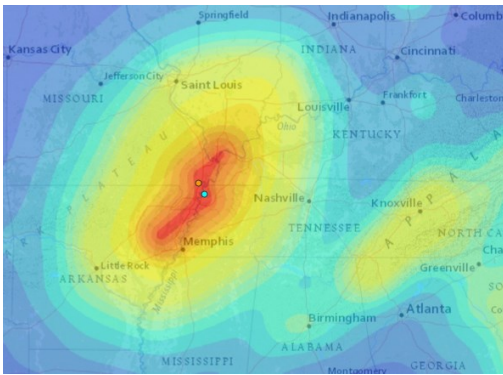


New Madrid County Multi-Jurisdictional Hazard Mitigation Plan Update 2023



CONTRIBUTORS

New Madrid County Hazard Mitigation Planning Committee

Jurisdictional Representatives

Name	Title	Department	Jurisdiction/Agency/Organization
Amy Brown	County Clerk		New Madrid County
Mark Baker	Presiding Commissioner	County Commission	New Madrid County
Bobby Aycock, Jr	Associate Commissioner	County Commission	New Madrid County
Kellams, Michael	Associate Commissioner	County Commission	New Madrid County
Brashears, Joe	Mayor		City of Morehouse
April Spraggs	City Clerk		City of Matthews
Virgie Johnson	Collector		City of Lilbourn
Aaron Griffin	City Administrator		City of New Madrid
Paige Keene	City Clerk		City of New Madrid
Chris Blackburn	Fire Chief	Parma Fire Department	City of Parma
Chris Cooley	Police/EMA	Portageville Police Dept	City of Portageville
Patty Johnson	Alderwoman	City Council	City of Portageville

Stakeholder Representatives

Name	Title	Department	Jurisdiction/Agency/Organization
Al Delisle	Emergency Management Director		Portageville Fire Department
Anthony Roberts	Assistant EMD	New Madrid Schools	New Madrid County
Dr. Amy Baker	Superintendent		Risco School District
Michael Allred	Superintendent		Portageville School District
James Breece	Superintendent		Gideon School District
Rob Starnes	Director	Development	Portageville Housing Authority
Christy Musgrave	Director	Development	New Madrid Housing Authority
Chris Hensley	Deputy	Hazard Mitigation	New Madrid County
Jeremy Gray	Regional Director	Hazard Mitigation	SEMA
Amber Childers	Community Outreach Specialist	Academia	University of Missouri Extension
Jared Brown	Community Outreach Liaison	Neighboring Community	Bootheel Regional Planning Commission
Clint Klipfel	Business Owner	Business	Kringle's Kitchen
Julie Aycock	Business Owner	Business	Juju Promotions
Bob Carter	Business Owner	Business	City Jewelry and Pawn
David Dittman	Pastor	Non-Profit serving underserved	First Church of God

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EXECUTIVE SUMMARY

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. New Madrid 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 in 2019. 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 met the qualifications for participation in the planning process:

- New Madrid County, unincorporated
- City of Matthews
- City of Morehouse
- City of New Madrid
- City of Portageville
- Gideon School District
- New Madrid School District
- Portageville School District
- Risco School District

New Madrid County and the entities listed above developed a Multi-Jurisdictional Hazard Mitigation Plan that was approved by FEMA on February 27, 2019 (hereafter referred to as the *2019 Hazard Mitigation Plan*). 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 New Madrid County and participating jurisdictions. The MPC updated the risk assessment that identified and profiled hazards that pose a risk to Stoddard 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 voted to retain previous goals for reducing risk from hazards. The goals are listed below:

- 1.) Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes and severe thunderstorms.
- 2.) Minimize property damage due to flooding.
- 3.) Minimize injuries and property damage due to seismic events.
- 4.) Minimize the impact to natural and human resources caused by drought and/or heat wave.
- 5.) Maintain public services to minimize the risk and reduce property damage caused by severe winter weather.

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 I. Mitigation Action Matrix

#	Action	Mathews	Morehouse	New Madrid (City)	Portageville	New Madrid County (Unincorporated)	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
1.1	Adopt most current IRC (residential), IBC (commercial building) and ICC600 (high wind areas) building codes to withstand high winds and possible tornado	X	X	X	X	X	Structural/ Infrastructure	Tornadoes/Severe Thunderstorm		X	
1.2	Host safety workshops and seek funding for storm sirens with a focus on all natural hazards	X	X	X	X	X	Education Outreach and Prevention	Tornadoes/Severe Thunderstorm			
1.3	Apply for funding for a FEMA safe room.		X	X		X	Prevention	Tornadoes/Severe Thunderstorm	X	X	
1.4	Upkeep of all EAS equipment as FEMA funds are available.					X	Emergency Services	Multi-Hazard	X	X	
2.1	Adopt roadway drainage design policy referencing MoDot Engineering Policy Guide "748 Hydraulics and Drainage".	X	X	X	X	X	Prevention	Flood-Related Hazards	X	X	X
2.2	Create program to clean and maintain current drainage systems	X	X	X	X	X	Prevention	Flood-Related Hazards	X	X	X
2.3	Perform a flood study to highlight localized problem areas in each jurisdiction. Use results to create mitigation actions to alleviate the problem areas.	X	X	X	X	X	Prevention	Flood-Related Hazards		X	X
2.4	Raise county road elevation above the base flood elevation to prevent repeated washout					X	Prevention	Flood-Related Hazards	X	X	X
2.5	Upgrade city drainage systems			X			Prevention	Flood-Related Hazards	X	X	X
2.6	Implementation of NFIP requirements to reduce flood risks within special flood hazard areas by adopting new NFIP Maps	X	X	X	X	X	Education and Outreach	Flood-Related Hazards	X	X	X
2.7	Provide Levee Failure Education to Public through distribution of information from the USACE	X	X	X	X	X	Education and Outreach	Flood-Related Hazards	X	X	X
3.1	Adopt additional building codes for new construction or improvements of any critical facilities to reflect the NEHRP Seismic Provisions.	X	X	X	X		Prevention	Earthquake / Geological / Sinkhole		X	
3.2	Designate an Emergency Operations Center and conduct annual coordination exercises					X	Emergency Services	Earthquake / Geological /Sinkhole	X	X	

#	Action	Matthews	Morehouse	New Madrid (City)	Portageville	New Madrid County (Unincorporated)	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
3.3	Co-sponsor with appropriate school boards and earthquake public awareness programs to create brochures on earthquake awareness and distribute to libraries, courthouse, city hall and school classrooms and offices.	X	X	X	X	X	Education and Outreach	Earthquake / Geological /Sinkhole	X	X	
3.5	Inform parents of school children regarding crisis plan and how it affects their students in case of disaster.					X	Education/ Outreach / Emergency Services	Earthquake / Geological /Sinkhole	X	X	
3.6	Adopt current USDA karst maps to identify areas most at risk of sinkhole development					X	Education and Outreach	Earthquake / Geological /Sinkhole	X	X	
3.7	Educate public on sinkhole warning signs to prevent property damage and/or injuries/death					X	Education and Outreach	Earthquake / Geological /Sinkhole	X	X	
4.1	Adopt "best practices" policy in conjunction with the Soil and Water Conservation Commission during periods of drought. Print information in brochures and distribute to public.	X	X	X	X	X	Prevention	Drought/Extreme Temp/Wildfire	X	X	
4.2	Adopt "best practices" policy in conjunction with the Public Electric Utility Companies during periods of heatwave. Print information in brochures and distribute them to public.	X	X	X	X		Prevention	Drought/Extreme Temp/Wildfire	X	X	
4.3	Take actions during periods of extreme heat to safeguard the health of students and staff by altering school activities.					X	Emergency Services	Drought/Extreme Temp/Wildfire	X	X	
4.4	Establish Cooling Centers in local jurisdictions					X	Prevention	Drought/Extreme Temp/Wildfire	X	X	
5.1	Create an emergency snow route map for county road system and coordinate snow removal activities with state and local officials in September of each year.					X	Prevention	Severe Winter Weather	X	X	
5.2	Meet annually with critical facilities administrators to develop severe winter weather strategies	X	X	X	X	X	Prevention	Severe Winter Weather	X	X	
5.3	Educate the public utility end user on preventive measures to reduce the risk to life and property	X	X	X	X	X	Education and Outreach	Severe Winter Weather	X	X	

#	Action	Matthews	Morehouse	New Madrid (City)	Portageville	New Madrid County (Unincorporated)	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
5.4	Develop school policies to protect students and staff during severe winter weather such as meeting with officials to set priorities for snow removal and cancelling classes					X	Prevention	Severe Winter Weather	X	X	
5.5	Purchase generator by applying for funding if needed.	X			X		Prevention	Severe Winter Weather	X	X	
5.6	Establish Warming Centers in local jurisdictions					X	Prevention	Severe Winter Weather	X	X	
	Total Count of Mitigation Actions	14	14	15	14	23					

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 C, and a model resolution is included on the following page.

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: _____

1 INTRODUCTION AND PLANNING PROCESS

1	INTRODUCTION AND PLANNING PROCESS.....	1.1
1.1	<i>Purpose</i>	1.1
1.2	<i>Background and Scope</i>	1.2
1.3	<i>Plan Organization</i>	1.2
1.4	<i>Planning Process</i>	1.4
1.4.1	Multi-Jurisdictional Participation.....	1.5
1.4.2	The Planning Steps.....	1.7

1.1 PURPOSE

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. The New Madrid County Hazard Mitigation Plan was created as a tool for the county and its communities and school districts to be proactive in reducing risk to their residents and property.

Through the years, residents of New Madrid County have experienced property loss, injury, economic loss and even death as a result of natural disasters. All city/villages and school districts of New Madrid County are susceptible to natural disasters. There is no way to eliminate the natural disasters, but counties, cities, and school districts, through hazard mitigation, can reduce the impact of these disasters. New Madrid County along with its jurisdictions and school districts have participated and adopted the current plan update. As participants of this multi-jurisdictional plan, the county, communities, and school districts are eligible to apply for Hazard Mitigation Assistance (HMA). As a result of the following legislation, any entity that does not participate or adopt a Hazard Mitigation Plan will not be eligible for HMA funding.

The Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288), which was later amended by The Disaster Mitigation Act of 2000 (Public Law 106-390), and implementation regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR §201.6) and finalized on October 31, 2007 establish the requirements for local hazard mitigation plans. (Hereafter, the amended law and implementing regulations will be referred to collectively as the Disaster Mitigation Act or DMA). The DMA sets forth the requirement for jurisdictions and special districts to adopt a hazard mitigation plan to be eligible to receive federal hazard mitigation grant funding. On October 1, 2002, FEMA published a change to the Interim Final Rule at 67 FR 61512, extending the effective date for state and local hazard mitigation plan adoption requirements to November 1, 2004. Since this date, participation within and adoption of a FEMA-approved hazard mitigation plan has been required for state, municipalities, and special districts to receive non-emergency Stafford Act assistance including hazard mitigation grant funding.

To assist jurisdictions and special districts in creating or updating their hazard mitigation plan, FEMA has created guidance documents. These documents, specifically FEMA's Local Mitigation Planning Handbook, May 2023, FEMA's Local Mitigation Plan Review Guide, October 1, 2011, the Local Mitigation Planning Policy Guide dated April 19, 2023 were

consulted by New Madrid County and its participating jurisdictions during the update of its 2019 New Madrid County Hazard Mitigation Plan. The last plan was approved 2/27/19.

1.2 BACKGROUND AND SCOPE

New Madrid County contracted with Bootheel Regional Planning & Economic Development Commission (BRPC) to develop its hazard mitigation plan. The plan identifies hazards that pose a risk to New Madrid County and its communities and then examines the communities' capabilities and plan mitigation actions accordingly. The actions included in this plan are not solutions, but rather short-term efforts to promote long-term impacts. The following jurisdictions participated and passed resolutions expressing their support of the 2023 New Madrid County Plan:

- New Madrid County, unincorporated
- City of Matthews
- City of Morehouse
- City of New Madrid
- City of Portageville
- Gideon 37 School District
- New Madrid County R-1
- Portageville School District
- Risco R-II School District

PLAN ORGANIZATION

The Plan is organized into five Chapters. The Plan chapters are:

- Chapter 1: Introduction and Planning Process

Section one provides an introduction to the multi-jurisdictional hazard mitigation planning process and a detailed look at the participation of the local jurisdictions and school districts. It also detailed the purpose of local hazard mitigation planning and outlined the requirements enacted by the Federal Emergency Management Agency

- Chapter 2: Planning Area Profile and Capabilities

Section Two of this plan provides general background information and statistics for New Madrid County and its municipalities and the disaster response and recovery capabilities found in the county. The section identifies key personnel, organizational leaders, and outlines existing plans regarding emergency planning. Additionally, it provides a brief assessment of each municipality's readiness regarding hazard mitigation.

- Chapter 3: Risk Assessment

Section Three, Risk Assessment, identifies and explores the types of natural hazards that pose a risk to the County, and the likelihood in which a hazard will occur. It provides a profile of each of the identified hazards, in addition to explaining the impact to the County and its jurisdictions should such hazards occur.

- Chapter 4: Mitigation Strategy

Section Four delivers the multi-jurisdiction mitigation strategies in response to the risk assessment. This chapter outlines the overall goals to reduce a disaster’s effect, specific objectives toward achieving those goals, and implementation plans for the county to complete.

- Chapter 5: Plan Implementation and Maintenance

Section Five outlines Hazard Mitigation Plan maintenance procedures

- Appendices

The goals listed in this plan are: 1.) Eliminate loss of life, minimize injuries and reduce property damage caused by tornadoes and severe thunderstorms. 2.) Minimize property damage due to flooding. 3.) Minimize injuries and property damage due to seismic events. 4.) Minimize the impact to natural and human resources caused by drought and/or heat wave. 5.) Maintain public services to minimize the risk and reduce property damage caused by severe winter weather.

Table 1.1 shows each chapter and summarizes the changes made in the update.

Table 1.1. Changes Made in Plan Update

Plan Chapter	Changes Made in Plan Update
Chapter 1: Intro and Planning Process	<ul style="list-style-type: none"> - Added Background and Scope Section - Added public involvement section describing community meetings and outreach efforts.
Chapter 2: Planning Area Profile and Capabilities	<ul style="list-style-type: none"> - Updated demographic information - Data Collection Questionnaires - Community Profiles more detailed with additional data.
Chapter 3: Risk Assessment	<ul style="list-style-type: none"> - Included more consistent data on past events. - Added summary of hazard vulnerability by jurisdiction. - Vulnerability assessment tables were added
Chapter 4: Mitigation Strategy	<ul style="list-style-type: none"> - Progress on actions summary was required.
Chapter 5: Plan Implementation and Maintenance	<ul style="list-style-type: none"> - Additional information required for plan monitoring and implementation.

1.3 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.

New Madrid County and Missouri State Emergency Management Agency (SEMA) have contracted with Bootheel Regional Planning & Economic Commission (BRPEC) to facilitate and manage the update process for the 2023 New Madrid County Hazard Mitigation Plan. Together BRPEC, New Madrid County and its municipalities and school districts will participate fully in creating an approved plan update. Once the plan receives the final approval from FEMA, the participating jurisdictions will be eligible for Hazard Mitigation Assistance Grants as well as have identified mitigation activities to reduce the impact of natural hazards in their communities

BRPEC's role as facilitator 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.

Table 1.2 provides a list of the Mitigation Planning Committee and Table 1.3 provides their MPC capability within the six mitigation categories.

Table 1.2. New Madrid County Mitigation Planning Committee

Name	Title	Department	Jurisdiction/Agency/Organization
Amy Brown	County Clerk	New Madrid County	New Madrid County
Mark Baker	Presiding Comm	New Madrid Co Commission	New Madrid County
Bobby Aycock Jr	Associate Comm	New Madrid Co Commission	New Madrid County
Michael Kellams	Associate Comm	New Madrid Co Commission	New Madrid County
Virgie Johnson	Collector	City of Lilbourn	City of Lilbourn
Joe Brashears	Mayor	City of Morehouse	City of Morehouse
April Spraggs	City Clerk	City of Matthews	City of Matthews
Aaron Griffin	City Administrator	City of New Madrid	City of New Madrid
Paige Keene	City Clerk	City of New Madrid	City of New Madrid
Chris Blackburn	Fire Chief	Parma Fire Department	City of Parma
Chris Cooley	Police/EMA	Portageville Police Department	City of Portageville
Patty Johnson	Alderwoman	City of Portageville	City of Portageville
Dr. Amy Baker	Superintendent	Risco School District	Risco School District
Michael Allred	Superintendent	Portageville School District	Portageville School District
James Breece	Superintendent	Gideon School District	Gideon School District
Al DeLisle	EMD	Portageville FD	New Madrid County
Anthony Roberts	Asst EMD	New Madrid Co Schools	New Madrid County

Rob Starnes*	Director	Development	Portageville Housing Authority
Christy Musgrave*	Director	Development	New Madrid Housing Authority
Chris Hensley*	Deputy	Hazard Mitigation Planning	New Madrid County
Jeremy Gray	Regional Director	Hazard Mitigation Planning	SEMA
Amber Childers*	Community Outreach Specialist	Academia	University of Missouri Extension
Jared Brown*	Community Outreach Liaison	Neighboring Community	Bootheel Regional Planning Commission
Clint Klipfel*	Business Owner	Business	Kringle's Kitchen
Julie Aycock*	Business Owner	Business	Juju Promotions
Bob Carter*	Business Owner	Business	City Jewelry and Pawn
David Dittman*	Pastor	Non-Profit serving underserved	First Church of God

Note: *Individuals invited to participate that were not responsive to invitations

Table 1.3. MPC Capability with Six Mitigation Categories

Community Department/Office	Preventive Measures	Property Protection	Structural Flood Control Projects	Natural Resource Protection	Public Information	Emergency Services
County Clerk	✓	✓		✓	✓	✓
Presiding Commissioner	✓	✓		✓	✓	
Associate Commissioner	✓	✓		✓	✓	✓
Collector		✓	✓		✓	✓
Mayor	✓	✓	✓		✓	✓
City Clerk	✓	✓	✓		✓	✓
City Administrator	✓	✓	✓		✓	✓
Fire Chief	✓	✓		✓		✓
Police/EMA	✓	✓		✓	✓	
Alderdwoman	✓	✓	✓		✓	✓
Superintendent	✓	✓	✓		✓	
EMD	✓	✓	✓	✓	✓	✓
Assistant EMD	✓	✓	✓	✓	✓	✓

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.

Bootheel Regional Planning & Economic Commission on behalf of New Madrid County invited each city/village, all school districts and emergency personnel located in New Madrid County to

attend a kick-off meeting to discuss the benefits and purpose of a Multi-Jurisdictional plan and the participation requirements for each jurisdiction and school district wanting to adopt the plan. The Disaster Mitigation Act of 2000 requires that jurisdictions within a multi-jurisdictional hazard mitigation plan participate in the planning process and formally adopt the completed plan before sending the plan draft to SEMA. Participation in the planning process will require representatives of each jurisdiction to:

- ✓ Attend at least 2 meetings
- ✓ Complete Data Collection Questionnaire
- ✓ Provide input into Risk Assessment
- ✓ Develop/update Mitigation Actions
- ✓ Review and comment on plan draft
- ✓ Formally adopt plan

BRPC staff as part of the agreement with New Madrid County has formed the planning committee, facilitated all the meetings, compiled all the data, issued public notices and documented each jurisdiction's attendance and participation. Documentation for attendance such as sign in sheets are included in *Appendix B: Planning Participation Documentation*.

Jurisdictions that have met the requirements for adopting the plan include New Madrid County (unincorporated), City of Matthews, City of Morehouse, City of New Madrid and City of Portageville. School districts participating this cycle are: Gideon, New Madrid, Portageville and Risco.

The planning process required countywide participation and attendance in three main meetings. The meetings were labeled Kick-off meeting, Meeting #2 and Meeting #3. The Kick-off meeting introduced the committee members and stakeholders to what hazard mitigation is, why they should participate in a multi-jurisdictional plan, and then introduced the data collection questionnaires. The group then reviewed all the hazards that impact the county and its municipalities then discussed critical facilities. Meeting #2 the group reviewed results of the public survey and the EMA, Al DeLisle presented information on recent disaster declarations. The group was also reminded of participation requirements and were given an update on where their school district or jurisdiction stood. The goals of the plan were reviewed and the group voted to repeat the same goals that were set forth in the 2019 plan. Meeting #3 the committee updated the mitigation strategy, updated previous action status, and developed and prioritized new actions.

The City of Lilbourn and the City of Parma did contribute as members of the planning committee but did not complete requirements to be full participants in the plan. Parma attended the kick-off meeting and completed the Data Collection Questionnaire but did not pass a resolution and did not draft action plans. Lilbourn attended the second planning meeting but did not complete any of the paperwork required to be a full participant. Both cities received follow up calls and emails but did not follow through.

The public was involved in the plan on two different occasions. First, they were invited to attend the Hazard Mitigation Kick-Off meeting. Second, a public survey was distributed to each jurisdiction and posted on the BRPC Facebook page encouraging the public to voice their thoughts and opinions on the topic.

Table 1.4. Jurisdictional Participation in Planning Process

Jurisdiction	Kick-off Meeting	Meeting #2	Meeting #3	Data Collection Questionnaire Response	Resolution	Update/Develop Mitigation Actions
New Madrid Co	X	X	X	X	pending	X
Lilbourn*		X				
Matthews	X	X		X	X	X
Morehouse	X	X	X	X	X	X
New Madrid	X	X	X	X	X	X
Parma*	X			X		
Portageville	X	X	X	X	X	X
Gideon School District	X	X		X	X	X
New Madrid Schools	X	X		X	X	X
Portageville Schools	X		X	X	X	X
Risco Schools	1 on 1	1 on 1		X	X	X

1.4.2 The Planning Steps

FEMA’s Local Mitigation Planning Policy Guide (April 2022), the previous New Madrid County Hazard Mitigation Plan, Training at the SEMA Operations Center in Jefferson City were all used in planning. The Plan Review Tool was used to ensure that all requirements were met. 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)

The Community Development Specialists from Bootheel Regional Planning & Economic Commission 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. An email was sent out to key individuals in February providing a brief summary of Hazard Mitigation and included an invite to the kick-off meeting. The notifications encouraged those invited to share the invitation with other individuals. (A2a, A3a) See Appendix B.

The Data Collection Questionnaires for the county’s school districts and municipalities were distributed at the very beginning of the update process via email after the kick-off. During the kick-off meeting time was spent to explain the procedure, the need for the data collection, how the data would be used, and to answer any questions the committee had regarding the contents of the Data Collection Questionnaires. All participating jurisdictions were informed of the upcoming planning meetings in the county where BRPC personnel would review relevant information needed to update hazard mitigation plans. In total, three planning meetings were held in New Madrid County – all at the New Madrid County Courthouse.

Table 1.6. Schedule of MPC Meetings

Meeting	Topic	Date
Kick-off Meeting (New Madrid County Courtroom)	<ul style="list-style-type: none"> • Purpose of Planning • Grant Programs Linked to Plan • Planning Tasks • Participation Requirements • Public Involvement • Data Collection Questionnaires • Hazards and Critical Facilities 	3/9/23
Planning Meeting #2 (New Madrid County Courtroom)	<ul style="list-style-type: none"> • Purpose of Meeting/Review Participation Requirements • Jurisdiction Status Review • Review of Public Survey Responses • Review of Previous Goals and Adopt New Ones • Review recent Disaster Declarations 	5/4/23
Planning Meeting #3 (New Madrid County Courtroom)	<ul style="list-style-type: none"> • Purpose of Meeting/Review Participation Requirements • Jurisdiction Status Review • Discussion of Vulnerable Populations • Action Plan Updates Using the STAPLEE risk assessment tool • Discussion of Next Steps 	6/8/23

Special Meeting for Stakeholders (Virtual Meeting Hosted Via WebEx) – scheduled but no one joined the WebEx.	<ul style="list-style-type: none"> • Overview of Hazard Planning in New Madrid County • Public Input Questions • Open Discussion 	10/11/23
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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.

Public involvement was a topic discussed during the kick-off meeting held on March 9, 2023 at the New Madrid County Courthouse. The Bootheel Regional Planning & Economic Commission staff explained the importance of public involvement during the planning process. The mitigation planning committee weighed in on a plan to engage the public during the update process. During the drafting stage a public survey link was distributed to all committee members who were encouraged to complete the survey and share it with friends, family members and co-workers. The survey was also posted on Bootheel Regional Planning & Economic Commission’s website and on social media. (See documentation in Appendix B) The second draft of the plan was posted on the BRPC website for review.

Individuals representing a variety of populations, including vulnerable populations, were contacted to provide input in a special meeting. The Emergency Management Director in New Madrid County was consulted to provide a list of contacts that represented a variety of populations, especially those who served the underserved. He provided phone numbers for most of the following organizations and individuals. Each was called and received an explanation of how they could be involved in providing input on the New Madrid Hazard Mitigation Plan. If they indicated they were willing to provide input, they were sent an email Outlook invitation to a special virtual meeting scheduled for 10/11/23.

- Bob Carter, owner – City Jewelry and Pawn, representing small businesses
- Julie Aycock, owner – Juju Promotions, representing small businesses
- Rev. Dave Dittman, pastor – First Church of God, representing non-profit organizations serving the underserved. The church has ministries to help those who need help.
- Clint Klipfel, owner – Kringle’s Kitchen, representing small businesses
- Rob Starnes, director – Portageville Housing Authority, representing housing of the poor and underserved
- Christy Musgrave, director – New Madrid Housing Authority, representing housing of the poor and underserved
- Chris Hensley, deputy – New Madrid County Sheriff’s Office, representing law enforcement and those who respond to disasters
- Jeremy Gray, director – SEMA, Southeast Region, representing those who respond to disasters
- Amber Childers, community liaison, University of Missouri Extension, representing those

- who reside in rural areas and small communities and academia
- Jared Brown, community outreach liaison, Bootheel Regional Planning Commission, representing a neighboring small community
- Christine Young, community development specialist, Bootheel Regional Planning Commission, representing a neighboring small community

Only Jeremy Gray logged into the meeting, so it was cancelled. See Appendix B for meeting invitation response on Outlook.

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 a few organizations that are multijurisdictional in nature whose interests interface with hazard mitigation planning in New Madrid County. These groups were included in the emailed invitation to the March 9, 2023 kick-off meeting at the New Madrid County Courthouse. A special meeting was organized for October 11, 2023 to broaden input as required by Hazard Mitigation guidelines. Several individuals were invited via phone and email, but none logged into the Web-Ex meeting. The agencies and interest groups who were invited to take part in hazard mitigation plan update are listed below:

- New Madrid Emergency Management Director
- New Madrid County Commission
- City of Catron
- City of Canalou
- City of Gideon
- Gideon School District
- City of Howardville
- City of Lilbourn
- City of Marston
- City of Matthews
- City of Morehouse
- City of New Madrid
- New Madrid County Central School District
- Village of North Lilbourn
- City of Parma
- Parma Fire Department
- City of Portageville
- Portageville School District
- Risco School District
- City of Risco
- City of Tallapoosa

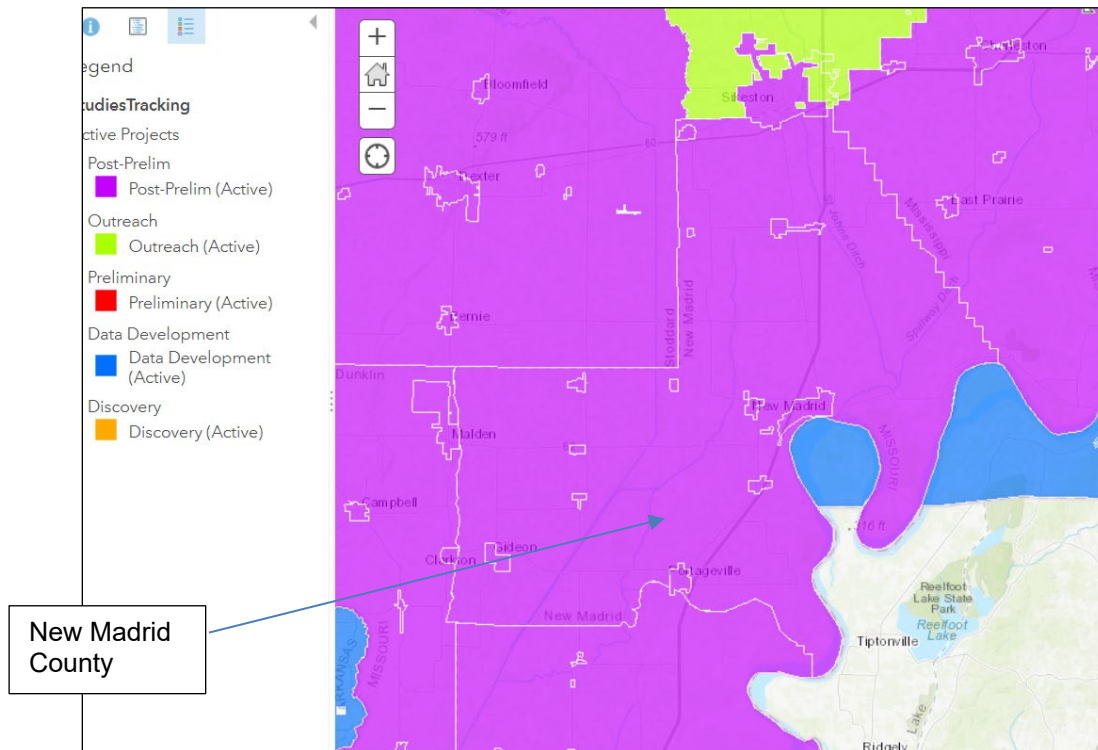
- Business Rep - City Jewelry and Pawn – Bob Carter
- Business Rep – Juju Promotions – Julie Aycock
- Business Rep – Kringle’s Kitchen – Clint Klipfel
- Non-Profit Rep – First Church of God – Rev. Dave Dittman
- Housing/Development Rep – Portageville Housing Authority – Rob Starnes
- Housing/Development Rep – New Madrid Housing Authority – Christy Musgrave
- Police/Law Enforcement Rep – NM Co Sheriff’s Office – Chris Hensley
- Disaster Assistance Rep – SEMA – Jeremy Gray
- Education – U of Missouri Extension – Amber Childers
- Neighboring Community – Jared Brown (Stoddard County)
- Neighboring Community – Christine Young (Stoddard County)

On October 11, 2023 Jeremy Gray of SEMA did log in. After no one else logged in, after about 10-15 minutes), the meeting was ended. After the meeting ended, Christy Musgrave reached out to join, but the meeting was already cancelled due to nearly no response.

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. Figure 1.1 shows the locations and status of RiskMAP projects in the state of Missouri. The map below indicates that New Madrid County is currently in the Post-Prelim (Active) stage. The Post-Prelim stage is when FEMA has contracted for basic and enhanced analysis. DFIRM production and Risk MAP products. (A4a)

Figure 1.1. Map of RiskMAP Projects



Integration of Other Data, Reports, Studies, and Plans

The most current data, reports, studies and plans were reviewed in order to input the data that mostly mocks the current view of New Madrid County and its local jurisdictions. The resources used were:

- Current Missouri State Hazard Mitigation Plan
- Flood Insurance Rate Maps (FIRMs)
- State Department of Natural Resources (DNR)
- National Inventory of Dams (NID)
- US Department of Agriculture’s (USDA) Risk Management Agency Crop Insurance Statistics
- 2020 & 2021 Census Estimates
- 2019 New Madrid County Hazard Mitigation Plan

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

The planning committee, attending the kick-off meeting, discussed what hazards would be reviewed in the plan’s Risk Assessment. They compared the list from the previous plan with the State Risk Assessment plan and the consensus was that the hazards from the previous plan would be acceptable. Each participating jurisdiction completed a Data Collection Questionnaire that BRPC staff reviewed for inclusion in the plan. Section 2 has more information on the hazards that were chosen as a threat to the county and the hazards that

were not considered a threat to the county.

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

In order to accumulate data for assets for jurisdictions there were different resources such as HAZUS, Data Collection Questionnaires, Current Missouri State Mitigation Plan, and previous New Madrid County Plan. Loss estimates were gathered through US Department of Agriculture's (USDA) Risk Management Agency Crop Insurance Statistics, NCEI storm event database, and data collection questionnaires. All of the vulnerability estimates were taken from the Current State Plan, as the best and most recent data.

Step 6: Set Goals (Handbook Task 6)

The MPC reviewed the goals adopted in the 2019 plan during Meeting #2. The overall consensus was to keep the same goals for the 2023 plan update. The goals are listed below:

- Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes and severe thunderstorms.
- Goal 2: Minimize property damage due to flooding
- Goal 3: Minimize injuries and property damage due to seismic events.
- Goal 4: Minimize the impact to natural and human resources caused by drought and/or heat wave.
- Goal 5: Maintain public services to minimize the risk and reduce property damage caused by severe winter weather.

Step 7: Review Possible Mitigation Actions and Activities

The Mitigation Planning Committee and representatives were emailed their previous action plans prior to Meeting #3 (if they participated in the last plan) and during that meeting were given the opportunity to discuss them with other representative from their jurisdictions, make updates, or take them back to their localities to review and update. BRPC encouraged development of new actions and for actions that covered all possible hazards. Committee members used the STAPLEE methodology to rate their intended actions to determine whether they were cost-beneficial and whether they were low, medium or high priority based on their ratings considering the social, technical, administrative, political, legal, economic and environmental aspects of each action. Participants were encouraged to focus on mitigation efforts that could be reasonably attained.

