DOUGLAS COUNTY, MISSOURI
HAZARD MITIGATION PLAN
2023 UPDATE

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CONTRIBUTORS

Douglas County, Missouri Hazard Mitigation Planning Committee

Jurisdictional Representatives

Name	Title	Department	Jurisdiction/Agency/Organization
Lance Stillings	Presiding Commissioner	County	Douglas County
Suzanne Welsh	Clerk	City	Ava
Aaron Dalton	Superintendent	School	Ava R-I

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

(1) Protect the lives and property of all citizens of Douglas County;
(2) Preserve functioning of civil government during natural disasters; and
(3) Maintain economic activities essential to the survival and recovery from natural disasters.

To advance 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, background information, ideas for implementation, responsible agency, timeline, cost estimate, potential funding sources, and more.

Stakeholder Representatives

Name	Title	Department	Jurisdiction/Agency/Organization
Burrely Loftin	Mayor	City	Ava
David Overcast	Police Chief	City - Police	Ava
Scotty Upchurch	Fire Chief	City – Fire Dept.	Ava
Travis Cheyney	District 1 Commissioner	County	Douglas County
Brad Loveless	District 2 Commissioner	County	Douglas County
Karry Davis	County Clerk	County	Douglas County
Cassie Cunningham	VP/Chief Growth Officer	Electrical Cooperative	White River Valley
Danny Maggard	EMD Coordinator	County	Douglas County

EXECUTIVE SUMMARY

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. Douglas County and participating jurisdictions and school/special districts developed this multi-jurisdictional local hazard mitigation plan update to reduce future losses from hazard events to the County and its communities and school/special districts. The plan is an update of a plan that was approved on 4/23/2018. The plan and the update were prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 to result in eligibility for the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance Grant Programs.

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

- Douglas County, Missouri
- City of Ava, Missouri
- Ava R-I School District

This current planning effort serves to update that previously approved plan.

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

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

(1) Protect the lives and property of all citizens of Douglas County;

(2) Preserve functioning of civil government during natural disasters; and

(3) Maintain economic activities essential to the survival and recovery from natural disasters.

To advance the identified goals, the MPC developed recommended mitigation actions, as summarized in the table on the following pages. The MPC developed an implementation plan for each action, which identifies priority level, background information, ideas for implementation, responsible agency, timeline, cost estimate, potential funding sources, and more. These additional details are provided in Chapter 4.

Table 1. Mitigation Action Matrix

#	Action	Jurisdiction	Priority	Goals Addressed	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
Douglas1	Purchase and install a backup generator at the county courthouse which serves various governmental functions	Douglas County	20	Goal 2	Thunderstorm/High Winds/Lightning/Hail	X		
Ava	Develop a coordinated plan to test outdoor warning sirens on a consistent basis	City of Ava	15	Goal 2	Tornado	X		
Ava	The city will attempt to improve floodplain management by identification of map amendments/updates	City of Ava	16	Goal 3	Flooding (Flash and River)	X		X
Douglas2	Continuously identify funding sources to update buildings and infrastructure to ensure that community assets are resilient to natural disaster	Douglas County	19	Goal 1	Tornado	X		

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 schools/special districts. The documentation of each adoption is included in Appendix D, and a model resolution is included below. The jurisdictions listed in the Executive Summary participated in the development of this plan and have adopted the multi-jurisdictional plan.

Model Resolution

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

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

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

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

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

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

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

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

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

ADOPTED by a vote of_____in favor and_____against, and_____abstaining, this___day of __,_____.

By (Sig):
Print name:

ATTEST:
By (Sig.):
Print name:

APPROVED AS TO FORM:
By (Sig.):
Print name: Table 1

1 INTRODUCTION AND PLANNING PROCESS

1.1 PURPOSE

Hazard Mitigation is the process of preparing for and taking action in order to reduce the long- term risk of natural disasters to financial and human consequences. Mitigation actions may be implemented prior to, during, or after a hazard event. However, it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs (http://www.fema.gov/what-mitigation).

By participating in the planning process and meeting the necessary requirements to do so, communities, school districts, and other special districts become eligible to apply for mitigation grant funding. FEMA has implemented the various hazard mitigation provisions through the Code of Federal Regulations (CFR) at 44 CFR Part 201. The CFR provisions set forth the mitigation plan requirements for local and tribal governments as a condition of receiving FEMA hazard mitigation assistance. Local governments, schools, or other publicly funded districts that do not participate or adopt a hazard mitigation plan will not be eligible to apply for grants as stated under 44 CFR §201.6. Section 322 of the Robert T. Stafford Relief and Emergency Assistance Act (P.L. 93-288), as amended by the Disaster Mitigation Act of 2000 (DMA) (P.L. 106-390), provides for States, Tribes, and local governments to undertake a risk-based approach to reducing risks to natural hazards through mitigation planning. Guidance is followed from FEMA's Local Mitigation Planning Handbook, March 2013 and FEMA's Local Mitigation Plan Review Guide, October 1, 2011.

1.2 BACKGROUND AND SCOPE

As required by 44 CFR §201.6(d)(3), a local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts and changes in priorities, and resubmit it for approval every five (5) years in order to continue to be eligible for mitigation project grant funding. The 2023 Douglas County Multi-Jurisdictional Natural Hazard Mitigation Plan, from here on referred to as the Plan, is a revision of the previous five-year update approved by FEMA during 2018, which was the first five-year update of the original countywide hazard mitigation plan completed in 2007.

The Plan is a major rewrite of the 2018 Plan and reflects changes in priorities and development, and the continued commitment of local governments to mitigate the impact of natural hazards in Douglas County. Local jurisdictions that participated in the 2018 Plan and are continuing participation in this 2023 Plan include:

- Douglas County
- City of Ava
- Ava R-I School District

All jurisdictions received letter and email communications notifying representatives of upcoming meetings and participation requirements. Jurisdictions listed above were represented during the planning process and met the minimum participation requirements.

The local mitigation plan is the representation of the jurisdictions' commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. Information in the Plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future.

1.3 PLAN ORGANIZATION

The Plan is organized into five chapters. The 2018 Plan included a chapter dedicated to local jurisdiction capabilities. This information has been incorporated into the Planning Area Profile and Capabilities Chapter. The format of the Plan was changed to conform to the local hazard mitigation plan outline template released by the Missouri State Emergency Management Agency (SEMA) in September 2017. The Plan chapters include:

- 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

Table 1.1 on the following page summarizes the changes made in the Plan by chapter:

Table 1.1. Changes Made in Plan Update

Plan Chapter	Summary of Changes Made
Introduction	• General Format Changes
Profile & Capabilities	• Added Geological and Karst features map • Critical features moved to Ch. 3 • Added table showing Unemployment, Poverty, education, and language percentages • Historic Sites and endangered species list moved to Ch. 3. • Added table showing FEMA HMA grants approved.
Risk Assessment	• General format updates • Expanded introduction section • Added Assets at Risk of exposure to current population and structures • Added Critical Facilities inventory of all included jurisdictions • Added inventory of parks, historical sites, and endangered species. • Added table for agricultural-related jobs and information and Major employers • Added Land Use Development section for development since previous plan and future land use expected. • Expanded Community profiles for each jurisdiction. • Added low water crossing information
Mitigation Strategy	• Updated mitigation actions development process • Included actions eliminated and reason for removal • Updated progress made towards mitigation goals from earlier plan • Updated cost benefit review method using STAPLEE and simple scores • Discussed funding sources, lead agencies and status of continuing, revised and new actions
Plan Maintenance	• Updated the responsibilities for plan monitoring, evaluation, and implementation.

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.

For the update of the 2023 Douglas County Hazard Mitigation Plan, the County and SEMA has contracted with the South Central Ozark Council of Governments (SCOCOG) and has participated fully in the update process. Once this plan receives final approval from the Federal Emergency Management Agency, Douglas County, and the participating cities and school districts within will be eligible for future mitigation assistance from FEMA and will be able to carry out the identified mitigation activities more effectively in an effort to lessen the adverse impact of future natural disasters that take place in the county.

SCOCOG's role as contractor includes the following elements:

- Assist in establishing a Mitigation Planning Committee (MPC) as defined by the Disaster Mitigation Act (DMA),
- Ensure the updated plan meets the DMA requirements as established by federal regulations and follows the most current planning guidance of the Federal Emergency Management Agency (FEMA),
- Facilitate the entire plan development process,
- Identify the data that MPC participants could provide and conduct the research and documentation necessary to augment that data,
- Assist in soliciting public input,
- Produce the draft and final plan update in a FEMA-approvable document and Coordinate the Missouri State Emergency Management Agency (SEMA) and (FEMA) plan reviews.

The plan update process followed a methodology prescribed by FEMA, which began with the formation of a Mitigation Planning Committee (MPC) comprised of representatives from Douglas County and participating jurisdictions. The MPC updated the risk assessment that identified and profiled hazards that pose a risk to the County and analyzed jurisdictional vulnerability to these hazards. The MPC also directed the planner-in-charge to analyze the capabilities in place to mitigate the hazard damages, with emphasis on changes that have occurred since the previously approved plan was adopted. The planner-in-charge determined that the planning area is vulnerable to several hazards that are identified, profiled, and analyzed in this plan. Flash flooding, winter storms, and tornadoes are among the hazards that historically have had the most significant impact.

Table 1.2. Jurisdictional Representatives of Douglas County Mitigation Planning Committee

Name	Title	Department	Jurisdiction, Agency or Organization
Lance Stillings	Presiding Commissioner	County	Douglas County
Suzanne Welsh	Clerk	City	City of Ava
Aaron Dalton	Superintendent	School	Ava R-I

Table 1.3 below demonstrates the expertise of the Douglas County MPC members in the six mitigation categories (Preventive Measures, Property Protection, Natural Resource Protection, Emergency Services, Structural Flood Control Projects, and Public Information).

Table 1.3. MPC Capability with Six Mitigation Categories[1(b)]

Office	Preventive Measures	Structure and Infrastructure Projects		Natural Resource Protection	Public Information	Emergency Services
		Property Protection	Structural Flood Control Projects			
Presiding Commissioner	✓	✓	✓	✓	✓	
Police Chief/EMD	✓		✓			✓
Mayor	✓			✓		
EMD/Fire Chief	✓		✓			✓
Superintendent	✓	✓			✓	

1.4.1 Multi-Jurisdictional Participation

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

The South Central Ozark Council of Governments, on behalf of Douglas County, invited all incorporated cities, all school districts, and many non-profit entities located within the county to participate in the Douglas County Hazard Mitigation Plan update planning meetings. FEMA accepts multi-jurisdictional plans which meet all the requirements of 44CFR §201.6(a)(3):

- The risk assessment must assess each jurisdiction's risk where they may vary from the risks facing the entire planning area.
- There must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.
- Each jurisdiction requesting approval of the plan must document that itself has formally adopted the plan.

DMA 2000 further requires that jurisdictions represented within a multi-jurisdictional hazard mitigation plan participate in the planning process in addition to formally adopting the completed plan. Each participating jurisdiction was required to meet planning participation requirements as defined by SCOCOG at the beginning of the update process. Minimum participation requirements were defined as follows:

Provide information to support the plan update through at least two of the following methods:

- Completion of jurisdiction questionnaire;
- Attendance at public meetings;
- Alternately scheduled meetings for data collection purposes;
- Email correspondence with SCOCOG staff for data collection purposes; and
- Formally adopt the hazard mitigation plan

SCOCOG was contracted by Douglas County to revise and update the 2018 Hazard Mitigation Plan and coordinate planning efforts between the municipalities and school districts of the County. SCOCOG planning staff led the development of the plan update by forming the planning committee, calling, and facilitating meetings, compiling data, composing, and reviewing drafts, issuing public notices, and drafting correspondence. All the jurisdictions listed as participants in the plan update met the minimum participation requirements as indicated in the following tables. Documentation of meeting attendance is included in ***Appendix A: Planning Participation Documentation*****.**

Participating jurisdictions include Douglas County (unincorporated), the incorporated city of Ava, and the school district of Ava R-I. In the 2018 iteration of the Douglas County Hazard Mitigation Plan, all jurisdictions participated fully. Other jurisdictions which participated in the planning process as stakeholders but are not seeking independent adoption and approval are: local police departments, electric cooperatives, emergency management agencies.

The Plan serves as a written document of the planning process. Active participation of local jurisdiction representatives and stakeholders in the hazard mitigation planning process is essential if the Plan is to have value. To be eligible for mitigation funding, local governments and school districts must adopt the FEMA-approved update of the Plan. The participation of the local government stakeholders in the planning process is considered critical to successful implementation of this plan. Each jurisdiction that is seeking approval for the plan must have its governing boy adopt the updated plan, regardless the degree of modifications. SCOCOG collaborated with the local governments in Douglas County to assure participating in the planning process to the greatest extent possible and the development of the plan that represents the needs and interests of Douglas County and its local jurisdictions.

The planning engagement took to the form of individual meetings with each of the participating jurisdictions, who reviewed findings from the updated Risk Assessment and completed a hazard mitigation data collection questionnaire (DCQ) that was developed in tandem with the Missouri SEMA planning outline template. This approach is different from previous plan updates, when county-wide planning meetings were held in an attempt to get input from all jurisdictions in one central location. From these meetings, goal refinement and potential mitigation actions were identified and MPC representatives were decided.

The public was engaged at two points during the development of the plan update. First, a public survey was posted on the SCOCOG website and advertised in the Douglas County Herald, the newspaper of widest circulation in the county. Second, the availability of the draft plan for review and comment was announced in the same newspaper in June of 2022. **Documentation for both public engagement efforts and results of the public survey are included in Appendix C.**

Table 1.4. Jurisdictional Participation in Planning Process

Jurisdiction	Kick-off Meeting	Meeting #2	Data Collection Questionnaire Response	Update/Develop Mitigation Actions
Douglas County	X	X	X	X
City of Ava	X	X	X	X
Ava R-I	X	X	X	X

1.4.2 The Planning Steps

FEMA's Local Mitigation Planning Handbook (March 2013), Local Mitigation Plan Review Guide (October 2013), and Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials (March 2013) were used as sources for development the Plan update process. The development of the plan followed the 10-step planning process adapted from FEMA's Community Rating System (CRS) and Flood Mitigation Assistance Programs. The 10-step process allows the Plan to meet funding eligibility requirements of the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, Community Rating System, and Flood Migration Assistance Program. Table 1.4 shows how the CRS process aligns with the Nine Task Process outlined in the 2013 Local Mitigation Planning Handbook.

Table 1.5. County Mitigation Plan Update Process

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

Step 1: Organize the Planning Team
(Handbook Tasks 1, 2, and 4)

The Council of Governments planners began the plan update process by contacting local stakeholders that were identified as key officials who would be valuable to the update of the mitigation plan. County commissioners, city officials, and emergency management personnel were targeted as potential members of the MPC. During an introductory conference call on June 8, 2021, the scope of the plan update was discussed, including planning participation requirements and general methodology. A timeline for completion the update was established, and planning meetings were scheduled and given 'tentative' dates.

The Data Collection Questionnaires for the county's school districts and municipalities were distributed at the very beginning of the update process via email along with a follow up phone call to explain the procedure, the need for the data collection, how the data would be used, and to answer any questions the Superintendents may have had regarding the contents of the Data Collection Questionnaires. All participating jurisdictions were informed of an upcoming planning meeting(s) throughout the county where SCOCOG planners would gather and review the questionnaire responses and help shore up any gaps in the data.

Table 1.6. Schedule of Planning Meetings

Meeting	Participation	Method	Date
Kick-off Meeting	9:00 a.m. • Prospective participants and stakeholders identified • Raising awareness for mitigation strategy/increase countywide resilience to natural hazards • Natural hazard vulnerability • Local plan participation • Project timeline	Teleconference	June 2022
Ava R-I	Superintendent, Principal, SCOCOG Planner	Phone Meeting	9/12/22
City of Ava	City Staff, SCOCOG Planner	In Person	6/13/22
Douglas County	County Commissioners, SCOCOG Planner	In Person	6/13/22
MPC Planning Meeting #2	Jurisdictions represented: All, various times and locations. • Review of 2018 Mitigation Goals, Objectives, and Actions • Review of completed Jurisdictional Risk Assessment • Identification of new mitigation actions • STAPLEE Prioritization • Completion of Data Collections Questionnaire, identifying capabilities, assets, vulnerability	Various	10/9 – 10/20 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.

Options for soliciting public input on the Plan update were discussed at the Planning Kickoff Meeting held on in June of 2022. SCOCOG staff explained the importance of public involvement during the planning process. *(See appendix C: Public Engagement)*

A plan to engage the public in the plan update process was developed in accordance with 44 CFR Requirement 201.6(b), ensuring the opportunity for the public to comment on the plan during the drafting stage and prior to FEMA approval. The consensus of the group was to (**1**) develop an online survey instrument which would be publicized in the Douglas County Herald and ran concurrent to the drafting of the plan update and (**2**) post the draft plan on the website of the South Central Ozark Council of Governments for public review and comment, and announce its availability in the Herald prior to the plan's submittal to the State Emergency Management Agency

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.

There are many organizations that are 'regional' in nature whose interest's interface with hazard mitigation planning in Douglas County. These groups were engaged via telephone calls and direct mail letters to invite interested parties to the June 8, 2021, planning meeting. The agencies and interest groups who were invited to take part in the hazard mitigation plan update are listed below:

- Red Cross
- Community Foundation of the Ozarks
- Douglas County Sheriff
- Ava Rural Fire Department

- Wright County Presiding Commissioner Zack Williams
- Ozark County Presiding Commissioner John Turner
- Goodhope Volunteer Fire Department
- Skyline Volunteer Fire Department
- Eastern Douglas County Volunteer Fire Department
- Missouri Department of Conservation
- Missouri Department of Transportation (Southeast District)

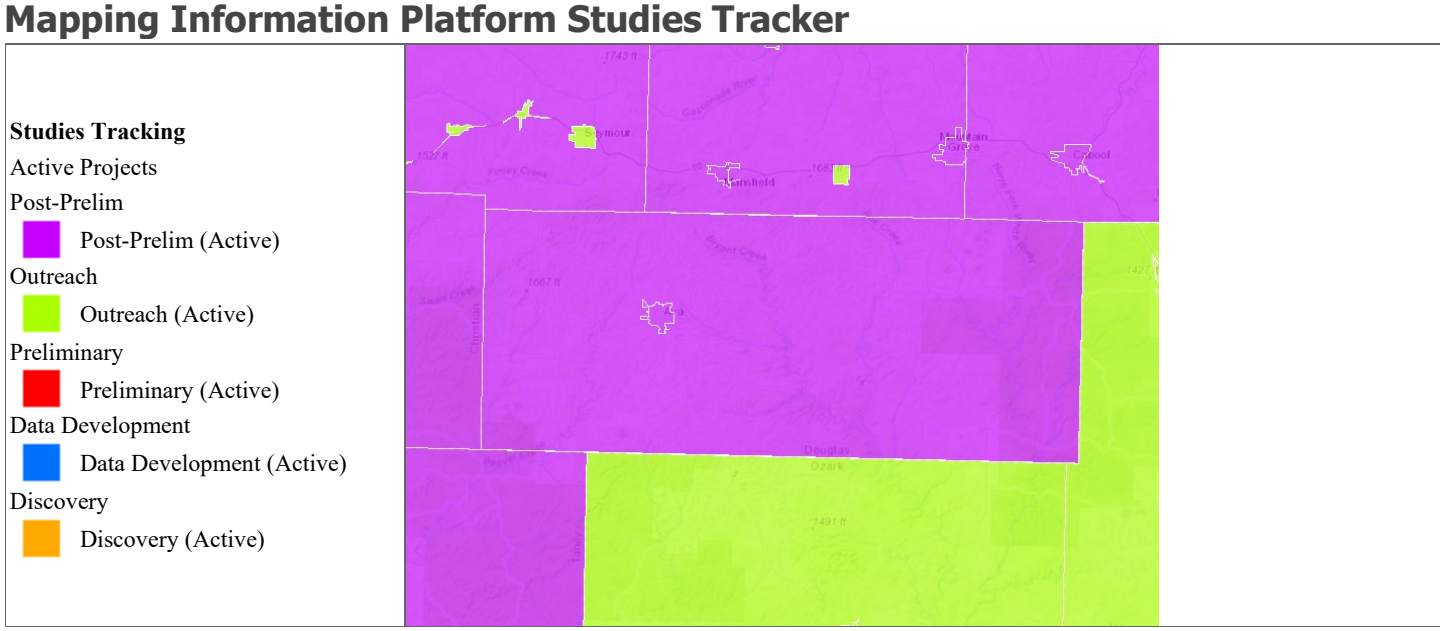
Integration of Other Data, Reports, Studies, and Plans

A review of the most current data, reports, studies and Plans relating to hazard mitigation planning in Douglas County were reviewed in order to provide the latest "snapshot" of existing conditions to inform the development of the 2023 Plan. Local planning documents that were reviewed were the Region G Threat Hazard Risk Assessment (THIRA), the Comprehensive Economic Development Strategy, the South Central Regional Transportation Plan, The State Transportation Plan, and the Douglas County Local Emergency Operations Plan. Where available, information from these Plans was integrated into the planning meeting discussions and into the Hazard Mitigation Plan narrative itself.

Coordination with FEMA Risk MAP Project

Risk Mapping, Assessment, and Planning (Risk MAP) is the Federal Emergency Management Agency (FEMA) Program that provides communities with flood information and tools they can use to enhance their mitigation plans and take action to better protect their citizens. Through collaboration with State, Tribal, and local entities, Risk MAP delivers quality data that increases public awareness and leads to action that reduces risk to life and property. As depicted in the following Figure 1.1 shows Douglas County is currently within the active Outreach phase of Risk MAP activities:

Figure 1.1. Map of RiskMAP projects



Douglas County Emergency Operations Plan (EOP)

Douglas County emergency management is set up along the following functional segments: direction and control; communications and warning; emergency public information; damage assessment; law enforcement; fire and rescue; civil disorder; hazardous materials response; public works; evacuation; in-place sheltering; reception and care; health and medial terrorism response; and resources and supply. This plan also defines lines of succession for the continuity of government operations during a disaster as well as the preservation of records and the logistics of administrative functions such as procedures for obtaining temporary use of facilities.

South Central Ozark Regional Transportation Plan (RTP)

SCOCOG maintains and updates annually the Regional Transportation Plan (RTP) as part of a work agreement with the Missouri Department of Transportation. The RTP begins with the statewide Long Range Transportation Plan's goals then refines them to fit the unique nature of the South Central region. The local planning process involves prioritization of transportation projects and defining broad transportation improvement strategies, including hazard mitigation (primarily roadway flooding and dangerous low-water crossings, economic development, safety, and expansion of multimodal opportunities.

Comprehensive Economic Development Strategy (CEDS)

The regional Comprehensive Economic Development Strategy was updated in 2019 following an extensive regional planning process. A dozen planning meetings were held throughout the seven-county region to identify economic development goals and strategies, gain input on the function and effectiveness of the regional planning commission's services, and identify vital economic development projects & programs for every jurisdiction in the region. The CEDS provides detailed information on social and economic data, and an overview of funding programs available to local governments and not-for-profit agencies.

Community, economic, and human resources development projects continue to be implemented across Douglas County. All three incorporated communities, and the county itself are very active in these areas. Douglas County acknowledged some of their emergency management and response needs in the Community Improvement Project List contained in the 2019 Comprehensive Economic Development Strategy.

A wide variety of technical data gathered from a number of state and federal agencies was integrated to the 2018 Plan to develop the Risk Assessment portion of the plan. Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at-risk structures in the county. NOAA data was used to compile event history for hazard profiles. Data from Missouri Department of Transportation, Missouri Department of Natural Resources, and Missouri Economic Resource Information Center (MERIC) were utilized to define the county's vulnerability to natural hazard events.

National datasets such as the National Agriculture Imagery Program, the National Inventory of Dams, the SILVIS Lab housed at the University of Wisconsin-Madison, and the 2020 U.S. Census were referenced in the updated Risk Assessment.

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

The hazard profiles contained within the 2018 Douglas County Hazard Mitigation Plan were reassessed during the kickoff planning meeting in June. During the remainder of the planning meetings in the county, attendees were provided the latest hazard data via the research conducted by the South Central Ozark Council of Governments. The attendees provided to SCOCOG their input on hazard events from the DCQs completed by each participating jurisdiction. By consensus the participants identified the natural hazards that are not considered a threat to their own jurisdiction and eliminated those disasters from consideration in the Risk Assessment process. A Hazard Vulnerability Sheet was completed by each participating jurisdiction to help determine the perceived threat faced by their respective jurisdictions for inclusion in the Hazard Mitigation Plan.

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

Identified assets in the planning area include population, structures, critical facilities and infrastructure, and other important assets that may be at risk to hazards. The inventory of assets for each jurisdiction were derived from GIS layers identified structures by use in the county and the local jurisdiction and school district data collection questionnaires, and FEMA DFIRM data. Potential losses to existing development were estimated on hazard event scenarios and annualized losses. In most cases the county assessor's valuations were used to estimate structure losses in impacted areas by structure occupancy type. The methodology for estimating losses varies by hazard. Loss estimates are included in each hazard profile contained in the Risk Assessment chapter.

Step 6: Set Goals
(Handbook Task 6)

The Mitigation Planning Committee reviewed the goals from the 2018 Douglas County Plan during the kickoff planning meeting in June 2021. The MPC opted to carry over the Mitigation Goals from the previous iteration of the plan, as they were determined to still be applicable:

Goal 1: Protect the Lives and Property of all Citizens of Douglas County

- Identify and provide sufficient emergency shelters.
- Review and maintain current warning systems for sufficient coverage.

Goal 2: Preserve the Functioning of Civil Government During Natural Disasters

- Implement proper maintenance and necessary upgrades of critical buildings and infrastructures in the county.
- Improve the efficiency, timing, and effectiveness of response and recovery efforts for natural hazard disasters.

Goal 3: Maintain Economic Activities Essential to the Survival and Recovery from Natural Disasters

- Periodically review chain of command of government organizations for emergency situations and keep up to date.
- Continuously review communications systems keeping in good working order.

Step 7: Review Possible Mitigation Actions and Activities

The Mitigation Planning Committee and representatives from participating jurisdictions reviewed the mitigation actions from the 2018 Plan during the June kickoff meeting, as well as subsequent planning meetings with participating jurisdictions. It was decided that a couple of the actions from the previous plan were vague or unclear in their intent and the consensus of the group was that the mitigation actions needed to be more individualized in nature. New actions were identified, potential costs were discussed, lead agencies and staff were identified. Actions were prioritized using the STAPLEE methodology during the second planning meetings with participating jurisdictions. The FEMA publication *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013)* was used as a primary source to guide the action formulation process. Participants were encouraged to focus on mitigation efforts that could be reasonably be attained in the next five-to-ten years.

Step 8: Draft an Action Plan

Progress in implementing the mitigation actions will be reviewed annually by the regional planner housed at the South Central Ozark Council of Governments. Additionally, as potential grant funding becomes available, SCOCOG planners will work with the jurisdictions of Douglas County to develop applications when a viable project arises.

Step 9: Adopt the Plan
(Handbook Task 8)

The jurisdictions will be asked to adopt the plan after SEMA's initial plan review to ensure that no wholesale changes are being required within the planning document. Upon approval of the draft Plan by SEMA staff, the SCOCOG planners will work with participating jurisdictions to facilitate the Plan Adoption process.

