan

Vulnerability

Vulnerability Overview

Many tornadoes are capable of great destruction and every tornado is a potential killer. Tornadoes can topple buildings, destroy mobile homes, uproot trees, hurl people and animals through the air for hundreds of yards and fill the air with lethal, windblown debris. Sticks, glass, roofing material and lawn furniture all become deadly missiles when driven by tornado winds.⁵¹ Osage County resides in a region of the United States that has a high frequency of dangerous and destructive tornadoes. This region seen in **Figure 3.65** is referred to as “Tornado Alley”.

The 2018 Missouri Hazard Mitigation Plan used statistical analysis of data from several sources to determine vulnerability to tornadoes across the state. 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). One limitation to the NCEI data is that many tornadoes that may have occurred in uninhabited areas and some in inhabited areas, may not have been reported. In addition, NOAA data cannot show a realistic frequency distribution of different Fujita scale tornado events, except for recent years. For these reasons 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.

⁵¹ 2018 Missouri Hazard Mitigation Plan

Figure 3.65. Tornado Alley in the U.S.



Source: <http://tornadochaser.net/>

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 one through five 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 3.89 provides the factors used and ranges for the rating values assigned. Once the ranges were established and applied to all factors, the ratings were combined to determine overall vulnerability. **Table 3.90** illustrates the ranges for tornado combined vulnerability rating.

Table 3.89. Ranges for Tornado Vulnerability Factor Ratings

Factors Considered	Low (1)	Low-medium (2)	Medium (3)	Medium-High (4)	High (5)
Common Factors					
Building Exposure (\$)	\$269,532-\$3,224,641	\$3,224,642-\$8,792,829	\$8,792,830-\$22,249,768	\$22,249,769-\$46,880,213	\$46,880,214-\$138,887,850
Population Density (#per sq. mile)	4.11-44.23	44.24-134.91	134.92-259.98	259.99-862.69	862.70-2,836.23
Social Vulnerability	1	2	3	4	5
Percent Mobile Homes	0.2-4.5%	4.51-8.8%	8.81-14%	14.01-21.2%	21.21-33.2%
Likelihood of Occurrence (# of events/ yrs. of data)	0.119 - 0.208	0.209 - 0.313	0.314 - 0.417	0.418 - 0.552	0.553 - 0.791
Total Annualized Property Loss (\$ / yrs. of data)	\$974 - \$281,874	\$281,875 - \$991,825	\$991,826 - \$2,099,000	\$2,099,001 - \$5,047,474	\$5,047,475 - \$42,467,109

Source: 2018 Missouri Hazard Mitigation Plan

Table 3.90. Ranges for Tornado Combined Vulnerability Rating

	Low (1)	Low-medium (2)	Medium (3)	Medium-High (4)	High (5)
Tornado Combined Vulnerability	7-10	11-12	13-14	15-16	17-21

Source: 2018 Missouri Hazard Mitigation Plan

Table 3.91 provides data on building exposure, population density, SOVI and mobile home data for Osage County that is used to determine overall vulnerability.

Table 3.91. Building Exposure, Population Density, SOVI and Mobile Home Data for Osage County

Total Building Exposure (Hazes)	Exposure Rating	Population Density	Population Rating	SOVI Ranking	SOVI Rating	Percent Mobile Homes	Mobile Home Rating
\$1,611,790,000	1	22.55	1	Low	1	8.8	2

Source: 2018 Missouri Hazard Mitigation Plan

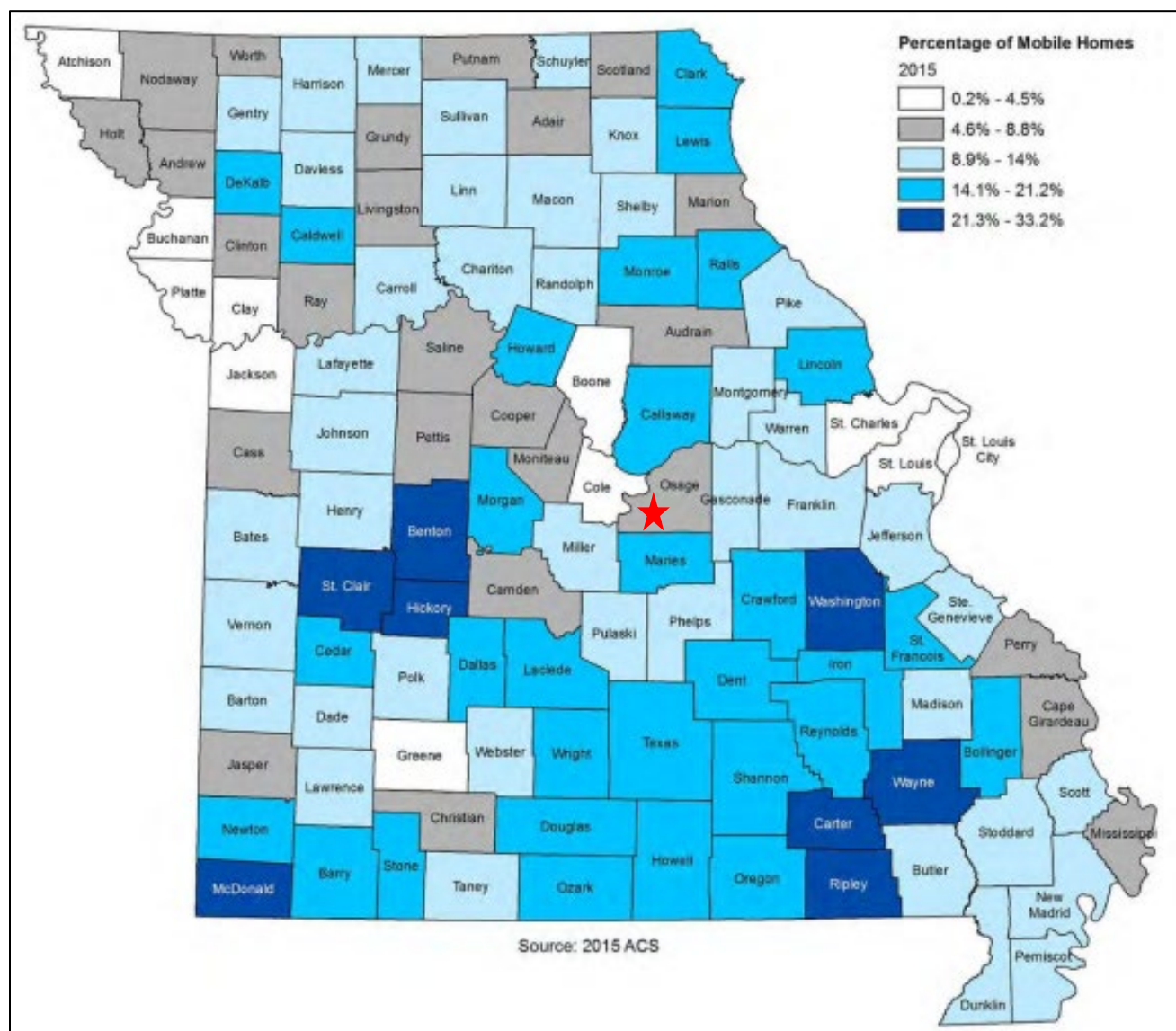
0 provides additional data, obtained from the National Centers for Environmental Information to complete the overall vulnerability analysis and the total overall vulnerability rating for tornadoes. **Figure 3.66** shows the percent of mobile homes per county throughout the state with Osage County determined to have low-medium mobile home density at 4.6 percent to 8.8 percent. **Figure 3.67** provides the average annual occurrence of tornadoes in Missouri and illustrates that Osage County falls into the low quadrant for historical events – 11 to 20 percentiles. Finally, **Figure 3.68** shows the county's overall vulnerability to tornadoes: Low.

Table 3.92. Likelihood of Occurrence, Annual Property Loss and Overall Vulnerability Rating for Tornadoes for Osage County

Total Number of Tornadoes	Likelihood of Occurrence	Likelihood of occurrence Rating	Total Annualized Property Loss	Total Annualized Property Loss Rating	Overall Vulnerability Rating	Overall Vulnerability Rating Description
10	0.149	1	\$56,720	1	7	Low

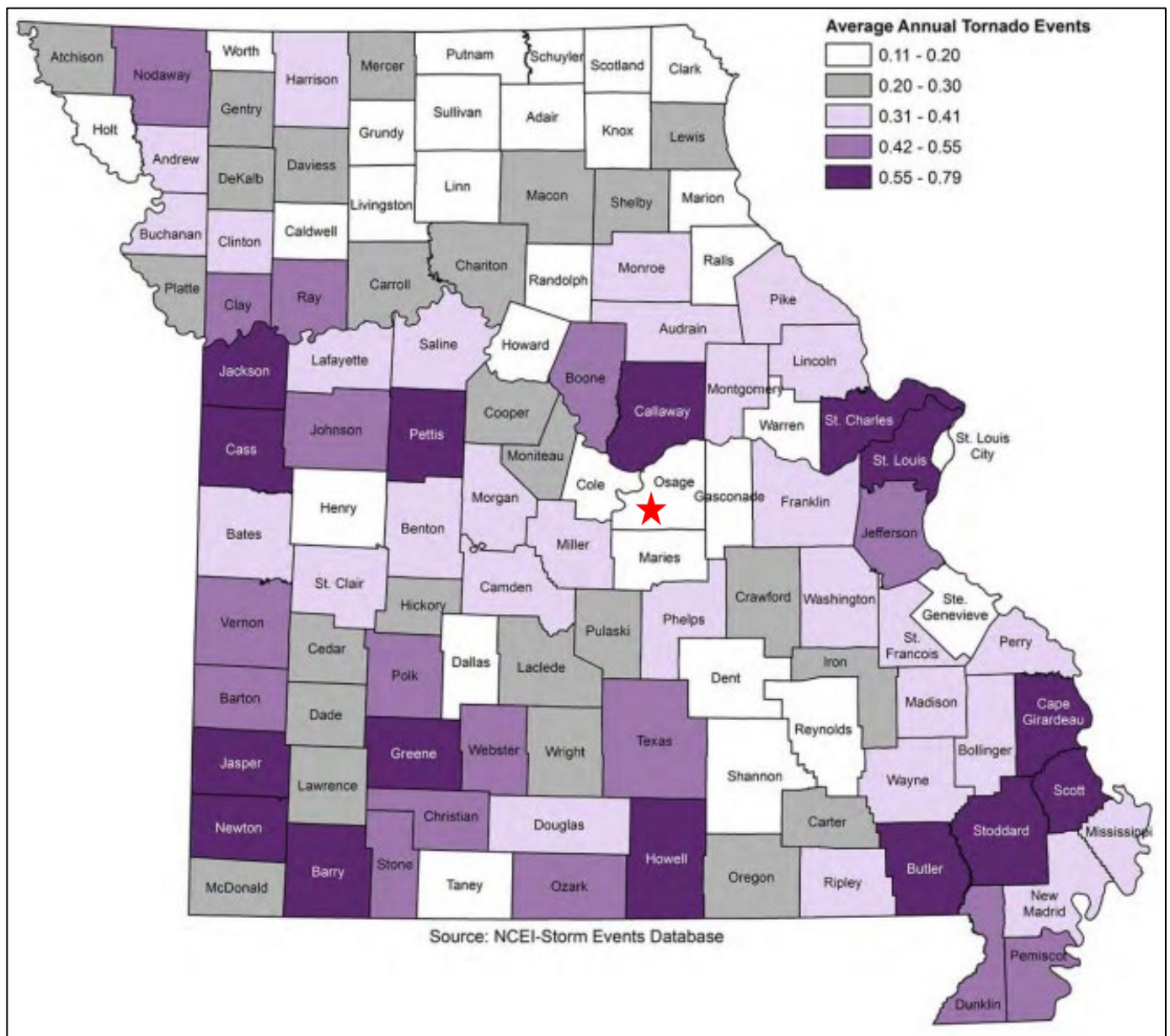
Source: 2018 Missouri Hazard Mitigation Plan

Figure 3.66. Missouri – Percent of Mobile Homes Per County



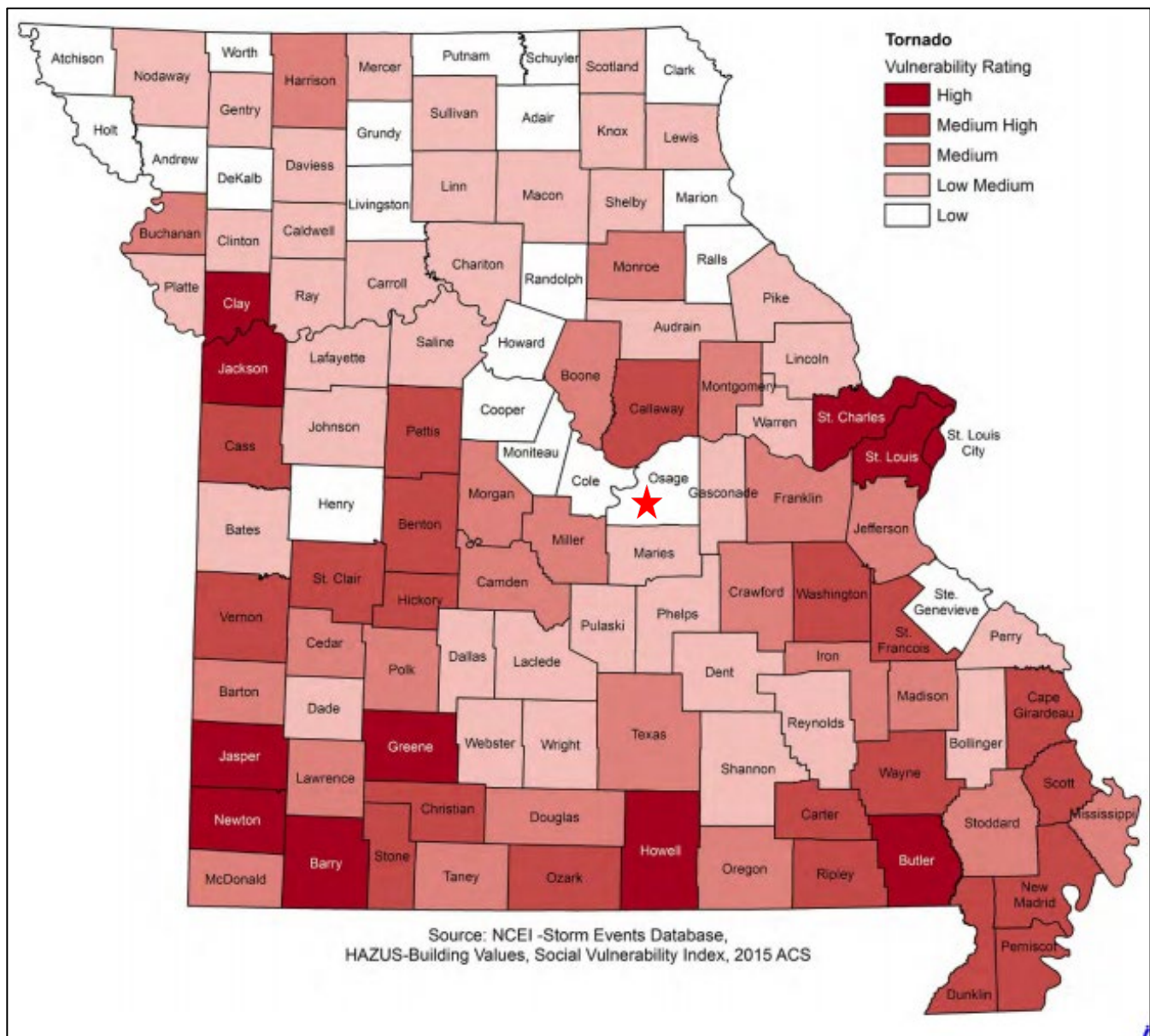
Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Figure 3.67. Average Annual Occurrence for Tornadoes



Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Figure 3.68. Overall Vulnerability to Tornadoes



Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Potential Losses to Existing Development

The annualized damage for Osage County due to tornadoes is \$56,720.15 (previous 60 years). Additionally, the largest recorded tornado in the planning area has been an EF-3. Utilizing this information, we can infer that there is potential for another tornado of equivalence.

Impact of Previous and Future Development

As populations and development increases across the county, the vulnerability will increase as well. In order to protect jurisdictions from increased tornado vulnerabilities future analysis, training, and implementation should be considered at the planning, engineering, and architectural design stages.

Hazard Summary by Jurisdiction

As previously stated, a tornado event could occur anywhere in the planning area. However, some jurisdictions would suffer heavier damages because of the age of housing or high concentration of mobile homes. See **Table 3.32** for jurisdictions most vulnerable to damage due to the age of the structure. Based on structure age, the village of Argyle would have higher vulnerability due to 50.6 percent of its housing stock being built prior to 1939. Furthermore, data was obtained from the U.S. Census Bureau for the number of mobile homes in Osage County and its jurisdictions. From the information provided in **Table 3.93**, Freeburg, with 25 mobile homes – 13.8 percent of housing, is most vulnerable to losses due to the number of mobile homes residing within the jurisdiction.

Table 3.93. Percentage of Mobile Homes in Osage County, 2019

Jurisdiction	Number of Mobile Homes	Percentage of Mobile Homes*
Unincorporated Osage County	234	5.9%
Argyle	0	0%
Chamois	12	6.7%
Freeburg	25	13.8%
Linn	0	0%
Meta	0	0%
Westphalia	0	0%

Source: U.S. Census Bureau, 2016-2020 5-Year American Community Survey

*Number of mobile homes per jurisdiction/total occupied housing units per jurisdiction

**Total housing units for all jurisdictions = 5,273

Problem Statement

Early warnings are possibly the best hope for residents when severe weather strikes. While more than two hours warning is not possible for tornadoes, citizens must immediately be aware when a city will be facing a severe weather incident. Jurisdictions that do not already possess warning systems should plan to purchase a system. Storm shelters are another important means of mitigating the effects of tornadoes. Additional public awareness also includes coverage by local media sources. A community-wide shelter program should be adopted for residents who may not have adequate shelter in their homes. Residents should also be encouraged to build their own storm shelters to prepare for emergencies. Local governments should encourage residents to purchase weather radios to ensure that everyone has sufficient access to information in times of severe weather.

3.4.11 Wildfires

The specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.11, Page 3.390
https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- Missouri Department of Conservation Wildfire Data Search at
<https://mdc12.mdc.mo.gov/Applications/MDCFireReporting/Home/FireReportSearch>
- Statistics, Missouri Division of Fire Safety at <https://dfs.dps.mo.gov/>;
- National Statistics, US Fire Administration at <https://www.usfa.fema.gov/statistics/>;
- Fire/Rescue Mutual Aid Regions in Missouri at
<https://dfs.dps.mo.gov/programs/resources/mutual-aid.php>;
- Forestry Division of the Missouri Dept. of Conservation at <https://mdc.mo.gov/your-property/fire-management>;
- National Fire Incident Reporting System (NFIRS),
<http://www.dfs.dps.mo.gov/programs/resources/fire-incident-reporting-system.php>
- University of Wisconsin Slivis Lab, <http://silvis.forest.wisc.edu/data/wui-change/>
- Missouri Hazard Mitigation Viewer
<http://bit.ly/MoHazardMitigationPlanViewer2018> - Website
<https://drive.google.com/file/d/1bPkcojgF9ofwQLnTL9N0u-oPFWi9hkst/view> - User Guide
 - Likelihood of Occurrence of wildfire by County
 - Average annual land burned (acres) by County
 - Number of structures within the WUI Interface/Intermix Area
 - Potential loss, average annual land burned by County

Hazard Profile

Hazard Description

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 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, approximately 700 rural fire departments in Missouri have mutual aid agreements with the Forestry Division to obtain assistance in wildfire protection if needed. Over 300 have mutual aid agreements with the State to obtain assistance in wildfire protection if needed. A cooperative agreement with the Mark Twain National Forest is renewed annually.

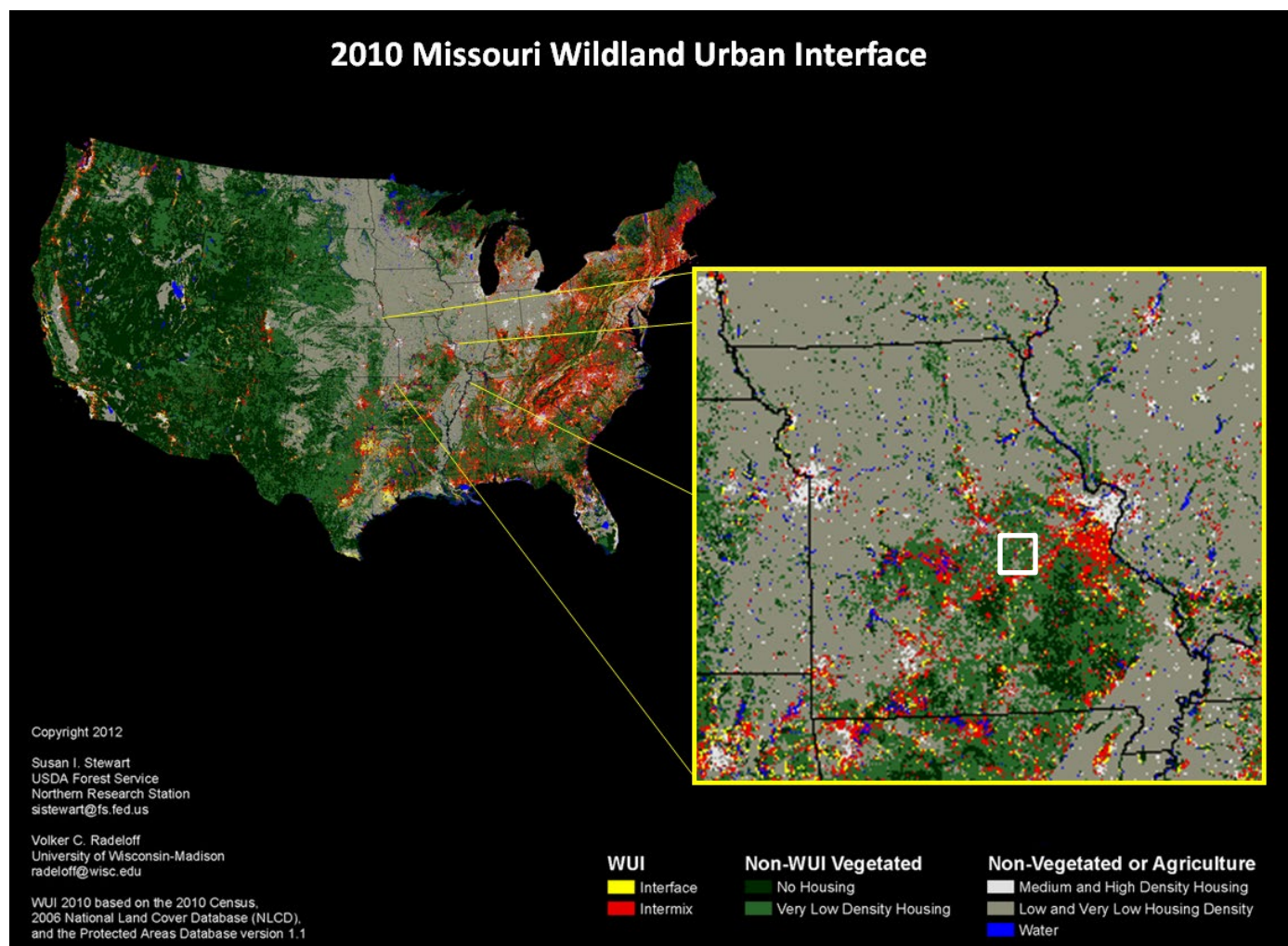
Most of Missouri fires occur during the spring season between February and May. The length and severity of both structural and wildland fires depend largely on weather conditions. Each year, an average of about 3,200 wildfires burn more than 52,000 acres of forest and grassland in Missouri. Spring in Missouri is usually characterized by low humidity and high winds. These conditions result in higher fire danger. Drought conditions can also hamper firefighting efforts, as decreasing water supplies

may not prove adequate for firefighting. It is common for rural residents to 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 wildfires. 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

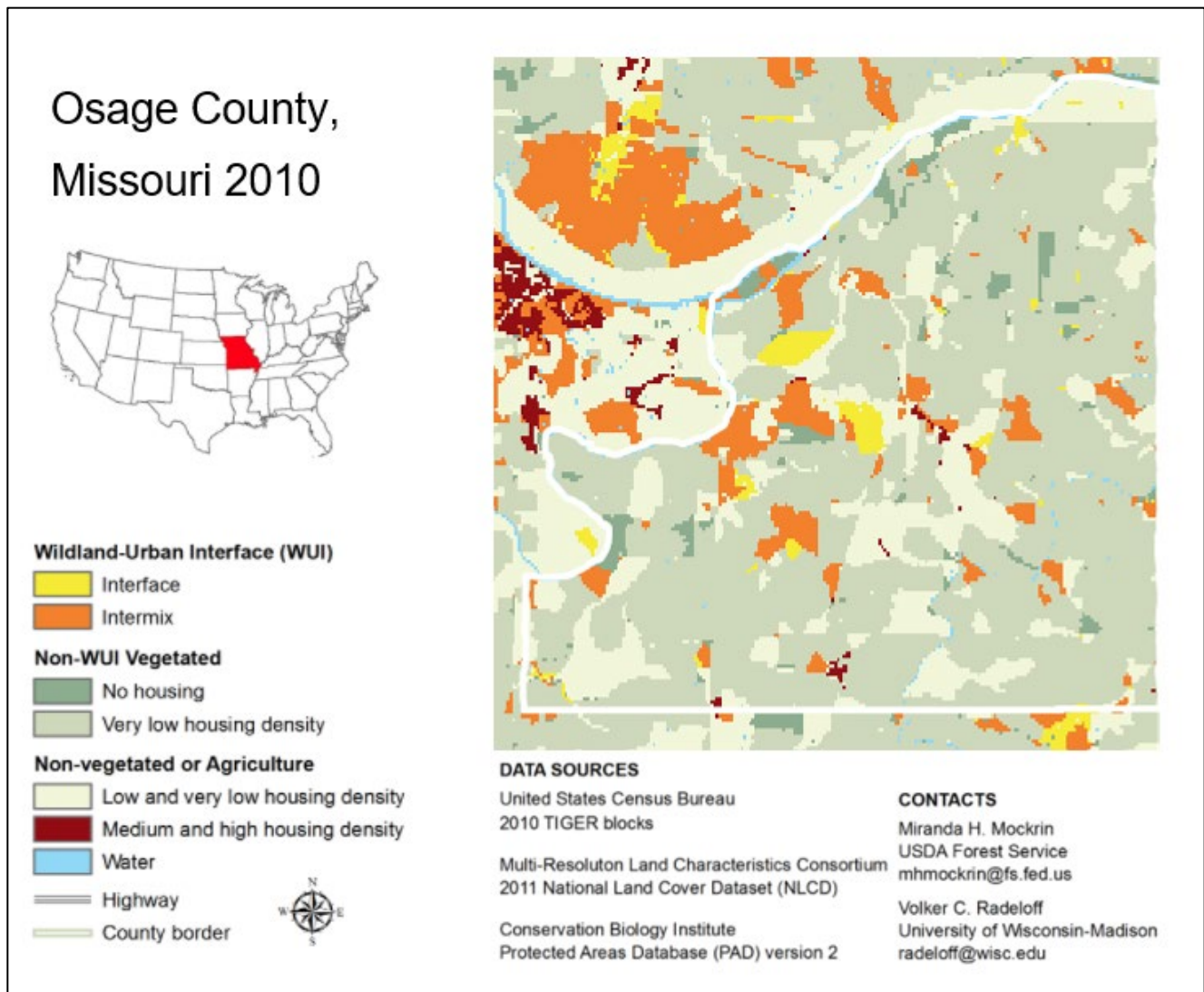
The risk of wildfire does not vary widely across the planning area. However, damages due to wildfires are expected to be higher in communities with more wildland–urban interface (WUI) areas. WUI refers to the zone of transition between unoccupied land and human development and needs to be defined in 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 (**Figure 3.69**). To determine specific WUI areas and variations, data was obtained from ArcGIS, Streets and SILVIS (**Figure 3.70**). According to the WUI area map of Osage County, all cities partially reside in a WUI area.

Figure 3.69. 2010 Missouri Wildland Urban Interface (WUI)



Source: <http://silvis.forest.wisc.edu/maps/wui/>; White square roughly estimates Osage County's location

Figure 3.70. Osage County Wildlife Urban Interface



Source: http://silvis.forest.wisc.edu/GeoData/WUI_cp12/maps/gifs/white/Missouri_WUI_cp12_white_2010.gif

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 some other natural event. Wildfires 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.

The severity of wildfires in Missouri is considered low to moderate, and wildfires in Missouri often 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. Large fires have the potential to kill people, livestock, fish and wildlife as well as destroy crops and pastures. Wildfires can destroy not only natural areas, but homes, businesses and other facilities. Loss of life due to wildfires is not common in Missouri, but injuries to residents and firefighters can include falls, sprains, abrasions or heat-related injuries such as dehydration.

Previous Occurrences

Between 2001 and 2020 there were 266 wildfires reported in Osage County, according to wildfire reporting to the Missouri Department of Conservation⁵². This is an average of 13.3 wildfires per year. The size of the fires varied from as small as 0 acre to as large as 234 acres. **Table 3.94** shows the cause of wildfires, number of wildfires and acres burned for the period 2001-2020. Unknown fires account for the largest number of fires and debris fires account for the greatest number of acres burned.

Table 3.94. 2001-2020 Osage County Wildfires by Cause

Cause	Number	Acres	% Number	% Acres
Equipment	15	463.98	5.6%	27.7%
Debris	104	424.99	39.1%	25.4%
Campfire	5	6.82	1.9%	0.4%
Children	2	3	0.8%	0.2%
Lightning	5	3.37	1.9%	0.2%
Unknown	61	171.82	22.9%	10.3%
Unreported	5	22.79	1.9%	1.4%
Railroad	1	0	0.4%	0%
Smoking	4	12.24	1.5%	0.7%
Miscellaneous	64	566.08	24.1%	33.8%
Totals	266	1,675.09	100.1%	100.1%

Records for school and special districts are not available at this time.

Probability of Future Occurrence

From the data obtained from the Missouri Department of Conservation⁵³ (Appendix: F), 266 wildfire events occurred in Osage County between 2001 and 2020. This information was utilized to determine the annual average percent probabilities of wildfires. Since multiple occurrences are anticipated per year (266 events/20 years), the probability of wildfires per year is 100% with an average of 13.3 events per year **Table 3.95**.

⁵² <https://mdc12.mdc.mo.gov/Applications/MDCFireReporting/Home/FireReportSearch>

⁵³ <https://mdc12.mdc.mo.gov/Applications/MDCFireReporting/Home/FireReportSearch>

Table 3.95. Annual Average Percentage Probability of Wildfires in Osage County

Location	Annual Avg. % P	Avg. Number of Events
Osage County	100%	13.3

*P = probability; see page 3.24 for definition.

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 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 are likely to increase, while the population of hickory trees is likely to decrease.⁵⁴

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.⁵⁵

Vulnerability

Vulnerability Overview

According to the 2018 Missouri State Hazard Mitigation Plan, the Department of Conservation historical wildfire data was the best resource for data on wildfires. The Missouri State Hazard Mitigation Plan used data from 2004-2016 and determined that Osage County should expect to have 16.23 wildfires per year, impacting 109 acres (**Table 3.96**).

The state plan also indicates that Osage County is at the low possible likelihood for building damage from wildfires – likely from the low population numbers in the county. **Figure 3.71** illustrates the likelihood of wildfire events based on data from 2004-2016. **Figure 3.72** provides a map that illustrates the average annual acreage burned.

⁵⁴ 2018 Missouri Hazard Mitigation Plan

⁵⁵ 2018 Missouri Hazard Mitigation Plan

Table 3.96. Statistical Data for Wildfire Vulnerability in Osage County

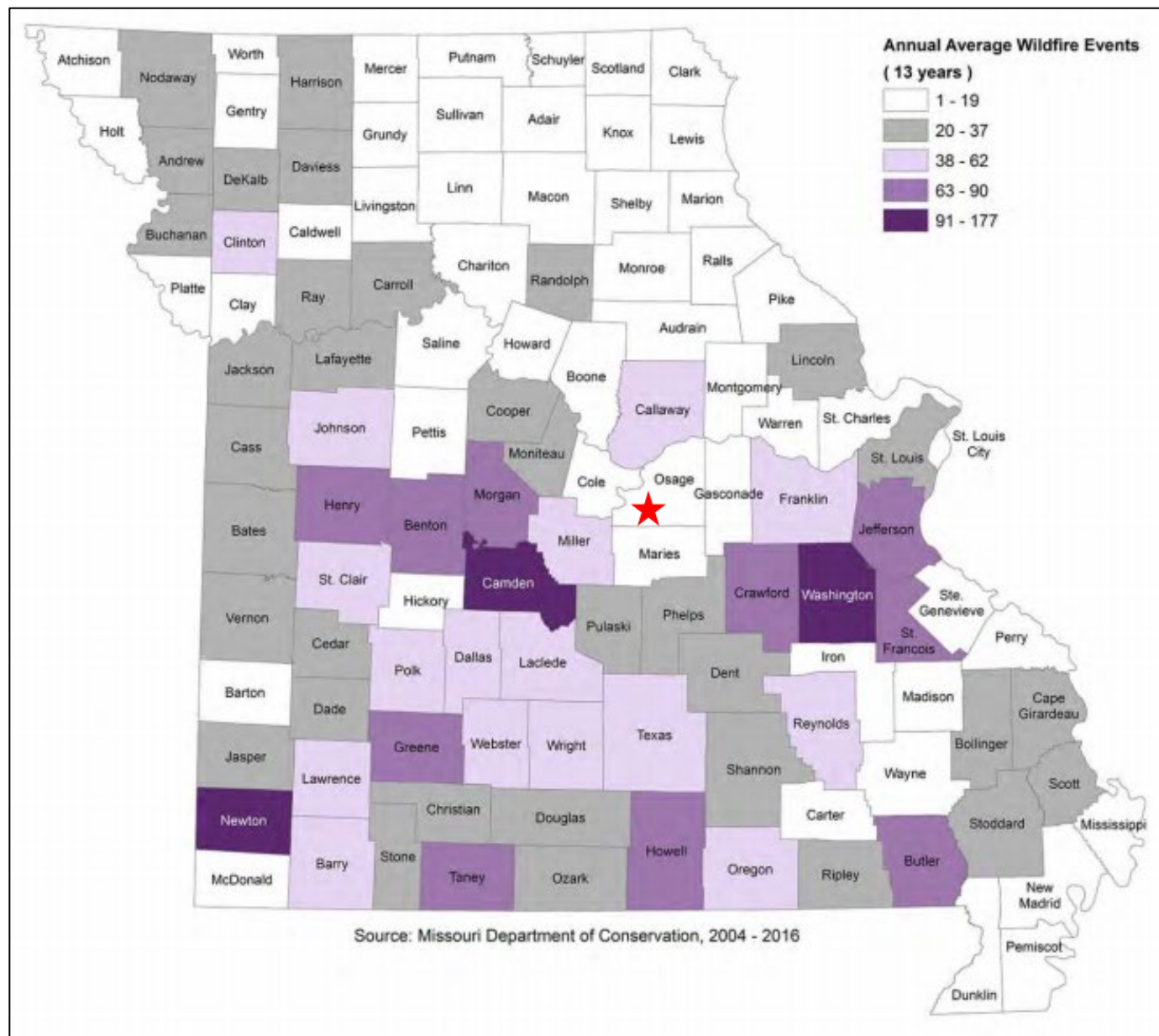
Number of Wildfires 2004-2016	Likelihood of Occurrence (#/year)	Total Acres Burned	Average Annual Acreage Burned
622	16.23	1,421.78	109

Source: 2018 Missouri State Hazard Mitigation Plan

The method used to determine vulnerability to wildfires in the 2018 Missouri Hazard Mitigation plan was a GIS comparative analysis of wildland urban interface and intermix (WUI) areas against building exposure data to determine the types, numbers and estimated values of buildings at risk to wildfire. This GIS-based analysis utilized data from several sources: the Missouri Spatial Data Inventory Service (MSDIS), HAZUS building exposure value data and wildland urban interface and intermix area data from the University of Wisconsin-Madison SILVIS Lab.