Step 8: Draft an Action Plan

Meeting #3 was when new actions were decided by many of the jurisdictions. Others took them back to their communities to consider further. Actions from the previous plans were reviewed and updated and then new actions were added as appropriate.

Step 9: Adopt the Plan (Handbook Task 8)

Jurisdictions and school districts were encouraged to introduce resolutions at their council and school board meetings in support of the New Madrid County Hazard Mitigation Plan. It was a requirement for inclusion in the plan to be supportive of it. Jurisdictions were told that when the

final plan is forthcoming from FEMA, if they are not supportive of the final plan, they may withdraw their support at that time. This option was given because the process of adoption of the resolution occurred prior to the first draft submission and approval.

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

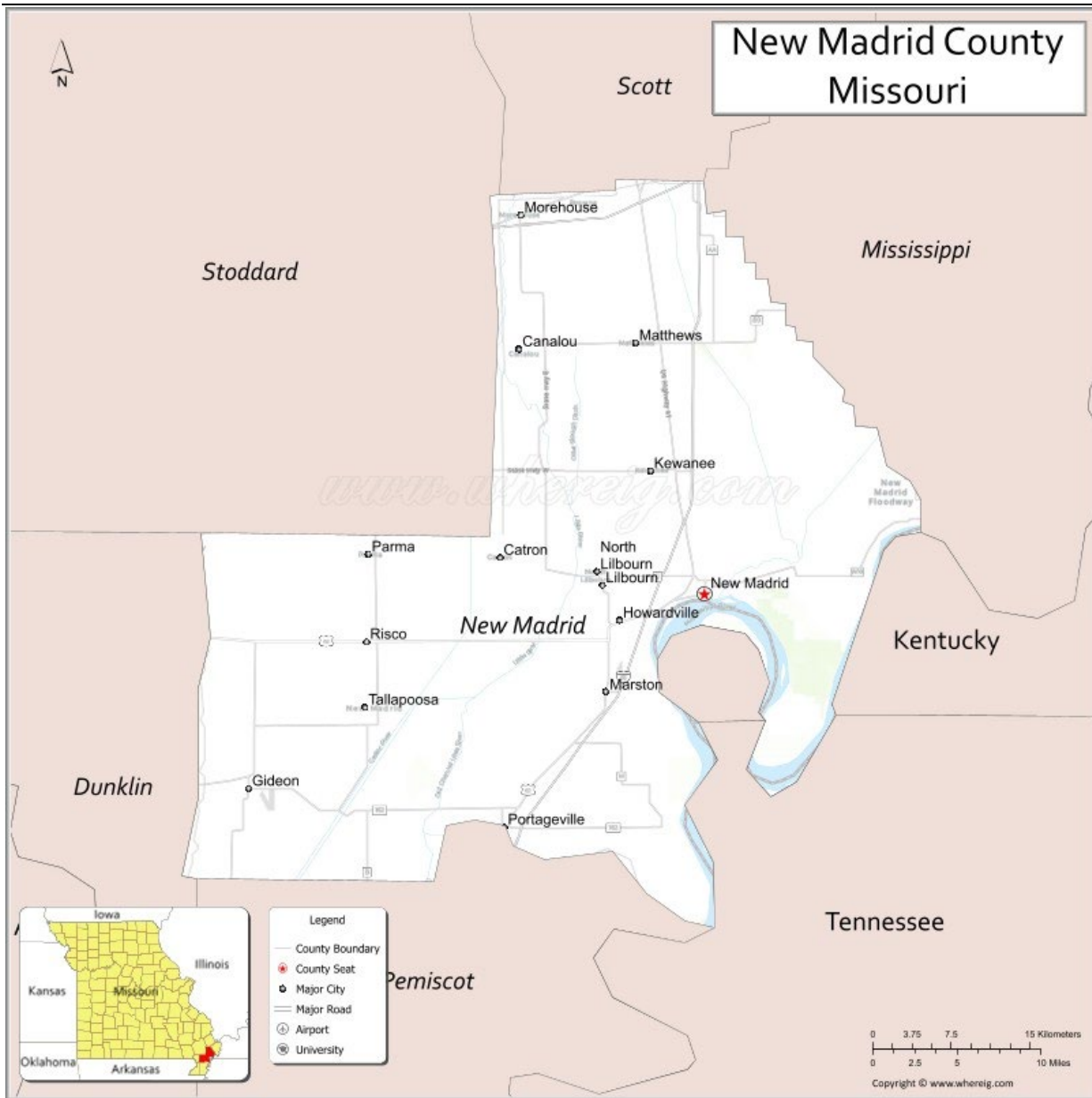
The strategy for plan implementation, monitoring and maintaining was done through phone calls and some emails. The details of implementation and monitoring are in chapter 5 of the plan.

2 PLANNING AREA PROFILE AND CAPABILITIES

2	PLANNING AREA PROFILE AND CAPABILITIES	2.0
	<i>New Madrid County Planning Area Profile</i>	<i>2.1</i>
2.1.2	Geography, Geology and Topography.....	2.2
2.1.3	Climate	2.2
2.1.4	Population/Demographics	2.2
2.1.5	History	2.3
2.1.6	Occupations.....	2.4
2.1.7	Agriculture.....	2.4
2.1.8	FEMA Hazard Mitigation Assistance Grants in Planning Area.....	2.4
2.1.9	FEMA PA Grants in Planning Area	2.5
	<i>Jurisdictional Profiles and Mitigation Capabilities.....</i>	<i>2.5</i>
2.2	New Madrid County, Missouri	2.6
2.2.1	Public School District Profiles and Mitigation Capabilities	2.14
2.2.2	Gideon 37 School District	2.14
2.2.3	New Madrid Co R1 School District	2.15
2.2.4	Portageville School District.....	2.15
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New Madrid County Planning Area Profile

Figure 2.1. Map of New Madrid County



According to the US Census Bureau, the 2020 population estimate of New Madrid County is 16,435. The current population represents a 13.2% decrease in population from 18,956 according to the 2010 US Census. During the same time period, the State of Missouri population reported an increase in population of 2.8% and the United States also reported an increase in population of 7.4%.

The median household income for New Madrid County rose 26.0% from \$33,630 in 2015 to \$42,370 in 2021. Even though the increase was large, household income in New Madrid County lags far behind the state and national figures of \$61,043 and \$69,021, respectively.

The median house value has increased 16.6% from \$73,100 in 2015 to \$85,200 in 2021.

2.1.2 Geography, Geology and Topography

New Madrid County is located in the Southeast part of Missouri. Stoddard, Scott and Mississippi counties border New Madrid on the north and west while Dunklin and Pemiscot lie to the west and south. Dunklin and New Madrid Counties border on the east and south. The City of New Madrid is the county seat.

The Mississippi River runs along parts of the eastern and southern borders of the county. The county is mainly flat land with fertile soil and sand mixture ideal for crop production. New Madrid County has a land area of 674.88 square miles (431,897.6 acres) and water area of 20 square miles (12,806 acres) according to the census data.

The county crosses three (3) watersheds shown in Figure 2.2.



Figure 2.2. [How's My Waterway | US EPA](https://www.epa.gov/3d/how-my-waterway)

2.1.3 Climate

According to the National Weather Service (NWS) that derives its data from NOAA, New Madrid County's average annual precipitation through the years of 1991-2020 was 49.3 inches. The average daily temperature is 58.9 degrees Fahrenheit.

2.1.4 Population/Demographics

Table 2.1. New Madrid County Population 2010-2022 by All Communities (Participating and Non-Participating)

Jurisdiction	2010 Population	2020 Population	2010-2020 # Change	2010-2020 % Change
New Madrid County, unincorporated	6,513	5,729	-784	-12.0%
City of Canalou	338	186	-152	-45.0%
City of Catron	41	36	-5	-12.2%
City of Gideon	1,093	704	-389	-35.6%
City of Howardville	383	329	-54	-14.1%
City of Lilbourn	1,190	994	-196	-16.5%
City of Marston	503	528	25	5.0%
City of Matthews	628	534	-94	-15.0%
City of Morehouse	973	741	-232	-23.8%

City of New Madrid	3,116	2,787	-329	-10.6%
Village of North Lilbourn	49	22	-27	-55.1%
City of Parma	555	616	61	11.0%
City of Portageville*	3,228	2,942	-286	-8.9%
City of Risco	346	286	-60	-17.3%

Source: U.S. Bureau of the Census, Decennial Census *population includes the portions of these cities in adjacent counties

There are a total of 6,816 households in New Madrid County per 2021 American Community Survey estimates. The average household size in the county is 2.40 which is similar to the state of Missouri average of 2.46 and slightly below the national average of 2.60. 6.4% of New Madrid County's population is younger than the age of 5 while 18.9% is older than 65 years.

It should be noted that Sikeston, Missouri lies in two counties – Scott and New Madrid. For purposes of hazard mitigation, Sikeston is participating in planning in Scott County, where a majority of its population resides and a majority of its businesses are located.

Table 2.2. Unemployment, Poverty, Education and Language Demographics, New Madrid County

Jurisdiction	Total in the Workforce	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)
New Madrid County	6487	2.4%	19.8%	82.3%	13.7%	3.0%
City of Matthews	236	3.2%	12.2%	63.7%	2.3%	0.0%
City of Morehouse	332	3.1%	11.8%	79.1%	6.4%	2.6%
City of New Madrid	1133	0.9%	19.6%	90.1%	19.4%	2.4%
City of Portageville*	1093	3.1%	19.7%	75.7%	12.3%	2.9%
State	3,048,766	4.5%	12.7%	91.0%	30.7%	6.2%
Nation	166,672,597	5.5%	11.6%	88.9%	33.7%	21.7%

Source: U.S. Census, 2021 American Community Survey, 5-year Estimates

2.1.5 History

Early records indicate that the Spanish explorer Hernando DeSoto visited the New Madrid County area in 1540. The first settlement in the county was founded in 1783 at the present site of New Madrid by Joseph and Francios Le Sieur. These Canadian Frenchmen were hunters and fur traders who established an outpost for the purpose of trading with the Indians. Transportation was especially difficult for those early pioneers who settled inland from the Mississippi River. In 1789, a road called the Kings Highway was built from Ste. Genevieve to New Madrid.

In 1789, Colonel George Morgan, a former Revolutionary War officer, attempted to establish New Madrid as the Spanish capital for the New World. Morgan formulated a grand plan for the development of New Madrid, and he widely advertised his scheme. Factors including the diminution of his land grant, the death of his brother and Morgan's subsequent inheritance and opposition by the Spanish Governor in New Orleans caused Morgan to lose interest in the venture. He never returned to New Madrid.

From 1795 to 1815, the area known as New Madrid District included all of the southeastern Missouri lowland and most of the northern part of Arkansas. New Madrid was organized as a county in 1812. When Missouri was admitted to the Union in 1821, the counties of Dunklin, Mississippi, Pemiscot, Scott and Stoddard were a part of New Madrid County.

On December 16, 1811, the area was shaken by the first of a series of violent earthquakes. The earth seemed to rise and fall like ocean waves. Landslides swept down the Mississippi River and areas were pushed up and still larger areas sank. Boats on the river were demolished by huge waves and thousands of trees were swept into the river. New Madrid, the county seat of New Madrid County, was incorporated in 1808. Most of the other towns in the county were started during the period between 1880 and 1907. Logging and sawmill operations along with the railroads resulted in the establishment of new communities within the county. By 1922, most of the timber had been cut and the Little River Drainage District was organized. Due to the efforts of the drainage district, large areas of swampland were drained and converted to farmland. Today, New Madrid County is one of the state’s most productive agricultural counties.

2.1.6 Occupations

Table 2.3 Occupation Statistics, New Madrid County, Missouri

Place	Management, Business, Science, and Arts Occupations	Service Occupations	Sales and Office Occupations	Natural Resources, Construction, and Maintenance Occupations	Production, Transportation, and Material Moving Occupations
New Madrid County	1,539	1,654	1,232	714	1,348
City of Matthews	19	42	40	52	83
City of Morehouse	59	106	73	18	76
City of New Madrid	233	361	216	100	223
City of Portageville*	293	395	170	77	218

Source: U.S. Census, 2021 American Community Survey, 5-year Estimates.

2.1.7 Agriculture

According to the 2017 Census of Agriculture, New Madrid County has a total of 290 farms on a total of 418,443 acres of land. The average size of each farm is 1,443 acres with an average of \$798,286 in product sales. New Madrid County’s top crops in acres are soybeans, corn and cotton. The farming industry employs 588 workers.

2.1.8 FEMA Hazard Mitigation Assistance Grants in Planning Area

Table 2.4 FEMA HMA Grants in New Madrid County from 1993-2022

Project Type	Sub applicant	Award Date	Project Total
206.2: Safe Room (Tornado and Severe Wind Shelter) - Public Structures	Portageville	2020	Not listed
206.2: Safe Room (Tornado and Severe Wind Shelter) - Public Structures	New Madrid	2019	Not listed
206.2: Safe Room (Tornado and Severe Wind Shelter) - Public Structures	Sikeston	2009	\$1,426,622

Source: Federal Emergency Management Agency

2.1.9 FEMA PA Grants in Planning Area

Table 2.4 FEMA PA Grants in New Madrid County from 2008-2020

Declaration number	Project Type	Project size	Project Total
1749	Debris Removal, Emergency Protective Measures, Roads and Bridges, Public Buildings, Public Utilities	Small & Large	\$313,184
1809	Debris Removal, Protective Measures, Public Buildings, Public Utilities	Small & Large	\$157,794
1822	Debris Removal, Protective Measures, Roads and Bridges, Public Buildings, Public Utilities, Recreational	Small & Large	\$2,151,188
1980	Debris Removal, Protective Measures, Roads and Bridges, Water Control Facilities, Public Buildings, Public Utilities, Recreational	Small & Large	\$1,782,833
4238	Protective Measures, Roads and Bridges	Small & Large	\$150,856
4250	Roads and Bridges	Small	\$31,591
4435	Protective Measures	Small	\$4,941
4451	Protective Measures, Roads and Bridges, Water Control Facilities, Public Utilities, Recreational, State Management	Small & Large	\$366,353
4452	Debris Removal, Protective Measures, Public Utilities	Small	\$148,154

Source: Federal Emergency Management Agency

Jurisdictional Profiles and Mitigation Capabilities

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

2.1.10 New Madrid County, Missouri

Table 2.2. Mitigation Capabilities Summary Table

CAPABILITIES	New Madrid County	Matthews	Morehouse	New Madrid	Portageville
Planning Capabilities					
Comprehensive or Land-Use Plan	NO	YES	NO	NO	NO
Capital Improvement Plan	YES	NO	NO	NO	NO
Transportation Plan / Highway Dept	YES	YES	NO	NO	NO
Emergency Operations Plan	YES -	NO	NO	YES	YES
Local Recovery Plan	YES	NO	NO	YES	NO
Debris Management Plan	NO	NO	NO	NO	NO
Firewise or other Fire Mitigation Plan	NO	NO	NO	YES	NO
Economic Development Plan	NO	NO	NO	NO	NO
Policies/Ordinance					
Zoning Ordinance	N/A	YES	NO	YES	YES
Building Code	N/A	YES	YES	NO	YES
Floodplain Ordinance	YES	YES	YES	YES	YES
Drainage/Storm Water Ordinance	NO	NO	NO	NO	YES
Drainage Ordinance	NO	NO	NO	NO	YES
Site Plan Review Requirements	NO	NO	NO	NO	NO
Historic Preservation Ordinance	NO	NO	NO	NO	NO
Program					
National Flood Insurance Program (NFIP)	YES	YES	YES	YES	YES
NFIP Community Rating System (CRS)	NO	NO		NO	YES
National Weather Service (NWS) Storm Ready	NO	YES		NO	NO
Firewise Community Certification	N/A	NO	YES	NO	NO
Building Code Effectiveness Grading (BCEG)s	N/A		YES	NO	YES
ISO Fire Rating	N/A	5		5	4
Public Education/Awareness	N/A	NO	NO	YES	YES
Mutual Aid Agreements	N/A	YES	YES	YES	YES
Studies/Reports/Maps					
Critical Facilities Inventory	NO	NO	NO	NO	YES
Vulnerable Population Inventory	NO	NO	NO	NO	NO
Staff/Department					
Building Code Official/Building Inspector	NO	NO	NO	NO	YES
Engineer	NO	NO	NO	NO	NO
Development Planner	NO	NO	NO	NO	NO
NFIP Floodplain Administrator	YES	NO	YES	NO	YES
Mapping Specialist	YES	NO	NO	NO	NO
Public Works Official	NO	YES	YES	YES	YES
Emergency Management Coordinator	YES	NO	NO	YES	YES
Local Emergency Planning Committee	NO	NO	NO	?	YES

CAPABILITIES	New Madrid County	Matthews	Morehouse	New Madrid	Portageville
Sanitation Department	NO	NO	NO	YES	YES
Highway/Transportation Department	YES	NO	NO	NO	YES
Economic Development Department	YES	NO	NO	YES	NO
Housing Department	N/A	NO	NO	NO	NO
Historic Preservation	N/A	NO	NO	YES	NO
Non-Governmental Organizations (NGOs)					
American Red Cross	YES	NO	NO	YES	YES
Salvation Army	YES	NO	NO	YES	NO
Veterans Groups	YES	NO	NO	YES	NO
Environmental Organization	NO	NO	NO	NO	NO
Homeowner Associations	N/A	NO	NO	NO	NO
Neighborhood Associations	N/A	NO	NO	NO	NO
Chamber of Commerce	N/A	NO	NO	YES	YES
Community Organizations (Lions, Kiwanis, etc.)	YES	YES	NO	YES	YES
Financial Resources					
Apply for Community Development Block Grants	YES	YES	YES	YES	YES
Fund projects through Capital Improvements funding	YES	NO	YES	YES	YES
Authority to levy taxes for specific purposes	YES	YES	YES	YES	YES
Fees for water, sewer, gas, or electric services	YES	YES	YES	YES	YES
Impact fees for new development	NO	NO	YES	NO	YES
Incur debt through general obligation bonds	NO	YES	YES	?	YES
Incur debt through special tax bonds	NO	YES	YES	?	YES
Incur debt through private activities	NO	NO	YES	?	YES
Withhold spending in hazard prone areas	NO	NO	YES	?	YES

Source: Data Collection Questionnaires, 2023

New Madrid County is a sparsely populated county positioned squarely on the New Madrid Fault and bordering the Mississippi River. It has made little progress in hazard mitigation due to limited capabilities and few resources. To improve its capabilities, the county might consider developing a comprehensive land use plan. Although the county has limited staff, it could look to the key personnel it does have to search for funding opportunities or to work with Bootheel Regional Planning Commission to assist. It should also develop mutual aid agreements with neighboring counties.

2.1.11 City of Matthews

The City of Matthews is in the northern portion of New Madrid County just off Interstate 55. The city has experienced a 15% dip in population from 2010 to 2020 from 628 to 534 residents. Matthews is governed by a mayor and a city council.

The unemployment rate in Matthews is only 3.2% and poverty is approximately 12%. The median household income is \$36,917. Of the 270 housing units, 38.1% were built between 1960 and 1979 and mobile homes make up 19.3% of the homes in the city.

The City of Matthews participated in the last update of the county-wide multijurisdictional plan. Mitigation

activities have been limited due to limited capabilities and resources. The City of Matthews carries mutual aid agreements with local governments and law enforcement departments. The city currently has one outdoor warning siren. Matthews could improve its capabilities by seeking funding to improve its planning, adding relevant ordinances to help improve mitigation and developing a critical assets inventory. None of these require much money to implement.

The city departments include:

- Mayor/City Council
- City Clerk
- Police Department
- Volunteer Fire Department
- Water/Sewer Department

Table 2.7. Matthews Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	Y
Builder's Plan	N
Capital Improvement Plan	N
Local Emergency Plan	N
Local Recovery Plan	N
Local Mitigation Plan	N
Economic Development Plan	N
Policies/Ordinance	
Zoning Ordinance	Y
Building Code	Y IPMC 2021
Floodplain Ordinance	Y
Storm Water Ordinance	N
Drainage Ordinance	N
Site Plan Review Requirements	N
Historic Preservation Ordinance	N
Program	
National Flood Insurance Program (NFIP) Participant	Y
NFIP Community Rating System (CRS) Participating Community	N
National Weather Service (NWS) Storm Ready	Y
Firewise Community Certification	N
Building Code Effectiveness Grading (BCEGs)	
ISO Fire Rating	5
Public Education/Awareness	Y
Mutual Aid Agreements	Y
Studies/Reports/Maps	
Critical Facilities Inventory	N
Vulnerable Population Inventory	N
Staff/Department	
Building Code Official	N
Engineer	N
Development Planner	N
NFIP Floodplain Administrator	N
Mapping Specialist (GIS)	N
Public Works Official	Y
Emergency Management Coordinator	N
Local Emergency Planning Committee	N
Sanitation Department	N
Transportation Department	N
Economic Development Department	N
Housing Department	N
Historic Preservation	N

Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	N
Salvation Army	N
Veterans Groups	N
Environmental Organization	N
Homeowner Associations	N
Neighborhood Associations	N
Chamber of Commerce	N
Community Organizations (Lions, Kiwanis, etc.)	Y
Financial Resources	Status Including Date of Document or Policy
Ability to apply for Community Development Block Grants	Y
Ability to fund projects through Capital Improvements funding	N
Authority to levy taxes for a specific purpose	Y
Fees for water, sewer, gas, or electric services	Y
Impact fees for new development	N
Ability to incur debt through general obligation bonds	N
Ability to incur debt through special tax bonds	Y
Ability to incur debt through private activities	N
Ability to withhold spending in hazard prone areas	N

2.1.12 City of Morehouse

The City of Morehouse is the northernmost city in New Madrid County and lies west of Sikeston, Missouri. The city has experienced a 24% decrease in population between 2010 to 2020 from 973 to 741 residents. The city is governed by a mayor and a board of aldermen.

The unemployment rate in Morehouse is 3.1% and poverty is approximately 12%. The median household income is \$39,107. Of the 483 housing units, 36.5% were built between 1960 and 1979 and mobile homes make up 17.8% of the homes in the city.

The City of Morehouse participated in the last update of the county-wide multijurisdictional plan. Mitigation activities have been limited due to limited capabilities and resources. The City of Matthews carries mutual aid agreements with local governments and law enforcement departments. The city currently has one outdoor warning siren that is not functioning. Morehouse could improve its capabilities by updating or initiating new ordinances that address mitigation-related topics and by developing and maintaining inventories of its critical facilities and vulnerable populations.

City departments include:

- Mayor/Board of Aldermen
- City Clerk
- Police Department
- Fire Department

Table 2.8. Morehouse Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	N
Builder's Plan	N
Capital Improvement Plan	N
Local Emergency Plan	N
Local Recovery Plan	N
Local Mitigation Plan	N
Economic Development Plan	N

Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	N
Building Code	Y 2018
Floodplain Ordinance	Y
Storm Water Ordinance	N
Drainage Ordinance	N
Site Plan Review Requirements	N
Historic Preservation Ordinance	N
Program	Status Including Date of Document or Policy
National Flood Insurance Program (NFIP) Participant	Y
NFIP Community Rating System (CRS) Participating Community	
National Weather Service (NWS) Storm Ready	
Firewise Community Certification	Y
Building Code Effectiveness Grading (BCEGs)	Y
ISO Fire Rating	
Public Education/Awareness	N
Mutual Aid Agreements	Y
Studies/Reports/Maps	
Critical Facilities Inventory	N
Vulnerable Population Inventory	N
Staff/Department	Status Including Date of Document or Policy
Building Code Official	N
Engineer	N
Development Planner	N
NFIP Floodplain Administrator	Y
Mapping Specialist (GIS)	N
Public Works Official	Y 2 PT
Emergency Management Coordinator	N
Local Emergency Planning Committee	N
Sanitation Department	N
Transportation Department	N
Economic Development Department	N
Housing Department	N
Historic Preservation	N
Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	N
Salvation Army	N
Veterans Groups	N
Environmental Organization	N
Homeowner Associations	N
Neighborhood Associations	N
Chamber of Commerce	N
Community Organizations (Lions, Kiwanis, etc.)	N
Financial Resources	Status Including Date of Document or Policy
Ability to apply for Community Development Block Grants	Y
Ability to fund projects through Capital Improvements funding	Y
Authority to levy taxes for a specific purpose	Y
Fees for water, sewer, gas, or electric services	Y
Impact fees for new development	Y
Ability to incur debt through general obligation bonds	Y
Ability to incur debt through special tax bonds	Y
Ability to incur debt through private activities	Y
Ability to withhold spending in hazard prone areas	Y

2.1.13 City of New Madrid

The City of New Madrid is the county seat and lies in the center of the county. The city has experienced a 10.6% decrease in population between 2010 to 2020 from 3,116 to 2,787 residents. The city is

governed by a mayor and a board of aldermen.

The unemployment rate in New Madrid is 0.9% and poverty is approximately 20%. The median household income is \$39,271. Of the 1,546 housing units, 43.6% were built between 1960 and 1979 and mobile homes make up 8.7% of the homes in the city.

The City of New Madrid participated in the last update of the county-wide multijurisdictional plan. Mitigation activities have been limited due to limited capabilities and resources. The City of New Madrid carries mutual aid agreements with neighboring towns. The city currently has three outdoor warning sirens. New Madrid could improve and expand on its mitigation-planning capabilities by updating or creating new ordinances that address mitigation and by developing and maintaining a critical asset and vulnerable population inventory.

City Departments include:

- Mayor/Board of Aldermen
- City Clerk
- Police Department
- Fire Department/Emergency Management
- Public Works Department
- Economic Development
- Transportation Department
- Sanitation Department

Table 2.9. New Madrid Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	N
Builder's Plan	N
Capital Improvement Plan	N
Local Emergency Plan	Y
Local Recovery Plan	Y
Local Mitigation Plan	N
Economic Development Plan	N
Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	Y
Building Code	N
Floodplain Ordinance	Y
Storm Water Ordinance	N
Drainage Ordinance	N
Site Plan Review Requirements	N
Historic Preservation Ordinance	N
Program	Status Including Date of Document or Policy
National Flood Insurance Program (NFIP) Participant	Y
NFIP Community Rating System (CRS) Participating Community	N
National Weather Service (NWS) Storm Ready	N
Firewise Community Certification	N
Building Code Effectiveness Grading (BCEGs)	N
ISO Fire Rating	5
Public Education/Awareness	Y
Mutual Aid Agreements	Y
Studies/Reports/Maps	
Critical Facilities Inventory	N
Vulnerable Population Inventory	N
Staff/Department	Status Including Date of Document or Policy
Building Code Official	N

Engineer	N
Development Planner	N
NFIP Floodplain Administrator	N
Mapping Specialist (GIS)	N
Public Works Official	Y FT
Emergency Management Coordinator	Y FT
Local Emergency Planning Committee	?
Sanitation Department	Y FT
Transportation Department	N
Economic Development Department	Y
Housing Department	N
Historic Preservation	
Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	Y
Salvation Army	Y
Veterans Groups	Y
Environmental Organization	N
Homeowner Associations	N
Neighborhood Associations	N
Chamber of Commerce	Y
Community Organizations (Lions, Kiwanis, etc.)	Y
Financial Resources	Status Including Date of Document or Policy
Ability to apply for Community Development Block Grants	Y
Ability to fund projects through Capital Improvements funding	Y
Authority to levy taxes for a specific purpose	Y
Fees for water, sewer, gas, or electric services	Y
Impact fees for new development	?
Ability to incur debt through general obligation bonds	?
Ability to incur debt through special tax bonds	?
Ability to incur debt through private activities	?
Ability to withhold spending in hazard prone areas	?

2.1.14 City of Portageville

The City of Portageville is located in south central New Madrid County just off Interstate 55. A small portion of the city lies in Pemiscot County, but for purposes of hazard mitigation planning, the city is included in the New Madrid County plan. The city has experienced an 8.9% decrease in population between 2010 to 2020 from 3,228 to 2,942 residents. The city is governed by a mayor and a board of aldermen.

The unemployment rate in Portageville is 3.1% and poverty is approximately 20%. The median household income is \$32,787. Of the 1,251 housing units, 35.9% were built between 1960 and 1979 and mobile homes make up 1.8% of the homes in the city.

The City of Portageville participated in the last update of the county-wide multijurisdictional plan. Mitigation activities have been limited due to limited capabilities and resources. The City of Portageville carries mutual aid agreements with neighboring counties. The city currently has three outdoor warning sirens. To better manage the impact of hazard events, Portageville could develop more local plans like land-use and recovery plans. It could also initiate a critical asset and vulnerable population inventory.

City Departments include:

- Mayor/Board of Aldermen
- City Clerk
- Police Department
- Fire Department

- Water/Sewer Department

Table 2.9. Portageville Mitigation Capabilities

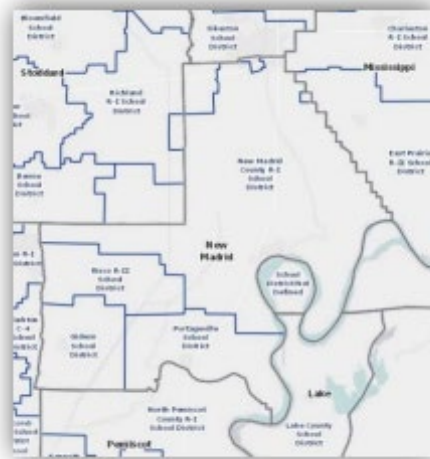
Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	N
Builder's Plan	N
Capital Improvement Plan	N
Local Emergency Plan	Y
Local Recovery Plan	N
Local Mitigation Plan	N
Economic Development Plan	N
Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	Y
Building Code	Y IRC 2018
Floodplain Ordinance	Y
Storm Water Ordinance	Y
Drainage Ordinance	Y
Site Plan Review Requirements	N
Historic Preservation Ordinance	N
Program	Status Including Date of Document or Policy
National Flood Insurance Program (NFIP) Participant	Y
NFIP Community Rating System (CRS) Participating Community	Y
National Weather Service (NWS) Storm Ready	N
Firewise Community Certification	N
Building Code Effectiveness Grading (BCEGs)	Y
ISO Fire Rating	4
Public Education/Awareness	N
Mutual Aid Agreements	Y
Studies/Reports/Maps	
Critical Facilities Inventory	N
Vulnerable Population Inventory	N
Staff/Department	Status Including Date of Document or Policy
Building Code Official	Y PT
Engineer	N
Development Planner	N
NFIP Floodplain Administrator	Y PT
Mapping Specialist (GIS)	N
Public Works Official	Y 2 FT
Emergency Management Coordinator	Y PT
Local Emergency Planning Committee	Y PT
Sanitation Department	Y FT
Transportation Department	Y FT
Economic Development Department	N
Housing Department	N
Historic Preservation	
Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	N
Salvation Army	N
Veterans Groups	N
Environmental Organization	N
Homeowner Associations	N
Neighborhood Associations	N
Chamber of Commerce	Y
Community Organizations (Lions, Kiwanis, etc.)	Y
Financial Resources	Status Including Date of Document or Policy
Ability to apply for Community Development Block Grants	Y

Ability to fund projects through Capital Improvements funding	Y
Authority to levy taxes for a specific purpose	Y
Fees for water, sewer, gas, or electric services	Y
Impact fees for new development	Y
Ability to incur debt through general obligation bonds	Y
Ability to incur debt through special tax bonds	Y
Ability to incur debt through private activities	Y
Ability to withhold spending in hazard prone areas	Y

2.1.15 Public School District Profiles and Mitigation Capabilities

This section provides general information about participating school districts in the Plan. There are four school districts based in New Madrid County and all are participating in this plan. Figure 2.3 is a map of school district boundaries in New Madrid County.

Figure 2.3. **New Madrid County School Districts**



2.1.16 Gideon 37 School District

The Gideon 37 School District buildings are located on 400 S Main St, Gideon, Missouri 63848. Table 2.9 provides building and enrollment information.

Table 2.3. **Gideon 37 School District Buildings and Enrollment Data, 2023**

District Name	Building Name	Building Enrolment
Gideon 37	Gideon High School	101
Gideon 37	Gideon Elementary School	136

[School Data | Missouri Department of Elementary and Secondary Education \(mo.gov\)](#)

Gideon 37 Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves 237 students approximately with 41 teachers and staff. District departments include:

- Transportation
- Cafeteria Services
- Custodial Services
- Health Services

- Central Office

Gideon completed a school emergency plan in August 2022. The school has a NOAA weather radio and an electronic alert system as well as emergency radios that will allow communication with the New Madrid County Sheriff's Office. To improve and expand its capabilities for hazard mitigation, Gideon might consider using its staff grant writer to seek funding offered by FEMA for mitigation planning. The district conducts drills throughout the year.

Table 2.13 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

2.1.17 New Madrid Co R1 School District

New Madrid R1 Schools are located at 310 US Highway 61, New Madrid, Missouri 63869. The district includes two additional elementary schools – one in Lilbourn and one in Matthews. Table 2.10 provides building and enrollment information.

Table 2.4. New Madrid Co R1 School District Buildings and Enrollment Data, 2023

District Name	Building Name	Building Enrolment
New Madrid County R1	High School	401
New Madrid County R1	Middle School	297
New Madrid County R1	Elementary (3): New Madrid, Lilbourn, Matthews	659

[School Data | Missouri Department of Elementary and Secondary Education \(mo.gov\)](#)

New Madrid Co R1 Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves 1357 students with approximately 165 teachers and staff. District departments include:

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

New Madrid County is equipped with NOAA weather radios and a PA system. The school is constructing a FEMA safe room. The schools perform periodic drills for inclement weather. The district might improve its hazard mitigation capabilities by seeking funding from FEMA with the assistance of Bootheel Regional Planning Commission to implement hazard mitigation planning activities. Table 2.13 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

2.1.18 Portageville School District

Portageville School District buildings are located at 904 and 1108 King Avenue in Portageville. Table 2.11 provides building and enrollment information.