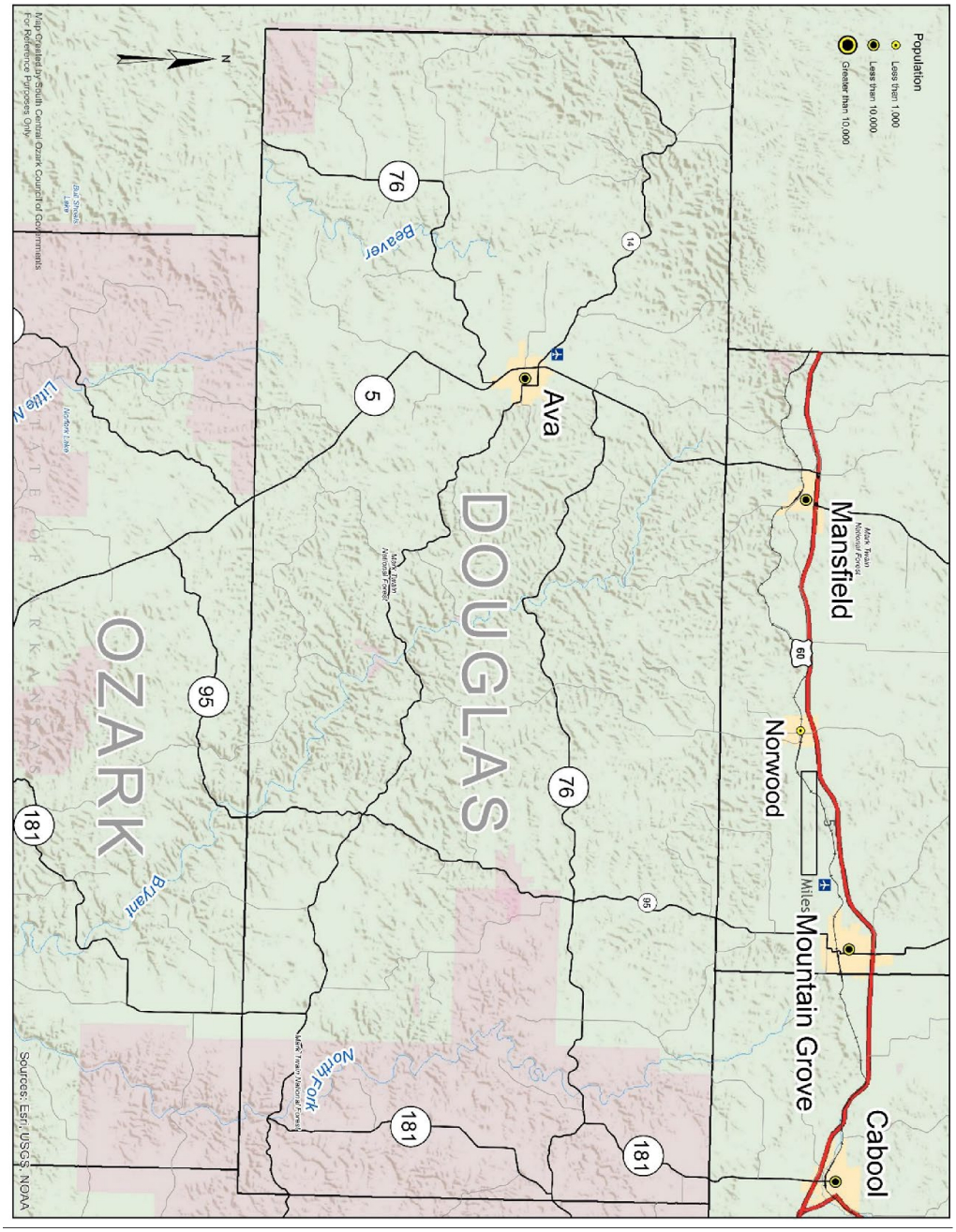
Step 10: Implement, Evaluate, and Revise the Plan
(Handbook Tasks 7 & 9)

During the planning kickoff meeting it was decided that the implementation the mitigation actions will be reviewed annually and revised (as needed) by the regional planner housed at the South Central Ozark Council of Governments. Additionally, as potential grant funding becomes available, SCOCOG planners will work with the jurisdictions of Douglas County to develop applications when a viable project arises. The process for Plan Maintenance is detailed in Chapter 5 of this document.

2 PLANNING AREA PROFILE AND CAPABILITIES

2.1 Douglas County Planning Area Profile

Figure 2.1. Map of Douglas County



According to the 2020 American Community Survey Census Estimates, the 2020 population of Douglas County was 11,578, which represented a decrease from the County's 2015 ACS estimated census population of 13,516. This represents a decrease of 2,070 residents or 15.3% decline since the 2015 ACS census. The State of Missouri's population increased 7.5% during the same time period.

The median household income for Douglas County rose from $36,711 in 2010 to $45,125 in the 2020 ACS Estimates, yet family income still lags far behind the state and national figures of $61,043 and $69,021, respectively.

The median home value in Douglas County in 2020 was $143,500, an increase of nearly 59.6% since 2010.

2.1.1 Geography, Geology and Topography

Douglas County is located in the south-central region of Missouri, in an area referred to as the Ozark Plateau. This part of Missouri is characterized by one of the most karstic regions in the continental United States. A region with outstanding water resources, numerous springs, sinkholes, losing streams, caves, and hollows.

The underground and surface water resources found in Douglas County are very much connected as a result of the karst topography of the county and region. There are seven unique watersheds in the county, each having their own unique drainage feature—creek or river—that flows south-southwest toward larger rivers and final destinations in Arkansas to the south.

Table 2.1. Douglas County Population 2015ACS-2020 by Community

Watershed	General Location in Douglas County	Tributary
Finley Creek	Extreme Northwest	James River
Swan Creek	West-Central	Bull Shoals Lake
Beaver Creek	Central	Bull Shoals Lake
Bryant Creek	Central-East	North Fork White River
Fox Creek	East-Central	Bryant Creek
Little North Fork	South	North Fork White River
North Fork White River	South	Norfork Lake
Spring Creek	Southeastern	North Fork White River
Dry Creek	Eastern	Bryant Creek

The vast majority of the county is rural. Farmland in Douglas County totals 253,922 acres or approximately 49%. Approximately 50,000 acres, or roughly 10%, is held by state or federal agencies. The overall population density in the county is 16.8sq. miles.

Elevations in Douglas County rand from approximately 1,689 feet located in the extreme northwestern part of the county, ½ mile north of the unincorporated community of Dogwood, to the lowest elevation about sea level of 708 feet located in the southeast corner of the county along the North Fork of White River.

2.1.2 Climate

Douglas County's average annual precipitation through the reporting years of 1971-2020 was 44.91 inches. The average annual temperature for the county is 56 degrees Fahrenheit. On average, the hottest month of the year in Douglas County is July, with a mean temperature of 78.6 degrees. The coldest month is January, with a mean temperature of 32.2 degrees.

2.1.3 Demographics

Table 2.2. Douglas County Population 2015ACS-2020 by Community

Jurisdiction	Total Population 2015 ACS Data	Population Estimate 2020	2015ACS-2020 # Change	2015ACS-2020 % Change
Douglas County	13,516	11,578	-2,070	-15.3%
City of Ava	2,961	2,894	-67	-2.3%

Source: U.S. Bureau of the Census, 2020 ACS estimates

There were 4,532 households out of which 25.3% had children under the age of 18 living with them, 44.00% were married couples living together, 8.50% had a female householder with no husband present, and 30.20% were non-families. 26.10% of all households were made up of individuals and 14.6% had someone living alone who was 65 years of age or older. The average family size was 2.47.

In the county, the population was spread out with 5.7% under 5 years of age, 6.3% 5 to 9 years of age, 6.5% 10 to 14 years of age, 5.3% 15 to 19 years of age, 4.5% 20 to 24 years of age, 9.0% 25 to 34 years of age, and 49.2% are females aged 18 and over, and 50.8% males.

Table 2.3. Unemployment, Poverty, Education, and Language Percentage Demographics

Jurisdiction	Percent of Population in Labor Force	Percent of Population Unemployed	Percent of Families Below the Poverty Level	Percentage of Population (High School graduate)	Percentage of Population (Bachelor's degree or higher)	Percentage of population (spoken language other than English)
Douglas County	49.6	4.2	11.3	42.4	9	0.7
City of Ava	50.3	8	5.4	47.2	9.8	0.9
State of Missouri	63	4.5	8.4	91	30.7	6.2

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

2.1.4 History

Douglas County is located in the southern region of the state. Counties that border Douglas are clockwise from the east: Christian, Webster, Wright, Texas, Howell, Ozark and Taney. Located in the heartland of the Missouri Ozarks, Douglas County was formally organized on October 29, 1857, from Ozark County and named for Stephen A. Douglas, Illinois Senator and later presidential candidate. Southern pioneers, attracted by forested hills, abundant game, spring-fed streams and fertile valleys were first settlers in the mid-1830s. Some 692 prehistoric mounds have been documented in the county, which is in the territory long utilized by various Native American tribes and held by the Osage tribe until 1808.

The first county seat was the town of Vera Cruz but the county records were stolen away following the Civil War and were moved to Arno in western Douglas County. In 1870, a new town, Ava, was created to serve as the county seat. It remains the county seat up through the present time. Ava was named for a biblical city by James Hailey, who with Judge Martin and Lock Alsup, selected the site. Ava is the county's only incorporated community.

Douglas County's cultivated hillsides and valleys supporting dairy and livestock operations contrast with its timber producing hills and ridges. Much of the county, which was harvested during the lumbering boom of the early 1900s, lies within the Mark Twain National Forest, established in the 1930s. Lead and Zinc have been mined in the past within the county's borders.

By 1910, the agricultural and lumbering productivity brought the Kansas City, Ozark and Southern Railroad, built from Mansfield to the north through the now-defunct Bryant community, south to the City of Ava. It had uneven success and ceased operation by 1935. Today the local economy is primarily agricultural with some light-to-moderate manufacturing firms, and a well-established timber industry.

Among early settlements in the county were: Rome, Topaz, and Arno. Settlements established after the Civil War include Drury, Squires, Denlow, Sweden, and Vanzant. Later settlements include Brushyknob, Goodhope and Smallett.

2.1.5 Occupations

Table 2.4. Occupation Statistics, Douglas County, Missouri

Place	Management, Business, Science, and Arts Occupations	Service Occupations	Sales and Office Occupations	Construction, Natural Resources, and Maintenance Occupations	Production, Transportation, and Material Moving Occupations
Douglas County	26.4%	16.8%	19%	14.1%	23.8%
Ava	11.2%	17.6%	26.9%	14.7%	29.6%

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

2.1.6 Agriculture

According to the 2017 Census of Agriculture, Douglas County is home to 984 farms, consisting of 253,922 acres. The average market value of products sold per farm is $37,851, a 9% increase in value from 2010. The top crop in the county is Forage-land, the top livestock item is cattle and calves. The farming sector is a significant part of the county's economy with an estimated 21.2% of workers employed as a farm owner or farm worker. This figure is slightly higher than the overall 19.8% for the seven county South Central Missouri region.

2.1.7 FEMA Hazard Mitigation Assistance Grants in Planning Area

Table 2.5. FEMA HMA Grants in Douglas County from 1993-2022

Project Type	Sub applicant	Award Date	Project Total
Douglas 2018 Buyout: DR-4317	Douglas County Commission	2018	$40,000
Ava 2018 Generator: DR4317	City of Ava	2018	$132,000
Ava SD 2006 Safe Room: FY05-PDM, non-disaster	Ava School District	2006	$2,725,000
Total	**-**	**-**	**$2,897,000**

Source: SCOCOG

2.1.8 FEMA Public Assistance (PA) Grants in Planning Area

Since 2002, jurisdictions in Douglas County have received over twenty million dollars in public assistance due to natural hazard damages. Table 2.6 shows all the public assistance payouts received by jurisdictions, as well as the project type and disaster declaration.

Table 2.6. PA Grants in Douglas County, Missouri 2002 – 2022

Disaster Number	Incident Type	Damage Category	Project Size	Project Amount ($)	Federal Share ($)
1412	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	1521.49
1412	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	14716.73
1412	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	19335
1412	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	24246.61
1412	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	21708.06
1412	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	13646.53
1412	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	21667
1631	Severe Storm(s)	A - Debris Removal	Debris Removal	Small	4506.52
1631	Severe Storm(s)	B - Protective Measures	Protective Measures	Small	1381.19
1631	Severe Storm(s)	E - Public Buildings	Public Buildings	Small	500
1631	Severe Storm(s)	B - Protective Measures	Protective Measures	Small	726.15
1676	Severe Ice Storm	A - Debris Removal	Debris Removal	Small	17250
1676	Severe Ice Storm	A - Debris Removal	Debris Removal	Small	3264
1676	Severe Ice Storm	F - Public Utilities	Public Utilities	Small	5544.23
1676	Severe Ice Storm	F - Public Utilities	Public Utilities	Large	73237.76
1676	Severe Ice Storm	B - Protective Measures	Protective Measures	Small	7657.34
1676	Severe Ice Storm	F - Public Utilities	Public Utilities	Small	45361.83
1676	Severe Ice Storm	A - Debris Removal	Debris Removal	Small	17145.7
1748	Severe Ice Storm	A - Debris Removal	Debris Removal	Small	2965.75
1748	Severe Ice Storm	A - Debris Removal	Debris Removal	Large	66589.24
1748	Severe Ice Storm	B - Protective Measures	Protective Measures	Small	1604.16
1748	Severe Ice Storm	B - Protective Measures	Protective Measures	Small	22663.03
1748	Severe Ice Storm	A - Debris Removal	Debris Removal	Small	53829.62
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	8467.11
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	3082.02
1749	Severe Storm(s)	B - Protective Measures	Protective Measures	Small	6981.46
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	12906.72
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	3266.82
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	4335.4
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	2295.32
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	5918.11
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	2547.63

1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	3374.02
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	3208.77
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	20013.41
Disaster Number	**Incident Type**	**Damage Category**	**Project Size**	**Project Amount ($)**	**Federal Share ($)**
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	16831.12
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	18139.46
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	18017.83
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	4171.89
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	4098.09
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	3010.13
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	4700.17
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	4812.01
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	10503.61
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	20583.53
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	15617.36
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	6809.93
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	8291.25
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	11434.29
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	18965.5
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	8990.88
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	11034.62
1749	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	16515.07
1809	Severe Storm(s)	A - Debris Removal	Debris Removal	Small	1499.38
1809	Severe Storm(s)	B - Protective Measures	Protective Measures	Small	1142.93
1809	Severe Storm(s)	E - Public Buildings	Public Buildings	Small	38239
1809	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	63441.57
1809	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	6556.39
1847	Severe Storm(s)	B - Protective Measures	Protective Measures	Small	9811.8
1847	Severe Storm(s)	A - Debris Removal	Debris Removal	Small	45365.79
1980	Severe Storm(s)	A - Debris Removal	Debris Removal	Small	3317.47
1980	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	8381.06
1980	Severe Storm(s)	F - Public Utilities	Public Utilities	Small	14326
1980	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	5818.64
1980	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	15479.1
1980	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	11393.49
1980	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	8415.25
1980	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	26068.19
1980	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	13048.44
1980	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	10006.41
1980	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	10089.47

1980	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	9237.31
4144	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Large	123431.78
4144	Severe Storm(s)	A - Debris Removal	Debris Removal	Small	3037.31
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	18693.97
4238	Severe Storm(s)	A - Debris Removal	Debris Removal	Small	0
4238	Severe Storm(s)	G - Recreational or Other	Recreational or Other	Small	3693.39
Disaster Number	**Incident Type**	**Damage Category**	**Project Size**	**Project Amount ($)**	**Federal Share ($)**
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	24081.7
4238	Severe Storm(s)	A - Debris Removal	Debris Removal	Small	6618.25
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	26711.97
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	12738.15
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	21309.36
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	21194.45
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	11136.47
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	24028.61
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	24703.89
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	17004.06
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	14047.22
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	14760.41
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	12388.63
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	23052.4
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	16290.88
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	19806.44
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	31476.89
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	24938.39
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	11683.33
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	12929.79
4238	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	27116.12
4317	Flood	C - Roads and Bridges	Roads and Bridges	Small	81104.06
4317	Flood	C - Roads and Bridges	Roads and Bridges	Small	54112.98
4317	Flood	C - Roads and Bridges	Roads and Bridges	Small	61506.11
4317	Flood	C - Roads and Bridges	Roads and Bridges	Small	54749.15
4317	Flood	C - Roads and Bridges	Roads and Bridges	Small	0
4317	Flood	C - Roads and Bridges	Roads and Bridges	Small	68931.33
4317	Flood	C - Roads and Bridges	Roads and Bridges	Small	21258.02
4451	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	114533.7
4451	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	70171.84
4451	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	83364.21
4451	Severe Storm(s)	A - Debris Removal	Debris Removal	Small	19642.11
4451	Severe Storm(s)	B - Protective Measures	Protective Measures	Small	11145.96

4451	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	46258.7
4451	Severe Storm(s)	C - Roads and Bridges	Roads and Bridges	Small	95771.83
4451	Severe Storm(s)	Z - State Management	State Management	Small	438.39
4490	Biological	B - Protective Measures	Protective Measures	Small	26289.19

Source: Federal Emergency Management Agency, https://www.fema.gov/data-visualization-summary-disaster-declarations-and-grants

2.2 Jurisdictional Profiles and Mitigation Capabilities

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

2.2.1 Unincorporated Douglas County, Missouri

Douglas County's jurisdiction includes all unincorporated areas within the county boundaries. Douglas is identified as a third-class county in the State of Missouri. The governing body of the County is the County Commission. The Commission consists of a Presiding Commissioner, a northern Commissioner and a southern Commissioner.

The County's elected governing body; the Board of County Commissioners directs the general administration of County Government. The Commission sets broad operating policies, enacts ordinances, and establishes budgets as mandated by State law. The County enters into contracts with other public and private agencies to ensure the smooth flow of services including law enforcement, construction and maintenance of public roads, bridges and the operations of county offices, equipment and services. The departments of the County government include:

- Board of Commissioners
- County Assessor
- County Attorney
- County Auditor
- County Recorder
- County Sheriff
- County Treasurer
- County Coroner
- County Clerk
- Emergency Management

Mitigation Initiatives and Capabilities

Staff capabilities to mitigate the impact of natural hazards include the local emergency management officials and local law enforcement members who are involved in mitigation planning, response, and recovery processes. Efforts in coordinating with local government officials and cooperating with private organizations to: 1) prevent avoidable disasters and reduce the vulnerability of the residents to any disaster that may strike; 2) establish capabilities for protecting citizens from the effects of disasters; 3) respond effectively to the actual occurrences of disasters; and 4) provide for recovery in the aftermath of any emergency involving extensive damage within the county. The Emergency Management Director (EMD) is responsible for the development and maintenance of the Local Emergency Operations Plan.

According to 2020 Estimates, the median year built for structures in Douglas County is 1977. Additionally, 24.4% of the population were over the age of 65, median household income was $43,714, and 15.1% of the families in the county were living below the poverty level.

Table 2.7 provides information about the mitigation capabilities and policies for the unincorporated county based on responses from the Mitigation Planning Data Collection Questionnaire.

Table 2.7. Unincorporated Douglas County Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	None
Capital Improvement Plan	None
Local Emergency Operations Plan	2018
Local Recovery Plan	None
Local Mitigation Plan	Yes, 2016
Economic Development Plan	Yes, 2019
Transportation Plan	Yes, 2019
Land-use Plan	None
Watershed Plan	None
Firewise or other fire mitigation plan	No
Open Space/Recreation Plan	Yes, 12/2015
Policies/Ordinance	
Zoning Ordinance	None
Building Code	None
Floodplain Ordinance	None
Subdivision Ordinance	None

Tree Trimming Ordinance	None
Nuisance Ordinance	None
Storm Water Ordinance	None
Drainage Ordinance	None
Site Plan Review Requirements	None
Historic Preservation Ordinance	None
Landscape Ordinance	None
Program	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
NFIP Participant	No
CRS Participating Community	No
Hazard Awareness Program	Yes, 12/2015
National Weather Service (NWS) Storm Ready	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	Multiple Rural Fire Departments 6-9ISO
Economic Development Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Mutual Aid Agreements	No
Studies/Reports/Maps	
Flood Insurance Maps	Yes, 2008
FEMA Flood Insurance Study (Detailed)	No
Evacuation Route Map	No
Critical Facilities Inventory	Yes, 2011
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	No
Emergency Response Team	Yes – HSRT
Hazardous Materials Expert	Yes – HSRT
Local Emergency Planning Committee	No
Transportation Department	Yes
Housing Authority	No
Local Funding Availability	Yes
Ability to apply for CDBG 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 GO bonds	Yes
Ability to incur debt through special tax bonds	Yes

Source: Data Collection Questionnaire, 2022

2.2.2 City of Ava

The City of Ava is located in the west-central portion of Douglas County at the intersection of State Routes 5 & 14. The governing body of Ava includes the Mayor and four City Council Members. Ava is the only incorporated community in Douglas County. The 2020 ACS reported the City's population as 2,894, which equals a 2.3% decline in population since 2015. The City of Ava participated in the last update of the County-wide plan; however, specific mitigation activities undertaken by the City have been limited since 2018. City departments include:

- Mayor/City Council
- City Clerk
- Building Code Official
- Public Works Staff
- Electric Department
- Sanitation Department
- Maintenance Department
- Wastewater Treatment Plant
- Water and Sewer

- City Maintenance
- Police Department

According to 2020 Estimates, the median year built for structures in Ava is 1978. Additionally, 23.1% of the population were over the age of 65, median household income was $34,907 and 21% of the families in Ava were living below the poverty level. Mitigation capabilities in Ava include:

- Four outdoor warning sirens
- Mutual aid agreements with local governments / law enforcement
- One 361-Design Tornado Saferoom
- Backup Generators

Table 2.8. City of Ava Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	Yes, 2012
Capital Improvement Plan	Yes, 2012
Local Emergency Operations Plan	Yes, 2013
Local Recovery Plan	None
Local Mitigation Plan	Yes, 2013
Economic Development Plan	Yes, 2014
Transportation Plan	Yes, 2015
Land-use Plan	Yes, 2012
Watershed Plan	None
Firewise or other fire mitigation plan	None
Open Space/Recreation Plan	None
Policies/Ordinance	
Zoning Ordinance	Yes
Building Code	Yes, 2012
Floodplain Ordinance	Yes, 2021
Subdivision Ordinance	Yes
Tree Trimming Ordinance	Yes
Nuisance Ordinance	Yes
Storm Water Ordinance	Yes, 1985
Drainage Ordinance	Yes, 1977
Site Plan Review Requirements	Yes
Historic Preservation Ordinance	Yes, Ordinance #737
Landscape Ordinance	Yes, Section #110-251 & 110-257
Program	

Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	Yes
NFIP Participant	Yes
CRS Participating Community	No
Hazard Awareness Program	No
National Weather Service (NWS) Storm Ready	No
Building Code Effectiveness Grading (BCEGs)	Yes,
ISO Fire Rating	Yes - 7
Economic Development Program	No
Public Education/Awareness	Yes
Property Acquisition	No
Planning/Zoning Boards	Yes
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Flood Insurance Maps	Yes, 1988
FEMA Flood Insurance Study (Detailed)	Yes, 1988
Evacuation Route Map	No
Critical Facilities Inventory	Yes, 2013
Vulnerable Population Inventory	No
Land Use Map	Yes
Staff/Department	
Building Code Official	Yes, FT
Building Inspector	Yes, FT
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	Yes, FT
Emergency Management Director	Yes, FT
NFIP Floodplain Administrator	Yes, PT
Emergency Response Team	Yes, PT
Hazardous Materials Expert	No
Local Emergency Planning Committee	Yes, PT
Transportation Department	Yes, FT
Housing Authority	Yes, FT
Local Funding Availability	
Ability to apply for CDBG Grants	Yes
Authority to levy taxes for a specific purpose	No
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	Yes
Ability to incur debt through GO bonds	Yes
Ability to incur debt through special tax bonds	Yes

Source: Data Collection Questionnaire 2022

Table 2.9. Governmental Mitigation Capabilities Summary Table

CAPABILITIES	Douglas County	Ava
Planning Capabilities		
Comprehensive Plan	N	None
Capital Improvement Plan	N	None
Local Emergency Operations Plan	Y, 2016	Yes 2018
Local Recovery Plan	N	None
Local Mitigation Plan	Y, 2013	Yes, 2017
Economic Development Plan	Y, 2014	Yes, 2014
Transportation Plan	Y, 2016	Yes, 2015
Land-use Plan	N	None
Watershed Plan	N	None
Firewise or other fire mitigation plan	N	None
Open Space/Recreation Plan	N	None
Policies/Ordinance		
Zoning Ordinance	N	None
Building Code	N	None
Floodplain Ordinance	N	Yes
Subdivision Ordinance	N	None
Tree Trimming Ordinance	N	None
Nuisance Ordinance	N	None
Storm Water Ordinance	N	None

CAPABILITIES	Douglas County	Ava
Drainage Ordinance	N	None
Site Plan Review Requirements	N	None
Historic Preservation Ordinance	N	None
Landscape Ordinance	N	None
Program		
Zoning/Land Use Restrictions	N	No
Codes Building Site/Design	N	No
NFIP Participant	N	Yes
CRS Participating Community	N	No
Hazard Awareness Program	Y	No
National Weather Service (NWS) Storm Ready	Y	No
Building Code Effectiveness Grading (BCEGs)	N	No
ISO Fire Rating	Multiple rural departments averaging 6-9 ISO	Yes - 8
Economic Development Program	N	No
Public Education/Awareness	Y	No
Property Acquisition	N	No
Planning/Zoning Boards	N	No
Mutual Aid Agreements	Y	No
Studies/Reports/Maps		
Flood Insurance Maps	N	Yes, 2019
FEMA Flood Insurance Study (Detailed)	N	No

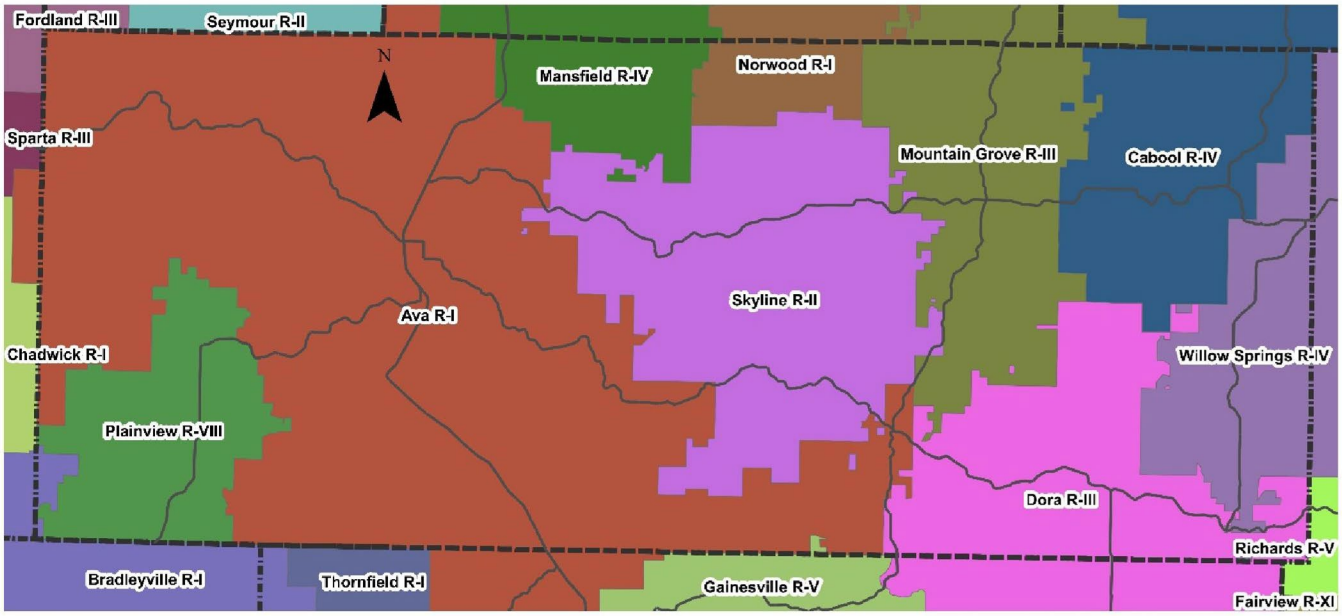
CAPABILITIES	Douglas County	Ava
Evacuation Route Map	No	No
Critical Facilities Inventory	Y,2013	Yes, 2013
Vulnerable Population Inventory	No	No
Land Use Map	No	Yes
Staff/Department		
Building Code Official	No	Yes, FT
Building Inspector	No	Yes, FT
Mapping Specialist (GIS)	No	No
Engineer	No	No
Development Planner	No	No
Public Works Official	Yes	Yes, FT
Emergency Management Director	Yes	Yes, FT
NFIP Floodplain Administrator	No	Yes, PT
Emergency Response Team	Yes	Yes, PT
Hazardous Materials Expert	No	No
Local Emergency Planning Committee	Yes	Yes, PT
Transportation Department	Yes	Yes, FT
Housing Authority	No	Yes, FT
Local Funding Availability		
Ability to apply for CDBG Grants	Yes	Yes
Authority to levy taxes for a specific purpose	Yes	No

CAPABILITIES	Douglas County	Ava
Fees for water, sewer, gas, or electric services	No	Yes
Impact fees for new development	No	Yes
Ability to incur debt through GO bonds	No	Yes
Ability to incur debt through special tax bonds	Yes	Yes

2.2.3 Public School District Profiles and Mitigation Capabilities

This section provides general information about participating school districts in the Plan. There are three school districts based in Douglas County. Other school district boundaries include areas of Douglas County but are not headquartered and do not have facilities within the county. Figure 2.2 is a map of school district boundaries in Douglas County.

Figure 2.2. Douglas County School Districts



2.2.4 Ava R-I School District

All of Ava R-I School District facilities are located entirely within the city limits of the county seat, Ava, MO. Table 2.10 provides building and enrollment information

Table 2.10. District Information

Building Name	Address	Building Occupants
Ava R-I	507 NE 3rd Street	1,531

Ava R-I Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves over 1,371 students and employees approximately 160 teachers and staff. District departments include:

- Transportation
- Cafeteria Services
- Custodial Services
- Health Services
- Central Office

Table 2.11 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

Table 2.11. Ava R-I School District Mitigation Capabilities

Capability		
Planning Elements	**Y/N**	**Date of Latest Version**
Master Plan	N	Currently Developing
Capital Improvement Plan	N	Currently Developing
School Emergency Plan	Y	2020
Weapons Policy	Y	2017
Personnel Resources	**Y/N**	**Department/Position**
Full Time Building Official	Y	Bldg. Principal
Emergency Manager	Y	Bldg. Principal
Grant Writer	Y	Bldg. Principal
Public Information Officer	N	
Information Technology	Y	Staff
Financial Resources	**Accessible/Eligible to Use?**	
Capital Improvement Project Funding	Y	
Local Funds	Y	
General Obligation Bonds	N	
Special Tax Bonds	N	
Private Activities Donations	Y	
State and Federal Grant Funds	Y	
Other		**Status Including Date of Document or Policy**
Fire Evacuation Training	Y	
Tornado Sheltering Exercises	Y	
Public Address/EAS	Y	
NOAA Weather Radios	Y	
Tornado Shelter/Saferoom	Y	
Campus Police	Y	

Source: Data Collection Questionnaire, 2022

3 RISK ASSESSMENT

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 - Land Use and Development** discusses development that has occurred since the last plan update and any increased or decreased risk that resulted. This section also discusses areas of planned future development and any implications on risk/vulnerability;
- **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 Strength/Magnitude/Extent, previous occurrences of hazard events, probability of future occurrence, risk summary by jurisdiction, impact of future development on the risks.
    2) Vulnerability Assessment further defines and quantifies populations, buildings, critical facilities, and other community/school or special district assets at risk to natural hazards.
    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 Plan profiles all natural hazards that can affect Douglas County. The natural hazards that can affect the county have been identified in the 2023 Douglas County Plan. Natural hazards are naturally occurring climatological, hydrological, or geologic events that have a negative effect of people and the built environment. Natural hazards identified include:

- Riverine and Flash Flood
- Dam Failure
- Earthquake
- Land Subsidence/ Sinkholes
- Drought
- Extreme Temperatures
- Severe Thunderstorm/ High Winds/ Lightning/ Hail
- Severe Winter Weather
- Tornado
- Wildfire

No new natural hazards have been identified since the adoption of the previous plan. The Missouri State Hazard Mitigation Plan also addresses human-caused and technological hazards; however, these will not be included in this plan update.