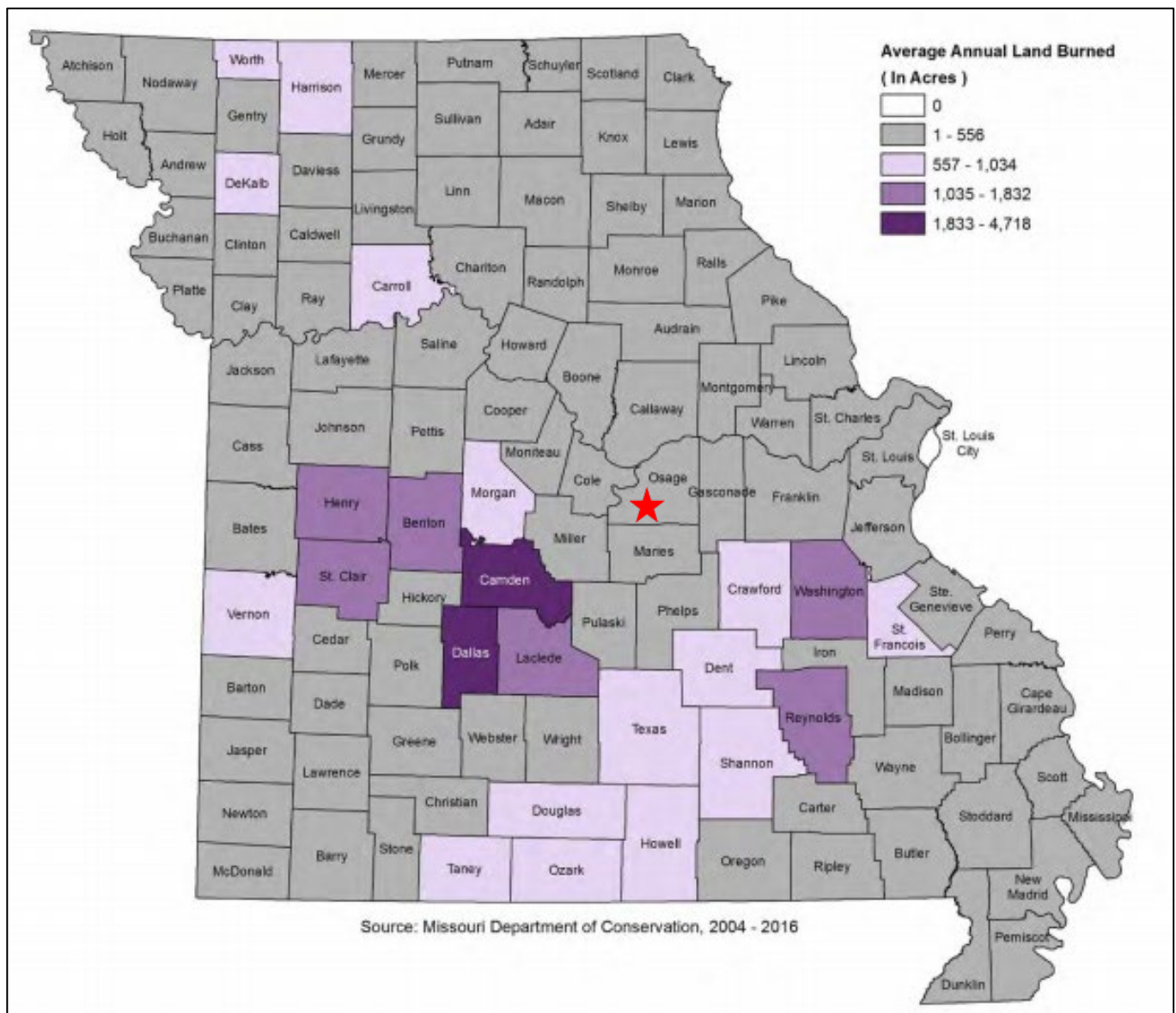
The results of that analysis, including estimated number of structures, value of structures and population are illustrated in **Table 3.97**. The total estimated number of structures vulnerable to wildfires is 2,390. The overall value of structures vulnerable to wildfire in Osage County is estimated at \$1,040,941,031. To further illustrate vulnerability in Osage County, maps from the 2018 Missouri Hazard Mitigation plan illustrating these numbers and comparing them statewide are included. The number of structures in the WUI interface and intermix areas statewide are shown in **Figure 3.73**. Osage County shows that it has between 0 and 3,217 structures within these areas. **Figure 3.74** shows the estimated value of structures in the WUI interface and intermix areas. **Figure 3.75** illustrates the number of people at risk to wildfire in the WUI interface and intermix areas.

Figure 3.71. Likelihood of Wildfire Events, 2004-2016



Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Figure 3.72. Average Annual Acreage Burned



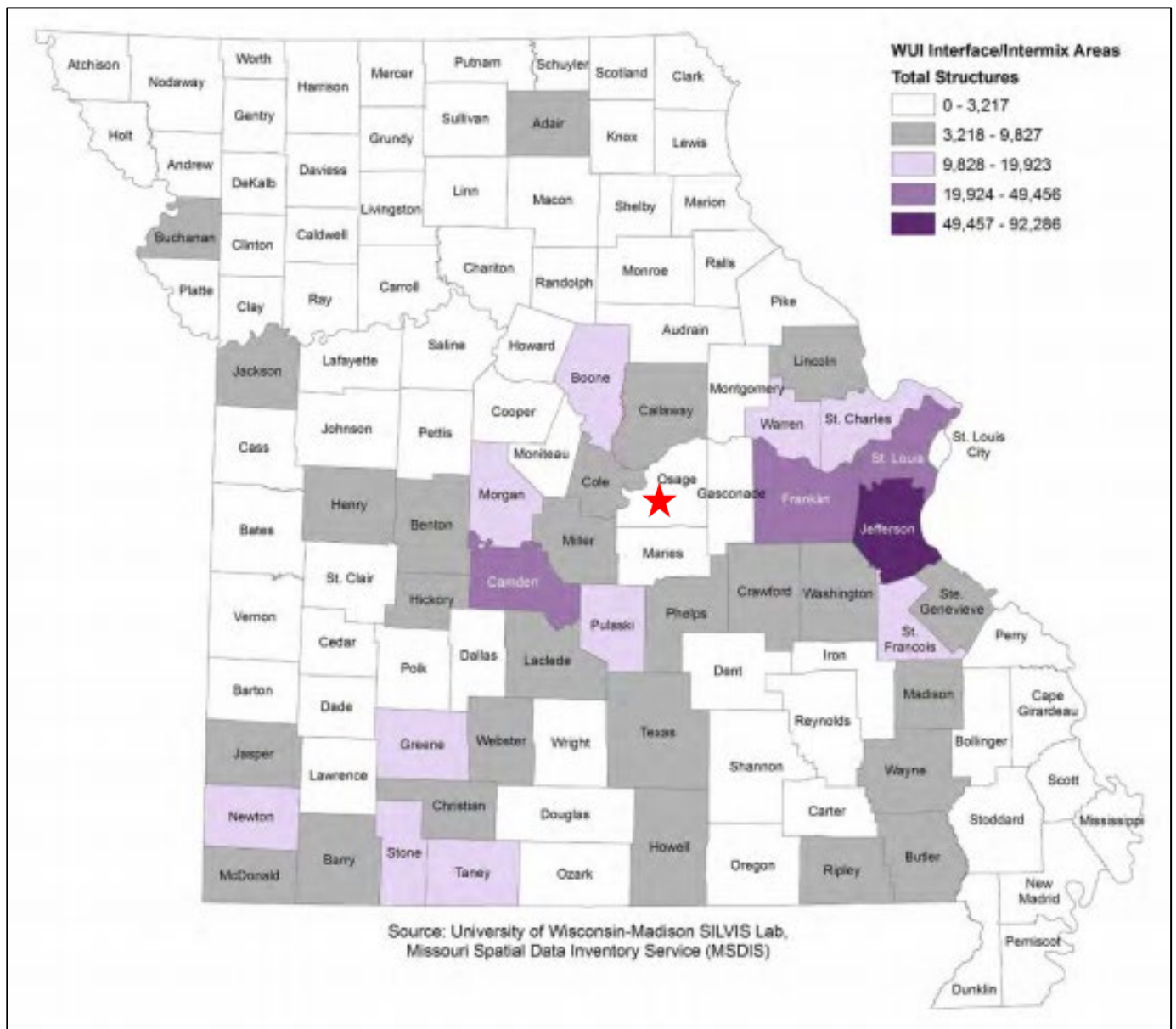
Source: 2018 Missouri State Hazard Mitigation Plan, *Red star indicates Osage County

Table 3.97. Estimated Numbers and Values of Structures and Population Vulnerable to Wildfire in Osage County

Osage County	Number of Structures	Value of Structures	Population
Agriculture	805	\$509,537,241	
Commercial	97	\$61,899,006	
Education	12	\$39,724,800	
Government	9	\$6,546,000	
Industrial	37	\$57,481,913	
Residential	1,801	\$366,249,542	
Totals	2,761	\$1,040,941,031	4,737

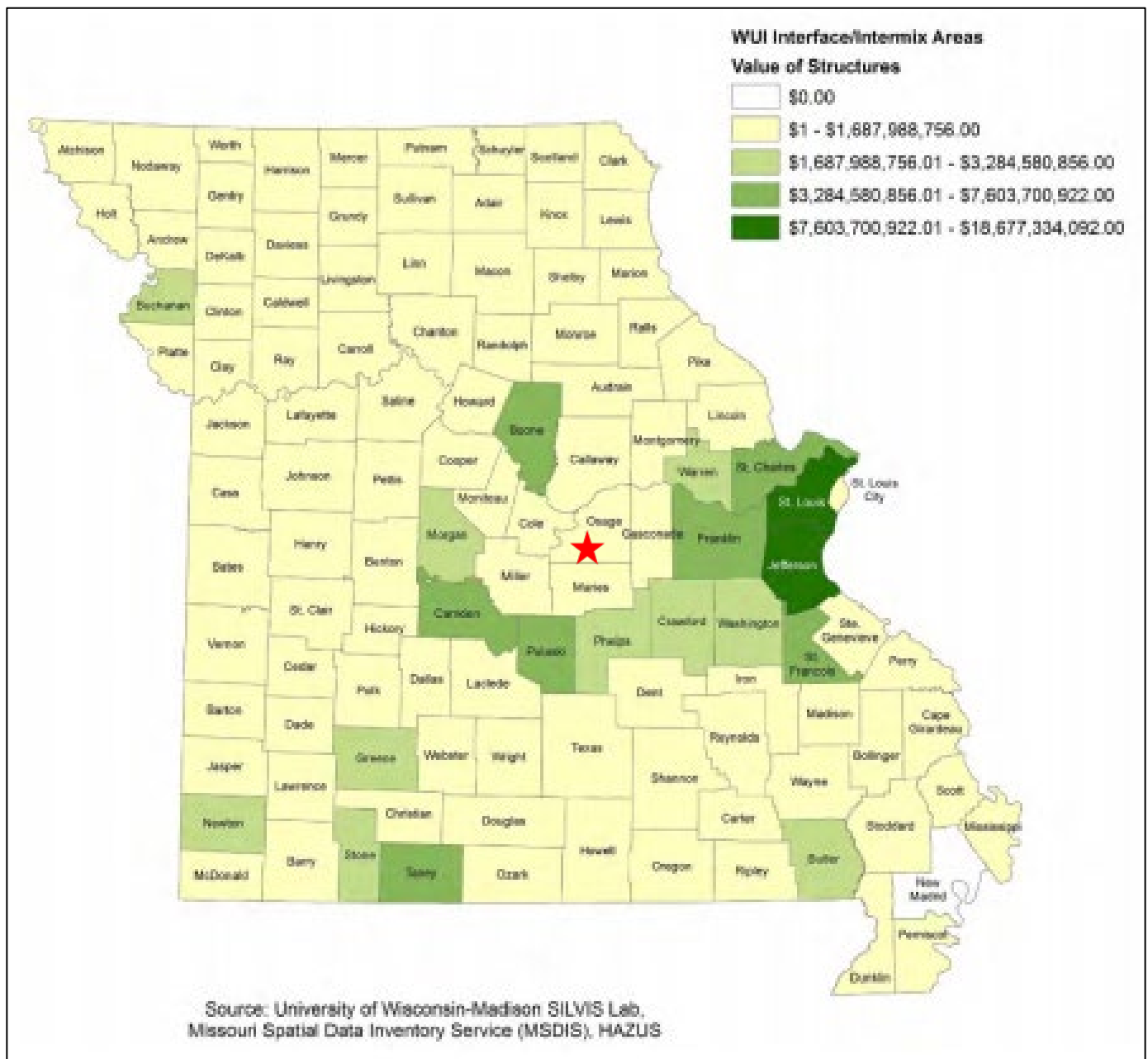
Source: 2018 Missouri State Hazard Mitigation Plan

Figure 3.73. Number of Structures in WUI Interface and Intermix Areas



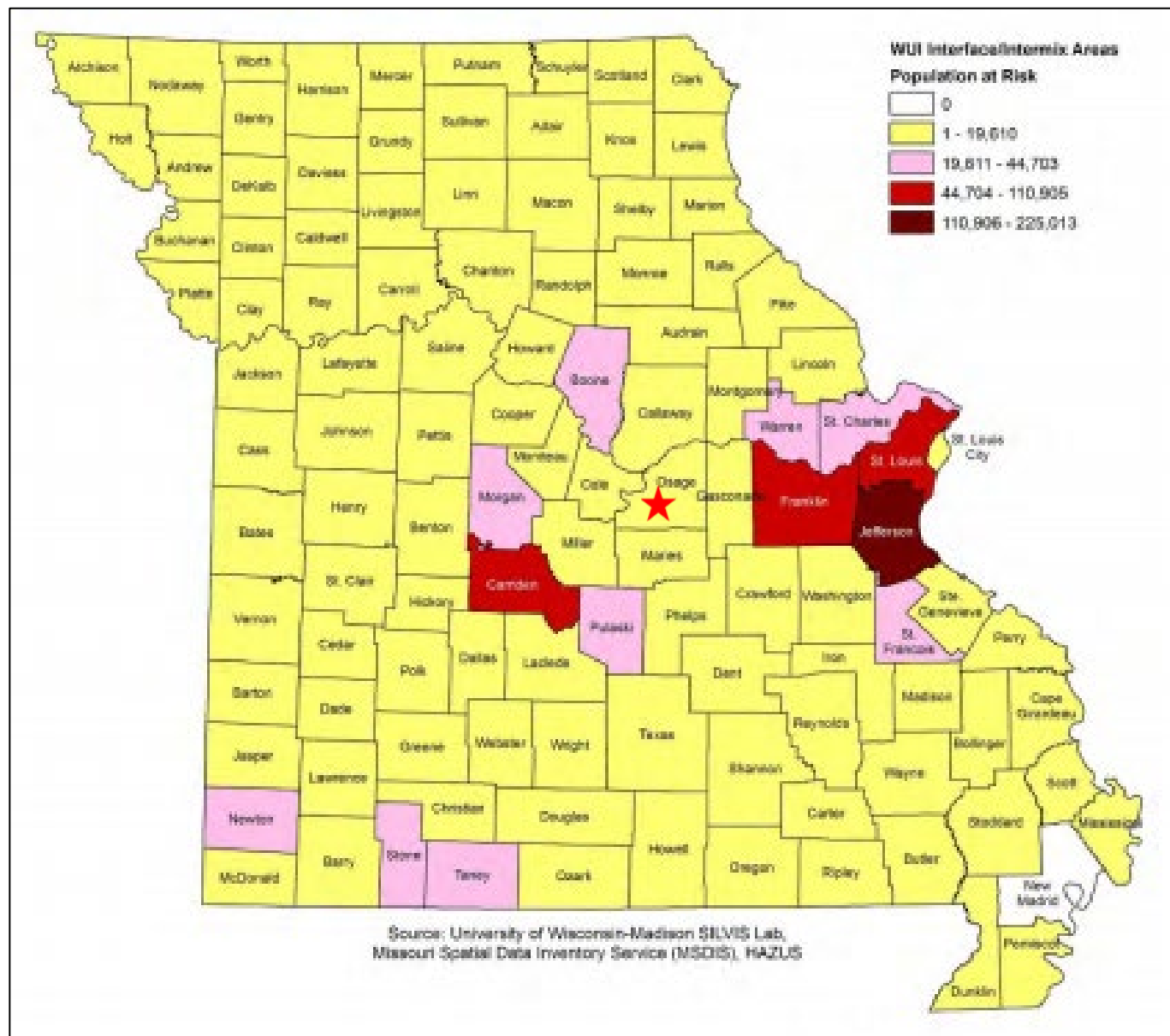
Source: 2018 Missouri Hazard Mitigation Plan, *Red star indicates Osage County,

Figure 3.74. Value of Structures in the WUI Interface and Intermix Areas



Source: 2018 Missouri Hazard Mitigation Plan, *Red star indicates Osage County

Figure 3.75. Population at Risk to Wildfire in WUI Interface and Intermix Areas



Source: 2018 Missouri Hazard Mitigation Plan, *Red star indicates Osage County

Potential Losses to Existing Development

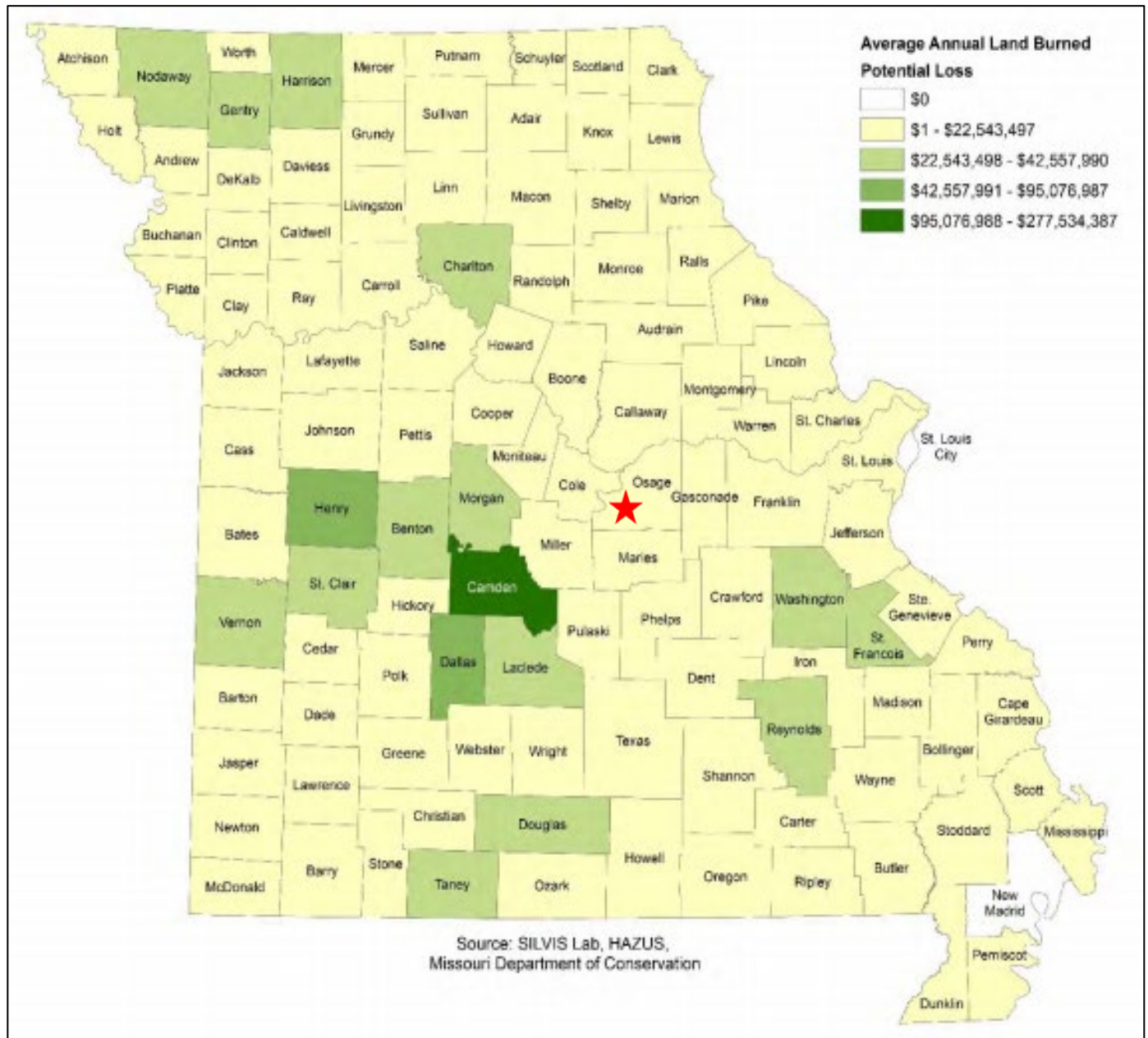
As there was not data available on Osage County specific losses, data was used from the 2018 Missouri State Hazard Mitigation Plan. The factors considered for estimating potential losses due to wildfires were average acreage burned each year per county and the average value of structures per acre in the WU-Interface/Intermix areas. **Table 3.98** and **Figure 3.76** that follows provide the potential loss figures for Osage County based on this methodology.

Table 3.98. Wildfire Potential Loss Estimates for Osage County

Total WUI Acreage	Total Structure Value Within WUI	Average Value/Acre within WUI	Average Annual Acreage Burned	Potential Loss
31,326.79	\$1,040,940,031	\$33,228	109	\$3,621,903

Source: 2018 Missouri Hazard Mitigation Plan

Figure 3.76. Annualized Wildfire Damages



Source: 2018 Missouri Hazard Mitigation Plan, *Red star indicates Osage County

Impact of Previous and Future Development

Few future developments are anticipated in WUI areas, however due to lack of data, it is difficult to enumerate. Additionally, as previously mentioned, each jurisdiction within the county resides in a WUI area. This increases the risk of fire hazards for future development.

Hazard Summary by Jurisdiction

As long as drought conditions are not severe, future wildfires in Osage County should have a negligible adverse impact on the community, as it would affect a small percentage of the population. Nonetheless, homes, businesses, and schools located in unincorporated areas are at higher risk from wildfires due to proximity to woodland and more importantly, distance from fire services. Both cities and school districts are in WUI areas but are closer to fire services.

Problem Statement

An estimated 2,761 structures and 4,737 people are vulnerable to wildfires in Osage County. Wildfires are expected to occur on an annual basis. To mitigate adverse impacts a comprehensive community awareness and educational campaign on wildfire danger should be designed and implemented. This campaign should include the development of capabilities, systems, and procedures for pre-deploying fire-fighting resources during times of high wildfire hazards; training of local fire departments for wildfire scenarios; encouraging the development and dissemination of maps relating to the fire hazards (WUI areas) to help educate and assist builders and homeowners in being engaged in wildfire mitigation activities; and guidance of emergency services during response. Residents should be educated on the dangers of wildfires and what steps they can take to mitigate their vulnerability. This could include landscaping and water supply.

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	4.5

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 developed by the Mitigation Planning Committee (MPC). The mitigation strategy was developed through a collaborative group process. The process included review of 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 identified 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 Osage County’s existing hazard mitigation plan originally approved by FEMA in April, 2005 and updated and approved by FEMA on March 22, 2013 and five years later in June, 2018. Therefore, the goals from the updated 2018 Osage 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 first 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 reviewed the goals and decided to consolidate them from six goals to three. The following goals were established for the 2023 Osage County plan update:

- Goal 1:** Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
- Goal 2:** Reduce the potential impact of natural disasters to property, infrastructure and the local economy.
- Goal 3:** Reduce the potential impact of natural disaster on the continuity of government and essential services.

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 first MPC meeting, the committee discussed what needed to be updated in the risk assessment. Changes in risk since adoption of the previously approved plan were discussed. Since the last update, there have been no deaths due to natural hazard events. Action items were reviewed and suggestions made for changes to address the changes in risk. Discussions from the 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.

The focus of Meeting #2 was to review, prioritize and update the mitigation strategy. The MPC reviewed the list of actions proposed in the previous mitigation plan and proposed additional mitigation actions. Facilitators also provided suggestions for actions based on what some of the surrounding counties had included in their plans. Participants were also encouraged to refer to the current State Plan and 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.

During the review of the plan document, MPC members were encouraged to review the details of the risk assessment vulnerability analysis specific to their jurisdiction.

The MPC reviewed the actions from the previously approved plan for progress made since the plan had been adopted. Copies of the list of actions for each jurisdiction were provided to MPC members at planning meetings and were emailed out to all members. Action items were reviewed and the MPC provided updates on the status of action items during both planning meetings and the meeting with the road and bridge department. Each action item was reviewed and assigned one of the following:

- Completed, with a description of the progress,
- Not Started/Continue in Plan Update, with a discussion of the reasons for lack of progress,
- In Progress/Continue in Plan Update, with a description of the progress made to date or
- Deleted, with a discussion of the reasons for deletion.

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 five completed actions for the county, Argyle, Chamois, Linn, Meta and Westphalia; four completed actions for Freeburg and two completed actions for the school districts. There were four deleted actions for all the jurisdictions. The county had ten actions that were combined with other, similar actions and eleven continuing actions. Argyle, Chamois, Linn, Meta and Westphalia had 13 actions that were combined with other similar actions and nine continuing actions. Freeburg had eleven actions that were combined with other, similar actions and six continuing actions. The school districts had four actions that were combined with other, similar actions, and three continuing 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
Osage County	5	11	14
Village of Argyle	5	9	13
City of Chamois	5	9	13
Village of Freeburg	4	6	11
City of Linn	5	9	13
City of Meta	5	9	13
City of Westphalia	5	9	13
Osage County R-I Schools	2	3	4
Osage County R-II Schools	2	3	4
Osage County R-III Schools	2	3	4

Table 4.1 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)
1.1.3 Promote development and implementation of emergency plans by businesses by providing examples on EMD website and raising awareness through public and social media	Emergency preparedness information is provided through email and social media by EMD. EMD advertises and uses smart 911 to share information. A template for business continuity plans is available on the EMD website.

Completed Actions	Completion Details (date, amount, funding source)
1.2.6 Monitor developments in data availability concerning the impact of levee failure, dam failure, tornados, sinkholes, land subsidence, and wildfire upon Osage County and all jurisdictions through local, state, and federal agencies for use in hazard mitigation planning.	This action is completed through the revision and update of the plan document every five years.
2.2.1 Educate and raise awareness of residents, contractors, and cities on the dangers of floodplain development and the benefits of the National Flood Insurance Program	The County EMD actively shares information on floodplain development and the benefits of the NFIP through social media, information on the EMD's website, press releases and availability of brochures on NFIP.
3.3.4 Awareness campaign for well testing/protection	Action item completed through information provided by the Extension Service, Health Department and EMD office.
6.3.1 Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.	Complete – accomplished through the hazard mitigation plan review and update process.
Deleted Actions	Reason for Deletion
1.3.1 Provide information on tree trimming and dead tree removal programs to utility companies and local government.	Deleted due to no local governments in the planning area being responsible for utility lines. Three Rivers Electric Cooperative and Ameren UE are already doing this.
1.3.5 Plan to identify standing pools of water (zika virus) and increase community awareness.	No cases of Zika have occurred in the county, nor in the state of Missouri. This action was no longer considered a high priority and falls under emergency response rather than mitigation.
2.1.8 Elevate County Road 275 due to flooding.	Combined with 1.3.2.
2.1.10 Increase culvert size as replacements are installed.	Combined with 1.3.2.
2.1.11 Add culverts in areas as needed.	Combined with 1.3.2.
3.3.1 Participating jurisdictions should regularly re-evaluate hazard mitigation plan and merge with other community planning.	Combined with 3.2.3.
3.3.2 Continue to provide information through press releases, brochures, website and Facebook regarding adopted mitigation measures to keep public abreast of changes and/or new regulations, especially in regard to floodplain management.	Combine with 6.2.2.

Deleted Actions	Reason for Deletion
3.3.3 Dam safety and maintenance awareness including public announcements/reminders	Deleted due to not being a high priority.
4.2.1 Encourage meetings between EMD, city/county, and SEMA to familiarize officials with mitigation planning and implementation and budgeting for mitigation projects.	Combined with 3.2.3.
4.2.2 Continue to encourage the incorporation of mitigation into other planning document and planning activities such as comprehensive plans and capital improvement plans.	Combine with 3.2.3.
5.1.1 Provide information to all communities on the benefits and costs of developing storm water management plans.	Deleted due to not meeting SMART criteria.
5.2.2 Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.	Combine with 5.2.1.
6.1.3 Work with state/local/federal agencies to include mitigation in all economic and community development projects.	Combine with 3.2.3
6.1.4 Provide information to jurisdictions on the benefits of budgeting for and implementing hazard mitigation projects.	Combine with 6.2.1.

Source: Previously approved County Hazard Mitigation Plan; MPC committee; data collection questionnaires

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 discuss the actions to be included in 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.

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

worked together to review and assign scores. The process 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 implanted action result in a reduction of disaster damage?

In addition to the STAPLEE process, each action item was also reviewed for Benefit/Cost. These two aspects of the prioritization process were scored as follows:

Benefit – two (2) points were added for each of the following avoided damages (8 points maximum = highest benefit)

- Injuries and/or casualties
- Property damages
- Loss-of-function/displacement impacts
- Emergency management costs/community costs

Cost – points were subtracted according to the following cost scale (-5 points maximum = highest cost)

- (-1) = Minimal – little cost to the jurisdiction involved
- (-3) = Moderate – definite cost involved but could likely be worked into operating budget
- (-5) = Significant – cost above and beyond most operating budgets; would require extra appropriations to finance or to meet matching funds for a grant

Note: For the Benefit/Cost Review, the benefit and cost of actions which used the word “encourage” were evaluated as if the action or strategy being encouraged was actually to be carried out.

In addition, the group considered the cost of mitigation versus the long-term savings in relation to potential lives saved and property damage avoided.

Total Score – The scores for the STAPLEE Review and Benefit/Cost Review were added to determine a Total Score for each action.

Priority Scale – To achieve an understanding of how a Total Score might be translated into a Priority Rating, a sample matrix was filled out for the possible range of ratings an action might

receive on both the STAPLEE and Benefit/Cost Review. The possible ratings tested ranged between:

- A hypothetical action with “Half probably NO and half maybe YES” answers on STAPLEE (i.e. poor STAPLEE score) and Low Benefit/High Cost: Total Score = 7
- A hypothetical action with “All definitely YES” on STAPLEE and High Benefit/Little Cost: Total Score = 28

An inspection of the possible scores within this range led to the development of the following Priority Scale based on the Total Score in the STAPLEE- Benefit/Cost Review process:

20 – 28 points = High Priority
14-19 points = Medium Priority
13 points and below = Low Priority

In addition to the STAPLEE and Benefit/Cost analysis, the committee was also asked to consider **SMART** – **S**pecific, **M**easurable, **A**chievable, **R**elevant, **T**ime-bound, per FEMA. All action items were reviewed with this criteria in mind. The results of the STAPLEE process and Benefit/Cost analysis were then mailed out to all MPC members for feedback and consensus.

The final scores are listed below in the analysis of each action. Correspondence regarding the STAPLEE process is included in Appendix C: A spreadsheet with the action items and final scores is illustrated in Figure 4.1.

Jurisdictional Floodplain Management Programs

Osage County and the cities of Argyle, Chamois, Linn, Meta, and Westphalia are members of the NFIP and regulate development in the floodplain by reviewing permit applications for all development including new and existing structures. Elevation certificates are required for all new construction, and existing structures with 50% or more damage following a flood are required to elevate. Floodplain maps are available in hard copy at the city halls of each community and the county’s flood maps can be obtained from the floodplain coordinator - MRPC. Furthermore, floodplain maps can be found online through FEMA’s website <https://msc.fema.gov/portal>.