Table 2.5. Portageville School District Buildings and Enrollment Data, 2023

District Name	Building Name	Building Enrolment
Portageville	Portageville High School	373
Portageville	Portageville Elementary	298

[School Data | Missouri Department of Elementary and Secondary Education \(mo.gov\)](#)

Portageville Schools are governed by a Board of Education consisting of the Board President and six board members. The district serves 671 students with approximately 69 teachers and staff. District departments include:

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

The school has an intercom system to broadcast emergency alerts. The district has NOAA weather radios. They practice safety drills throughout the year. They have a FEMA Safe Room in its final stages of being awarded. The district might consider seeking funding to expand its mitigation capabilities by adding a safe room or needed equipment. Table 2.13 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

2.1.19 Risco R-II School District

All Risco School District buildings are located on Highway 62, Risco, Missouri 63874. Table 2.16 provides building and enrollment information.

Table 2.6. Risco R-II School District Buildings and Enrollment Data, 2023

District Name	Building Name	Building Enrolment
Risco R-II	Risco High School	109
Risco R-II	Risco Elementary	106

[School Data | Missouri Department of Elementary and Secondary Education \(mo.gov\)](https://schools.mo.gov)

Risco R-II Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves 215 students approximately with 30 teachers and staff. District departments include:

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

Risco R-II Schools have NOAA weather radios and a PA system. The school district conducts safety drills throughout the school year. The school might consider adding a FEMA Safe Room or to seeking FEMA funding to provide additional equipment that would keep the district safer. Table 2.13 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

Table 2.7. Summary of Mitigation Capabilities – New Madrid County School Districts

Capability	Gideon 37	New Madrid Co R-1	Portageville	Risco R-II
Planning Elements				
Master Plan/ Date	Y	Y	Y	Y
Capital Improvement Plan/Date	Y	N	Y	N
School Emergency Plan / Date	Y	Y	Y	Y
Weapons Policy/Date	Y	Y	Y	Y
Personnel Resources				

Full-Time Building Official (Principal)	Y	Y	Y	Y
Emergency Manager	Y	N	Y	Y
Grant Writer	Y	N	Y	Y
Public Information Officer	Y	N	Y	Y
Financial Resources				
Capital Improvements Project Funding	Y	N	Y	Y
Local Funds	Y	Y	Y	Y
General Obligation Bonds	N	N	Y	N/A
Special Tax Bonds	N	N	Y	N/A
Private Activities/Donations	N	N	N	Y
State And Federal Funds/Grants	Y	Y	Y	Y
Capability				
Fire Evacuation Training	Y	Y	Y	Y
Tornado Sheltering Exercises	Y	Y	Y	Y
Public Address/ Emergency Alert System	Y	Y	Y	Y
NOAA Weather Radios	Y	Y	Y	Y
Lock-Down Security Training	Y	Y	Y	Y
FEMA Tornado Shelter/Saferoom	N	Y	Y	N
Campus Police	N	Y	Y	Y

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3 RISK ASSESSMENT

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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 risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these 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 in the planning area to better understand their potential risk to natural hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

A Multi-Jurisdictional Local Hazard Mitigation Plan was adopted in 2019. This risk assessment is an update to the risk assessment previously prepared.

The risk assessment for New Madrid County and participating jurisdictions followed the methodology described in the 2023 FEMA *Local Mitigation Planning Policy Guide*, which outlines the following risk assessment requirements:

- 1—Description of all natural hazards that can affect the jurisdiction
- 2—Inclusion of information on location for each identified hazard
- 3—Provision of the extent of the hazards that can affect the planning area
- 4—Inclusion of information on previous hazard events for each hazard that affects the planning area

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 risk; 2) Vulnerability Assessment further defines and quantifies populations, buildings, critical facilities, and other community/school or special district assets at risk to natural hazards; and 3) Problem Statement briefly summarizes the problem and develops possible solutions.

3.1 HAZARD IDENTIFICATION

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

The New Madrid County Hazard Mitigation Planning Committee has determined that this updated plan, as with past county plans, will address only natural hazards. Natural Hazard has been defined by I. Burton, R. Kates, and G. White in *The Environment as Hazard*, as “those elements of the physical environment, harmful to man

and caused by forces extraneous to him.” Consistent with this definition, war, chemical contamination, and other manmade phenomena are excluded from classification as a natural hazard. Natural hazards can take many forms. Happenings such as those listed below, which occur in a populated area, are referred to as hazardous events. It is not until significant property damage and loss of life result from a natural hazard that the phenomena are classified as a natural disaster.

3.1.1 Review of Existing Mitigation Plans

The Hazard Mitigation Planning Committee (HMPC) reviewed data and discussed the impacts of each hazard of prime concern that are included and profiled in the most recent State of Missouri Hazard Mitigation Plan and the 2019 New Madrid County Multi-Jurisdictional Local Hazard Mitigation Plan. The ten natural hazards of prime concern for Missouri and New Madrid County were:

- Flooding (Riverine and Flash);
- Levee Failure;
- Earthquake;
- Drought;
- Land Subsidence/Sinkholes;
- Extreme Temperatures;
- Severe Thunderstorms;
- Severe Winter Weather;
- Tornadoes; and
- Wildfires.

3.1.2 Review Disaster Declaration History

One method used by the HMPC to identify hazards was to examine events that triggered federal and/or state disaster declarations. Federal and/or state declarations may be granted when the severity and magnitude of an event surpasses the ability of the 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. Should the disaster be 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 federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), and/or the Small Business Administration. 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 the scale and type of damages and institutions or industrial sectors affected.

Table 3.1 lists federal disaster declarations received by New Madrid County. Each of the disaster events affected multiple counties. Some involved individual assistance, public assistance or both types of claims. Severe storms, tornadoes, and flooding were the most prevalent disasters.

A new type of disaster was declared in the timeframe from issuance of the last New Madrid County Hazard Plan in 2019 to this version of the report and that was the COVID-19 pandemic that swept the nation, impacting nearly every aspect of life in New Madrid County. The entry in Table 3.1 illustrates the huge impact in comparison with natural disasters that have been declared.

It is important to note that the federal government may issue a disaster declaration through the U.S. Department of Agriculture, as well as through FEMA. The quantity and types of damage and their impact on food sources are the factors that determine whether such declarations are issued.

The U.S. Department of Agriculture (USDA) provides assistance to farmers and other rural residents, as the

result of natural disasters. Agricultural-related disasters are quite common. One-half to two-thirds of the counties in the United States have been designated as disaster areas in each of the past several years. Agricultural producers may apply for low-interest emergency loans in counties named as primary or contiguous in a disaster designation.

Table 3.1. FEMA Disaster Declarations that included New Madrid County, Missouri, 1990-2022

Disaster Number	Declaration Date	Description	Individual Assistance (IA) Public Assistance (PA)
Major Disaster Declarations			
995	7/9/1993	SEVERE STORMS AND FLOODING	IA, PA
1054	6/2/1995	SEVERE STORMS, TORNADOES AND HAIL	IA, PA
1412	5/6/2002	SEVERE STORMS, TORNADOES AND FLOODING	IA, PA
3232	9/10/2005	HURRICANE KATRINA EVACUATION	PA
1631	3/16/2006	SEVERE STORMS, TORNADOES, AND FLOODING	IA, PA
3281	12/12/2007	SEVERE WINTER STORMS	PA
1749	3/19/2008	SEVERE STORMS AND FLOODING	IA, PA
1773	6/25/2008	SEVERE STORM AND FLOODING	IA, PA
1809	11/13/2008	SEVERE STORMS AND FLOODING	PA
3303	1/30/2009	SEVERE WINTER STORM	PA
1822	2/17/2009	SEVERE WINTER STORM	PA
3317	2/3/2011	SEVERE WINTER STORM	PA
1980	5/9/2011	SEVERE STORMS, TORNADOES, AND FLOODING	IA, PA
3374	1/2/2016	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS	PA
4250	1/21/2016	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS	PA
4317	6/2/2017	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS	PA
4435	3/11/2019	SEVERE STORMS, STRAIGHT-LINE WINDS AND FLOODING	PA
4451	7/9/2019	SEVERE STORMS, TORNADOES, FLOODING	IA, PA
3482	3/13/2020	MISSOURI COVID-19	PA
4490	3/26/2020	COVID-19 PANDEMIC	IA, PA
4552	7/9/2020	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, FLOODING	PA

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

3.1.3 Research Additional Sources

Additional sources of data on locations and past impacts of hazards in the planning area include:

- Missouri Hazard Mitigation Plans (2023 and 2019)
- Previously approved New Madrid County Multi-Jurisdictional Local Hazard Mitigation Plan (2019)
- Federal Emergency Management Agency (FEMA)
- Missouri Department of Natural Resources
- 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 Conservation
- Missouri Department of Transportation
- Missouri Division of Fire Marshal Safety
- Missouri Public Service Commission
- National Fire Incident Reporting System (NFIRS)
- National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI);
- New Madrid County Comprehensive Plans to the extent available
- New Madrid County Emergency Management
- New Madrid County Flood Insurance Rate Map, FEMA
- New Madrid County Flood Insurance Study, FEMA
- SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin
- U.S. Army Corps of Engineers
- U.S. Department of Transportation
- United States Geological Survey (USGS)
- Information provided by members of the Hazard Mitigation Planning Committee
- Various articles and publications available on the internet (sources are indicated where data is cited)

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 March 2023, as entered by the NWS. Due to changes in the data collection and processing procedures over time, there are unique periods of record available depending on the event type. The following timelines show the different time spans for each period of unique data collection and processing procedures.

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

Injuries and deaths caused by a storm event are reported on an area-wide basis. When reviewing a table resulting from an NCEI search by county, the death or injury listed in connection with that county search did not necessarily occur in that county.

3.1.4 Hazards Identified

After reviewing the hazards in the State Plan as well as the disaster declaration history, the HMPC agreed on a list of natural hazards that significantly affect the planning area. These hazards are listed below in Table 3.2 with an “X” indicating the affected jurisdictions. Each of these hazards is profiled in further detail in the next section. (B1a, B1b)

Table 3.2. Hazards Identified for Each Jurisdiction

Jurisdiction	Drought	Earthquake, seismic activity	Flooding (riverine and flash)	Extreme Temperatures	Levee Failure	Severe winter weather – snow, ice, extreme cold	Thunderstorms/ Hail, Winds	Tornado	Wildfires
New Madrid County	X	X	X	X	X	X	X	X	X
Matthews	X	X	X	X		X	X	X	X
Morehouse	X	X	X	X		X	X	X	X
New Madrid	X	X	X	X	X	X	X	X	X
Portageville	X	X	X	X		X	X	X	X
Gideon 37	X	X	X	X		X	X	X	X
New Madrid Co R-1	X	X	X	X	X	X	X	X	X
Portageville	X	X	X	X		X	X	X	X
Risco R-II	X	X	X	X		X	X	X	X

3.1.5 Multi-Jurisdictional Risk Assessment

For this multi-jurisdictional plan, the risk assessment presents each jurisdiction’s risks where they deviate from the risks facing the entire planning area. New Madrid County is located in the Bootheel of Missouri and its east border is the Mississippi River. The county is fairly uniform in terms of climate and construction characteristics. The entire county is rural. Therefore, most of the hazards apply to most jurisdictions. Each hazard includes a profile and any risk differences based on jurisdiction are included in each hazard profile.

Accordingly, overall hazards and vulnerability do not vary greatly across the planning area for most hazards. Weather-related hazards, such as drought, extreme temperatures, severe thunderstorms, severe winter weather, and tornado affect the entire planning area.

The two largest jurisdictions are New Madrid and Portageville. These two cities have more assets at a greater density, and therefore have greater vulnerability to weather-related hazards than the remaining areas. Rural areas in New Madrid County are comprised of agricultural assets, primarily crops, which are vulnerable to natural hazards such as flooding, high winds, extreme heat, and drought. The differences in vulnerability will be discussed in greater detail in the following sections of each hazard.

The previous chapter, Chapter 2 Planning Area Profile and Capabilities, discussed the existing mitigation capabilities of each jurisdiction, such as plans and policies, personnel, and financial resources, which are or could be used to implement measures to reduce hazard losses.

3.2 ASSETS AT RISK

This section assesses the population, structures, critical facilities and infrastructure, and other important assets in the planning area that may be at risk to natural hazards. There have been population decreases in the county. The communities in New Madrid County are small and rural with the greatest asset being the land.

3.2.1 Total Exposure of Population and Structures

Unincorporated County and Incorporated Cities

In the following three tables, population data is based on 2020 Decennial Census published by the US Census Bureau. Building counts and building exposure values are based on parcel data provided by the State of Missouri Geographic Information Systems (GIS) database. 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 Table 3.3. Land values have been purposely excluded from consideration because land remains following disasters, and subsequent market devaluations are frequently short term and difficult to quantify. Another reason for excluding land values is that state and federal disaster assistance programs generally do not address loss of land (other than crop insurance). It should be noted that the total valuation of buildings is based on 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. It should be noted 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 participating city. Table 3.4 that follows provides the building value exposures for the county and each participating city in the planning area broken down by usage type. Table 3.5 provides the building count total for the county and each participating city in the planning area broken out by building usage types (residential, commercial, industrial, and agricultural).

Table 3.3. Maximum Population and Building Exposure by Jurisdiction

Jurisdiction	2020 Population	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
City of Matthews	534	479	\$35,204,000	\$16,881,000	\$52,085,000
City of Morehouse	741	866	\$53,654,435	\$28,118,360	\$81,772,795
City of New Madrid	2,787	2,152	\$151,535,753	\$84,506,057	\$326,041,810
City of Portageville	2,942	2,062	\$146,712,302	\$79,439,546	\$226,151,848
Unincorporated New Madrid County	9,430	10,702	\$398,382,224	\$225,136,213	\$623,518,437
Totals	16,434	16,261	\$785,488,714	\$434,081,176	\$1,309,569,890

Source: U.S. Bureau of the Census, 2021 population estimates ; Building Count and Building Exposure, Missouri Outreach Folders – All Hazards Risk Data; 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/Content Exposure by Usage Type

Jurisdiction	Agriculture	Commercial	Education	Government	Industrial	Residential	Total
City of Matthews	\$62,000	\$3,822,000	\$4,534,000	\$400,000	\$1,303,000	\$41,963,000	\$52,084,000
City of Morehouse	\$177,000	\$3,822,000	\$0	\$1,001,000	\$434,000	\$76,339,000	\$81,773,000
City of New Madrid	\$508,000	\$42,046,000	\$5,829,000	\$2,802,000	\$1,737,000	\$183,119,000	\$236,041,810
City of Portageville	\$35,000	\$25,228,000	\$6,477,000	\$2,401,000	\$6,081,000	\$185,929,000	\$226,151,000
Unincorporated New Madrid County	\$24,364,000	\$59,629,000	\$8,420,000	\$2,001,000	\$67,325,000	\$461,779,000	\$623,518,000
Totals	\$25,146,000	\$134,547,000	\$25,260,000	\$8,605,000	\$76,880,000	\$949,129,000	\$1,219,567,810

Source: Missouri Outreach Folders

Table 3.5. Building Counts by Usage Type

Jurisdiction	Agriculture	Commercial	Education	Government	Industrial	Residential	Total
City of Matthews	14	5	7	2	3	448	479
City of Morehouse	40	5	0	5	1	815	866
City of New Madrid	115	55	9	14	4	1,955	2,152
City of Portageville	8	33	10	12	14	1,985	2,062
Unincorporated New Madrid County	5,516	78	13	10	155	4,930	10,702
Totals	5,693	176	39	43	177	10,133	16,261

Source: Missouri Outreach Folders, All Hazards Risk Data

The number of enrolled students at 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) from school Data Collection Questionnaires.

Table 3.6. Population and Building Exposure by Participating Public School Districts

Public School District	Enrollment	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
Gideon 37	237	10	\$10,715,938	\$2,958,965	\$13,674,903
New Madrid Co R-1	1,357	5	\$96,929,640	\$16,334,521	\$113,264,161
Portageville	671	14	\$29,640,702	\$5,269,394	\$34,910,096
Risco R-II	215	6	\$13,456,952	\$1,702,262	\$15,159,214
Totals	2,480	35	\$150,743,232	\$26,265,142	\$177,008,374

Source: [School Directory | Missouri Department of Elementary and Secondary Education \(mo.gov\)](#), HMPC Data Collection Questionnaires from Public School Districts 2023

3.2.2 Critical and Essential Facilities and Infrastructure

As part of the update to the New Madrid County Multi-Jurisdictional Hazard Mitigation Plan, participating jurisdictions assessed the vulnerability of the following types of facilities below:

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

Table 3.7 includes a summary of the inventory of critical and essential facilities and infrastructure in the planning area. This inventory was compiled from the 2023 Data Collection Questionnaires. The full list of critical facilities is included in Appendix F. This was created in 2023 by New Madrid County Emergency Management.

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

Jurisdiction	Airport Facility	Childcare Facility	Communications Towers	Emergency Operations	Fire Service	Government	Hospital/Health Care	Nursing Homes	Police Station	School Facilities	Stormwater/Wastewater	TOTAL
Matthews	0	0	1	0	1	2	1	1	1	1	0	8
Morehouse	0	0	1	0	0	0	0	0	0	0	0	1
New Madrid	0	2	17	3	1	3	1	2	2	2	0	33
Portageville	0	2	18	1	1	2	2	1	1	4	1	33
Unincorporated New Madrid County	0	0	0	0	0	0	0	0	1	0	0	1
Totals	0	4	37	4	3	7	4	4	5	7	1	76

Source: Information from New Madrid County EMD

Figure 3.1 illustrates the locations of bridges in the planning area included in the National Bridge Inventory data set. For 2020, the Bureau of Transportation Statistics data set identified 284 bridges within New Madrid County, 150 in good condition, 110 in fair condition and 24 in poor condition.

There are 221 scour critical bridges in Missouri, according to the 2023 State Hazard Mitigation Plan. Of those, seven are in New Madrid County and an eighth is on its border with Pemiscot County as shown in Figure 3.2. Scour critical bridges are those bridges that are vulnerable to scour during a flood. Bridge scour is the removal of sediment such as sand and rocks from around bridge abutments or piers. Scour is caused by swiftly moving water and can scoop out scour holes, compromising the integrity of the bridge. The National Bridge Inventory uses a classification system of 0-3 to indicate the potential for scour. Bridges in the 0-1 categories are those that are at or near failure due to scour; those in the 2-3 categories are vulnerable to scour and determined to be unstable.

Figure 3.1. New Madrid County Bridges



Source: modot.org

Figure 3.2. Missouri Scour Critical 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.

The following section of the plan identifies specific natural, historic, cultural, and economic assets in the planning area.

Threatened and Endangered Species:

Table 3.8 lists federally threatened, endangered, proposed and candidate species in New Madrid County.

Table 3.8. Threatened and Endangered Species in New Madrid County

Common Name	Scientific Name	Status
Gray Bat	Myotis grisescens	Endangered
Indiana Bat	Myotis sodalis	Endangered
Northern Long-Eared Bat	Myotis septentrionalis	Endangered
Pallid Sturgeon	Scaphirhynchus albus	Endangered
Tri-colored Bat	Perimyotis subflavus	Proposed Endangered
Alligator Snapping Turtle	Macrochelys temminckii	Proposed Threatened
Fat Pocketbook	Potamilus capax	Endangered
Monarch Butterfly	Danaus plexippus	Candidate

Source: US Fish and Wildlife Service iPAC ecosphere

Natural Resources: As part of its mission to protect and manage the fish, forest, and wildlife resources of the state and to facilitate and provide opportunity for all citizens to use, enjoy, and learn about these resources, the Missouri Department of Conservation (MDC) maintains a database of lands the MDC owns, leases, or manages for public use. Table 3.9 provides the names and locations of access and conservation areas in the planning area and also top parks as listed by anyplaceamerica.com.

Table 3.9. Conservation Areas in New Madrid County

Conservation Area Name	Location	City
Swift Ditch Access	9 miles south of Sikeston on I-55, exit Hwy 80 east .1 miles and then Route V south 1.3 miles, then continue on Co Rd 702 .25 miles.	South of Sikeston
New Madrid Bend Access	From I-55 exit 44 at New Madrid, take Hwy 61 east approx. 1 mile, then take Bloomfield Rd south.	Southeast of New Madrid
Donaldson Point Conservation Area	From New Madrid, take Rte WW east, then Rte AB south and Co Rd 405.	Southeast of New Madrid
John L and Georgia Girvin Conservation Area	From Portageville, take Hwy 162 east, then 439 south 1 mile, cross the levee and park. Proceed 2.5 miles southeast on private dirt roads.	South of Portageville
Seven Island Access	From New Madrid, take Rte WW east 11 miles.	East of New Madrid

Source: [Conservation Areas Search | Missouri Department of Conservation \(mo.gov\)](#)

Public Park Name	City
Hunter-Dawson State Park	New Madrid
Meatte Park	Portageville
Skate Park	New Madrid
Veterans Park	New Madrid

Source: anyplaceamerica.com; 2019 New Madrid Hazard Mitigation Plan

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 identifies the properties in New Madrid County that are on the National Register of Historic Places.

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

Property	Address	City	Date Listed
Double Bridges Archaeological Site	Address restricted		7/25/74
Howardville School	6916 US Hwy 61	Howardville	11/22/17
Hunter-Dawson House	312 Dawson Road	New Madrid	8/28/12
Hurricane Ridge Site	Address restricted		11/9/72
King II Archaeological Site	Address restricted		6/26/75
LaPlant Archaeological Site	Address restricted		7/25/74
Lilbourn Fortified Village Archaeological Site	Address restricted		7/29/69
Portwood Village and Mound	Address restricted		11/25/77
St Johns-LaPlant IV Archaeological District	Address restricted		8/28/75
Sikeston Fortified Village Archaeological Site	Address restricted		2/12/71

Source: Missouri Department of Natural Resources – Missouri National Register Listings by County

Economic Resources: Table 3.11 identifies major non-government employers in the planning area.

Table 3.11. Major Non-Government Employers in New Madrid County

Employer Name	Main Locations	Product or Service	Employees
SRG Global	Portageville	Plastics/Automotive	400+
Riceland	Marston	Rice Milling	100+
Magnitude 7 Metals	Marston	Metal Production	107
Pilot, Loves, T/A Truck Stops	Matthews	Retail	150+
Associated Electric	New Madrid	Power Plant	150+
Pioneer Hi-Bred	New Madrid	Ag Production	65+

Source: Data Collection Questionnaires 2023, Internet search

Agriculture: Agriculture plays a significant role in New Madrid County's economy. The top crops in acres are corn, soybeans and cotton. Table 3.12 details agriculture-related jobs in New Madrid County.

Table 3.12. Agriculture-Related Jobs in New Madrid County

	Unpaid	1 Worker	2 Workers	3-4 workers	5-9 workers	10 or more workers
# of Farms	70	28	44	51	33	5
# of Workers	117	28	88	173	223	76

Source: Census of Agriculture 2017, County Data

As of 2017, 161 farms in New Madrid County reported having a total of 588 workers across all farms reporting.

3.3 LAND USE AND DEVELOPMENT

3.3.1 Development Since Previous Plan Update

Since 2010, New Madrid County has decreased in population by 13.3% (2,522 persons) and the number of housing units has declined as well. Table 3.13 and Table 3.14 present this data by participating jurisdiction.

Table 3.13. County Population Growth, 2010 to 2020

Jurisdiction	2010 Population	2020 Population	2010-2020 # Change	2010-2020 % Change
New Madrid County total	18,956	16,434	2,522	-13.3%
City of Matthews	628	534	-94	-15.1%
City of Morehouse	973	741	-232	-23.8%
City of New Madrid	3,116	2,787	-329	-10.6%
City of Portageville	3,228	2,942	-286	8.9%

Source: U.S. Bureau of the Census, Decennial Census, Population as reported by the Census Bureau

Population growth or decline is generally accompanied by increases or decreases in the number of housing units. Table 3.14 depicts the change in numbers of housing units in the planning area from 2010 to 2020.

Table 3.14. Change in Housing Units, 2010-2020

Jurisdiction	Housing Units 2010	Housing Units 2020	2010-2020 # Change	2010-2020 % Change
New Madrid County	8,608	8,609	+1	0.0%
City of Matthews	345	272	-73	-21.2%
City of Morehouse	485	486	-1	0.2%
City of New Madrid	1,482	1,663	-181	-12.2%
City of Portageville	1,383	1,269	-114	-8.2%

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 likely trend in New Madrid County is that agricultural and agricultural related industry will continue to be a large part of the county economy. The county is experiencing a steady population decline.

Future development plans as reported on Data Collection Questionnaires are below. None of these developments should have a significant impact on hazard mitigation in the county.

City of Matthews – no future development is planned.

City of Morehouse – the city has had a flurry of recent grants that were awarded that will lead to new construction and facilities:

- Community Center grant
- Wastewater Infrastructure grant
- CWERG grant
- Lead service line grant

City of New Madrid – There are two new planned facilities – CST, a waste to renewable energy plant and another is yet to be named but it will be a soybean production facility. Neither is in the 100 year floodplain.

City of Portageville – none.

Unincorporated New Madrid County – none.

School District's Future Development

Data Collection Questionnaires were reviewed to see what planned improvements each participating school district has.

Gideon 37 School District – no new construction is being planned. The plan is to maintain the buildings the district already has.

New Madrid County R-1 School District – no new construction is being planned.

Portageville School District - the district is adding a FEMA safe room and a new football concession building. Neither are in known hazard areas.

Risco R-II School District – no new construction is being planned unless awarded FEMA funding.

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 is profiled individually in this section in alphabetical order. The level of information presented in the profiles varies by hazard based on the information available. With each update of this plan, new information will be incorporated to provide for 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:** (B1f) This section describes the geographic areas in the planning area that are affected by the hazard. Where available, maps indicate the specific locations of the planning area that are vulnerable to the subject hazard. For most 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. This section should also include information on the typical or expected strength/magnitude/extent of the hazard in the planning area. 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 can be 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 should be 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 can be based on the number of months in drought in a given time-period and expressed as the probability for any given month to be in drought.(B1e)

- **Changing Future Conditions Considerations and the Impact of Climate Change:** This section presents potential changes to each hazard that are expected to occur due to variations in environment and climate. Predictions about the changes are contingent upon available research; therefore, some hazards have limited or unknown information.

It is difficult to predict the scope, severity, and pace of changing future conditions and the impacts posed by more intense storms, frequent heavy participation, heat waves, drought, and extreme flooding; none-the-less, according to the FEMA Climate Change Adaptation Policy Statement, they can significantly change the probabilities and magnitudes of hazards faced by communities.

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 natural hazards. The vulnerability assessment for this plan followed the methodology described in the FEMA publication *Understanding Your Risks—Identifying Hazards and Estimating Losses* (2002).

The vulnerability assessment was conducted based on the best available data, including data that was collected for the previous plan update. Data to support the vulnerability assessment was collected from the following sources:

- Personal interviews with HMPC members and other stakeholders; and,
- Other sources as cited.

The Vulnerability Assessment is divided into four parts:

- **Vulnerability Overview:** Provides 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:** Describes the potential impacts of the hazard. Impact means the consequences of effect of the hazard on the jurisdiction and its assets. Assets are determined by the community and include, for example, people, structures, facilities, systems, capabilities, and/or activities that have value to the community.
- **Previous and Future Development:** Presents how changes in development have impacted the community’s vulnerability to this hazard and describes how any changes in development that occurred in known hazard prone areas since the previous plan have increased or decreased the community’s vulnerability. This section also describes anticipated future development in the county, and how that would impact hazard risk in the planning area.
- **Hazard Summary by Jurisdiction:** For hazard risks that vary by jurisdiction, this section provides an overview of the variation and the factual basis for that variation.

Problem Statements

Each hazard analysis includes a summary of the problems created by the hazard in the planning area and possible ways to resolve those problems. The focus of the problem statements sub-section is to synthesize the “problems” revealed through the risk assessment with the process of updating the mitigation strategy and developing mitigation actions that are aimed at “solving” the identified problems.

3.4.1 Flooding (Riverine and Flash)

Hazard Profile

Hazard Description

A flood is partial or complete inundation of normally dry land areas. Riverine flooding is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt, or ice. There are several types of riverine floods, including headwater, backwater, interior drainage, and flash flooding. Riverine flooding is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt or ice melt. The areas adjacent to river 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 levee failure is discussed in Section 3.4.2. It will not be addressed in this section.

A flash flood occurs when water levels rise at an extremely fast rate due to 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 disperse 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 up 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

The table below (3.15) provides the number of riverine flood events by location as recorded by the NCEI for the 26-year period between 1997 and 2022 within New Madrid County and its incorporated cities.

Table 3.15. NCEI New Madrid County Flood Events Summary, 1997 to 2022 (B2c)

Location	# of Events
New Madrid (city)	38
Portageville	2
New Madrid County, incorporated and other non-participating cities	14
- Bayouville	1
- Canalou	1
- Howardville	1
- Linda	1

Source: National Centers for Environmental Information

Flash floods occur in SFHA (Special Flood Hazard Areas) and in low-lying areas in the planning area. They also occur in areas without adequate drainage to carry away the amount of water that falls during intense rainfall events. Table 3.16 summarizes the number of flash flood events during a 20-year time period.

Table 3.16. NCEI New Madrid County Flash Flood Events Summary, 2003 to 2022 (B2c)

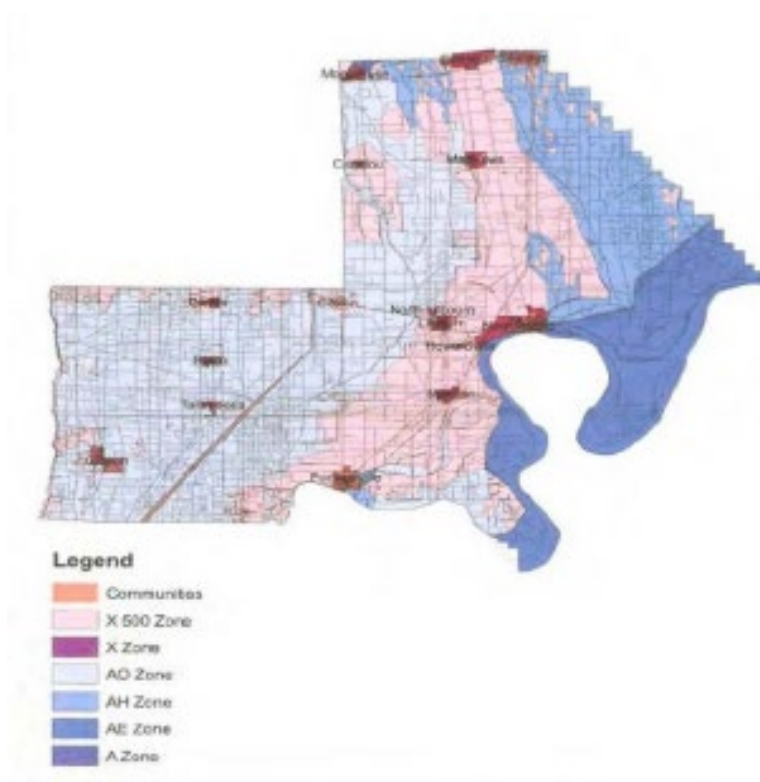
Location	# of Events
Matthews	1
Morehouse	1
New Madrid	3
New Madrid County, unincorporated and other non-participating cities	4
- Bayouville - 1	

Location	# of Events
- Howardville - 2	
- Noxall - 1	
- Wardell – 1	
- Kinfolk Ridge – 1	

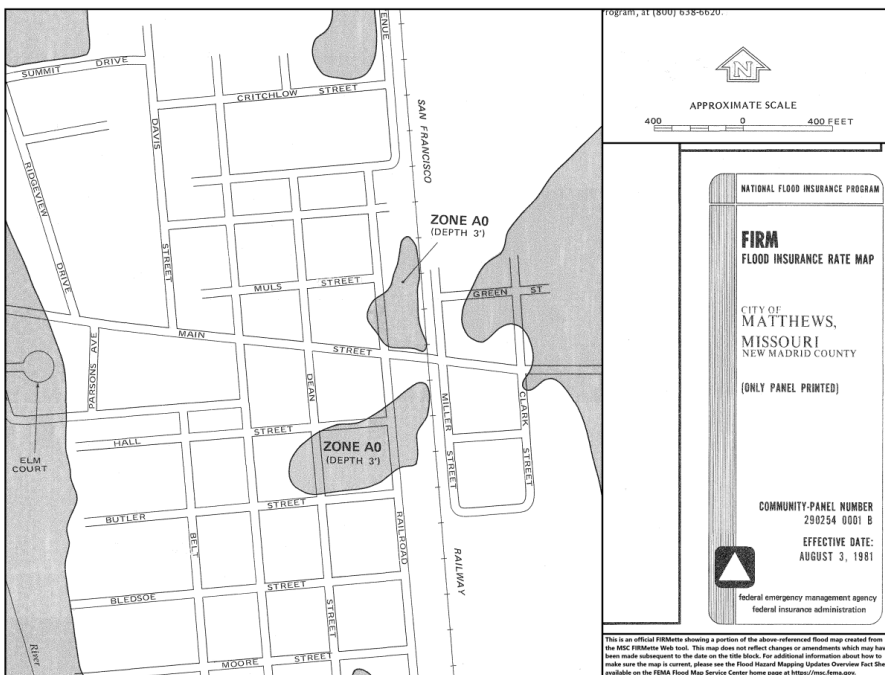
Figure 3.3 depicts the areas of the planning area that are at risk to the 1% annual chance of flood, also known

as the 100-year floodplain. Figures following 3.3 are each of the participating communities' FIRM maps.