3.1.1 Review of Existing Mitigation Plans

The Plan profiles all natural hazards that affect Douglas County. The hazards identified in the 2023 Douglas County Plan are identified in the 2018 Missouri State Plan. The State Plan also includes levee failure. Levy failure was excluded from the mitigation planning process as there are no mapped levees nor associated levee protected areas within or immediately upstream of Douglas County.

Human-caused and technological hazards identified in the State Plan include:

- CBRNE Attack
- Civil Disorder
- Cyber Disruption
- Structural and Urban Fires
- Hazardous Materials
- Mass Transportation Accidents
- Nuclear Power Plants
- Public Health Emergencies/Environmental Issues
- Special Events
- Terrorism
- Utility Interruptions and System Failures

In Missouri, local plans customarily include only natural hazards, as only natural hazards are required by federal regulations to be included. It was determined to include only natural hazards. The MPC 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 MPC agreed that human-caused and technological hazards are addressed in a Regional Homeland Security Oversight Committee (RHSOC) Threat and Hazard Identification Risk Assessment (THIRA) and that including only natural hazards would meet the needs of local entities participating in the plan update.

3.1.2 Review Disaster Declaration History

From 1990 to present, Douglas County has experienced a number of severe storms, severe ice storms, and floods. Federal and/or state declarations may be granted when the severity and magnitude of an event surpasses the ability of a local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. If the disaster is so severe that both the local and state governments' capacities are exceeded; a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The Robert T. Stafford Disaster Relief and Emergency Assistance Act, (PL 100-707) requires that all requests for a declaration by the President must be made by the governor of the affected state. State and federal officials conduct a Preliminary Damage Assessment (PDA) to show that the disaster is of such severity and magnitude that effective response is beyond state and local capabilities. Based on the governor's request, the president may declare that a major disaster or emergency exists, thus activating federal programs to assist in the response and recovery effort. Not all programs are activated for every disaster. Some declarations will provide only individual assistance or public assistance, while others provide both.

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

Since 1973, Douglas County has experienced fifteen (15) disaster events that triggered federal declarations. The most recent occurred in June of 2020 (Severe Storms/Tornadoes).

Table 3.1. FEMA Disaster Declarations that included Douglas County, Missouri, 1965-Present

Disaster Number	IH Program Declared	IA Program Declared	PA Program Declared	Declaration Date	Disaster Type	Title
4552	No	No	Yes	**6/9/2020**	DR	SEVERE STORMS, TORNADOES, STRAIGHT LINE WINDS, AND FLOODING
4490	No	Yes	Yes	**3/26/2020**	DR	COVID-19 PANDEMIC
4451	No	Yes	Yes	**6/9/2019**	DR	SEVER STORMS, TORNADOES, AND FLOODING
4317	Yes	Yes	Yes	**6/2/2017**	DR	SEVER STORMS, TORNADOES, STRAIGHT LINE WINDS, AND FLOODING
4250	Yes	No	Yes	**1/21/2016**	DR	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING
4238	No	No	Yes	**8/7/2015**	DR	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING
1980	Yes	No	Yes	**5/9/2011**	DR	SEVERE STORMS, TORNADOES, AND FLOODING
1847	Yes	No	Yes	**6/19/2009**	DR	SEVERE STORMS, TORNADOES, AND FLOODING
1809	Yes	No	Yes	**11/13/2008**	DR	SEVERE STORMS, FLOODING, AND A TORNADO
1749	Yes	Yes	Yes	**3/19/2008**	DR	SEVERE STORMS AND FLOODING
1748	No	No	Yes	**3/12/2008**	DR	SEVERE WINTER STORMS AND FLOODING
1463	No	Yes	Yes	**5/6/2003**	EM	SEVERE STORMS, TORNADOES, AND FLOODING
1412	No	Yes	Yes	**5/6/2002**	DR	SEVERE STORMS, TORNADOES AND FLOODING
995	No	Yes	Yes	**7/9/1993**	DR	SEVERE STORMS & FLOODING
372	No	Yes	Yes	**4/19/1973**	DR	HEAVY RAINS, TORNADOES, AND FLOODING

Source: Federal Emergency Management Agency, https://www.fema.gov/data-visualization-summary-disaster-declarations-and-grants

3.1.3 Research Additional Sources

A variety of sources were researched for data on natural hazards. Primary sources included FEMA, State Emergency Management Agency (SEMA), National Centers for Environmental Information (NCEI) and National Oceanic and Atmospheric Administration (NOAA). The U.S. Geological Survey (USGS) and the Center for Earthquake Research and Information (CERI) were major sources for earthquake information. The Missouri Department of Natural Resources (MDNR) Dam Safety Division provided information concerning dams and the Missouri Department of Conservation (MDC). Other information sources included county officials; existing city, county, regional and state plans; and information from local officials. The additional sources of data on locations and past impacts of hazards in Douglas County include:

- Missouri Hazard Mitigation Plans (2013 and 2018)
- Previously approved planning area Hazard Mitigation Plan (2017)
- 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
- 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 Assessors Data
- County Flood Insurance Rate Map, FEMA
- SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin
- U.S. Army Corps of Engineers
- United States Geological Survey (USGS)

Note that 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 January 2022, 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.

- Tornado: From 1950 through 1954, only tornado events were recorded.
- 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. All Event Types (48 from Directive 10-1605): From 1996 to present, 48 event types are recorded as defined in NWS Directive 10-1605.

Note that 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

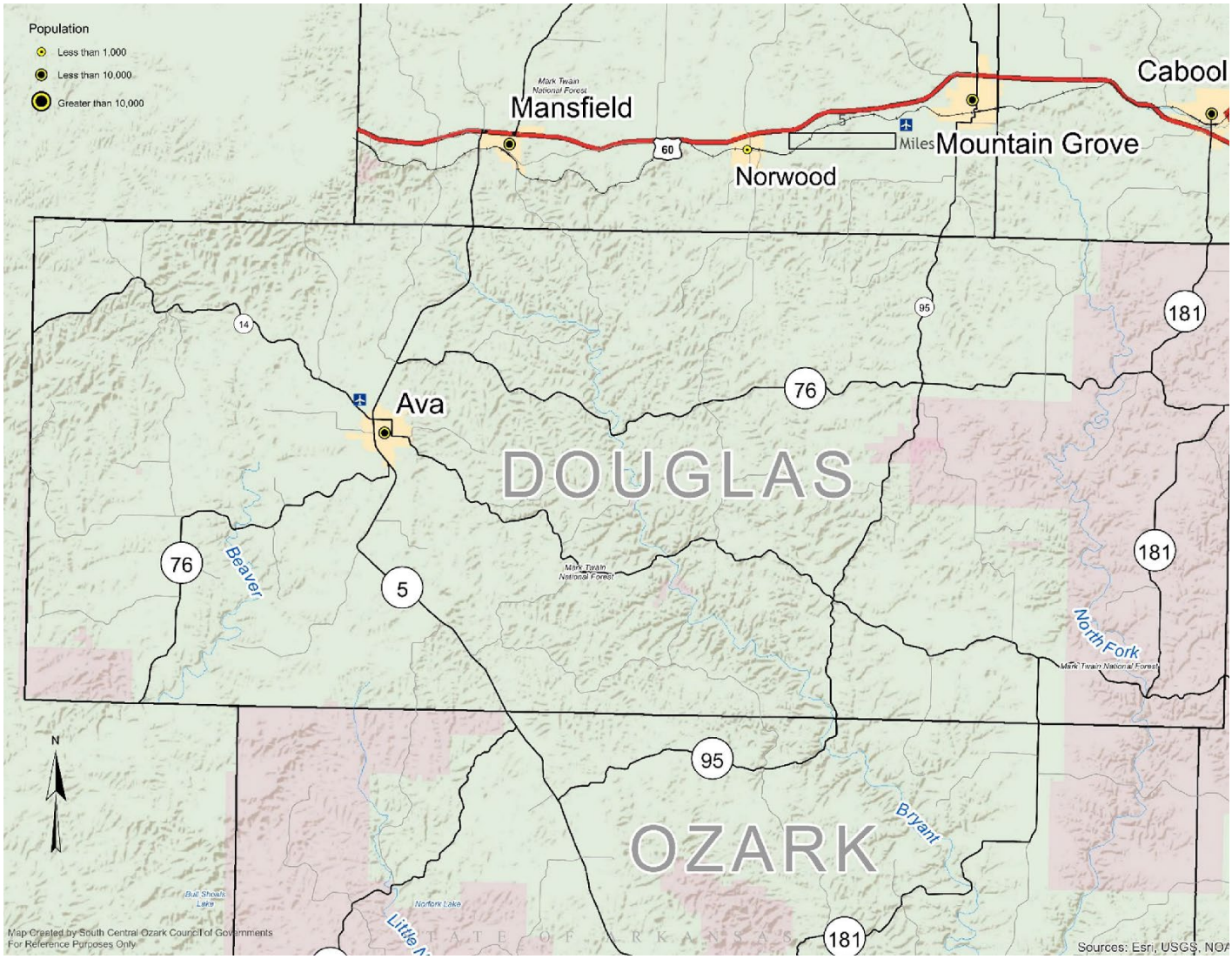
The natural hazards that may impact or have affected Douglas County are profiled below. All hazards do not necessarily affect every jurisdiction participating in the same way. Table 3.2 provides a summary of the jurisdictions that may be affected by each hazard. An "x" in the table indicates that jurisdiction is affected by the hazard, and a "-" indicates the hazard is not applicable to that jurisdiction.

Table 3.2. Hazards Identified for Each Jurisdiction

Jurisdiction	Dam Failure	Drought	Earthquake	Extreme Heat	Wildfire	Flooding (River and Flash)	Land Subsidence/Sinkholes	Severe Winter Weather	Thunderstorm/Lightning/Hail/High Wind	Tornado
Douglas County	X	X	X	X	X	X	X	X	X	X
City of Ava	-	X	X	X	X	X	X	X	X	X
Ava R-I	-	X	X	X	X	-	-	X	X	X

3.1.5 Multi-Jurisdictional Risk Assessment

Figure 3.1. Map of Planning Area



The risk assessment assesses each participating jurisdiction's vulnerability to each hazard that may affect Douglas County. Many of the hazards identified in the risk assessment have the same probability of occurrence throughout Douglas County. The hazards that vary across Douglas County in terms of risk include dam failure, flash flood, grass or wildland fire, river flood, and sinkholes/land subsidence. These differences are detailed in each hazard profile under geographic location and vulnerability.

Douglas County has a continental climate with mild winters and hot summers. The City of Ava is the most urbanized, experiencing more construction and development than most other portions of the county. Naturally, the urbanized areas of Douglas County have a greater density of important assets, which are more

vulnerable to weather-related hazards. These communities plan to continue to grow and expand City boundaries, which will increase vulnerability to natural hazards. This increase in vulnerability, however, can be mitigated through updated building codes and code enforcement, as well as land use planning.

Agricultural uses are primarily located in rural, unincorporated Douglas County. These areas are especially vulnerable to hail damages or drought.

These capabilities and resources to mitigate the impact of natural hazards vary across jurisdictions in Douglas County. These differences will be discussed in greater detail in the vulnerability sections of each hazard.

3.2 ASSETS AT RISK

This section assesses Douglas County population, structures, critical facilities and infrastructure, and other important assets that may be at risk to hazards. The inventory of assets for each jurisdiction were derived from parcel data from the Douglas County Assessor, the Douglas County Structures dataset downloaded from Missouri Spatial Data information Service (MSDIS), and local jurisdiction data collection questionnaires. The Missouri Mitigation Viewer was also referenced to ensure that total counts looked accurate.

3.2.1 Total Exposure of Population and Structures

Missouri Spatial Data Information Service (MISDIS) data was used for structure points and paired with Douglas County Assessors data for values.

Unincorporated County and Incorporated Cities

In the following three tables, population data is based on 2020 ACS data. Building counts and building exposure values are based on parcel data provided by the State of Missouri Geographic Information Systems (GIS) database and Douglas County Assessor.

Contents exposure values were calculated by factoring a multiplier to the building exposure values based on usage type. The multipliers were derived from the HAZUS and are defined below in Tab**le 3.3** Land values have been purposely excluded from consideration because land remains following disasters, and subsequent market devaluations are frequently short term and difficult to quantify. Another reason for excluding land values is that state and federal disaster assistance programs generally do not address loss of land (other than crop insurance). It should be noted that the total valuation of buildings is based on county assessors' data which may not be current. In addition, government-owned properties are usually taxed differently or not at all, and so may not be an accurate representation of true value. Note that public school district assets and special districts assets are included in the total exposure tables assets by community and county.

Table 3.3 shows the total population, building count, estimated value of buildings, estimated value of contents and estimated total exposure to parcels for the unincorporated county and each incorporated city.

Table 3.4 that follows provides the building value exposures for the county and each city in the planning area broken down by usage type.

Table 3.5 provides the building count total for the county and each city in the planning area broken out by building usage types (residential, commercial, industrial, and agricultural). To accommodate for mixed-use parcels, the data has been based on the lowest class of use for each parcel (e.g. residential-agricultural mixture is considered residential). Douglas County assessor data does not recognize any parcel in the county as industrial, though a small amount of buildings in Ava, are identified as industrial in the Missouri structure point data. Assessor data classifies these parcels as commercial. Estimates below consolidate commercial and industrial values.

Table 3.3. Maximum Population and Building Exposure by Jurisdiction

Jurisdiction	2020 Annual Population Estimate	Parcel Count	Parcel Exposure ($)	Contents Exposure ($)	Total Exposure ($)
Unincorporated Douglas County	11,578	13,299	120,736,000	65,984,000	186,720,000
City of Ava	2,894	1,617	37,466,000	3,125,000	40,591,000
Totals	**14,472**	**14,916**	**158,202,000**	**69,109,000**	**227,311,000**

Source: U.S. Bureau of the Census, Annual population estimates/ 5-Year American Community Survey 2020; Building Count and Building Exposure, Missouri GIS Database from SEMA Mitigation Management; Contents Exposure derived by applying multiplier to Building Exposure based on Hazus MH 2.1 standard contents multipliers per usage type as follows: Residential (50%), Commercial (100%), Industrial (150%), Agricultural (100%). For purposes of these calculations, government, school, and utility were calculated at the commercial contents rate.

Table 3.4. Building Values/Exposure by Usage Type

Jurisdiction	Residential	Commercial	Agricultural	Total
Unincorporated Douglas County	82,557,000	11,547,000	14,563,000	**108,667,000**
City of Ava	19,968,000	17,685,000	105,000	**37,758,000**
Totals	**102,525,000**	**29,232,000**	**14,668,000**	**146,425,000**

Source: Missouri GIS Database, SEMA Mitigation Management Section

Table 3.5. Building Counts by Usage Type

Jurisdiction	Residential Counts	Commercial Counts	Ag./ Industrial Counts	Total
Unincorporated Douglas County	5,175	122	8,023	**13,320**
City of Ava	1,355	234	60	**1,649**
Totals	**6,530**	**356**	**8,083**	**14,969**

Source: Missouri GIS Database, SEMA Mitigation Management Section; Public School Districts and Special Districts

Even though schools and special districts' total assets are included in the tables above, additional discussion is needed, based on the data that is available from the districts' completion of the Data Collection Questionnaire and district-maintained websites. The number of enrolled students at the participating public school districts is provided in Table 3.6 below. Additional information includes 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 3.6. Population and Building Exposure by Jurisdiction-Public School Districts

Public School District	Enrolment	Building Count	Building Exposure ($)	Contents Exposure ($)	Total Exposure ($)
Ava R-I	1,372	3	$ 15,000,000	$ 1,000,000	$ 16,000,000

Source: http://mcds.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx., select the file for the most recent year called "2020 Building Enrollment PK-12", filter the spreadsheet by selecting only the public school districts in the planning area. The Building Exposure, Contents Exposure, and Total Exposure amounts come from the completed Data Collection Questionnaires from Public School Districts. In general, the school districts obtain this information from their insurance coverage amounts.

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.

Douglas County Courthouse, Ava

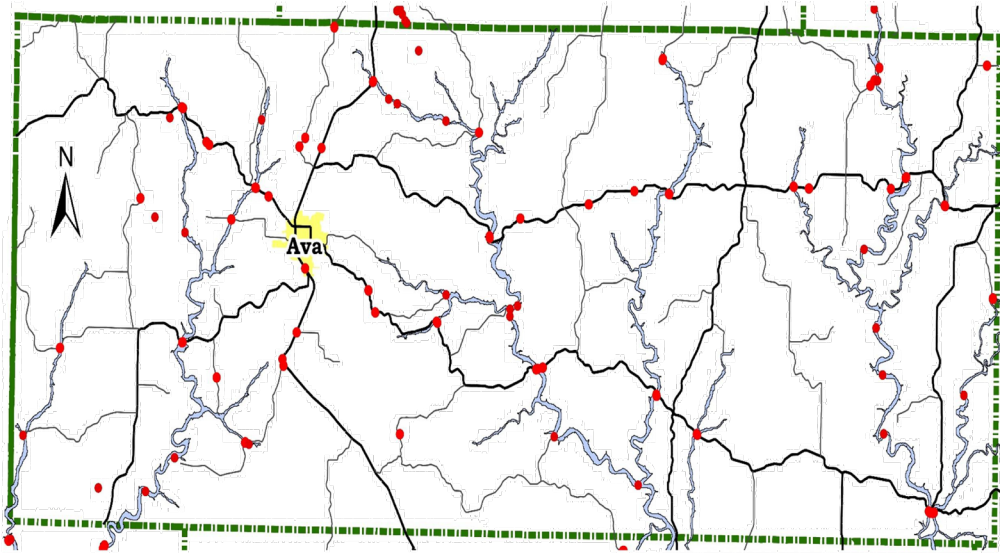
Table 3.7 below includes a summary of the inventory of critical and essential facilities and infrastructure in the planning area. The list was compiled from the Data Collection Questionnaire as well as the following sources:

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

Jurisdiction	Airport Facility	Bus Facility	Childcare Facility	Communications Tower	Electric Power Facility	Emergency Operations	Fire Service	Government	Highway Bridge	Hospital/Health Care	Military	Natural Gas Facility	Nursing Homes	Police Station	Potable Water Facility	Rail	Sanitary Pump Stations	School Facilities	Tier II Chemical Facility	Wastewater Facility	TOTAL
Douglas County	0	0	0	25	0	0	5	2	74	1	0	0	0	0	0	0	0	2	0	0	**109**
City of Ava	1	1	5	5	1	1	1	2	2	5	0	0	2	2	1	0	1	3	0	1	**34**
Totals	**1**	**1**	**5**	**30**	**1**	**1**	**6**	**4**	**76**	**6**	**0**	**0**	**2**	**2**	**1**	**0**	**1**	**5**	**0**	**1**	**143**

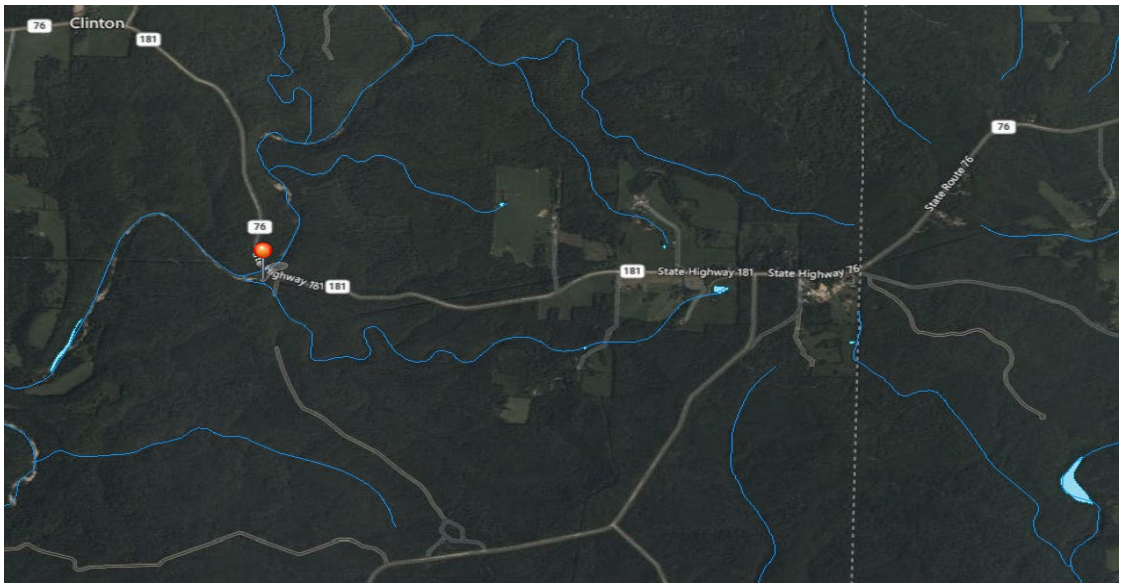
Source: Missouri 2018 State Hazard Mitigation Plan and Hazard Mitigation Viewer; Data Collection Questionnaires; Hazus,

Figure 3.2. Douglas County Bridges



Source : https://nepassisttool.epa.gov/nepassist/nepamap.aspx

Figure 3.3. Douglas County Structurally Deficient Bridges



Indian Creek – located on MO 76 East / Lat/Long: 36.969208 -92.134839
Source: https://www.modot.org/Bridges

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.

Table 3.8. Threatened and Endangered Species in Douglas County

Common Name	Scientific Name	Status
Gray Bat	Myotis grisescens	Endangered
Indiana Bat	Myotis sodalist	Endangered
Northern Long-Eared Bat	Myotis septentrionalis	Threatened
Ozark Hellbender	Cryptobranchus alleganiensis bishopi	Endangered
Decurrent false aster	Boltonia decurrens	Threatened
Virginia Sneezeweed	Helenium virginicum	Threatened

Source: U.S. Fish and Wildlife Service, http://www.fws.gov/midwest/Endangered/lists/missouri-cty.html; see also https://ecos.fws.gov/ipac/ and select 'Get Started" > Step '1 Find Location', choose select by state or county and enter the county name, selecting the appropriate community > follow remaining on-screen instructions.

Table 3.9. Conservation Areas and Parks in Douglas County

Park / Conservation Area	Address	City
Mark Twain National Forrest	Eastern ½ of the county	Eastern Douglas County
Grundy CA	O Highway	Redbank
Ava Upper Park	8th Street	Ava
Ava Lower Park	10th Street	Ava
Downtown Park	3rd Street	Ava
Bryant Creek State Park	South Central Douglas County	Ava

Source: http://mdc7.mdc.mo.gov/applications/moatlas/AreaList.aspx?txtUserID=guest&txtAreaNm=s
The best source for park information is usually county and community websites.

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 3.10. Douglas County - Properties on the National Register of Historic Places

Property	Address	City	Date Listed
Ava Ranger Station Historic District	Route 5S – Box 188	Ava	8/4/2003

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

Table 3.11. Major Non-Government Employers in Douglas County

Employer Name	Main Locations	Product or Service	Employees
Ava R-I School District	City of Ava	Education	150+
Emerson Climate Technologies	City of Ava	Manufacturing	125+
Wal-Mart	City of Ava	Retail Sales	80+

Source: Data Collection Questionnaires; local Economic Development Commissions

Agricultural Assets

Table 3.12. Agriculture-Related Sales in Douglas County

Value of Sales by Commodity Group	State Rank (out of 114)
Milk from cows	97
Fruits, tree nuts, and berries	44
Cattle and Calves	31
Vegetables, melons, potatoes, and sweet potatoes	89

Source: 2017 Missouri Agricultural Census

Table 3.13. Top Livestock Inventories in Douglas County

Livestock Inventory	State Rank (out of 114)
Poultry and eggs	79
Cattle and calves	31
Goats, all	33
Horses and ponies	69

Source: 2017 Missouri Agricultural Census

3.3 LAND USE AND DEVELOPMENT

3.3.1 Development Since Previous Plan Update

Douglas County has overall experienced a population decline since 2015-2020. Since the previous plan update in 2018 the population in Douglas County has declined by -15.3%. Some communities have seen minimal new construction or development, but as a whole Douglas County and the incorporated jurisdictions have had minimal development since the previous plan update in 2018.

Table 3.14. County Population Growth, 2010-2020

Jurisdiction	Total Population 2015 ACS Data	Population Estimate 2020	2015-2020 # Change	2015-2020 % Change
Douglas County	13,516	11,578	-2,070	-15.3%
City of Ava	2,961	2,894	-67	-2.3%

Source: U.S. Bureau of the Census, Decennial Census, Annual Population Estimates, American Community Survey 5-year Estimates; Population Statistics are for entire incorporated areas as reported by the Census bureau

Table 3.15. Change in Housing Units, 2010-2020

Jurisdiction	Housing Units 2010	Housing Units 2020	2010-2020 # Change
Douglas County	6,519	5,346	-18%
City of Ava	1,494	1,400	-6.3%

Source: U.S. Bureau of the Census, Decennial Census, American Community Survey 5-year Estimates; Population Statistics are for entire incorporated areas as reported by the U.S. Census Bureau

3.3.2 Future Land Use and Development

The City of Ava

The City of Ava's comprehensive plan was last updated in 2012. Ava has experienced 2.3 percent decrease in population from 2015 to 2020. While the community has lost residents, a fair amount of commercial development has taken place in the community over the last 15 years, as the community continues to serve and the commerce hub of the county. It is expected that any additional growth inside the city limits of Ava will continue to occur near the junction of State Routes 5 and 14 in the northwest quadrant of the city.

School District's Future Development

Ava School District

The Ava School District does not have plans for future development. A community safe room was constructed in 2008 that is capable of holding students and faculty and nearby residents of the community. The district expects a decrease of approximately 5% in enrollment over the next five years.

3.4 HAZARD PROFILES, VULNERABILITY, AND PROBLEM STATEMENTS

Each hazard will be analyzed individually in a hazard profile. The profile will consist of a general hazard description, location, strength/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. 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 areas in the planning area that are affected by the hazard. 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 of available data 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 is reported as 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 is 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:** Changing future conditions are also considered, including the effects of long-term changes in weather patterns and climate on identified hazards.

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 are based on the best available data, including data that was collected for the 2018 State Hazard Mitigation Plan Update.

The vulnerability assessments in this Douglas County plan are also 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.

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

- **Vulnerability Overview:** An overall summary of each jurisdiction's vulnerability to the identified hazards. The overall summary of vulnerability identifies structures, systems, populations or other community assets as defined by the community that are susceptible to damage and loss for hazard events.
- **Potential Losses to Existing Development:** Includes the types and numbers of building and critical facilities.
- **Previous and Future Development:** This section will include information on how changes in development have impacted the community's vulnerability to this hazard. It also includes a description of how changes in development that occurred in known hazard prone areas since the previous plan have increased or decreased the community's vulnerability, and any anticipated future development in the county, and how that would impact hazard risk in Douglas County.
- **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. For example, a community that has adopted more recent building codes and constructed safe rooms would be less vulnerable to the impact of tornados.

Problem Statements

Each hazard analysis will conclude with a brief summary of the problems created by the hazard in Douglas County, and possible ways to resolve those problems. Jurisdiction-specific information in those cases where the risk varies across Douglas County is included.

3.4.1 Flooding

Hazard Profile

Hazard Description

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

Flooding caused by dam failure is discussed in Section 3.4.2 below, it will not be further 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.