Table 4.1. Jurisdictional Floodplain Ordinance Adoption Date

Community Name	Ordinance Adoption Date
Osage County	9/20/12
Argyle	8/14/12
Chamois	01/14/21
Freeburg	Not participating in the NFIP
Linn	2012
Meta	04/11/12
Westphalia	6/2020

Source: FEMA’s Community Status Book Report¹; NSFHA (SEMA)

¹ www.fema.gov/cis/mo.html

Figure 4.4 Prioritization of Mitigation Actions		3 = Def YES 1 = Prob NO 2 = Maybe YES 0 = Def NO													
Action No.	Mitigation Actions	S	T	A	P	L	E	E	STAPLEE Total	Losses Avoided (2 pts. Each)	Benefit	Cost	B/C Total	Total	Priority
1.3.2 [1.1]	Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.	3	2	2	3	3	2	3	18	IC, PD, LF, EMCC	8	-3	5	23	H
1.3.4 [1.2]	Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows	3	3	3	3	3	2	2	19	IC, LF, EMCC	6	-3	3	22	H
6.2.2 [1.3]	Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.	3	3	2	3	3	3	2	19	IC, PD, LF, EMCC	8	-1	7	26	H
1.4	Obtain and upgrade early warning systems and improved communication systems as funding allows.	3	2	2	3	3	2	2	17	IC, PD, LF, EMCC	8	-3	5	22	H
2.1.9 [2.1]	Elevate structures located in the floodplain to be compliant with local flood ordinances as funding allows.	2	3	3	2	3	3	2	18	IC, PD, LF, EMCC	8	-3	5	23	H
2.2.2 [2.2]	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	3	2	2	3	3	3	3	19	IC, LF, EMCC	6	-1	5	24	H
5.2.1 [2.3]	Purchase properties in the floodplain as funds become available and convert that land into open public space.	2	3	3	2	3	2	2	17	IC, PD, LF, EMCC	8	-3	5	22	H
6.2.1 [2.4]	Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole.	3	2	2	3	3	3	2	18	IC, PD, LF, EMCC	8	-1	7	25	H

Figure 4.4 Prioritization of Mitigation Actions		3 = Def YES 1 = Prob NO 2 = Maybe YES 0 = Def NO													
Action No.	Mitigation Actions	S	T	A	P	L	E	E	STAPLEE Total	Losses Avoided (2 pts. Each)	Benefit	Cost	B/C Total	Total	Priority
3.2.3 [3.1]	Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.	3	3	2	3	3	3	2	19	IC, PD, LF, EMCC	8	-3	5	24	H
6.3.2 [3.2]	Acquire generators for essential service providers as funding allows.	3	2	2	2	3	3	3	18	IC, LF, EMCC	6	-1	5	23	H
2.1.2 [3.3]	On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.	3	3	3	3	3	3	3	21	IC, PD, LF, EMCC	8	-1	7	28	H

Denotes new numbering.

Osage County

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Action 1.3.2 [1.1]: Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.

Action Worksheet	
Name of Jurisdiction:	Osage County
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with flooding and inadequate road/bridge structures and impacts on residents and their property.
Hazard(s) Addressed:	Flood, earthquake
Action or Project	
Action/Project Number:	1.3.2 [1.1]
Name of Action or Project:	Road and bridge mitigation
Action or Project Description:	Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables.
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	County Commission, Road and Bridge Department
Action/Project Priority:	23 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Local government capital improvement plans, budgets for road, bridge and utilities
Progress Report	
Action Status	Revised – Continuing – in progress
Report of Progress	The Osage County Commission and Road and Bridge Department reviews each project undertaken and searches for ways to improve it by upsizing culverts; moving projects to improve drainage, etc. The County also adopted road and bridge standards and a policy and procedures manual for improvements. The county would like to elevate County Road 275 as funding allows.

Action 1.3.4 [1.2]: Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.

Action Worksheet	
Name of Jurisdiction:	Osage County
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with nonexistent/inadequate shelters for residents during storm events
Hazard(s) Addressed:	Severe Storm (Hail/Wind) and Tornado
Action or Project	
Action/Project Number:	1.3.4 [1.2]
Name of Action or Project:	Construct storm shelters and tornado safe rooms near areas of high population densities
Action or Project Description:	Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	County Commission, EMD
Action/Project Priority:	22 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised – Continuing
Report of Progress	A community certified tornado safe room exists on the campus of State Technical College of Missouri. However, the County would benefit from having additional certified shelters at schools and other population dense areas.

Action 6.2.2 [1.3]: Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.

Action Worksheet	
Name of Jurisdiction:	Osage County
Risk / Vulnerability	
Problem being Mitigated:	Lack of knowledge among the general public on the importance / benefit of hazard mitigation projects.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.2 [1.3]
Name of Action or Project:	Public awareness program on hazard mitigation
Action or Project Description:	Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD
Action/Project Priority:	26 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, comprehensive plans, capital improvement plans, strategic plans
Progress Report	
Action Status	Revised - Continuing in progress
Report of Progress	There has been some progress on this activity. Press releases on the hazard mitigation plan raise awareness. Press releases and activities following disasters such as flooding raised awareness of mitigation and activities that local governments as well as private citizens can do to reduce their vulnerabilities to disasters. The county publicizes road and bridge improvements. This activity would benefit from the development and distribution or posting of brochures on hazard mitigation.

Action 1.4: Obtain and upgrade early warning systems and improved communication systems as funding allows.

Action Worksheet	
Name of Jurisdiction:	Osage County
Risk / Vulnerability	
Problem being Mitigated:	
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Obtain and upgrade early warning systems and improved communication systems.
Action or Project Description:	Obtain and upgrade early warning systems and improved communication systems as funding allows, including tornado sirens and text and phone systems.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	County Commission, EMD
Action/Project Priority:	22 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	New – in Progress
Report of Progress	Osage County has Smart911 available for the public to receive warnings. The county also uses Wireless Emergency Alerts (WEAs). The EMA website shares information on both systems.

Goal 2: Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.

Action 2.1.9 [2.1]: Elevate structures located in the floodplain to be compliant with local flood ordinances as funding allows.

Action Worksheet	
Name of Jurisdiction:	Osage County
Risk / Vulnerability	
Problem being Mitigated:	Risk and vulnerabilities associated with non-elevated structures in the floodplain.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.1.9
Name of Action or Project:	Elevate structures in the floodplain.
Action or Project Description:	Work with property owners to get all structures located in the flood plain in compliance with the county flood ordinance and elevated as necessary.
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$30,000 and up per structure
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, County Commission, EMD
Action/Project Priority:	23 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services, Increased Cost of Compliance grants
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan, county floodplain ordinance
Progress Report	
Action Status	Revised – in Progress
Report of Progress	Osage County floodplain manager notifies those property owners who are required to elevate.

Action 2.2.2 [2.2]: Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.

Action Worksheet	
Name of Jurisdiction:	Osage County
Risk / Vulnerability	
Problem being Mitigated:	Risk and vulnerabilities associated with lack of compliance with NFIP requirements.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.2.2 [2.2]
Name of Action or Project:	NFIP compliance
Action or Project Description:	Continued compliance with NFIP requirements.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$4,000 - \$8,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, County Commission
Action/Project Priority:	24 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services, Increased Cost of Compliance grants
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan, county floodplain ordinance
Progress Report	
Action Status	Continuing – in Progress
Report of Progress	Osage County floodplain manager continues to enforce the floodplain ordinance and provide information to local property owners on the benefits and requirements of the NFIP.

Action 5.2.1 [2.3]: Purchase properties in the floodplain as funds become available and convert that land into open public space.

Action Worksheet	
Name of Jurisdiction:	Osage County
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with floodplain properties
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	5.2.1
Name of Action or Project:	Purchase properties in the floodplain as funds become available and convert that land into public space.
Action or Project Description:	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	County Commission, Floodplain Manager
Action/Project Priority:	22 –High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	No properties have been purchased by the county to date.

Action 6.2.1 [2.4]: Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole

Action Worksheet	
Name of Jurisdiction:	Osage County
Risk / Vulnerability	
Problem being Mitigated:	Lack information/awareness of the benefits of hazard mitigation projects and of cost-share programs with private property owners
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.1 [2.4]
Name of Action or Project:	Program to provide information on benefits of mitigation projects and mitigation cost-share programs.
Action or Project Description:	Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$2,500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	County Commission, EMDs
Action/Project Priority:	25 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard mitigation plan, capital improvement plans, comprehensive plans, strategic plans
Progress Report	
Action Status	Revised - Continuing - in progress
Report of Progress	The county will install a culvert if the individual pays for the culvert to insure that installation is done correctly and the culvert is sized appropriately. The county also publicizes road and bridge projects but could do more to tie those projects to mitigation to raise awareness. This is a program that could benefit from more organized guidelines and focused efforts if additional funding could be secured.

Goal 3: Reduce the potential impact of natural disaster on the continuity of government and essential services.

Action 3.2.3 [3.1]: Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.

Action Worksheet	
Name of Jurisdiction:	Osage County
Risk / Vulnerability	
Problem being Mitigated:	Lack of communication between jurisdictions and related organizations for on-going mitigation planning.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	3.2.3 [3.1]
Name of Action or Project:	Meeting of local jurisdictions to participate in efforts to identify, assess, and prioritize hazard mitigation projects throughout the county, merge hazard mitigation with other plans and projects.
Action or Project Description:	Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.
Applicable Goal Statement:	Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.
Estimated Cost:	\$100 - \$250
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	County Commission, EMD
Action/Project Priority:	28 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, road and bridge capital improvement plans
Progress Report	
Action Status	Revised - Continuing– in progress
Report of Progress	The county EMD regularly meets with jurisdictions and response agencies – routinely as well as following incidents. County commissioners also regularly visit cities in their jurisdiction to discuss issues. More focus will be placed on hazard mitigation planning.

Action 6.3.2 [3.2]: Acquire generators for essential service providers as funding allows.

Action Worksheet	
Name of Jurisdiction:	Osage County
Risk / Vulnerability	
Problem being Mitigated:	Loss of essential services during power outages
Hazard(s) Addressed:	Severe Storm, Tornado, Severe Winter Weather
Action or Project	
Action/Project Number:	6.3.2 [3.2]
Name of Action or Project:	Maintaining power to essential services businesses.
Action or Project Description:	Acquire generators for essential service providers as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$8,000 - \$75,000 per unit
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	County EMD
Action/Project Priority:	23 - High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	No progress.

Action 2.1.2 [3.3]: On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.

Action Worksheet	
Name of Jurisdiction:	Osage County
Risk / Vulnerability	
Problem being Mitigated:	Risks and vulnerabilities of not having updated LEOPs.
Hazard(s) Addressed:	All Hazard
Action or Project	
Action/Project Number:	2.1.2 [3.3]
Name of Action or Project:	Maintaining/updating LEOPs.
Action or Project Description:	On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$100 - \$2,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD
Action/Project Priority:	28 - High Priority
Timeline for Completion:	Annually – on-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	EMD meets regularly with public agencies in the county and at the state level to review and update emergency operations and plans.

Argyle

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Action 1.3.2 [1.1]: Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.

Action Worksheet	
Name of Jurisdiction:	Argyle
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with flooding and inadequate road/bridge structures and impacts on residents and their property.
Hazard(s) Addressed:	Flood, earthquake
Action or Project	
Action/Project Number:	1.3.2 [1.1]
Name of Action or Project:	Road and bridge mitigation
Action or Project Description:	Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables.
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Chair, Board of Trustees, Public Works Department
Action/Project Priority:	23 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Local government capital improvement plans, budgets for road, bridge and utilities
Progress Report	
Action Status	Revised – Continuing
Report of Progress	No progress.

Action 1.3.4 [1.2]: Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.

Action Worksheet	
Name of Jurisdiction:	Argyle
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with nonexistent/inadequate shelters for residents during storm events
Hazard(s) Addressed:	Severe Storm (Hail/Wind) and Tornado
Action or Project	
Action/Project Number:	1.3.4 [1.2]
Name of Action or Project:	Construct storm shelters and tornado safe rooms near areas of high population densities
Action or Project Description:	Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Chair, Board of Trustees, EMD
Action/Project Priority:	22 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised – Continuing
Report of Progress	No progress. The city does not have a FEMA certified tornado shelter or designated shelters of any kind.

Action 6.2.2 [1.3]: Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.

Action Worksheet	
Name of Jurisdiction:	Argyle
Risk / Vulnerability	
Problem being Mitigated:	Lack of knowledge among the general public on the importance / benefit of hazard mitigation projects.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.2 [1.3]
Name of Action or Project:	Public awareness program on hazard mitigation
Action or Project Description:	Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Chair, EMD
Action/Project Priority:	26 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, comprehensive plans, capital improvement plans, strategic plans
Progress Report	
Action Status	Revised - Continuing
Report of Progress	No progress.

Action 1.4: Obtain and upgrade early warning systems and improved communication systems as funding allows.

Action Worksheet	
Name of Jurisdiction:	Argyle
Risk / Vulnerability	
Problem being Mitigated:	
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Obtain and upgrade early warning systems and improved communication systems.
Action or Project Description:	Obtain and upgrade early warning systems and improved communication systems as funding allows, including tornado sirens and text and phone systems.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	County Commission, EMD
Action/Project Priority:	22 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	New – in Progress
Report of Progress	The city has one tornado siren. Osage County has Smart911 available for the public to receive warnings. The county also uses Wireless Emergency Alerts (WEAs). Both are available for resident of Argyle.

Goal 2: Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.

Action 2.1.9 [2.1]: Elevate structures located in the floodplain to be compliant with local flood ordinances as funding allows.

Action Worksheet	
Name of Jurisdiction:	Argyle
Risk / Vulnerability	
Problem being Mitigated:	Risk and vulnerabilities associated with non-elevated structures in the floodplain.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.1.9
Name of Action or Project:	Elevate structures in the floodplain.
Action or Project Description:	Work with property owners to get all structures located in the flood plain in compliance with the county flood ordinance and elevated as necessary.
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$30,000 and up per structure
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, Chair, Board of Trustees
Action/Project Priority:	23 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services, Increased Cost of Compliance grants
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan, floodplain ordinance
Progress Report	
Action Status	Revised – Continuing
Report of Progress	To date, no repetitive loss structures in Argyle have been elevated.

Action 2.2.2 [2.2]: Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.

Action Worksheet	
Name of Jurisdiction:	Argyle
Risk / Vulnerability	
Problem being Mitigated:	Risk and vulnerabilities associated with lack of compliance with NFIP requirements.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.2.2 [2.2]
Name of Action or Project:	NFIP compliance
Action or Project Description:	Continued compliance with NFIP requirements.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$4,000 - \$8,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, County Commission
Action/Project Priority:	24 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services, Increased Cost of Compliance grants
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan, floodplain ordinance
Progress Report	
Action Status	Continuing – in Progress
Report of Progress	The city continues to enforce the floodplain ordinance to remain in compliance with the NFIP but would benefit from a more focused approach to provide information to local property owners on the benefits and requirements of the NFIP.

Action 5.2.1 [2.3]: Purchase properties in the floodplain as funds become available and convert that land into open public space.

Action Worksheet	
Name of Jurisdiction:	Argyle
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with floodplain properties
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	5.2.1
Name of Action or Project:	Purchase properties in the floodplain as funds become available and convert that land into public space.
Action or Project Description:	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Chair, Board of Trustees, Floodplain Manager
Action/Project Priority:	22 –High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	No properties have been purchased by the city to date.

Action 6.2.1 [2.4]: Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole

Action Worksheet	
Name of Jurisdiction:	Argyle
Risk / Vulnerability	
Problem being Mitigated:	Lack information/awareness of the benefits of hazard mitigation projects and of cost-share programs with private property owners
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.1 [2.4]
Name of Action or Project:	Program to provide information on benefits of mitigation projects and mitigation cost-share programs.
Action or Project Description:	Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$2,500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	County Commission, EMDs
Action/Project Priority:	25 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard mitigation plan, capital improvement plans, comprehensive plans, strategic plans
Progress Report	
Action Status	Revised - Continuing
Report of Progress	No progress.

Goal 3: Reduce the potential impact of natural disaster on the continuity of government and essential services.

Action 3.2.3 [3.1]: Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.

Action Worksheet	
Name of Jurisdiction:	Argyle
Risk / Vulnerability	
Problem being Mitigated:	Lack of communication between jurisdictions and related organizations for on-going mitigation planning.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	3.2.3 [3.1]
Name of Action or Project:	Meeting of local jurisdictions to participate in efforts to identify, assess, and prioritize hazard mitigation projects throughout the county, merge hazard mitigation with other plans and projects.
Action or Project Description:	Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.
Applicable Goal Statement:	Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.
Estimated Cost:	\$100 - \$250
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Chair, EMD
Action/Project Priority:	28 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, public works capital improvement plans
Progress Report	
Action Status	Revised - Continuing– in progress
Report of Progress	The county EMD regularly meets with jurisdictions and response agencies – routinely as well as following incidents. More focus will be placed on hazard mitigation planning and the city would benefit from participating in these meetings.

Action 6.3.2 [3.2]: Acquire generators for essential service providers as funding allows.

Action Worksheet	
Name of Jurisdiction:	Argyle
Risk / Vulnerability	
Problem being Mitigated:	Loss of essential services during power outages
Hazard(s) Addressed:	Severe Storm, Tornado, Severe Winter Weather
Action or Project	
Action/Project Number:	6.3.2 [3.2]
Name of Action or Project:	Maintaining power to essential services businesses.
Action or Project Description:	Acquire generators for essential service providers as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$8,000 - \$75,000 per unit
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD, Chair, Board of Trustees
Action/Project Priority:	23 - High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	No progress. The city does not own any generators.

Action 2.1.2 [3.3]: On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.

Action Worksheet	
Name of Jurisdiction:	Argyle
Risk / Vulnerability	
Problem being Mitigated:	Risks and vulnerabilities of not having updated LEOPs.
Hazard(s) Addressed:	All Hazard
Action or Project	
Action/Project Number:	2.1.2 [3.3]
Name of Action or Project:	Maintaining/updating LEOPs.
Action or Project Description:	On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$100 - \$2,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD, Chair
Action/Project Priority:	28 - High Priority
Timeline for Completion:	Annually – on-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	County EMD meets regularly with public agencies in the county and at the state level to review and update emergency operations and plans. The city would benefit from being more involved in these activities.

Chamois

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Action 1.3.2 [1.1]: Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.

Action Worksheet	
Name of Jurisdiction:	Chamois
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with flooding and inadequate road/bridge structures and impacts on residents and their property.
Hazard(s) Addressed:	Flood, earthquake
Action or Project	
Action/Project Number:	1.3.2 [1.1]
Name of Action or Project:	Road and bridge mitigation
Action or Project Description:	Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables.
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, Public Works Department
Action/Project Priority:	23 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Local government capital improvement plans, budgets for road, bridge and utilities
Progress Report	
Action Status	Revised – Not started
Report of Progress	No progress.

Action 1.3.4 [1.2]: Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.

Action Worksheet	
Name of Jurisdiction:	Chamois
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with nonexistent/inadequate shelters for residents during storm events
Hazard(s) Addressed:	Severe Storm (Hail/Wind) and Tornado
Action or Project	
Action/Project Number:	1.3.4 [1.2]
Name of Action or Project:	Construct storm shelters and tornado safe rooms near areas of high population densities
Action or Project Description:	Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	22 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised – Continuing
Report of Progress	No progress. The city does not have a FEMA certified tornado shelter.

Action 6.2.2 [1.3]: Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.

Action Worksheet	
Name of Jurisdiction:	Chamois
Risk / Vulnerability	
Problem being Mitigated:	Lack of knowledge among the general public on the importance / benefit of hazard mitigation projects.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.2 [1.3]
Name of Action or Project:	Public awareness program on hazard mitigation
Action or Project Description:	Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD, Mayor
Action/Project Priority:	26 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, comprehensive plans, capital improvement plans, strategic plans
Progress Report	
Action Status	Revised - Continuing
Report of Progress	There has been no progress on the part of the city. However, press releases on the hazard mitigation plan raise awareness. Press releases and activities following disasters such as flooding raised awareness of mitigation and activities that local governments as well as private citizens can do to reduce their vulnerabilities to disasters. This activity would benefit from the development and distribution or posting of brochures on hazard mitigation.

Action 1.4: Obtain and upgrade early warning systems and improved communication systems as funding allows.

Action Worksheet	
Name of Jurisdiction:	Chamois
Risk / Vulnerability	
Problem being Mitigated:	
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Obtain and upgrade early warning systems and improved communication systems.
Action or Project Description:	Obtain and upgrade early warning systems and improved communication systems as funding allows, including tornado sirens and text and phone systems.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	22 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	New – in Progress
Report of Progress	The city has one tornado siren. In addition, residents can use Osage County's Smart911 and Wireless Emergency Alerts to receive warnings.

Goal 2: Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.

Action 2.1.9 [2.1]: Elevate structures located in the floodplain to be compliant with local flood ordinances as funding allows.

Action Worksheet	
Name of Jurisdiction:	Chamois
Risk / Vulnerability	
Problem being Mitigated:	Risk and vulnerabilities associated with non-elevated structures in the floodplain.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.1.9 [2.1]
Name of Action or Project:	Elevate structures in the floodplain.
Action or Project Description:	Work with property owners to get all structures located in the flood plain in compliance with the county flood ordinance and elevated as necessary.
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$30,000 and up per structure
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, County Commission, EMD
Action/Project Priority:	23 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services, Increased Cost of Compliance grants
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan, floodplain ordinance
Progress Report	
Action Status	Revised – in Progress
Report of Progress	The floodplain manager notifies those property owners who are required to elevate.

Action 2.2.2 [2.2]: Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.

Action Worksheet	
Name of Jurisdiction:	Chamois
Risk / Vulnerability	
Problem being Mitigated:	Risk and vulnerabilities associated with lack of compliance with NFIP requirements.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.2.2 [2.2]
Name of Action or Project:	NFIP compliance
Action or Project Description:	Continued compliance with NFIP requirements.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$4,000 - \$8,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, Mayor, Board of Aldermen
Action/Project Priority:	24 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services, Increased Cost of Compliance grants
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan, city floodplain ordinance
Progress Report	
Action Status	Continuing – in Progress
Report of Progress	The floodplain manager continues to enforce the floodplain ordinance.

Action 5.2.1 [2.3]: Purchase properties in the floodplain as funds become available and convert that land into open public space.

Action Worksheet	
Name of Jurisdiction:	Chamois
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with floodplain properties
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	5.2.1
Name of Action or Project:	Purchase properties in the floodplain as funds become available and convert that land into public space.
Action or Project Description:	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Floodplain Manager, Board of Aldermen
Action/Project Priority:	22 –High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	No properties have been purchased by the city to date.

Action 6.2.1 [2.4]: Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole

Action Worksheet	
Name of Jurisdiction:	Chamois
Risk / Vulnerability	
Problem being Mitigated:	Lack information/awareness of the benefits of hazard mitigation projects and of cost-share programs with private property owners
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.1 [2.4]
Name of Action or Project:	Program to provide information on benefits of mitigation projects and mitigation cost-share programs.
Action or Project Description:	Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$2,500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, EMD
Action/Project Priority:	25 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard mitigation plan, capital improvement plans, comprehensive plans, strategic plans
Progress Report	
Action Status	Revised - Continuing
Report of Progress	The city does not have a cost-share program. This is a program that could benefit from more organized guidelines and focused efforts if additional funding could be secured.

Goal 3: Reduce the potential impact of natural disaster on the continuity of government and essential services.

Action 3.2.3 [3.1]: Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.

Action Worksheet	
Name of Jurisdiction:	Chamois
Risk / Vulnerability	
Problem being Mitigated:	Lack of communication between jurisdictions and related organizations for on-going mitigation planning.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	3.2.3 [3.1]
Name of Action or Project:	Meeting of local jurisdictions to participate in efforts to identify, assess, and prioritize hazard mitigation projects throughout the county, merge hazard mitigation with other plans and projects.
Action or Project Description:	Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.
Applicable Goal Statement:	Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.
Estimated Cost:	\$100 - \$250
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, EMD
Action/Project Priority:	28 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, capital improvement plans
Progress Report	
Action Status	Revised - Continuing– in progress
Report of Progress	The county EMD meets with jurisdictions and response agencies – routinely as well as following incidents. County commissioners also regularly visit cities in their jurisdiction to discuss issues. More focus will be placed on hazard mitigation planning. The city would benefit from becoming more involved in these activities.

Action 6.3.2 [3.2]: Acquire generators for essential service providers as funding allows.

Action Worksheet	
Name of Jurisdiction:	Chamois
Risk / Vulnerability	
Problem being Mitigated:	Loss of essential services during power outages
Hazard(s) Addressed:	Severe Storm, Tornado, Severe Winter Weather
Action or Project	
Action/Project Number:	6.3.2 [3.2]
Name of Action or Project:	Maintaining power to essential services businesses.
Action or Project Description:	Acquire generators for essential service providers as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$8,000 - \$75,000 per unit
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	County EMD
Action/Project Priority:	23 - High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	The city has one portable generator.

Action 2.1.2 [3.3]: On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.

Action Worksheet	
Name of Jurisdiction:	Chamois
Risk / Vulnerability	
Problem being Mitigated:	Risks and vulnerabilities of not having updated LEOPs.
Hazard(s) Addressed:	All Hazard
Action or Project	
Action/Project Number:	2.1.2 [3.3]
Name of Action or Project:	Maintaining/updating LEOPs.
Action or Project Description:	On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$100 - \$2,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD
Action/Project Priority:	28 - High Priority
Timeline for Completion:	Annually – on-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	The County EMD meets regularly with public agencies in the county and at the state level to review and update emergency operations and plans. The city would benefit from participating more in these activities.

Freeburg

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Action 1.3.2 [1.1]: Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.

Action Worksheet	
Name of Jurisdiction:	Freeburg
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with flooding and inadequate road/bridge structures and impacts on residents and their property.
Hazard(s) Addressed:	Flood, earthquake
Action or Project	
Action/Project Number:	1.3.2 [1.1]
Name of Action or Project:	Road and bridge mitigation
Action or Project Description:	Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables.
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Chair, Board of Trustees, Public Works Department
Action/Project Priority:	23 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Local government capital improvement plans, budgets for road, bridge and utilities
Progress Report	
Action Status	Revised – Continuing
Report of Progress	No progress.

Action 1.3.4 [1.2]: Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.

Action Worksheet	
Name of Jurisdiction:	Freeburg
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with nonexistent/inadequate shelters for residents during storm events
Hazard(s) Addressed:	Severe Storm (Hail/Wind) and Tornado
Action or Project	
Action/Project Number:	1.3.4 [1.2]
Name of Action or Project:	Construct storm shelters and tornado safe rooms near areas of high population densities
Action or Project Description:	Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Chair, Board of Trustees, EMD
Action/Project Priority:	22 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised – Continuing
Report of Progress	The city does not currently have any FEMA certified storm shelters. The city does have a designated storm shelter for the community.

Action 6.2.2 [1.3]: Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.

Action Worksheet	
Name of Jurisdiction:	Freeburg
Risk / Vulnerability	
Problem being Mitigated:	Lack of knowledge among the general public on the importance / benefit of hazard mitigation projects.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.2 [1.3]
Name of Action or Project:	Public awareness program on hazard mitigation
Action or Project Description:	Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD
Action/Project Priority:	26 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, comprehensive plans, capital improvement plans, strategic plans
Progress Report	
Action Status	Revised - Continuing in progress
Report of Progress	There has been some progress on this activity. Press releases on the hazard mitigation plan raise awareness. Press releases and activities following disasters such as flooding raised awareness of mitigation and activities that local governments as well as private citizens can do to reduce their vulnerabilities to disasters. This activity would benefit from a more focused approach and the development and distribution or posting of brochures on hazard mitigation.

Action 1.4: Obtain and upgrade early warning systems and improved communication systems as funding allows.

Action Worksheet	
Name of Jurisdiction:	Freeburg
Risk / Vulnerability	
Problem being Mitigated:	
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Obtain and upgrade early warning systems and improved communication systems.
Action or Project Description:	Obtain and upgrade early warning systems and improved communication systems as funding allows, including tornado sirens and text and phone systems.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Chair, Board of Trustees, EMD
Action/Project Priority:	22 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	New – in Progress
Report of Progress	The city has two tornado sirens. Residents are also able to access Osage County's Smart911 and Wireless Emergency Alerts (WEAs).

Goal 2: Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.

Action 6.2.1 [2.4]: Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole

Action Worksheet	
Name of Jurisdiction:	Freeburg
Risk / Vulnerability	
Problem being Mitigated:	Lack information/awareness of the benefits of hazard mitigation projects and of cost-share programs with private property owners
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.1 [2.4]
Name of Action or Project:	Program to provide information on benefits of mitigation projects and mitigation cost-share programs.
Action or Project Description:	Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$2,500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD, Chair, Board of Trustees
Action/Project Priority:	25 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard mitigation plan, capital improvement plans, comprehensive plans, strategic plans
Progress Report	
Action Status	Revised - Continuing
Report of Progress	No progress. The city currently does not have a program in place. This is a program that could benefit from more organized guidelines and focused efforts if additional funding could be secured.

Goal 3: Reduce the potential impact of natural disaster on the continuity of government and essential services.

Action 3.2.3 [3.1]: Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.

Action Worksheet	
Name of Jurisdiction:	Freeburg
Risk / Vulnerability	
Problem being Mitigated:	Lack of communication between jurisdictions and related organizations for on-going mitigation planning.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	3.2.3 [3.1]
Name of Action or Project:	Meeting of local jurisdictions to participate in efforts to identify, assess, and prioritize hazard mitigation projects throughout the county, merge hazard mitigation with other plans and projects.
Action or Project Description:	Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.
Applicable Goal Statement:	Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.
Estimated Cost:	\$100 - \$250
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Chair, Board of Trustees, EMD
Action/Project Priority:	28 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, capital improvement plans
Progress Report	
Action Status	Revised - Continuing– in progress
Report of Progress	The county EMD regularly meets with jurisdictions and response agencies – routinely as well as following incidents. County commissioners also regularly visit cities in their jurisdiction to discuss issues. More focus will be placed on hazard mitigation planning. The city would benefit from participating more in these activities.

Action 6.3.2 [3.2]: Acquire generators for essential service providers as funding allows.

Action Worksheet	
Name of Jurisdiction:	Freeburg
Risk / Vulnerability	
Problem being Mitigated:	Loss of essential services during power outages
Hazard(s) Addressed:	Severe Storm, Tornado, Severe Winter Weather
Action or Project	
Action/Project Number:	6.3.2 [3.2]
Name of Action or Project:	Maintaining power to essential services businesses.
Action or Project Description:	Acquire generators for essential service providers as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$8,000 - \$75,000 per unit
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD, Chair
Action/Project Priority:	23 - High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	The city has one fixed generator.

Action 2.1.2 [3.3]: On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.

Action Worksheet	
Name of Jurisdiction:	Freeburg
Risk / Vulnerability	
Problem being Mitigated:	Risks and vulnerabilities of not having updated LEOPs.
Hazard(s) Addressed:	All Hazard
Action or Project	
Action/Project Number:	2.1.2 [3.3]
Name of Action or Project:	Maintaining/updating LEOPs.
Action or Project Description:	On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$100 - \$2,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD, Chair
Action/Project Priority:	28 - High Priority
Timeline for Completion:	Annually – on-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	EMD meets regularly with public agencies in the county and at the state level to review and update emergency operations and plans. The city would benefit from participating more in these activities.

Linn

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Action 1.3.2 [1.1]: Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.

Action Worksheet	
Name of Jurisdiction:	Linn
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with flooding and inadequate road/bridge structures and impacts on residents and their property.
Hazard(s) Addressed:	Flood, earthquake
Action or Project	
Action/Project Number:	1.3.2 [1.1]
Name of Action or Project:	Road and bridge mitigation
Action or Project Description:	Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables.
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, Public Works Department
Action/Project Priority:	23 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Local government capital improvement plans, budgets for road, bridge and utilities
Progress Report	
Action Status	Revised – Continuing – in progress
Report of Progress	The city and Public Works Department reviews projects and searches for ways to improve by upsizing culverts; moving projects to improve drainage, etc. This program would benefit from a more focused approach to mitigating problem areas in the community.

Action 1.3.4 [1.2]: Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.

Action Worksheet	
Name of Jurisdiction:	Linn
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with nonexistent/inadequate shelters for residents during storm events
Hazard(s) Addressed:	Severe Storm (Hail/Wind) and Tornado
Action or Project	
Action/Project Number:	1.3.4 [1.2]
Name of Action or Project:	Construct storm shelters and tornado safe rooms near areas of high population densities
Action or Project Description:	Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	22 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised – Continuing
Report of Progress	A community certified tornado safe room exists on the campus of State Technical College of Missouri just east of the city. However, the city would benefit from having additional certified shelters at schools and other population dense areas.

Action 6.2.2 [1.3]: Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.

Action Worksheet	
Name of Jurisdiction:	Linn
Risk / Vulnerability	
Problem being Mitigated:	Lack of knowledge among the general public on the importance/benefit of hazard mitigation projects.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.2 [1.3]
Name of Action or Project:	Public awareness program on hazard mitigation
Action or Project Description:	Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD
Action/Project Priority:	26 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, comprehensive plans, capital improvement plans, strategic plans
Progress Report	
Action Status	Revised - Continuing in progress
Report of Progress	There has been some progress on this activity. Press releases on the hazard mitigation plan raise awareness. Press releases and activities following disasters such as flooding raised awareness of mitigation and activities that local governments as well as private citizens can do to reduce their vulnerabilities to disasters. This activity would benefit from the development and distribution or posting of brochures on hazard mitigation.

Action 1.4: Obtain and upgrade early warning systems and improved communication systems as funding allows.

Action Worksheet	
Name of Jurisdiction:	Linn
Risk / Vulnerability	
Problem being Mitigated:	
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Obtain and upgrade early warning systems and improved communication systems.
Action or Project Description:	Obtain and upgrade early warning systems and improved communication systems as funding allows, including tornado sirens and text and phone systems.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	22 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	New – in Progress
Report of Progress	The city has two tornado sirens. Residents can also use Osage County's Smart911 and Wireless Emergency Alerts (WEAs).

Goal 2: Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.

Action 2.1.9 [2.1]: Elevate structures located in the floodplain to be compliant with local flood ordinances as funding allows.

Action Worksheet	
Name of Jurisdiction:	Linn
Risk / Vulnerability	
Problem being Mitigated:	Risk and vulnerabilities associated with non-elevated structures in the floodplain.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.1.9
Name of Action or Project:	Elevate structures in the floodplain.
Action or Project Description:	Work with property owners to get all structures located in the flood plain in compliance with the county flood ordinance and elevated as necessary.
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$30,000 and up per structure
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, Mayor, Board of Aldermen
Action/Project Priority:	23 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services, Increased Cost of Compliance grants
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan, floodplain ordinance
Progress Report	
Action Status	Revised – in Progress
Report of Progress	The floodplain manager notifies those property owners who are required to elevate.

Action 2.2.2 [2.2]: Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.

Action Worksheet	
Name of Jurisdiction:	Linn
Risk / Vulnerability	
Problem being Mitigated:	Risk and vulnerabilities associated with lack of compliance with NFIP requirements.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.2.2 [2.2]
Name of Action or Project:	NFIP compliance
Action or Project Description:	Continued compliance with NFIP requirements.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$4,000 - \$8,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, Mayor, Board of Aldermen
Action/Project Priority:	24 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services, Increased Cost of Compliance grants
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan, floodplain ordinance
Progress Report	
Action Status	Continuing – in Progress
Report of Progress	The floodplain manager continues to enforce the floodplain ordinance and provide information to local property owners on the benefits and requirements of the NFIP.

Action 5.2.1 [2.3]: Purchase properties in the floodplain as funds become available and convert that land into open public space.