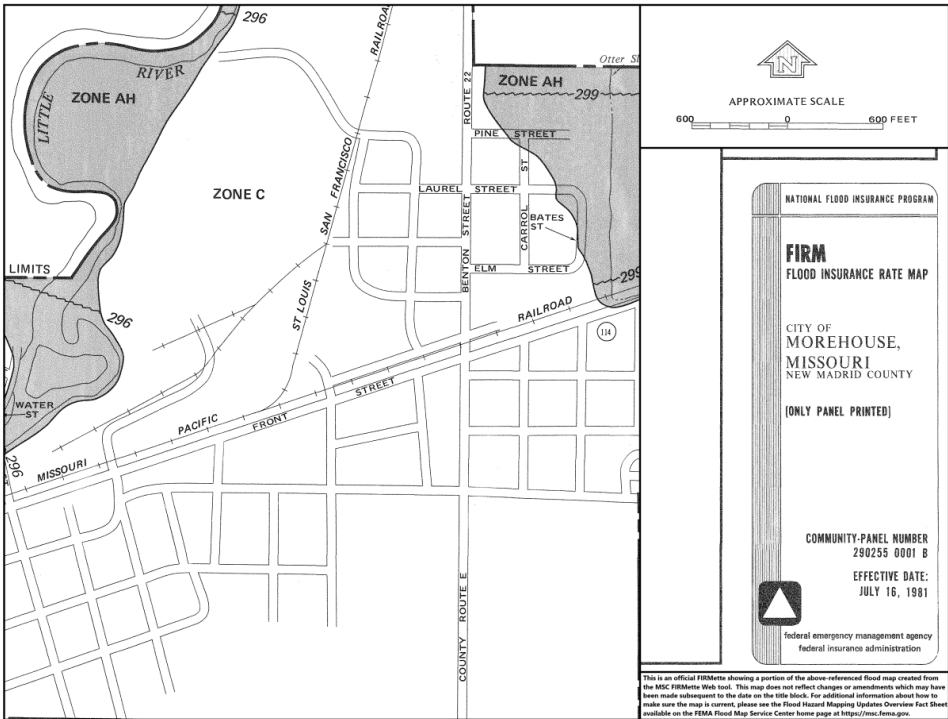
Figure 3.3. New Madrid County Floodplain Map



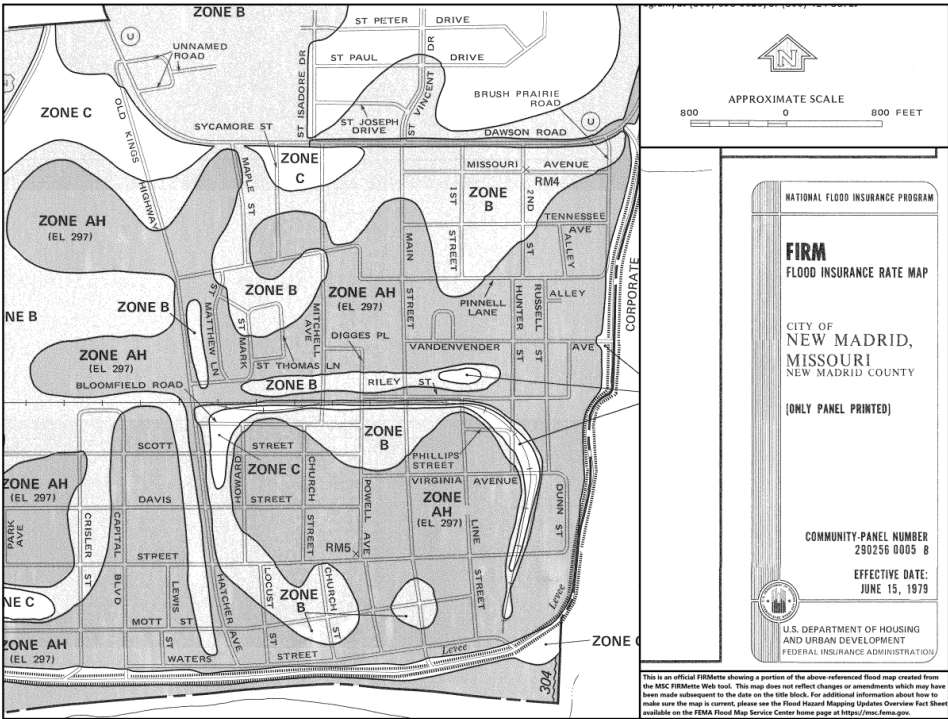
City of Matthews FIRM



City of Morehouse FIRM



City of New Madrid FIRM



City of Portageville



Strength/Magnitude/Extent

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

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

National Flood Insurance Program (NFIP) Participation

Table 3.17 provides details on participation in the National Flood Insurance Program, as well those responsible for floodplain administration. Table 3.18 details policy and claim statistics. Copies of floodplain ordinances can be found in Appendix G. All participating jurisdictions have a floodplain ordinance that addresses specific NFIP requirements regarding their substantial damage/substantial improvement provisions and development in the SFHA as illustrated in Table 3.19.

Table 3.17. Community Participation in the National Flood Insurance Program in New Madrid County, 2023

Jurisdiction	Status Date – Participating Regular Since	Floodplain Management Ordinance In Place	CRS Participant (Y/N)/ Class	Effective FIRM Date	Responsible for Floodplain Regs in SFHAs	Responsible for Floodplain Admin
Matthews	8/03/81	X	N	8/03/81	Jody O’Barr	Jody O’Barr
Morehouse	1/06/11	X	N	1/06/11	Joe Brashears	Joe Brashears
New Madrid	6/15/79			6/15/79		
Portageville	12/4/79	X	N	11/2/90	Jonathan Thacker	Jonathan Thacker
Unincorporated New Madrid County	9/5/90	X	N	9/5/90	Patrick Hunter	Patrick Hunter

Source: NFIP Community Status Book and New Madrid County Hazard Mitigation Committee

Table 3.18. NFIP Policy and Claim Statistics as of 9/30/23

Community Name	Policies in Force	Insurance in Force	Closed Losses	Total Payments
Matthews	5	\$559,000	0	\$0
Morehouse	7	\$1,013,000	0	\$0
New Madrid	157	\$25,818,000	9	\$119,011
Portageville	13	\$2,857,000	2	\$36,981
Unincorporated New Madrid County	120	\$19,052,000	3	\$11,137

Source: [nfip_hudex-policy-and-loss-data-by-geography_20220930.xlsx \(live.com\)](https://www.flood.gov/nfip-hudex-policy-and-loss-data-by-geography-20220930.xlsx)

The City of New Madrid incurred the most losses (9), collecting \$119,011.

Table 3.19. Jurisdiction Approach to NFIP Compliance for Damage, Improvement, Development in SFHA

Community Name	Substantial Damage/Substantial Improvement Provisions	Development in SFHA
Matthews	Ordinance Article II	Ordinance Article II
Morehouse	Ordinance p 18-19	Ordinance p 3, Article 3
New Madrid	Ordinance Sect 2, Division 3	Ordinance Sect 2, Division 2
Portageville	Ordinance Article II	Ordinance Article IV
Unincorporated New Madrid County	Ordinance p 20	Ordinance p. 3-4, p 19

Source: Floodplain Ordinances, participating jurisdictions

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. According to the Flood Insurance Administration, participating jurisdictions included in the planning area have a combined total of 12 repetitive loss properties. As of 2023, no properties have been mitigated.

Table 3.20. New Madrid County Repetitive Loss Properties

Jurisdiction	# of Properties Unmitigated	Type of Property	# Mitigated	Building Payments	Content Payments	Total Payments	Average Payment	# of Losses
New Madrid County	4	Residential	0	\$183,633	\$34,060	\$217,693	\$27,212	8
New Madrid, City of	8	Residential	0	\$333,843	\$38,664	\$372,507	\$18,625	20

Source: Missouri SEMA as of 10/2/23

Severe Repetitive Loss (SRL): A SRL property is defined it as a single family property (consisting of one-to-four residences) that is covered under flood insurance by the NFIP; and has (1) incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage with the amount of each claim payment exceeding \$5,000 and with cumulative amounts of such claims payments exceeding \$20,000; or (2) for which at least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property. There were no severe repetitive losses in New Madrid County.

Previous Occurrences

Flood events, as reported in the NOAA (National Oceanic and Atmospheric Administration) storm events database were reviewed. There were flood events in the Planning Area between 2003 and 2022. Of these 55, 8 were reported as flash flood events and 47 were reported as riverine events.

In addition, New Madrid County has been included in 10 Presidential disaster declarations that included flooding between 1990 and 2022. Historical accounts of flooding events are recorded below. Sources include the NOAA database, FEMA, local news, and planning committee member accounts.

Table 3.21. NCEI New Madrid County Flash Flood Events Summary, 2003 to 2022 (B2c)

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
2004	1	0	0	0	0
2006	1	0	0	\$40,000	0
2007	1	0	0	0	0
2011	1	0	0	\$70,000,000	\$30,000
2014	1	0	0	0	0
2017	1	0	0	0	0
2018	1	0	0	0	0
2019	1	0	0	0	0
Total	8	0	0	\$70,040,000	\$30,000

Source: [Storm Events Database - Search Results | National Centers for Environmental Information \(noaa.gov\)](#)

Table 3.22. NCEI New Madrid County Riverine Flood Events Summary, 2003 to 2022

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
2003	1	0	0	0	0
2004	1	0	0	0	0
2005	1	0	0	0	0
2006	1	0	0	\$750,000	\$17,000,000
2008	3	0	0	\$275,000	0
2009	2	0	0	0	\$30,000
2010	3	0	0	0	\$10,000
2011	6	0	0	\$3,500,000	0
2013	3	0	0	0	0
2014	1	0	0	0	0
2015	3	0	0	0	\$300,000
2016	1	0	0	\$20,000	0

2017	1	0	0	\$8,000	\$100,000
2018	3	0	0	0	0
2019	7	0	0	\$60,000	\$1,030,000
2020	7	0	0	\$20,000	\$50,000
2021	2	0	0	\$5,000	0
2022	1	0	0	0	0
Total	47	0	0	\$4,638,000	\$18,520,000

Source: [Storm Events Database - Search Results | National Centers for Environmental Information \(noaa.gov\)](https://www.noaa.gov/storm-events-database-search-results)

Probability of Future Occurrence

The potential for flooding can change and increase through various land use changes and changes to land surface. A change in environment can create localized flooding problems inside and outside of natural floodplains through the alteration or confinement of natural drainage channels. These changes can be created by human activities or by other events, such as wildfires, earthquakes, or landslides.

Based on data from NCEI from 2003 to 2022, there were 55 records of flooding, 47 flood and 8 flash flood events over a 20-year period. That equates to a probability of 2.35 for flood events and .4 for flash flood events. The average number of any type of flood event calculates to 2.75 per year.

Changing Future Conditions Considerations and the Impact of Climate Change

According to the 2023 Missouri State Hazard Mitigation Plan, “the expected increases in rainfall frequency and intensity are likely to put additional stress on natural hydrological systems and community stormwater systems. Heavier snowfalls in the winter will lead to intensified spring flooding, and groundwater levels will remain high even in non-floodplain areas. Such changes in climate patterns can lead to the development of compounding events that interact to create extreme conditions. Flooding caused by high groundwater levels typically recedes more slowly than riverine flooding, slowing the response and recovery process. Groundwater-fed rivers and streams are also likely to experience heightened flooding when groundwater levels are high.”

Vulnerability

Vulnerability Overview

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

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

When roads and bridges are inundated by water, damage can occur as the water scours materials around bridge abutments and gravel roads. Flood waters can also cause erosion undermining road beds. In some instances, steep slopes that are saturated with water may cause mud or rock slides onto roadways. These damages can cause costly repairs for state, county, and city road and bridge maintenance departments. When sewer back-up occurs, this can result in costly clean-up for home and business owners as well as present a health hazard.

The 2023 State Hazard Mitigation Plan takes into account the following for calculating the vulnerability of the state to flood incidents: spatial analysis of exposure, estimation of losses and a review of historical damages. See Section 3.3.2 Critical and Essential Structures and Infrastructure for a discussion on scour critical bridges.

Potential Losses to Existing Development

It should be noted that all New Madrid County communities can be impacted by flooding of major roads and low water crossings in the areas proximate to their corporate limits. Several incorporated areas in the county

are susceptible to street flooding during periods of heavy rain. Tables 3.21 and 3.22 above illustrate the dollars in damage incurred from riverine and flash floods in the county for the past 20 years. Table 3.23 provides the average losses by jurisdiction annually due to flooding.

Table 3.23. Average Yearly Losses by Jurisdiction 2003-2022

Jurisdiction	Riverine Flooding	Flash Flooding
City of Matthews	0	0
City of Morehouse	0	0
City of New Madrid	\$30,650	0
City of Portageville	\$0	0
Unincorporated New Madrid County	\$37,500	\$2,000
Total	\$68,150	\$2,000

Impact of Previous and Future Development

Future development could impact flash and riverine flooding in New Madrid County. 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 of flash flooding. Future development would also increase impervious surfaces causing additional water run-off and drainage problems during heavy rainfall events.

According to the population and housing unit trend analysis, there is very little growth occurring in New Madrid County and participating communities. Flood risk should not be increasing; assuming that floodplain ordinances are being effectively implemented and wise use of floodplains is being encouraged.

Any future development should also take into consideration the impact of additional impervious surfaces to water run-off and drainage capabilities during heavy rainfall events.

EMAP Consequence Analysis

Table 3.24. EMAP Impact Analysis: Flooding

Subject	Detrimental Impacts
Public	Localized impact expected to be severe for incident areas and moderate to light for other adversely affected areas.
Responders	Localized impact expected to limit damage to personnel in the flood areas at the time of the incident.
Continuity of Operations	Damage to facilities/personnel in the area of the incident may require temporary relocation of some operations. Localized disruption of roads, facilities, and/or utilities caused by incident may postpone delivery of some services.
Property, Facilities, and Infrastructure	Localized impact to facilities and infrastructure in the area of the incident. Some severe damage possible.
Environment	Localized impact expected to be severe for incident areas and moderate to light for other areas affected by the flood or HazMat spills.
Economic Condition of Jurisdiction	Local economy and finances adversely affected, possibly for an extended period of time.
Public Confidence in the Jurisdiction’s Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective.

Hazard Summary by Jurisdiction

Flooding, especially flash flooding, can impact any area of New Madrid County. The flooding will vary by jurisdiction. Risco R-2 is the only school district located in an SFHA (Special Flood Hazard Area). In general, school districts face the same risk as the city or county in which they are located. The following is a hazard summary by jurisdiction.

New Madrid County – the unincorporated portion of the county has experienced 2 flash flood and 6 riverine flood events in the past 20 years.

City of Matthews – has experienced 1 flash flood event and no riverine floods in the past 20 years.

City of Morehouse – has experienced 1 flash flood event in the past 20 years.

City of New Madrid – is most susceptible to flooding than the remainder of the county illustrated by 2 flash and 36 riverine flooding events in the past 20 years.

City of Portageville – has experienced no flash flooding and 2 riverine flooding events in the past 20 years.

Problem Statement

- The county is bordered by the Mississippi River on the east which is the reason it has endured many riverine floods in the past 20 years. There have been many floods that have caused extensive damage. The county should continue to be vigilant in following NFIC recommendations.
- Flash flooding in New Madrid County occurs occasionally. Jurisdictions should monitor areas that flood most and make infrastructure adjustments as needed.

3.4.2 Levee Failure

Hazard Profile

Hazard Description

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

Levees can be small agricultural levees that protect farmland from high-frequency flooding. Levees can also be larger, designed to protect people and property in larger urban areas from less frequent flooding events such as the 100-year and 500-year flood levels. For purposes of this discussion, levee failure will refer to both overtopping and breach as defined in FEMA's Publication "So You Live Behind a Levee" (<http://mrcc.isws.illinois.edu/1913Flood/awareness/materials/SoYouLiveBehindLevee.pdf>).

Following are the FEMA publication descriptions of different kinds of levee failure.

Overtopping: When a Flood Is Too Big

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

Breaching: When a Levee Gives Way

A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed

levee with little or no warning.

Earthen levees can be damaged in several ways. For instance, strong river currents and waves can erode the surface. Debris and ice carried by floodwaters—and even large objects such as boats or barges—can collide with and gouge the levee. Trees growing on a levee can blow over, leaving a hole where the root wad and soil was. Burrowing animals can create holes that enable water to pass through a levee. If severe enough, any of these situations can lead to a zone of weakness that could cause a levee breach. In seismically active areas, earthquakes and ground shaking can cause a loss of soil strength, weakening a levee and possibly resulting in failure. Seismic activity can also cause levees to slide or slump, both of which can lead to failure.

Geographic Location

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

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

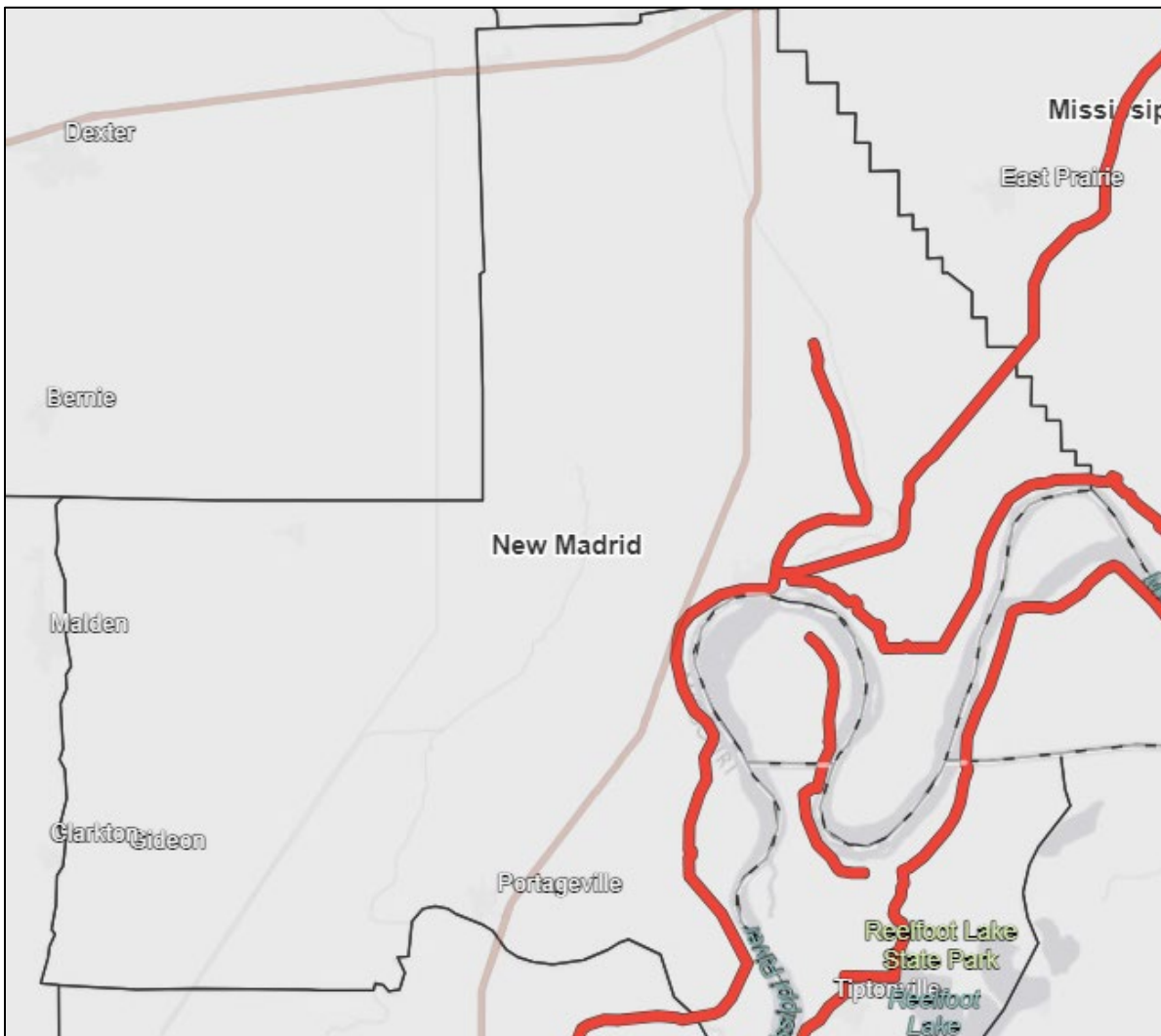
It is likely that agricultural levees and other non-regulated levees within the planning area exist that are not inventoried or inspected. These levees that are not designed to provide protection from the 1-percent annual chance flood would overtop or fail in the 1-percent annual chance flood scenario.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

The latest version of the NLD includes a searchable database of levees. In New Madrid County, there are three levee systems shown on the NLD:

- Commerce Mo – St Francis River System
- New Madrid Floodway System
- New Madrid – Sikeston Ridge Levee System

Figure 3.4 presents the location of these levees in and around New Madrid County. Figures 3.5, 3.6 and 3.7 present areas protected by levee systems.

Figure 3.4. NLD Levee Locations in and near New Madrid County



Source: National Levee Database

Approximately 40 miles of the Mississippi River borders New Madrid County on the southeastern side. Levee systems have been put into place to help alleviate flooding of the county.

Strength/Magnitude/Extent

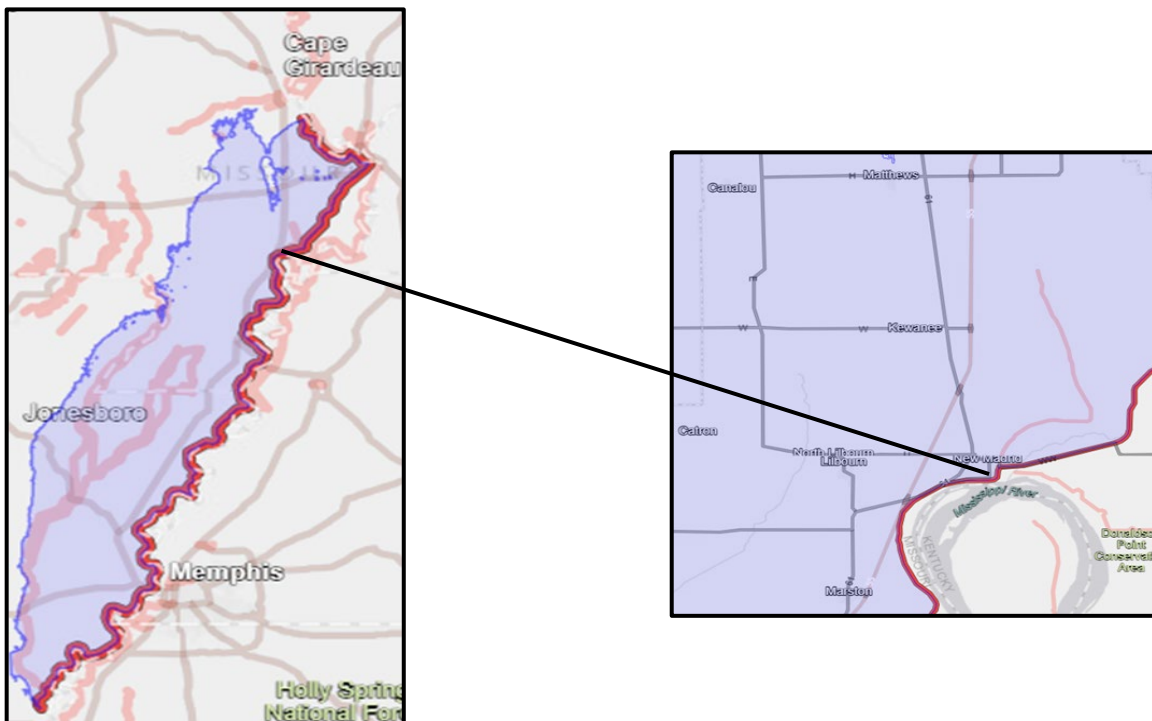
Levee failure is typically an additional or secondary impact of another disaster such as flooding or earthquake. The main difference between levee failure and losses associated with riverine flooding is magnitude. Levee failure often occurs during a flood event, causing destruction in addition to what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

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

Previous Occurrences

Generally, levees protecting New Madrid County have held firm in the recent past. The most notable nearby levee breach was intentional in Mississippi County to the north in 2011. The US Army Corps of Engineers activated the Birds Point-New Madrid floodway by detonating explosives along a stretch of the Mississippi River levee downstream of Cairo, Illinois.

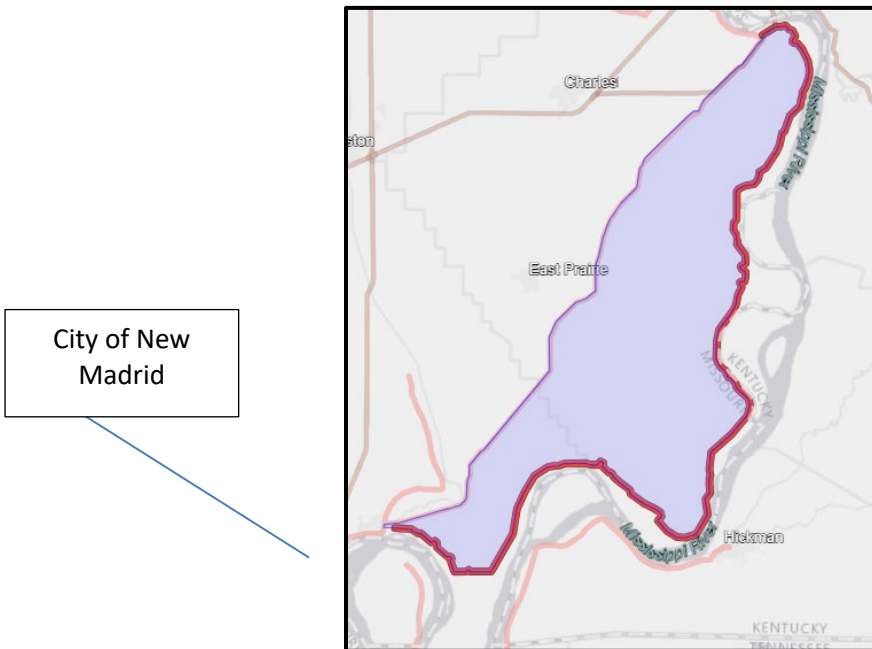
Figure 3.5. Mapping Areas Protected by Levee Systems Serving New Madrid County – the Commerce, Mo – St Francis River Levee System



Source: National Levee Database

The Commerce, Mo – St Francis River Basin Levee System spans from just south of Cape Girardeau, Missouri past Memphis, Tennessee into Arkansas. It protects thousands of acres of farmland and communities, including virtually the entirety of New Madrid County. Behind the levee is a population of 135,261 along with 58,066 buildings with an estimated property value of \$6.82 billion, per the National Levee Database.

Mapping Areas Protected by Levee Systems Serving New Madrid County – New Madrid Floodway



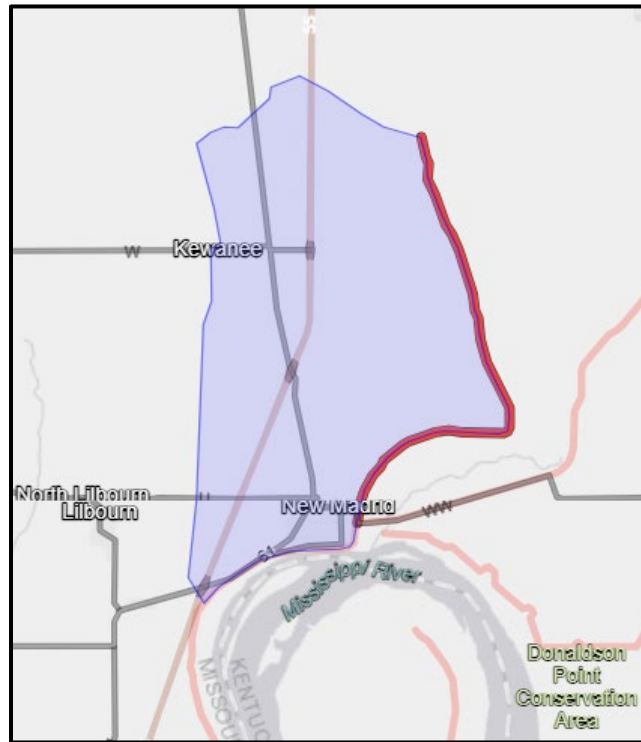
Source: National Levee Database

The New Madrid Floodway spans from Mississippi County south to New Madrid County. It protects a population of 513 and 501 buildings valued at \$37.1 million. The levee system is part of the Mississippi River and Tributaries (MR&T) project. It was authorized by the 1928 Flood Control Action after the devastating 1927 flood. It is considered one of the world's most comprehensive and successful flood risk reduction projects and is rated low risk of breach.

Figure 3.6.

Mapping Areas Protected by Levee Systems Serving New Madrid County – New Madrid-Sikeston Ridge

Levee System



Source: National Levee Database

The New Madrid-Sikeston Ridge Levee System runs 10.5 miles exclusively in New Madrid County. It was built originally to protect the City of New Madrid. It protects 3,698 individuals; 1,916 buildings valued at \$362 million. It is rated moderate risk of breach.

Probability of Future Occurrence

Probability of any occurrence of levee breach would be highly unlikely with the data available today. Levee breaches in New Madrid County are very rare. There was an intentional breach created by explosives in Mississippi County in May 2011. The US Army Corps of Engineers has the legal authority to breach the mainline levee any time the Ohio River at Cairo, Illinois crests about 50 feet. The 2011 was the only reported intentional breach during the past 15 years.

Changing Future Conditions Considerations and the Impact of Climate Change

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

can weaken a levee) coupled with more extreme weather events may increase risk of future levee failure.

Vulnerability

Vulnerability Overview

The USACE regularly inspects levees within its Levee Safety Program to monitor their overall condition, identify deficiencies, verify that maintenance is taking place, determine eligibility for federal rehabilitation

assistance (in accordance with P.L. 84-99), and provide information about the levees on which the public relies. Inspection information also contributes to effective risk assessments and supports levee accreditation decisions for the National Flood Insurance Program administered by the Federal Emergency Management Agency (FEMA).

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

Both Routine and Periodic Inspections result in a rating for operation and maintenance. Each levee segment receives an overall segment inspection rating of Acceptable, Minimally Acceptable, or Unacceptable. 9 defines the three ratings. Figure 3.8 defines the three ratings.

Figure 3.7. Definitions of the Three Levee System Ratings

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

The National Levee Database showed no levee systems in New Madrid County that were rated unacceptable. The Commerce Mo St Francis River System and Sikeston-New Madrid Ridge Levee are rated Moderate in terms of risk level. The New Madrid Floodway Levee System risk is rated Low.

Potential Losses to Existing Development

Levee failure in New Madrid County that occurs every 100 years has the potential of impacting the entire land mass of the county by visual assessment of Figure 3.5. All communities are at risk.

Similarly, all structures are also at risk. The loss from levee failures could amass losses of more than \$6.8 billion based on total building and contents exposure. New Madrid is one of the five counties in Missouri that would be most impacted for building loss in the event of levee failure according to the 2023 Missouri State Hazard Mitigation Plan.

Impact of Previous and Future Development

According to the population and housing unit trend analysis, there is little to no growth and development in the county. Per Figure 3.5 above, all communities are in or very near levee protected areas.

Table 3.25. EMAP Impact Analysis: Levee Failure

Subject	Detrimental Impacts
Public	Localized impact expected to be severe for inundation area and moderate to light for other adversely affected areas.
Responders	Localized impact expected to limit damage to personnel in the inundation area at the time of the incident.
Continuity of Operations	Damage to facilities/personnel in the area of the incident may require temporary relocation of some operations. Localized disruption of roads and/or utilities may postpone delivery of some services.
Property, Facilities, and Infrastructure	Localized impact to facilities and infrastructure in the inundation area of the incident. Some severe damage possible.
Environment	Localized impact expected to be severe for inundation area and moderate to light for other adversely affected areas.
Economic Condition of Jurisdiction	Local economy and finances adversely affected, possibly for an extended period of time, depending on damage and length of investigation.
Public Confidence in the Jurisdiction’s Governance	Localized impact expected to adversely affect confidence in local, state, and federal government, regardless of the levee owner.

Hazard Summary by Jurisdiction

All communities in New Madrid County have levee protected areas. Figure 3.5 above shows these areas. All school districts in the county are within city limits and are therefore not listed separately in hazard summaries. Risco R-2 is the only school district in the 100-year floodplain.

New Madrid County – the county overall has three levee systems protecting it. Within these systems are multiple individual levees. Although the possibility of a levee breach is rather remote, the impact could be catastrophic in terms of loss of property, crops and potentially lives.

City of Matthews – is less susceptible than towns bordering the Mississippi River. The of a levee breach involving the Commerce, Mo – St Francis River System Levee could be devastation to Matthews and the entire county.