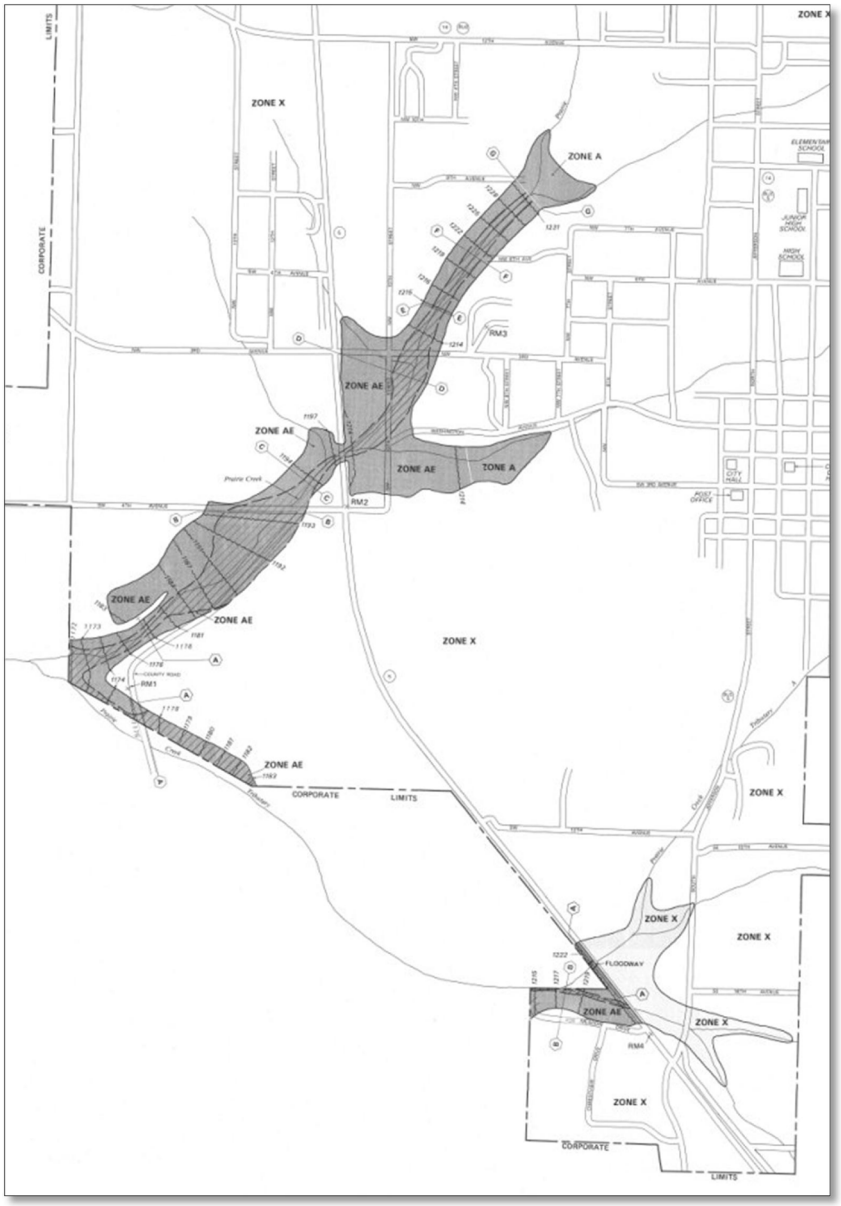
Although flash floods are somewhat unpredictable, there are factors that can point to the likelihood of flash floods occurring. Weather surveillance radar is being used to improve monitoring capabilities of intense rainfall. This, along with knowledge of the watershed characteristics, modeling techniques,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

advanced warning systems has increased the warning time for flash floods.

Geographic Location

Douglas County SFHAs have not been mapped by FEMA. The City of Ava has been mapped with an effective FIRM date of 8/4/88. See Figure 3.4. There are no Digital Flood Insurance Rate Maps (DFIRM) available for Douglas County jurisdictions.

Figure 3.4. City of Ava SFHA (1988 F.I.R.M.)



Severity/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 the communities located downstream sufficient time to take protective measures, such as sandbagging and evacuations. Nevertheless, floods exact a heavy toll in terms of human suffering and losses to public and private property. By contrast, flash flood events in recent years have caused a higher number of deaths and major property damage in many areas of Missouri.

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

National Flood Insurance Program (NFIP) Participation

Table 3.16. NFIP Participation in Douglas County

Community ID #	Community Name	NFIP Participant (Y/N/Sanctioned)	Current Effective Map Date	Regular-Emergency Program Entry Date
N/A	Douglas County, Unincorporated	N	N/A	N/A
290121	City of Ava	Y	08-04-88	3/4/85

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

Table 3.17. NFIP Policy and Claim Statistics as of July 1, 2022

Community Name	Policies in Force	Insurance in Force	Closed Losses	Total Payments
Douglas County, Unincorporated	0	-	-	-
City of Ava	2	$80,000	0	$0

Source: NFIP Community Status Book, [insert date]; BureauNet, http://bsa.nfipstat.fema.gov/reports/reports.html; *Closed Losses are those flood insurance claims that resulted in payment.

Only the City of Ava has experienced NFIP damage payments.

Repetitive Loss/Severe Repetitive Loss Properties

Repetitive Loss Properties are those properties with at least two flood insurance payments of $1,000 or more in a 10-year period. A severe repetitive loss 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.

Previous Occurrences

Riverine and Flash flooding is most likely to occur in Special Flood Hazard Areas (SFHAs) where the 1% chance floodplain has been mapped. According to NCEI storm event data from 2017 through 2021, there were 76 riverine flood events and 52 flash flood events recorded in the county during this period. These events are typically regional in nature and affect rivers, streams and tributaries across a wide area. Table 3.18, Table 3.19, and Table 3.20 are mapped Special Flood Hazard Areas for at risk communities in Douglas County.

Table 3.18. Douglas County NCEI Flood Events by Location, 2017-2021

Location	# of Events
Douglas County	61
City of Ava	15
Total Unique Events	**76**

Source: National Centers for Environmental Information, 2021

The NCEI storm event data lists flash flood events according to the nearest community or place. Most of these events cover larger areas than the smaller geographic areas reported in the data. Although some events may not be inside the corporate limits of the community identified in the narrative, they are in such proximity that the community named would be the most affected by impassible roads. It is safe to assume that numerous low water crossings would be impacted by heavy rains that exacerbate flash flooding across the county. In addition, multiple records are related to the same event and vice versa.

Table 3.19. Douglas County Flash Flooding Events by Location, 2017-2021

Location	# of Events
Douglas County	42
City of Ava	10
Total Unique Events	**52**

Source: National Centers for Environmental Information, 2021

Probability of Future Occurrences

According to NCEI storm even data, there have been fifty-two (52) flash flood events recorded in Douglas County from 2017 through 2021. One of these events, occurring on April 30, 2017, resulted in reported property damage of $3,000,000 and is described in NCEI narratives as follows:
Multiple rounds of severe thunderstorms and extremely heavy rainfall over several days led to historic and devastating flash floods, record breaking river levels, large hail, wind damage, and at least one tornado across the Missouri Ozarks region. Most counties across the Missouri Ozarks region were declared a federal disaster from the President and FEMA.

Numerous homes and at least four businesses sustained severe flood damage across Douglas County. Numerous roads and bridges were severely damaged or washed away across the county.

In addition to the damages described above, one flash flood event occurring on April 30, 2019, resulted in one death. The event is described in NCEI narratives as follows:

Heavy rainfall across portions of Douglas County caused Hunter Creek to rise quickly out of its banks during the late evening of April 30th and continued into May 1st. Nearly 7.00 inches of rain fall across portions of the Hunter Creek basin. A 59 year old male was camping in the Vera Cruz Conservation Area and was overtaken by flood waters during the night.

Table 3.20 summarizes flash flood events by year from 2017 to 2021 in Douglas County.

Table 3.20. NCEI Douglas County Flash Flood Events Summary, 2017 to 2021

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
2017	5	0	0	$3,005,000	0
2018	7	0	0	$15,000	0
2019	9	1	0	$0	0
2020	16	0	0	$0	0
2021	15	0	0	$10,000	0
TOTAL	**52**	**1**	**0**	**$3,030,000**	**0**

Source: NCEI, 2021

Table 3.21. NCEI Douglas County Riverine Flood Events Summary, 2017 to 2021

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
2017	11	0	0	$0	$0
2018	10	0	0	$0	$0
2019	16	0	0	$10,000	$0
2020	25	0	0	$0	$0
2021	14	0	0	$0	$0
TOTAL	**76**	**0**	**0**	**$10,000**	**$0**

Source: NCEI, 2021

Table 3.21 above summarizes riverine flood events listed in the NCEI in Douglas County by year. The data contains record of 76 events from 2017 to 2021 with the greatest amount of losses occurring in 2019.

Changing Future Conditions Considerations

With changing climate conditions comes more uncertainty and less predictability for hazard events. An overall increasing global temperature is likely to lead to increased precipitation and intense rainstorms. Over the last fifty-years, the average annual precipitation in most of the Midwest has increased by 5-10%; however, rainfall during the four wettest days of the year has increased nearly 35%. The amount of water flowing in most streams during the worst flood of the year has increased by more than 20%.

The National Climate Assessment states that extreme rainfall events and flooding have increased in the last century and that those trends are expected to continue. Heavy rain events are likely to cause erosion, diminished water quality, and negative impacts on transportation, agriculture, human health, and infrastructure.

Vulnerability

Vulnerability Overview

Flooding has been included in 10 of the 16 presidential natural disaster declarations that have included Douglas County. Periods of heavy rain falling at the rate of one inch per hour floods low water crossings throughout the county making many roads impassable. This creates a severe threat to motorists that attempt to drive through flood waters over the roadway. Riverine flooding occurs less frequently than flash flooding. Spaces in low lying areas outsides the identified floodplain are frequently flooding. Street flooding over roadways has been reported in the City of Ava, and in unincorporated portions of the County. There are no school district facilities in SFHAs in Douglas County. Increases in development add to surface runoff and can potentially exacerbate flash flooding in areas that previously have not experienced flooding.

Potential Losses to Existing Development

Flood loss estimates were developed using a GIS methodology. A county-wide structures layer development by the University of Missouri in partnership with regional planning commissions across the state was overlaid on FEMA DFIRM maps to show number of structures and structure types situated inside Special Flood Hazard Areas. An average valuation from the Douglas County Assessor for each structure type: Residential, Commercial, or Agriculture was applied to the structures in identified SFHAs. A review of GIS data indicates that no school district facilities in Howell County are located in the FEMA SFHA.

Table 3.22. Potential Flood Losses for Building Types by Jurisdiction

Jurisdiction	Residential	Commercial	Agricultural	Total Building Count
Douglas County	29	0	79	108
City of Ava	0	0	0	1

Table 3.23 below provides the total exposure for structures and contents by building type and jurisdiction. Losses were estimated by applying a 5% damage factor to total exposure. A 5% damage factor was used under the assumption that not all at-risk structures in the county would be affected simultaneously during a flooding event, nor would the individual structures sustain catastrophic damage.

Table 3.23. Total Flood Exposure and Estimated Losses by Jurisdiction (in dollars)

Jurisdiction	Residential	Commercial	Agricultural	Estimated Exposure	Estimated Loss
Douglas County	$362,529	0	$93,141	$455,670	$35,000
City of Ava	0	0	0	0	0

Impact on Future Development

Future development could impact flash flooding and riverine flooding in the planning area. Development in low-lying areas near rivers and streams or where interior drainage systems are not adequate to provide drainage during heavy rainfall events will be at risk to flash flooding. Future development would also increase impervious surfaces causing additional water run-off and drainage problems during heavy rainfall events. Not all jurisdictions in the county participate in the NFIP. Not all jurisdictions in the county have identified SFHAs. Zoning regulations that prohibit development in SFHAs and violations of floodplain management regulations are effective mitigation strategies in participating municipalities.

Hazard Summary by Jurisdiction

All local governments in the county are not equally at risk to flood hazards. Table 3.19 above details the exposure of assets near SFHAs and how it varies by jurisdiction. Many parts of the county are vulnerable to street and road flooding during periods of heavy rainfall. In particular, Highway 38 in northeastern Douglas County is extremely vulnerable to closure during flash flooding events. The greatest impact of flooding is felt in the City of Ava and in unincorporated part of the county. Due to the topography and many streams in the county, numerous low water crossings are damaged and create a significant hazard to public safety during flood events. This heightens the risk and exposure to infrastructure maintained by the Douglas County Commission. There is no heightened risk to school district facilities due to flood as no facilities are located inside FEMA SFHAs. No previous damage to school facilities by flooding was reported on the Data Collection Questionnaires used in the planning process.

Problem Statement

Floods are frequent events and have been listed in 9 out of 13 presidential disaster declarations that have included Douglas County. Historic flooding that occurred within a month of the development of this plan produced approximately $250,000 in damages throughout the county – a figure that many believe to be largely under-reported. Numerous water rescues have occurred in the county since 2002. Significant debris accumulation and damages at low water crossings have become regular occurrences due to flash flooding events.

The County Commission is in the process of developing a low water crossing inventory and improvement priority list for inclusion in their ongoing maintenance and management efforts. It is desired that warning signs, gauges, and perhaps warning lights be installed at frequently flooded low water crossings. The county is focusing on the replacements of frequently damaged crossings. Hazard awareness programs and education, such as “turn around, don’t drown” messages during and prior to flood events in the county broadcast by local media can mitigate future risks to motorists at low water crossings.

3.4.2 Dam Failure

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:

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

According to the State Plan, Missouri had some 5,423 recorded dams in 2013, the largest number of man-made dams of any state in the country. Missouri topography allows lakes to be built easily and inexpensively, which accounts for the high number of dams. Despite the large number of dams, there are only 682 (about 13 percent) state regulated dams, with an additional 66 federally regulated dams. Federal dams in Missouri are primarily regulated by two federal agencies; the US Army Corps of Engineers (USACE) and the US Department of Agriculture Forest Service. The remaining 4,495 dams are unregulated.

Dams that fall under state regulation are non-federally regulated dams that are more than 35 feet in height. Most nonfederal dams are privately owned structures built either for agricultural, water supply or recreational use. The Department of Natural Resources (MDNR) Water Resources Center maintains the Dam and Reservoir Safety Program in Missouri. The program ensures that dams over 35 feet in height are safely constructed, operated, and maintained pursuant to Chapter 236 of the Revised Statutes of Missouri.

The Department of Natural Resources provided information about regulated and unregulated dams in Missouri. The information includes details of the dam dimensions, date of construction, approximate reservoir volume, contributing drainage basin area and hazard classification. In addition, USACE maintains the National Inventory of Dams (NID). The information in the NID database matches the list from the MDNR website with some additional details for dams in Douglas County. Although both agencies proved a hazard classification for dams, the dam classification systems differ.

The Missouri Dam and Reservoir Safety Council Rules and Regulations uses three classes of downstream environmental zones used when considering permits. The downstream environment zone is the area below the damn that would become inundated should the dam fail. Inundation is defined as water two feet or more over the submerged ground outside of the stream channel. These classes are based on the number of structures and types of development contained within the inundation area as presented in Table 3.24. The downstream environment zone classification is also used to prescribe the frequency of inspection.

Table 3.24. MDNR Dam Hazard Classification Definitions

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

Source: Missouri Department of Natural Resources, http://dnr.mo.gov/env/wrc/docs/rules_reg_94.pdf

Dams in the NID are classified according to hazard potential, an indicator of the consequences of dam failure. A dam's hazard potential classification, presented in Table 3.25 does not indicate its condition. Dams assigned the high hazards potential classification are those where failure will potentially result in loss of human life. Significant hazard potential are those dams where failure results in no probable loss of human life but can cause economic loss. Dams assigned the low hazard potential classification are those where failure will result in no probable loss of human life and low economic or environmental losses. Losses are principally limited to the owner's property.

Table 3.25. NID Dam Hazard Classification Definitions

Hazard Class	Definition
Low Hazard	Failure results in only minimal property damage
Significant Hazard	Failure could possibly result in the loss of life and appreciable property damage
High Hazard	If the dam were to fail, lives would likely be lost and extensive property damage would result

Source: National Inventory of Dams

There is not a direct correlation between the State Hazard classification and the NID classifications. However, most dams that are in the States Classes I and II are considered NID High Hazard Dams.

Geographic Location

According to the MDNR there are 5 total dams in Douglas County and zero regulated dams. MDNR lists zero dams as Class I hazards, and two dams as Class II Hazards; Hailey Dam and Noblett Lake Dam.

NID data also indicated that there are 5 total dams in the county, with three being listed as low hazard potential, and two listed as high hazard potential.

Dams in Planning Area

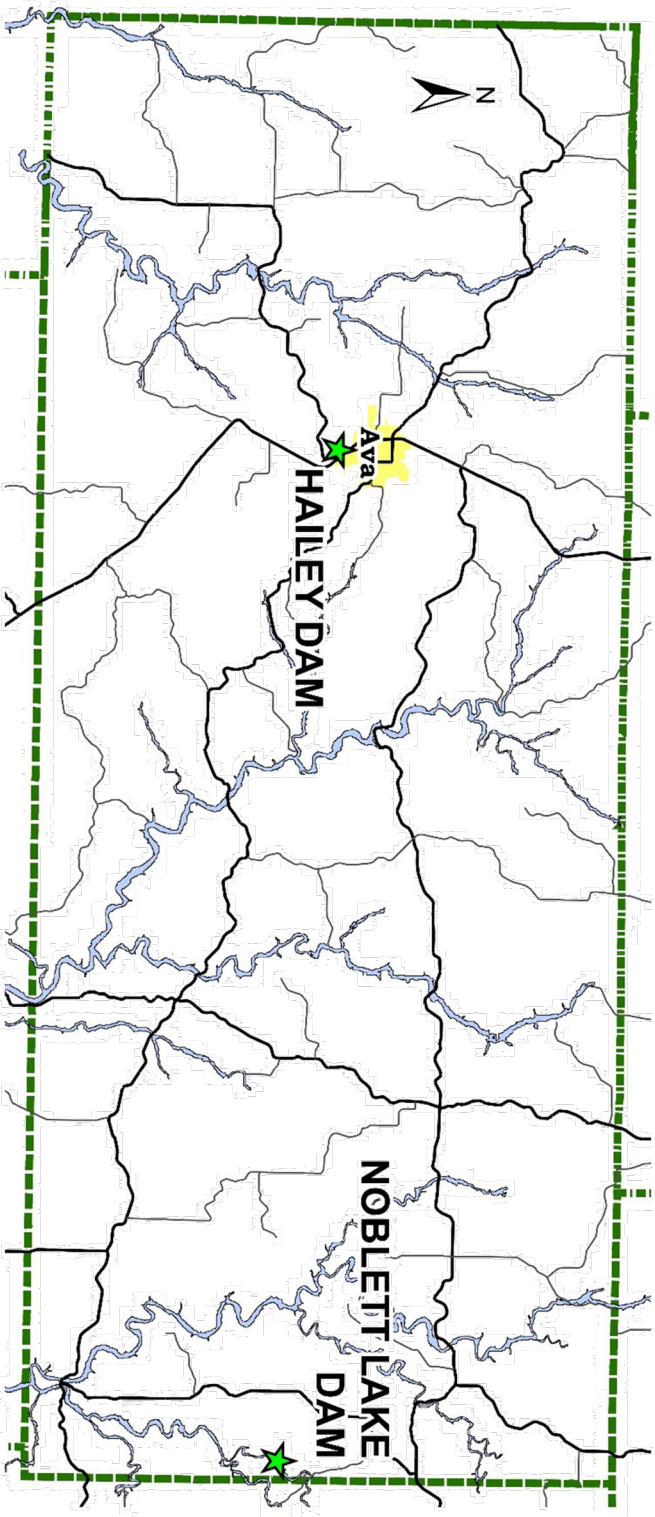
Table 3.26 lists the names, locations, and other pertinent information for all high hazard dams in the planning area.

Table 3.26. High Hazard (NID) Dams in the Douglas County Planning Area

Dam Name	Emergency Action Plan (EAP)AP	Dam Height (Ft)	Normal Storage (Acre-Ft)	Last Inspection Date	River	Nearest Downstream City	Distance To Nearest City (Miles)	Dam Owner
Noblett Lake Dam	No	30	N/A	N/A	Noblett Creek	Mountain Home, AR	158	USDA
Hailey Dam	No	25	N/A	N/A	Beaver Branch	Bradleyville	35	Private

Sources: Missouri Department of Natural Resources, http://dnr.mo.gov/env/wrc/dam-safety/statemap.htm and National Inventory of Dams, http://nid.usace.army.mil/cm_apex/f?p=838:12By the end of 2015, the Missouri DNR anticipates having Emergency Action Plans, including inundation maps for all state-regulated Class 1 and Class 2 dams. Contact the DNR Dam and Reservoir Safety Program at 800-361-4827 to request the inundation maps for your county to show geographic locations at risk, extent of failure and to perform GIS analysis of those assets at risk to dam failure.

Figure 3.5. High Hazard Dams in Douglas County



Upstream Dams Outside the Planning Area

There are no high hazard dams located in areas upstream of Douglas County.

Severity/Magnitude/Extent

The severity/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. Note that for this reason, dam failures could flood areas outside of mapped flood hazards.

Actual dam failure can result not only in loss of life, but also considerable loss of capital investment, loss of income, and property damage. Loss of the reservoir itself can cause hardship for those dependent on it for their livelihood or water supply.

Previous Occurrences

There are no records of dam failure in Douglas County. Since there are zero recorded events in the planning area, a calculation of a probability percent is not possible. According to information from the 2018 State Plan, Missouri's percentage of high hazard dams in the MDNR inventory puts the State at about the national average for that category. However, if development occurs downstream of dams the percentage of high hazard dams will increase. Additionally, the probability of dam failure increases as many of the smaller and privately owned dams continue to deteriorate without the benefit of further regulation or improvements. Regular inspection and maintenance schedules for dams greatly reduces the probability of dam failure. The last inspection of a high hazard dam in Douglas County was 40 years ago.

Probability of Future Occurrence

There are no records of dam failure in Douglas County. Since there are zero recorded events in the planning area, a calculation of a probability percent is not possible. According to information from the 2018 State Plan, Missouri's percentage of high hazard dams in the DNR inventory puts the State at about the national average for that category. However, if development occurs downstream of dams the percentage of high hazard dams will increase. Additionally, the probability of dam failure increases as many of the smaller and privately owned dams continue to deteriorate without the benefit of further regulation or improvements. Regular inspection and maintenance schedules for dams greatly reduces the probability of dam failure.

Vulnerability

Vulnerability to dam failure in Douglas County is limited to structures and critical infrastructure located in dam inundation zones. The two dams located in the located rated as high hazard are in unincorporated parts of the county. There are no regulated dams in the county, and no existing inundation zone maps for any dams in Douglas County. Also, there are no EAPs for dams in the county. The following Figure 3.6 and Figure 3.7 depict the location of the two high hazard dams in the county and the captions describe the likely direction of inundation.

Figure 3.6. Noblett Lake Dam

Noblett Lake Dam – Built by the Civilian Conservation Corps in the 1930's, Noblett Lake Dam is located in a very remote and very scenic area of Douglas County. There are no structures located in the potential inundation area to the south/southwest.

Figure 3.7. Hailey Dam

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

Fortunately, the eight high hazard dams located in Douglas County are located in areas where there is no significant development in downstream areas. In the absence of MDNR inundation zone maps and Emergency Action Plans, it is difficult to determine the exact areas where inundation would occur, but in reviewing recent aerial photography, it can be stated that the risk to human life, and the risk for property damage in the event of a failure of one of the eight high hazard dams in Douglas County would be minimal.

Impact of Future Development

The planning area, specifically, the areas downstream of Douglas County's high hazard dams are rural in nature. However, growth in the county is moderately strong and any future development in potential inundation areas will increase vulnerability to dam failure hazards. However, due to the amount and affordability of developable land, it is unlikely that residential structures will be developed in a location that is inside an inundation zone.

Hazard Summary by Jurisdiction

Unincorporated Douglas County is the only jurisdiction in the Plan that is vulnerable to dam failure. Unfortunately, there are no mapped inundation areas or potential inundation areas within cities. No school district facilities are located within potential inundation areas or downstream environments from existing dams.

Problem Statement

There are two dams in the county with high hazard potential. However, none of the dams have mapped inundation zones or EAPs therefor it is difficult to gauge the vulnerability of downstream environments. The development of inundation zone maps by MDNR would help the citizenry of Douglas County become more familiar with the risk they face due to the potential for dam failure. Additionally, the inspection rate of the high hazard dams in Douglas County seems to be lacking. Of the two high hazard dams, the last inspection took place in 1979. The MPC feels it would be beneficial if these dams were inspected more regularly.

3.4.3 Drought

Hazard Profile

Hazard Description

Drought is generally defined as a condition of moisture levels significantly below normal for an extended period of time over a large area that adversely affects plants, animal life, and humans. A drought period can last for months, years, or even decades. There are four types of drought conditions relevant to Missouri, according to the 2018 State Plan, which are as follows;

- Meteorological drought is defined in terms of the basis of the degree of dryness (in comparison to some "normal" or average amount) and the duration of the dry period. A meteorological drought must be considered as region-specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region.

- Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (e.g., streamflow, reservoir and lake levels, ground water). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system. Hydrological droughts are usually out of phase with or lag the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and ground water and reservoir levels. As a result, these impacts also are out of phase with impacts in other economic sectors.

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

- Socioeconomic drought refers to when physical water shortage begins to affect people.

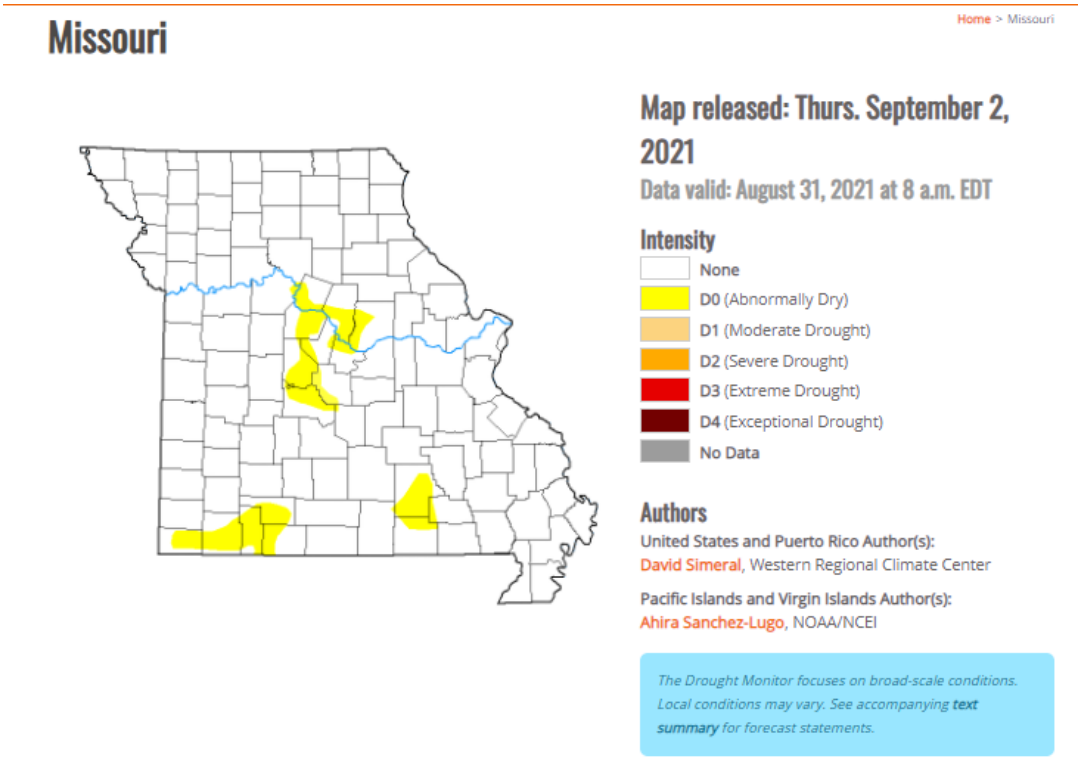
Geographic Location

Droughts are regional climatic events that can impact large areas and multiple counties. The entire county is as risk to the impacts of drought. However, drought most directly impacts the agricultural sector, so areas within the county where there is extensive agricultural land use can experience significant impacts. As noted previously in the plan, Douglas County is home to intensive livestock production. All incorporated communities in the county rely on wells for water supply. The impact of drought on deeper public wells would not be significant unless the drought was of such historic severity to reduce groundwater levels.

Severity/Magnitude/Extent

Figure 3.8 is a recent map from the US Drought Monitor and an example of the size of the geographic area that could be in drought conditions at any given moment in time. The map is only a snapshot of conditions at a given time and indicates the severity of drought conditions.

Figure 3.8. U.S. Drought Monitor Map of Missouri on 9-7-2021



Week	Date	None	D0-D4	D1-D4	D2-D4	D3-D4	D4	DSCI
Current	2021-08-31	93.26	6.74	0.00	0.00	0.00	0.00	7
Last Week	2021-08-24	95.17	4.83	0.00	0.00	0.00	0.00	5
3 Months Ago	2021-06-01	96.40	3.60	0.00	0.00	0.00	0.00	4
Start of Calendar Year	2020-12-29	55.47	44.53	10.22	0.00	0.00	0.00	55
Start of Water Year	2020-09-29	63.43	36.57	10.96	3.34	0.00	0.00	51
One Year Ago	2020-09-01	76.70	23.30	5.42	0.75	0.00	0.00	29

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

The most commonly used indicator of drought severity is the Palmer Drought Severity Index (PDSI), jointly published by the NOAA and the United States Department of Agriculture. 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.

According to the MDNR Missouri Drought Plan revised in 2002, Missouri Drought Response System is divided into four phases based on Palmer Index values:

- **Phase I: Advisory Phase**—Requires a drought monitoring and assessment system to provide enough lead time for state and local planners to take appropriate action;
- **Phase II: Drought Alert**—When the PDSI reads -1.0 to -2.0, and stream flows, reservoir levels, and groundwater levels are below normal over a several month period, or when the Drought Assessment Committee (DAC) determines that Phase II conditions exist based on other drought determination methods;
- **Phase III: Conservation Phase**—When the PDSI reads -2.0 to -4.0, and stream flows, reservoir levels, and groundwater levels continue to decline, along with forecasts indicating an extended period of below-normal precipitation, or when the DAC determines that Phase III conditions exist based on other drought determination models;
- **Phase IV: Drought Emergency**—When the PDSI is lower than -4.0, or when the DAC determines that Phase IV conditions exist based on other drought determination methods.