Action Worksheet	
Name of Jurisdiction:	Linn
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with floodplain properties
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	5.2.1
Name of Action or Project:	Purchase properties in the floodplain as funds become available and convert that land into public space.
Action or Project Description:	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, Mayor, Board of Aldermen
Action/Project Priority:	22 –High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	No properties have been purchased by the city to date.

Action 6.2.1 [2.4]: Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole

Action Worksheet	
Name of Jurisdiction:	Linn
Risk / Vulnerability	
Problem being Mitigated:	Lack information/awareness of the benefits of hazard mitigation projects and of cost-share programs with private property owners
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.1 [2.4]
Name of Action or Project:	Program to provide information on benefits of mitigation projects and mitigation cost-share programs.
Action or Project Description:	Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$2,500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMDs
Action/Project Priority:	25 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard mitigation plan, capital improvement plans, comprehensive plans, strategic plans
Progress Report	
Action Status	Revised - Continuing - in progress
Report of Progress	The city does not currently have a cost-share program for mitigation projects done by residents. This is a program that could benefit from more organized guidelines and focused efforts to raise awareness if additional funding could be secured.

Goal 3: Reduce the potential impact of natural disaster on the continuity of government and essential services.

Action 3.2.3 [3.1]: Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.

Action Worksheet	
Name of Jurisdiction:	Linn
Risk / Vulnerability	
Problem being Mitigated:	Lack of communication between jurisdictions and related organizations for on-going mitigation planning.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	3.2.3 [3.1]
Name of Action or Project:	Meeting of local jurisdictions to participate in efforts to identify, assess, and prioritize hazard mitigation projects throughout the county, merge hazard mitigation with other plans and projects.
Action or Project Description:	Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.
Applicable Goal Statement:	Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.
Estimated Cost:	\$100 - \$250
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	28 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, road and bridge capital improvement plans
Progress Report	
Action Status	Revised - Continuing– in progress
Report of Progress	The county EMD regularly meets with jurisdictions and response agencies – routinely as well as following incidents. County commissioners also regularly visit cities in their jurisdiction to discuss issues. More focus will be placed on hazard mitigation planning. The city would benefit from participating more in these meetings.

Action 6.3.2 [3.2]: Acquire generators for essential service providers as funding allows.

Action Worksheet	
Name of Jurisdiction:	Linn
Risk / Vulnerability	
Problem being Mitigated:	Loss of essential services during power outages
Hazard(s) Addressed:	Severe Storm, Tornado, Severe Winter Weather
Action or Project	
Action/Project Number:	6.3.2 [3.2]
Name of Action or Project:	Maintaining power to essential services businesses.
Action or Project Description:	Acquire generators for essential service providers as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$8,000 - \$75,000 per unit
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD
Action/Project Priority:	23 - High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	The city has two generators.

Action 2.1.2 [3.3]: On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.

Action Worksheet	
Name of Jurisdiction:	Linn
Risk / Vulnerability	
Problem being Mitigated:	Risks and vulnerabilities of not having updated LEOPs.
Hazard(s) Addressed:	All Hazard
Action or Project	
Action/Project Number:	2.1.2 [3.3]
Name of Action or Project:	Maintaining/updating LEOPs.
Action or Project Description:	On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$100 - \$2,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD
Action/Project Priority:	28 - High Priority
Timeline for Completion:	Annually – on-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	The County EMD meets regularly with public agencies in the county and at the state level to review and update emergency operations and plans. The city would benefit from participating more in these activities.

Meta

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Action 1.3.2 [1.1]: Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.

Action Worksheet	
Name of Jurisdiction:	Meta
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with flooding and inadequate road/bridge structures and impacts on residents and their property.
Hazard(s) Addressed:	Flood, earthquake
Action or Project	
Action/Project Number:	1.3.2 [1.1]
Name of Action or Project:	Road and bridge mitigation
Action or Project Description:	Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables.
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, Public Works Department
Action/Project Priority:	23 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Local government capital improvement plans, budgets for road, bridge and utilities
Progress Report	
Action Status	Revised – Continuing – in progress
Report of Progress	The public works department searches for ways to improve drainage when doing street and bridge work. This program would benefit from a more focused approach to including mitigation in projects.

Action 1.3.4 [1.2]: Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.

Action Worksheet	
Name of Jurisdiction:	Meta
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with nonexistent/inadequate shelters for residents during storm events
Hazard(s) Addressed:	Severe Storm (Hail/Wind) and Tornado
Action or Project	
Action/Project Number:	1.3.4 [1.2]
Name of Action or Project:	Construct storm shelters and tornado safe rooms near areas of high population densities
Action or Project Description:	Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	22 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised – Continuing
Report of Progress	The city does not have a FEMA certified tornado shelter. The city would benefit from having certified shelters at population dense employers.

Action 6.2.2 [1.3]: Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.

Action Worksheet	
Name of Jurisdiction:	Meta
Risk / Vulnerability	
Problem being Mitigated:	Lack of knowledge among the general public on the importance / benefit of hazard mitigation projects.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.2 [1.3]
Name of Action or Project:	Public awareness program on hazard mitigation
Action or Project Description:	Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD
Action/Project Priority:	26 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, comprehensive plans, capital improvement plans, strategic plans
Progress Report	
Action Status	Revised - Continuing in progress
Report of Progress	There has been some progress on this activity. Press releases on the hazard mitigation plan raise awareness. Press releases and activities following disasters such as flooding raised awareness of mitigation and activities that local governments as well as private citizens can do to reduce their vulnerabilities to disasters. This activity would benefit from the development and distribution or posting of brochures on hazard mitigation.

Action 1.4: Obtain and upgrade early warning systems and improved communication systems as funding allows.

Action Worksheet	
Name of Jurisdiction:	Meta
Risk / Vulnerability	
Problem being Mitigated:	
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Obtain and upgrade early warning systems and improved communication systems.
Action or Project Description:	Obtain and upgrade early warning systems and improved communication systems as funding allows, including tornado sirens and text and phone systems.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	22 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	New – in Progress
Report of Progress	The city has one tornado siren. Residents are able to use Osage County's Smart911 and Wireless Emergency Alerts (WEAs).

Goal 2: Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.

Action 2.1.9 [2.1]: Elevate structures located in the floodplain to be compliant with local flood ordinances as funding allows.

Action Worksheet	
Name of Jurisdiction:	Meta
Risk / Vulnerability	
Problem being Mitigated:	Risk and vulnerabilities associated with non-elevated structures in the floodplain.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.1.9 [2.1]
Name of Action or Project:	Elevate structures in the floodplain.
Action or Project Description:	Work with property owners to get all structures located in the flood plain in compliance with the county flood ordinance and elevated as necessary.
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$30,000 and up per structure
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, Mayor
Action/Project Priority:	23 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services, Increased Cost of Compliance grants
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan, county floodplain ordinance
Progress Report	
Action Status	Revised – Continuing
Report of Progress	The city contracts with a floodplain management coordinator who notifies those property owners who are required to elevate.

Action 2.2.2 [2.2]: Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.

Action Worksheet	
Name of Jurisdiction:	Meta
Risk / Vulnerability	
Problem being Mitigated:	Risk and vulnerabilities associated with lack of compliance with NFIP requirements.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.2.2 [2.2]
Name of Action or Project:	NFIP compliance
Action or Project Description:	Continued compliance with NFIP requirements.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$4,000 - \$8,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, Mayor
Action/Project Priority:	24 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services, Increased Cost of Compliance grants
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan, county floodplain ordinance
Progress Report	
Action Status	Continuing – in Progress
Report of Progress	The floodplain manager and coordinator continue to enforce the floodplain ordinance and provide information to local property owners on the benefits and requirements of the NFIP. Press releases are distributed annually and brochures are made available at city hall and the local bank.

Action 5.2.1 [2.3]: Purchase properties in the floodplain as funds become available and convert that land into open public space.

Action Worksheet	
Name of Jurisdiction:	Meta
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with floodplain properties
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	5.2.1 [2.3]
Name of Action or Project:	Purchase properties in the floodplain as funds become available and convert that land into public space.
Action or Project Description:	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Floodplain Manager
Action/Project Priority:	22 –High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	No properties have been purchased by the city to date.

Action 6.2.1 [2.4]: Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole

Action Worksheet	
Name of Jurisdiction:	Meta
Risk / Vulnerability	
Problem being Mitigated:	Lack information/awareness of the benefits of hazard mitigation projects and of cost-share programs with private property owners
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.1 [2.4]
Name of Action or Project:	Program to provide information on benefits of mitigation projects and mitigation cost-share programs.
Action or Project Description:	Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$2,500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	25 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard mitigation plan, capital improvement plans, comprehensive plans, strategic plans
Progress Report	
Action Status	Revised - Continuing - in progress
Report of Progress	This is a program that could benefit from the development of a cost-share program and more awareness activities on hazard mitigation benefits if additional funding could be secured.

Goal 3: Reduce the potential impact of natural disaster on the continuity of government and essential services.

Action 3.2.3 [3.1]: Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.

Action Worksheet	
Name of Jurisdiction:	Meta
Risk / Vulnerability	
Problem being Mitigated:	Lack of communication between jurisdictions and related organizations for on-going mitigation planning.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	3.2.3 [3.1]
Name of Action or Project:	Meeting of local jurisdictions to participate in efforts to identify, assess, and prioritize hazard mitigation projects throughout the county, merge hazard mitigation with other plans and projects.
Action or Project Description:	Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.
Applicable Goal Statement:	Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.
Estimated Cost:	\$100 - \$250
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	28 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, road and bridge capital improvement plans
Progress Report	
Action Status	Revised - Continuing– in progress
Report of Progress	The county EMD regularly meets with jurisdictions and response agencies – routinely as well as following incidents. County commissioners also regularly visit cities in their jurisdiction to discuss issues. More focus will be placed on hazard mitigation planning. The city would benefit from participating more in these activities.

Action 6.3.2 [3.2]: Acquire generators for essential service providers as funding allows.

Action Worksheet	
Name of Jurisdiction:	Meta
Risk / Vulnerability	
Problem being Mitigated:	Loss of essential services during power outages
Hazard(s) Addressed:	Severe Storm, Tornado, Severe Winter Weather
Action or Project	
Action/Project Number:	6.3.2 [3.2]
Name of Action or Project:	Maintaining power to essential services businesses.
Action or Project Description:	Acquire generators for essential service providers as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$8,000 - \$75,000 per unit
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	23 - High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	The city does not have any generators.

Action 2.1.2 [3.3]: On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.

Action Worksheet	
Name of Jurisdiction:	Meta
Risk / Vulnerability	
Problem being Mitigated:	Risks and vulnerabilities of not having updated LEOPs.
Hazard(s) Addressed:	All Hazard
Action or Project	
Action/Project Number:	2.1.2 [3.3]
Name of Action or Project:	Maintaining/updating LEOPs.
Action or Project Description:	On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$100 - \$2,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD, Mayor
Action/Project Priority:	28 - High Priority
Timeline for Completion:	Annually – on-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	The County EMD meets regularly with public agencies in the county and at the state level to review and update emergency operations and plans. The city would benefit from participating more in these activities.

Westphalia

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Action 1.3.2 [1.1]: Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.

Action Worksheet	
Name of Jurisdiction:	Westphalia
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with flooding and inadequate road/bridge structures and impacts on residents and their property.
Hazard(s) Addressed:	Flood, earthquake
Action or Project	
Action/Project Number:	1.3.2 [1.1]
Name of Action or Project:	Road and bridge mitigation
Action or Project Description:	Complete road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows. This includes culvert upgrades and replacements as well as elevating roads and improving bridges and low water crossings.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables.
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, Public Works Department
Action/Project Priority:	23 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Local government capital improvement plans, budgets for road, bridge and utilities
Progress Report	
Action Status	Revised – Continuing – in progress
Report of Progress	The Public Works Department searches for ways to improve projects to improve drainage. This activity would benefit from a more focused approach to mitigation.

Action 1.3.4 [1.2]: Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.

Action Worksheet	
Name of Jurisdiction:	Westphalia
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with nonexistent/inadequate shelters for residents during storm events
Hazard(s) Addressed:	Severe Storm (Hail/Wind) and Tornado
Action or Project	
Action/Project Number:	1.3.4 [1.2]
Name of Action or Project:	Construct storm shelters and tornado safe rooms near areas of high population densities
Action or Project Description:	Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	22 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised – Continuing
Report of Progress	No progress. There are no FEMA certified tornado safe rooms in Westphalia. The City would benefit from having certified shelters at schools and large employers facilities.

Action 6.2.2 [1.3]: Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.

Action Worksheet	
Name of Jurisdiction:	Westphalia
Risk / Vulnerability	
Problem being Mitigated:	Lack of knowledge among the general public on the importance / benefit of hazard mitigation projects.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.2 [1.3]
Name of Action or Project:	Public awareness program on hazard mitigation
Action or Project Description:	Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook, including changes to mitigation policy to keep the public aware of changes and/or new regulations.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD, Mayor
Action/Project Priority:	26 - High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, capital improvement plans
Progress Report	
Action Status	Revised - Continuing in progress
Report of Progress	There has been some progress on this activity. Press releases on the hazard mitigation plan raise awareness. Press releases and activities following disasters such as flooding raised awareness of mitigation and activities that local governments as well as private citizens can do to reduce their vulnerabilities to disasters. This activity would benefit from the development and distribution or posting of brochures on hazard mitigation.

Action 1.4: Obtain and upgrade early warning systems and improved communication systems as funding allows.

Action Worksheet	
Name of Jurisdiction:	Westphalia
Risk / Vulnerability	
Problem being Mitigated:	
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Obtain and upgrade early warning systems and improved communication systems.
Action or Project Description:	Obtain and upgrade early warning systems and improved communication systems as funding allows, including tornado sirens and text and phone systems.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	22 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	New – in Progress
Report of Progress	The city has one tornado siren. Residents can use Osage County's Smart911 and Wireless Emergency Alerts (WEAs).

Goal 2: Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.

Action 2.1.9 [2.1]: Elevate structures located in the floodplain to be compliant with local flood ordinances as funding allows.

Action Worksheet	
Name of Jurisdiction:	Westphalia
Risk / Vulnerability	
Problem being Mitigated:	Risk and vulnerabilities associated with non-elevated structures in the floodplain.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.1.9
Name of Action or Project:	Elevate structures in the floodplain.
Action or Project Description:	Work with property owners to get all structures located in the flood plain in compliance with the county flood ordinance and elevated as necessary.
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$30,000 and up per structure
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, Mayor
Action/Project Priority:	23 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services, Increased Cost of Compliance grants
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan, county floodplain ordinance
Progress Report	
Action Status	Revised – in Progress
Report of Progress	In the past five years the city has required one business to elevate a structure in the floodplain.

Action 2.2.2 [2.2]: Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.

Action Worksheet	
Name of Jurisdiction:	Westphalia
Risk / Vulnerability	
Problem being Mitigated:	Risk and vulnerabilities associated with lack of compliance with NFIP requirements.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.2.2 [2.2]
Name of Action or Project:	NFIP compliance
Action or Project Description:	Continued compliance with NFIP requirements.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	\$4,000 - \$8,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Manager, Mayor
Action/Project Priority:	24 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services, Increased Cost of Compliance grants
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan, county floodplain ordinance
Progress Report	
Action Status	Continuing – in Progress
Report of Progress	The floodplain manager continues to enforce the floodplain ordinance and provide information to local property owners on the benefits and requirements of the NFIP.

Action 5.2.1 [2.3]: Purchase properties in the floodplain as funds become available and convert that land into open public space.

Action Worksheet	
Name of Jurisdiction:	Westphalia
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with floodplain properties
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	5.2.1 [2.3]
Name of Action or Project:	Purchase properties in the floodplain as funds become available and convert that land into public space.
Action or Project Description:	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, Floodplain Manager
Action/Project Priority:	22 –High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	No properties have been purchased by the city in the past five years.

Action 6.2.1 [2.4]: Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole

Action Worksheet	
Name of Jurisdiction:	Westphalia
Risk / Vulnerability	
Problem being Mitigated:	Lack information/awareness of the benefits of hazard mitigation projects and of cost-share programs with private property owners
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	6.2.1 [2.4]
Name of Action or Project:	Program to provide information on benefits of mitigation projects and mitigation cost-share programs.
Action or Project Description:	Provide information on the benefits of local governments budgeting for and implementing both hazard mitigation projects and cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole
Applicable Goal Statement:	Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.
Estimated Cost:	\$2,500 - \$5,500
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, EMD
Action/Project Priority:	25 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard mitigation plan, capital improvement plans, comprehensive plans, strategic plans
Progress Report	
Action Status	Revised - Continuing - in progress
Report of Progress	The city could do more to publicize mitigation activities to raise awareness. This is a program that could benefit from more organized guidelines and focused efforts if additional funding could be secured.

Goal 3: Reduce the potential impact of natural disaster on the continuity of government and essential services.

Action 3.2.3 [3.1]: Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.

Action Worksheet	
Name of Jurisdiction:	Westphalia
Risk / Vulnerability	
Problem being Mitigated:	Lack of communication between jurisdictions and related organizations for on-going mitigation planning.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	3.2.3 [3.1]
Name of Action or Project:	Meeting of local jurisdictions to participate in efforts to identify, assess, and prioritize hazard mitigation projects throughout the county, merge hazard mitigation with other plans and projects.
Action or Project Description:	Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.
Applicable Goal Statement:	Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.
Estimated Cost:	\$100 - \$250
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor, Board of Aldermen, EMD
Action/Project Priority:	28 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, road and bridge capital improvement plans
Progress Report	
Action Status	Revised - Continuing– in progress
Report of Progress	The county EMD regularly meets with jurisdictions and response agencies – routinely as well as following incidents. County commissioners also regularly visit cities in their jurisdiction to discuss issues. More focus will be placed on hazard mitigation planning. The city would benefit from participating more in these activities.

Action 6.3.2 [3.2]: Acquire generators for essential service providers as funding allows.

Action Worksheet	
Name of Jurisdiction:	Westphalia
Risk / Vulnerability	
Problem being Mitigated:	Loss of essential services during power outages
Hazard(s) Addressed:	Severe Storm, Tornado, Severe Winter Weather
Action or Project	
Action/Project Number:	6.3.2 [3.2]
Name of Action or Project:	Maintaining power to essential services businesses.
Action or Project Description:	Acquire generators for essential service providers as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$8,000 - \$75,000 per unit
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	County EMD
Action/Project Priority:	23 - High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	The city has one portable generator for use at the sewer plant.

Action 2.1.2 [3.3]: On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.

Action Worksheet	
Name of Jurisdiction:	Westphalia
Risk / Vulnerability	
Problem being Mitigated:	Risks and vulnerabilities of not having updated LEOPs.
Hazard(s) Addressed:	All Hazard
Action or Project	
Action/Project Number:	2.1.2 [3.3]
Name of Action or Project:	Maintaining/updating LEOPs.
Action or Project Description:	On an annual basis, the EMD will coordinate with other public agencies to hold a meeting to evaluate and update emergency operation plans.
Applicable Goal Statement:	Reduce the potential impact of natural disaster on the continuity of government and essential services.
Estimated Cost:	\$100 - \$2,000
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	EMD
Action/Project Priority:	28 - High Priority
Timeline for Completion:	Annually – on-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Revised - Continuing
Report of Progress	The county EMD meets regularly with public agencies in the county and at the state level to review and update emergency operations and plans. The city would benefit from participating more in these activities.

Osage County R-I:

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Action 1.3.4 [1.2]: Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.

Action Worksheet	
Name of Jurisdiction:	Osage County R-I
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with nonexistent/inadequate shelters for residents during storm events
Hazard(s) Addressed:	Severe Storm (Hail/Wind) and Tornado
Action or Project	
Action/Project Number:	1.3.4 [1.2]
Name of Action or Project:	Construct storm shelters and tornado safe rooms near areas of high population densities
Action or Project Description:	Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Superintendent, School Board
Action/Project Priority:	22 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, School Emergency Plan
Progress Report	
Action Status	Revised – Continuing – No Progress
Report of Progress	The school district does not currently have a FEMA certified storm shelter.

Action 1.4: Obtain and upgrade early warning systems and improved communication systems as funding allows.

Action Worksheet	
Name of Jurisdiction:	Osage County R-I
Risk / Vulnerability	
Problem being Mitigated:	Risks and vulnerabilities associated with the lack of adequate early warning and communication systems.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Obtain and upgrade early warning systems and improved communication systems.
Action or Project Description:	Obtain and upgrade early warning systems and improved communication systems as funding allows, including tornado sirens and text and phone systems.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Superintendent, School Board
Action/Project Priority:	22 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, School Emergency Plan
Progress Report	
Action Status	New – in Progress
Report of Progress	Osage County R-I has an intercom system to use within the school and a weather radio. The school also shares information through its website. The district would benefit from a phone/text messaging system to communicate with parents. The County has Smart911 available for the public to receive warnings. The county also uses Wireless Emergency Alerts (WEAs).

Goal 3: Reduce the potential impact of natural disaster on the continuity of government and essential services.

Action 3.2.3 [3.1]: Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.

Action Worksheet	
Name of Jurisdiction:	Osage County R-I
Risk / Vulnerability	
Problem being Mitigated:	Lack of communication between jurisdictions and related organizations for on-going mitigation planning.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	3.2.3 [3.1]
Name of Action or Project:	Meeting of local jurisdictions to participate in efforts to identify, assess, and prioritize hazard mitigation projects throughout the county, merge hazard mitigation with other plans and projects.
Action or Project Description:	Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.
Applicable Goal Statement:	Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.
Estimated Cost:	\$100 - \$250
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	28 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, school budget
Progress Report	
Action Status	Revised - Continuing– in progress
Report of Progress	The county EMD regularly meets with jurisdictions and response agencies – routinely as well as following incidents. More focus will be placed on hazard mitigation planning and the school would benefit from participating.

Osage County R-II:

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Action 1.3.4 [1.2]: Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.

Action Worksheet	
Name of Jurisdiction:	Osage County R-II
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with nonexistent/inadequate shelters for residents during storm events
Hazard(s) Addressed:	Severe Storm (Hail/Wind) and Tornado
Action or Project	
Action/Project Number:	1.3.4 [1.2]
Name of Action or Project:	Construct storm shelters and tornado safe rooms near areas of high population densities
Action or Project Description:	Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Superintendent, School Board
Action/Project Priority:	22 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, School Emergency Plan
Progress Report	
Action Status	Revised – Continuing – No Progress
Report of Progress	The school district does not currently have a FEMA certified storm shelter.

Action 1.4: Obtain and upgrade early warning systems and improved communication systems as funding allows.

Action Worksheet	
Name of Jurisdiction:	Osage County R-II
Risk / Vulnerability	
Problem being Mitigated:	Risks and vulnerabilities associated with the lack of adequate early warning and communication systems.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Obtain and upgrade early warning systems and improved communication systems.
Action or Project Description:	Obtain and upgrade early warning systems and improved communication systems as funding allows, including tornado sirens and text and phone systems.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Superintendent, School Board
Action/Project Priority:	22 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, School Emergency Plan
Progress Report	
Action Status	New – in Progress
Report of Progress	Osage County R-II has an intercom system to use within the school. The district would benefit from a phone/text messaging system to communicate with parents. The County has Smart911 available for the public to receive warnings. The county also uses Wireless Emergency Alerts (WEAs).

Goal 3: Reduce the potential impact of natural disaster on the continuity of government and essential services.

Action 3.2.3 [3.1]: Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.

Action Worksheet	
Name of Jurisdiction:	Osage County R-II
Risk / Vulnerability	
Problem being Mitigated:	Lack of communication between jurisdictions and related organizations for on-going mitigation planning.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	3.2.3 [3.1]
Name of Action or Project:	Meeting of local jurisdictions to participate in efforts to identify, assess, and prioritize hazard mitigation projects throughout the county, merge hazard mitigation with other plans and projects.
Action or Project Description:	Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.
Applicable Goal Statement:	Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.
Estimated Cost:	\$100 - \$250
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	28 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, school budget
Progress Report	
Action Status	Revised - Continuing– in progress
Report of Progress	The county EMD regularly meets with jurisdictions and response agencies – routinely as well as following incidents. More focus will be placed on hazard mitigation planning and the school would benefit from participating.

Osage County R-III:

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Action 1.3.4 [1.2]: Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.

Action Worksheet	
Name of Jurisdiction:	Osage County R-III
Risk / Vulnerability	
Problem being Mitigated:	Risks/vulnerabilities associated with nonexistent/inadequate shelters for residents during storm events
Hazard(s) Addressed:	Severe Storm (Hail/Wind) and Tornado
Action or Project	
Action/Project Number:	1.3.4 [1.2]
Name of Action or Project:	Construct storm shelters and tornado safe rooms near areas of high population densities
Action or Project Description:	Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown due to variables
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Superintendent, School Board
Action/Project Priority:	22 – High Priority
Timeline for Completion:	1 – 10 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, School Emergency Plan
Progress Report	
Action Status	Revised – Continuing – No Progress
Report of Progress	The school district does not currently have a FEMA certified storm shelter.

Action 1.4: Obtain and upgrade early warning systems and improved communication systems as funding allows.

Action Worksheet	
Name of Jurisdiction:	Osage County R-III
Risk / Vulnerability	
Problem being Mitigated:	Risks and vulnerabilities associated with the lack of adequate early warning and communication systems.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Obtain and upgrade early warning systems and improved communication systems.
Action or Project Description:	Obtain and upgrade early warning systems and improved communication systems as funding allows, including tornado sirens and text and phone systems.
Applicable Goal Statement:	Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.
Estimated Cost:	Unknown
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damage, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Superintendent, School Board
Action/Project Priority:	22 - High Priority
Timeline for Completion:	1 – 5 years
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, School Emergency Plan
Progress Report	
Action Status	New – in Progress
Report of Progress	Osage County R-III has an intercom system to use within the school and a system to contact parents and students via email phone/text. The County has Smart911 available for the public to receive warnings. The county also uses Wireless Emergency Alerts (WEAs).

Goal 3: Reduce the potential impact of natural disaster on the continuity of government and essential services.

Action 3.2.3 [3.1]: Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.

Action Worksheet	
Name of Jurisdiction:	Osage County R-III
Risk / Vulnerability	
Problem being Mitigated:	Lack of communication between jurisdictions and related organizations for on-going mitigation planning.
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	3.2.3 [3.1]
Name of Action or Project:	Meeting of local jurisdictions to participate in efforts to identify, assess, and prioritize hazard mitigation projects throughout the county, merge hazard mitigation with other plans and projects.
Action or Project Description:	Local jurisdictions will meet with SEMA and local EMDs to identify, assess and prioritize hazard mitigation projects throughout the county; merge hazard mitigation action items with other plan documents such as capital improvement and comprehensive plans; and look for ways to include hazard mitigation in economic development projects.
Applicable Goal Statement:	Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.
Estimated Cost:	\$100 - \$250
Benefits:	Losses avoided by implementing this action include injuries and/or casualties, property damages, loss-of-function/displacement impacts, and emergency management costs/community costs.
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	28 – High Priority
Timeline for Completion:	On-going
Potential Fund Sources:	Grants, local general revenue funds, and private donations of cash, goods, or services.
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan, school budget
Progress Report	
Action Status	Revised - Continuing– in progress
Report of Progress	The county EMD regularly meets with jurisdictions and response agencies – routinely as well as following incidents. More focus will be placed on hazard mitigation planning and the school would benefit from participating.

5 PLAN MAINTENANCE PROCESS

5 PLAN MAINTENANCE PROCESS5.1

5.1 Monitoring, Evaluating, and Updating the Plan..... 5.1

5.1.1 Responsibility for Plan Maintenance 5.1

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5.3 Continued Public Involvement 5.7

This chapter 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

Periodic revisions and updates of the Plan are required by Missouri SEMA to ensure that the goals and objectives for Osage County are kept current. More importantly, revisions may be necessary to ensure the plan is in full compliance with Federal regulations and state statutes. This portion of the plan outlines the procedures for completing such revisions and updates.

A key component of the ongoing plan monitoring, evaluating and updating will be the Osage County Hazard Mitigation Planning Committee (MPC). In order to carry out the activities necessary for maintaining the plan, the MPC will need to remain in place and meet periodically. The coordination of this group, as indicated in the mitigation strategy, should be a responsibility of the county EMD. On-going activities of the MPC are:

- 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 Board of Supervisors and governing bodies of participating jurisdictions; and
- Inform and solicit input from the public.

The MPC (or other designated responsible entity) 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 (or other designated responsible entity) agrees to meet annually and after a state or federally declared hazard event, as appropriate, to monitor progress and update the mitigation strategy. The Osage County Emergency Management Director will be responsible for initiating the plan reviews and will invite members of the MPC (or other designated responsible entity) to the meeting.

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 in the plan. The MPC (or other designated responsible entity) 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 (or designated responsible entity) 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 (or designated responsible entity) 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 (or designated responsible entity) deems appropriate and necessary. Changes will be approved by the Osage County Hazard Mitigation Planning Committee 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. Additionally, as jurisdictions review and update existing planning mechanisms, relevant action items and data from the HMP will be integrated. Those existing plans and programs were described in **Section 2.2** of this plan. Based on the capability assessments of the participating jurisdictions, communities in Osage County will continue to plan and implement programs to reduce losses to life and property from hazards. 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:

- Regional Comprehensive Economic Development Strategy (CEDS) document
- General or master plans of participating jurisdictions;
- Ordinances of participating jurisdictions;
- Osage County Local Emergency Operations Plan (LEOP);
- Capital improvement plans and budgets;
- Other community plans within 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 Chapter 2 of this plan.

The MPC (or designated responsible entity) 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 (or designated responsible entity) 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 Osage County Emergency Management Director (EMD) will provide the updated Mitigation Strategy with current status of each mitigation action to the County (Boards of Supervisors or Commissions) as well as all Mayors, City Clerks, and School District Superintendents. The EMD 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 Osage County	County Emergency Operations Plan County Mitigation Plan Regional Transportation Plan Comprehensive Economic Development Strategy Construction/Road & Bridge Budget	Hazard Mitigation action items were incorporated into the regional CEDS and Regional Transportation Plan by MRPC. EMD was encouraged to incorporate hazard mitigation into LEOP where applicable.	County Commission and road and bridge supervisors incorporating hazard mitigation projects into budgets and future road and bridge improvements. EMD will review LEOP again and incorporate hazard mitigation updates where applicable. CEDS and Regional Transportation Plan will be reviewed to update with revised action items.
Argyle	Comprehensive Plan Capital Improvement Plan City Emergency Operation Plan County Emergency Operations Plan County Mitigation Plan Regional Transportation Plan Comprehensive Economic Development Strategy	Hazard Mitigation action items were incorporated into the regional CEDS and Regional Transportation Plan by MRPC. EMD was encouraged to incorporate hazard mitigation into LEOP where applicable.	Mayor, Board Members will work toward incorporating hazard mitigation projects into Comprehensive Plan, Capital Improvement Plan, city budget where possible and future public works improvements. EMD will review City Emergency Operations Plan and incorporate hazard mitigation updates where applicable. CEDS and Regional Transportation

Jurisdiction	Planning Mechanisms	Integration Process for Previous Plan	Integration Process for Current Plan
			Plan will be reviewed to update with revised action items.
Chamois	Emergency Operations Plan (part of county) County Mitigation Plan Regional Transportation Plan Comprehensive Economic Development Strategy Public Works Construction Budget	Hazard Mitigation action items were incorporated into the regional CEDS and Regional Transportation Plan by MRPC. City EMD was encouraged to incorporate hazard mitigation into LEOP where applicable.	Mayor, Aldermen, and public works department will work toward incorporating hazard mitigation projects into city budget where possible and future public works improvements. EMD will review LEOP again and incorporate hazard mitigation updates where applicable. CEDS and Regional Transportation Plan will be reviewed to update with revised action items.
Freeburg	Emergency Operations Plan (part of county) County Mitigation Plan Regional Transportation Plan Comprehensive Economic Development Strategy	Hazard Mitigation action items were incorporated into the regional CEDS and Regional Transportation Plan by MRPC. EMD was encouraged to incorporate hazard mitigation into LEOP where applicable.	Chairman and Trustee will work toward incorporating hazard mitigation projects into city budget where possible and future public works improvements. EMD will review LEOP again and incorporate hazard mitigation updates where applicable. CEDS and Regional Transportation Plan will be reviewed to update with revised action items.
Linn	Emergency Operations Plan (part of county) County Mitigation Plan Regional Transportation Plan Comprehensive Economic Development Strategy Public Works Construction Budget	Hazard Mitigation action items were incorporated into the regional CEDS and Regional Transportation Plan by MRPC. EMD was encouraged to incorporate hazard mitigation into LEOP where applicable.	Mayor, Aldermen, public works department will work toward incorporating hazard mitigation projects into city budget where possible and future public works improvements. The EMD will review LEOP again and incorporate hazard mitigation updates where applicable. CEDS and Regional Transportation Plan will be reviewed to update with

Jurisdiction	Planning Mechanisms	Integration Process for Previous Plan	Integration Process for Current Plan
			revised action items.
Meta	City Emergency Operation Plan Emergency Operations Plan (part of county) County Mitigation Plan Regional Transportation Plan Comprehensive Economic Development Strategy	Hazard Mitigation action items were incorporated into the regional CEDS and Regional Transportation Plan by MRPC. EMD was encouraged to incorporate hazard mitigation into LEOP where applicable.	Mayor and City Council will work toward incorporating hazard mitigation projects into city budget where possible and future public works improvements. EMD will review LEOP and incorporate hazard mitigation updates where applicable. CEDS and Regional Transportation Plan will be reviewed to update with revised action items.
Westphalia	Emergency Operations Plan (part of county) County Mitigation Plan Regional Transportation Plan Comprehensive Economic Development Strategy	Hazard Mitigation action items were incorporated into the regional CEDS and Regional Transportation Plan by MRPC. EMD was encouraged to incorporate hazard mitigation into LEOP where applicable.	Mayor and City Council will work toward incorporating hazard mitigation projects into city budget where possible and future public works improvements. EMD will review LEOP and incorporate hazard mitigation updates where applicable. CEDS and Regional Transportation Plan will be reviewed to update with revised action items.
Osage county R-I	Master Plan School Emergency Plan Weapons Policy District Budget	School board and superintendent reviewed district emergency plan and district budget to see where hazard mitigation actions could be incorporated.	School board and superintendent will review Master Plan, School Emergency Plan and district budget to update applicable areas with revised action items list. Superintendent will work toward including the certified tornado safe room(s) into the district budget.
Osage County R-II	Capital Improvement Plan School Emergency Plan Weapons Policy District Budget	School board and superintendent reviewed district emergency plan and district budget to see where hazard mitigation actions could be	School board and superintendent will review Capital Improvement Plan, School Emergency Plan, and district budget to update applicable areas

Jurisdiction	Planning Mechanisms	Integration Process for Previous Plan	Integration Process for Current Plan
		incorporated.	with revised action items list. Superintendent will work toward including the certified tornado safe room(s) into the district budget.
Osage County R-III	Capital Improvement Plan School Emergency Plan District Budget	School board and superintendent reviewed district emergency plan and district budget to see where hazard mitigation actions could be incorporated.	School board and superintendent will review Capital Improvement Plan, School Emergency Plan, and district budget to update applicable areas with revised action items list. Superintendent will work toward including the certified tornado safe room(s) into the district budget.