City of Morehouse – is also less susceptible to flooding than other New Madrid towns because of its location in the northwest part of the county, miles from the Mississippi River. The city would experience major impact if the main levee system breaches.

City of New Madrid – perpetually experiences flooding issues due to riverine and occasionally flash flooding. Due to its proximity to the river, New Madrid would experience catastrophic consequences of a levee breach.

City of Portageville – is of moderate risk to a levee breach. The city is not directly adjacent to the Mississippi River, but would be inundated if the Commerce, Mo St Francis Levee System breaches.

Problem Statement

Flooding is the most common hazard associated with levee failure, breach or overtopping. Levee failure, breach or overtopping can result not only in loss of life, but also considerable loss of capital investment, loss of income and property damage. Levees can provide a false sense of security in property owners and may lead to a misunderstanding of the true risk of assets in levee protected zones. While levees do provide flood protection, given enough time most will either overtop or fail leading to unplanned damages.

- Nearly all of New Madrid County is in the path of potential levee failure. Flood insurance within the areas protected by levees should be encouraged. Public outreach to residents, as well as real estate agents and lenders would be beneficial.
- Not all levees have been inspected recently. Coordination with the USACE to understand levee inspections and schedule to address any deficiencies is also recommended.
- Not all residents may be aware that they are located in an inundation area. Education and outreach may be helpful.

3.4.3 Earthquakes

Hazard Profile

Hazard Description

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

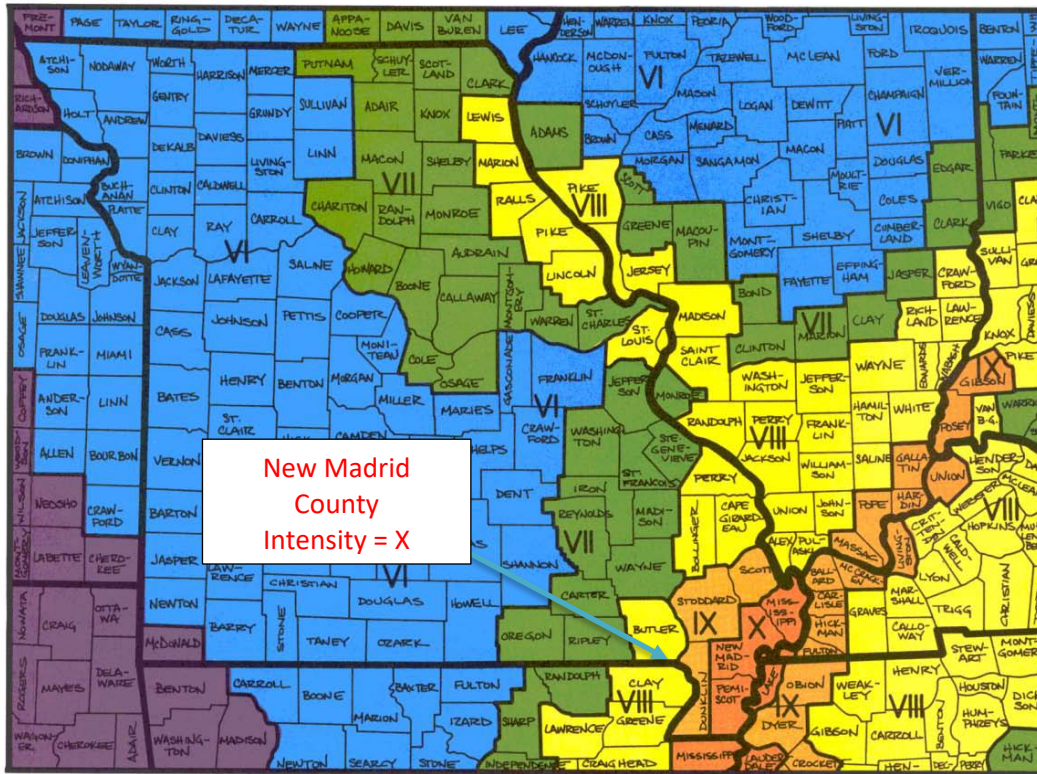
The New Madrid Earthquakes of 1811-1812 had a profound impact on the Missouri Bootheel. New Madrid County lies squarely at the epicenter of the quakes that were terrifyingly intense. The quakes caused liquefaction of the soil, sand blows, shifting of elevation of portions of the region and even a change in course of the Mississippi River. Although more than 200 years ago, the effect of the quakes that were estimated between 7.0 and 8.0 in magnitude must be considered when planning for a possible future seismic hazard.

There are eight seismic zones in the central United States. According to the US Geological Survey, the most active of the eight is the New Madrid Seismic Zone. It runs from northern Arkansas through southeast Missouri, western Tennessee and Kentucky and into the Ohio River Valley.

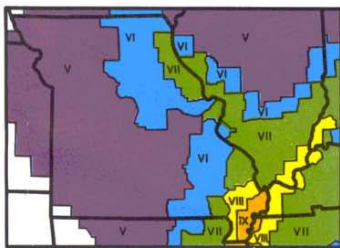
Geographic Location

New Madrid County is squarely the center of the New Madrid Seismic Zone. The planning area is most susceptible to earthquakes due to its location, therefore the earthquake intensity will not vary across New Madrid County. In the map below, Figure 3.9, the highest projected Modified Mercalli intensities by county for a potential magnitude 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid Seismic Zone. The secondary maps in Figure 3.9 show the same regional intensities for 6.7 and 8.6 earthquakes, respectively. New Madrid County experiences the greatest intensity in either scenario. Figure 3.10 is a narrative description of the Modified Mercalli Intensity Scale.

Figure 3.8. Impact Zones for Earthquake Along the New Madrid Fault

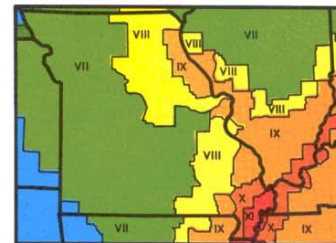


This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



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

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



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

Figure 3.9. Projected Earthquake Intensities

MODIFIED MERCALLI INTENSITY SCALE

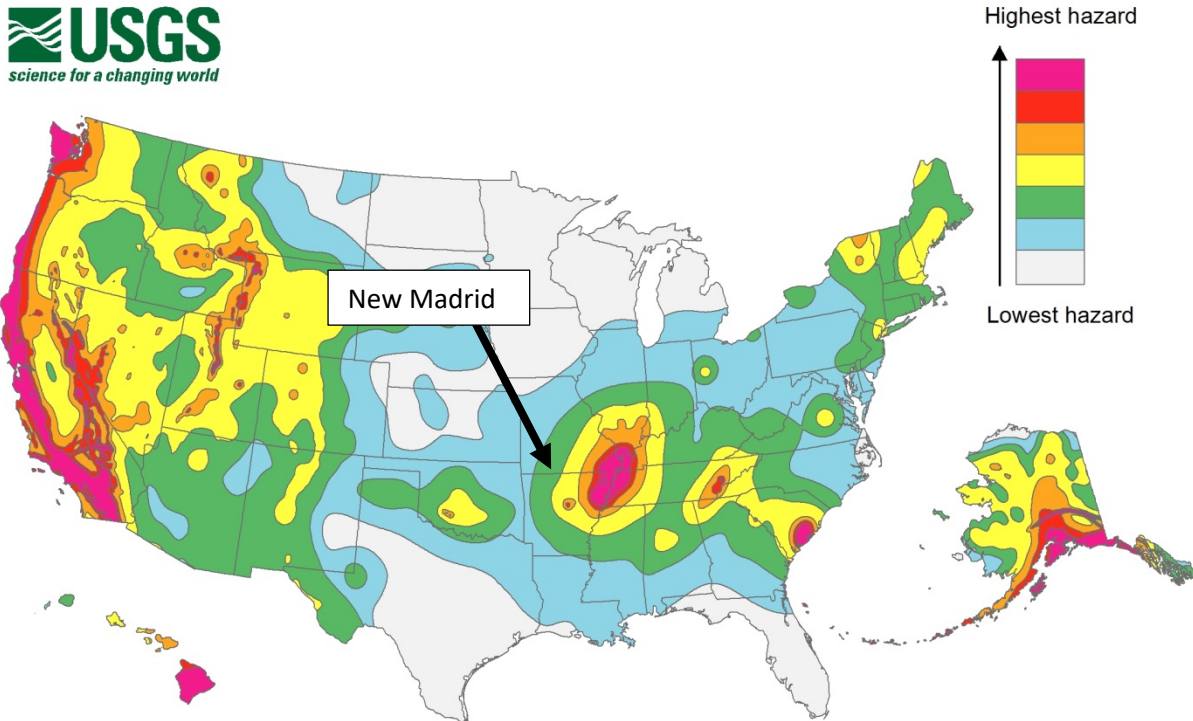
I	People do not feel any Earth movement.	IX	Most buildings suffer damage. Houses that are not bolted down move off their foundations. Some underground pipes are broken. The ground cracks conspicuously. Reservoirs suffer severe damage.
II	A few people might notice movement.	X	Well-built wooden structures 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.
III	Many people indoors feel movement. Hanging objects swing.	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.
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.	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.
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.		

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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Telephone: 573-526-9100

Figure 3.11 presents the location of New Madrid County relative to a seismic hazard map of the United States, with New Madrid County located in the category of highest hazard.

Figure 3.10. United States Seismic Hazard Map, New Madrid County



Source: United States Geological Survey at https://earthquake.usgs.gov/hazards/hazmaps/conterminous/2014/images/HazardMap2014_lg.jpg

Strength/Magnitude/Extent

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

Richter Magnitude Scale

The Richter Magnitude Scale was developed in 1935 as a device to compare the intensity 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

layman a more meaningful idea of the severity.

Previous Occurrences

Previous occurrences of earthquakes with a magnitude greater than 3.0 within and near New Madrid in the past 10 years include the following:

- 2014-04-07 – M 3.1 – 5.1 miles SE of Ridgely, Tennessee
- 2014-05-15 – M 3.1 – 3.3 miles W of Malden, Missouri
- 2014-05-15 – M 3.1 – 3.4 miles W of Malden, Missouri
- 2014-08-31 – M 3.0 – 2.3 miles NW of Tiptonville, Tennessee
- 2015-02-28 – M 3.0 – 3.6 SSE of Lilbourn, Missouri
- 2015-11-24 – M 3.0 – 3.8 miles S of Lilbourn, Missouri
- 2016-05-19 – M 3.0 – 4.2 miles NE of Ridgely, Tennessee
- 2016-09-09 – M 3.5 – 6.5 miles NW of Tiptonville, Tennessee
- 2017-07-30 – M 3.1 – 3.6 miles N of Ridgely, Tennessee
- 2017-08-18 – M 3.1 – 6.2 miles NE of Portageville, Missouri
- 2018-11-21 – M 3.0 – 6 miles NW of Tiptonville, Tennessee
- 2019-09-27 – M 3.1 – 2.7 miles SW of Lilbourn, Missouri
- 2019-10-12 – M 3.0 – 3.1 miles SW of Lilbourn, Missouri
- 2021-09-12 – M 3.0 – 4.2 miles E of Ridgely, Tennessee
- 2022-05-31 – M 3.0 – 7.3 miles NW of Newbern, Tennessee
- 2023-02-09 – M 3.0 – 4.5 miles S of Catron, Missouri

Additionally, there have been thousands of earthquake reports within the New Madrid seismic zone. Most of these earthquakes are too small to be felt, but on average about one earthquake per year is strong enough to be felt in the area. Damage from these earthquakes has been minimal, if any, due to the rural nature of the planning area.

The largest earthquake ever felt in the United States was the New Madrid earthquakes in 1811-1812. The earthquake sequence consisted of three large earthquakes. 1) Magnitude 7.5 on December 16, 1811, 2) Magnitude 7.3 on January 23, 1812 and 3) Magnitude 7.5 on February 7, 1812. The first earthquake of the series was followed by six aftershocks in the range of magnitude 5.5-6.3 in the first two days. Hundreds of aftershocks were felt in 1813.

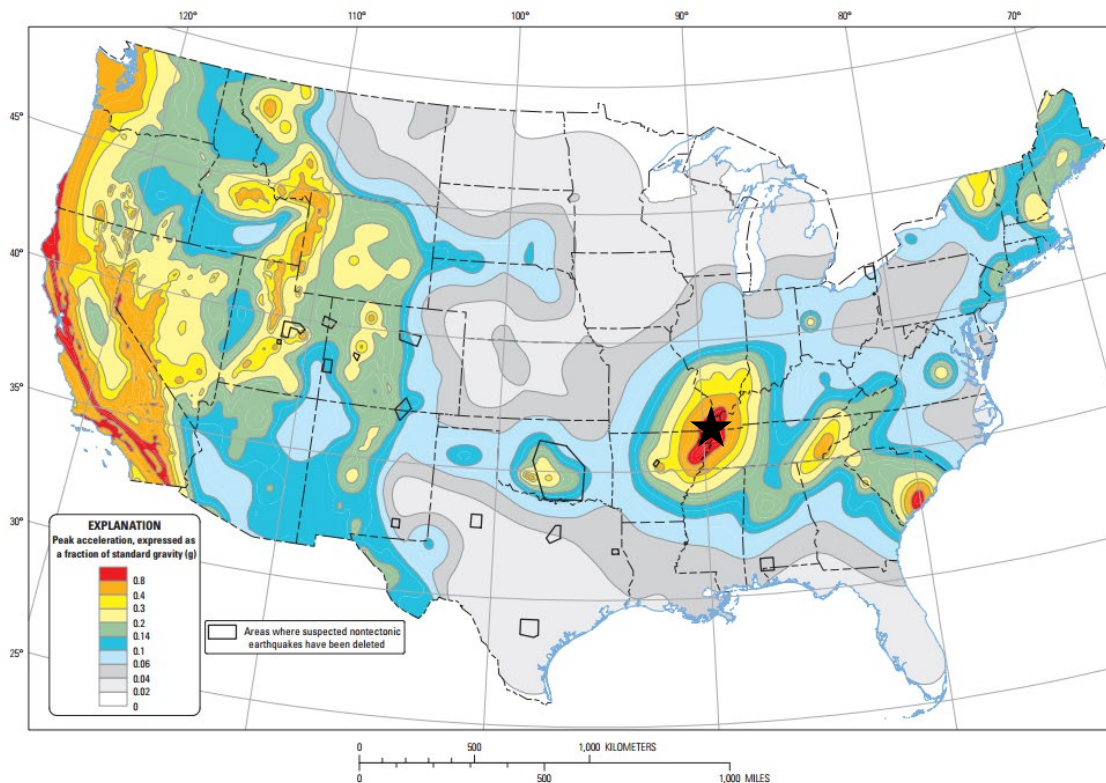
Probability of Future Occurrence

Ground motion is the movement of the earth's surface due to earthquakes or explosions. It is produced by waves generated by a sudden slip on a fault or sudden pressure at the explosive source and travels through the earth and along its surface. Ground motion is amplified when surface waves of unconsolidated materials bounce off or are refracted by adjacent solid bedrock. The probability of ground motion is depicted in USGS earthquake hazard maps by showing, by contour values, the earthquake ground motions (of a particular frequency) that have a common given probability of being exceeded in 50 years.

In developing Figure 3.12, the ground motions being considered at a given location are those from all future possible earthquake magnitudes at all possible distances from that location. The ground motion coming from a particular magnitude and distance is assigned an annual probability equal to the annual probability of occurrence of the causative magnitude and distance. The method assumes a reasonable future catalog of earthquakes, based upon historical earthquake locations and geological information on the recurrence rate of fault ruptures. When all the possible earthquakes and magnitudes have been considered, a ground motion value is determined such that the annual rate of its being exceeded has a certain value.

Therefore, as presented on Figure 3.12, for the given probability of exceedance, two percent, the locations shaken more frequently will have larger ground motions. New Madrid County is located within the red zone representing the largest peak acceleration of 0.8% g.

Figure 3.11. Two-Percent Probability of Exceedance in 50 Years of Peak Ground Acceleration



Source: U.S. Geological Survey, <https://earthquake.usgs.gov/static/lfs/nshm/conterminous/2014/2014pga2pct.pdf>
Note: Black star shows the approximate location of New Madrid County.

Changing Future Conditions Considerations and the Impact of Climate Change

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

Vulnerability

Vulnerability Overview

The impacts and severity of earthquakes on New Madrid County are potentially significant as illustrated by the 1811-1812 earthquakes. The most important direct earthquake hazard is ground shaking. According to MoDNR's Missouri Geological Survey, damage from earthquakes in the New Madrid Seismic Zone will vary depending on the earthquake magnitude, the character of the land, and the degree of urbanization. Since the county is rural dotted with small towns, the major damage will likely be to farmland.

During earthquakes liquefaction occurs. This could be an enormous problem when a large earthquake happens due to infrastructure damage making rescue and recovery difficult. Preparedness is needed as scholars estimate that the New Madrid Seismic Zone has the capability of generating Mercalli intensities of X in southeast Missouri. Studies and reports have been produced on the impact of a large earthquake to the region: *Impact of Earthquakes on the Central USA* (2018) is intended to provide scientific data upon which to base response and recovery planning for devastating earthquakes predicted for the New Madrid region.

Insurance is one defense families can leverage against personal loss from an earthquake. Missouri is the third largest market for earthquake insurance among US states, exceeded only by California and Washington. Regular homeowners' policies do not cover damage from earthquakes. Earthquake coverage is purchased as separate coverage. Only 10.8% of homeowners in New Madrid County in 2022 had earthquake coverage as compared with 20.2% in 2013. This aligns with the regional trend. As the average annual cost of earthquake coverage increases, the number of homeowners carrying it is dropping according to *2022 Residential Earthquake Coverage in Missouri* – a report published by the Missouri Department of Commerce & Insurance.

Potential Losses to Existing Development

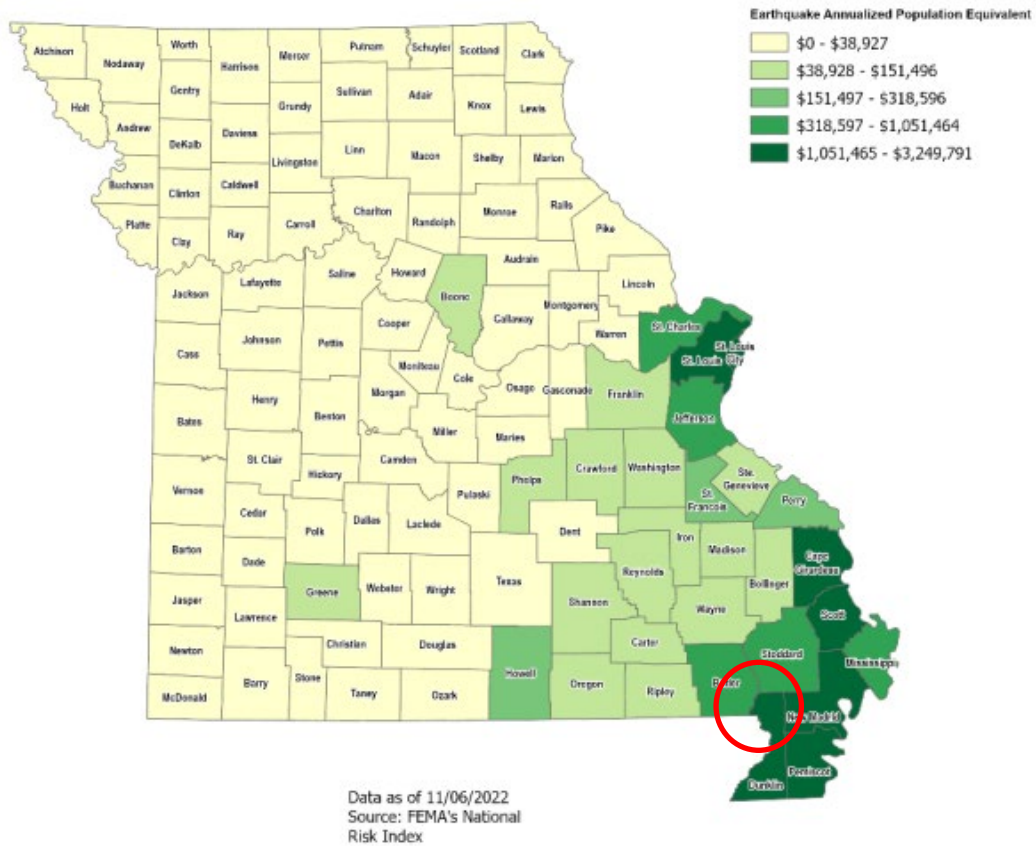
Annualized Loss Scenario

Per the 2023 Missouri Hazard Mitigation Plan, large earthquake impact on New Madrid County would be extensive. Only St. Louis County is estimated to have greater loss than the New Madrid Zone counties. Annualized loss is the maximum potential annual dollar loss resulting from various return periods averaged on a 'per year' basis. It is the summation of all HAZUS-supplied return periods multiplied by the return period probability (as a weighted calculation). This is the same scenario that FEMA National Risk Index uses to compare relative risk from earthquakes and other hazards at the county level nationwide.

Figure 3.13 is a FEMA National Risk Index map. The Risk Index calculates an annualized loss value for population. This population equivalence is calculated using a Value of Statistical Life (VSL) approach in which each fatality or ten injuries is treated as \$7.6 million of economic loss and adjusted for inflation for 2020 values. FEMA's National Risk Index combines the annualized losses for buildings and population for an overall expected annualized loss and loss rating. New Madrid County is circled in red.

Figure 3.12. FEMA National Risk Index Annualized Loss Scenario – Missouri Population

Equivalence New Madrid County (Red Circle)

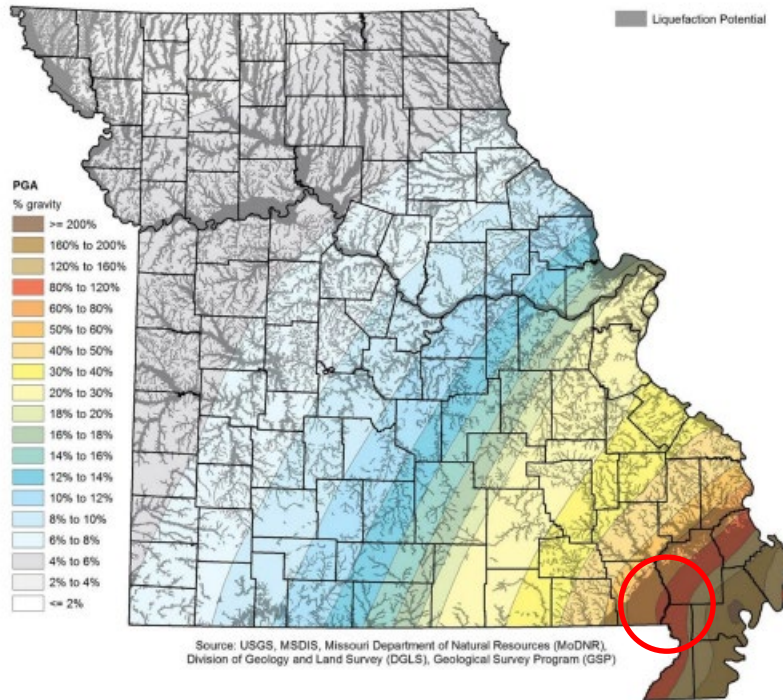


Source: 2023 Missouri State Hazard Mitigation Plan

2% Probability of Exceedance in 50-Years Earthquake Scenario

A second scenario, based on an event with a 2% probability of exceedance in 50 years, was done to model a worst-case scenario. This scenario is equivalent to the 2,500-year earthquake scenario in Hazus. Figure 3.14 presents the ground shaking and liquefaction potential for this scenario. The entire county would experience the most intense liquefaction.

Figure 3.13. Hazus Earthquake 2% Probability of Exceedance in 50-Years – Ground Shaking and Liquefaction Potential, New Madrid County (Red Circle)



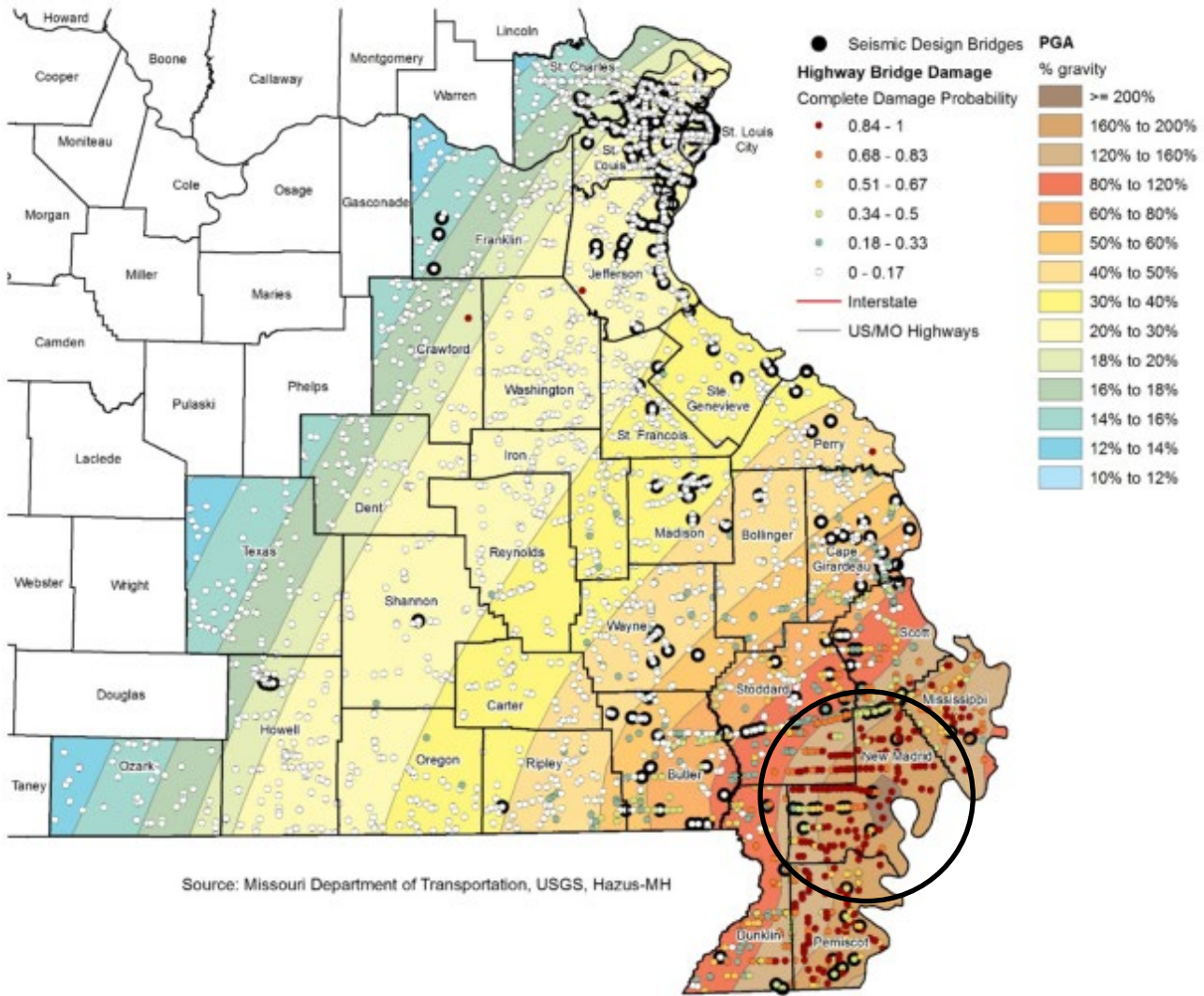
Source: 2023 Missouri State Hazard Mitigation Plan

In addition to building loss and loss of lives, the damage potential to bridges, hazardous materials facilities, and essential facilities is also likely in the event of a major earthquake in New Madrid County.

For New Madrid County, there were 148 bridges identified by MODOT. Of these, 3% are expected to have no damage; 4% are expected to have slight damage; 4% are expected to have moderate damage; 11% are expected to have extensive damage; and 77% are expected to be completely damaged, per the 2023 Missouri State Hazard Mitigation Plan. See Figure 3.16.

Critical Facilities with greater than 50% complete damage probability may include: all fire and police departments, all nursing facilities, all medical facilities and all schools.

Figure 3.14. Map of Bridge Damage Probability, New Madrid County (Black Circle)



Source: 2023 Missouri State Hazard Mitigation Plan

Impact of Previous and Future Development

According to population trends analysis, there is generally very little to no development and growth occurring in New Madrid County. To some extent, modern building codes will help to reduce damage and casualties associated with future structures from earthquakes. Future facilities in the high-risk areas of New Madrid County should be built to account for potential earth shaking and earthquake impacts.

EMAP Consequence Analysis

Table 3.26. EMAP Impact Analysis: Earthquakes

Subject	Detrimental Impacts
Public	Adverse impact expected to be severe for unprotected personnel and moderate to light for protected personnel.
Responders	Adverse impact expected to be severe for unprotected personnel and moderate to light for protected personnel.
Continuity of Operations	Damage to facilities/personnel in the area of the incident may require relocation of operations and lines of succession execution. Disruption of lines of communication and destruction of facilities may extensively postpone delivery of services.
Property, Facilities, and Infrastructure	Damage to facilities and infrastructure in the area of the incident may be extensive for facilities, people, infrastructure, and HazMat.
Environment	May cause extensive damage, creating denial or delays in the use of some areas. Remediation needed.
Economic Condition of Jurisdiction	Local economy and finances adversely affected, possibly for an extended period of time.
Public Confidence in the Jurisdiction’s Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective.

Hazard Summary by Jurisdiction

Earthquake intensity is not likely to vary greatly throughout the planning area; thus, the risk will be the same throughout. However, damages could differ if there are structural variations in the planning area. For example, if one community has a higher percentage of residences built prior to 1939 than the other participants, that community is likely to experience greater damage. See Table 3.27 for a summary of the age of each jurisdiction’s buildings.

Table 3.27. Housing Units Built in 1939 or Earlier

Jurisdiction	Built 1939 or earlier #	Built 1939 or earlier %
New Madrid County	529	7.8%
City of Matthews	33	14.0%
City of Morehouse	100	24.8%
City of New Madrid	80	6.3%
City of Portageville	87	7.4%

Source: US Census Bureau American Community Survey 2021 5 Year Estimates <https://data.census.gov/>

Morehouse has a higher percentage of very old homes, but the county is also at risk due to the quantity of older homes.

Problem Statement

- As identified within a high hazard area for earthquakes, seismic-resistant building codes are recommended throughout New Madrid County.
- It is estimated 77% of bridges within New Madrid County are expected to be completely damaged from the worst-case scenario event. Bridges with a high probability of damage/low post-earthquake functionality that are on major routes should be further evaluated for seismic hazard and retrofit potential.
- Fire, medical, and education facilities with a high probability of damage/low post-earthquake functionality should be further evaluated for seismic hazard and retrofit potential.
- Post-earthquake shelter planning should address alternate facilities and consider options for relocating people out of the hardest hit areas.
- With the decrease in earthquake insurance coverage over the past decade, public outreach and education efforts would be beneficial.

3.4.4 Land Subsidence/Sinkholes

Hazard Profile

Hazard Description

New Madrid County does not contain the type of topography (karst) that causes sinkholes. Sinkholes result from a depression in the landscape where limestone formations have dissolved. Soils in New Madrid County are fine-loamy, fine silty, mixed, thermic, clayey or loamy. The soil tends to be stable which can be important when construction is considered. Because of this, land subsidence/sinkholes will not be included in future updates of the plan.

3.4.5 Drought

Hazard Profile

Hazard Description

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

- **Meteorological** drought is defined in terms of the basis of the degree of dryness (in comparison to some “normal” or average amount) and the duration of the dry period.
A meteorological drought must be considered as region-specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region.
- **Hydrological** drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (e.g., streamflow, reservoir and lake levels, ground water). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system. Hydrological droughts are usually out of phase with or lag the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and ground water and reservoir levels. As a result, these impacts also are out of phase with impacts in other economic sectors.
- **Agricultural** drought focus is on soil moisture deficiencies, differences between actual and potential

evaporation, reduced ground water or reservoir levels, etc. Plant demand for water depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil.

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

Geographic Location

Drought can occur anywhere within the New Madrid County planning area; however, the agricultural sector typically experiences the most direct impacts from drought. According to the USDA's 2017 Census of Agriculture, New Madrid County contained 290 farms which covered 418,443 acres of land or 93.8 percent of the county's total land area. It should be noted that the total number of farms declined by 3%, but the land in farms increased slightly. The average size of farms increased by 2%, indicating that smaller farms may be selling out to larger corporate farms. Any new development that may occur in the county, because it is so limited, will have little influence on drought impact.

Figure 3.16 shows the U.S. Drought Monitor Map for the State of Missouri as of September 12, 2023. The location of New Madrid County is indicated on the map by the blue square. As of this date, the New Madrid County planning area is experiencing no drought conditions. The U.S Drought Monitor provides a snapshot of current drought conditions. It does not illustrate past conditions or predict potential for future drought.