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.

The USDA's Risk Management Agency provides insure crop loss payments in the county as a result of drought from 1948 to present. The 2018 State Plan states that Douglas County is categorized as "low" in crop loss ration ratings. Data indicates that from 1998 through 2020 there were zero dollars in insured crop loss payments with annualized losses of $0.

Previous Occurrences

The NCEI database shows one (1) drought event occurring in Douglas County from 2017 through 2021. Table 3.27 provides a summary of these events.

Table 3.27. Previous Drought Occurrences 2017-2021

Drought Year	Duration	Property Damage	Crop Damage
2017	n/a	$0	$0
2018	n/a	$0	$0
2019	n/a	$0	$0
2020	8/25/2020 to 10/31/2020	$0	$0
2021	n/a	$0	$0

The single drought event occurring in Douglas County from 2017 through 2021 is described in NCEI narratives as follows:

Dry conditions continued through much of the month of October, continuing the drought conditions which began in August. The 30/60/90 Day precipitation amounts continued to decline with Severe (D2) and Extreme (D3) drought developing or expanding across portions of the Ozarks. Low stream flows were noted on some area rivers and KBDI indices rose indicating enhanced fire weather concerns. Some indication in the agricultural community were beginning to occur with some farmers started feeding hay about a month early. Much of the impacts felt through the increasing drought were limited by the end of the growing season. Primary impacts were limited for the most part to surface and ground water issues and fire weather concerns.

Probability of Future Occurrence

NCEI data for Douglas County over the five-year period between 2017 and 2021 shows one (1) drought event with a total duration of three (3) months of drought conditions. The calculated risk percent from the number of months of drought over the five-year period equates to the annual average percentage of 5.0% probability of drought occurrence in the county.

Although drought is not predictable, long-range outlooks and predicted impacts of climate change could indicate an increased chance of drought.

Vulnerability

Vulnerability Overview

The agriculture sector is particularly vulnerable to drought. Periods of dry weather can reduce stock ponds and force the early sale of livestock. Crop production can be disrupted, and vegetative diseases can spread, reducing yields. Cities that operate water wells can experience water shortages during persistent drought periods like the seven month drought period in 2012. Those that rely on private wells are more likely to be impacted by reductions in the groundwater supply due to the fact that public wells are far deeper than private wells.

Potential Losses to Existing Development

The 2018 State Plan states that from 1998 through 2022 there or $0 in insured crop loss payments in Douglas County. The absence of payment could be due to the absence of crop insurance. There are no anticipated structural losses, loss of life, or injuries associated with this hazard. In addition, according to the NCEI estimates there were $0 in crop losses from 2017-2022.

Impact of Future Development
Increases in acreage planted with crops would add to exposure to drought-related agricultural losses. In addition, increases in population result in increased demand for treated water, adding additional strain on natural water supply systems.

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.

The Natural Resources Defense Council developed a new water supply sustainability index. The risk to water sustainability is based on the following criteria:

- Projected water demand as a share of available precipitation
- Groundwater use as a share of projected available precipitation
- Susceptibility to drought
- Projected increase in freshwater withdrawals
- Projected increase in summer water deficit

The risk to water sustainability for counties meeting two of the criteria are classified as “moderate”, while those meeting three of the criteria are classified as “high”, and those meeting four or more are classified as “extreme”. Counties meeting less than two criteria are considered to have minimal risk to water sustainability. According to the Natural Resources Defense Council, without climate change the water sustainability index for Douglas County is “low.” With climate change, the water supply sustainability index is “low”.

Hazard Summary by Jurisdiction
Although the probability of drought is the same for the entire county, farming and livestock enterprises in the unincorporated parts of the county would feel the greatest impact. These impacts can be mitigated somewhat by the purchase of crop insurance. The existence of private farms and ranches are more concentrated in the western and southern portion of the county where the land is not under government ownership. The City of Ava, utilize groundwater wells for public water supply and could potentially be impacted during water shortages due to the reliance on these limited source wells.

Problem Statement

Although drought most likely will not cause structure damage, the impact is greatest on the agriculture sector and if persistent enough, could cause reductions in groundwater and water shortages in communities that provide potable water services. Potential solutions to mitigate the impact of drought would be for communities to develop an ordinance to restrict the use of public water resources for non-essential usage, such as landscaping, washing cars, filling swimming pools, etc. during extreme drought periods. School districts can also implement water conservation measures at all district facilities.

3.4.4 Earthquakes

Hazard Profile

Hazard Description

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

The subterranean faults were formed many millions of years ago on or near the surface of the earth. Subsequent to that time, these ancient faults subsided, while the areas adjacent were pushed up. As this fault zone (also known as a rift) lowered, sediments filled in the lower areas. Under pressure, the sediments hardened into limestones, sandstones, and shales – thus burying the rifts. The pressures on the North American plan and the movements along the San Andreas Fault by the Pacific plate have reactivated the buried rift(s) in the Mississippi embayment. This rift system is called the Reelfoot Rift and underlies the New Madrid Seismic Zone. (Braile et al., 1986)

Geographic Location

The greatest hazard from earthquakes in Douglas County comes from the New Madrid Seismic Zone situated in the boot heel area of southeast Missouri. The potential of high magnitude earthquakes occurring along the New Madrid fault presents risk that does not vary across the planning area. The Nemaha uplift is central Kansas is also prone to seismic activity, however the center of the Humbolt fault zone near the Nemeha Uplift is approximately 300-350 miles west/northwest of Douglas County and lower magnitude seismic events that will not impact jurisdictions in Douglas County.

The 2018 USGS National Seismic Hazard Maps display earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes, insurance rate structures, risk assessments and other public policy. The updated maps represent an assessment of the best available science in earthquake hazards and incorporate new findings on earthquake ground shaking, faults, seismicity, and geodesy. The USGS National Seismic Hazard Mapping Project developed these maps by incorporating information on potential earthquakes and associated ground shaking obtained from interaction in science and engineering workshops involving hundreds of participants, review by several science organizations and State surveys, and advice from expert panels and a Steering Committee. Figure 3.9 is a USGS map illustrating seismicity in the United States. A star showing the general location of Douglas County has been inserted on the map.

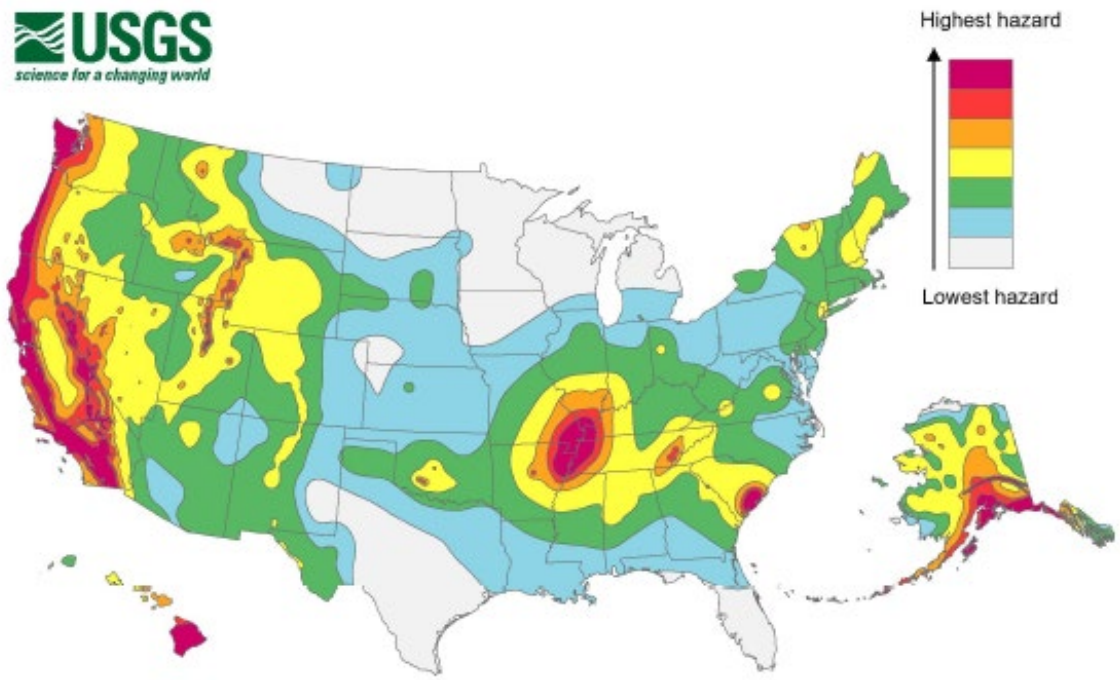
Severity/Magnitude/Extent

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

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

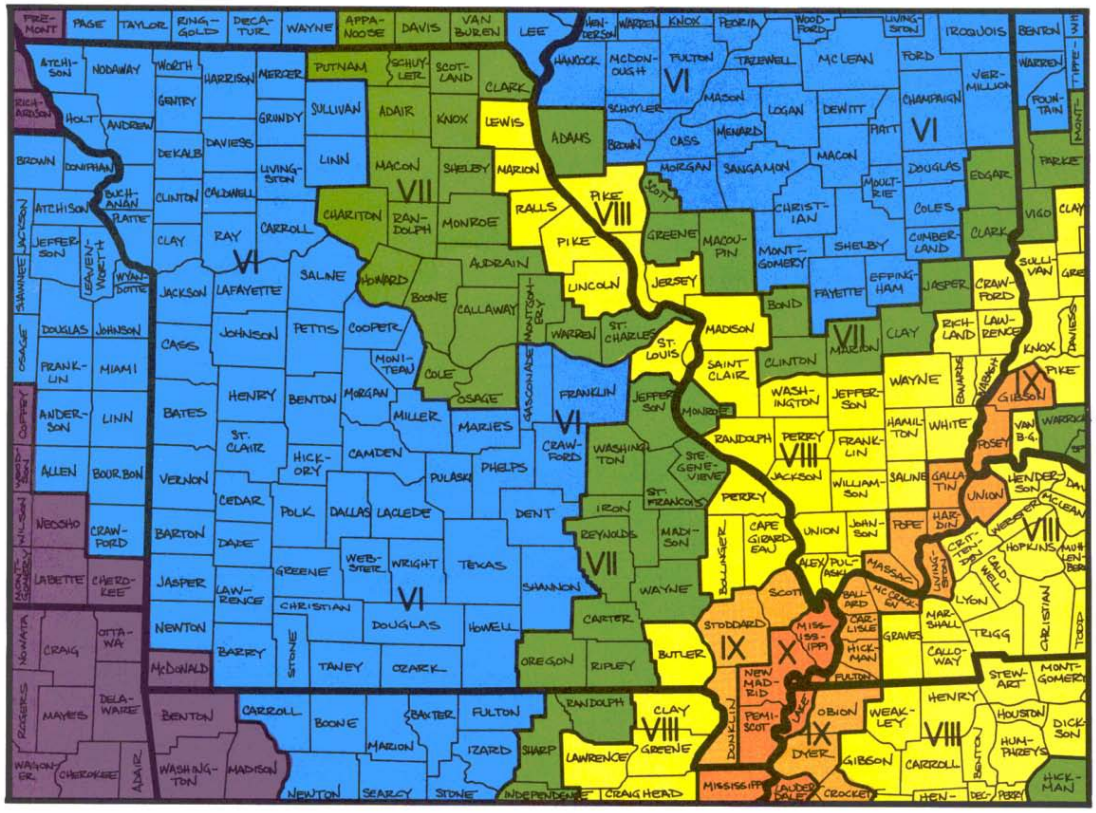
- *Modified Mercalli Intensity Scale*
    - The intensity of an earthquake is measured by the effect of the earthquake on the earth's surface. The intensity scale is based on the responses to the quake, such as people awakening, movement of furniture, damage to chimneys, etc. The intensity scale currently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

Figure 3.9. USGS Earthquake Hazard Map



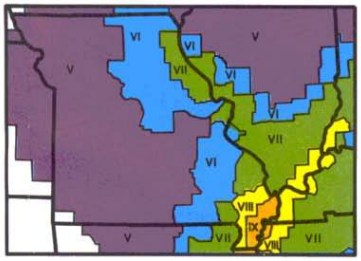
Source: United States Geological Survey at http://earthquake.usgs.gov/hazards/products/conterminous/2018/HazardMap2018_lg.jpg

Figure 3.10. 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 any where along the length of the New Madrid seismic zone.

6.7

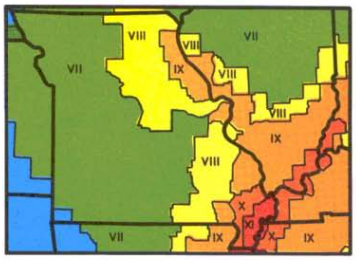


This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude – 6.7 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.

7.6

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.

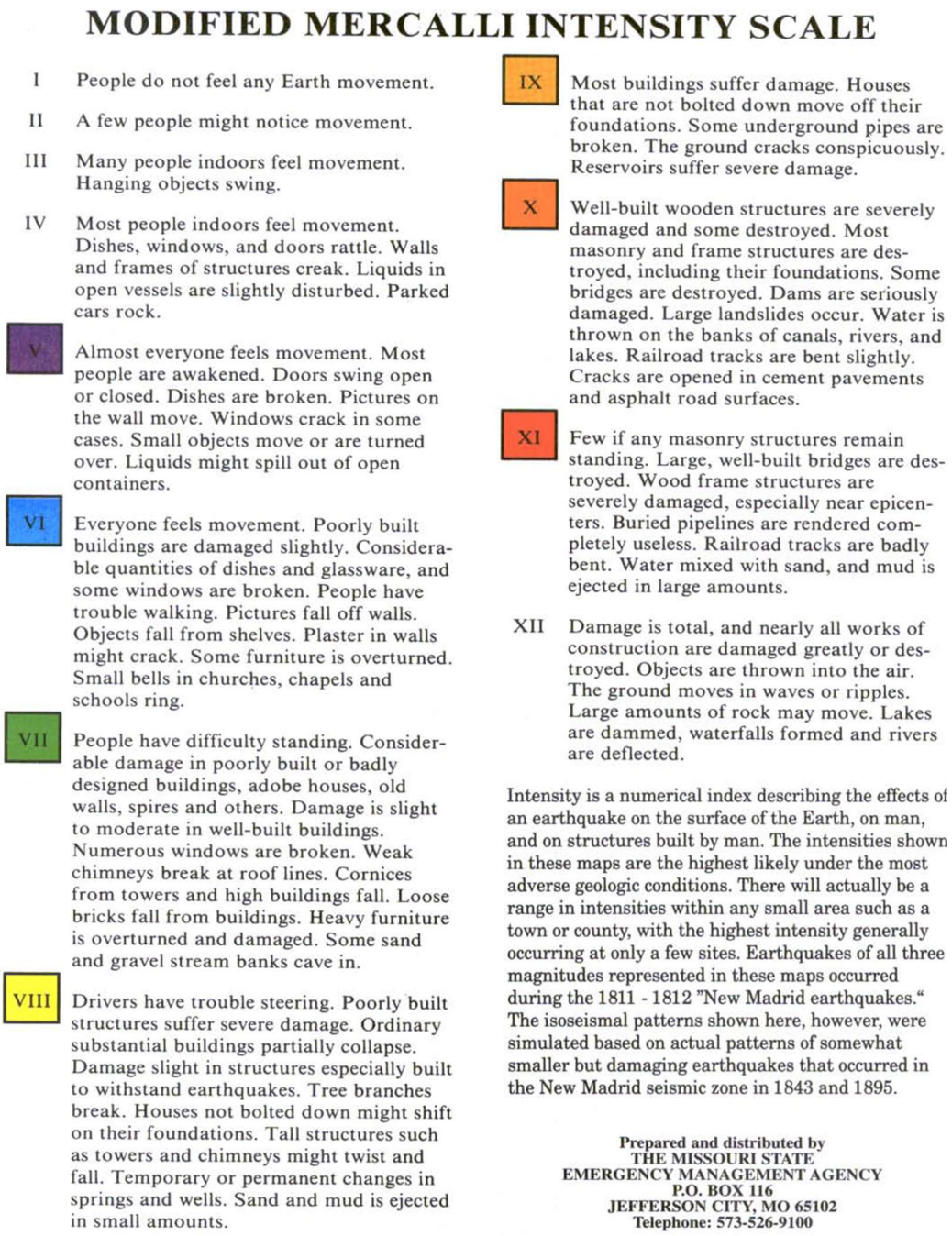
8.6



Source: http://sema.dps.mo.gov/docs/programs/Planning,%20Disaster%20&%20Recovery/State%20of%20Missouri%20Hazard%20Analysis/2012-State-Hazard-Analysis/Annex_F_Earthquakes.pdf

Figure 3.10 (above) shows the highest projected Modified Mercalli Intensities by county from a potential magnitude 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid Seismic Zone. The secondary maps in the figure above show the same regional intensities for 6.7 and 8.6 earthquake, respectively. Douglas County is located in zone VI from a potential magnitude 7.6 earthquake along the New Madrid fault.

Figure 3.11. 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.

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.

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.

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.

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.

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.

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.

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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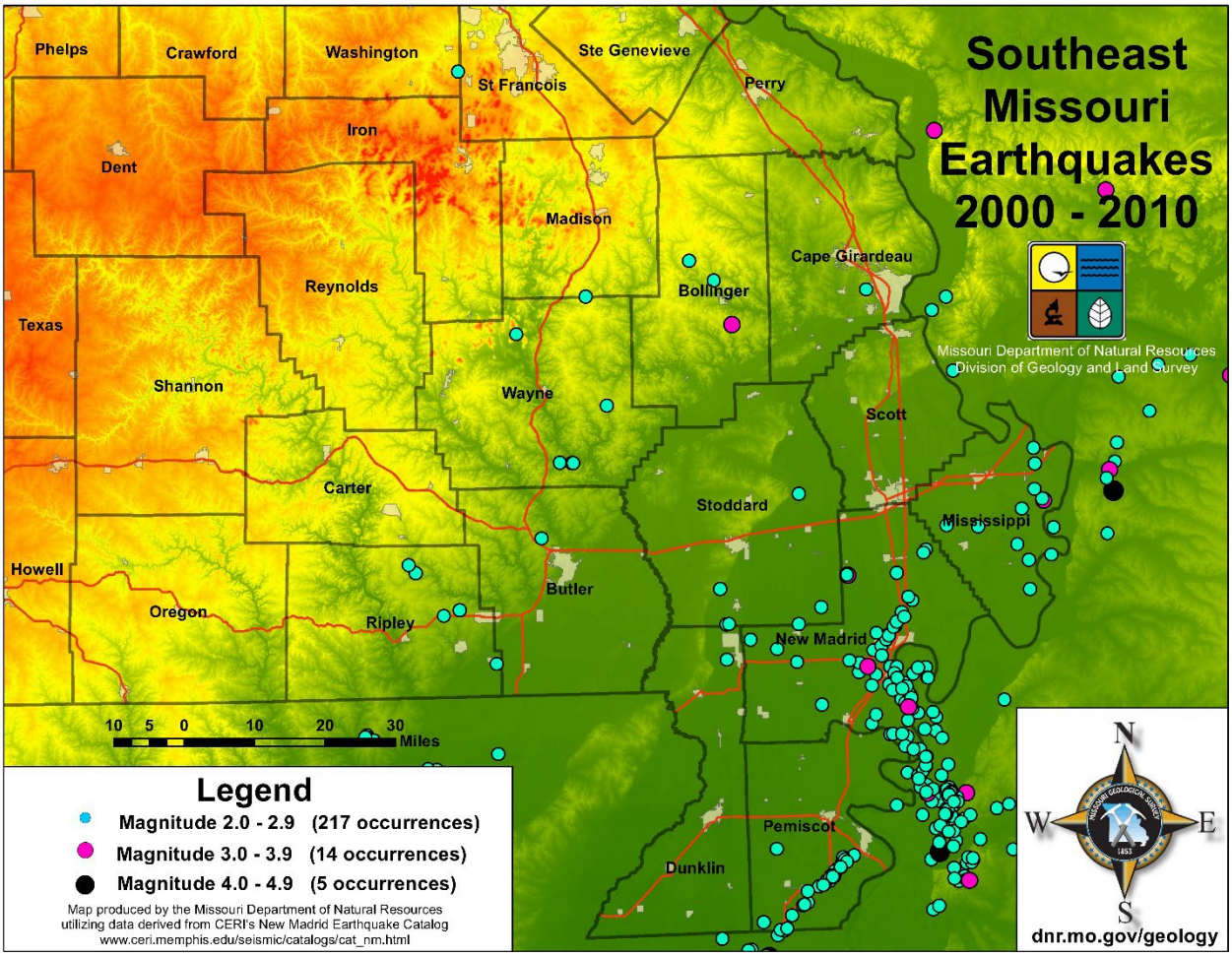
Previous Occurrences

There is no record of recent earthquake occurrence within Douglas County (2000-2021). The southeastern portion of Missouri is most susceptible to earthquakes because it overlies the New Madrid Seismic Zone. No area of Missouri is immune from the danger of earthquakes. Minor, but potentially damaging earthquakes can occur anywhere in the state. (SEMA, 2018)

Figure 3.12 provides the latest and best data from the MDNR regarding earthquake occurrence in southeast Missouri.

Figure 3.12. Earthquakes of Southeast Missouri



Probability of Future Occurrence

Without a historical record for earthquakes in Douglas County it is not possible to calculate a precise probability of earthquake occurrence. The Center for Earthquake Research and Information (CERI) at the University of Memphis has computed conditional probabilities of a magnitude 6.0 earthquake in the New Madrid Seismic Zone. According to a fact sheet prepared by SEMA in 2003, the probability for a magnitude 6.0 to 7.5 earthquake

along the New Madrid Fault is 25 to 40 percent chance of occurrence over the next 50 years. At the 25% level, the likelihood of an earthquake happening in a given year is 1.0%. At the 40% level, the likelihood of an earthquake happening in a given year is 1.6%. The previous map Figure 3.11. indicates the potential severity for Douglas County of a 6.7, 7.6, and 8.6 magnitude earthquake anywhere along the New Madrid Fault.

Hazard Summary by Jurisdiction

Earthquake intensity is not likely to vary greatly throughout the planning area, the risk of occurrence is the same throughout. However, damages will differ where there are variations in the planning area based on percentage of structures build prior to 1939. For example, if one community has a high percentage of residences built prior to 1939 than the other participants, that community is likely to experience higher damages. Table 3.28 lists the number and percentage of housing units built in 1939 or earlier.

Table 3.28. Percent of Housing Units Built in 1939 or Earlier

Jurisdiction	Built in 1939 or earlier #	Built 1939 or earlier %
Douglas County	1,099	12.7%
City of Ava	86	22.0%

Source: Missouri Census Data Center (2020) ACS Profiles

Census data indicates that the City of Ava has the highest number of housing units built prior to 1939, therefore Ava is the most vulnerable by this measure.

School districts with facilities constructed prior to 1939 could suffer more damages than newer facilities, however, the majority of the currently utilized school facilities in the district have been constructed after 1939 and are considered well-built structures and therefore, less vulnerable to potential ground shaking.

Impact of Future Development

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

Vulnerability

Vulnerability Overview

Ground shaking is the most damaging effect from earthquakes. Ground shaking will impact all structures and critical infrastructure such as roads and electrical transmission systems. Although Nearby Ripley County experienced a 3.3 magnitude earthquake there were no document damages associated with this low magnitude event. The greatest earthquake risk to Douglas County is the New Madrid Fault in the bootheel region of Missouri. A 7.6 magnitude earthquake would result in people have difficulty standing; Considerable damage in poorly built or badly designed buildings, adobe houses, old walls, and spires; Damage is slight to moderate in well-built buildings; Numerous windows are broken; Weak chimneys break at rooflines; 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. In addition, some underground utilities would likely be damaged. Some injuries may occur, but fatalities are unlikely.

Potential Losses to Existing Development

In Douglas County, 7.6 magnitude earthquake along the New Madrid Fault could be expected to result in everyone feeling ground shaking; poorly built buildings are damaged slightly; considerable quantities of dishes, glassware and windows are broken; people have trouble walking; pictures fall off walls; objects fall from shelves; plaster in walls might crack; some furniture is overturned; and small bells in churches, chapels, and schools will ring. In addition, some underground utilities would likely be damaged. Injuries may occur but are unlikely.

A smaller yet still significant 6.7 quake along the fault line in would likely result in almost everyone feeling movement. Most people will be awakened if sleeping; 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.

Problem Statement

Based on likely damage from a 7.6 magnitude earthquake along the New Madrid fault, it is clear that the downtowns and historic districts of communities in Douglas County are at risk to significant damage. These older structures could perhaps be retrofitted with earthquake resistance measures to ensure their stability in the event of an earthquake of severe magnitude. Potential damages to future development can be mitigated by adopting and enforcing IBC 2012 building codes. Currently, only the City of Ava enforces such codes. Updating and enforcing building codes in other jurisdictions would mitigate the impact on future development from an earthquake event.

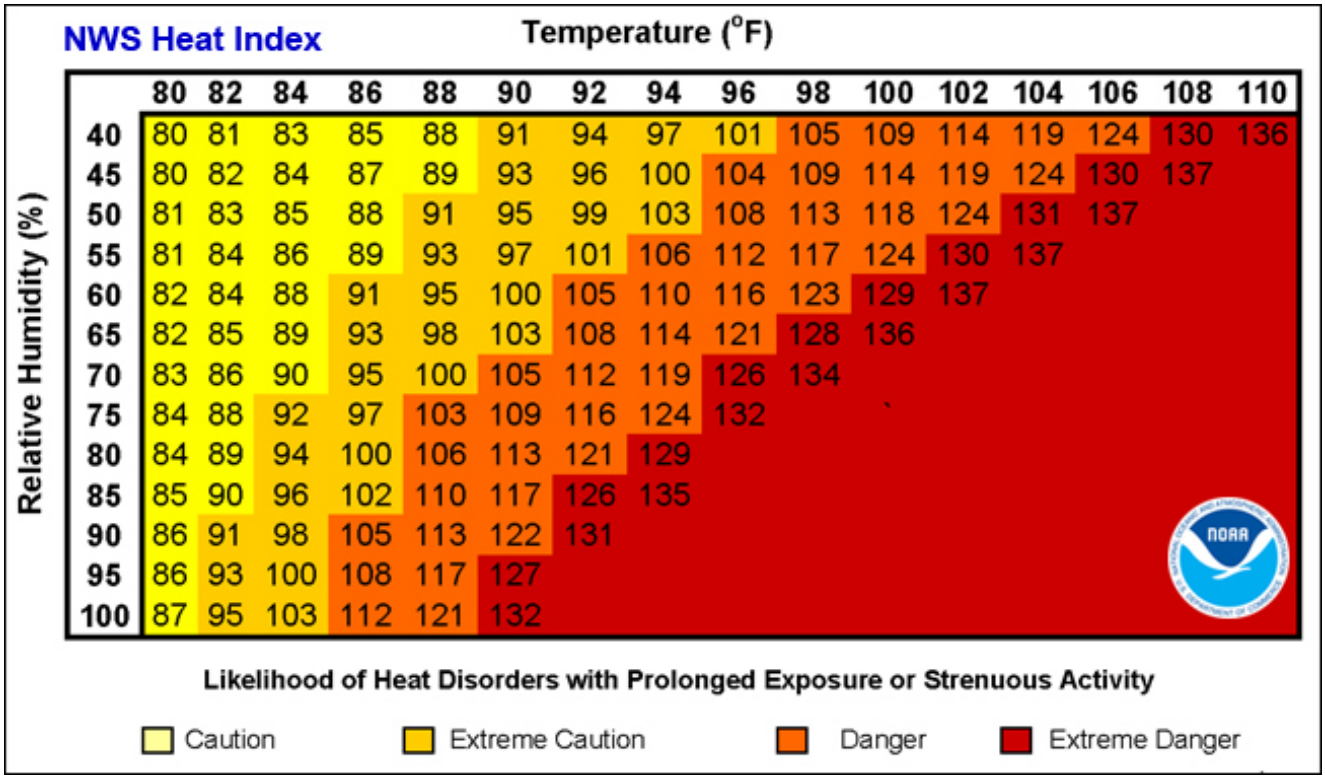
3.4.5 Extreme Temperatures

Hazard Profile

Hazard Description

Extreme temperature events, both hot and cold, can impact human health and mortality, natural ecosystems, agriculture, and other economic sectors. According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index chart shown in Figure 3.13 uses both factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

Figure 3.13. Heat Index (HI) Chart



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

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.

Geographic Location

Extreme heat is an area-wide hazard event, the risk of extreme heat does not vary across Douglas County.

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 nighttime 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.

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

Table 3.29. Typical Health Impacts of Extreme Heat

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

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

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

There are zero (0) recorded extreme heat events in the National Centers for Environmental Information (NCEI) database from 2017 to 2021 for Douglas County.