Source: Jurisdiction surveys 2022

Including hazard mitigation is now routine for any planning projects or plan updates carried out by the Meramec Regional Planning Commission (MRPC). Applicable goals and action items from hazard mitigation plans have been incorporated into the regional transportation plan as well as the Community Economic Development Strategy for the region. Both of these documents are resources for cities and counties within the eight-county area and are updated on a regular basis with input from city and county representatives. This review and update process has helped city and county representatives better understand and appreciate the importance of including hazard mitigation in all applicable plans. In addition, MRPC and the hazard mitigation planning committee are also working to encourage the incorporation of hazard mitigation into the planning activities of all local governments, school districts and local entities through presentations and participation in planning activities.

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 Meramec Regional Planning Commission's 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.

6 Appendix

A: References	6.2
B: Planning Process	6.6
C: Public Survey	6.37
D: Adoption Resolutions	6.54
E: Critical/Essential Facilities	6.65
F: MDC Wildfire Data Search	6.68

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55. EPA, How's My Waterway, <https://mywaterway.epa.gov/>
56. SEMA, Flood Insurance Administration—Repetitive Loss List
57. National Centers for Environmental Information, <http://www.ncdc.noaa.gov/stormevents/>
58. FEMA Data Visualization Tool, <https://www.fema.gov/data-visualization-floods-data-visualization>
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64. University of Florida, How to Spot a Sinkhole, <https://ufonline.ufl.edu/infographics/how-to-spot-a-sinkhole/>
65. FEMA 320, Taking Shelter from the Storm, 3rd edition,
http://www.weather.gov/media/bis/FEMA_SafeRoom.pdf
66. Lightning Map, National Weather Service, <https://www.vaisala.com/sites/default/files/documents/WEA-MET-Annual-Lightning-Report-2020-B212260EN-A.pdf>
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68. Wind Zones in the U.S. map, FEMA, https://www.fema.gov/pdf/library/ism2_s1.pdf
69. Annual Windstorm Probability (65+knots) map U.S. 1980-1994, NSSL,
http://www.nssl.noaa.gov/users/brooks/public_html/bigwind.gif
70. Hailstorm intensity scale, The Tornado and Storm Research Organization (TORRO),
<https://www.torro.org.uk/research/hail/hscale>
71. National Severe Storms Laboratory – hail map, http://www.nssl.noaa.gov/users/brooks/public_html/bighail.gif
72. Enhanced F Scale for Tornado Damage, NWS, www.spc.noaa.gov/faq/tornado/ef-scale.html
73. Enhanced Fujita Scale’s damage indicators and degrees of damage table, NOAA Storm Prediction Center,
www.spc.noaa.gov/efscale/ef-scale.html
74. Tornado Activity in the U.S. map (1950-2006), FEMA 320, Taking Shelter from the Storm, 3rd edition
75. Tornado Alley in the U.S. map, <http://tornadochaser.net/>
76. Midwest Regional Climate Center, <https://mrcc.purdue.edu/gismaps/cntytnorm.htm>
77. Wind chill chart, National Weather Service, <http://www.nws.noaa.gov/om/winter/windchill.shtml>
78. Average Number of House per year with Freezing Rain, American Meteorological Society. “Freezing Rain Events in the United States.” <http://ams.confex.com/ams/pdfpapers/71872.pdf>
79. National Levee Database, <https://levees.sec.usace.army.mil/#/>
80. FEMA Map Service Center for Flood Insurance Rate Maps and Flood Insurance Studies, msc.fema.gov/portal;
<https://www.fema.gov/fema-levee-resources-library>

B: Planning Process

HMPC Mailing list

Presiding Commissioner Daryl Griffin
Osage County
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Linn, MO 65051

Ron Hoffman Osage County EMD
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Linn, MO 65051

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Argyle Vol. Fire Dept.
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Linn Police Dept.
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Road & Bridge Foreman Ron
Kempker
Osage County
205 East Main St.
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Argyle, MO 65001

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Linn Fire Prot. Dist.
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Osage County
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Superintendent Larry Fredrich
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Clerk Kerry Bax
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Ameren UE
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Three Rivers Electric Cooperative
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Linn, MO 65051

Captain Corey J. Schoeneberg
Troop F
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Jefferson City, MO 65102

MoDOT
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Linn, MO 65051

Socket Internet Services
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Columbia, MO 65202

Mediacom Comm. Corp.
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Jefferson City, MO 65109

Administrator Laci Tambke
Linn Oak Rehabilitation Center
196 Highway CC
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Administrator Julie Heckman
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Westphalia, MO 65085

Melissa Wilding
American Red Cross
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Jefferson City, MO 65109

MO State Emergency Management
Agency
Floodplain Management Officer
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U.S. Army Corps of Engineers
US Army Engineer District, St. Louis
Matt Shively
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FEMA Region VII
ATTN: Ken Sessa
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Kansas City, MO 64131-3626

U.S. Fish & Wildlife Service
Ecological Services Field Office
Karen Herrington, Field Supvr.
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Missouri Department of
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Superintendent Chuck Woody
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Brenda Gerlach, MO State Emergency
Management Agency Region F Area
Coordinator
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Jefferson City, MO 65102

Nicci Kammerich, County Clerk
106 East Main Street
Linn, MO 65051

Administrator Gina Huckstep
Harbor Place – Linn
24 Trenshaw Trail
Linn, MO 65051

MEMORANDUM

TO: Osage County Hazard Mitigation Planning Committee

FROM: Tammy Snodgrass, MRPC Environmental Programs Manager/Assistant Director
Patrick Stites, MRPC Environmental Programs Specialist

DATE: October 27, 2021

SUBJECT: Hazard mitigation planning meeting November 16, 2021

The Meramec Regional Planning Commission (MRPC) has been contracted by Osage County and the State Emergency Management Agency (SEMA) to review and update the multi-jurisdictional hazard mitigation plan for Osage County, its cities and school districts. The project is being funded by state and federal dollars with matching funds from Osage County. We need your help to successfully complete this project.

The county must submit an approved, updated hazard mitigation plan to SEMA and FEMA by December, 2022 in order to continue to be eligible for hazard mitigation grant funds and certain recovery funds after a natural disaster occurs. It is in every jurisdiction's best interest to participate in the review and update of this plan. Hazard mitigation funds are used for such projects as floodplain buyouts, burying electrical lines, tornado shelters for schools, etc.

A meeting of the Osage County Hazard Mitigation Planning Committee is scheduled for Tuesday, November 16 at 10:30 a.m. at the Osage County Courthouse in the County Commission Chambers located at 106 E Main St, Linn, MO. The focus of this meeting will be to review existing goals and action items and determine if any changes need to be made. In addition, the group will need to report on what action items have been accomplished and what mitigation activities have occurred since the plan was updated five years ago. This can include activities such as improvements to roads and bridges that were prone to flooding, new programs that have reduced risk to residents and/or businesses and new tornado shelters that have been constructed in the past five years. Additionally, we request that **each jurisdiction and school district bring a filled-out Hazard Mitigation Plan Questionnaire** (included). After the meeting we will answer questions and assist with filling out the questionnaire.

As the county, each city and school district are required to participate in the planning process and will be asked to formally approve and adopt the Phelps County Hazard Mitigation Plan, we strongly encourage you to participate in this committee or to send a representative who will convey your jurisdiction or department's needs for hazard mitigation as well as report on your hazard mitigation accomplishments. It is important to include representatives from emergency management offices, law enforcement, city/county officials, fire protection, road and bridge departments, utilities and public works, local health services, disaster relief volunteer services and other appropriate groups. If you are not able to attend, please send a representative from your organization. It is very important that we have good participation from all stakeholders in Osage County.

Thank you for your assistance in addressing hazard mitigation for Osage County. If you have any questions, contact me at (573) 265-2993, or via e-mail: tsnodgrass@meramecregion.org. I look forward to seeing you at the meeting.

PS

Enclosures: Meeting Agenda

Osage County
Multi-Jurisdictional Hazard Mitigation Plan Update
Planning Meeting

Tuesday, November 16, 2021 ~ 10:30 a.m.
County Commission Chambers, Osage County Courthouse

AGENDA

- I. Welcome/Introductions – Tammy Snodgrass, Assistant Director, Meramec Regional Planning Commission
- II. Hazard Mitigation Planning Purpose
- III. Grant Programs Linked to Approved Plan
- IV. Planning Tasks / Multi-jurisdictional Approach
- V. Participation Requirements
- VI. Public Involvement
- VII. Data Collection Questionnaires
- VIII. Discussion of Hazards
- IX. Critical Facilities
- X. Next Steps in the Planning Process
- XI. Set Next Meeting Date(s)

NOTICE OF PUBLIC MEETING

Date and time of posting:

Notice is hereby given that the **Osage County Hazard Mitigation Planning Committee** will meet at **10:30 a.m. on Tuesday, November 16, 2021** at the **Osage County Courthouse, County Commission Chambers, 106 E Main St, Linn, MO.**

The tentative agenda of this meeting includes:

- Welcome and Introductions
- Hazard Mitigation Planning Purpose
- Grant Programs Linked to Approved Plan
- Planning Tasks/Multi-Jurisdictional Approach
- Participation Requirements
- Public Involvement
- Data Collection Questionnaires
- Discussion of Hazards
- Critical Facilities
- Next Steps in the Planning Process
- Setting of Date and Time for Next Meeting
- Adjourn

Representatives of the news media may obtain copies of this notice by contacting:

Tamara Snodgrass
#4 Industrial Drive
St. James, MO 65559
(573) 265-2993

tsnodgrass@meramecregion.org

If you require any accommodations (i.e. qualified interpreter, large print, hearing assistance) in order to attend this meeting, please notify this office at 573-265-2993 no later than 48 hours prior to the scheduled commencement of the meeting.

Osage County Hazard Mitigation Plan Review Meeting
November 16, 2021 ~ 10:30 a.m.

Name	Representing	Email Address	Phone #	Address
② Melissa Wright	Osage County R-3 Schools	Wrightm@fatimaComets.org	573-455-2375 573-308-9290	143 E Main St. Fatima Westphalia School District
② Michael Bickell	City of Linn	Michael.bickell@cityoflinn.com	573-897-2236	1200 E. Main St., Linn, MO 65051
② Larry Friedrich	City of Linn	lfriedrich@cityoflinn.com	573-897-2236	1200 E. Main St., Linn, MO 65051
② John Trenchaw	OSAGE COUNTY Assoc. Commissioner	JohnTrenchaw920@gmail.com	573 897 2139 415736806057	205 E MAIN ST LINN MO 65057
② DARRYL GRIFFIN	OSAGE CO. PRESIDENT COMMISSIONER	griffindarryl@gmail.com	573-694-6027	205 E. MAIN P.O. BOX 826
② Larry Kliethermes	Assoc Commissioner OSAGE CO.	larrykliet@gmail.com	(573) 619-3431	205 E Main St Linn MO. 65051 P.O. Box 826
② Amy Ames	State Tech	amy.ames@statetechmo.edu	573-897-5224	One Technology Drive Linn, MO 65051
② Lyle Best	OsagecoH-ISO	bestl@osageco1.com	573-763-5666	614 S. Poplar Chambers, MO 65024
② Ron Kempker	OSAGE COUNTY R-3	rd-bridge@yahoo.com	573-897-3919	523 Hwy 89S LINN, MO. 65051

Name	Representing	Email Address	Phone #	Address
① Ronald C Hoffman	Osage County EMD	director911@ osagecountyma.com	573-897- 357 3561	Po Box 192 Linn, Mo 65051
② Dena Smith	Osage Co. E-11	smithd@linn.k12. mo.us	573-897-4200	141 Wildcat Dr. Linn, MO 65051
③ Cliff Wilson	General Baptist Nursing Home Linn	c.wilson@gb-healthcare.com	573-821-3124	196 Hwy CC Linn Mo.
④ Orena Gill	General Baptist Nursing Home	omcclendon@gb-healthcare.com	660-988-1980	196 Hwy CC Linn, MO
⑤ Travis Shaffer	Osage County Sheriff's Office	tshaffer@osagesheriff.org	573-897-3927 x803	106 E Main st Linn, MO 65051
⑥ H B Dadds	LD	hbdadds@wanjuba.com	507-420-6557	1080 E. Jefferson 65051
⑦ Janice Frank	Interim Clerk to Comm.		573-897-2193	205 E Main Linn mo 65051
Patrick Stiles	MRPC			
Kathryn Hawes	MRPC			
Tammy Snodgrass	MRPC			

For immediate release
Jan. 4, 2022

For more information, contact
Tammy Snodgrass at (573) 265-2993

MRPC begins holding meetings to update Osage County hazard mitigation plan

OSAGE COUNTY—Meramec Regional Planning Commission (MRPC) is working on updating the hazard mitigation plan for Osage County. The next meeting, which is open to the public, is scheduled for Feb. 8 at 10:30 a.m. at the Osage County Administrative Building, 205 E. Main St., Linn.

The first Osage County hazard mitigation planning meeting was held on Nov. 16, 2021 at the Administration Building. MRPC staff did a presentation on hazard mitigation and the process that the group would be going through to update the Osage County plan. Discussions included explanation that hazard mitigation planning is focused on reducing risk before disasters strike (burying electric lines, elevating homes in the floodplain) and sharing the county must have a current, updated plan to be eligible for some hazard mitigation grants.

The first draft of the revised plan must be submitted to SEMA by Dec. 8, 2022. Jurisdictions within the county, such as cities, the county itself, schools, fire departments and others, are asked to participate in the planning process, complete the questionnaire, review the revised plan and adopt the new plan. It was also discussed that a survey on hazard mitigation would be promoted throughout the county to get public input into the plan. That survey can be found and completed at <https://www.meramecregion.org/surveys/>.

If you have questions, please contact Tammy Snodgrass at MRPC at 573-265-2993 or by email at tsnodgrass@meramecregion.org.

Formed in 1969, MRPC is a voluntary council of governments serving Crawford, Dent, Gasconade, Maries, Osage, Phelps, Pulaski and Washington counties and their respective cities. Steve Vogt, representing the city of Belle, serves as MRPC chairman. A professional staff of 34, led by Executive Director Bonnie Prigge, offers technical assistance and services, such as grant preparation and administration, housing assistance, transportation planning, environmental planning, ordinance codification, business loans and other services to member communities.

To keep up with the latest MRPC news and events, visit the MRPC website at www.meramecregion.org or on Facebook at www.facebook.com/meramecregion/.

For immediate release
Feb. 1, 2022

For more information, contact
Tammy Snodgrass at (573) 265-2993

MRPC to hold public meeting for Osage County hazard mitigation plan

OSAGE COUNTY—Meramec Regional Planning Commission (MRPC) will be meeting with the Osage County hazard mitigation planning committee at 10:30 a.m. on Feb. 8, 2022, at the Osage County Administrative Building, 205 E. Main St., Linn, to update the county's hazard mitigation plan. The meeting is open to the public.

Hazard mitigation planning is focused on reducing risk before disasters strike. Activities such as burying electric lines, reduces damage during tornadoes and elevating homes in the floodplain help reduce damage and loss of life during natural disasters. Public input is necessary to truly understand the risks that could be facing the county. Additionally, the county must have a current, updated plan to be eligible for some hazard mitigation grants.

The first draft of the revised plan must be submitted to SEMA by Dec. 8, 2022. Jurisdictions within the county, such as cities, the county itself, schools, fire departments and others, are asked to participate in the planning process. Jurisdictions such as local governments and the school districts are required to complete questionnaires, review the revised plan and adopt the new plan. For those members of the public interested in providing input, a public survey can be found and completed at <https://www.meramecregion.org/surveys/>.

County-level hazard mitigation plans cover a five-year timeframe. Osage County's last plan was approved in June 2018 and can be found at <https://www.meramecregion.org/publications/>.

If you have questions, please contact Tammy Snodgrass at MRPC at 573-265-2993 or by email at tsnodgrass@meramecregion.org.

Formed in 1969, MRPC is a voluntary council of governments serving Crawford, Dent, Gasconade, Maries, Osage, Phelps, Pulaski and Washington counties and their respective cities. Steve Vogt, representing the city of Belle, serves as MRPC chairman. A professional staff of 34, led by Executive Director Bonnie Prigge, offers technical assistance and services, such as grant preparation and administration, housing assistance, transportation planning, environmental planning, ordinance codification, business loans and other services to member communities.

To keep up with the latest MRPC news and events, visit the MRPC website at www.meramecregion.org or on Facebook at www.facebook.com/meramecregion/.

MEMORANDUM

TO: Osage County Hazard Mitigation Planning Committee

FROM: Tammy Snodgrass, MRPC Environmental Programs Manager/Assistant Director
Patrick Stites, MRPC Environmental Programs Specialist

DATE: January 20, 2022

SUBJECT: Hazard mitigation planning meeting February 8, 2022

The next meeting of the Osage County hazard mitigation planning committee is scheduled for Tuesday, February 8, at 10:30 a.m. in the Osage County Commission Chambers located at 205 E. Main St. Linn, MO. The focus of this meeting will be to review pieces of the draft risk assessment for the county and review existing action items and determine what changes need to be made. A copy of a revised list of action items is attached for your review. In addition, the group will need to report on what action items have been accomplished and what mitigation activities have occurred since the plan was updated five years ago. This can include activities such as improvements to roads and bridges that were prone to flooding, new programs that have reduced risk to residents and/or businesses and new tornado shelters that have been constructed in the past five years. If you have data on damages from natural events that have occurred in the last five years, or information on hazard mitigation projects that have been accomplished in the past five years, please bring this and any other pertinent data with you to the meeting.

The Meramec Regional Planning Commission (MRPC) has been contracted by Osage County and the State Emergency Management Agency (SEMA) to review and update the multi-jurisdictional hazard mitigation plan for Osage County, its cities and school districts. The project is being funded by state and federal dollars with matching funds from Osage County. We need your help to successfully complete this project. If your jurisdiction has not completed and returned the data collection questionnaire, please do so at your earliest convenience.

The county must submit the first draft of an updated hazard mitigation plan to SEMA and FEMA by December 8, 2022 in order to continue to be eligible for some hazard mitigation grants, so it is in every jurisdiction's best interest to participate in the review and update of this plan. Hazard mitigation funds are used for such projects as floodplain buyouts, burying electrical lines, tornado shelters for schools, etc.

As the county, each city and school district are required to participate in the planning process and will be asked to formally approve and adopt the Osage County Hazard Mitigation Plan, we strongly encourage you to participate in this committee or to send a representative who will convey your jurisdiction or department's needs for hazard mitigation as well as report on your hazard mitigation accomplishments. It is important to include representatives from road and bridge, local planners, emergency management offices, law enforcement, city/county officials, fire protection, local health services, disaster relief volunteer services and other appropriate groups.

Thank you for your assistance in addressing hazard mitigation for Phelps County. If you have any questions, contact me at (573) 265-2993, extension 135 or via e-mail: pstites@merameregion.org. I look forward to seeing you at the meeting.

PS

Osage County
Multi-Jurisdictional Hazard Mitigation Plan Update
Planning Meeting

Tuesday, February 8, 2022 ~ 10:30 a.m.
Osage County Courthouse Courtroom

AGENDA

- I. Welcome/Introductions – Tammy Snodgrass, Assistant Director, Meramec Regional Planning Commission
- II. Brief Review
- III. Public Survey Update
- IV. Participation Requirements/Status
- V. Plan Update Format
- VI. Sample Results of Countywide Risk Assessment Update
- VII. Discuss Mitigation Action Updates – *(Which have been accomplished or had progress made; which are no longer high priority; which can be combined or eliminated)*
- VIII. Next Steps
- IX. Set Next Meeting Date(s)

NOTICE OF PUBLIC MEETING

Date and time of posting:

Notice is hereby given that the **Osage County Hazard Mitigation Planning Committee** will meet at **10:30 a.m. on Tuesday, February 8, 2022** at the **Osage County Commission Chambers, 205 E Main St, Linn, MO.**

The tentative agenda of this meeting includes:

- Welcome and Introductions
- Integration of Other Data, Reports, Studies, Plans
- Discussion of Goals and Objectives and Progress Made in Past Five Years
- Review and Prioritize Action Items
- Jurisdiction and School District Questionnaire Assistance
- Adjourn

Representatives of the news media may obtain copies of this notice by contacting:

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St. James, MO 65559
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tsnodgrass@meramecregion.org

If you require any accommodations (i.e. qualified interpreter, large print, hearing assistance) in order to attend this meeting, please notify this office at 573-265-2993 no later than 48 hours prior to the scheduled commencement of the meeting.

OSAGE
~~Washington~~ County Hazard Mitigation Plan Review Meeting
 February 28, 2022 ~ 10:00 a.m.
 08

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✓ Amy Ames	State Tech	amy.ames@state-tech.mo.edu	573-897-5224	
✓ Kim Sallin	Health Department	Kim.Sallin@LPHA.MO.gov	573-897-3103	
Elizabeth Anderson	MU Extension	elizabethanderson@missouri.edu	573-897-2497 ext 353	
✓ Michael Bickell	Linn Police Dept.	Michael.bickell@cityoflinn.com	573-897-2236	
✓ LUKEFAHR PROBST	LINN POLICE DEPT.	lukefahr.probst@cityoflinn.com	573-897-2236	
✓ Andrea Rice	✓ Sheriff's Office Floodplain Mgmt	arice@osagesheriff.org	(573) 897-3921	
✓ AB Dadds	U-ID.	h.b.dadds@waukegan.il.us	507-420-6557	

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John Trenchaw	OSAGE CO.	JohnTrenchaw920@gmail.com	573-680-6057	11
Tommy Snodgrass				
Kathryn Hawes				
Patrick Stiles				

From Last Plan Update

Goal 1: Reduce risks and vulnerabilities of people in hazard-prone areas through current technology, better planning and hazard mitigation activities.

Goal 2: Reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local economy.

Goal 3: Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.

Goal 4: Strengthen communication and coordinate participation between public agencies, citizens, non-profit organizations, business, and industry to create a widespread interest in mitigation.

Goal 5: Establish priorities for reducing risks to the people and their property with emphasis on long-term and maximum benefits to the public rather than short-term benefit of special interests.

Goal 6: Secure resources for investment in hazard mitigation.

New Goals Accepted by Committee

Goal 1: Reduce the potential impact of natural disasters on the lives and livelihoods of the citizens of the county.

Goal 2: Reduce the potential impact of natural disaster to property, infrastructure, and the local economy.

Goal 3: Reduce the potential impact of natural disaster on the continuity of government and essential services.

From Last Plan Update		Revision Suggestions
1.1.3	Promote development and implementation of emergency plans by businesses by providing examples on EMD website and raising awareness through public and social media	<i>Complete. Remove. Emergency preparedness book – provided thru email, social media by EMD. EMA advertises and uses smart 911. Business continuity plan template available on EMA website.</i>
1.2.6	Monitor developments in data availability concerning the impact of levee failure, dam failure, tornados, sinkholes, land subsidence, and wildfire upon Osage County and all jurisdictions through local, state, and federal agencies for use in hazard mitigation planning.	<i>Revise to include all hazards possible in the jurisdiction.</i>
1.3.1	Provide information on tree trimming and dead tree removal programs to utility companies and local government.	<i>Complete. Remove. No local governments in planning area are responsible for utility lines. Three rivers and Ameren UE are already doing this.</i>
1.3.2 – goal 1	Continue to identify and prioritize potential road and bridge upgrades that would reduce danger to residents during occurrences of natural disasters.	Complete 4 road and bridge upgrade projects that would reduce danger to residents during occurrences of natural disasters as funding allows.
1.3.4 – goal 1	Disseminate information on the importance of and funding sources for storm shelters and tornado safe rooms near areas of high population densities (schools and large employers).	Construct storm shelters and tornado safe rooms near areas of high population densities (schools and large employers) as funding allows.
1.3.5 – goal 1	Plan to identify standing pools of water (zika virus) and increase community awareness.	<i>Complete. No cases of Zika in the since 2019. No cases ever in Missouri. Replace. Health Department will treat standing water pools resulting from flooding for mosquito abatement.</i>
2.1.2 – goal 3	Continue to evaluate and update emergency operation plans.	<i>Revise Annually EMD to coordinate with other public agencies have a meeting to evaluate and update emergency operation plans.</i>
2.1.8	Elevate County Road 275 due to flooding.	<i>Not complete. Falls under 1.3.2</i>
2.1.9 – goal 2	Elevate structures to be compliant with flood ordinance.	Elevate structures located in the flood plain to be compliant with local flood ordinances as funding allows.
2.1.10	Increase culvert size as replacements are installed.	<i>Combine with 2.1.11</i>
2.1.11 – goal 2	Add culverts in areas as needed.	Add new culverts and increase the size of replacement culverts to control stormwater in areas as needed.

2.2.1	Educate and raise awareness of residents, contractors, and cities on the dangers of floodplain development and the benefits of the National Flood Insurance Program.	<i>Complete. Remove.</i>
2.2.2 – goal 2	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements in cities.	<i>Keep. State requested.</i>
3.2.3 – goal 3	Encourage local jurisdictions to participate in efforts to identify, assess and prioritize hazard mitigation projects throughout the county.	County Commissioners will meet with municipal governments in the planning area annually to identify, assess, and prioritize hazard mitigation projects throughout the planning area by incorporating hazard mitigation into the long-range planning and development activities of each jurisdiction.
3.3.1	Participating jurisdictions should regularly re-evaluate hazard mitigation plan and merge with other community planning.	<i>Combine with 3.2.3. Competed through planning process.</i>
3.3.2	Continue to provide information through press releases, brochures, website and Facebook regarding adopted mitigation measures to keep public abreast of changes and/or new regulations, especially in regard to floodplain management.	<i>Combine with 6.2.2.</i>
3.3.3	Dam safety and maintenance awareness including public announcements/reminders	<i>Remove. Not high priority.</i>
3.3.4	Awareness campaign for well testing/protection	<i>Complete.</i>
4.2.1	Encourage meetings between EMD, city/county, and SEMA to familiarize officials with mitigation planning and implementation and budgeting for mitigation projects.	<i>This is accomplished through planning process.</i>
4.2.2	Continue to encourage the incorporation of mitigation into other planning document and planning activities such as comprehensive plans and capital improvement plans.	<i>Combine with 3.3.1</i>
5.1.1	Provide information to all communities on the benefits and costs of developing storm water management plans.	<i>Remove.</i>
5.2.1 – goal 2	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/retention area.	Purchase properties in the floodplain to convert land into public space/recreation areas as funds allow.
5.2.2	Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.	<i>Combine with 5.2.1? Only city of Linn and Westphalia have zoning ordinances. Check with them.</i>
6.1.3	Work with state/local/federal agencies to include mitigation in all economic and community development projects.	<i>Combine with 3.3.1</i>
6.1.4	Provide information to jurisdictions on the benefits of budgeting for and implementing hazard mitigation projects.	<i>Combine with 6.2.1</i>
6.2.1 – goal 2	Provide information on the benefits of local governments implementing cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole	Provide information on the benefits of local governments budgeting for and implementing cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole. <i>County provides labor for installing new culverts but culvert must meet required size.</i>

6.2.2 – goal 1	Implement public awareness program about the benefits of hazard mitigation projects, both public and private through press releases, brochures, EMD website and Facebook.	Implement public awareness program about the benefits of adopted hazard mitigation projects, both public and private, through press releases, brochures, EMD website and Facebook including changes to mitigation policy to keep the public abreast of changes and/or new regulations.
6.3.1	Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health, and property.	<i>Accomplished through planning process. Complete</i>
6.3.2 – goal 3	Encourage businesses (e.g. pharmacies) to invest in generators.	Acquire generators for essential service providers as funding allows.

Some infrastructure and policy improvements common to mitigation plans

- Shelters and safe rooms
- Bridges and roads
- Generators
- Emergency communication systems
- Code development (building/fire/stormwater/debris removal)
- property upgrades (earthquake proofing, landscaping for flooding, etc.)

MEMORANDUM

TO: Osage County Hazard Mitigation Planning Committee

FROM: Tammy Snodgrass, MRPC Environmental Programs Manager/Assistant Director
Patrick Stites, MRPC Environmental Programs Specialist

DATE: August 29, 2022

SUBJECT: Hazard mitigation planning meeting September 22, 2022

The next meeting of the Osage County hazard mitigation planning committee is scheduled for Thursday, September 22, at 10:00 a.m. in the Osage County Commission Chambers located at 205 E. Main St. Linn, MO. The focus of this meeting will be to review and discuss all completed draft chapters of the hazard mitigation plan and discuss the formal adoption process for each jurisdiction. The draft of chapter 3 of the plan has already been sent out via email. As additional chapter drafts are completed, we will continue to send those out. As you spend time reviewing these drafts it is very important that you document those hours spent and submit in-kind match forms so that we can get those hours counted. If you have comments or corrections, please feel free to send those over to me via email and I will get those addressed.

The Meramec Regional Planning Commission (MRPC) has been contracted by Osage County and the State Emergency Management Agency (SEMA) to review and update the multi-jurisdictional hazard mitigation plan for Osage County, its cities and school districts. The project is being funded by state and federal dollars with matching funds from Osage County. We need your help to successfully complete this project.

All jurisdictions must formally adopt the plan document prior to submittal to be included in the plan. The first draft of the updated hazard mitigation plan must be submitted to SEMA and FEMA by December 8, 2022 in order to continue to be eligible for some hazard mitigation grants, so it is in every jurisdiction's best interest to participate in the review and update of this plan. Hazard mitigation funds are used for such projects as floodplain buyouts, burying electrical lines, tornado shelters for schools, etc.

As the county, each city and school district are required to participate in the planning process and will be asked to formally approve and adopt the Osage County Hazard Mitigation Plan, we strongly encourage you to participate in this committee or to send a representative who will convey your jurisdiction or department's needs for hazard mitigation as well as report on your hazard mitigation accomplishments. It is important to include representatives from road and bridge, local planners, emergency management offices, law enforcement, city/county officials, fire protection, local health services, disaster relief volunteer services and other appropriate groups.

Thank you for your assistance in addressing hazard mitigation for Osage County. If you have any questions, contact me at (573) 265-2993, extension 135 or via e-mail: pstites@merameregion.org. I look forward to seeing you at the meeting.

PS

Osage County
Multi-Jurisdictional Hazard Mitigation Plan Update
Planning Meeting

Tuesday, September 22, 2022 ~ 10:00 a.m.
Osage County Commission Chambers

AGENDA

- I. Welcome/Introductions – Tammy Snodgrass, Assistant Director, Meramec Regional Planning Commission
- II. Brief Review
- III. Participation Requirements/Status
- IV. Review and Discussion on Draft Chapters
- V. Plan Maintenance
- VI. Adoption Process
- VII. Next Steps
- VIII. Adjourn

NOTICE OF PUBLIC MEETING

Date and time of posting:

Notice is hereby given that the **Osage County Hazard Mitigation Planning Committee** will meet at **10:00 a.m. on Thursday, September 22, 2022**, at the **Osage County Commission Chambers, 205 E Main St, Linn, MO.**

The tentative agenda of this meeting includes:

- Welcome and Introductions
- Brief Review
- Participation Requirements
- Review and Discussion on Draft Chapters
- Plan Maintenance
- Adoption Process
- Next Steps
- Adjourn

Representatives of the news media may obtain copies of this notice by contacting:

Tamara Snodgrass
#4 Industrial Drive
St. James, MO 65559
(573) 265-2993
tsnodgrass@meramecregion.org

If you require any accommodations (i.e. qualified interpreter, large print, hearing assistance) in order to attend this meeting, please notify this office at 573-265-2993 no later than 48 hours prior to the scheduled commencement of the meeting.

~~Washington County~~ ^{Osage County} Hazard Mitigation Plan Review Meeting
September 22, 2022 ~ 10:00 a.m.

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Lori Clenney	R & B	"	"	"
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Ron Hoffman	EMD			
Patrick Stiles	MRPC			

Name	Representing	Email Address	Phone #	Address
Kathryn Hawes	MRPC			
Temmy Snodgrass	MRPC			

For immediate release
October 6, 2022

For more information, contact
Tammy Snodgrass at (573) 265-2993

Public comment being accepted on Osage County Hazard Mitigation Plan until Oct. 31

OSAGE COUNTY—Public comment is being accepted until Oct. 31, 2022, on the Osage County Hazard Mitigation Plan. The plan update is available for review on Meramec Regional Planning Commission's website, <http://www.meramecregion.org/publications/>. The 2022 plan update is located under the Hazard Mitigation Plans by county along with the county's approved 2018 plan. A hard copy of the plan is also available at the Osage County Courthouse in the county clerk's office.

The purpose of the plan is to reduce or eliminate long-term risk to people and property from natural hazards. It is required that the county have this plan in place in order to be eligible for several Federal Emergency Management Agency grant programs.

Several entities participated in the planning process to update the plan, including Osage County, the cities of Argyle, Chamois, Freeburg, Linn, Meta and Westphalia, as well as Osage County R-I School District, Osage County R-II School District, Osage County R-III School District, State Technical College of Missouri, Missouri University Extension, The Unterrified Democrat and General Baptist Nursing Home.

The Meramec Regional Planning Commission (MRPC) facilitated focus group meetings and assisted these entities in developing the plan. Following a public comment period, a final draft will be created and sent to FEMA and SEMA for review and approval.

If you need assistance locating the plan or have questions, please contact Tammy Snodgrass at MRPC at 573-265-2993 or by email at tsnodgrass@meramecregion.org.

Formed in 1969, MRPC is a voluntary council of governments serving Crawford, Dent, Gasconade, Maries, Osage, Phelps, Pulaski and Washington counties and their respective cities. Steve Vogt, representing the city of Belle, serves as MRPC chairman. A professional staff of 34, led by Executive Director Bonnie Prigge, offers technical assistance and services, such as grant preparation and administration, housing assistance, transportation planning, environmental planning, ordinance codification, business loans and other services to member communities.

To keep up with the latest MRPC news and events, visit the MRPC website at www.meramecregion.org or on Facebook at www.facebook.com/meramecregion/.

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Ecological Services Field Office
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US Army Engineer District, St. Louis
Matt Shively
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Missouri Department of
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ATTN: Resource Science Division
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Meramec Regional Planning Commission
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Osage County
Hazard
Mitigation Plan is
Ready for Review!