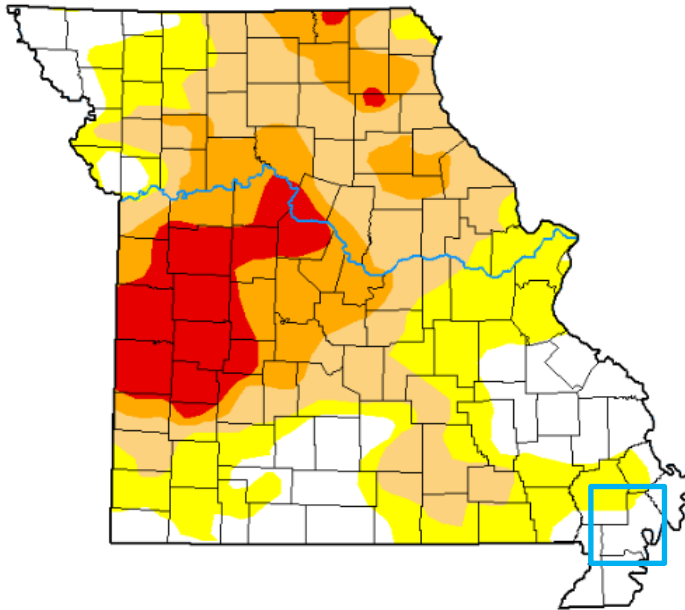
Figure 3.15. U.S. Drought Monitor as of September 12, 2023 - New Madrid County (Blue Square)

U.S. Drought Monitor Missouri

September 12, 2023

(Released Thursday, Sep. 14, 2023)

Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	21.39	78.61	54.00	27.11	10.71	0.00
Last Week 09-05-2023	22.12	77.88	53.00	25.27	8.53	0.00
3 Months Ago 06-13-2023	9.39	90.61	56.51	28.11	8.01	0.00
Start of Calendar Year 01-03-2023	50.31	49.69	12.51	1.61	0.00	0.00
Start of Water Year 09-27-2022	18.48	81.52	56.59	15.39	4.83	1.92
One Year Ago 09-13-2022	48.17	51.83	12.18	5.39	0.90	0.00

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:
Brad Pugh
CPC/NOAA



droughtmonitor.unl.edu

Source: U.S. Drought Monitor, <https://droughtmonitor.unl.edu/Maps/MapArchive.aspx>

Strength/Magnitude/Extent

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

Palmer also developed a formula for standardizing drought calculations for each individual location based on the variability of precipitation and temperature at that location. The Palmer index can therefore be applied to any site for which sufficient precipitation and temperature data is available.

Previous Occurrences

The NCEI database reports 29 drought events in New Madrid County during the 20-year period from 2003 through 2022. NCEI’s reporting method designates each month of new or continuing severe drought as a new

event. Periods of severe drought are combined and detailed in Table 3.28.

Table 3.28. NCEI New Madrid County Drought Events Summary, 2003 through 2022

Event Dates	Months in Drought	Event Description
9/2004	1	This was the driest September on record for southeast Missouri. By the end of the month, moderate drought conditions were assessed over southeast Missouri. The dry weather set in too late to harm crops. In fact, the timing of the dry weather helped farmers harvest one of their best crops on record.
06/2005-8/2005	3	Drought conditions progressively worsened during June. During July, heavy rain from Hurricane Dennis brought some relief, but it came too late for some crops. Drought conditions eased considerably during August as thunderstorm activity increased to typical levels. Dredging on the Mississippi River was necessary due to low river levels.
08/2007-09/2007	2	Severe drought conditions spread to southeast Missouri. The drought greatly affected agriculture., with 99 percent of pasture land across the region being rated poor or very poor. Fire danger was high during part of the drought.
07/2010-01/2011	7	Moderate drought conditions developed over southeast Missouri after a very dry June. Many locations were 1 to 3 inches below normal for rainfall during August. Hurricane Hermine brought some relief but was followed by no further precipitation the rest of September. The drought expanded with very little rainfall in October. Outdoor fire danger became very high.
05/2012-01/2013	9	One of the warmest and driest Mays on record worsened the rare spring drought over the planning area. By the end of June, all of the area was upgraded to extreme drought. By September, most of the region improved from extreme to severe drought conditions. One of the main impacts of the long-term drought was on farm ponds used for irrigating fields or raising livestock. The drought finally ended in January 2013.
11/2016	1	Severe drought conditions spread into extreme southeast Missouri. A lack of precipitation caused soil moisture to decrease rapidly. Pasture land deteriorated, causing some farmers to begin feeding hay to livestock. A heavy rainfall event late in the month brought some improvement.
07/2022-12/2022	6	Extreme drought conditions developed over the region. Pastures were in poor or very poor condition. Wildfire risk was high and the Mississippi River level was unusually low.

Source: NCEI Storm Events Database

The National Drought Mitigation Center (NDMC), located at the University of Nebraska in Lincoln, provides a clearinghouse for information on the effects of drought, based on reports from media, observers, impact records, and other sources.

According to the National Drought Mitigation Center’s Drought Impact Reporter, during the 10-year period from January 2013 through December 2022, drought impacts were noted for the State of Missouri, of which several were reported to affect New Madrid County. Table 3.29 summarizes the number of impacts reported by category and the year’s impacts were reported for each category. Note that the Drought Impact Reporter assigns multiple categories to each impact.

Table 3.29. Drought Impacts Reported for New Madrid County from 2013 through 2022

Category	Impacts	Years Reported
Agriculture	9	2017, 2018, 2022
Business & Industry	1	2022
Fire	1	2022
Plants & Wildlife	4	2017, 2018, 2022
Relief, Response & Restrictions	3	2018, 2022
Society & Public Health	1	2022

Descriptions of impacts are provided below as reported in the Drought Impact Reporter.

- **Oct – Nov 2022** – Hay thefts are occurring in Missouri.
- **Aug 2022 – Oct 2022** - Above normal fire activity in southeast Missouri.
- **July – Dec 2022** - Missouri governor signed executive order concerning drought actions.
- **Oct – Nov - 2018** – High nitrate levels in some baled cornstalks in Missouri.
- **Aug - Sept 2018** – Missouri Gov. Mike Parson announced a new relief program for farmers, allowing them to hay and pump water from some state land as intense drought gripped the state.
- **July - Aug 2018** – Missouri senators seeking additional drought assistance for farmers, ranchers.
- **July - Aug 2018** – Missouri farmers who responded to a Missouri Farm Bureau survey reported that the drought was severely hitting hay production and will likely force many producers to sell livestock.
- **June – Sept 2018** - The Missouri Soil and Water Districts Commission granted a statewide variance, allowing grazing in livestock-excluded areas that were under maintenance of a state cost-share contract.
- **April – May 2017** – Missouri farmers were cautioned about toxic fescue.

According to the USDA’s Risk Management Agency (RMA), between 2013-2022, the sum of claims paid for crop damage resulting from drought in New Madrid County was \$458,736, or an average of \$45,874 in losses every year. Losses were greatest in 2022, when 2,332 acres of soybeans were affected, resulting in \$311,583 in crop losses. Table 3.30 summarizes the agricultural losses due to drought reported in the RMA system.

Table 3.30. Crop Losses Resulting from Drought in New Madrid County, 2013-2022

Year	Commodity Affected	Determined Acres	Indemnity Amount
2013	Soybeans	32.87	\$706
2014	Soybeans	76.3	\$18,557
2015	Cotton, Grain Sorghum, Soybeans, Wheat	604.36	\$28,551
2016	Soybeans	96.7	\$11,426
2017	Grain Sorghum, Soybeans, Wheat	614.74	\$28,488
2018	Corn, Soybeans	773.41	\$59,425
2022	Soybeans	2332.27	\$311,583
TOTAL		4530.65	\$458,736

Source: USDA Risk Management Agency

Probability of Future Occurrence

Based on data from NCEI, New Madrid County has experienced approximately 29 months of severe drought or worse during the 120-month period from 2013 through 2022. This equates to a 24 percent probability of severe drought occurring in the planning area in any given month.

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

Changing Future Conditions Considerations and the Impact of Climate Change

The U.S. Climate Resilience Toolkit’s modeled data projects that New Madrid County could experience an increase in average daily maximum temperature of between five and nine degrees Fahrenheit on average from 1990 to 2090. As discussed in the 2023 Missouri State Hazard Mitigation Plan, although the number of heavy rainfall events is expected to increase, the total rainfall is not expected to change. That means that there will likely be longer periods of time between rainfall events resulting in more dry days. Higher temperatures may fuel increases in evaporation rates which could increase the intensity of naturally occurring droughts in the future.

An 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 the 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.

Vulnerability

Vulnerability Overview

According to county level data from the 2023 Missouri State Hazard Mitigation Plan, New Madrid County has a drought vulnerability rating of medium-high to high. The state plan notes that most of southern Missouri is less vulnerable to drought due to the abundant groundwater resources in the area with the exception of the southern corners of the state that are more likely to irrigate.

To determine vulnerability, the State of Missouri conducted a statistical analysis of data from several sources: USDA Risk Management Agency's insured crop losses as a result of drought (2007-2016), USDA crop exposure by county, the calculated Social Vulnerability Index for Missouri Counties from the Hazards and Vulnerability Research Institute in the Department of Geography at the University of South Carolina, storm events data (1950 to December 31, 2016) and probability of severe drought based on historic Palmer Drought Severity Index. The USDA crop exposure by county is from the 2012 Agricultural Census and assumes that the larger the exposure, the greater potential for loss and impact on the local economy.

From the statistical data collected, four factors were considered in determining overall vulnerability to drought as follows: social vulnerability, crop exposure ratio, annualized crop claims paid, and likelihood of occurrence. Based on natural breaks in the statistical data, a rating value of 1 through 5 was assigned to each factor. These rating values correspond to the following descriptive terms:

- 1) Low
- 2) Low-medium
- 3) Medium
- 4) Medium-high
- 5) High

Using this system, New Madrid County has a high rating for social vulnerability and drought occurrence as well as a high rating for crop exposure.

Potential Losses to Existing Development

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

Although it is difficult to quantify many of the potential losses that may occur due to drought, agricultural losses are direct economic costs that can be easily quantified through insurance claims. New Madrid County's crop

exposure is high, with more than 90 percent of the county’s total land area in use for agriculture. Over the past 10 years, New Madrid County has experienced an average of \$45,874 in crop losses annually.

Impact of Previous and Future Development

Increases in acreage planted with crops would increase the exposure to drought-related agricultural losses. If the population decline reverses and turns into population increases, additional residents will impose additional strains on water supply systems to meet the growing demand for treated water, and these strains could prove impactful during times of drought.

EMAP Consequence Analysis

Table 3.31. EMAP Impact Analysis: Drought

Subject	Detrimental Impacts
Public	Most damage expected to be agricultural in nature. However, water supply disruptions may adversely affect people.
Responders	Nature of hazard expected to minimize any serious damage to properly equipped and trained personnel.
Continuity of Operations	Unlikely to necessitate execution of the Continuity of Operations Plan. Nature of hazard expected to minimize serious damage to services, except for moderate impact on water utilities.
Property, Facilities, and Infrastructure	Nature of hazard expected to minimize any serious damage to facilities.
Environment	May cause disruptions in wildlife habitat, increasing interface with people, and reducing numbers of animals.
Economic Condition of Jurisdiction	Local economy and finances dependent on abundant water supply adversely affected for duration of drought.
Public Confidence in the Jurisdiction’s Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective.

Hazard Summary by Jurisdiction

Drought has the potential to impact all of New Madrid County, but the ways in which impacts will be experienced vary. As discussed in the previous occurrences and vulnerability sections, most of the damages seen historically resulting from drought in New Madrid County affect agriculture; plants and wildlife; relief, response, and restrictions services and water supply. Therefore, the magnitude of the impacts of drought may be greater in rural parts of the county, which have large areas of crops and wildlife and a huge need for water for irrigation. In the cities, the frequency of drought conditions may remain the same, but the impacts would fall on lawns, local gardens, and outdoor fields in school districts. In areas where there is greater building density, there is more exposure to potential shrinking and expanding soil problems around foundations resulting from drought. If drought conditions are severe and prolonged, water supplies could also be affected. The entire county is highly dependent on groundwater resources.

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. Data from the 2021 American Community Survey was used to identify populations under 5 and over 65 years old. However, data was not available for overweight individuals and those on medications vulnerable to extreme heat. Table 3.32 below summarizes vulnerable populations in the participating jurisdictions.

Table 3.32. New Madrid County Population Younger than Age 5 and Older than Age 65

Jurisdiction	Younger than 5	Older than 65	% of Total Population
New Madrid County	1,068	3,155	25.3%
City of Matthews	38	114	23.9%
City of Morehouse	51	126	19.7%
City of New Madrid	135	684	29.2%
City of Portageville	254	487	25.1%

Source: US Census Bureau American Community Survey 2021 5 Year Estimates <https://data.census.gov/>

Problem Statement

- New Madrid County is highly dependent on groundwater resources which may be impacted by severe or prolonged drought. Possible solutions include the development of agreements with neighboring communities or state properties for a secondary water source and review of local ordinance/regulation for inclusion of water-use restrictions during periods of drought.
- New Madrid County has a high level of crop exposure. Possible solutions include encouraging farmers to purchase crop insurance and providing information to farmers on drought-resistant farming practices.

3.4.6 Extreme Temperatures

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 3.17 uses both factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

Extreme cold often accompanies severe winter storms and can lead to hypothermia and frostbite in people without adequate clothing protection. Cold can cause fuel to congeal in storage tanks and supply lines, stopping electric generators. Cold temperatures can also overpower a building's heating system and cause water and sewer pipes to freeze and rupture. Extreme cold 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. See Figure 3.18.

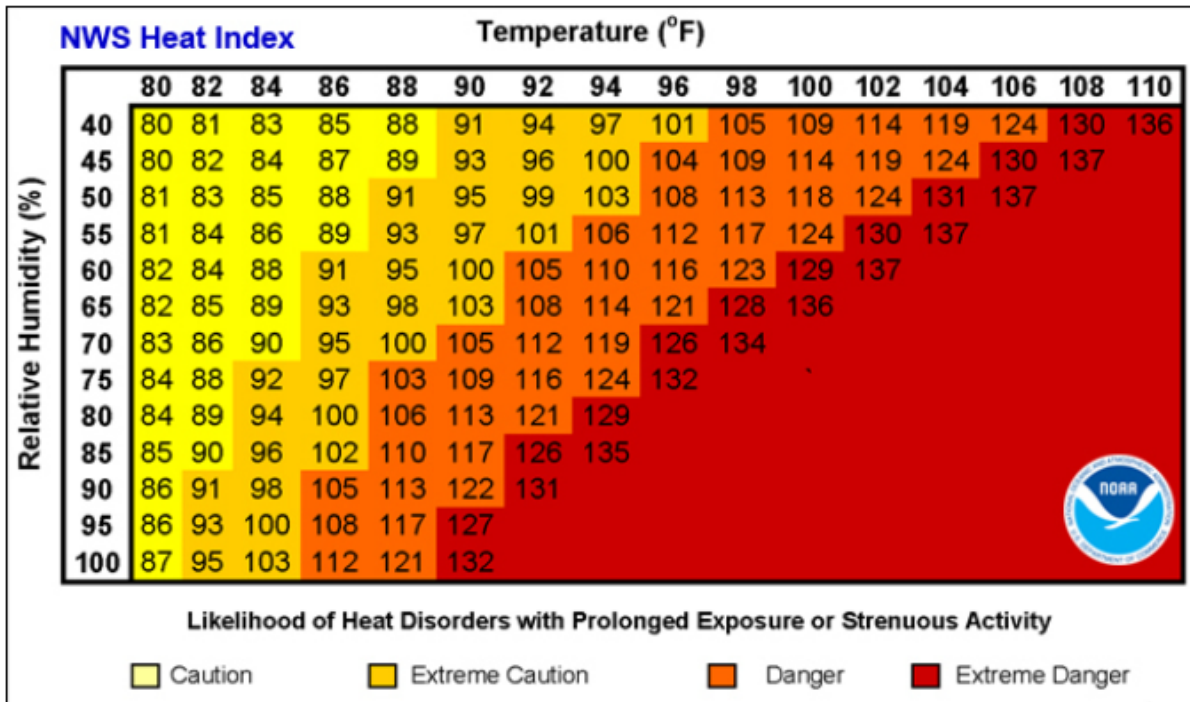
Geographic Location

Extreme temperatures are area-wide events. The entire planning area is subject to very high and very low temperatures and the risk of this hazard does not vary across jurisdictions.

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 refers to two or more consecutive days: (1) when the maximum daytime Heat Index is expected to equal or exceed 105 degrees Fahrenheit (°F); and (2) 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.

Figure 3.16. Heat Index (HI) Chart



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

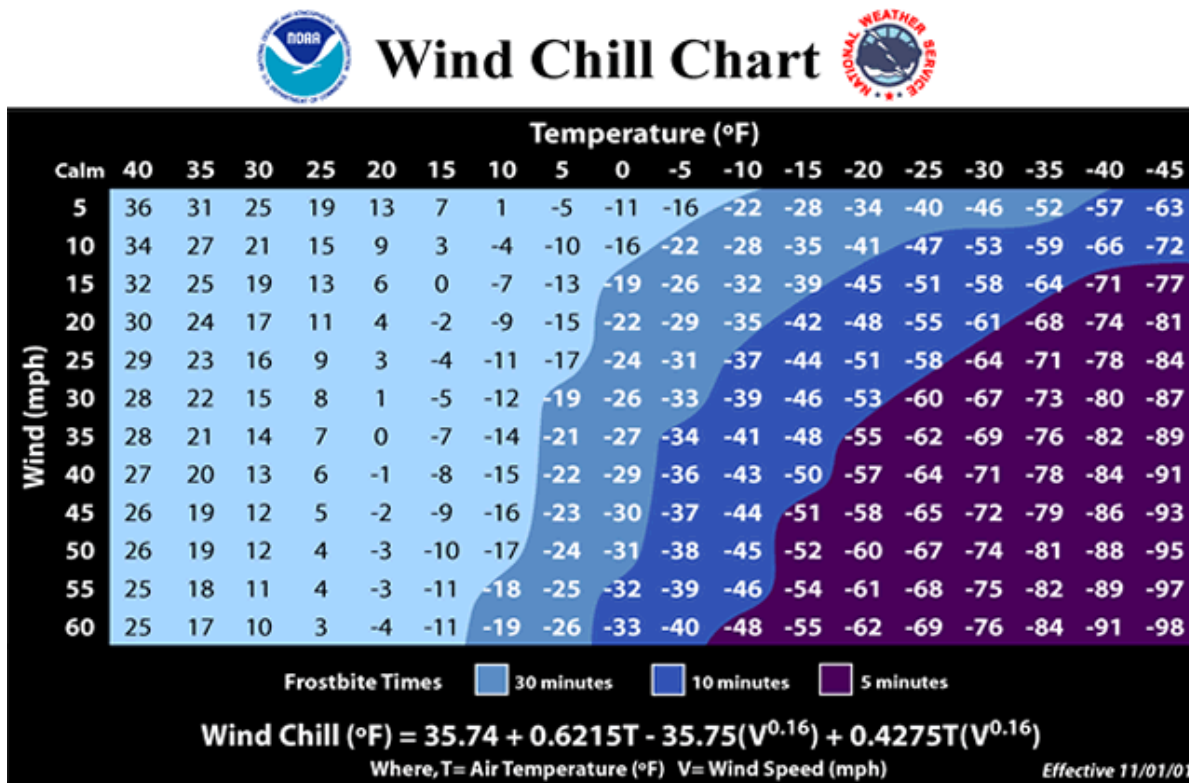
Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. The shaded zone above 105°F corresponds to a HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

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

The National Weather Service issues the following wind chill 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.

- 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.

Figure 3.17. Wind Chill Chart



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

Previous Occurrences

According to the National Centers for Environmental Information (NCEI) Storm Events database, from 2003 through 2022, there have been 74 recorded events related to extreme heat and 45 events related to extreme cold. These events are summarized in the table below. NCEI reports indicated four deaths directly resulting from the heat-related events. Event narratives indicating significant impacts in New Madrid County are summarized below.

Table 3.33. NCEI New Madrid County Extreme Temperature Recorded Events Summary, 2003-2022

Event Type	Event Count	Injuries	Deaths	Property Damage
Extreme Heat-Related Events	74	0	4	0
<i>Heat</i>	54	0	2	0
<i>Excessive Heat</i>	20	0	2	0
Extreme Cold Related Events	45	0	0	0
<i>Cold/Wind Chill</i>	6	0	0	0
<i>Extreme Cold/Wind Chill</i>	2	0	0	0
<i>Frost/Freeze</i>	37	0	0	0
Total	119	0	4	0

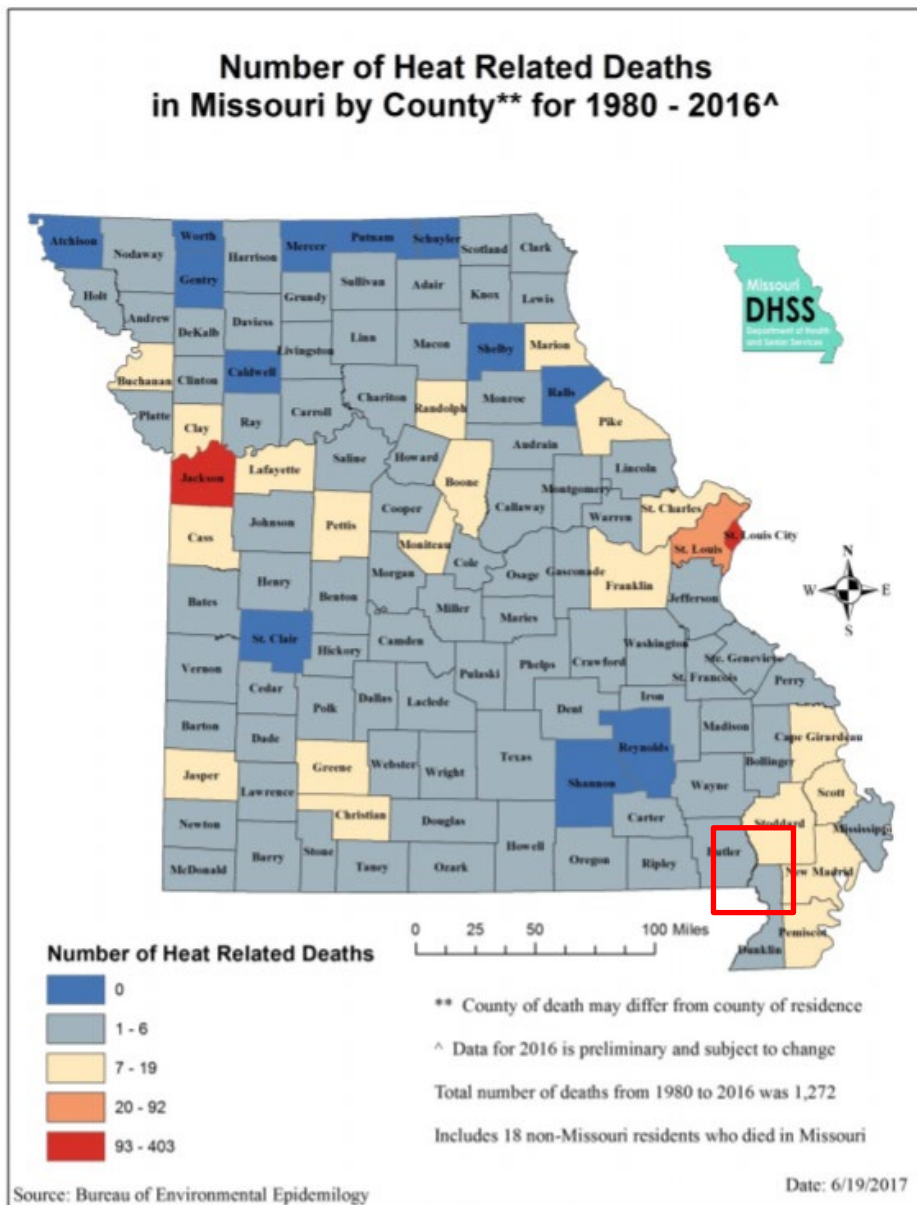
- **June 16, 2010** – An upper-level ridge over the Mississippi Valley contributed to unseasonably hot and

humid conditions. Twin two-year old girls were found dead in a hot car at an apartment complex in Portageville. The deaths were attributed to heat.

- **July 4-8, 2022** – A prolonged heat wave gripped the region for several days, with the heat index peaking between 111 and 119. The heat resulted in two fatalities at a home in Gideon due to heat exposure. Three dogs were also found deceased. The house had no air conditioning.
- **April 8, 2007** – This was the fourth and most extreme of several freezes on consecutive nights. Extensive damage occurred to some crops, gardens and even trees. Record warm temperatures in March preceded these freezes. Low temperatures were near records for the entire month of April.
- **December 22, 2022** – a powerful cold front swept through the region, with wind chills dropping to 20 to 30 below zero. These were the coldest wind chills observed in more than 25 years.

Figure 3.19, based on data from the Missouri Bureau of Environmental Epidemiology, indicates the number of heat-related deaths that have occurred between 1980 and 2016 by County. New Madrid County (indicated by the red square) experienced between 7 and 19 deaths during this time.

Figure 3.18. Heat Related Deaths in Missouri 1980 - 2016



Source: <https://health.mo.gov/living/healthcondiseases/hyperthermia/pdf/stat-report.pdf>

The National Weather Service reports that from 1992-2021, the U.S. has averaged 158 deaths related to heat annually. The National Weather Service stated that among hazards, no other natural disaster—not lightning, hurricanes, tornadoes, floods, or earthquakes—causes more deaths.

Extreme heat can cause stress to agricultural products. According to USDA Risk Management Agency (RMA), losses to insurable crops during the 10-year time period from 2013 through 2022 were substantial due to heat and hot wind. See Table 3.34.

Table 3.34. Crop Insurance Claims Paid in New Madrid County from Extreme Heat and Hot Winds,

2013-2022

Year	Commodity Affected	Determined Acres	Indemnity Amount
2013	Corn, Soybeans	1,219.2	\$58,424
2014	Cotton, Soybeans	167.08	\$19,197
2015	Corn, Rice, Soybeans	996.92	\$91,848
2016	Corn, Grain Sorghum, Soybeans	862.38	\$21,979
2017	Corn, Soybeans, Wheat	482.00	\$61,183
2018	Corn, Soybeans	1,043.83	\$163,154
2019	Soybeans	1,526.22	\$10,664
2021	Corn, Soybeans	746.25	\$345,703
2022	Corn, Cotton, Rice, Soybeans	21,182.69	\$3,221,334
Totals		26,700.35	\$4,009,533

Source: USDA RMA Crop Losses

Extreme cold and frost have also caused crop damage. According to USDA RMA, losses to insurable crops due to cold wet weather, frost and cold winter during the 10-year time period from 2013 through 2022 were more than \$1,600,000. See details in Table 3.35.

Table 3.35. Crop Insurance Claims Paid in New Madrid County from Extreme Cold and Cold Wet Weather, 2013-2022

Year	Commodity Affected	Determined Acres	Indemnity Amount
2013	Cotton, Rice	3,235.87	\$482,649
2014	Corn, Cotton, Rice, Soybeans, Wheat	2,883.23	\$354,170
2015	Cotton, Rice, Soybeans, Wheat	1,961.54	\$500,552
2016	Cotton, Soybeans	447.68	\$56,734
2017	Corn, Cotton, Rice	1,203.99	\$124,505
2020	Corn, Cotton, Popcorn, Soybeans	922.56	\$151,166
2021	Corn, Rice, Soybeans	1,283.13	\$62,808
2022	Wheat	135.38	\$18,071
Totals		10,869.39	\$1,626,275

Source: USDA RMA Crop Losses

NCEI records report that New Madrid County has experienced 74 extreme heat related events from 2003 through 2022, which equates to an annual average of 3.7 extreme heat events. Over the same period, there were 45 extreme cold related events, which equates to an annual average of 2.3 extreme cold events. Note that extreme temperature events may be underreported in the NCEI, therefore annual probability may be greater. Overall, extreme temperature events are likely to occur in New Madrid County and are increasing.

Changing Future Conditions Considerations and the Impact of Climate Change

According to the Fourth National Climate Assessment (NCA), the modeled historical average annual five-day maximum temperature for Southern Missouri is 97 degrees Fahrenheit. This temperature is projected to increase to between 102 and 103 degrees Fahrenheit depending on emissions scenario by the mid-twenty-first century. Such temperature extremes could jeopardize crop growth and reproduction. Additionally, the NCA reports that the Midwest is projected to have the largest increase in temperature-related premature deaths under the high emission scenario, with 2,000 additional premature deaths per year by 2090. Conversely, risk of death from extremely cold temperatures is expected to decrease. Additionally, increased financial and health burdens are expected because of increased electricity demand, higher utility bills, lost work hours, and premature deaths.

The U.S. Climate Resilience Toolkit indicates that in New Madrid County, the average number of days with a maximum temperature above 100 degrees Fahrenheit will likely increase by the end of the century from less than 10 days to more than 20 days under lower emissions scenarios and more than 60 days under higher emissions scenarios. The average number of days with a minimum temperature below 32 degrees Fahrenheit is projected to decrease by approximately 20-40 days, depending on emissions scenario.

Vulnerability

Vulnerability Overview

According to the 2023 Missouri State Hazard Mitigation Plan, New Madrid County has a vulnerability rating of high for extreme heat and high for extreme cold. This scoring is based on the total population, the percentage of the population over 65, the likelihood of occurrence, and social vulnerability. New Madrid County has a high rating for social vulnerability and a medium low rating for percentage of population over 65.

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

Table 3.36. Typical Health Impacts of Extreme Heat

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

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

The National Institute on Aging estimates that more than 49 million Americans over the age of 65 are particularly vulnerable to hypothermia, with isolated elders being most at risk. For an older person, a body temperature of 95° or lower can cause many health problems, such as heart attack, kidney problems, liver damage or worse.

Also at risk are those without shelter, those who are stranded, and those 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.

Potential Losses to Existing Development

Extreme heat can strain electricity delivery infrastructure overloaded during peak use of air conditioning during extreme heat events. Another type of infrastructure damage from extreme heat is road damage. When asphalt is exposed to prolonged extreme heat, it can cause buckling of asphalt-paved roads, driveways, and parking lots.

New Madrid County's crop exposure is significant, with a large portion of the county's total land area in use for agriculture. Over the timeframe from 2013 - 2022, New Madrid County has experienced an average of \$400,953 in crop losses annually due to extreme heat and \$162,627 in annual losses due to extreme cold.

Based on Missouri Bureau of Environmental Epidemiology data for heat-related deaths, New Madrid County has experienced at least 7 heat-related deaths over a 36-year period, which equates to approximately a 19 percent chance of a heat-related death occurring in any given year.

Impact of Previous and Future Development

Population growth can result in increases in the age groups that are most vulnerable to extreme heat. Population growth also increases the strain on electricity infrastructure, as more electricity is needed to accommodate a growing population.

EMAP Consequence Analysis

Table 3.37. EMAP Impact Analysis: Extreme Temperatures

Subject	Detrimental Impacts
Public	Localized impact expected to be severe for incident areas and moderate to light for other adversely affected areas.
Responders	Localized impact expected to limit damage to personnel in the areas at the time of the incident.
Continuity of Operations	Unlikely to necessitate execution of the Continuity of Operations Plan. The extent of agricultural damage depends on duration. Water supplies and electricity may be disrupted.
Property, Facilities, and Infrastructure	Nature of hazard expected to minimize any serious damage to facilities. Asphalt parking lots and roads are routinely damaged during periods of extreme heat as the hot asphalt becomes less rigid and can be displaced by heavy equipment or automobiles.
Environment	Potential for crop damage; May cause disruptions in wildlife habitat, increase interface with people, and reduce numbers of animals.
Economic Condition of Jurisdiction	Local economy and finances dependent on stable electricity and water supply adversely affected for duration of heat wave.
Public Confidence in the Jurisdiction's Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective.

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 census on population percentages in each jurisdiction comprised of those under age 5 and over age 65. Data was not available for overweight individuals and those on medications vulnerable to extreme heat. **Table 3.38** 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 3.38. New Madrid County Population Under Age 5 and Over Age 65

Jurisdiction	Population Under 5 yrs (%)	Population 65 yrs and over (%)
New Madrid County	6.4%	18.9%
Matthews	6.0%	17.9%
Morehouse	5.7%	14.0%
New Madrid	4.8%	24.4%
Portageville	8.6%	16.5%

Source: American Community Survey 2021 5-year Estimates

Problem Statement

- Portageville has the highest proportion of residents under 5 years old and New Madrid (city) has the highest proportion over 65 years old who are at a heightened risk for extreme-temperature related illnesses, injuries, and death. Possible solutions include organizing outreach to the vulnerable elderly populations, including establishing and promoting accessible heating or cooling centers in the community and creating a database in coordination with the Health Department to track those individuals at high risk.
- New Madrid County has a high level of crop exposure. Possible solutions include encouraging farmers to purchase crop insurance and plant heat-resistant and/or frost-resistant crops.

3.4.7 Severe Thunderstorms Including High Winds, Hail, and Lightning

Hazard Profile

Hazard Description

Thunderstorms

A thunderstorm is defined as a storm that contains lightning and thunder which is caused by unstable atmospheric conditions. When cold upper air sinks and warm moist air rises, storm clouds or ‘thunderheads’ develop resulting in thunderstorms. This can occur singularly, as well as in clusters or lines. The National Weather Service defines a thunderstorm as “severe” if it includes hail that is one inch or more, or wind gusts that are at 58 miles per hour or higher. At any given moment across the world, there are about 1,800 thunderstorms occurring. Severe thunderstorms most often occur in Missouri in the spring and summer, during the afternoon and evenings, but can occur at any time. Other hazards associated with thunderstorms are heavy rains resulting in flooding (discussed separately in **Section 3.4.1** and tornadoes discussed separately in **Section 3.4.9**).