There is one (1) Extreme Cold/Wind Chill event in the National Centers for Environmental Information (NCEI) database from 2017 to 2021 for Douglas County with no resulting deaths, injuries or damages reported. The event narratives describe the episode as follows:

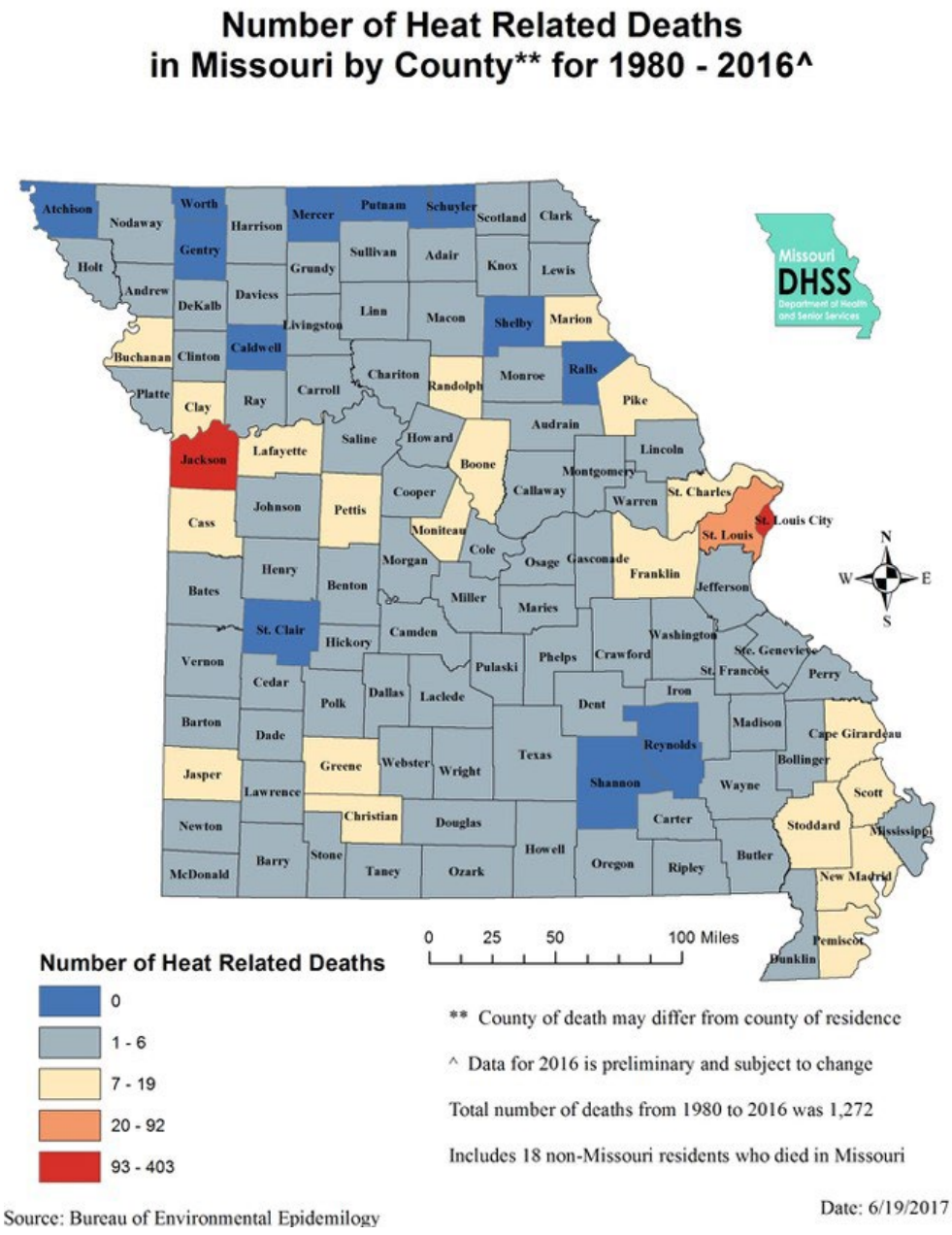
An extended period of unseasonably cold weather gripped central and southwest Missouri between February 7 and February 18. The coldest temperatures and wind chills occurred from February 14 through February 16. Record to near record low temperatures were common on the mornings of February 15 and 16th with subzero lows and highs just in the single digits and teens above zero. In addition, wind chill readings between -20 and -30 were reported across the area.

Along with the bitter cold, widespread snow occurred across central and southwest Missouri from the early morning hours of February 14 into the late afternoon hours of February 15. This created widespread snow-covered roads and the cold and snow combined resulted in numerous if not all schools being closed.

An extended period of unseasonably cold weather gripped central and southwest Missouri between February 7 and February 18. The coldest temperatures and wind chills occurred from February 14 through February 16. Record to near record low temperatures were common on the mornings of February 15 and 16th with subzero lows and highs just in the single digits and teens above zero. In addition, wind chill readings between -20 and -30 were reported across the area. Along with the bitter cold, widespread snow occurred across central and southwest Missouri from the early morning hours of February 14 into the late afternoon hours of February 15. This created widespread snow-covered roads and the cold and snow combined resulted in numerous if not all schools being closed.

On the morning of February 15th, minimum wind chills ranged from -13 degrees in Squires to -18 degree 3 miles northeast of Vanzant. In addition, morning low temperatures on February 16th ranged from -9 degrees in Vanzant to -13 degrees Ava.

Figure 3.14. Heat Related Deaths in Missouri



Probability of Future Occurrence

The probability that an extreme cold/wind chill event will occur in Douglas County in any given year is 20%. This equates to dividing the one (1) year with an event period by the total number of years in the record period from 2017 to 2021 (5) and multiplying by 100.

Heat advisories and warnings are issued for shorter periods of extreme heat nearly every year and may not meet the threshold for consecutive days in the NCEI database. This data limitation indicates that extreme heat events could be underreported in the NCEI.

Vulnerability

Vulnerability Overview

High humidity, which often accompanies heat in Missouri, can make the effects of heat even more harmful. 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. Consequently, the persistence of a heat wave increases the threat to public health. The people most at risk are children under five years of age and adults over the age of 65 as well as people who work outdoors. The agriculture sector can also suffer crop loss during periods of extreme heat. Extreme heat may also cause buckling of roads.

Potential Losses to Existing Development

Based on the information in the 2018 State Plan and DHSS, one-to-three heat related deaths have occurred in Douglas County in the past 13 years. While the likelihood of heat related death is unlikely, the possibility of occurrence should not be completely ruled out.

Impact of Future Development

Population growth can result in increases in the age groups that are most vulnerable to extreme heat. Population growth also increases the strain on electricity infrastructure, as more electricity is needed to accommodate the growing population. All jurisdictions in the county exhibit very slow population growth, or decline.

Hazard Summary by Jurisdiction

Those at greatest risk for heat-related illness and deaths include children up to five years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. To determine jurisdictions within the planning area with populations more vulnerable to extreme heat, demographic data was obtained from the 2020 US Census estimates identifying the population percentages in each jurisdiction comprised of those under age 5 and over age 65. Data was not available for overweight individuals and those on medications vulnerable to extreme heat. Table 3.30 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 3.30. County Population Under Age 5 and Over Age 65, 2020 ACS Data

Jurisdiction	Population Under 5 yrs.	Population 65 yrs. and over
City of Ava	190/6.5%	674/23.1%
Douglas County	784/5.9%	3,253/24.4%

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

Problem Statement

Older and younger segments of the population are more vulnerable to the impact of extreme heat. In addition, people living below the poverty level may be more vulnerable during periods of extreme heat hue to lack of air conditions or proper utilities in their homes. Douglas County is among the oldest and poorest counties in the State. Institutionalized populations such as those living in nursing homes become more vulnerable to extreme heat due to power outages. This problem would best be mitigated by installation of emergency generators at these institutional facilities. Provision and advertisement of cooling centers in the county would help mitigate the impact on vulnerable populations in the planning area.

3.4.6 Land Subsidence/Sinkholes

Hazard Profile

Hazard Description

Sinkholes are depressed or collapsed areas formed by dissolution of carbonate bedrock or collapse of underlying caves. They range in size from several square yards to hundreds of acres and may be very shallow or hundreds of feet deep. Sinkholes are part of what is called karst topography, which also includes caves, springs and losing streams. 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. Land subsidence may also result from human activities such as, underground mining, groundwater or petroleum withdrawal, and drainage of organic soils.

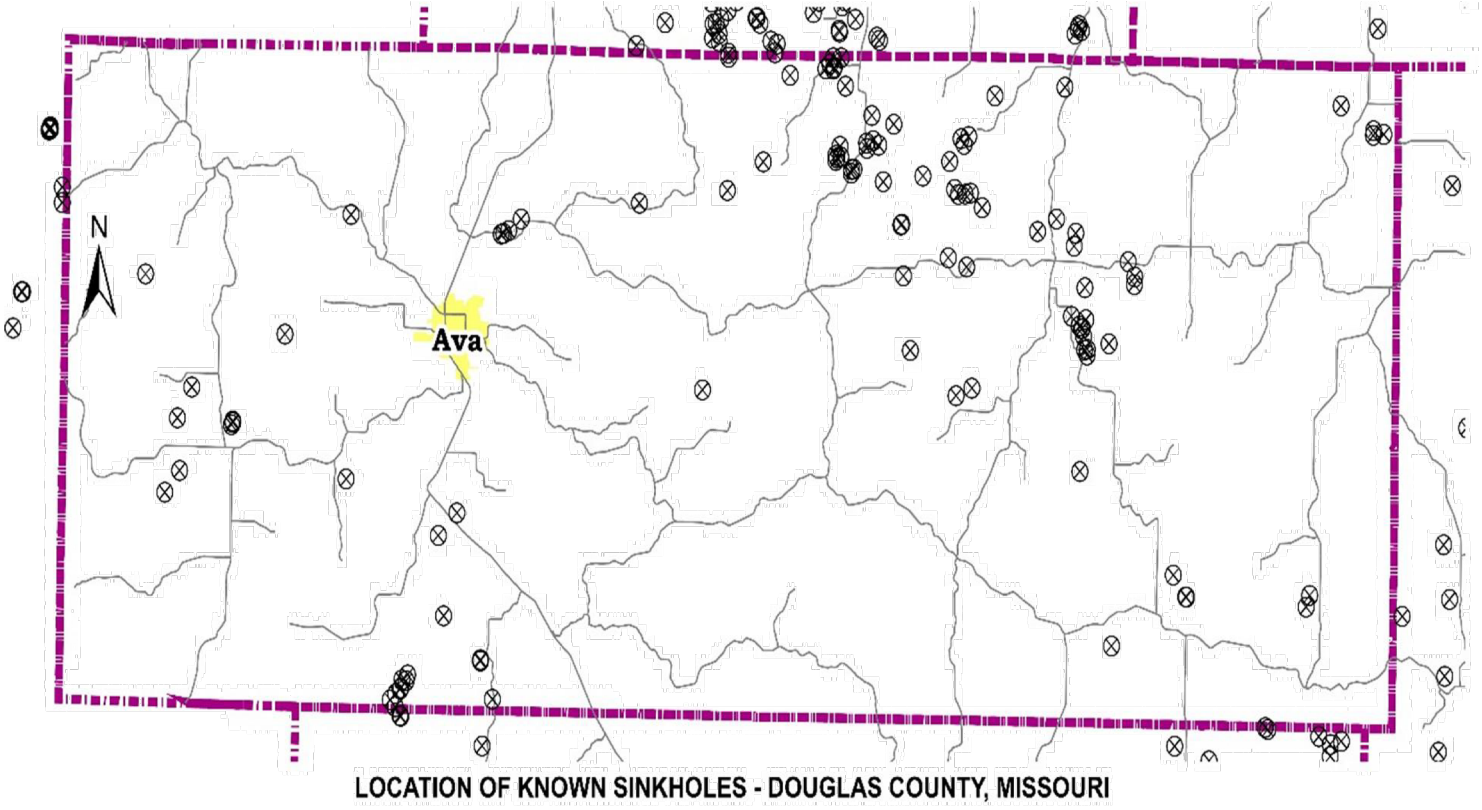
In the case of sinkholes, the rock below the surface is rock that has been dissolving by circulating groundwater. As the rock dissolves, spaces and caverns form, and ultimately the land above the spaces collapse. In Missouri, sinkhole problems are usually a result of surface materials above openings 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. 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 a change in stormwater runoff patterns resulting from an increase in impervious surfaces from land development.

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. Sinkholes can also vary is shape like shallow bowls or saucers whereas other have vertical walls. Some hold water and form natural ponds.

Geographic Location

According to spatial data from Missouri Geological Survey, there are 357 sinkhole formations have been identified in Douglas County. Figure 3.15, below, provides the location of known sinkholes in the county. Although the risk of sinkhole formation exists countywide, the map shows that the unincorporated areas of the county and in particular locales in the south central part of the county have an elevated risk to sinkhole formation more so than other communities in the county.

Figure 3.15. Known Sinkholes in Douglas County



Severity/Magnitude/Extent

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

Previous Occurrences

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

Probability of Future Occurrence

Based on local information and the 2018 Missouri State Hazard Mitigation Plan, there have been zero documented sinkhole formations or expansions in the county during an eleven year period from 2006-2015. This equates to a 0% probability of a sinkhole formation in any given year in the county. However, in considering the large number of known sinkholes in Douglas County, it is likely that unreported sinkhole formation occurs every year.

Vulnerability

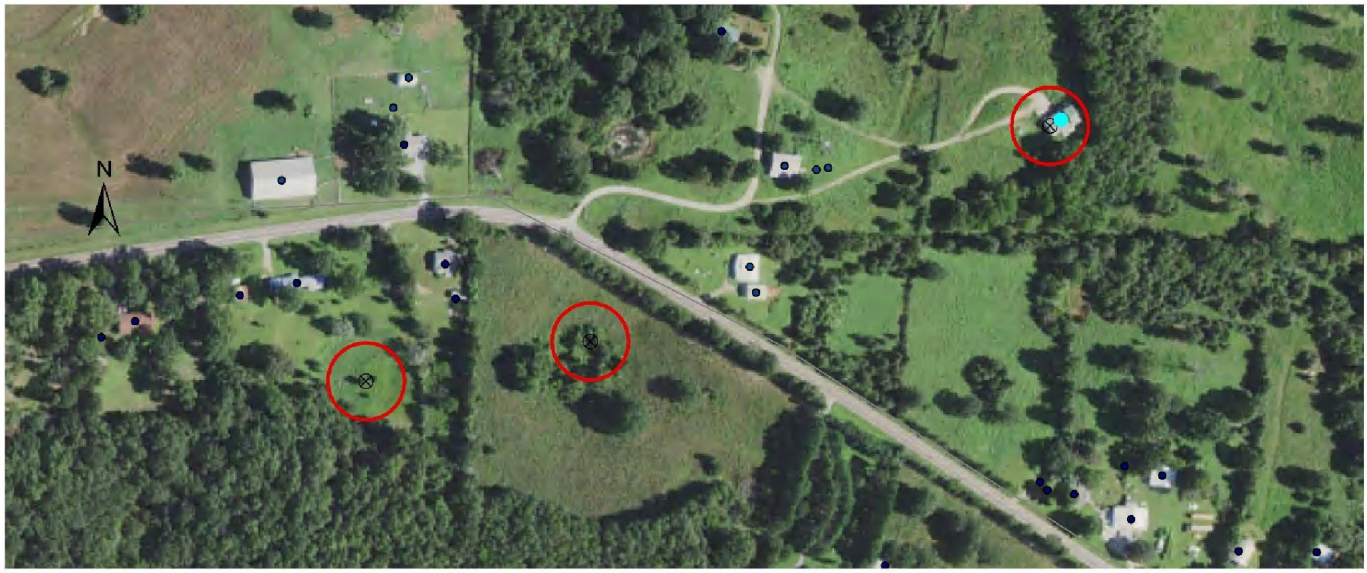
Vulnerability Overview

Sinkholes in Missouri are a common feature where limestone and dolomite outcrop. Dolomite is a rock similar to limestone with magnesium as an additional element with the calcium normally present in the minerals that form the rocks. While some sinkholes may be considered a slow changing nuisance; other more sudden catastrophic collapses can destroy property, delay construction projects, contaminated groundwater resources, and damage underground utilities. The entire county is underlain with limestone and dolomite bedrock.

Potential Losses to Existing Development

A 75-foot buffer zone was created in GIS then overlaid on the Douglas County Structures layer to identify structures located in close proximity to known sinkholes. The results of this operation show that in Douglas County there are one (1) structure located within 75 feet of a known sinkhole. Both located just outside the corporate boundaries of the City of Ava in central Douglas County.

Figure 3.16. Structure in Proximity to Known Sinkhole



Structures located within 75 feet distance of known sinkholes

Impact of Future Development

Future development in areas of known risk to sinkhole formation in the planning area will increase vulnerability to this hazard. Population and development in these areas, specifically in the Ava area and northern Douglas County will increase exposure to sinkhole occurrence. While no building codes currently restrict construction within a certain distance of known sinkholes, in is encouraged that local officials explore options to implement this regulatory condition.

Hazard Summary by Jurisdiction

The risk of sinkhole damage for individual communities and school districts is limited to the amount of exposure of buildings and infrastructure. The entire county is at risk for potential sinkhole development; however, the north-central and northeast portions of unincorporated Douglas County are located in areas with high density of known sinkholes. This indicates that the subsurface conditions are currently favorable for the development of sinkhole features. It is unlikely that school districts will be greatly affected by sinkholes due to the localized nature of their exposure.

Problem Statement

It is likely that more sinkholes will occur as development occurs within the county. Sinkholes can be remediated with fill material. Once a sinkhole has been remediated, building should be prohibited at the site. Existing sinkholes can expand if surface runoff erodes the edges of the sinkhole. Best efforts to divert stormwater runoff from known sinkholes should be made. Douglas County has a high density of sinkholes and the effects of collapse sinkholes on the built environment should be noted as a public service to the county's residents.

3.4.7 Severe Thunderstorms

Including High Winds, Hail, and Lightning

Hazard Profile

Hazard Description

Thunderstorms

A thunderstorm is defined as a storm that contains lightning and thunder which is caused by unstable atmospheric conditions. When cold upper air sinks and warm moist air rises, storm clouds or 'thunderheads' develop resulting in thunderstorms. This can occur singularly, as well as in clusters or lines. The National Weather Service defines a thunderstorm as "severe" if it includes hail that is one inch or more, or wind gusts that are at 58 miles per hour or higher. At any given moment across the world, there are about 1,800 thunderstorms occurring. Severe thunderstorms most often occur in Missouri in the spring and summer, during the afternoon and evenings, but can occur at any time. Other hazards associated with thunderstorms are heavy rains resulting in flooding (discussed separately in Section 3.4.6) and tornadoes (discussed separately in Section 3.4.9).

High Winds

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

Lightning

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

Hail

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

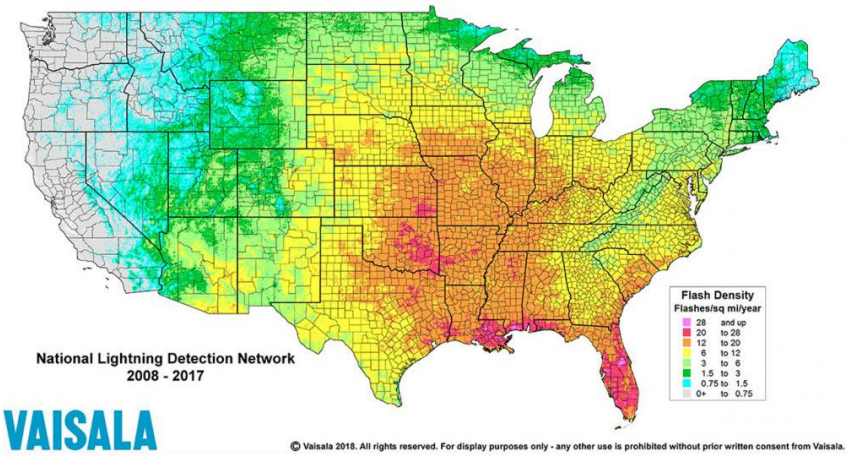
At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a ¼" diameter or pea sized hail requires updrafts of 24 miles per hour, while a 2 ¾" diameter or baseball sized hail requires an updraft of 81 miles per hour. According to the NOAA, the largest 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

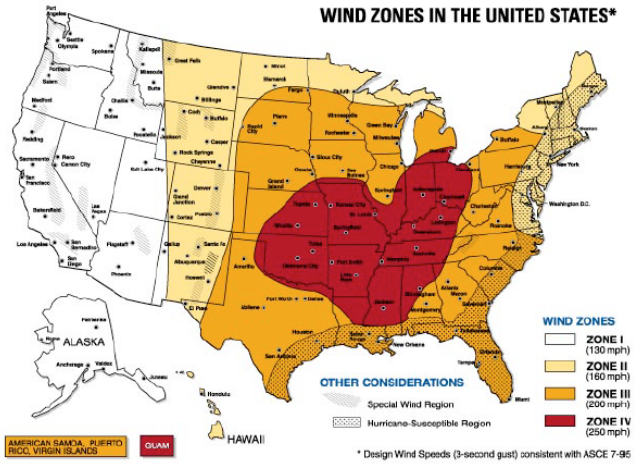
Thunderstorms/high winds/hail/lighting events are an area-wide hazard that can happen anywhere in the county. Although these events occur similarly throughout the planning area, they are more frequently reported in the incorporated communities. In addition, damages are more likely to occur in more densely developed parts of the county. Figure 3.17 shows lightning frequency in the state. Douglas County is located in the 6 to 8 flash density zone on the map.

Figure 3.17. Location and Frequency of Lightning in Missouri



Source: National Weather Service, http://www.vaisala.com/en/products/thunderstormandlightningdetectionsystems/Pages/NLDN.aspx

Figure 3.18. 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

Strength/Magnitude/Extent

Based on information provided by the Tornado and Storm Research Organization (TORRO), Table 3.31 below describes typical damage impacts of the various sizes of hail.

Table 3.31. Tornado and Storm Research Organization Hailstorm Intensity Scale

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

Source: Tornado and Storm Research Organization (TORRO), Department of Geography, Oxford Brookes University
Notes: In addition to hail diameter, factors including number and density of hailstones, hail fall speed and surface wind speeds affect severity. http://www.torro.org.uk/site/hscale.php

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

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

Previous Occurrences

Thunderstorm Wind

There are sixty-one (61) Thunderstorm Wind events reported to the NCEI from 2017-2020 in Douglas County.

Twenty-one (21) of these events resulted in reported property damages. The total damages from these events include $318,000 in property damages with average losses per damaging event totaling $15,143.

The costliest event occurred on April 28, 2021, and is described as follows in NCEI narratives:

Heavy rain developed over southern Missouri on the night of the 27th and continued through the evening of the 28th as a slow-moving cold front moved across the region and interacted with a moist and unstable airmass over the region. Several inches of rain fell in a short period of time during the early morning of the 28th and led to flash flooding in Reeds Spring and at Roaring River State Park, where numerous campers were evacuated. Between 1.50 and 5 inches of rain fell across much of the Ozarks in a 24-hour period. Some readings indicated that as much as 2.5 inches of rain fell in about a 30-minute period In Barry and Stone Counties. In addition to the flooding, several brief tornadoes occurred in Barry, Christian and Douglas Counties.

A NWS storm survey concluded that three large outbuildings were slightly to heavily damaged from high winds.

Table 3.32. NCEI T-Storm Wind Events in Douglas County 2017-2021

Location	# of Events	Deaths	Injuries	Property Damage	Crop Damage
Unincorporated Douglas County	47	0	0	$209,000	$0
Ava	14	0	0	$109,000	$0
Total	**61**	**0**	**0**	**$318,000**	**$0**

Source, NCEI, 2021

Hail

There are thirty-six (36) Hail events reported to the NCEI from 2017-2021. There were no reported damages associated with these events. The largest magnitude event was on May 19, 2018, when hailstones 2.50 inches in diameter were reported near Squires in unincorporated Douglas County. This event is described as follows in NCEI narratives:

A slow-moving weather system with a stalled out frontal boundary caused several rounds of thunderstorms with damaging wind and large hail.

Table 3.33 below provides information about damaging hail events in the county.

Table 3.33. NCEI Hail Events in Douglas County 2017-2021

Location	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Unincorporated Douglas County	-	-	-	-	-	-
Ava	-	-	-	-	-	-
TOTALS	**-**	**-**	**-**	**-**	**-**	**-**

Source: NCEI, 2021

Lightning

Limitation 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.

There are four (4) lightning events recorded in the NCEI data from 2017-2021. The costliest event occurred on May 9, 2021, and is described in NCEI narratives as follows:

Low pressure deepened over eastern Colorado and moved eastward along a stationary front into southern Illinois through the morning of the 9th before the front moved south of the Ozarks. Strong to severe storms moved over the region during the early morning of the 9th. Hail up the golf ball size occurred in Barry County southeast of Cassville, and several locations along the south of Highway 60 reported wind damage to trees and powerlines. Several rounds of rainfall led to flooding near Ava in Douglas County, near Sycamore and Hardenville in Ozark County, and near Bradleyville in Taney County.

Lightning struck the Ava High School damaging seven network switches.

Table 3.34. NCEI Lightning Events in Douglas County 2017-2021

Location	# of Events	Deaths	Injuries	Property Damage	Crop Damage
Unincorporated Douglas County	2	0	0	$15,000	$0
Ava	2	0	0	$47,000	$0
Total	**4**	**0**	**0**	**$62,000**	**$0**

Source: NCEI, 2021

Probability of Future Occurrence

Thunderstorm Wind

There have been 61 recorded unique thunderstorm wind events over a 5-year period from 2017-2020 with an average of more than 12 occurrences annually and a 100% probability of occurrence. There were twenty-one (21) events that resulted in $318,000 in property damage. This equates to an average of four (4) damaging events per year and annualized losses of $63,600.

Hail

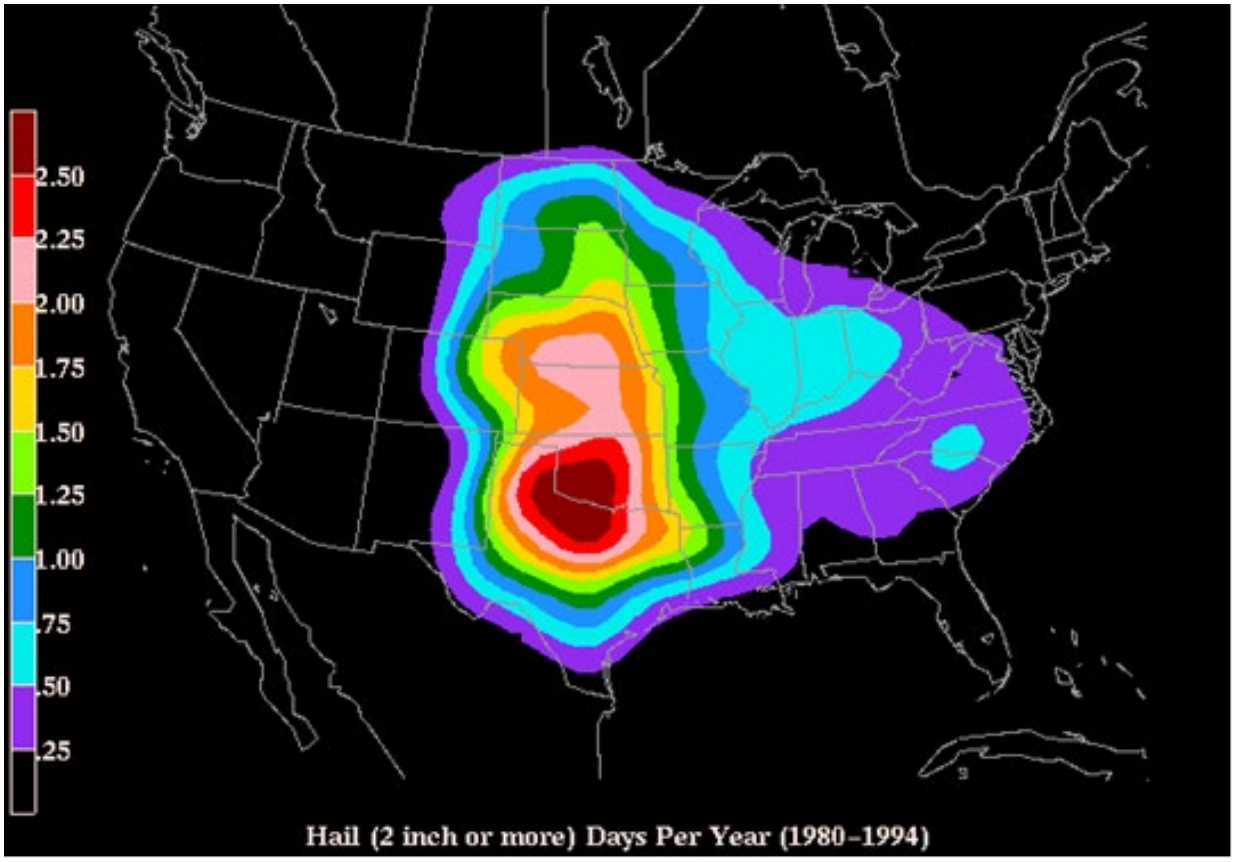
There have been thirty-six (36) recorded hail events over a 5-year period from 2017-2021. This equates to approximately seven (7) events in any given year with a 100% probability of occurrence. There were no event resulting in property damages during this time period, according to NCEI data. Figure 3.19 below is a map based on hailstorm data from 1980 to 1994. It shows the probably of hailstorm occurrence (2" diameter or larger) based on number of days per year. Douglas County is bisected by the dark blue and light blue zones on the map meaning that the county can be expected to experience hail greater than 2" in diameter .75 to 1 day per year.