10/05/22

Attention Members of the Osage County Hazard Mitigation Planning Committee and neighboring jurisdictions:

The first draft of the Osage County Hazard Mitigation Plan is now available for review on the MRPC website — <http://www.meramecregion.org/publications/>. A hard copy of the draft document is being made available at the Osage County Clerk's Office for public viewing as well. Please take some time to review the planning document, especially sections that have specifics regarding your jurisdiction. The public comment period will be open until October 31, 2022. Please notify us no later than **October 31, 2022** with any recommended changes or corrections. Contact Tammy Snodgrass at (573) 265 -2993 or via email at tsnodgrass@meramecregion.org.

C: Public Survey

Public Survey: Osage County

Multi-jurisdictional Hazard Mitigation Plan

The federal government requires all states and local governments to have hazard mitigation plans approved by FEMA that are consistent with the Disaster Mitigation Act of 2000. Approved mitigation plans are required to maintain eligibility for certain types of federal Hazard Mitigation Assistance Grants.

A planning committee comprised of representatives from Osage County, the incorporated cities, and the public school districts is currently developing an update to the comprehensive Osage County Multi-jurisdictional Hazard Mitigation Plan with a strategy to reduce the vulnerability of people and property in the planning area to the impacts of hazards and to remain eligible for mitigation funding programs from FEMA.

One of the key components of a hazard mitigation plan is public input during the planning process. The planning committee will be evaluating information on the hazards that impact each jurisdiction within Osage County. The committee is seeking your input on the hazards that will be evaluated as well as your opinions on the types of activities that should be considered to reduce future impacts. Your comments will be considered by your community's representatives on the planning committee as the plan is developed. Please take a few moments to answer the following questions. Thank you for your participation.

1. Please select your jurisdiction from the list. You may only select one jurisdiction for each survey completed. If you belong to more than one jurisdiction in this list, please complete multiple surveys.

- | | |
|--|---|
| <input type="checkbox"/> Unincorporated Osage County | <input type="checkbox"/> City of Westphalia |
| <input type="checkbox"/> City of Chamois | <input type="checkbox"/> Osage County R-I School District |
| <input type="checkbox"/> Village of Freeburg | <input type="checkbox"/> Osage County R-II School District |
| <input type="checkbox"/> City of Linn | <input type="checkbox"/> Osage County R-III School District |
| <input type="checkbox"/> City of Meta | |

2. The hazards addressed in the Multi-jurisdictional Hazard Mitigation Plan Update are listed below. Please indicate your opinion on the likelihood for each hazard to impact YOUR JURISDICTION (identified above). **Please rate EACH hazard 1 through 4 as follows:**

1 = Unlikely, 2 = Occasional, 3 = Likely, 4 = Highly Likely

- | | | |
|---------------------------|------------------------------------|---|
| ____ Dam Failure | ____ Flooding (Riverine and Flash) | ____ Severe Thunderstorms
Including High Winds, Hail and
Lightening |
| ____ Drought | ____ Land Subsidence / Sinkholes | |
| ____ Earthquakes | ____ Levee Failure | ____ Tornado |
| ____ Extreme Temperatures | ____ Severe Winter Weather | ____ Wildfires |

3. Please indicate your opinion on the potential magnitude of each hazard's impact on YOUR JURISDICTION (identified above). **Please rate EACH hazard 1 through 4 as follows:**

1 = Negligible, 2 = Limited, 3 = Critical, 4 = Catastrophic

_____ Dam Failure	_____ Flooding (Riverine and Flash)	_____ Severe Thunderstorms Including High Winds, Hail and Lightening
_____ Drought	_____ Land Subsidence / Sinkholes	
_____ Earthquakes	_____ Levee Failure	_____ Tornado
_____ Extreme Temperatures	_____ Severe Winter Weather	_____ Wildfires

4. FEMA Hazard Mitigation Assistance Grants are administered by the State Emergency Management Agency. Listed below are some types of projects considered.

Please check all those that could benefit your jurisdiction, in your opinion:

- | | |
|--|---|
| <input type="checkbox"/> Flood-prone Property Acquisition & Structure Demolition /Relocation | <input type="checkbox"/> Retrofitting of Existing Buildings, and Facilities from Wind Damage. |
| <input type="checkbox"/> Flood-Prone Structure Elevation | <input type="checkbox"/> New Tornado Safe Room Construction |
| <input type="checkbox"/> Dry Floodproofing of Historical Residential Structures and/or Non-residential Structures | <input type="checkbox"/> Electrical Utilities Infrastructure Retrofit |
| <input type="checkbox"/> Minor Localized Flood Reduction Projects (storm water management or localized flood control projects) | <input type="checkbox"/> Soil Erosion Stabilization |
| <input type="checkbox"/> Structural Retrofitting of Existing Buildings to Add a Tornado Safe Room | <input type="checkbox"/> Wildfire Mitigation |
| <input type="checkbox"/> Storm Sirens | <input type="checkbox"/> Other (please specify) |
| <input type="checkbox"/> Early Warning Systems such as phone/text alerts | _____ |
| | _____ |
| | _____ |

5. Please comment on any other issues that the Osage County Hazard Mitigation Planning Committee should consider in developing a strategy to reduce future losses caused by hazard events.

Please return your completed survey no later than March 15, 2021 to:

Tamara Snodgrass
 Meramec Regional Planning Commission
 4 Industrial Drive ~ St. James, MO 65559
 Phone: 573-265-2993, ext. 104 ~ FAX: 573-265-3550
tsnodgrass@meramecregion.org



Public Survey: Osage County Multi-jurisdictional Hazard Mitigation Plan

8 responses

Please select your jurisdiction from the list. You may only select one jurisdiction for each survey completed. If you belong to more than one jurisdiction in this list, please complete multiple surveys.

8 out of 8 answered

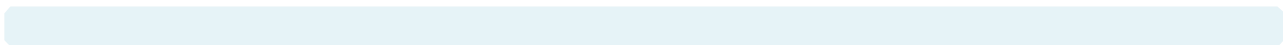
City of Linn 4 resp. 50%



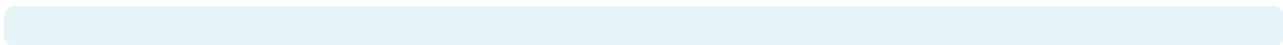
Osage County R-II School District 4 resp. 50%



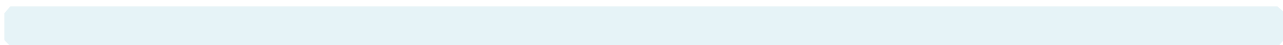
City of Chamois 0 resp. 0%



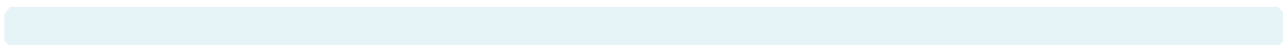
City of Meta 0 resp. 0%



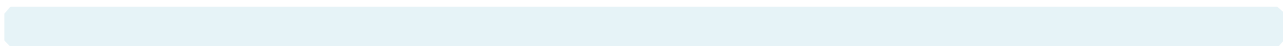
City of Westphalia 0 resp. 0%



Osage County R-ISchool District 0 resp. 0%



Osage County R-III School District 0 resp. 0%



Unincorporated Osage County 0 resp. 0%



Village of Argyle 0 resp. 0%



Village of Freeburg 0 resp. 0%



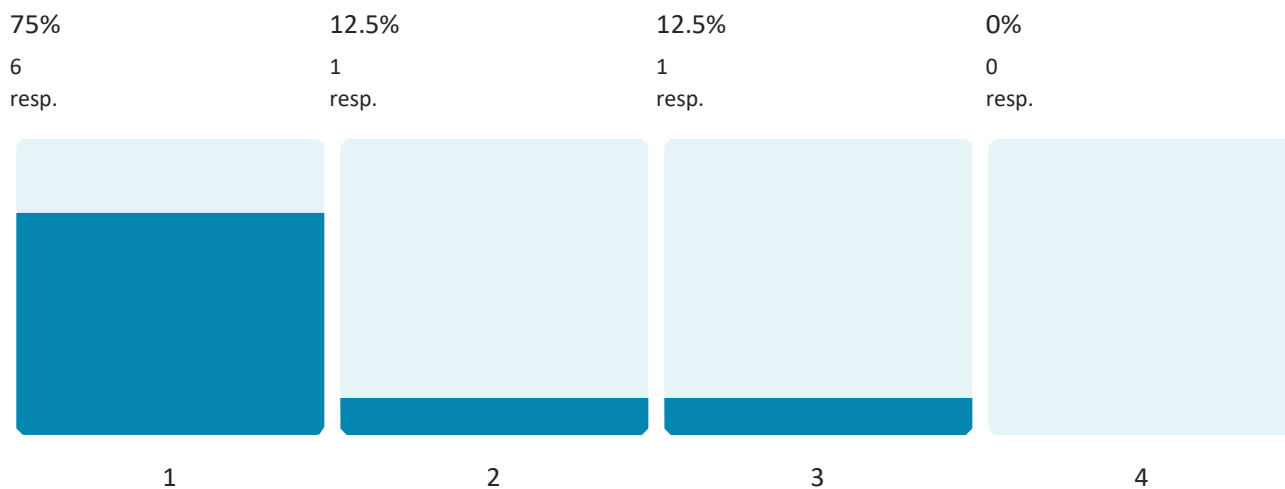
Please indicate your opinion on the likelihood for each hazard addressed in the Multi-jurisdictional Hazard Mitigation Plan Update to impact YOUR JURISDICTION (identified above). Please rate EACH hazard 1 through 4 as follows:

1 = Unlikely, 2 = Occasional, 3 = Likely, 4 = Highly Likely

Dam Failure

8 out of 8 answered

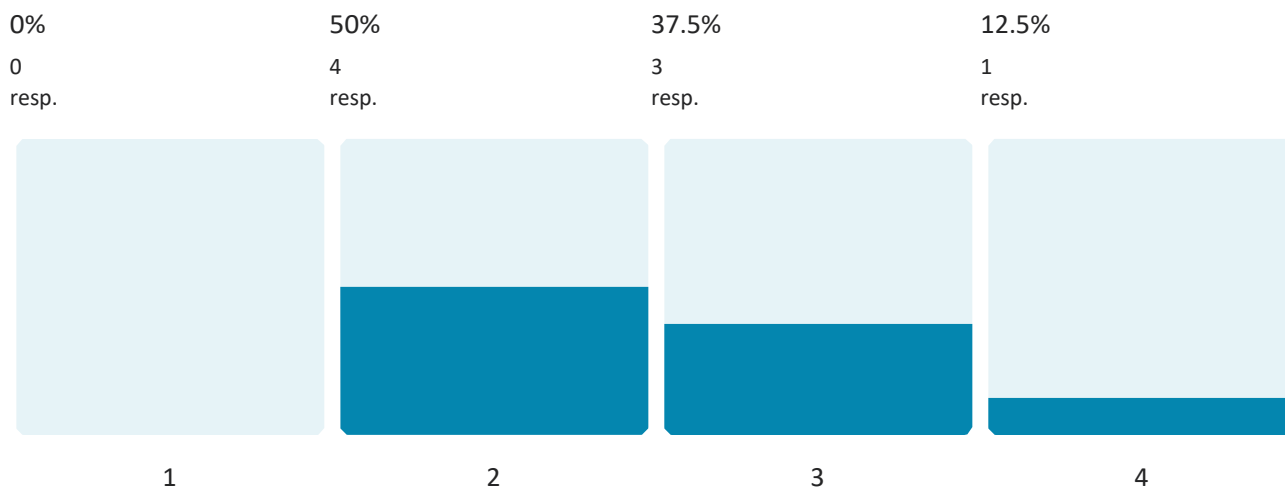
1.4 Average rating



Drought

8 out of 8 answered

2.6 Average rating



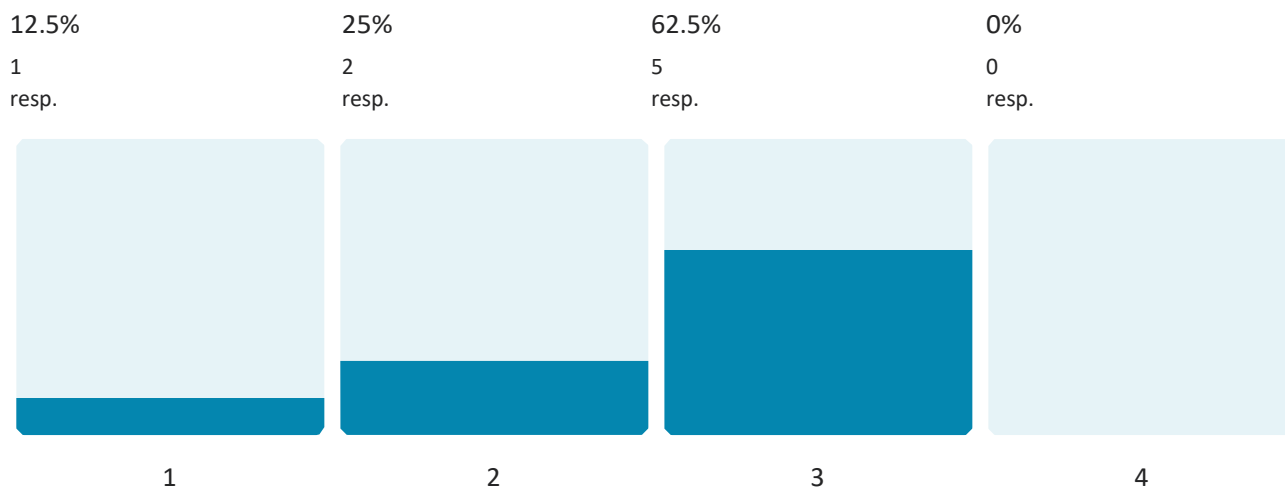
Please indicate your opinion on the likelihood for each hazard addressed in the Multi-jurisdictional Hazard Mitigation Plan Update to impact YOUR JURISDICTION (identified above). Please rate EACH hazard 1 through 4 as follows:

1 = Unlikely, 2 = Occasional, 3 = Likely, 4 = Highly Likely

Earthquake

8 out of 8 answered

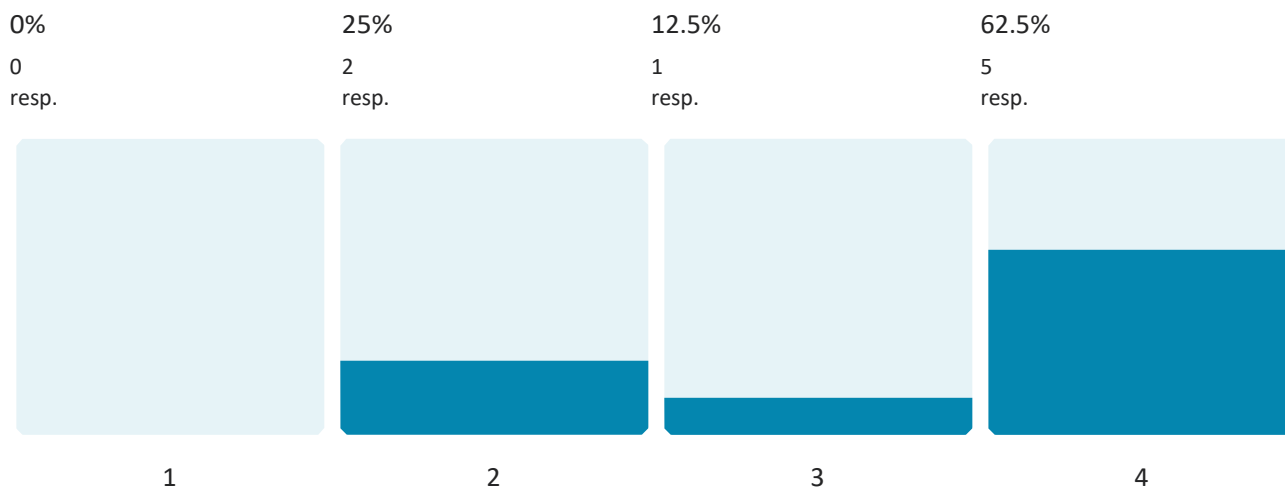
2.5 Average rating



Extreme Temperatures 8

out of 8 answered

3.4 Average rating



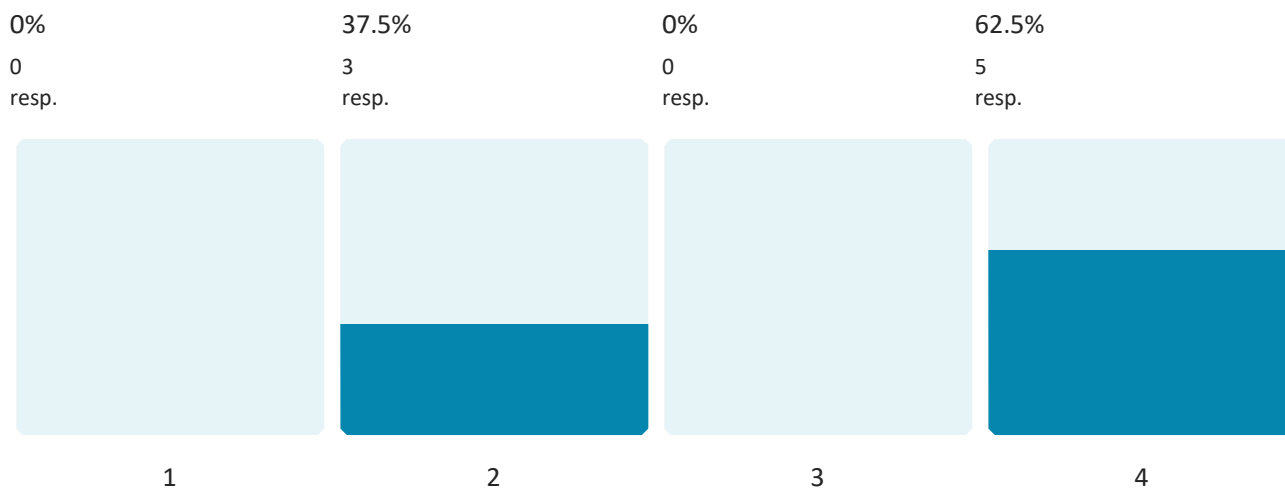
Please indicate your opinion on the likelihood for each hazard addressed in the Multi-jurisdictional Hazard Mitigation Plan Update to impact YOUR JURISDICTION (identified above). Please rate EACH hazard 1 through 4 as follows:

1 = Unlikely, 2 = Occasional, 3 = Likely, 4 = Highly Likely

Flooding (Flash and River) 8

out of 8 answered

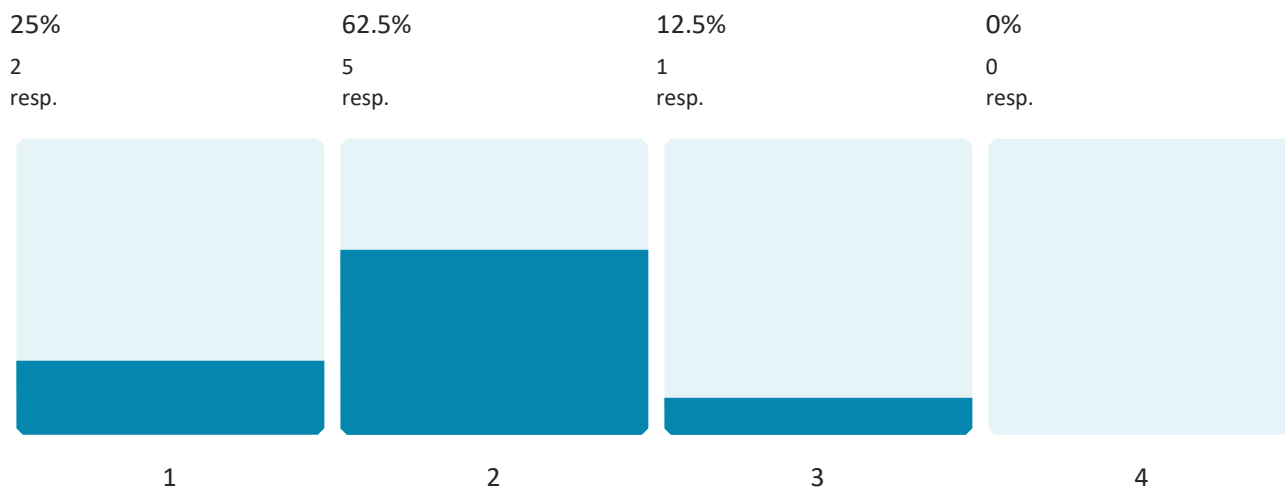
3.2 Average rating



Land Subsidence/Sinkholes 8

out of 8 answered

1.9 Average rating



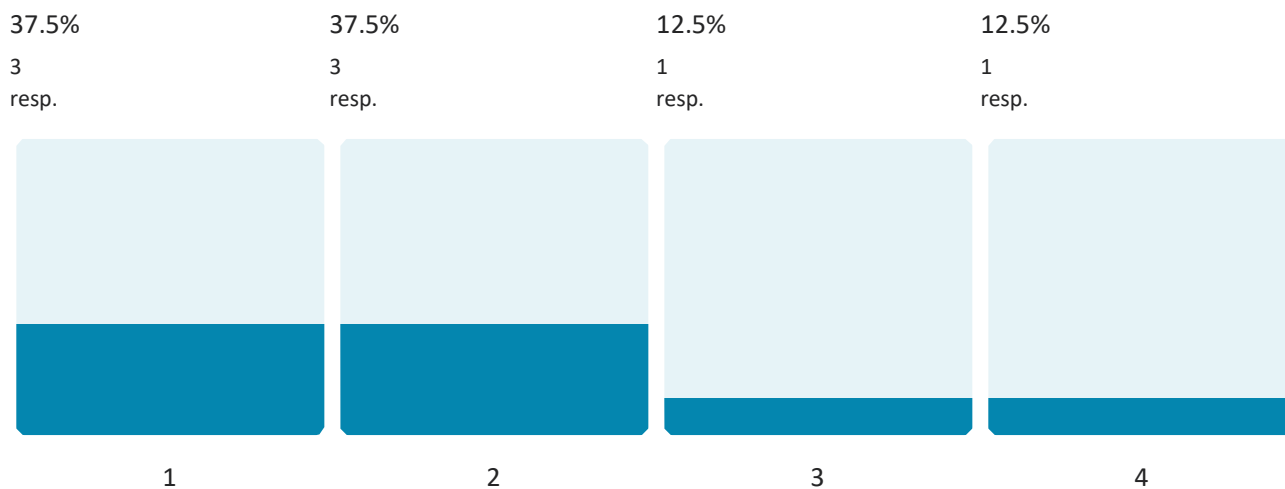
Please indicate your opinion on the likelihood for each hazard addressed in the Multi-jurisdictional Hazard Mitigation Plan Update to impact YOUR JURISDICTION (identified above). Please rate EACH hazard 1 through 4 as follows:

1 = Unlikely, 2 = Occasional, 3 = Likely, 4 = Highly Likely

Levee Failure

8 out of 8 answered

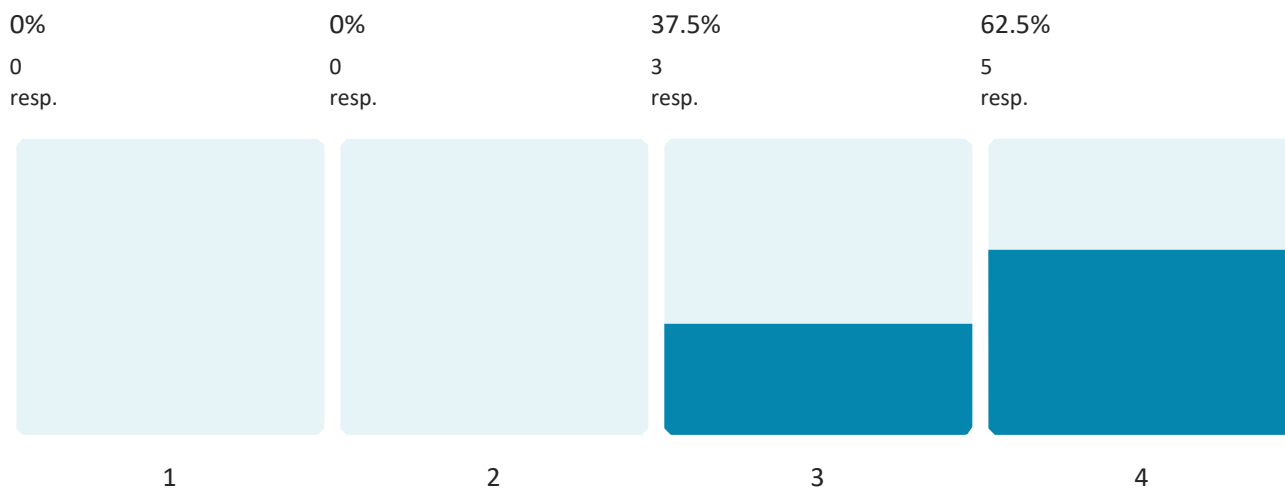
2.0 Average rating



Severe Thunderstorms - Including high winds, hail, & lightning

8 out of 8 answered

3.6 Average rating



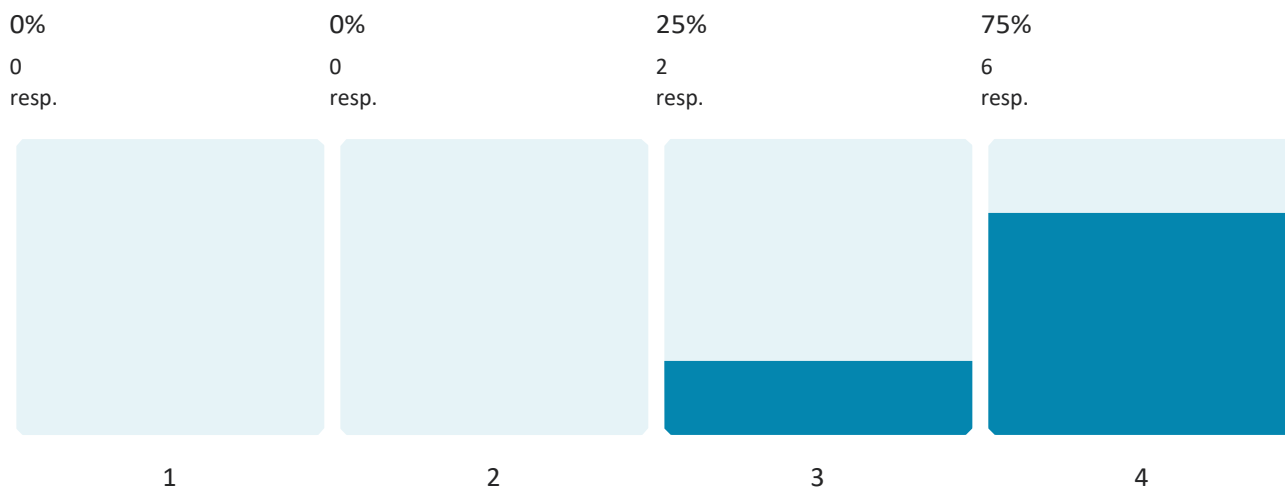
Please indicate your opinion on the likelihood for each hazard addressed in the Multi-jurisdictional Hazard Mitigation Plan Update to impact YOUR JURISDICTION (identified above). Please rate EACH hazard 1 through 4 as follows:

1 = Unlikely, 2 = Occasional, 3 = Likely, 4 = Highly Likely

Severe Winter Weather 8

out of 8 answered

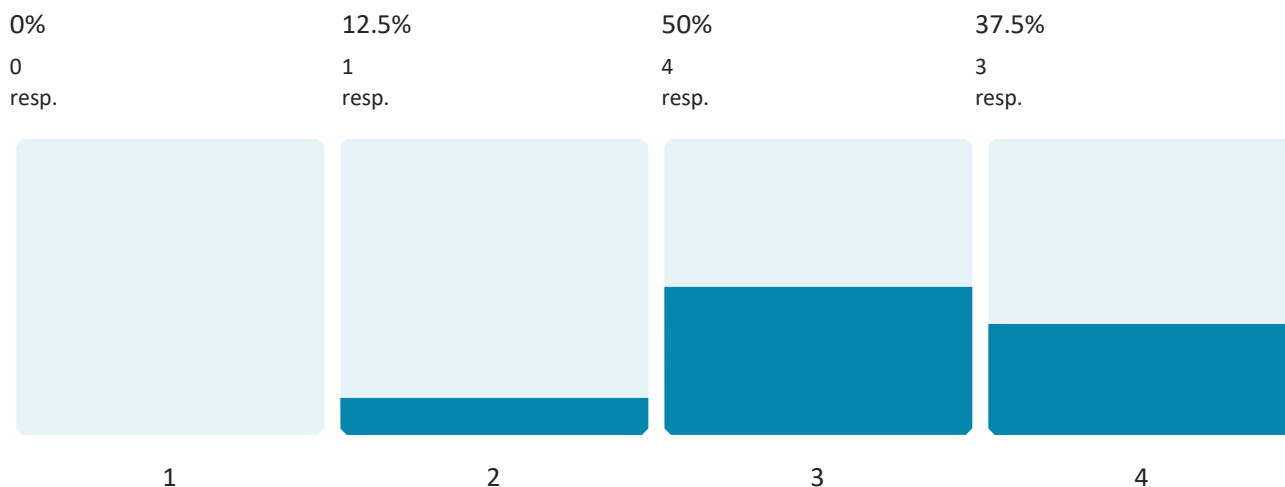
3.8 Average rating



Tornadoes

8 out of 8 answered

3.2 Average rating



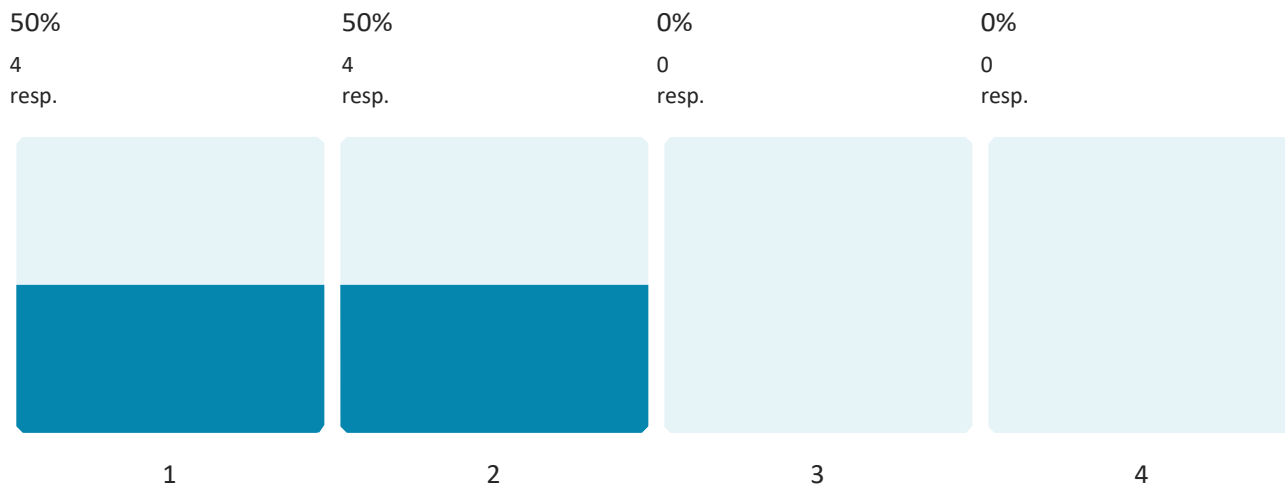
Please indicate your opinion on the likelihood for each hazard addressed in the Multi-jurisdictional Hazard Mitigation Plan Update to impact YOUR JURISDICTION (identified above). Please rate EACH hazard 1 through 4 as follows:

1 = Unlikely, 2 = Occasional, 3 = Likely, 4 = Highly Likely

Wildfire

8 out of 8 answered

1.5 Average rating



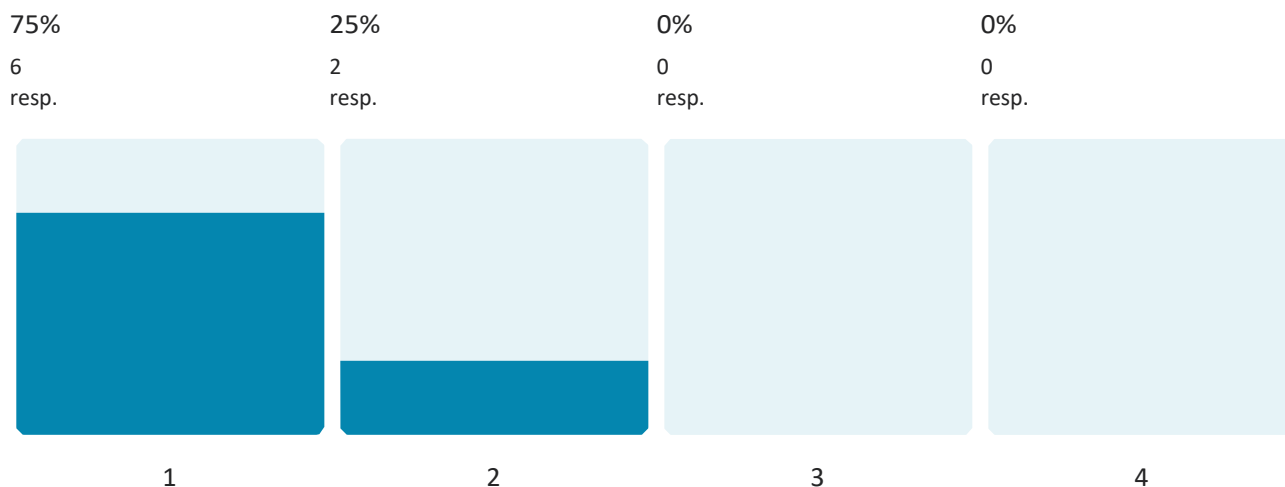
Please indicate your opinion on the potential magnitude of each hazard's impact on YOUR JURISDICTION (identified above). Please rate EACH hazard 1 through 4 as follows:

1 = Negligible, 2 = Limited, 3 = Critical, 4 = Catastrophic

Dam Failure

8 out of 8 answered

1.2 Average rating



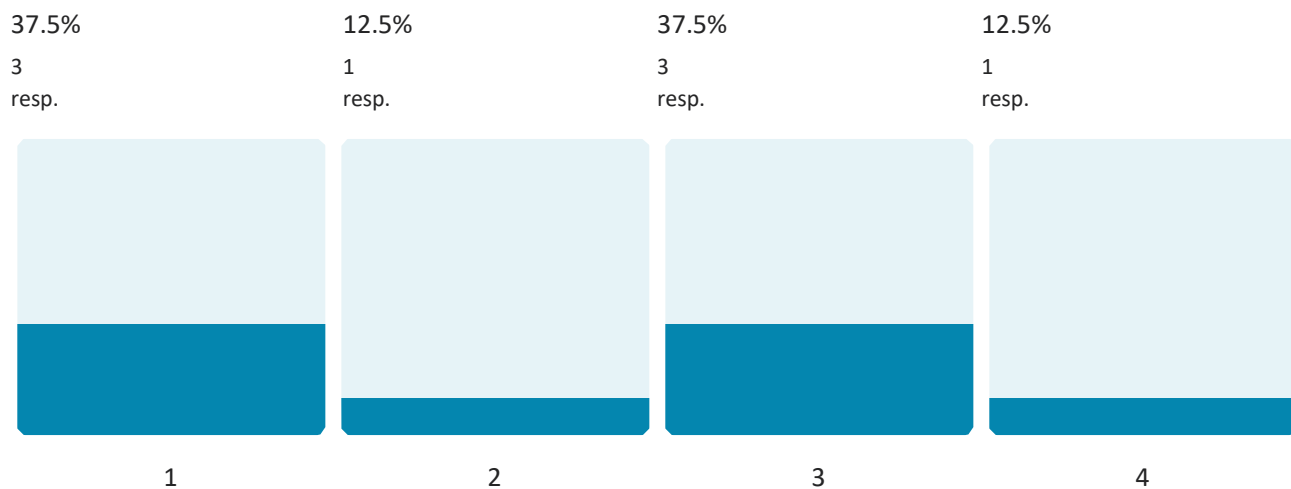
Please indicate your opinion on the potential magnitude of each hazard's impact on YOUR JURISDICTION (identified above). Please rate EACH hazard 1 through 4 as follows:

1 = Negligible, 2 = Limited, 3 = Critical, 4 = Catastrophic

Drought

8 out of 8 answered

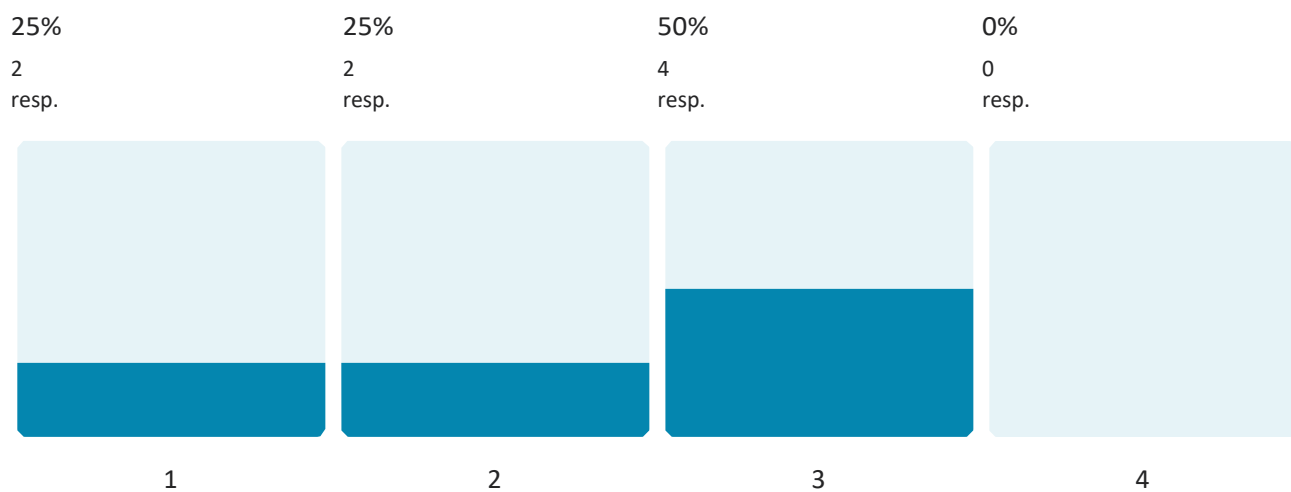
2.2 Average rating



Earthquake

8 out of 8 answered

2.2 Average rating

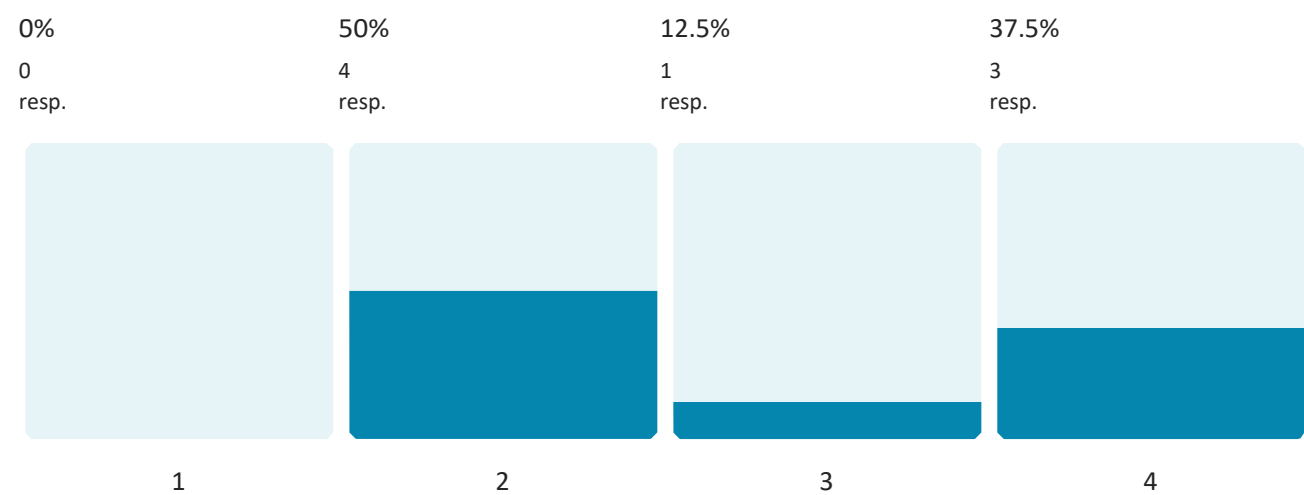


Please indicate your opinion on the potential magnitude of each hazard’s impact on YOUR JURISDICTION (identified above). Please rate EACH hazard 1 through 4 as follows:

1 = Negligible, 2 = Limited, 3 = Critical, 4 = Catastrophic

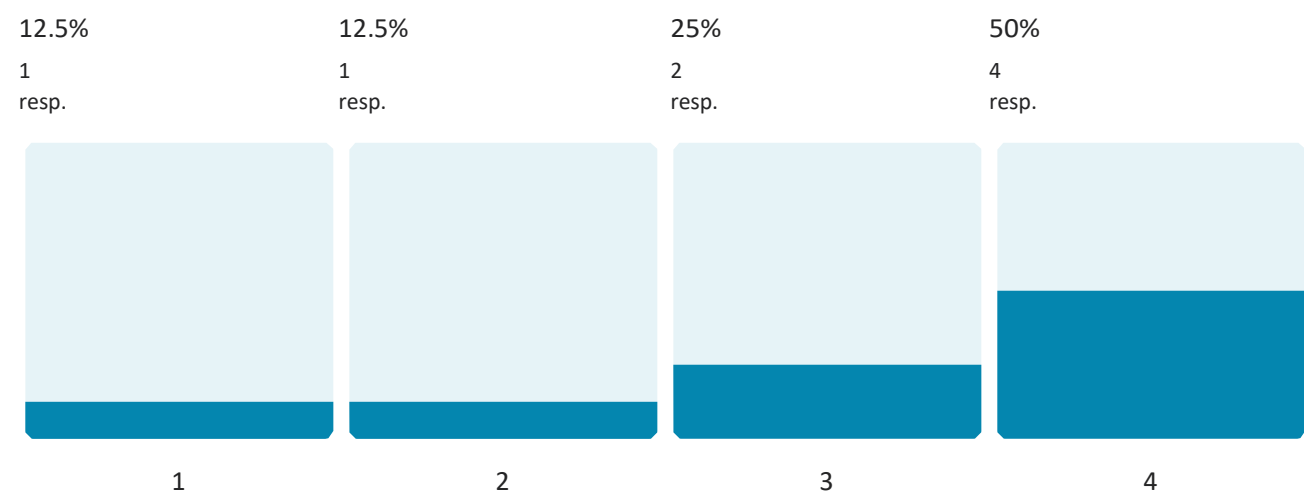
Extreme Temperatures 8
out of 8 answered

2.9 Average rating



Flooding (Flash and River) 8
out of 8 answered

3.1 Average rating



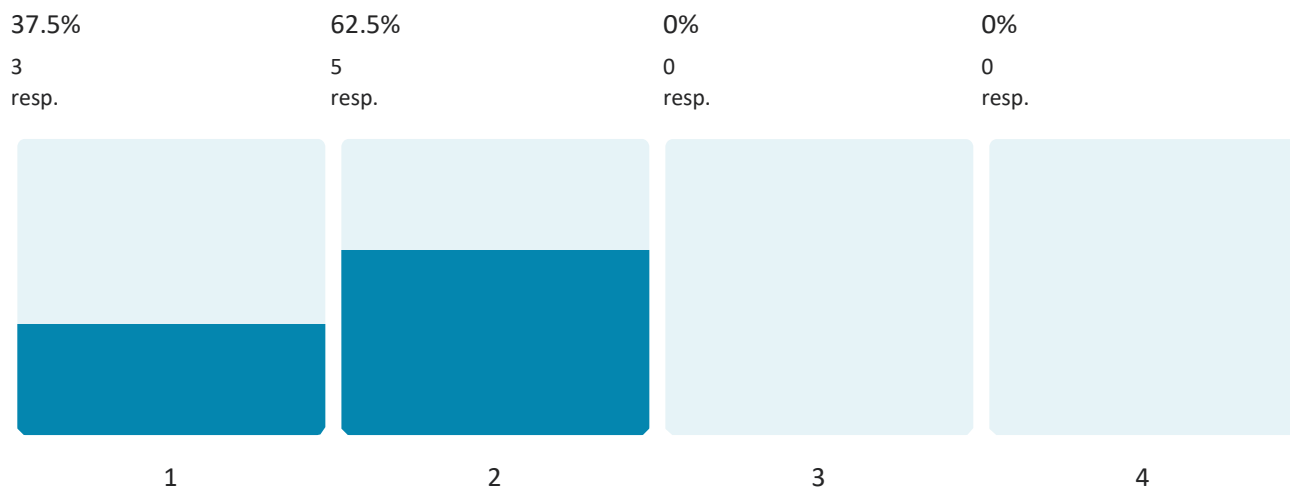
Please indicate your opinion on the potential magnitude of each hazard's impact on YOUR JURISDICTION (identified above). Please rate EACH hazard 1 through 4 as follows:

1 = Negligible, 2 = Limited, 3 = Critical, 4 = Catastrophic

Land Subsidence/Sinkholes 8

out of 8 answered

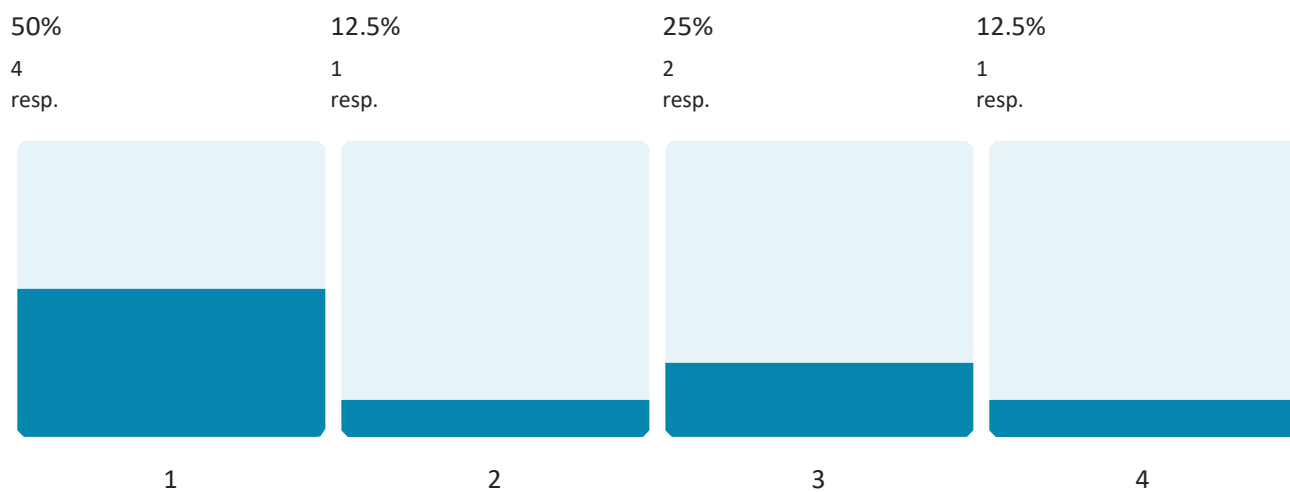
1.6 Average rating



Levee Failure

8 out of 8 answered

2.0 Average rating



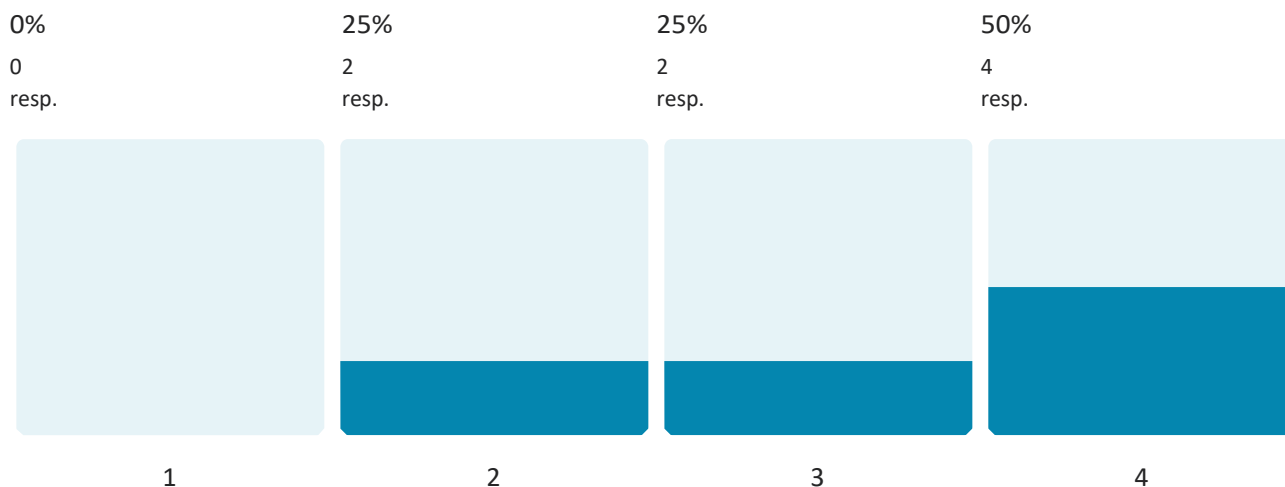
Please indicate your opinion on the potential magnitude of each hazard's impact on YOUR JURISDICTION (identified above). Please rate EACH hazard 1 through 4 as follows:

1 = Negligible, 2 = Limited, 3 = Critical, 4 = Catastrophic

Severe Thunderstorms - Including high winds, hail, & lightning

8 out of 8 answered

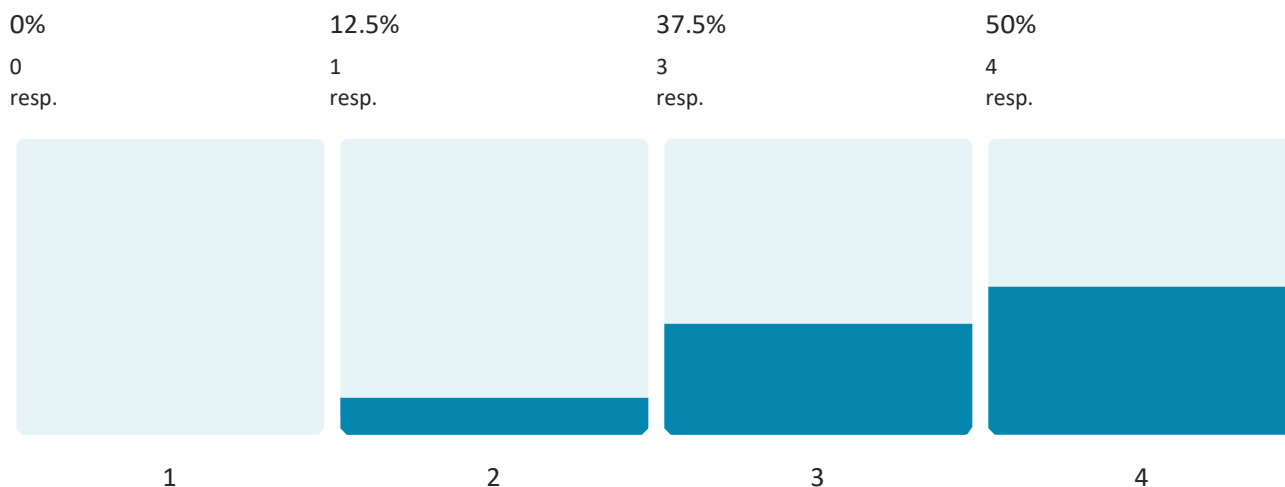
3.2 Average rating



Severe Winter Weather 8

out of 8 answered

3.4 Average rating



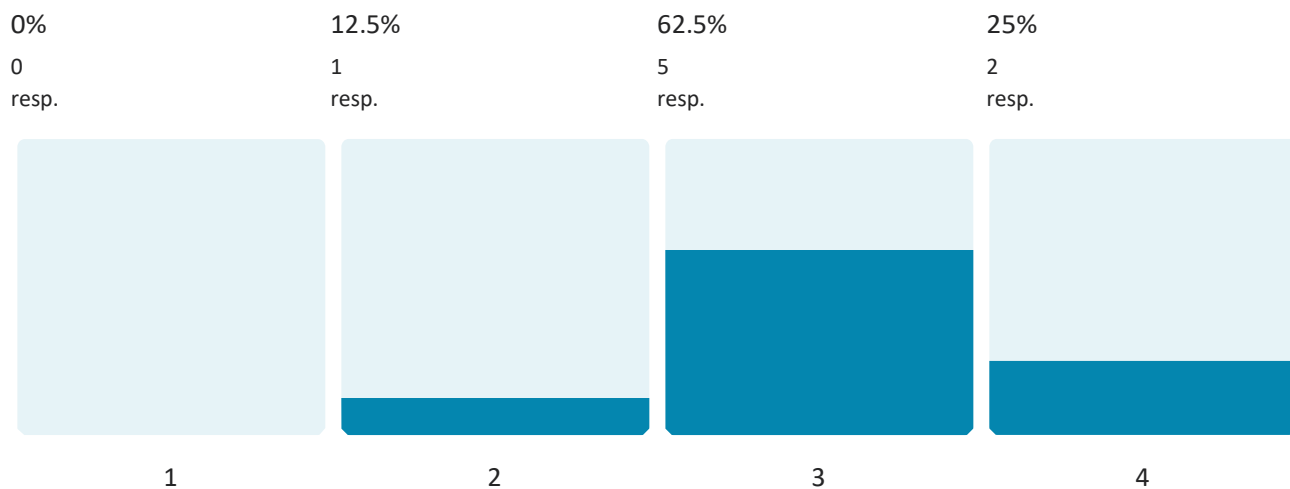
Please indicate your opinion on the potential magnitude of each hazard's impact on YOUR JURISDICTION (identified above). Please rate EACH hazard 1 through 4 as follows:

1 = Negligible, 2 = Limited, 3 = Critical, 4 = Catastrophic

Tornadoes

8 out of 8 answered

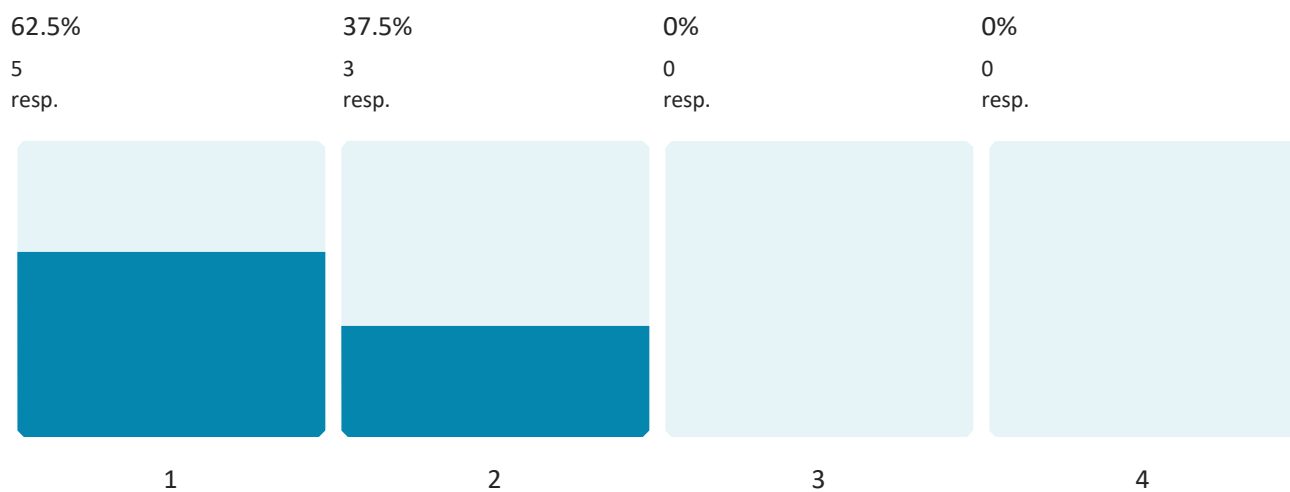
3.1 Average rating



Wildfire

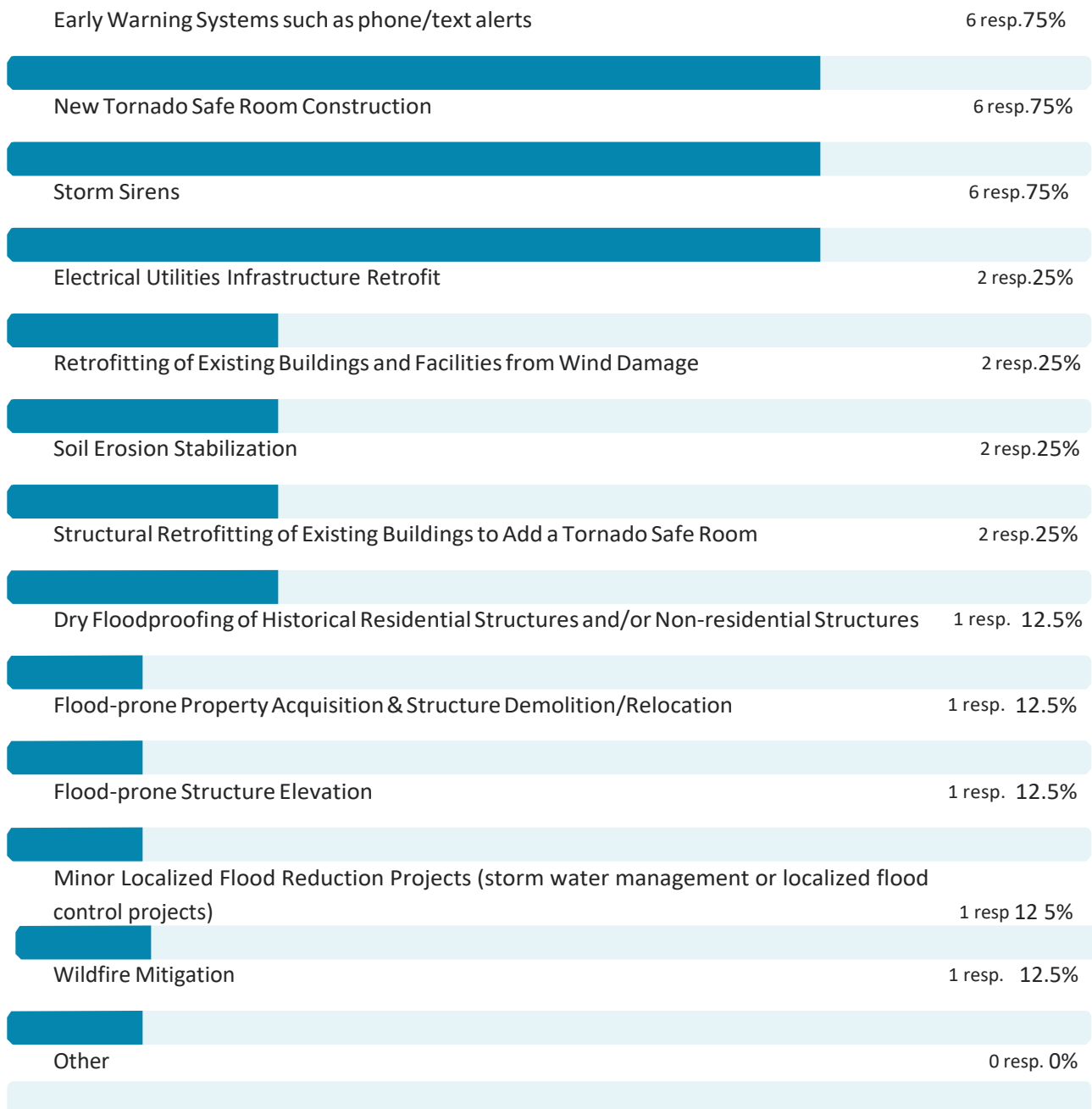
8 out of 8 answered

1.4 Average rating



FEMA Hazard Mitigation Assistance Grants are administered by the State Emergency Management Agency. Listed below are some types of projects considered.

8 out of 8 answered



Please comment on any other issues that the Osage County Hazard Mitigation Planning Committee should consider in developing a strategy to reduce future losses caused by hazard events.

- Completion of the Hwy 50 construction project north of the City of Linn to reduce traffic congestion through town with the continued growth of Linn Tech. Also the establishment of building construction codes/ordinances for residential or rental properties county wide. The recent increase in student housing construction appears to be driven by developer profit potential and the college administration pressures while quality of construction is overlooked. While we're working on local ordinances, establish a countywide on-site wastewater treatment system ordinance.
- Traffic control around school's
- Flash flood

D: Adoption Resolutions

RESOLUTION NO. 10062022

**A RESOLUTION TO ADOPT THE OSAGE COUNTY
MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN**

WHEREAS, Osage County recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Multi-Jurisdiction Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre-and post-disaster mitigation grant programs; and

WHEREAS, Osage County fully participated in the FEMA prescribed mitigation planning process to prepare this Mitigation Plan; and

WHEREAS, Osage County desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Osage County Multi-Jurisdiction Natural Hazards Mitigation Plan; and

WHEREAS, adoption by the governing body of Osage County demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

NOW, THEREFORE BE IT RESOLVED, that Osage County Commission adopts the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.


Presiding Commissioner

10-6-2022
Date


Associate Commissioner

10/6/2022
Date


Associate Commissioner

10/6/2022
Date

RESOLUTION NO. _____

**A RESOLUTION TO ADOPT THE OSAGE COUNTY
MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN**

WHEREAS, the Town of Argyle recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Multi-Jurisdiction Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre-and post-disaster mitigation grant programs; and

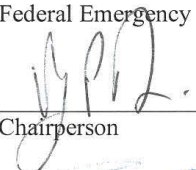
WHEREAS, the Town of Argyle fully participated in the FEMA prescribed mitigation planning process to prepare this Mitigation Plan; and

WHEREAS, the Town of Argyle desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Osage County Multi-Jurisdiction Natural Hazards Mitigation Plan; and

WHEREAS, adoption by the governing body of the Town of Argyle demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

NOW, THEREFORE BE IT RESOLVED, that the Town of Argyle Board of Trustees adopts the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.



Chairperson



Date



Witness



Date

RESOLUTION NO. 2022-2

**A RESOLUTION TO ADOPT THE OSAGE COUNTY
MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN**

WHEREAS, the City of Chamois recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Multi-Jurisdiction Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre-and post-disaster mitigation grant programs; and

WHEREAS, the City of Chamois fully participated in the FEMA prescribed mitigation planning process to prepare this Mitigation Plan; and

WHEREAS, the City of Chamois desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Osage County Multi-Jurisdiction Natural Hazards Mitigation Plan; and

WHEREAS, adoption by the governing body of the City of Chamois demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

NOW, THEREFORE BE IT RESOLVED, that the City of Chamois Board of Aldermen adopts the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.



Mayor

10-20-22

Date



Witness

10-20-22

Date

RESOLUTION NO. 133

**A RESOLUTION TO ADOPT THE OSAGE COUNTY
MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN**

WHEREAS, the Village of Freeburg recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Multi-Jurisdiction Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre-and post-disaster mitigation grant programs; and

WHEREAS, the Village of Freeburg fully participated in the FEMA prescribed mitigation planning process to prepare this Mitigation Plan; and

WHEREAS, the Village of Freeburg desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Osage County Multi-Jurisdiction Natural Hazards Mitigation Plan; and

WHEREAS, adoption by the governing body of the Village of Freeburg demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

NOW, THEREFORE BE IT RESOLVED, that the Village of Freeburg Board of Aldermen adopts the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.


Chairperson

10-03-2022
Date


Witness

10/3/2022
Date

RESOLUTION NO. 1290

**A RESOLUTION TO ADOPT THE OSAGE COUNTY
MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN**

WHEREAS, the City of Linn recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Multi-Jurisdiction Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre-and post-disaster mitigation grant programs; and

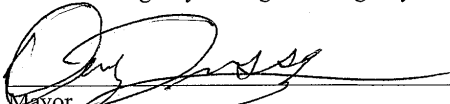
WHEREAS, the City of Linn fully participated in the FEMA prescribed mitigation planning process to prepare this Mitigation Plan; and

WHEREAS, the City of Linn desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Osage County Multi-Jurisdiction Natural Hazards Mitigation Plan; and

WHEREAS, adoption by the governing body of the City of Linn demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

NOW, THEREFORE BE IT RESOLVED, that the City of Linn Board of Aldermen adopts the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.



Mayor

10/18/2022

Date



Witness

10/18/2022

Date

**RESOLUTION NUMBER 2022-11 OF THE BOARD OF ALDERMEN
CITY OF META**

**A RESOLUTION TO ADOPT THE OSAGE COUNTY
MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN**

WHEREAS, the City of Meta recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Multi-Jurisdiction Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre-and post-disaster mitigation grant programs; and

WHEREAS, the City of Meta fully participated in the FEMA prescribed mitigation planning process to prepare this Mitigation Plan; and

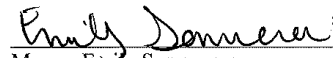
WHEREAS, the City of Meta desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Osage County Multi-Jurisdiction Natural Hazards Mitigation Plan; and

WHEREAS, adoption by the governing body of the City of Meta demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

NOW, THEREFORE BE IT RESOLVED, that the City of Meta Board of Aldermen adopts the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.

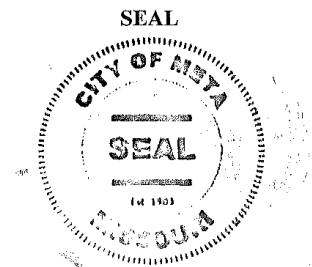
APPROVED and ADOPTED by the Mayor and Board of Alderman of the City of Meta this 14TH day of September, 2022.



Mayor, Emily Sommerer

Attest:


City Clerk, Deidra Buechter



RESOLUTION NO. 22-02

**A RESOLUTION TO ADOPT THE OSAGE COUNTY
MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN**

WHEREAS, the City of Westphalia recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Multi-Jurisdiction Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre-and post-disaster mitigation grant programs; and

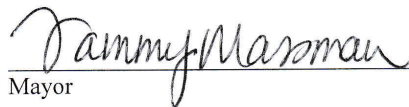
WHEREAS, the City of Westphalia fully participated in the FEMA prescribed mitigation planning process to prepare this Mitigation Plan; and

WHEREAS, the City of Westphalia desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Osage County Multi-Jurisdiction Natural Hazards Mitigation Plan; and

WHEREAS, adoption by the governing body of the City of Westphalia demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

NOW, THEREFORE BE IT RESOLVED, that the City of Westphalia Board of Aldermen adopts the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.



Mayor

9/27/22

Date



Witness

9/27/22

Date

RESOLUTION NO. 22-02

**A RESOLUTION TO ADOPT THE OSAGE COUNTY
MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN**

WHEREAS, the City of Westphalia recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Multi-Jurisdiction Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre-and post-disaster mitigation grant programs; and

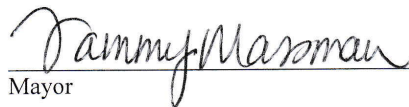
WHEREAS, the City of Westphalia fully participated in the FEMA prescribed mitigation planning process to prepare this Mitigation Plan; and

WHEREAS, the City of Westphalia desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Osage County Multi-Jurisdiction Natural Hazards Mitigation Plan; and

WHEREAS, adoption by the governing body of the City of Westphalia demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

NOW, THEREFORE BE IT RESOLVED, that the City of Westphalia Board of Aldermen adopts the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.



Mayor

9/27/22

Date



Witness

9/27/22

Date

RESOLUTION NO. _____

**A RESOLUTION TO ADOPT THE OSAGE COUNTY
MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN**

WHEREAS, the Osage County R-I School District recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Multi-Jurisdiction Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre-and post-disaster mitigation grant programs; and

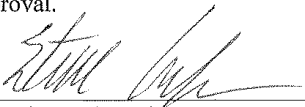
WHEREAS, the Osage County R-I School District fully participated in the FEMA prescribed mitigation planning process to prepare this Mitigation Plan; and

WHEREAS, the Osage County R-I School District desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Osage County Multi-Jurisdiction Natural Hazards Mitigation Plan; and

WHEREAS, adoption by the governing body of the Osage County R-I School District demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

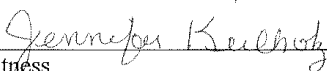
NOW, THEREFORE BE IT RESOLVED, that the Osage County R-I School District Board of Education adopts the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.