High Winds

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

Hail

According to the National Oceanic and Atmospheric Administration (NOAA), hail is precipitation that is formed when thunderstorm updrafts carry raindrops upward into the extremely cold atmosphere causing them to freeze. The raindrops form into small frozen droplets. They continue to grow as they make 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 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 and could be extremely destructive, but even small pea-sized hail can do damage.

Lightning

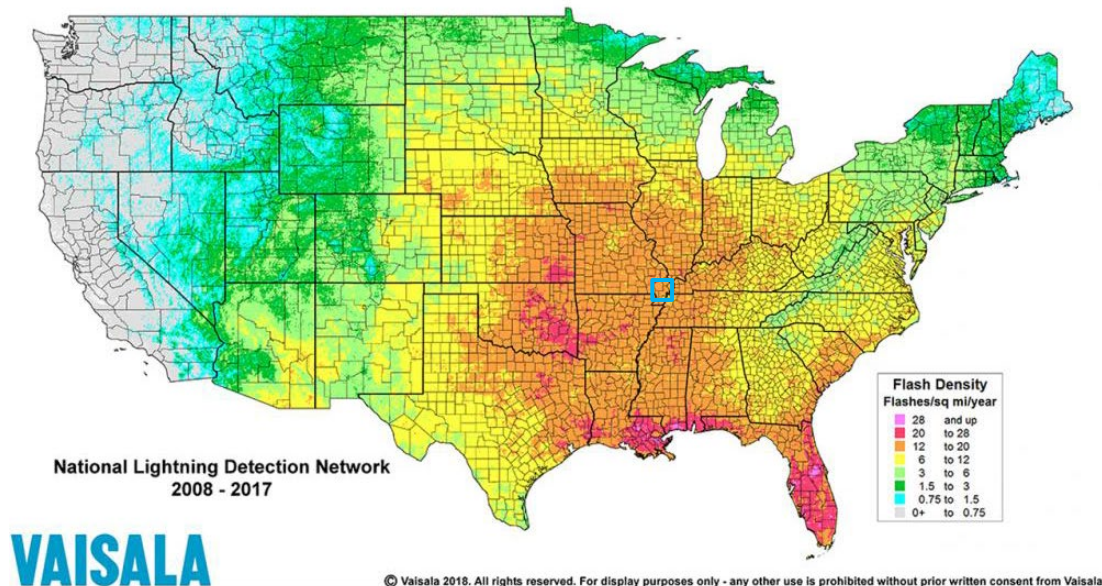
All thunderstorms produce lightning which can strike outside of the area where it is raining, even known to fall more than 10 miles away from the rainfall area. Thunder is simply the sound that lightning makes. Lightning is a huge discharge of electricity that shoots through the air causing vibrations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

Geographic Location

Thunderstorms and the associated winds, lightning, and hail are area-wide hazards that can occur anywhere in the county. Although these events occur similarly throughout the planning area, they are more frequently reported in more urbanized areas because damages are more likely to occur where exposure is greater in more densely developed areas.

Figure 3.20 shows lightning frequency in the state and nation. New Madrid County is within the blue square. The county is located in the second highest flash density region of the nation and in the highest impacting the state.

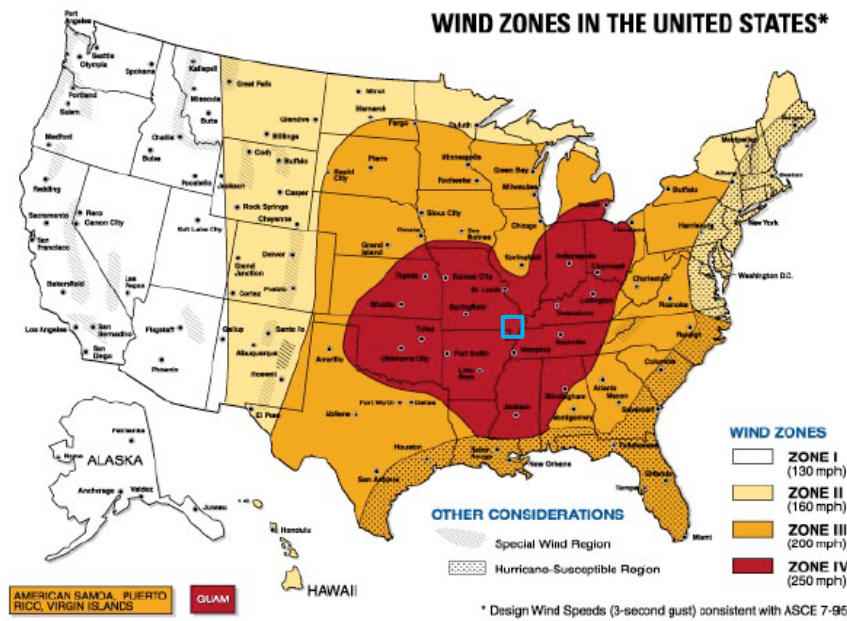
Figure 3.19. Location and Frequency of Lightning in Missouri



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

Figure 3.21 shows wind zones in the United States. New Madrid County, indicated by the blue square, is within Wind Zone IV, which indicates that speeds of up to 250 mph have the potential to occur within the county.

Figure 3.20. 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 3.39** below describes typical damage impacts of the various sizes of hail.

Table 3.39. 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 wildfires, as well as damage electrical systems and equipment.

Previous Occurrences

The following tables detail the severe weather events recorded in the NCEI Storm Events database from 2003 through 2022. Where multiple events were reported for the same day, these events were combined and assigned the largest magnitude recorded. Narratives for specific events are reported below the tables. Note that there are limitations to NCEI data. For example, only reported lightning events that result in fatality, injury and/or property and crop damage are included in the NCEI.

Table 3.40 summarizes the 20 unique thunderstorm wind events reported during this 10-year period. Across all impacted areas, the events caused no deaths or injuries, and an estimated \$5,611,500 in property damages.

Table 3.40. NCEI New Madrid County Thunderstorm Wind Events Summary, 2013 – 2022

Dates	Location	Magnitude	Deaths	Injuries	Property Damages
1/29/13	Lilbourn	65	0	0	\$100,000
6/7/14	New Madrid	70	0	0	\$50,000
7/1/14	Kewanee	61	0	0	\$7,000
3/1/17	Matthews	70	0	0	\$150,000
3/7/17	Canalou	61	0	0	\$10,000
3/9/17	New Madrid	74	0	0	\$50,000
6/18/17	Marston	65	0	0	\$25,000
7/7/17	Parma	52	0	0	\$5,000
5/19/18	Tallapoosa	61	0	0	\$7,000
5/20/18	Portageville	52	0	0	\$3,000
6/16/18	Morehouse	52	0	0	\$4,000
3/9/19	Matthews	52	0	0	\$10,000
5/29/19	New Madrid	61	0	0	\$25,000
6/21/19	Matthews	56	0	0	\$5,000
6/23/19	New Madrid	52	0	0	\$500
6/26/19	Howardville	52	0	0	\$1,000
8/21/19	Marston	54	0	0	\$2,000
5/4/20	Gideon	96	0	0	\$5,012,000
10/25/21	New Madrid	52	0	0	\$25,000
2/22/22	Conran	70	0	0	\$120,000
Total			0	0	\$5,611,500

Source: NCEI Storm Database

- March 1, 2017** – A squall line of severe thunderstorms moved through the region. Northwest through north of Matthews, a section of roof was blown off an older farmhouse. A barn was levelled. Power poles were leaning or broken. Numerous shingles were missing off one house. A carport was leaning sideways. Numerous large limbs were down. Many irrigation systems were blown over.
- May 4, 2020** - A very intense macroburst caused extensive damage across southwest New Madrid County, including the Gideon area. Peak winds were estimated near 110 mph, based on NWS storm

surveys. The local emergency management agency estimated at least 5 million dollars damage, with 4 million of that at a farm south of Gideon.

- **February 22, 2022** - A broken line of thunderstorms moved rapidly east-northeastward during the early morning hours. A few microbursts accompanied the storms. Several houses and other buildings lost some siding and shingles.

There were no high wind events reported during the 10-year period from 2013 – 2022 per the NCEI Storm Events Database.

Table 3.41 summarizes the 5 unique hail events that included hail of at least 1 inch in diameter reported during this 10-year period. These events caused \$4,000 in damages across the total affected areas as detailed in the following table. There were several additional days with hail events for hail less than 1 inch in diameter as reported by NCEI during this period but are not reported in the table. There were no reported deaths or injuries associated with these smaller magnitude events, and minimal property damages were reported.

Table 3.41. NCEI New Madrid County Hail Events Summary, 2013 – 2022

Dates	Location	Magnitude (Diameter, inches)	Deaths	Injuries	Property Damages
4/19/15	Parma	1.00 in.	0	0	\$0
12/17/16	Portageville	3.20 in.	0	0	\$0
5/27/17	Parma	1.25 in.	0	0	\$0
5/20/18	Portageville	1.00 in.	0	0	\$4,000
6/19/19	Lilbourn	1.00 in.	0	0	\$0
Total			0	0	\$4,000

Source: NCEI, Storm Event Database

- **December 17, 2016** – Thunderstorms intensified along and ahead of a strong cold front as it moved across the Lower Ohio Valley and southeast Missouri during the afternoon. A rotating supercell dropped very large, irregularly shaped hailstones. The maximum diameters of the largest hailstones were just over three inches, including the protrusions. The supercell that produced this hail contained strong rotation in the middle levels of the storm.
- **May 20, 2018** - Along and ahead of a cold front moving eastward across southeast Missouri into southern Illinois, thunderstorms developed. Strong heating rapidly destabilized the air mass, with mixed-layer capes in excess of 3000 j/kg. Weak winds aloft limited the potential for sustained severe storms.

There were no unique lightning events recorded for New Madrid County in the 10-year period from 2013 through 2022.

Table 3.42 and **Table 3.43** summarize past crop damages due to high winds and hail as indicated by crop insurance claims. In total, high winds and hail caused \$1,013,246 in crop losses over the 10-year period from 2013 through 2022. The tables illustrate the magnitude of the impact on the planning area’s agricultural economy.

Table 3.42. Crop Insurance Claims Paid in New Madrid County from High Winds, 2013-2022

Crop Year	Crop Name	Cause of Loss Description	Determined Acres	Insurance Paid
2013	Rice	Wind/Excess Wind	28.6	\$1,734
2014	Rice	Wind/Excess Wind	0	\$63,584
2015	Rice, Corn	Wind/Excess Wind	275.79	\$150,477
2016	Soybeans	Wind/Excess Wind	59.70	\$1,585
2017	Cotton	Wind/Excess Wind	538.03	\$135,146

2018	Rice, Corn	Wind/Excess Wind	218.14	\$92,758
2019	Rice, Cotton	Wind/Excess Wind	150.00	\$73,828
2020	Rice, Corn	Wind/Excess Wind	153.58	\$29,667
2021	Rice, Soybeans	Wind/Excess Wind	390.21	\$79,058
2022	Rice, Soybeans	Wind/Excess Wind	108.1	\$13,532
Total			1922.15	\$641,369

Source: USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/data/cause>

Table 3.43. Crop Insurance Claims Paid in New Madrid County from Hail, 2013-2022.

Crop Year	Crop Name	Cause of Loss Description	Determined Acres	Insurance Paid
2018	Soybeans, Cotton	Hail	135.36	\$7,967
2019	Soybeans, Cotton	Hail	1046.22	\$338,657
2020	Soybeans, Wheat	Hail	751.49	\$25,253
Total			1933.07	\$371,877

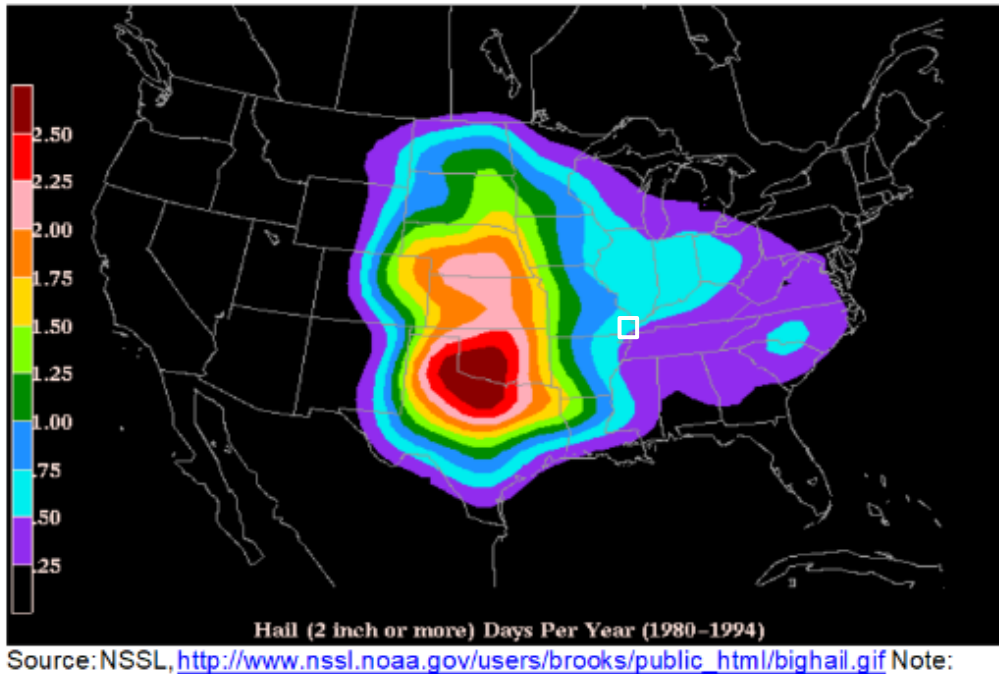
USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/data/cause>

Probability of Future Occurrence

Severe weather events are highly likely to occur in New Madrid County. According to storm events data reported by NCEI, New Madrid County has experienced 20 thunderstorm wind events and 5 significant hail events, many resulting in reported damages in the past 10 years. Based on this historical data, the New Madrid County planning areas is likely to average 2.0 thunderstorm wind events and .3 severe hail events annually.

Figure 3.22 shows severe hail frequency across the United States. New Madrid County, indicated by the white square, has a .5 to .75 probability of experiencing 2" or larger hail in any given year.

Figure 3.21. Annual Hailstorm Probability (2" diameter or larger), U 1980-1994



Changing Future Conditions Considerations and the Impact of Climate Change

Research on the effects of climate change on severe weather is limited. However, according to the Fourth National Climate Assessment, some preliminary studies suggest that the frequency and intensity of severe thunderstorms may increase as the climate changes, especially during spring months in the Midwest and Great Plains regions. As stated in the 2023 Missouri State Hazard Mitigation Plan, predicted increases in temperature could help create atmospheric conditions that are fertile breeding grounds for severe thunderstorms and tornadoes in Missouri. These conditions increase risk to life and property in both the public and private sectors.

Vulnerability

Vulnerability Overview

The 2023 Missouri State Hazard Mitigation Plan assigns New Madrid County a vulnerability rating of Medium Low. This rating is based on six factors: housing density, building exposure, percentage of mobile homes, social vulnerability, likelihood of occurrence, and average annual property loss. New Madrid County has high vulnerability scores for social vulnerability. New Madrid gets a medium rating for percentage of mobile homes. The county gets a medium high score for annualized property loss due to high wind.

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 led 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 including people, crops, vehicles and built structures in the county are vulnerable to

thunderstorms with lightning, high winds and hail. 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 damage occurs 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 damage 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 as per information from [National Lightning Detection Network \(NLDN\) Vaisala Digital | National Lightning Detection Network Vaisala](#) and [Lightning Tips \(weather.gov\)](#).

Potential Losses to Existing Development

According to historical loss data reported for thunderstorm wind, high wind, hail, and lightning by NCEI, from 2013 through 2022, 25 unique severe weather events impacted New Madrid County and caused an estimated \$5,615,500 in property damage. Note that damage estimates are for the entire area reported as affected by an event and therefore may overestimate actual damages. Based on this estimate, New Madrid County experiences an average annual property loss of \$561,550.

The USDA’s RMA also reports crop losses resulting from hail and wind. Based on the \$1,013,246 in reported crop insurance claims from 2013 through 2022, New Madrid County experiences an average annual crop loss of \$101,325 due to severe thunderstorms, wind and hail.

Using these historic losses as an indicator of potential future loss, New Madrid County may experience an annual average of \$662,875 in total losses due to severe thunderstorms annually.

Previous and Future Development

Any additional development that occurs in the planning area will result in increased exposure and thus increased vulnerability to severe thunderstorms and their associated wind, hail, and lightning.

EMAP Consequence Analysis

Table 3.44. EMAP Impact Analysis: Severe Thunderstorms

Subject	Detrimental Impacts
Public	Localized impact expected to be severe for incident areas and moderate to light for other adversely affected areas.
Responders	Localized impact expected to limit damage to personnel in the areas at the time of the incident.
Continuity of Operations	Damage to facilities/personnel in the area of the incident may require temporary relocation of some operations. Localized disruption of roads, facilities, and/or utilities caused by incident may postpone delivery of some services.
Property, Facilities, and Infrastructure	Localized impact to facilities and infrastructure in the area of the incident. Some severe damage possible.
Environment	Localized impact expected to be severe for incident areas and moderate to light for other areas affected by the storm or HazMat spills.
Economic Condition of Jurisdiction	Losses to private structures covered, for the most part, by private insurance.
Public Confidence in the Jurisdiction’s Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective.

Hazard Summary by Jurisdiction

Thunderstorms, high winds, lightning, and hail events are area-wide and expected to occur uniformly across the planning area. However, the magnitude of impacts may vary by jurisdiction based on the physical vulnerability of structures.

Table 3.45 details the percentage of housing built before 1939 and the percentage of manufactured housing units in each jurisdiction, as both characteristics may indicate increased vulnerability to severe thunderstorms. No jurisdictions have 25 percent or more housing falling into either category, although Morehouse is very close to this measure based on the age of its housing.

Table 3.45. Housing Vulnerability Indicators by New Madrid County Jurisdiction, 2021

Jurisdiction	Housing built before 1939 (%)	Mobile homes (%)
New Madrid County	7.8%	10.8%
Matthews	14.0%	12.8%
Morehouse	24.8%	14.9%
New Madrid	6.3%	9.2%
Portageville	7.4%	1.9%

Source: US Census Bureau, American Community 2021 5-Year Estimates

Problem Statement

- Severe thunderstorm events are highly likely to continue occurring in New Madrid County. Possible solutions for wind vulnerability include review of local ordinance and building codes to address high winds and/or construction techniques to include structural bracing, straps and clips, or anchor bolts.
- Possible solutions for vulnerability to lightning include installation of lightning rods and surge protection.
- Possible solutions for vulnerability to hail include use of building materials less prone to damage and encouraging farmers to purchase crop insurance.

3.4.8 Severe Winter Weather

Hazard Profile

Hazard Description

A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, and heavy snowfall. Note that extreme cold temperatures may also accompany winter storms and are addressed in **Section 3.4.6**. The National Weather Service describes different types of winter storm events as follows.

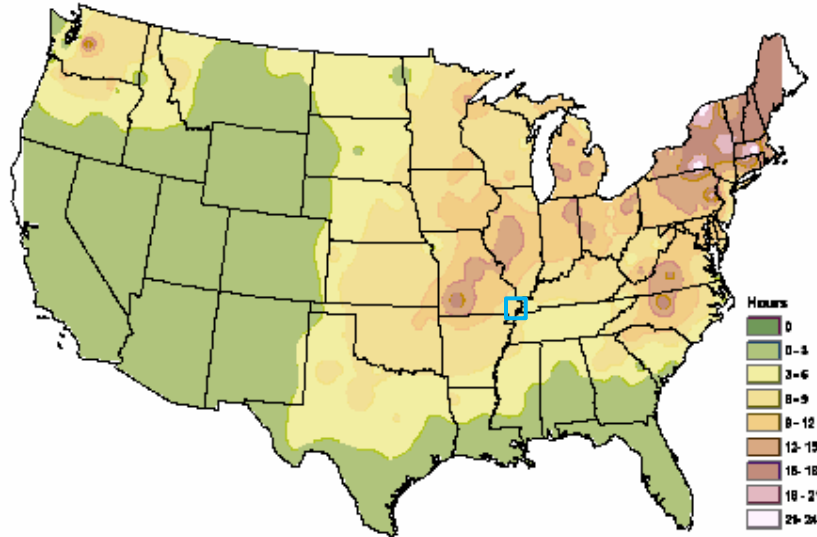
- **Blizzard**—Winds of 35 miles per hour or more with snow and blowing snow reducing visibility to less than ¼ mile for at least three hours.
- **Blowing Snow**—Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- **Snow Squalls**—Brief, 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

All of New Madrid 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 occurring across the United States. New Madrid County, indicated by the blue square, averages between 3-6 hours of freezing rain per year.

Figure 3.22. 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

NCEI reports 32 winter storm-related events for the period from 2013 through 2022, summarized in **Table 3.45**. According to these records, events have resulted in \$15,000 in property damages across all impacted areas. No deaths or injuries were recorded.

Table 3.46. NCEI New Madrid County Winter Weather Events Summary, 2013-2022

Type of Event	Start Date	# of Deaths	# of Injuries	Property Damages
Winter Weather	1/15/2013	0	0	0
Winter Weather	2/21/2013	0	0	0
Winter Storm	12/5/2013	0	0	0
Winter Storm	2/2/2014	0	0	0
Winter Storm	2/4/2014	0	0	0
Winter Storm	3/2/2014	0	0	\$10,000
Winter Weather	11/16/2014	0	0	0
Winter Storm	2/15/2015	0	0	0
Winter Weather	2/17/2015	0	0	0
Winter Storm	2/20/2015	0	0	0
Winter Storm	3/4/2015	0	0	0
Winter Weather	1/22/2016	0	0	0
Winter Weather	2/14/2016	0	0	0
Winter Weather	1/5/2017	0	0	0
Winter Storm	1/12/2018	0	0	0
Winter Weather	2/16/2018	0	0	0
Winter Weather	4/7/2018	0	0	0
Winter Weather	11/14/2018	0	0	0
Winter Weather	12/8/2018	0	0	0
Winter Weather	1/19/2019	0	0	0
Winter Weather	2/15/2019	0	0	0
Winter Weather	11/11/2019	0	0	0
Winter Weather	1/27/2021	0	0	0
Winter Storm	2/10/2021	0	0	0
Winter Storm	2/14/2021	0	0	0
Winter Weather	2/17/2021	0	0	0
Winter Storm	2/2/2022	0	0	\$5,000
Winter Weather	2/23/2022	0	0	0
Winter Weather	3/11/2022	0	0	0
Winter Weather	11/12/2022	0	0	0
Winter Storm	12/22/2022	0	0	0
Winter Weather	12/26/2022	0	0	0
Total		0	0	\$15,000

Source: NCEI, Storm Event Database

The following event narratives for incidents with significant impacts on New Madrid County were reported in NCEI:

- **March 2, 2014** – A major winter storm produced a variety of precipitation types including freezing rain, sleet, thunder, lightning and snow. At New Madrid, four inches of snow fell on top of 2.5 inches of sleet. The weight of the sleet and ice caused the collapse of a carport at Lilbourn. Very cold temperatures hampered road crews and rendered road chemicals ineffective.
- **February 22, 2022** – A powerful cold front swept through the region, with wind chills dropping to 20 to 30 below zero. In addition to the extreme cold, one to three inches of snow fell. The snow and flash freeze heavily impacted travel across the region. Despite relatively light traffic, there were numerous traffic mishaps.

- **December 26, 2022** – An area of snow produced an inch or two of accumulation during the late night and early morning hours. Driving conditions were treacherous during the morning commute.

Winter storms can take a toll on crop production in New Madrid County. **Table 3.46** shows the USDA’s Risk Management Agency payments for insured crop losses in the planning area resulting from cold conditions and snow for the past 10 years. From 2013 through 2022, New Madrid County has experienced \$1,628,855 in crop losses due to severe winter weather.

Table 3.47. Crop Insurance Claims Paid in New Madrid County as a Result of Cold Conditions, 2013-2022

Year	Commodity Affected	Determined Acres	Indemnity Amount
2013	Rice, Cotton	3235.87	\$482,649
2014	Corn, Rice, Wheat, Cotton, Soybeans	2883.12	\$353,720
2015	Cotton, Rice, Wheat, Soybeans	1961.72	\$499,493
2016	Cotton, Soybeans	447.68	\$56,734
2017	Cotton, Rice, Corn	1203.99	\$124,505
2020	Rice, Cotton, Corn, Popcorn, Soybeans	955.33	\$30,875
2021	Rice, Corn, Soybeans	1284.03	\$62,808
2022	Wheat	135.38	\$18,071
Totals		12,107	\$1,628,855

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

Probability of Future Occurrence

According to NCEI historical storm events data for 2013 through 2022, there have been 32 winter storm related events in New Madrid County, including, 12 winter storm events, and 20 winter weather events. This equates to an average of 3.2 winter storm-related events annually.

Changing Future Conditions Considerations and the Impact of Climate Change

Per the 2023 Missouri State Hazard Mitigation Plan, “a shorter overall winter season and fewer days of extreme cold may have both positive and negative indirect impacts. As both temperature and precipitation increase during the winter months, freezing rain will be more likely. Additional wintertime precipitation in any form will contribute to saturation and increase the risk and/or severity of spring flooding. A greater proportion of wintertime precipitation may fall as rain rather than snow.”

Vulnerability Overview

The 2023 Missouri State Hazard Mitigation Plan rates vulnerability to severe winter weather based on five factors: housing density, building exposure, social vulnerability, likelihood of occurrence, and average annual property loss. New Madrid County was rated Low housing density and building exposure, High for SOVI Rating and Medium for annualized property loss, resulting in an overall rating of Medium High.

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

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

Overhead power lines and infrastructure are also vulnerable to damage from winter storms. In particular, ice accumulation during winter storm events may cause damage to power lines due to the ice weight on the lines and equipment. Damage also occurs to lines and equipment from falling trees and tree limbs weighted down by

ice. Potential losses could include the cost of repair or replacement of damaged facilities and lost economic opportunities for businesses.

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

Potential Losses to Existing Development

Based on NCEI data for historical winter weather events from 2008 through 2022, New Madrid County has averaged \$1,500 annually in property losses as a result of winter weather.

Based on data from the USDA’s RMA from 2013 through 2022, New Madrid County averages \$162,886 per year in crop losses due to winter weather conditions.

Overall, New Madrid County can expect an average of \$164,386 in annual losses due to severe winter weather.

Previous and Future Development

There is minimal future development projected for New Madrid County. Therefore, the potential impact of winter weather is not expected to increase due to development within the planning area

EMAP Consequence Analysis

Table 3.48. EMAP Impact Analysis: Severe Winter Weather

Subject	Detrimental Impacts
Public	Localized impact expected to be severe for affected areas and moderate to light for other less affected areas.
Responders	Adverse impact expected to be severe for unprotected personnel and moderate to light for trained, equipped, and protected personnel.
Continuity of Operations	Unlikely to necessitate execution of the Continuity of Operations Plan. Localized disruption of roads and/or utilities caused by incident may postpone delivery of some services.
Property, Facilities, and Infrastructure	Localized impact to facilities and infrastructure in the areas of the incident. Power lines and roads most adversely affected.
Environment	Environmental damage to trees, bushes, etc.
Economic Condition of Jurisdiction	Local economy and finances may be adversely affected, depending on damage.
Public Confidence in the Jurisdiction’s Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective.

Hazard Summary by Jurisdiction

Agricultural exposure is higher in the unincorporated areas of the county. Building and infrastructure exposure is greater in more densely populated parts of the county. Transportation incidents related to winter storms impact all jurisdictions. Buildings with high occupancy and mobile home parks may be more vulnerable to winter storm events. According to the American Community 2017-2021 Survey 5-Year Estimates only New Madrid (city) has housing with 10 or more units. The percentage of manufactured and/or mobile homes by

jurisdiction is discussed above and below within information on vulnerability.

New Madrid County – The unincorporated portion of the county is likely to experience 3 winter weather events per year. Damages are not anticipated to be as significant as within jurisdictions. This is due solely to the low population density of the county—29.0 persons per square mile for the county as a whole—as compared to Missouri’s at 89.5 and the US’s at 93.8. About 10.8% of housing in the county is mobile homes.

Matthews – While the City of Matthews is also likely to experience an average of approximately 3 winter weather events per year, its vulnerability to damage from these types of events is slightly higher than its neighboring cities because mobile homes make up 12.8% of housing in the city.

Morehouse – The City of Morehouse is also likely to experience 3 or more winter weather events per year and its vulnerability to damage from these types of events is similar to the City of Matthews. 14.9% of its housing is manufactured homes.

New Madrid – The City of New Madrid is the most densely populated jurisdiction in the county because it has housing units with multiple apartments. The percentage of mobile homes is 9.2%.

Portageville – The city has a comparatively low rate of manufactured homes in the city – 1.9% and has no building complexes with 10 or more units. Portageville, like the county, will experience an average of 3 winter weather events annually.

Gideon 37 School District – lies in the southwestern part of the county in a non-participating county. It has the same vulnerability to severe winter weather as the rest of the planning area.

New Madrid R-1 School District – is on Highway 61, near the City of New Madrid. It has the largest enrollment in the county and has a similar risk to severe winter weather as the city.

Portageville School District – lies within the city limits of Portageville and has the same risk as the city.

Risco R-II School District – lies within the City of Risco, a non-participating community and has the same vulnerability to severe winter weather as the remainder of the planning area.

Problem Statement

- New Madrid County is very likely to continue experiencing severe winter weather events. Possible solutions include providing and publicizing the locations of warming shelters, burying overhead power lines, and educating the public on the safe use of generators.
- Mobile homes may suffer structural damage from the weight of snow and ice accumulation on their roofs. Possible solutions include providing public education on proper safety precautions for winter storm preparedness.

3.4.9 Tornado

Hazard Profile

Hazard Description

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

Although tornadoes have been documented in all 50 states, most of them occur in the central United States. The unique geography of the central United States allows for the development of thunderstorms that spawn tornadoes. The jet stream, which is a high-velocity stream of air, determines which area of the central United States will be prone to tornado development. The jet stream normally 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 large thunderstorms that breed tornadoes.

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

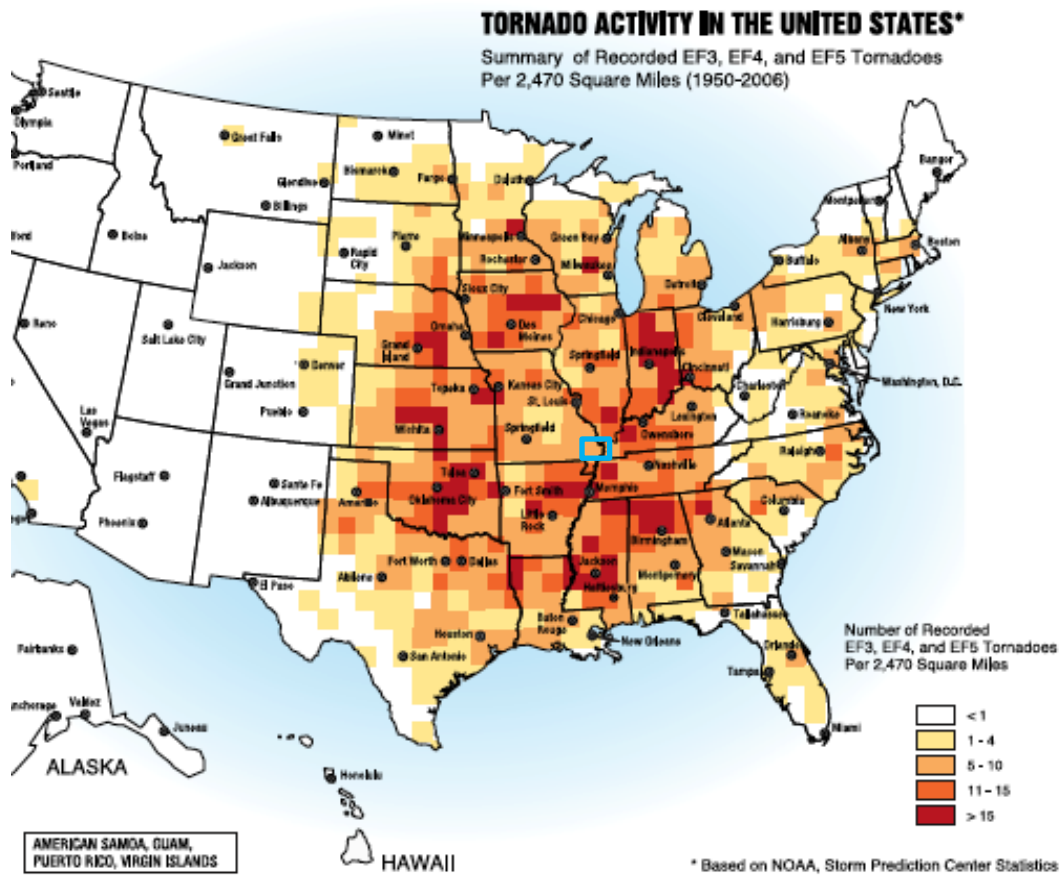
A typical tornado can be described as a funnel-shaped cloud that is "anchored" to a cloud, usually a cumulonimbus that is also in contact with the earth's surface. This contact on average lasts 30 minutes and covers an average distance of 15 miles. The width of the tornado (and its path of destruction) 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 within the New Madrid County planning area. Figure 3.24 illustrates the average tornado activity across the United States from 1950 to 2006. New Madrid County, indicated by the blue square, is in an area that experiences an average of 5 to 10 tornados per 2,470 square miles annually.