Lightning

There have been four (4) recorded lightning events over the 5-year period from 2017-2021. This equates to

an 80% probability of occurrence. The four events resulted in a total of $62,000 of property damage. Annualized losses from lightening events are $12,400 per year.

Figure 3.19. Annual Hailstorm Probability (2'' diameter or larger), 1980 - 1994



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

Changing Future Conditions Considerations

Increases in temperature and more frequent droughts will accelerate the evaporation of water into the atmosphere, which will produce higher water concentrations. Elevated levels of moisture raise the likelihood of severe thunderstorms and tornadoes. Lives and property are endangered when the risk of these events increases, especially in jurisdictions that do not have a community safe room or the funds to construct one. This kind of event also possesses the threat of increasing the magnitude and frequency of other hazard events like riverine flooding, sinkhole occurrence, and flash flooding, putting residents in even greater danger.

Vulnerability

Vulnerability Overview

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

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

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

Potential Losses to Existing Development

The average annual loss determined from historical losses for thunderstorms, high wind, hail and lightning are indicators of the potential losses to existing development. Thunderstorm wind events in the county have damaged critical facilities, schools, local governments, and private property. Potential annual losses throughout Douglas County are Thunderstorm - $318,000; Hail - $0. Potential annual losses from high winds and lightning are not calculable but should be expected to occur and cause damages in the future.

Impact of Previous and Future Development

Growth in Douglas County is occurring at a slow rate, Ava is the only city in Douglas County. Additional development in these areas results in the exposure of more households and businesses vulnerable to damages from high winds, hail, and lightning.

Hazard Summary by Jurisdiction

Although thunderstorms, high winds, lightning, hail events are area-wide, communities with a greater percentage of structures built prior to 1939 are more vulnerable to the impact of high wind and hail damage. All of Douglas County, except for Ava, have at least 10% of structures built prior to 1939. The unincorporated county is also above 10%. New construction and population growth would increase the exposure and risk to this hazard; however, the communities in Douglas County with building codes will assist in mitigating the effects of strong storms.

Problem Statement

Poorly built structures, barns, and outbuildings are more vulnerable to the impact of high winds during thunderstorms. High winds can topple utility poles and lead to power outages. Both high winds and hail can damage roofs. Hail can also damage crops and dent cars and trucks. People are also at risk to injury and death during high wind events. Crop insurance mitigates the risk to farmers and the agriculture sector within the county. Lightning events have caused structural fires, can strike electrical utilities leading to power outages, or strike municipal water systems causing water supply outages.

The risk of property damage, injury, and death in the county can be mitigated by identifying safe refuge areas in public buildings, nursing homes and other facilities that house vulnerable populations that do not have a safe room. The purchasing and installation of NOAA weather radios in schools, government buildings and public areas may assist in providing early warning to allow for public to seek shelter during high wind events. Education and hazard awareness programs in public schools would also increase public safety in the event of severe thunderstorm events. Additionally, school systems with existing alert systems may utilize for severe weather notifications and the County may investigate a county-wide alert system to provide important severe weather information.

3.4.8 Tornado

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 3.4.8, Thunderstorm/High Wind/Hail/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

Tornadoes can occur anywhere in the planning area.

Severity/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 3.35 below, 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 3.35. Enhanced F Scale for Tornado Damage

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest ¼-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

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

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center as listed in Table 3.36 below, 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 3.36. Enhanced Fujita Scale with Potential Damage

Enhanced Fujita Scale			
Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF0	65-85	53.5%	Light. Peels surface off some roofs; some damage to gutters 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%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	Considerable. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes complete destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
EF3	136-165	3.4%	Severe. Entire stores of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	0.7%	Devastating. Well-constructed houses and whole frame houses completely levelled; cars thrown, and small missiles generated.
EF5	>200	<0.1%	Explosive. Strong frame houses levelled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur.

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

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

Previous Occurrences

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 3.37. Recorded Tornadoes in Douglas County, 1993-2022

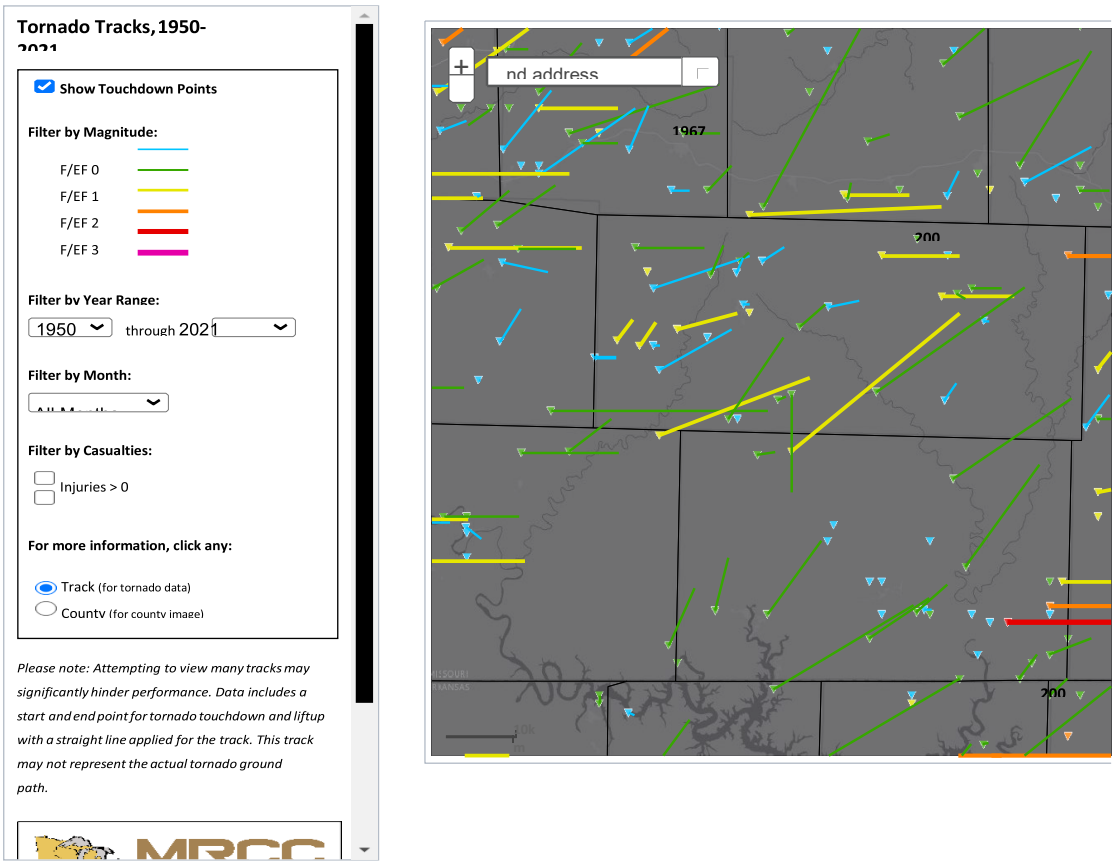
Date	Beginning Location	Ending Location	Length (miles)	Width (yards)	F/EF Rating	Death	Injury	Property Damage	Crop Damages
8/12/2002	Squires	Squires	0.10	100	F0	0	0	0	0
11/05/2005	Goodhope	Goodhope	13.00	530	F1	0	0	500,000	0
3/11/2006	Vanzant	Vanzant	0.10	20	F0	0	0	15,000	0
1/08/2008	Tigris	Mt. Zion	9.65	50	EF0	0	0	75,000	0
1/08/2008	Drury	Goodville	2.23	75	EF1	0	0	125,000	0
4/10/2008	Topaz	Topaz	0.33	75	EF0	0	0	40,000	0
5/02/2008	Roy	Ava	7.38	250	EF0	0	0	0	0
5/02/2008	Ava	Ava	0.35	100	EF0	0	0	100,000	0
5/08/2009	Merritt	Merritt	2.31	880	EF1	0	0	100,000	0
5/08/2009	Merritt	Goodhope	2.3	1320	EF2	0	0	200,000	0
5/08/2009	Goodhope	Goodhope	2.48	880	EF2	0	0	20,000	0
5/08/2009	Mt. Zion	Mt. Zion	1.13	200	EF1	0	0	50,000	0
5/25/2011	Dogwood	Tigris	3.69	100	EF1	0	0	20,000	0
4/27/2014	Goodhope	Goodhope	0.88	100	EF0	0	0	10,000	0
5/08/2014	Ava Muni Airport	Mt. Zion	2.5	100	EF1	0	0	15,000	0
4/02/2015	Vanzant	Vanzant	0.92	100	EF1	0	0	15,000	0
7/09/2015	Mt. Zion	Mt. Zion	1.38	100	EF0	0	0	0	0
7/09/2015	Midway	Midway	2.36	100	EF0	0	0	0	0
5/03/2018	Squires	Squires	0.78	75	EF1	0	0	$10,000	$0
4/30/2019	Merritt	Merritt	1.84	50	EF0	0	0	$0	$0
4/30/2019	Smallett	Ava	8.57	200	EF1	0	0	$75,000	$0
4/30/2019	Ava	Brushy Knob	3.05	200	EF1	0	0	$0	$0
4/30/2019	Brushy Knob	Brushy Knob	2.86	100	EF0	0	0	$0	$0
10/21/2019	Rippee	Topaz	16.32	450	EF1	0	0	$25,000	$0
10/21/2019	Richville	Twin Bridges	6.71	450	EF1	0	0	$0	$0
4/28/2021	Blanche	Buckhart	1.88	100	EF0	0	0	$250,000	$0
	Total	-	-	-	-	**0**	**0**	**$1,645,000**	**$0**

Source: National Centers for Environmental Information, http://www.NCEI.noaa.gov/stormevents/

Probability of Future Occurrence

According to the NCEI, twenty-six tornadoes have occurred during the 30-year reporting period from 1993 – 2022 resulting in an 87% probability of a tornado of any magnitude event in the planning area in any given year with average annual property damages of $54,833.

Figure 3.20. Douglas County Map of Historic Tornado Events



Source: Missouri Tornado History Project, http://www.tornadohistoryproject.com/tornado/Missouri

Vulnerability

Vulnerability Overview

Douglas County is located in a region of the United States with high frequency of dangerous and destructive tornadoes referred to as "Tornado Alley" as is the entire State of Missouri. Figure 3.21 below illustrates the areas where dangerous tornadoes historically have occurred.

Figure 3.21. Tornado Alley in the U.S.

Source: http://www.tornadochaser.net/tornalley.html

The 2018 State Plan applies a certain methodology to each county in the state to determine each county's vulnerability to tornadoes. While this approach attempts to prioritize tornado vulnerable counties, it does not identify any particular geographic patters to tornado risk. The state's analysis combines annualized losses and frequency of occurrence to determine the greatest likelihood of being impacted by a tornado. The state's vulnerability rating ranged from very high, high, and moderate. The vulnerability for Douglas County was rated as Moderate.

Potential Losses to Existing Development

During the five-year period from 2017 through 2021, a total of **$5,740,000** in property losses equates to $1,148,000 in average annual losses countywide. This value indicates that potential future losses in the county will remain significant. The most common tornado events recorded in the county are EF0 magnitude. The average magnitude for tornado events in the county is 0.84 on the Enhanced Fujita Scale.

Future Development

Douglas County as whole is experiencing a moderate decline. The City of Ava in Douglas County is the only jurisdiction in the county. The unincorporated parts of the county are showing slow to moderate decline. Additional population growth and development will increase exposure and risk to tornado events due to the area-wide geographic nature of this hazard.

Hazard Summary by Jurisdiction

Although tornado events are area-wide hazards, communities with a greater percentage of structures built prior to 1939 are more vulnerable to the impact of tornadoes. The City of Ava has 5.37% of their structures built prior to 1939 followed by Unincorporated Douglas County (8.06%). The county's school districts have mostly modernized facilities and are considered well-built structures. However, most districts have outbuildings used for storage and maintenance that may be at higher risk to high wind and hail events.

School district facilities are at risk to the damages of tornadoes. School districts in South Central Missouri have been highly successful in securing grant funding to construct FEMA-standard tornado safe rooms, Ava R-I school district has a FEMA standard safe room in Douglas County.

Problem Statement

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. Significant tornado events in Douglas County since 1950 have resulted in numerous injuries (7) and millions of dollars in property damage ($7.10MM). Information in the 2018 State Plan indicates that Douglas County has a moderate vulnerability to tornadoes based on frequency of occurrence and previous damages.

The risk of property damage, injury and death in the county can be mitigated by constructing FEMA standard saferooms in facilities that house vulnerable populations such as nursing homes, government buildings, and schools. In addition, identifying safe refuge areas in public buildings, nursing homes and other facilities with protective filming of windows and installation of blast proof doors will provide more protection for students and staff and school facilities that are not served by FEMA standard saferooms. Additional warnings and alerts will also provide the public and schools more time to take cover during tornado warnings. Aldo, public safety fairs and expos in the county hosted by communities provide an opportunity to disseminate information to homeowners about individual saferoom construction in residences.

Cities can adopt or update and enforce IBC 2012 building codes that include construction techniques such as roof tie down straps to mitigate damage to future development.

3.4.9 Wildfire

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.

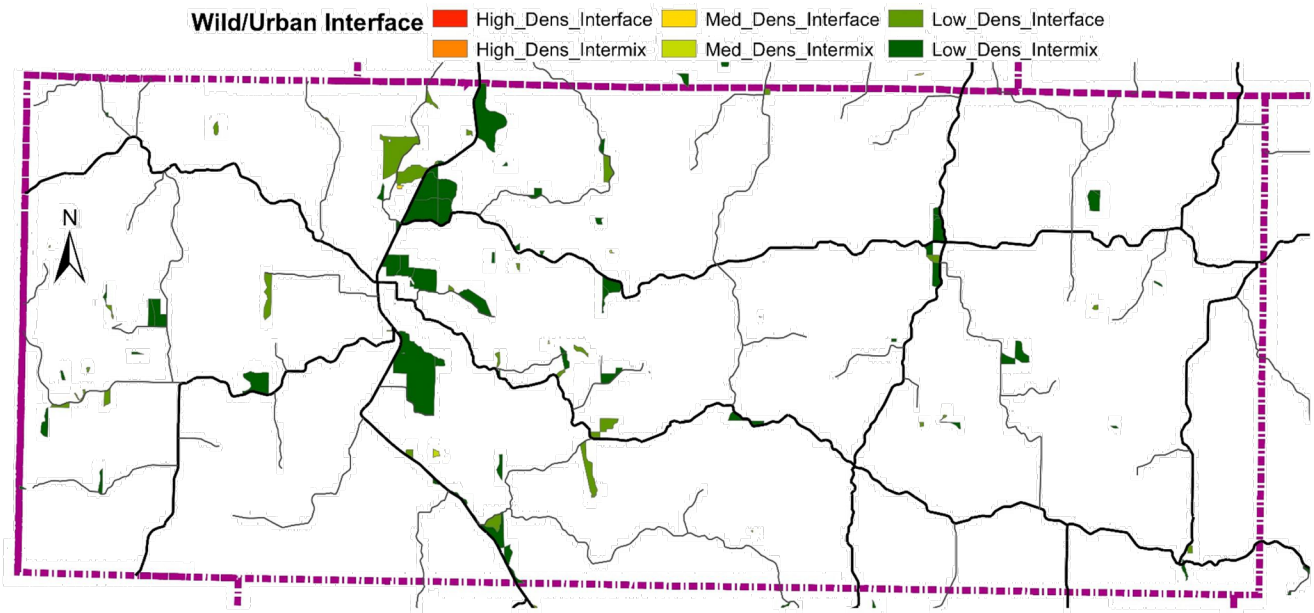
The Forestry Division of the Missouri Department of Conservation (MDC) is responsible for protecting privately owned and state-owned forests and grasslands from wildfires. To accomplish this task, eight forestry regions have been established in Missouri for fire suppression. The Forestry Division works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

Most of Missouri fires occur during the spring season between February and May. The length and severity of wildland fires depend largely on weather conditions. Spring is Missouri is usually characterized by low humidity and high winds. These conditions result in higher fire danger. In addition, due to the recent lack of moisture throughout many areas of the state, conditions are likely to increase the risk of wildfires. Drought conditions can also hamper firefighting efforts, as decreasing water supplies may not prove adequate for firefighting. It is common for rural residents to burn their garden spots, brush piles, and pastures 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 accumulation. Therefore, spring months are the more 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

Absent demographic information indicating otherwise, the risk of structural fire probably does not vary widely across the planning area. However, damages due to wildfires would be higher in communities with more wildland–urban interface (WUI) areas. The term refers to the zone of transition between unoccupied land and human development and needs to be defined in the plan. Within the WUI, there are two specific areas identified: 1) Interface and 2) Intermix. The interface areas are those areas that abut wildland vegetation and the Intermix areas are those areas that intermingle with wildland areas. Figure 3.22 below shows WUI areas in Douglas County.

Figure 3.22. Douglas County Wildland Urban Intermix, Interface



Severity/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.
See *http://www.firewisemissouri.org/wildfire-in-missouri.html*

Often wildfires in Missouri go unnoticed by the general public because the sensational fire behavior that captures the attention of television viewers is rare in the state. Yet, from the standpoint of destroying homes and other property, Missouri wildfires can be quite destructive.

Previous Occurrences

According to MDC Wildfire Data, there have been 190 wildfires reported in Douglas County from 2017 to 2021. A total of 3,469 acres were burned as a result of these reported wildfires. In addition, 5 buildings were destroyed, 7 structures were damaged, and 266 structures were threatened as a result of the wildfires in the county. Table 3.38 below contains a summary of MDC wildfire statistics by year.

Table 3.38. Douglas County Wildfires 2017-2021

Year	# Wildfires	Buildings Destroyed	Buildings Damaged	Buildings Threatened	Acres Burned
2017	43	0	0	39	797
2018	58	1	5	93	1,283
2019	32	1	1	34	302
2020	31	0	0	25	491
2021	26	3	1	75	596
Total	190	5	7	266	3,469

There are no records from school districts and special districts about previous wildfire events and the damages resulting from them.

P*robability of Future Occurrence*

Based on the last five (5) years of fire reporting statistics from the Missouri Department of Conservation (MDC) in Table 3.38, there were a total of 190 reported wildfires in Douglas County from 2017-2021. ThisĚ equates to an average of thirty-eight (38) wildfire events annually and a 100% probability of occurrence in anyĚ given year.

Vulnerability

Vulnerability Overview

Wildfires occur throughout wooded and open vegetation areas of Missouri. They can occur any time of year, but mostly occur during long, dry hot spells. Any small fire, if not quickly detected and suppressed, can get out of control. Most wildfires are caused by human carelessness or negligence. However, some are precipitated by lightning strikes, and in rare instances, spontaneous combustion. Structures and people in Wildland-Urban Interface areas in the county and cities are more vulnerable to the impact of wildfires due to the level of fuel mixed with structures.

Potential Losses to Existing Development

In looking at the statistics over the last five years, an average of 1.6 buildings are destroyed every year, and 0.8 buildings per year are damaged. Another 6.6 structures are threatened per year with an average of 198 acres burned annually.

Impact of Future Development

It is anticipated that there will be future development in WUI areas throughout incorporated and unincorporated areas of the county. Future growth in WUI areas of the county will increase the risk and exposure to wildfires.

Hazard Summary by Jurisdiction

The vulnerability to wildfire damages is greatest near the city of Ava. Areas identified as WUI, but with lower associated risk are around the communities of Ava. These areas include State Route 14 and State Route 5. All school district campuses in the county are located outside areas identified as interface and/or intermix.

Problem Statement

Wildfire occurrence is frequent within Douglas County. These events can destroy, damage, and threaten structures in hazard prone areas. Populations and structures in WUI areas of the county have an increased risk to wildfires due to the level of fuel mixed with built environments. Cities have not adopted landscape ordinances that could potentially include fire safe landscape design requirements. The unincorporated areas of the county have the highest risk and exposure to wildfires. Thankfully, many of these areas are sparsely population. However, when new construction is occurring promoting the use of fire-resistant construction materials is highly advisable. More information about these materials and techniques are available in the MDC publication *Living with Wildfire*.

3.4.10 Severe Winter Weather

Hazard Profile

Hazard Description

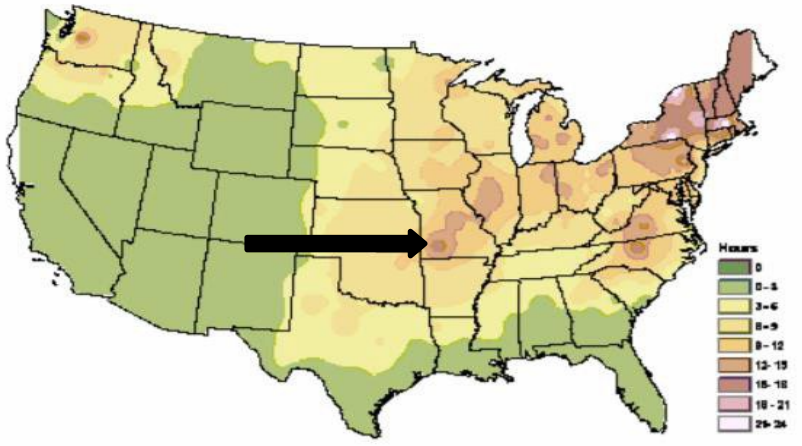
A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. The National Weather Service describes different types of winter storm events as follows.

- **Blizzard**—Winds of 35 miles per hour or more with snow and blowing snow reducing visibility to less than 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

The entire county is vulnerable to heavy snow, ice, extreme cold temperatures, and freezing rain. Figure 3.23 depicts the average number of hours per year with freezing rain. Douglas County is in a zone that can expect 15-18 hours of freezing rain per year.

Figure 3.23. NWS Statewide Average Number of Hours per Year with Freezing Rain



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

Strength/Magnitude/Extent

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

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

- Winter Weather Advisory — Winter weather conditions are expected to cause significant inconveniences and may be hazardous. If caution is exercised, these situations should not become life threatening. Often the greatest hazard is to motorists.
- Winter Storm Watch — Severe winter conditions, such as heavy snow and/or ice are possible within the next day or two.
- Winter Storm Warning — Severe winter conditions have begun or are about to begin.
- Blizzard Warning — Snow and strong winds will combine to produce a blinding snow (near zero visibility), deep drifts, and life-threatening wind chill.
- Ice Storm Warning -- Dangerous accumulations of ice are expected with generally over one quarter inch of ice on exposed surfaces. Travel is impacted, and widespread downed trees and power lines often result.
- Wind Chill Advisory -- Combination of low temperatures and strong winds will result in wind chill readings of -20 degrees F or lower.
- Wind Chill Warning -- Wind chill temperatures of -35 degrees F or lower are expected. This is a life-threatening situation.

Previous Occurrences

Table 3.39 summarizes the Winter Weather events in Douglas County from 2017-2021

Table 3.39. NCEI Douglas County Winter Weather Events Summary, 2017-2021

Type of Event	Inclusive Dates	# of Injuries	Property Damages	Crop Damages
Ice Storm	1/11/2019	0	0	0
Winter Storm	2/14/2021	0	0	0
Total	--	0	**$0**	0

Source: NCEI, 2021

Of the two (2) events listed in the NCEI data, one was an Ice Storm and one was a Winter Storm event. There are no reported deaths, injuries, or crop damage associated with these winter weather events. While not listed within the 5-year period of record covered by this update, the most damaging Douglas County winter storm event listed in the NCEI database was the January 1999 Winter Storm in which $125,000 of property damages were reported.

Ice Storm

The Ice Storm event of January 11, 2019, is described in the NCEI narrative as follows:

> A winter storm that started as rain as it moved into central and southern Missouri, then turned to a wintry mix of sleet, freezing rain and snow before changing over to all snow in some areas. Heavy snow fell across central Missouri with accumulations between 6 and 12 inches. Portions of south central Missouri saw significant ice accumulations that resulted in power outages and numerous trees and limbs down. As the precipitation was winding down, areas of freezing drizzle persisted through the overnight hours of January 12.
>
> Ice accumulations across Douglas county resulted in multiple reports of tree limbs and trees down in the Ava area. Power outages were also reported. Largest tree limbs were 6 to 8 inches in diameter.

Winter Storm

On February 14, 2021, a Winter Storm event occurred in Douglas County and is described as follows in the NCEI narratives:

> An extended period of unseasonably cold weather gripped central and southwest Missouri between February 7 and February 18. The coldest temperatures and wind chills occurred from February 14 through February 16. Record to near record low temperatures were common on the mornings of February 15 and 16th with subzero lows and highs just in the single digits and teens above zero. In addition, wind chill readings between -20 and -30 were reported across the area. Along with the bitter cold, widespread snow occurred across central and southwest Missouri from the early morning hours of February 14 into the late afternoon hours of February 15. This created widespread snow covered roads and the cold and snow combined resulted in numerous if not all schools being closed.

Probability of Future Occurrence

The probability for all the different types of winter weather is included as one probability, since one storm generally includes a lot of the different types of events. There were two (2) severe winter weather events in Douglas County from 2017-2021. This equates to an 40% probability of occurrence in any given year.

Vulnerability

Vulnerability Overview

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 excessive 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. People over 65 and those living in poverty have an increased risk of hypothermia and frostbite due to extreme cold and wind chill hazards.

In the 2018 State Plan, seven factors were considered in determining overall severe winter storm vulnerability as follows: housing density, likelihood of occurrence, building exposure, crop exposure, average annual property loss ratio, average annual crop insurance claims and social vulnerability. The state ranked each of these criteria using a scale from one to five, one being lowest and five being the highest, to rank each county's vulnerability to severe winter weather. Douglas County received a vulnerability rating of medium-low.

Potential Losses to Existing Development

During the four-year period of record from 2017 to 2021, there wasn't property loss or injuries reported.

Future Development

Increased development and resulting increase in population will increase exposure to damage from severe winter weather. Future commercial development can expect functional downtime and decreased revenues during periods of severe winter weather. Road construction in the county will increase the need for snow removal and slat to keep transportation lifelines open during periods of severe winter weather.

Hazard Summary by Jurisdiction

Severe winter weather can cause power outages and put structures at risk to fires when individuals in homes resort fuel heaters. The risk of extreme cold deaths and frostbite varies among segments of the populations. People over 65 and those living below the poverty level have an increased vulnerability to severe winter weather. Table 3.40 includes information on population over 65 and the percent living below the poverty level by jurisdiction.

Table 3.40. Population over 65 and Percent Living Below the Poverty Level by Jurisdiction

Jurisdiction	% of Families Living Below Poverty Level	% Population over 65
Douglas County	15.3%	17.1%
City of Ava	17.1%	16.0%

Source: ACS Profiles; ACS five year estimates 2020

All jurisdictions have large percentages of families living below the poverty level. The City of Ava has the highest percentages of impoverished families. The largest populations of people over 65—by percentage—reside in Ava.

Problem Statement

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 travelled extremely difficult and hazardous. People over 65 and those living in poverty have an increased risk of hypothermia and frostbit due to extreme cold and wind chill.

It is important that the Douglas County EMA maintain a list of heating centers throughout the county as they become available. These locations could be promoted through avenues such as radio, Facebook or the county government's website. These locations can provide individuals who are at risk refuge from periods of extreme cold. Public works departments can develop snow removal plans and maintain adequate snow removal equipment and slat to quickly open roads after periods of heavy snow and freezing rain. The county and cities can work with local electric cooperatives to development vegetation management programs in rights of way to minimize damages of falling tree limbs laden with ice resulting from ice storms to minimize power outages throughout the county.

4 MITIGATION STRATEGY

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

This section presents the mitigation strategy updated by the Mitigation Planning Committee (MPC) based on the [updated] risk assessment. The mitigation strategy was developed through a collaborative group process. The process included review of [updated] general goal statements to guide the jurisdictions in lessening disaster impacts as well as specific mitigation actions to directly reduce vulnerability to hazards and losses. The following definitions are taken from FEMA's *Local Hazard Mitigation Review Guide (October 1, 2016)*.

- **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 Douglas County's existing hazard mitigation plan approved by FEMA in April of 2018. Therefore, the goals from the 2018 Douglas County Hazard Mitigation Plan were reviewed to see if they were still valid, feasible, practical, and applicable to the defined hazard impacts. During planning meetings, MPC members and local stakeholders held a discussion in order to review and update the plan goals.

To ensure that the goals developed for this update were comprehensive and supported State goals, the 2018 State Hazard Mitigation Plan goals were reviewed. The MPC also reviewed the goals from current surrounding county plans.

Goal 1: Protect the Lives and Property of all Citizens of Douglas County

- Identify and provide sufficient emergency shelters.
- Review and maintain current warning systems for sufficient coverage.

Goal 2: Preserve the Functioning of Civil Government During Natural Disasters

- Implement proper maintenance and necessary upgrades of critical buildings and infrastructures in the county.
- Improve the efficiency, timing, and effectiveness of response and recovery efforts for natural hazard disasters.

Goal 3: Maintain Economic Activities Essential to the Survival and Recovery from Natural Disasters

- Periodically review chain of command of government organizations for emergency situations and keep up to date.
- Continuously review communications systems and keep in good working order.