School Board President

10-12-22

Date



Witness

10-12-22

Date

RESOLUTION NO. _____

**A RESOLUTION TO ADOPT THE OSAGE COUNTY
MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN**

WHEREAS, the Osage County R-II School District recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Multi-Jurisdiction Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre-and post-disaster mitigation grant programs; and

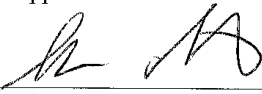
WHEREAS, the Osage County R-II School District fully participated in the FEMA prescribed mitigation planning process to prepare this Mitigation Plan; and

WHEREAS, the Osage County R-II School District desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Osage County Multi-Jurisdiction Natural Hazards Mitigation Plan; and


WHEREAS, adoption by the governing body of the Osage County R-II School District demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

NOW, THEREFORE BE IT RESOLVED, that the Osage County R-II School District Board of Education adopts the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.



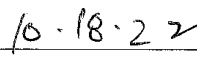
School Board President



Date



Witness



Date

RESOLUTION NO. _____

**A RESOLUTION TO ADOPT THE OSAGE COUNTY
MULTI-JURISDICTION NATURAL HAZARDS MITIGATION PLAN**

WHEREAS, the Osage County R-III School District recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Multi-Jurisdiction Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre-and post-disaster mitigation grant programs; and

WHEREAS, the Osage County R-III School District fully participated in the FEMA prescribed mitigation planning process to prepare this Mitigation Plan; and

WHEREAS, the Osage County R-III School District desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Osage County Multi-Jurisdiction Natural Hazards Mitigation Plan; and

WHEREAS, adoption by the governing body of the Osage County R-III School District demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

NOW, THEREFORE BE IT RESOLVED, that the Osage County R-III School District Board of Education adopts the Osage County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.

Douglas Luebking

School Board President

Date

9-26-22

Tim Luebking

Witness

Date

9-26-22

E: Critical/Essential Facilities

The table below (**Table 6.1**) provides information for critical facilities in the planning area. Specific information includes a Hazus ID if applicable, jurisdiction, building name/owner, and address.

Table 6.1 Osage County Critical Facilities by Type and Jurisdiction

HazusID	Jurisdiction	Building Name	Address	City	State	Zip
Emergency Facilities						
	Osage Co.	Osage Co. E-911	205 E. Main St.	Linn	MO	65051
	Osage Co.	Emergency Management Director	205 E. Main St.	Linn	MO	65051
Fire Department Facilities						
	Argyle	Argyle Volun. Fire Dept. #1	223 3 rd St.	Argyle	MO	65001
	Chamois	Chamois Volunteer Fire Dept.	200 S Main St.	Chamois	MO	65024
	Chamois	Chamois Volunteer Fire Dept.	338 E Missouri Ave.	Chamois	MO	65024
	Freeburg	Freeburg Comm. Fire Assoc. #1	600 Hwy. 63	Freeburg	MO	65035
	Freeburg	Freeburg Comm. Fire Assoc. #2	4339 HWY U	Rich Fountain	MO	65035
	Linn	Linn Fire Prot. Dist. #1	210 W. Main St.	Linn	MO	65051
MO000400	Linn	Linn Fire Prot. Dist. #2	1986 HWY A	Bonnotts Mill	MO	65051
MO000679	Linn	Linn Fire Prot. Dist. #3	633 HWY 89 N	Linn	MO	65051
MO000401	Linn	Linn Fire Prot. Dist. #4	1200 E. Main St.	Linn	MO	65051
	Linn	Linn Fire Prot. Dist. #5	100 S. Clay St.	Linn	MO	65051
MO000402	Meta	Meta Fire & Rescue	112 E Third St.	Meta	MO	65058
	Westphalia	Westphalia Fire Prot. Dist.	3388 County Road 503	Westphalia	MO	65085
	Westphalia	Westphalia Fire Prot. Dist.	1926 HWY 63	Westphalia	MO	65085
Law Enforcement Facilities						
MO000165	Linn	Linn Police Dept.	1200 E Main St.	Linn	MO	65051
MO000015	Osage Co.	Osage County Sheriff's Office	106 Main St.	Linn	MO	65051
Medical Facilities						
	Linn	Capital Region Physicians - Linn	916 E. Main St.	Linn	MO	65051
	Linn	Community Health Center of Central Missouri	1016 E Main St.	Linn	MO	65051

HazusID	Jurisdiction	Building Name	Address	City	State	Zip
	Linn	JCMG Family Care Clinic - Linn	1306 E Main St.	Linn	MO	65051
	Linn	Osage Ambulance District	119 MO-89	Linn	MO	65051
	Meta	Comm-Unity Ambulance Service	PO Box 132, Locust Street	Meta	MO	65058
	Belle	Osage Ambulance District	1001 E. First St.	Belle	MO	65013
	Osage County	Osage Co. Health Dept	205 E Main St.	Linn	MO	65051
School Facilities						
HazusID	Jurisdiction	Building Name	Address	City	State	Zip
MO001582	Bonnotes Mill	St. Mary's School	1641 HWY C	Bonnotes Mill	MO	65016
MO002940	Chamois	Chamois Elem.	614 S Poplar St.	Chamois	MO	65024
MO002941	Chamois	Chamois High	614 S Poplar St.	Chamois	MO	65024
MO001256	Freeburg	Holy Family School	110 W Oliver St.	Freeburg	MO	65035
MO002942	Linn	Linn Elem.	141 Wildcat Dr.	Linn	MO	65051
MO000710	Linn	Linn High	141 Wildcat Dr.	Linn	MO	65051
MO001253	Linn	St. George Elem. School	601 E Main St.	Linn	MO	65051
MO001581	Loose Creek	Immaculate Conception School	147 County Road 402	Loose Creek	MO	65054
MO001255	Rich Fountain	Sacred Heart School	4309 HWY U	Rich Fountain	MO	65035
MO001093	Westphalia	Fatima Elem.	143 E Main	Westphalia	MO	65085
MO001796	Westphalia	Fatima High	143 E Main	Westphalia	MO	65085
MO001254	Westphalia	St. Joseph Catholic School	123 E Main St.	Westphalia	MO	65085
Childcare Facilities						
	Belle	Doodlebugs Learning Center LLC	501 E First St.	Belle	MO	65013
	Bonnotes Mill	Blauvelt, Whitney Ann	93 Vosholl Ln.	Bonnotes Mill	MO	65016
	Bonnotes Mill	Jansen, Kim D	71 Cote Dessein Ln.	Bonnotes Mill	MO	65016
	Chamois	Osage County R-I School District	614 S Poplar St.	Chamois	MO	65024
	Chamois	The Sunflower Patch	59 Sunflower Ln.	Chamois	MO	65024
	Freeburg	Roberson, Megan	23 County Road 521	Freeburg	MO	65035
	Jefferson City	Little Sprout's Clubhouse LLC	332 County Road 501	Jefferson City	MO	65101
	Jefferson City	Miss Kathy's Preschool LLC	62 Playtime Ln.	Jefferson City	MO	65101

HazusID	Jurisdiction	Building Name	Address	City	State	Zip
	Linn	Central Missouri Community Action	1315 E Main St. # b	Linn	MO	65051
	Linn	Bartlett, Nicky and Hoffman, Kim	3785 Highway U	Linn	MO	65051
	Linn	Dudenhoeffer, Judy A	371 Highway 100	Linn	MO	65051
	Linn	Jacobs, Erin Lucero	13 County Road 804	Linn	MO	65051
	Linn	Scheulen, Deidre Anne	657 County Road 606	Linn	MO	65051
	Linn	Mimi's Playschool	24 Boonedocks Trail	Linn	MO	65051
	Linn	The Schoolhouse Childcare LLC	1214 E Lee St. Ste. E	Linn	MO	65051
	Loose Creek	Bailey's Learn & Play, LLC	191 County Road 402	Loose Creek	MO	65054
	Loose Creek	Creative Kids Learning Center, LLC	564 Loose Creek Highway	Loose Creek	MO	65054
	Loose Creek	Lisa's Little Ones	149 Rosetrail	Loose Creek	MO	65054
	St Thomas	Hoffman, Erica	400 N Olive St.	St Thomas	MO	65076
	Westphalia	Osage County R-III School District	1927 Highway 63	Westphalia	MO	65085
Nursing Homes						
	Linn	Harbor Place – Linn	24 Trenshaw Trail	Linn	MO	65051
	Westphalia	Westphalia Hill Nursing Home	1899 Highway 63	Westphalia	MO	65085

Source: Hazard Mitigation Plan Data Collection Questionnaire (2020-2021); Missouri Department of Health and Senior Services website-health.mo.gov

F: MDC Wildfire Data Search

View	Discovered Date	County	Station	Cause	Acres Burned
2010-07607-053856	11/10/2010	Osage	Linn Fire Protection District	Campfire	1
2015-01899-128751	09/30/2015	Osage	MDC Test Station	Campfire	2
2015-01899-128970	10/08/2015	Osage	MDC Test Station	Campfire	3
2015-06303-130445	10/12/2015	Osage	Belle Volunteer Fire Department	Campfire	0
2018-03731-177869	08/03/2018	Osage	Bland Fire Protection District	Campfire	0.82
2014-07607-111130	07/30/2014	Osage	Linn Fire Protection District	Children	2
2015-01899-128972	10/08/2015	Osage	MDC Test Station	Children	1
2003-07615-001146	03/17/2003	Osage	Argyle Volunteer Fire Dept	Debris	0.5
2004-00001-005810	03/08/2004	Osage	MDC REPORTING REGION - CENTRAL	Debris	1
2004-07611-024099	02/26/2004	Osage	Westphalia Fire Protection District	Debris	1
2004-07615-005812	03/14/2004	Osage	Argyle Volunteer Fire Dept	Debris	0.5
2005-07607-008412	03/12/2005	Osage	Linn Fire Protection District	Debris	1
2005-07614-009993	02/22/2005	Osage	Meta Fire & Rescue Fpd	Debris	1
2006-07609-012632	02/27/2006	Osage	Freeburg Community Fire Association	Debris	1
2006-07609-012633	02/26/2006	Osage	Freeburg Community Fire Association	Debris	1
2006-07614-012631	03/18/2006	Osage	Meta Fire & Rescue Fpd	Debris	10
2006-07614-012634	01/24/2006	Osage	Meta Fire & Rescue Fpd	Debris	0.75
2007-07607-028549	02/11/2007	Osage	Linn Fire Protection District	Debris	1
2007-07607-028550	03/04/2007	Osage	Linn Fire Protection District	Debris	0.5
2007-07607-028555	03/05/2007	Osage	Linn Fire Protection District	Debris	10
2007-07607-028557	03/06/2007	Osage	Linn Fire Protection District	Debris	0.25
2007-07607-032823	04/01/2007	Osage	Linn Fire Protection District	Debris	2
2007-07607-032824	03/06/2007	Osage	Linn Fire Protection District	Debris	100
2007-07607-032825	03/14/2007	Osage	Linn Fire Protection District	Debris	1
2007-07607-032826	03/16/2007	Osage	Linn Fire Protection District	Debris	2

2007-07607-032827	03/20/2007	Osage	Linn Fire Protection District	Debris	0.5
2007-07607-032828	03/25/2007	Osage	Linn Fire Protection District	Debris	0.5
2007-07607-032829	04/21/2007	Osage	Linn Fire Protection District	Debris	1
2007-07607-032830	04/22/2007	Osage	Linn Fire Protection District	Debris	1
2007-07607-032831	04/23/2007	Osage	Linn Fire Protection District	Debris	0.5
2007-07607-032832	08/15/2007	Osage	Linn Fire Protection District	Debris	8
2007-07609-028626	03/08/2007	Osage	Freeburg Community Fire Association	Debris	15
2007-07609-028627	03/08/2007	Osage	Freeburg Community Fire Association	Debris	5
2007-07609-028628	03/07/2007	Osage	Freeburg Community Fire Association	Debris	5
2007-07609-028629	03/16/2007	Osage	Freeburg Community Fire Association	Debris	5
2007-07614-028134	02/11/2007	Osage	Meta Fire & Rescue Fpd	Debris	1
2008-07607-033172	01/05/2008	Osage	Linn Fire Protection District	Debris	0.75
2008-07607-033173	01/25/2008	Osage	Linn Fire Protection District	Debris	3
2008-07607-033174	01/26/2008	Osage	Linn Fire Protection District	Debris	0.5
2008-07607-033175	01/26/2008	Osage	Linn Fire Protection District	Debris	6
2008-07607-035298	05/29/2008	Osage	Linn Fire Protection District	Debris	0.5
2008-07607-035327	03/01/2008	Osage	Linn Fire Protection District	Debris	2
2008-07607-035329	03/05/2008	Osage	Linn Fire Protection District	Debris	0.5
2008-07614-032732	01/03/2008	Osage	Meta Fire & Rescue Fpd	Debris	1
2008-07614-036115	11/26/2008	Osage	Meta Fire & Rescue Fpd	Debris	1
2009-03734-039963	03/03/2009	Osage	Owensville Volunteer Fire Department	Debris	1
2009-03734-039964	03/04/2009	Osage	Owensville Volunteer Fire Department	Debris	2
2009-03734-039966	03/05/2009	Osage	Owensville Volunteer Fire Department	Debris	2
2009-07607-037018	01/22/2009	Osage	Linn Fire Protection District	Debris	2
2009-07607-037020	01/22/2009	Osage	Linn Fire Protection District	Debris	4
2009-07607-037486	02/06/2009	Osage	Linn Fire Protection District	Debris	1
2009-07607-037489	02/06/2009	Osage	Linn Fire Protection District	Debris	4
2009-07607-038126	02/20/2009	Osage	Linn Fire Protection District	Debris	25
2009-07607-038178	03/04/2009	Osage	Linn Fire Protection District	Debris	2

2009-07607-042422	11/07/2009	Osage	Linn Fire Protection District	Debris	0.25
2009-07609-038283	02/25/2009	Osage	Freeburg Community Fire Association	Debris	15
2009-07611-037606	02/07/2009	Osage	Westphalia Fire Protection District	Debris	2
2009-07614-039873	04/22/2009	Osage	Meta Fire & Rescue Fpd	Debris	1
2010-07607-044882	03/05/2010	Osage	Linn Fire Protection District	Debris	1
2010-07607-044883	03/06/2010	Osage	Linn Fire Protection District	Debris	2.5
2010-07607-045408	04/01/2010	Osage	Linn Fire Protection District	Debris	0.25
2010-07611-045405	03/23/2010	Osage	Westphalia Fire Protection District	Debris	0.2
2010-07611-053039	11/15/2010	Osage	Westphalia Fire Protection District	Debris	1
2011-02628-062219	11/02/2011	Osage	TAOS VFD	Debris	5
2011-07521-058161	03/19/2011	Osage	Thayer Rural Fire Department	Debris	1
2011-07521-058166	03/23/2011	Osage	Thayer Rural Fire Department	Debris	1
2011-07607-066688	04/13/2011	Osage	Linn Fire Protection District	Debris	3
2011-07607-066689	04/22/2011	Osage	Linn Fire Protection District	Debris	1
2011-07611-054021	01/05/2011	Osage	Westphalia Fire Protection District	Debris	5
2011-07611-065393	12/02/2011	Osage	Westphalia Fire Protection District	Debris	0.5
2012-07609-067485	02/28/2012	Osage	Freeburg Community Fire Association	Debris	3
2012-07609-068537	03/06/2012	Osage	Freeburg Community Fire Association	Debris	60
2012-07609-077963	07/09/2012	Osage	Freeburg Community Fire Association	Debris	10
2012-07609-077964	07/22/2012	Osage	Freeburg Community Fire Association	Debris	1
2012-07609-077966	08/19/2012	Osage	Freeburg Community Fire Association	Debris	2
2012-07611-078625	08/10/2012	Osage	Westphalia Fire Protection District	Debris	0
2012-07611-078626	08/10/2012	Osage	Westphalia Fire Protection District	Debris	0
2014-07607-111132	04/10/2014	Osage	Linn Fire Protection District	Debris	1.5
2014-07607-111150	04/09/2014	Osage	Linn Fire Protection District	Debris	2
2014-07607-111151	03/24/2014	Osage	Linn Fire Protection District	Debris	0.25
2014-07607-113210	01/07/2014	Osage	Linn Fire Protection District	Debris	0.1
2014-07607-113212	01/27/2014	Osage	Linn Fire Protection District	Debris	0.1
2014-07607-113215	01/29/2014	Osage	Linn Fire Protection District	Debris	3

2014-07607-113230	02/27/2014	Osage	Linn Fire Protection District	Debris	0.5
2014-07607-113231	02/28/2014	Osage	Linn Fire Protection District	Debris	1
2014-07607-113234	03/10/2014	Osage	Linn Fire Protection District	Debris	3
2014-07607-113235	03/10/2014	Osage	Linn Fire Protection District	Debris	2
2014-07607-113237	03/15/2014	Osage	Linn Fire Protection District	Debris	2
2014-07607-113239	03/25/2014	Osage	Linn Fire Protection District	Debris	1
2014-07609-096400	03/10/2014	Osage	Freeburg Community Fire Association	Debris	10
2014-07609-096402	03/18/2014	Osage	Freeburg Community Fire Association	Debris	6
2014-07609-096404	03/18/2014	Osage	Freeburg Community Fire Association	Debris	1
2014-07614-112433	01/12/2014	Osage	Meta Fire & Rescue Fpd	Debris	1
2014-07614-112436	01/26/2014	Osage	Meta Fire & Rescue Fpd	Debris	2
2014-07614-112438	02/21/2014	Osage	Meta Fire & Rescue Fpd	Debris	2
2015-07611-116824	01/18/2015	Osage	Westphalia Fire Protection District	Debris	3
2016-06303-140864	02/07/2016	Osage	Belle Volunteer Fire Department	Debris	1
2016-06303-140867	02/29/2016	Osage	Belle Volunteer Fire Department	Debris	0.2
2016-07611-136571	05/06/2016	Osage	Westphalia Fire Protection District	Debris	1
2017-03734-150532	03/18/2017	Osage	Owensville Volunteer Fire Department	Debris	5
2019-07607-178660	03/03/2018	Osage	Linn Fire Protection District	Debris	0.42
2019-07607-178663	04/17/2018	Osage	Linn Fire Protection District	Debris	2.44
2019-07607-178665	04/19/2018	Osage	Linn Fire Protection District	Debris	0.05
2019-07607-178666	04/19/2018	Osage	Linn Fire Protection District	Debris	0.17
2019-07607-178669	09/23/2018	Osage	Linn Fire Protection District	Debris	1.84
2019-07607-178672	01/01/2018	Osage	Linn Fire Protection District	Debris	0.25
2019-07617-179234	09/03/2019	Osage	Chamois Volunteer Fire Dept	Debris	
2019-07617-179260	05/11/2018	Osage	Chamois Volunteer Fire Dept	Debris	0.08
2019-07617-179261	05/10/2018	Osage	Chamois Volunteer Fire Dept	Debris	0.09
2020-07617-190436	04/11/2020	Osage	Chamois Volunteer Fire Dept	Debris	0.35
2020-07617-241047	11/19/2020	Osage	Chamois Volunteer Fire Dept	Debris	19.3
2020-07617-251288	12/05/2020	Osage	Chamois Volunteer Fire Dept	Debris	0.4

2004-07614-009994	03/20/2004	Osage	Meta Fire & Rescue Fpd	Equipment	3
2007-07607-028561	03/08/2007	Osage	Linn Fire Protection District	Equipment	85
2009-07607-042445	11/07/2009	Osage	Linn Fire Protection District	Equipment	1.5
2011-01899-059025	08/01/2011	Osage	MDC Test Station	Equipment	234
2011-07614-062013	11/01/2011	Osage	Meta Fire & Rescue Fpd	Equipment	1
2012-07607-073615	06/05/2012	Osage	Linn Fire Protection District	Equipment	15
2014-07607-111131	07/02/2014	Osage	Linn Fire Protection District	Equipment	2
2014-07607-113211	01/12/2014	Osage	Linn Fire Protection District	Equipment	0.1
2014-07609-094036	01/26/2014	Osage	Freeburg Community Fire Association	Equipment	10
2014-07611-093829	01/30/2014	Osage	Westphalia Fire Protection District	Equipment	0.5
2015-03623-129571	10/19/2015	Osage	Gerald-Rosebud Fire Prot. Dist.	Equipment	50
2015-06303-130447	10/19/2015	Osage	Belle Volunteer Fire Department	Equipment	50
2018-03731-177870	06/09/2018	Osage	Bland Fire Protection District	Equipment	3.07
2019-07617-179259	07/23/2018	Osage	Chamois Volunteer Fire Dept	Equipment	8.22
2020-03734-200548	02/19/2020	Osage	Owensville Volunteer Fire Department	Equipment	0.59
2010-07607-053863	05/12/2010	Osage	Linn Fire Protection District	Lightning	0.25
2012-07607-073651	07/09/2012	Osage	Linn Fire Protection District	Lightning	2
2012-07609-077962	07/07/2012	Osage	Freeburg Community Fire Association	Lightning	1
2014-07607-113238	03/18/2014	Osage	Linn Fire Protection District	Lightning	0.1
2019-07607-178582	04/18/2019	Osage	Linn Fire Protection District	Lightning	0.02
2004-07614-009995	04/03/2004	Osage	Meta Fire & Rescue Fpd	Miscellaneous	2
2004-07614-009996	10/25/2004	Osage	Meta Fire & Rescue Fpd	Miscellaneous	1
2005-07607-009971	07/09/2005	Osage	Linn Fire Protection District	Miscellaneous	0.1
2005-07614-009991	03/02/2005	Osage	Meta Fire & Rescue Fpd	Miscellaneous	4
2005-07614-009992	03/05/2005	Osage	Meta Fire & Rescue Fpd	Miscellaneous	10
2007-07607-028547	01/10/2007	Osage	Linn Fire Protection District	Miscellaneous	0.5
2007-07611-030831	08/16/2007	Osage	Westphalia Fire Protection District	Miscellaneous	0.25
2007-07611-032368	11/11/2007	Osage	Westphalia Fire Protection District	Miscellaneous	0.1
2008-07607-035297	02/14/2008	Osage	Linn Fire Protection District	Miscellaneous	0.5

2008-07607-035320	04/05/2008	Osage	Linn Fire Protection District	Miscellaneous	0.1
2008-07607-035321	06/19/2008	Osage	Linn Fire Protection District	Miscellaneous	5
2008-07607-035323	03/26/2008	Osage	Linn Fire Protection District	Miscellaneous	0.1
2008-07607-035326	03/01/2008	Osage	Linn Fire Protection District	Miscellaneous	30
2008-07607-035328	03/02/2008	Osage	Linn Fire Protection District	Miscellaneous	2
2008-07607-035330	03/10/2008	Osage	Linn Fire Protection District	Miscellaneous	0.1
2008-07607-035331	03/10/2008	Osage	Linn Fire Protection District	Miscellaneous	0.5
2008-07607-035332	03/11/2008	Osage	Linn Fire Protection District	Miscellaneous	75
2008-07607-035333	03/12/2008	Osage	Linn Fire Protection District	Miscellaneous	3.5
2008-07607-035334	03/12/2008	Osage	Linn Fire Protection District	Miscellaneous	25
2008-07607-036045	11/23/2008	Osage	Linn Fire Protection District	Miscellaneous	0.1
2009-07607-038127	02/22/2009	Osage	Linn Fire Protection District	Miscellaneous	1
2009-07607-038158	02/22/2009	Osage	Linn Fire Protection District	Miscellaneous	5
2009-07607-038499	03/12/2009	Osage	Linn Fire Protection District	Miscellaneous	1
2009-07607-039150	03/15/2009	Osage	Linn Fire Protection District	Miscellaneous	1.5
2009-07607-039152	03/17/2009	Osage	Linn Fire Protection District	Miscellaneous	50
2009-07607-039155	03/19/2009	Osage	Linn Fire Protection District	Miscellaneous	0.1
2009-07607-039912	04/17/2009	Osage	Linn Fire Protection District	Miscellaneous	1
2009-07607-041208	07/02/2009	Osage	Linn Fire Protection District	Miscellaneous	0.25
2009-07607-042681	11/23/2009	Osage	Linn Fire Protection District	Miscellaneous	1
2009-07607-042682	11/27/2009	Osage	Linn Fire Protection District	Miscellaneous	1
2009-07614-038191	03/06/2009	Osage	Meta Fire & Rescue Fpd	Miscellaneous	15
2010-07607-053857	11/11/2010	Osage	Linn Fire Protection District	Miscellaneous	0.25
2010-07611-045401	03/07/2010	Osage	Westphalia Fire Protection District	Miscellaneous	1
2010-07614-044578	03/04/2010	Osage	Meta Fire & Rescue Fpd	Miscellaneous	1
2011-07614-056287	04/03/2011	Osage	Meta Fire & Rescue Fpd	Miscellaneous	1
2013-07614-112432	06/22/2013	Osage	Meta Fire & Rescue Fpd	Miscellaneous	1
2014-06313-111570	01/25/2014	Osage	Vichy Volunteer Fire Protection Assoc	Miscellaneous	175
2014-07607-113213	01/27/2014	Osage	Linn Fire Protection District	Miscellaneous	7

2014-07607-113214	01/27/2014	Osage	Linn Fire Protection District	Miscellaneous	0.1
2014-07607-113216	02/19/2014	Osage	Linn Fire Protection District	Miscellaneous	0.5
2014-07607-113232	03/01/2014	Osage	Linn Fire Protection District	Miscellaneous	2
2014-07607-113236	03/10/2014	Osage	Linn Fire Protection District	Miscellaneous	1.5
2014-07609-094034	01/26/2014	Osage	Freeburg Community Fire Association	Miscellaneous	5
2014-07609-096399	03/09/2014	Osage	Freeburg Community Fire Association	Miscellaneous	10
2014-07611-094611	02/22/2014	Osage	Westphalia Fire Protection District	Miscellaneous	2
2014-07614-112435	01/16/2014	Osage	Meta Fire & Rescue Fpd	Miscellaneous	1
2014-07614-112440	03/22/2014	Osage	Meta Fire & Rescue Fpd	Miscellaneous	2
2015-06303-129330	10/18/2015	Osage	Belle Volunteer Fire Department	Miscellaneous	25
2015-06313-129841	10/19/2015	Osage	Vichy Volunteer Fire Protection Assoc	Miscellaneous	10
2015-06313-129843	10/22/2015	Osage	Vichy Volunteer Fire Protection Assoc	Miscellaneous	0.1
2019-07607-178463	03/19/2019	Osage	Linn Fire Protection District	Miscellaneous	0.94
2019-07607-178465	03/22/2019	Osage	Linn Fire Protection District	Miscellaneous	7.1
2019-07607-178466	03/18/2019	Osage	Linn Fire Protection District	Miscellaneous	54.68
2019-07607-178467	02/02/2019	Osage	Linn Fire Protection District	Miscellaneous	0.05
2019-07607-178468	01/21/2018	Osage	Linn Fire Protection District	Miscellaneous	0.05
2019-07607-178657	01/21/2018	Osage	Linn Fire Protection District	Miscellaneous	3.89
2019-07607-178661	03/24/2018	Osage	Linn Fire Protection District	Miscellaneous	0
2019-07607-178662	03/30/2018	Osage	Linn Fire Protection District	Miscellaneous	0.01
2019-07607-178664	04/17/2018	Osage	Linn Fire Protection District	Miscellaneous	0.09
2019-07607-178668	07/09/2018	Osage	Linn Fire Protection District	Miscellaneous	0
2019-07617-179262	03/10/2018	Osage	Chamois Volunteer Fire Dept	Miscellaneous	0.12
2019-07617-179263	02/02/2018	Osage	Chamois Volunteer Fire Dept	Miscellaneous	2.34
2020-03734-200554	04/16/2020	Osage	Owensville Volunteer Fire Department	Miscellaneous	0.1
2020-07617-190160	03/07/2020	Osage	Chamois Volunteer Fire Dept	Miscellaneous	14.56
2014-07607-113219	02/21/2014	Osage	Linn Fire Protection District	Not Reported	0.1
2014-07607-113221	02/22/2014	Osage	Linn Fire Protection District	Not Reported	3
2019-07607-178658	02/13/2018	Osage	Linn Fire Protection District	Not Reported	0.02

2019-07617-178420	03/27/2019	Osage	Chamois Volunteer Fire Dept	Not Reported	19.67
2019-07617-179122	06/20/2019	Osage	Chamois Volunteer Fire Dept	Not Reported	0
2019-07617-179123	08/09/2019	Osage	Chamois Volunteer Fire Dept	Railroad	0
2011-01899-059026	08/02/2011	Osage	MDC Test Station	Smoking	9
2014-07611-094704	02/28/2014	Osage	Westphalia Fire Protection District	Smoking	3
2019-07607-178656	04/08/2019	Osage	Linn Fire Protection District	Smoking	0
2019-07617-179264	01/06/2018	Osage	Chamois Volunteer Fire Dept	Smoking	0.24
2006-07611-024100	01/08/2006	Osage	Westphalia Fire Protection District	Unknown	1
2006-07614-012630	03/17/2006	Osage	Meta Fire & Rescue Fpd	Unknown	1
2007-07611-030711	08/12/2007	Osage	Westphalia Fire Protection District	Unknown	1
2008-07607-035324	01/27/2008	Osage	Linn Fire Protection District	Unknown	0.1
2008-07607-035325	01/28/2008	Osage	Linn Fire Protection District	Unknown	0.1
2008-07607-036893	12/30/2008	Osage	Linn Fire Protection District	Unknown	1
2009-07607-037019	01/22/2009	Osage	Linn Fire Protection District	Unknown	1
2009-07607-037021	01/22/2009	Osage	Linn Fire Protection District	Unknown	1
2009-07607-039151	03/15/2009	Osage	Linn Fire Protection District	Unknown	1
2009-07607-039153	03/17/2009	Osage	Linn Fire Protection District	Unknown	1
2009-07607-039156	03/20/2009	Osage	Linn Fire Protection District	Unknown	0.1
2009-07607-040057	04/26/2009	Osage	Linn Fire Protection District	Unknown	2
2009-07607-040314	05/20/2009	Osage	Linn Fire Protection District	Unknown	0.1
2009-07614-037384	02/07/2009	Osage	Meta Fire & Rescue Fpd	Unknown	1
2010-07607-056330	03/12/2010	Osage	Linn Fire Protection District	Unknown	18
2010-07611-045062	03/05/2010	Osage	Westphalia Fire Protection District	Unknown	1
2010-07611-045404	03/08/2010	Osage	Westphalia Fire Protection District	Unknown	0.25
2010-07611-045406	03/29/2010	Osage	Westphalia Fire Protection District	Unknown	1
2010-07611-053061	11/08/2010	Osage	Westphalia Fire Protection District	Unknown	0.5
2011-07607-066686	03/12/2011	Osage	Linn Fire Protection District	Unknown	20
2011-07607-066687	04/03/2011	Osage	Linn Fire Protection District	Unknown	1
2011-07607-066690	07/21/2011	Osage	Linn Fire Protection District	Unknown	1

2011-07607-066691	11/13/2011	Osage	Linn Fire Protection District	Unknown	50
2011-07607-066742	04/03/2011	Osage	Linn Fire Protection District	Unknown	1
2011-07607-066743	09/12/2011	Osage	Linn Fire Protection District	Unknown	1
2011-07607-066744	11/13/2011	Osage	Linn Fire Protection District	Unknown	3
2011-07607-066745	11/15/2011	Osage	Linn Fire Protection District	Unknown	3
2011-07607-066746	11/19/2011	Osage	Linn Fire Protection District	Unknown	1
2011-07611-057381	04/02/2011	Osage	Westphalia Fire Protection District	Unknown	0.5
2012-07609-068554	03/06/2012	Osage	Freeburg Community Fire Association	Unknown	20
2012-07609-068555	03/07/2012	Osage	Freeburg Community Fire Association	Unknown	2
2012-07611-078624	06/29/2012	Osage	Westphalia Fire Protection District	Unknown	0.1
2013-07611-090962	10/23/2013	Osage	Westphalia Fire Protection District	Unknown	0.1
2014-07607-113233	03/09/2014	Osage	Linn Fire Protection District	Unknown	1
2014-07611-094418	02/20/2014	Osage	Westphalia Fire Protection District	Unknown	0.5
2014-07611-095284	03/09/2014	Osage	Westphalia Fire Protection District	Unknown	1
2014-07611-095532	03/15/2014	Osage	Westphalia Fire Protection District	Unknown	4
2014-07611-102802	04/22/2014	Osage	Westphalia Fire Protection District	Unknown	2
2015-06303-129676	07/16/2015	Osage	Belle Volunteer Fire Department	Unknown	0.2
2015-06303-129679	02/08/2015	Osage	Belle Volunteer Fire Department	Unknown	5
2015-06303-130443	09/14/2015	Osage	Belle Volunteer Fire Department	Unknown	0.02
2015-06303-130446	10/17/2015	Osage	Belle Volunteer Fire Department	Unknown	0.01
2015-06303-130448	10/20/2015	Osage	Belle Volunteer Fire Department	Unknown	0
2015-07611-119923	03/07/2015	Osage	Westphalia Fire Protection District	Unknown	1
2015-07611-119924	03/07/2015	Osage	Westphalia Fire Protection District	Unknown	1
2016-06303-140868	03/06/2016	Osage	Belle Volunteer Fire Department	Unknown	0.2
2016-06303-140870	03/26/2016	Osage	Belle Volunteer Fire Department	Unknown	0.5
2016-06303-140871	04/03/2016	Osage	Belle Volunteer Fire Department	Unknown	3
2016-06303-140874	06/18/2016	Osage	Belle Volunteer Fire Department	Unknown	1
2016-06303-141960	11/15/2016	Osage	Belle Volunteer Fire Department	Unknown	2
2016-06303-141963	11/21/2016	Osage	Belle Volunteer Fire Department	Unknown	1

2016-07611-141071	10/27/2016	Osage	Westphalia Fire Protection District	Unknown	2
2016-07611-141832	11/18/2016	Osage	Westphalia Fire Protection District	Unknown	1
2016-07611-142531	12/10/2016	Osage	Westphalia Fire Protection District	Unknown	0.1
2017-03734-150142	02/12/2017	Osage	Owensville Volunteer Fire Department	Unknown	1
2017-07611-147331	03/08/2017	Osage	Westphalia Fire Protection District	Unknown	0.5
2019-07607-178670	10/25/2018	Osage	Linn Fire Protection District	Unknown	0.49
2019-07614-178256	02/27/2019	Osage	Meta Fire & Rescue Fpd	Unknown	2.88
2019-07617-179258	12/11/2018	Osage	Chamois Volunteer Fire Dept	Unknown	0.06
2020-07607-230936	10/17/2020	Osage	Linn Fire Protection District	Unknown	4.48
2020-07617-251289	12/26/2020	Osage	Chamois Volunteer Fire Dept	Unknown	0.03

Source: Missouri Department of Conservation, Fire Report Search, <https://mdc12.mdc.mo.gov/Applications/MDCFireReporting/Home/FireReportSearch>