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 hazard mitigation planning meetings in the county and at the final MPC work session, the results of the risk assessment update were provided to the participants for review and the key issues were identified for specific hazards. Changes in risk since adoption of the previously approved plan were discussed. The meetings concluded with the distribution of a list of possible mitigation actions submit to the MPC for their review and approval. The list included possible new mitigation actions, as well as actions from the previously approved plan that were candidates for removal, due to the nature of them not being measurable or fundable. Actions from the previous plan included completed actions, on-going actions, and actions upon which progress had not been made. SCOCOG planners discussed SEMA's identified funding priorities and the types of mitigation actions generally recognized by FEMA.

The focus of the MPC work session then shifted to development the mitigation strategy. For a comprehensive range of mitigation actions to consider, the SCOCOG planners provided information to the MPC reviewing the following information:

- A list of actions proposed in the previous mitigation plan, the current State Plan, and approved plans in surrounding counties;
- Key issues from the risk assessment and vulnerability analysis;
- State priorities established for Hazard Mitigation Assistance grants, and
- Public input via the online survey tool, and other efforts to involve the public in the plan development process.

Table 4.1 below consists of a summary of the hazard mitigation actions listed within this update of the county hazard mitigation plan, by participating jurisdiction:

Table 4.1. Action Status Summary

Jurisdiction	Completed Actions	Continuing Actions (ongoing or modified)	Deleted Actions
Douglas County	1	1	0
City of Ava	1	2	0
Ava R-I	0	0	0

Table 4.2 below provides a summary of the completed and deleted actions from the previous plan. The 2018 Plan had a series of county-wide mitigation actions that address five mitigation goals. Based on the status updates, there was two completed actions, zero deleted actions, 2 continuing actions and zero new actions.

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

Completed Actions	Completion Details (date, amount, funding source)
Installation of a backup generator at City Hall in Ava	Ava 2018 Generator: DR-4317
Residential Buyout - Flood Buyout of home located in a floodway/floodplain	Douglas County 2018 Buyout: DR-4317
Deleted Actions	**Reason For Deletion**
None	N/A

Source: Previously approved County Hazard Mitigation Plan; Data Collection Questionnaire 2022.

Table 4.3. Mitigation Action Matrix

#	Action	Jurisdiction	Priority	Goals Addressed	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
Douglas1	Purchase and install a backup generator at the county courthouse which serves various governmental functions	Douglas County	20	Goal 2	Thunderstorm/High Winds/Lightning/Hail	X		
Ava1	Develop a coordinated plan to test outdoor warning sirens on a consistent basis	City of Ava	15	Goal 2	Tornado	X		
Ava2	The city will attempt to improve floodplain management by identification of map amendments/updates	City of Ava	16	Goal 3	Flooding (Flash and River)	X		X
Douglas2	Continuously identify funding sources to update buildings and infrastructure to ensure that community assets are resilient to natural disaster	Countywide	19	Goal 3	Tornado	X		

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.

A cost benefit review of all new and continuing actions in the finalized plan was conducted during the MPC work session. 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 used worksheets to assign scores. The worksheets posed questions based on the STAPLEE elements as well as the potential mitigation effectiveness of each action. Scores were based on the responses to the following questions and ensuing discussion:

Definitely "YES"	Maybe "YES"	Probably "NO"	Definitely "NO"
3 points	2 points	1 point	Zero points

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)

The resulting list of actions were summed and divided into classes and labeled as high, medium, or low priorities. The result of the STAPLEE analysis is found in the forthcoming mitigation action worksheets.

Figure 4.1. Blank STAPLEE Worksheet

XXXXXX COUNTY
MULTI-JURISDICTIONAL
LOCAL HAZARD MITIGATION PLAN

Action Title:	**Jurisdiction:**
Action ID:	

STAPLEE Criteria	Evaluation Rating Definitely YES = 3 Maybe YES = 2 Probably NO = 1 Definitely NO = 0	Score
S: Is it Socially acceptable?		
T: Is it Technically feasible and potentially successful?		
A: Does the jurisdiction have the administrative capacity to execute this action?		
P: Is it Politically acceptable?		
L: Is there Legal authority to implement?		
E: Is it Economically beneficial?		
E: Will the project have either a neutral or positive impact on the natural environment? (score a 3 if positive impact, 2 if neutral impact)		
Will historic structures be saved or protected?		
Could it be implemented quickly?		
STAPLEE Score		

Mitigation Effectiveness Criteria	**Evaluation Rating**	**Score**
Will the implemented action result in lives saved?	Assign from 5-10 points based on the likelihood that lives would be saved.	
Will the implemented action result in a reduction of disaster damages?	Assign from 5-10 points based on the relative reduction of disaster damages.	
Mitigation Effectiveness Score		

Total Score (STAPLEE Score + Mitigation Effectiveness Score): _____

Priority Level: ☐High (30+ points) ☐Medium (25-29 points) ☐Low (less than 25 points)

Completed by (name/title/phone #): _____

In addition to the STAPLEE cost benefit review prioritization at the final MPC meeting, an implementation plan for each action was discussed. An action worksheet was used to development the implementation plan. The action worksheets are presented on the following pages.

MITIGATION ACTIONS

Goal 2: Preserve the Functioning of Civil Government During Natural Disasters

Mitigation Action Worksheet	
Name of Jurisdiction:	Douglas County
Risk / Vulnerability	
Problem being Mitigated:	Lack of back-up power source at the county's jail/dispatch/emergency operations center
Hazard(s) Addressed:	Thunderstorm/High Winds/Lightning/Hail
Action or Project	
Action/Project Number:	**Douglas1**
Name of Action or Project:	Courthouse Generator
Action or Project Description:	Purchase and install a backup generator at the county courthouse which serves various governmental functions
Applicable Goal Statement:	Goal 2
Estimated Cost:	$10,000 to $50,000
Benefits:	Provide emergency backup power
Plan for Implementation	
Responsible Organization/Department:	County Emergency Management
Action/Project Priority:	20-HIGH
Timeline for Completion:	1 year
Potential Fund Sources:	FEMA, RHSOC
Local Planning Mechanisms to be Used in Implementation, if any:	Hazard Mitigation Plan
Progress Report	
Action Status	Incomplete
Report of Progress	Notice of Interest has been prepared and will be submitted to SEMA

Goal 2: Preserve the Functioning of Civil Government During Natural Disasters

Mitigation Action Worksheet	
Name of Jurisdiction:	City of Ava
Risk / Vulnerability	
Problem being Mitigated:	The threat to human life result from tornadic storms in and around the City of Ava, Missouri
Hazard(s) Addressed:	Tornado
Action or Project	
Action/Project Number:	**Ava1**
Name of Action or Project:	Siren Testing
Action or Project Description:	Develop a coordinated plan to test outdoor warning sirens on a consistent basis
Applicable Goal Statement:	Goal 2
Estimated Cost:	Little or no cost
Benefits:	Ensure sirens are functioning properly
Plan for Implementation	
Responsible Organization/Department:	City Emergency Management
Action/Project Priority:	15-LOW
Timeline for Completion:	2-3 years
Potential Fund Sources:	Local
Local Planning Mechanisms to be Used in Implementation, if any:	LEOP, Hazard Mitigation Plan
Progress Report	
Action Status	Ongoing
Report of Progress	Ongoing

Goal 3: Maintain Economic Activities Essential to the Survival and Recovery from Natural Disasters

Mitigation Action Worksheet	
Name of Jurisdiction:	City of Ava
Risk / Vulnerability	
Problem being Mitigated:	The threat of flooding to the built environment
Hazard(s) Addressed:	Flooding (Flash and River)
Action or Project	
Action/Project Number:	**Ava2**
Name of Action or Project:	NFIP
Action or Project Description:	The city will attempt to improve floodplain management by identification of map amendments/updates
Applicable Goal Statement:	Goal 3
Estimated Cost:	Little or no cost
Benefits:	Improve the delivery of floodplain management services
Plan for Implementation	
Responsible Organization/Department:	Floodplain Administrator
Action/Project Priority:	15-LOW
Timeline for Completion:	2-3 years
Potential Fund Sources:	Local
Local Planning Mechanisms to be Used in Implementation, if any:	Floodplain Ordinance
Progress Report	
Action Status	Ongoing
Report of Progress	Ongoing

Goal 3: Maintain Economic Activities Essential to the Survival and Recovery from Natural Disasters

Mitigation Action Worksheet	
Name of Jurisdiction:	Countywide
Risk / Vulnerability	
Problem being Mitigated:	The failure and increasing vulnerability of aging infrastructure and community failures
Hazard(s) Addressed:	Tornado
Action or Project	
Action/Project Number:	**Douglas2**
Name of Action or Project:	Asset Management
Action or Project Description:	Continuously identify funding sources to update buildings and infrastructure to ensure that community assets are resilient to natural disaster
Applicable Goal Statement:	Goal 3
Estimated Cost:	Little or no cost
Benefits:	Ensure that the local governments are aware of the resources available to them
Plan for Implementation	
Responsible Organization/Department:	County Emergency Management Regional Planning Commission
Action/Project Priority:	20 - HIGH
Timeline for Completion:	Less than one year
Potential Fund Sources:	Local
Local Planning Mechanisms to be Used in Implementation, if any:	Comprehensive Economic Development Strategy
Progress Report	
Action Status	Continue In-Progress
Report of Progress	Local jurisdictions are continuously kept up to date by SCOCOG staff on hazard mitigation funding availability

5 PLAN MAINTENANCE PROCESS

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

The MPC is not a standing committee, with oversight by a responsible agency or elected body. The MPC representatives and stakeholders are represented on the Local Emergency Planning Committee (LEPC) in Douglas County and the Regional Homeland Security Oversight Committee (RHSOC – Region G). The LEPC is responsible for developing and implementing the Local Emergency Operations Plan and is a standing committee that meets regularly and is administered through the Douglas County Emergency Management agency. The RHSOC is responsible for developing and implementing the Threat Hazard Identification Risk Assessment for the region, including Douglas County. The goals and actions and representation are aligned with the missions of the RHSOC, which is a standing committee. As such, the RHSOC will be responsible for plan monitoring, evaluation, and maintenance.

- 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 RHSOC is an advisory body only, 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. South Central Ozark Council of Government (SCOCOG) will work with all stakeholders to complete any updates or addendums to the plan as needed. The LEPC and RHSOC are advisory committees and only make recommendations to the county, city, town or district elected officials.

5.1.2 Plan Maintenance Schedule

The RHSOC agrees to meet annually and after a state or federally declared hazard event as appropriate to monitor the progress and update the mitigation strategy. The Douglas County Emergency Management Director, who also serves on the RHSOC, will be responsible for initiating the plan reviews and will invite members of the Douglas County contingent to the RHSOC 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 RHSCOC 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 RHSOC 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 RHSOC 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 RHSOC deems appropriate and necessary. Changes will be approved by the Douglas County Commission and the governing boards of the other participating jurisdictions.

5.2 Incorporation into Existing Planning Mechanisms

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

Where possible, plan participants, including school and special districts, will use existing plans and/or programs to implement hazard mitigation actions. Those existing plans and programs were described in Section Two of this plan. Based on the capability assessments of the participating jurisdictions, communities in Douglas 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:

- General or master plans of participating jurisdictions;
- Ordinances of participating jurisdictions;
- Douglas Co. Emergency Operations Plan;
- 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 RHSOC members involved in updating these existing planning mechanisms will be responsible for integrating the findings and actions of the mitigation plan, as appropriate. The RHSOC 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 Douglas County Emergency Management Director 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 Emergency Manager Director will request that the mitigation strategy be incorporated, where appropriate, in other planning mechanisms.

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

Table 5.1. Planning Mechanisms Identified for Integration of Hazard Mitigation Plan

Jurisdiction	Planning Mechanisms	Integration Process for Previous Plan	Integration Process for Current Plan
Unincorporated County	Highway Department Capital Improvement Project List	Highway Department attended all planning meetings and identified actions relating to transportation infrastructure were included in annual update to CIP List	Highway Department attended all planning meetings. Identified new actions or ongoing actions relating to transportation infrastructure will be included in annual update to CIP List
South Central Region	Comprehensive Economic Development Strategy	Douglas County Jurisdictions acknowledged some of their emergency management and response needs in the Community Improvement Project List	Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at-risk structures in the county. NOAA data was used to compile event history for hazard profiles.
South Central Region	Regional Transportation Plan	Acknowledgment of the impact of natural hazards on the prioritization of long-range improvement planning	Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at-risk structures in the county. NOAA data was used to compile event history for hazard profiles.

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[10(b)] reviews will be posted in the local newspaper, as well as, on the South Central Ozark Council of Governments website following each annual review of the mitigation plan and will solicit comments from the public based on the annual review. 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.

Appendix A – Planning Participation Documentation

MEETING SIGN-IN SHEET PLEASE PRINT CLEARLY

Project:	Hazard Mitigation Planning – 5 year update	**Meeting Date:**	6/15/2022
Facilitator:	Trent Courtney	**Place/Room:**	Douglas Co Courthouse

Name	Occupation/Affiliation	Phone	E-Mail
Trent Courtney	SCOCOG	417 256 4226	TCourtney@scocog.org
Sarah Callahan	SCOCOG	417-256-4226	scallahan@scocog.org
Travis Cheyney	Douglas County	417-543-8751	Associate Commissioner

MEETING SIGN-IN SHEET PLEASE PRINT CLEARLY

Project:	Hazard Mitigation Planning – 5 year update	**Meeting Date:**	6/13/2022
Facilitator:	Trent Courtney	**Place/Room:**	City Hall – AVA

Name	Occupation/Affiliation	Phone	E-Mail
Burrely Loftin	City Administrator/Mayor	417-683-5516	
Trent Courtney	SCOCOG	417-256-4226	
Sarah Callahan	SCOCOG	417-256-4226	
Suzanne Welsh	City Clerk	417-256-4226	

MEETING SIGN-IN SHEET PLEASE PRINT CLEARLY			
Project:	Hazard Mitigation Planning – 5 year update	**Meeting Date:**	9/12/2022
Facilitator:	Trent Courtney	**Place/Room:**	Phone Meeting

Name	Occupation/Affiliation	Phone	E-Mail
Aaron Dalton	Ava R-I Schools	417-683-4717	adalton@avabears.net
Trent Courtney	SCOCOG	417 256 4226	tcourtney@scocog.org

Appendix B – Completed & Deleted Mitigation Actions

Completed Actions	Completion Details (date, amount, funding source)
Installation of a backup generator at City Hall in Ava	Ava 2018 Generator: DR-4317
Residential Buyout - Flood Buyout of home located in a floodway/floodplain	Douglas County 2018 Buyout: DR-4317
Deleted Actions	**Reason For Deletion**
None	N/A

Appendix C – Public Engagement

Affidavit of Publication

State of Missouri)
County of Douglas) ss.

I, Christie Degase, being duly sworn according to law, State that I am the Advertising Manager of the Douglas County Herald, a weekly newspaper of general circulation in the County of Douglas, State of Missouri, where located; which newspaper has been admitted to the Post Office as periodical class matter in the City of Ava, Missouri, the city of publication; which newspaper has been published regularly and consecutively for a period of three years and has a list of bona fide subscribers, voluntarily engaged as such who have paid or agreed to pay a stated price for a subscription for a definite period of time, and that such newspaper has complied with the provisions of section 493.050, Revised Statutes of Missouri and section 59.310, then Revision Statutes of Missouri 2000. The affixed notice appeared in said newspaper in the following consecutive issues:

1st Insertion: Vol. 136 No. 39 June 9, 2022

2nd Insertion: Vol. No.

3rd Insertion: Vol. No.

4th Insertion: Vol. No.

Christie Degase
Advertising Manger

Subscribed and sworn before me this 13th day of June, 2022.

Notary Public, my commission expires: 1·30·26.

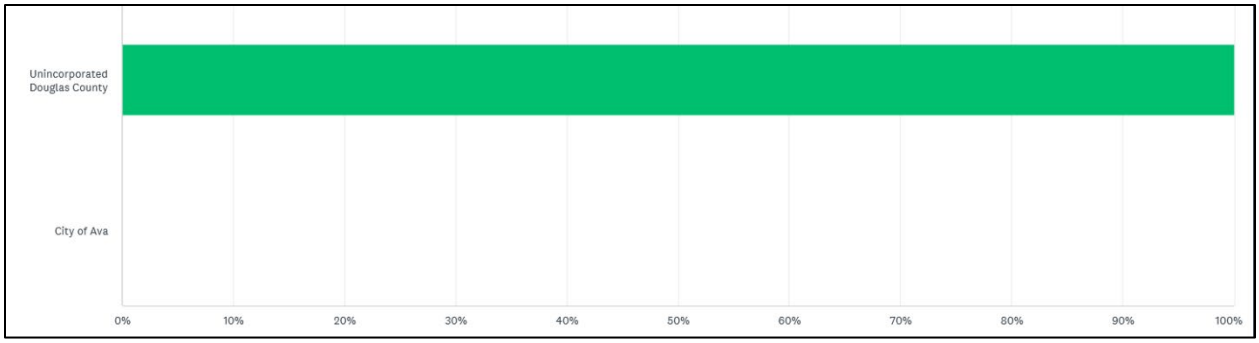
SHARON CURTIS
NOTARY PUBLIC - NOTARY SEAL
STATE OF MISSOURI
COMMISSIONED FOR OZARK COUNTY
MY COMMISSION EXPIRES JAN. 30, 2026
ID #22184356

NOTICE

Update of the Douglas County Hazard Mitigation Plan

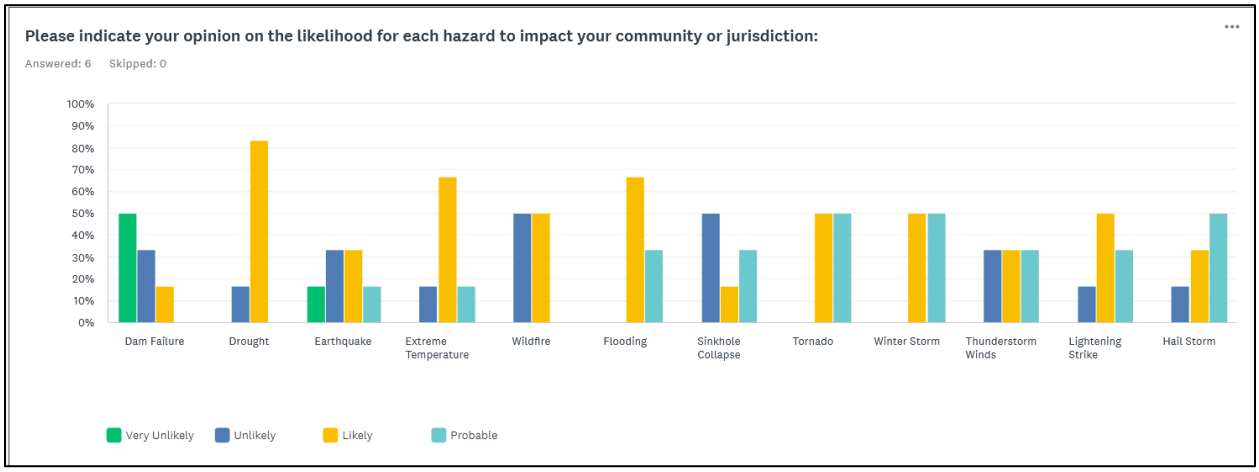
The Douglas County Hazard Mitigation Plan is currently in process of its recurring five-year update. The purpose of the county's Hazard Mitigation Plan is to devise and retain a strategy to reduce the impact of risks posed by disastrous natural events, such as tornados, ice storms and floods. The Plan must be updated by the county commission every five years and approved by the Federal Emergency Management Agency in order for the County, its municipalities and school districts to remain eligible for FEMA grant funding for current and ongoing Hazard Mitigation projects such as Tornado Safe Rooms, Flood Mitigation projects, and purchases of disaster response equipment.

An essential part of the Hazard Mitigation planning process is to gain public input during the development of the Plan. The South Central Ozark Council of Governments has created an online survey tool to obtain input from citizens of Douglas County regarding the natural hazards that threaten your county and potential solutions to address those vulnerabilities. Please navigate to the following web address and take a few minutes to respond to the survey. The survey for Douglas County can be found at www.SCOCOG.org/hazard-mitigation-planning



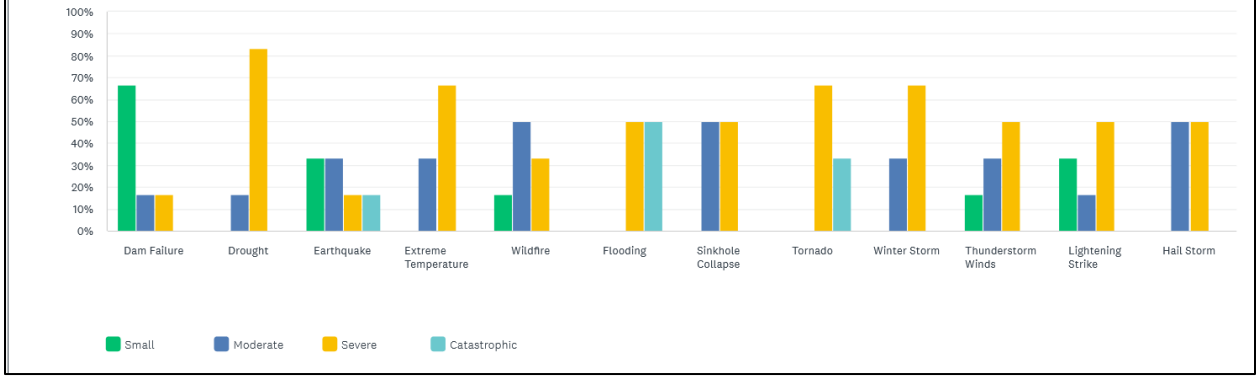
Please indicate your opinion on the likelihood for each hazard to impact your community or jurisdiction:

Answered: 6 Skipped: 0



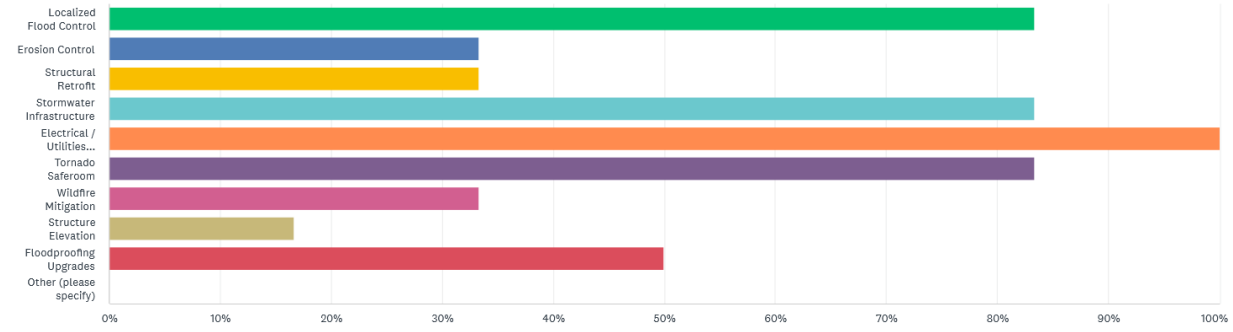
Please indicate your opinion on the potential magnitude or impact severity of natural hazard's impact on your jurisdiction:

Answered: 6 Skipped: 0



Please select the types of hazard mitigation project(s) that you feel could benefit your community or jurisdiction:

Answered: 6 Skipped: 0



Affidavit of Publication

State of Missouri)
County of Douglas) ss.

I, Christie Degase, being duly sworn according to law, State that I am the Advertising Manager of the Douglas County Herald, a weekly newspaper of general circulation in the County of Douglas, State of Missouri, where located; which newspaper has been admitted to the Post Office as periodical class matter in the City of Ava, Missouri, the city of publication; which newspaper has been published regularly and consecutively for a period of three years and has a list of bona fide subscribers, voluntarily engaged as such who have paid or agreed to pay a stated price for a subscription for a definite period of time, and that such newspaper has complied with the provisions of section 493.050, Revised Statutes of Missouri and section 59.310, then Revision Statutes of Missouri 2000. The affixed notice appeared in said newspaper in the following consecutive issues:

1st Insertion: Vol. 137 No. 19 February 16, 2023

2nd Insertion: Vol. No.

3rd Insertion: Vol. No.

4th Insertion: Vol. No.

Christie Degase
Advertising Manger

Subscribed and sworn before me this 16th day of February 2023.

Sharon Curtis Notary Public, my commission expires: 1-30-2026.

SHARON CURTIS
NOTARY PUBLIC - NOTARY SEAL
STATE OF MISSOURI
COMMISSIONED FOR OZARK COUNTY
MY COMMISSION EXPIRES JAN. 30, 2026
ID #22184356

Notice to Public: Douglas County Hazard Mitigation Plan Update

Douglas County, with the assistance of the South Central Ozark Council of Governments, has finalized the 2023 update of the Multi-Jurisdictional Hazard Mitigation Plan. This plan is pursuant to Federal Emergency Management Agency's (FEMA) requirements.

A final draft of the plan is available at the SCOCOG office located at 4407 County Road 2340 Pomona, MO or at the SCOCOG website: www.SCOCOG.org. Please direct comments to: mail@scocog.org. Planning staff will be available for discussion, comments, or suggestions on or about the Hazard Mitigation Plan at the SCOCOG office Monday-Friday 8:00-4:00 until the plan is submitted to FEMA.

The purpose of the plan is to devise and retain a strategy to reduce the impact and risks posed by disastrous natural events, such as tornadoes, ice storms and floods. The plan must be updated by the County and approved by FEMA every five years in order for the County and its jurisdictions—including school districts—to remain eligible for FEMA grant funding for current and ongoing hazard mitigation projects.

Appendix D – Jurisdictional Adoption Documentation

Resolution # _____

Adopting the Douglas County Multi-Jurisdictional Local Hazard Mitigation Plan

Whereas, the County of Douglas 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 ("Disaster Mitigation Act") emphasizing the need for pre-disaster mitigation of potential hazards;

Whereas, the Disaster Mitigation Act made available hazard mitigation grants to state and local governments; and

Whereas, an adopted Local Hazard 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 County of Douglas fully participated in the hazard mitigation planning process to prepare this Multi-Jurisdictional Local Hazard Mitigation Plan; and

Whereas, the Missouri State Emergency Management Agency and the Federal Emergency Management Agency Region VII officials will review the Douglas County Multi-Jurisdictional Local Hazard Mitigation Plan, and approved it as to form and content; and

Whereas, the County of Douglas desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts *by formally adopting* the Douglas County Multi-Jurisdictional Local Hazard Mitigation Plan; and

Whereas, adoption by the governing body for the County of Douglas demonstrates the jurisdictions' desire to fulfill the mitigation goals outlined in this Multi- Jurisdictional Local Hazard Mitigation Plan; and

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

Now, therefore, be it resolved, that the County of Douglas has adopted the Douglas County Multi-Jurisdictional Local Hazard Mitigation Plan as an official plan

Date: 6-13-22

Certifying Official: _____

Resolution # _____

Adopting the Douglas County Multi-Jurisdictional Local Hazard Mitigation Plan

Whereas, the Ava 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 ("Disaster Mitigation Act") emphasizing the need for pre-disaster mitigation of potential hazards;

Whereas, the Disaster Mitigation Act made available hazard mitigation grants to state and local governments; and

Whereas, an adopted Local Hazard 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 Ava R-I School District fully participated in the hazard mitigation planning process to prepare this Multi-Jurisdictional Local Hazard Mitigation Plan; and

Whereas, the Missouri State Emergency Management Agency and the Federal Emergency Management Agency Region VII officials will review the Douglas County Multi-Jurisdictional Local Hazard Mitigation Plan, and approved it as to form and content; and

Whereas, the Ava 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 Douglas County Multi-Jurisdictional Local Hazard Mitigation Plan; and

Whereas, adoption by the governing body for the Ava R-I School District demonstrates the jurisdictions' desire to fulfill the mitigation goals outlined in this Multi- Jurisdictional Local Hazard Mitigation Plan; and

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

Now, therefore, be it resolved, that the Ava R-I School District has adopted the Douglas County Multi-Jurisdictional Local Hazard Mitigation Plan as an official plan

Date: 7/14/22

Certifying Official: 

RESOLUTION #2022/07.06

Adopting the Douglas County Multi-Jurisdictional Local Hazard Mitigation Plan

Whereas, the City of Ava 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 ("Disaster Mitigation Act") emphasizing the need for pre-disaster mitigation of potential hazards;

Whereas, the Disaster Mitigation Act made available hazard mitigation grants to state and local governments; and

Whereas, an adopted Local Hazard 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 Ava fully participated in the hazard mitigation planning process to prepare this Multi-Jurisdictional Local Hazard Mitigation Plan; and

Whereas, the Missouri State Emergency Management Agency and the Federal Emergency Management Agency Region VII officials will review the Douglas County Multi-Jurisdictional Local Hazard Mitigation Plan, and approved it as to form and content; and

Whereas, the City of Ava desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Douglas County Multi-Jurisdictional Local Hazard Mitigation Plan; and

Whereas, adoption by the governing body for the City of Ava demonstrates the jurisdictions' desire to fulfill the mitigation goals outlined in this Multi- Jurisdictional Local Hazard Mitigation Plan; and

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

Now, therefore, be it resolved, that the City of Ava Board of Aldermen have adopted the Douglas County Multi-Jurisdictional Local Hazard Mitigation Plan as an official plan

Passed and approved by the City of Ava, Missouri, Board of Aldermen this 12th day in July, 2022.

CITY OF AVA
SEAL
DOUGLAS COUNTY, MISSOURI

Burrely Loftin
Mayor Burrely Loftin

Attest: Suzanne Welsh
City Clerk Suzanne Welsh