Figure 3.23. Tornado Activity in the United States



Source: FEMA 320, Taking Shelter from the Storm, 3rd edition

Strength/Magnitude/Extent

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

Tornado magnitude is classified according to the EF- Scale (or the Enhance Fujita Scale, based on the original Fujita Scale developed by Dr. Theodore Fujita, a renowned severe storm researcher). The EF- Scale (see **Table 3.49**) ranks 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 3.49. Enhanced F Scale for Tornado Damage

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

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

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center as listed in **Table 3.50**. The damage descriptions are summaries. For the actual EF scale it is necessary to look up the damage indicator (type of structure damaged) and refer to the degrees of damage associated with that indicator. Information on the Enhanced Fujita Scale's damage indicators and degrees of damage is located online at www.spc.noaa.gov/efscale/ef-scale.html.

Table 3.50. 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
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 to take shelter. Tornadoes may not be visible on the ground if they occur after sundown or due to blowing dust or driving rain and hail.

Previous Occurrences

Table 3.51 lists NCEI reported tornado events and damages since 1993 in the New Madrid County planning area. Prior to 1993, only tornadoes causing significant destruction were recorded.

There are limitations to the use of NCEI tornado data that must be noted. Tornadoes reported in Storm Data and the Storm Events Database are in segments, and 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.

Based on NCEI data, 25 tornado segments have occurred in New Madrid County across 19 different days between 1993 and 2022. These events caused 4 injuries and no deaths and an estimated \$1,975,000 in property damage.

Table 3.51. Recorded Tornadoes in New Madrid County, 1993 – 2022

Date	Beginning Location	Ending Location	Length (miles)	Width (yards)	F/EF Rating	Death	Injury	Property Damage
6/5/1994	Risco	Risco	2	20	F0	0	0	0
7/16/1997	Howardville	Howardville	.2	30	F0	0	0	0
7/16/1997	Conran	Conran	.2	20	F0	0	0	0
1/21/1999	Morehouse	Morehouse	.3	30	F0	0	0	0
1/21/1999	Morehouse	Morehouse	1	100	F1	0	0	\$10,000
5/26/2000	Portageville	Portageville	.5	40	F0	0	0	\$20,000
9/2/2001	Parma	Parma	1.5	30	F0	0	0	0
4/28/2002	Portageville	Portageville	.1	70	F0	0	0	0
11/15/2005	Matthews	Matthews	.2	50	F0	0	0	0
11/15/2005	Lilbourn	Lilbourn	.2	50	F0	0	0	\$10,000
11/15/2005	Lilbourn	Lilbourn	1	75	F1	0	2	\$60,000
4/30/2006	Gideon	Gideon	.2	50	F0	0	0	0
4/5/2012	Portageville	Conran	3.93	100	EF0	0	0	0
10/31/13	Matthews	Matthews	2.99	50	EF1	0	0	\$175,000
6/7/2014	New Madrid	Lena	3.41	200	EF1	0	0	\$10,000
3/1/2017	Matthews	Matthews	4.69	200	EF1	0	0	\$200,000
3/9/2017	Kewanee	Kewanee	1.14	150	EF1	0	0	\$50,000
3/9/2017	Bayouville	Bayouville	.93	250	EF2	0	0	\$20,000
4/30/2017	Mattnews	Matthews	4.04	150	EF2	0	0	\$60,000
2/24/2018	Broadwater	Broadwater	.34	50	EF0	0	0	\$2,000
2/24/2018	Matthews	Matthews	.95	150	EF2	0	2	\$750,000
4/3/2018	Canalou	Matthews	2.55	125	EF1	0	0	\$90,000
3/2/2020	Broadwater	Risco	3.06	50	EF0	0	9	0
5/3/2020	Conran	Marston	5.84	150	EF1	0	0	\$500,000
3/18/2022	Conran	Jaywye	.71	50	EF0	0	0	0
Total						0	4	\$1,957,000

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

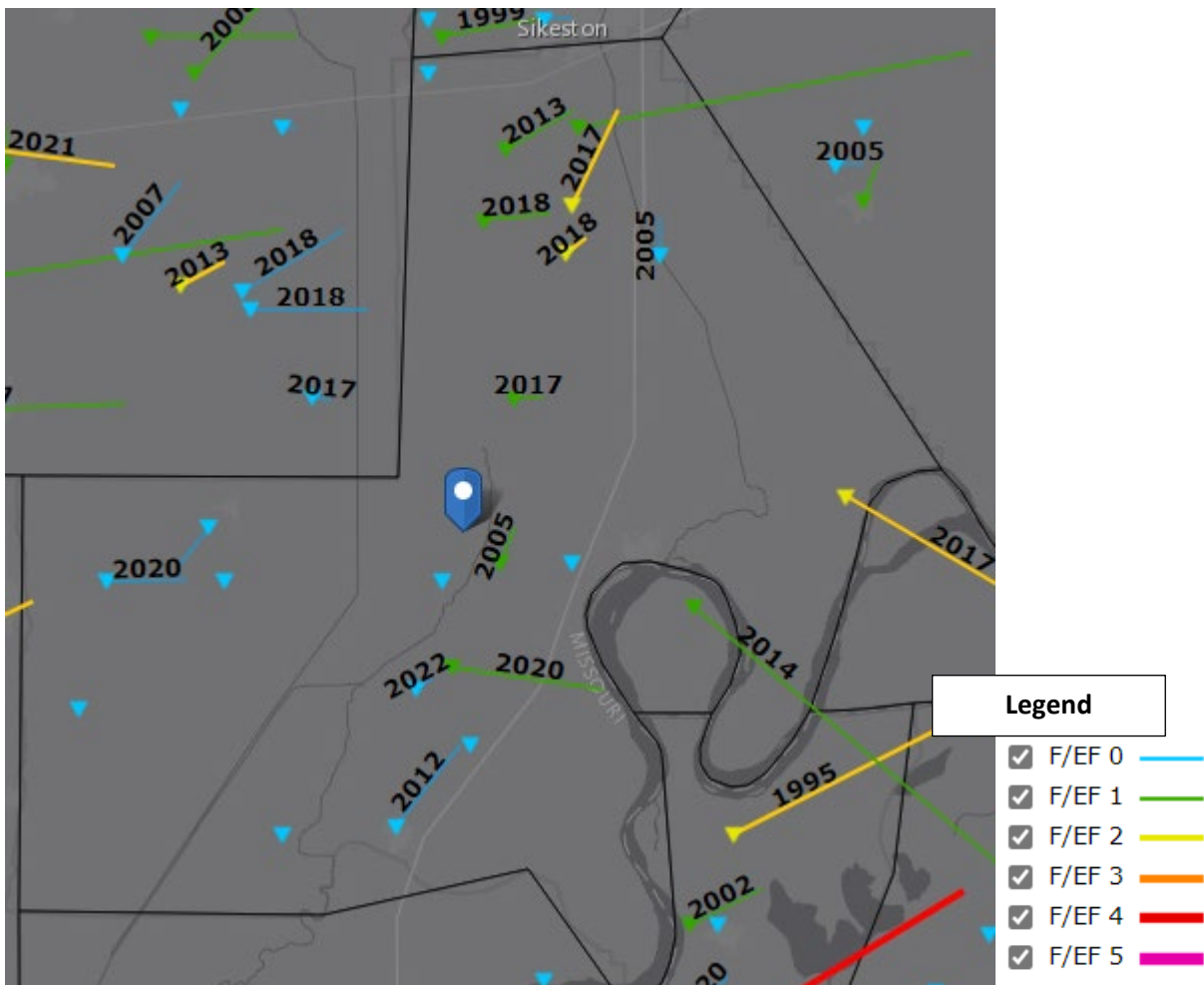
The following event narratives were reported by NCEI.

- Nov 15, 2005** - A couple of mobile homes were pushed off their foundations several feet. Several projectiles were embedded in one of the mobile homes. A considerable amount of debris was stuck in trees in the area. Numerous trees were either topped or blown down. A couple of small outbuildings were damaged or destroyed. Near the end of the tornado track, a couple of farm trailers and a couple of empty semi trailers were overturned. Peak winds were estimated near 80 MPH.

- **February 24, 2018** – An EF2 tornado tracked from the south side of Matthews to one mile east of town. Roofs were partially or completely torn off dozens of homes. Semi trucks were blown over and destroyed. Numerous outbuildings were destroyed. A couple of injuries occurred due to windows being blown out of a nursing home. Peak winds were estimated near 120 mph.
- **May 3, 2020** – An EF-1 tornado damaged or destroyed several large metal farm buildings. The concrete anchors of a shed were pulled from the ground. The tornado cut through the city of Marston, where the city hall and an apartment building were partially unroofed. At least three power poles were broken. Numerous trees were uprooted. The discernable tornado path ended in the Mississippi River flood plain. Peak winds were estimated at 95 mph.

Figure 3.25 maps historic tornado events that impacted New Madrid County according to mapping produced by the Midwestern Regional Climate Center (MRCC). These events resulted in no deaths.

Figure 3.24. New Madrid County Map of Historic Tornado Events



Source: Midwestern Regional Climate Center

Tornadoes have the potential to cause significant crop damage, and past events in NCEI describe damages to crops as well as farm buildings and equipment. These events are accounted for in **Section 3.4.7** as part of the Thunderstorms, High Wind, Hail and Lightning hazard. There are no crop losses reported by RMA for tornadoes in New Madrid County. This may be due to crop losses being processed as damaged due to wind or excess wind.

Probability of Future Occurrence

Based on the 25 historical events reported by NCEI for the period from 1993 through 2022, New Madrid County has an 83 percent chance of being impacted by a tornado in any given year.

Changing Future Conditions Considerations and the Impact of Climate Change

Scientists do not know how the frequency and severity of tornadoes will change. As reported in the Fourth National Climate Assessment, some research suggests that tornado activity has become more variable, concluding that the number of days with large outbreaks have been increasing since the 1950s and that densely concentrated tornado outbreaks are on the rise. The 2023 Missouri State Hazard Mitigation Plan notes research that shows that the area of tornado activity is not expanding, but rather the areas already subject to tornado activity are seeing more densely packed tornadoes.

Vulnerability

Vulnerability Overview

New Madrid County is in a region of the U.S. with high frequency of dangerous and destructive tornadoes referred to as “Tornado Alley”, illustrated below.

Figure 3.25. Tornado Alley in the U.S.



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

The 2023 Missouri State Hazard Mitigation Plan rates tornado vulnerability based on the following criteria: building exposure, population density, social vulnerability, percentage of mobile homes, likelihood of occurrence, and annual property loss. The State plan rates New Madrid County’s overall vulnerability at Medium High.

Potential Losses to Existing Development

Of the 25 tornado segments reported by NCEI that hit New Madrid County from 1993 through 2022, 14 were F0/EF0, 8 were F1/EF1 and 3 were EF2. There was \$1,957,000 in property damage reported from these events, which equates to an average annual loss of \$65,233 due to tornadoes.

Previous and Future Development

Although New Madrid County is not in a population growth phase, some jurisdictions are experiencing small population gains which logically means additional exposure to tornadoes. Buildings with high occupancy such as schools, government offices, skilled care facilities and mobile home parks are always at risk for loss of life and injuries due to concentrated populations. Table 3.52 shows the impact analysis of tornadoes.

EMAP Consequence Analysis

Table 3.52. EMAP Impact Analysis: Tornadoes

Subject	Detrimental Impacts
Public	Localized impact expected to be severe for incident areas and moderate to light for other adversely affected areas.
Responders	Localized impact expected to limit damage to personnel in the areas at the time of the incident.
Continuity of Operations	Damage to facilities/personnel in the area of the incident may require temporary relocation of some operations. Localized disruption of roads, facilities, and/or utilities caused by incident may postpone delivery of some services.
Property, Facilities, and Infrastructure	Localized impact to facilities and infrastructure in the area of the incident. Some severe damage possible.
Environment	Localized impact expected to be severe for incident areas and moderate to light for other areas affected by the storm or HazMat spills.
Economic Condition of Jurisdiction	Local economy and finances adversely affected, possibly for an extended period of time.
Public Confidence in the Jurisdiction’s Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective.

Hazard Summary by Jurisdiction

A tornado event could occur anywhere in the planning area, but some jurisdictions would suffer heavier damages because of the age of the housing, the increased density of buildings and infrastructure, or the high concentration of mobile homes. New Madrid County Unincorporated and Morehouse have the greatest number of buildings constructed prior to 1939, making them more vulnerable to tornado damage. Communities that have adopted building codes may be less vulnerable to damages. Housing vulnerability related to structure age was detailed in **Table 3.27**. Event narratives above mention mobile homes frequently. It is generally accepted that mobile homes are highly vulnerable to damage or devastation by tornadoes. Below, **Table 3.53** illustrates the number and percentage of mobile homes in each jurisdiction.

Table 3.53. Mobile Homes in New Madrid County

Jurisdiction	Number of Mobile Homes	Percentage of Mobile Homes
Matthews	52	12.8%
Morehouse	86	14.9%
New Madrid	134	9.2%
Portageville	23	1.9%
New Madrid County, entire	945	10.8%

Source: US Census Bureau American Community Survey 2020 5 Year Estimates <https://data.census.gov/>

Problem Statement

- There are no tornado warning sirens within some New Madrid County jurisdictions. Possible solutions include promoting the use of NOAA weather radios and conducting public education and outreach activities to increase awareness of tornado risk.
- Mobile homes are particularly vulnerable to tornadoes. A possible solution is to provide public outreach and/or conduct inspections to ensure the proper tie downs are installed on mobile homes.

3.4.10 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 with fire suppression activities. Currently, more than 700 rural fire departments in Missouri have mutual aid agreements with the Forestry Division to obtain assistance in wildfire protection if needed.

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

Geographic Location

Damages due to wildfires are 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.

New Madrid County is predominately classified as non-vegetated or agricultural with very few pockets of WUI intermix areas and very minimal dense housing in its larger communities. See Figure 3.27. New Madrid County is marked by a black rectangle.

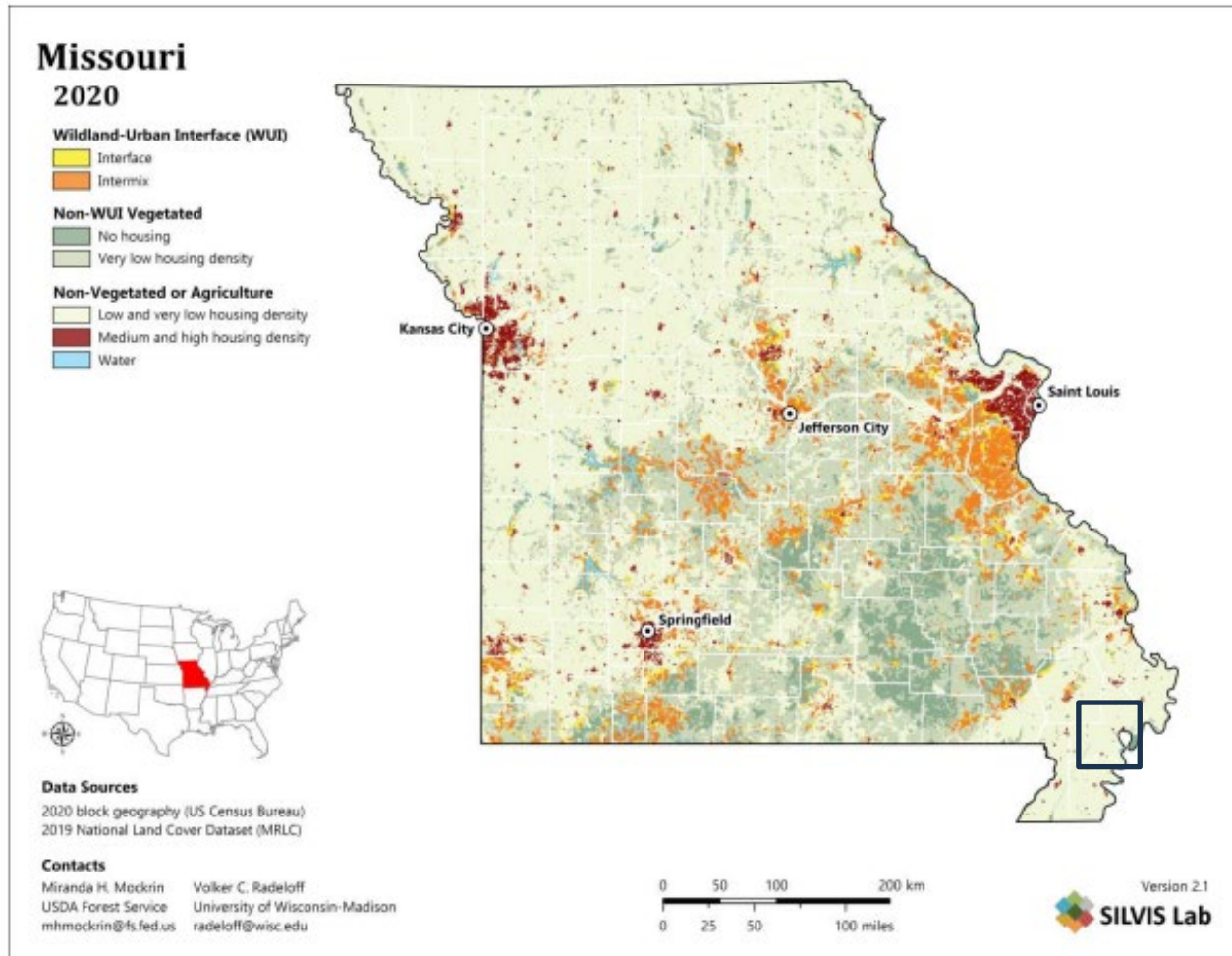
Strength/Magnitude/Extent

Wildfires damage the environment, killing some plants and occasionally animals. Firefighters have been injured

or killed, and structures can be damaged or destroyed. The loss of plants can heighten the risk of soil erosion and landslides. Although Missouri wildfires, including those in New Madrid County, are not the size and intensity of those in the western United States, they could impact agricultural areas 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 sometimes “torch” or “crown” out in certain dense evergreen stands like eastern red cedar and shortleaf pine. However, New Madrid County does not have the extensive stands of evergreens found in the western US that fuel the large fire storms seen on television news stories.

Figure 3.26. WUI Areas in Missouri, 2020



Source: University of Wisconsin-Madison, SILVIS Lab,
https://geoserver.silvis.forest.wisc.edu/geodata/wui_change_2020/maps/gifs/white/MO_WUI_v21_white_2020.gif

While very unusual, crown fires can and sometimes 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 firefighters to suppress fires safely.

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

Previous Occurrences

According to the Missouri Department of Conservation, there were approximately 114 noted wildfires within New Madrid County between 2003 and 2022. One of them burned 20 or more acres. There was no additional data records for the school districts within New Madrid County.

The wildfire event that burned 20 or more acres was:

- July 9, 2009 – 20 acres – Report of 20 acres of no-till soybeans over wheat straw burned. Cause – unknown.

Probability of Future Occurrence

With 114 wildfires noted within New Madrid County between 2003 and 2022, the likelihood of occurrence can be calculated to average 6 wildfire events per year. With the total acreage burned during this same period as 182.62 acres, the annual average acreage burned can be calculated as 9.1 acres burned per year and the average event can be calculated as .6 acres. The most common known cause noted was “unknown.” This information came from the Missouri Department of Conservation Wildfire Reporting database.

Changing Future Conditions Considerations and the Impact of Climate Change

According to the 2023 State Hazard Mitigation plan, higher temperatures will reduce the number of days prescribed burning can be performed. Reduction of prescribed burning will allow for growth of understory vegetation. Drought is also anticipated to increase in frequency and intensity during the summer months under projected scenarios. Drought can lead to dead or dying vegetation and landscaping material close to structures which creates fodder for wildfires within both urban and rural settings.

Vulnerability

Vulnerability Overview

Based on data from the Missouri Department of Conservation Wildfire Report. The average amount of land burned in one year as a result of wildfires in New Madrid County was almost 10 acres. This average was based on 114 wildfires occurring in the county between 2003 and 2022. The total acreage burned during this 20-year time period was 183 acres. According to the 2023 Missouri State Hazard Mitigation Plan, the western U.S. and the southeastern U.S. are most vulnerable to wildfires. More specifically, since New Madrid has little WUI and Intermix, it is at somewhat low risk.

With climate changing to more extreme weather conditions, the possibility of wildfires may increase. Potential wildfires pose a risk to people, buildings and wildlife. The risk is not only from the fire itself, but from smoke produced and the remaining residue. There are some limitations of the data on wildfires, although the MDC data is generally agreed to be the most accurate source.

Potential Losses to Existing Development

To estimate potential damage to existing development, WUI areas should be closely examined. Per the 2023 Missouri State Hazard Mitigation Plan, New Madrid is the only county in the state with no WUI interface/intermix areas with structures. The county is also the only one in the state with zero population at risk of wildfires. Overall, New Madrid County is the only county in the state with an average annual land potential loss of \$0.

Impact of Previous and Future Development

There is very little planned development in New Madrid County and very little WUI, but there is much agricultural acreage. Those fields located near more densely populated areas could pose a threat to residential areas.

EMAP Consequence Analysis

Table 3.54. EMAP Impact Analysis: Wildfire

Subject	Detrimental Impacts
Public	Localized impact expected to be severe for incident areas and moderate to light for other adversely affected areas.
Responders	Localized impact expected to limit damage to personnel in the incident areas at the time of the incident.
Continuity of Operations	Damage to facilities/personnel in the area of the incident may require temporary relocation of some operations. Localized disruption of roads and/or utilities caused by incident may postpone delivery of some services.
Property, Facilities, and Infrastructure	Localized impact to facilities and infrastructure in the area of the incident. Some severe damage possible.
Environment	Localized impact expected to be severe for incident areas and moderate to light for other areas affected by smoke or HazMat remediation.
Economic Condition of Jurisdiction	Local economy and finances may be adversely affected, depending on damage and length of investigations.
Public Confidence in the Jurisdiction's Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective.

Hazard Summary by Jurisdiction

For those jurisdictions without identified wildfire urban interface or intermix areas, the probability of wildfire is noted as unlikely. School district risk is based upon their corresponding jurisdiction.

Because the county is more than 90% agricultural which is open and unpopulated, the risk to human life is minimal. The largest jurisdictions, New Madrid and Portageville, are at greatest risk of the damage of a wildfire due to concentrations of housing.

Problem Statement

- Virtually no New Madrid County parcels are located within the identified WUI areas. Jurisdictions with new housing construction should note the location of WUI areas and inform residents of wildfire protection measures for new structures.
- There are multiple fire departments within New Madrid County: Canalou, Gideon, Howardville, Kewanee/Laforge Volunteer, Lilbourn Volunteer, Marston, Matthews Volunteer, Morehouse Volunteer, New Madrid, Parma Volunteer, Portageville and Risco. The departments should confirm mutual aid agreements with neighboring counties and among each other; publicize information on open burning under Missouri regulations and continue to report wildfire incidents to the National Fire Incident Reporting System through Missouri Department of Public Safety.

4	MITIGATION STRATEGY.....	4.1
4.1	Goals.....	4.1
4.2	Identification and Analysis of Mitigation Actions.....	4.2
4.3	Implementation of Mitigation Actions	4.5

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

This section presents the mitigation strategy 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 (2023)*.

- **Mitigation Goals** are general guidelines that explain desired achievement. Goals are long-term policy statements and global visions that support the mitigation strategy. 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 an existing hazard mitigation plan. Therefore, the goals from the *2019 New Madrid County Hazard Mitigation Plan* were reviewed to determine if they are still valid. The MPC participated in a facilitated discussion during their second meeting to review and update the plan goals. To ensure that the goals are comprehensive and support State goals, the *2023 Missouri State Hazard Mitigation Plan* goals were reviewed as well by consulting staff. Although the goals were slightly different, they were in alignment. The MPC voted to maintain the goals from the 2019 plan.

The current goals adopted by the planning committee are as follows:

- 1.) Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes and severe thunderstorms.
- 2.) Minimize property damage due to flooding.
- 3.) Minimize injuries and property damage due to seismic events.
- 4.) Minimize the impact to natural and human resources caused by drought and/or heat wave.
- 5.) Maintain public services to minimize the risk and reduce property damage caused by severe winter weather.

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 second MPC meeting, the results of the public survey were provided to the MPC members for review and the key issues were identified for specific hazards. The survey results were plotted on a grid to visually illustrate opinions on the likelihood and magnitude of potential hazards. The County Emergency Management Director, Beau Bishop, presented information on disaster declarations that have occurred in the county since the previous plan update. Members were informed that Meeting #3 would be their opportunity to assess risks and review previous Action Plans, updating them based on STAPLEE assessment, current available priorities and resources. Actions from the previous plan included completed actions, on-going actions, and actions upon which progress had not been made. The MPC was reminded that there are funding opportunities through FEMA that help address needs in their jurisdictions.

Problem statements are included in the plan update at the end of each hazard profile. The problem statements summarize the risk to the planning area presented by each hazard and include possible methods to reduce that risk. Use of problem statements allowed the planners to recognize new and innovative strategies to mitigate risks in the planning area.

The focus of Meeting #3 was to update the mitigation strategy. For a comprehensive range of mitigation actions to consider, the MPC reviewed the following information during Meeting #3:

- A list of actions proposed in the previous mitigation plan, the current State Plan, and approved plans in surrounding counties,
- Key issues from the risk assessments.
- State priorities and hazard mitigations established for HMA grants, and
- Public input during meetings, responses to data collection questionnaires, and public survey results.

During Meeting #3, most individual jurisdictions, including school districts, developed final mitigation strategy for inclusion in the plan. Those that needed more time, were absent for Meeting #3 or who wanted to take it back to their jurisdictions for further discussion and consideration were granted more time to complete their action plans. They were encouraged to use previous action plans as a basis but to consider new actions that made sense based on the multiple resources at their disposal.

The MPC reviewed the actions from the previously approved plan for progress made since the plan had been adopted, using worksheets included in Appendix F of this plan. Prior to Meeting #3, the list of actions for each jurisdiction was emailed to that jurisdiction's MPC representative along with the worksheets. Each jurisdiction was instructed to provide information regarding the "Action Status" directly on the old action plans by marking them as:

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

Additionally, the future inclusion of each mitigation action in the plan update was identified as either keep, delete, or modify. Based on the status updates and a comparison of previous plans to new proposed plans, there was 1 completed action, 97 continuing actions (either ongoing or modified, and no actions were deleted).

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

Table 4.1. Action Status Summary

Jurisdiction	Total Number of Existing Mitigation Actions	Completed Actions	Continuing Actions (ongoing or modify)	Deleted Actions
Matthews	12	0	12	0
Morehouse	11	0	11	0
New Madrid (City)	14	0	14	0
Portageville	10	0	10	0
New Madrid County	20	0	20	0
Gideon School 37	8	1	7	0
New Madrid County Central R-1 School	8	0	8	0
Portageville School	8	0	8	0
Risco RII School	7	0	7	0
Total	98	1	97	0

Submitted revised 2023 Action Worksheets. N/A – Updated information not available/not provided by jurisdiction and/or school Source district.

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

Table 4.2. Summary Deleted Actions from the Previous Plan

	Deleted Actions	Jurisdiction	Reason for Deletion
	None		

Source: 2023 Jurisdiction Action Plans

For a comprehensive range of mitigation actions to consider, the jurisdictions were provided relevant information and sources to be used in development of new mitigation actions including:

- Updated Plan Goals
- Previous Actions from 2019 Plan
- State Priorities for Hazard Mitigation Assistance Grants
- Public Opinion from Surveys

To facilitate discussion and ideas on new actions that jurisdictions may want to submit to the plan update, the planning committee reviewed the plan goals that were updated at Meeting #2. Key issues/problem statements for hazards in the risk assessment were also discussed, as well as the actions from the 2019 plan that were identified relative to each hazard. The discussion was geared toward identifying any gaps that may exist between the problems identified and actions already developed to address the problems to develop new actions.

The jurisdictions were encouraged to be comprehensive and include all appropriate actions to work toward becoming more disaster resistant. They were encouraged to maintain a realistic approach and were reminded that the hazard mitigation plan is a “living document.” As capabilities, vulnerabilities, or the nature of hazards that threaten each jurisdiction change, the mitigation actions can and should be updated to reflect those changes, including addition or deletion of actions, as appropriate.

As part of the meeting discussion, jurisdictions were instructed to consider the potential cost of each project in relation to the anticipated future cost savings and the value of human lives. Jurisdictions used the STAPLEE risk assessment tool to gauge the cost-benefit of proposed actions.

4.3 Implementation of Mitigation Actions

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

Jurisdictional MPC members were given the option to meet with others in their communities to finalize the actions to be submitted for the updated mitigation strategy. Throughout the MPC consideration and discussion, emphasis was placed on the importance of a cost-benefit analysis in determining project priority. The Disaster Mitigation Act requires cost-benefit 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 2023 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 jurisdictions used worksheets to assign scores. The worksheets posed questions based on the STAPLEE elements as well as the potential mitigation effectiveness of each action. Scores were based on the responses to the questions as follows:

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

The following questions were asked for each proposed action.

- **Social:** Will the action be acceptable to the community? Could it have an unfair effect on a particular segment of the population?
- **Technical:** Is the action technically feasible? Are there secondary impacts? Does it offer a long-term solution?
- **Aministrative:** Are there adequate staffing, funding, and maintenance capabilities to implement the project?
- **Political:** Will there be adequate political and public support for the project?
- **Legal:** Does your jurisdiction have the legal authority to implement the action?
- **Economic:** Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- **Environmental:** Will there be negative environmental consequences from the action? Does it comply with environmental regulations? Is it consistent with community environmental goals?

Will historic structures be saved or protected?
Could it be implemented quickly?
Will the implemented action result in lives saved?

Will the implanted action result in a reduction of disaster damage?

The final scores are listed below in the analysis of each action. The worksheets are attached to this plan as Appendix F. The STAPLEE final score for each action, absent other considerations, such as a localized need for a project, determined the priority. Low priority action items were those that had a total score of between 0 and 24. Moderate priority actions were those scoring between 25 and 29. High priority actions scored 30 or above. A blank STAPLEE worksheet is shown in Figure 4.1.

The mitigation action summary table presenting the summary of continuing and new mitigation actions for each jurisdiction is provided in Table 4.3 and for each school district in Table 4.4. The Action ID for each action has been carried over from the 2019 plan for continuing actions. As a result of completed and deleted actions, the Action ID does not follow a sequential order. New actions were assigned the next sequential Action ID for each jurisdiction. Following the action summary tables, additional details are provided for each continuing and new through action worksheets for each specific jurisdiction. The action worksheets, see Figure 4.2, serve as the roadmap describing how each action will be implemented and administered by the local jurisdiction. STAPLEE sheets are located in Appendix F.

The jurisdictions of Canalou, Catron, Gideon, Howardville, Lilbourn, Marston, Parma, Risco and the Village of North Lilbourn in New Madrid County did not participate in the mitigation plan update:

Figure 4.1. Blank STAPLEE Worksheet

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

Completed by
(Name, Title, Phone Number) _____

Figure 4.2. Mitigation Action Worksheet

Action Worksheet	
Name of Jurisdiction:	
Risk / Vulnerability	
Hazard(s) Addressed:	List the hazard or hazards that will be addressed by this action
Problem being Mitigated:	Provide a brief description of the problem that the action will address. Utilize the problem statement developed in the risk assessment.
Action or Project	
Applicable Goal Statement:	Choose the goal statement that applies to this action
Action/Project Number:	Insert a unique action number for this action for future tracking purposes. This can be a combination of the jurisdiction name, followed by the goal number and action number (i.e. Joplin1.1)
Name of Action or Project:	
Mitigation Category:	Prevention; Structure and Infrastructure Projects; Natural Systems Protection; Education and Outreach; Emergency Services
Action or Project Description:	Describe the action or project.
Estimated Cost:	Provide an estimate of the cost to implement this action. This can be accomplished with a range of estimated costs.
Benefits:	Provide a narrative describing the losses that will be avoided by implementing this action. If dollar amounts of avoided losses are known, include them as well.
Plan for Implementation	
Responsible Organization/Department:	Which organization will be responsible for tracking this action? Be specific to include the specific department or position within a department.
Supporting Organization/Department:	Which organization/department will assist in implementation of this action?
Action/Project Priority:	Include the STAPLEE score and Priority (H, M, L)
Timeline for Completion:	How many months/years to complete.
Potential Fund Sources:	List specific funding sources that may be used to pay for the implementation of the action.
Local Planning Mechanisms to be Used in Implementation, if any:	
Progress Report	
Action Status:	Indicate status as New, Continuing Not Started, or Continuing in Progress)
Report of Progress:	For Continuing actions only, indicate the report on progress. If the action is not started, indicate any barriers encountered to initiate the action. If the action is in progress, indicate the activity that has occurred to date.

Table 4.3. Mitigation Action Matrix - Jurisdictions

#	Action	Matthews	Morehouse	New Madrid (City)	Portageville	New Madrid County (Unincorporated)	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
1.1	Adopt most current IRC (residential), IBC (commercial building) and ICC600 (high wind areas) building codes to withstand high winds and possible tornado	X	X	X	X	X	Structural/ Infrastructure	Tornadoes/Severe Thunderstorm		X	
1.2	Host safety workshops and seek funding for storm sirens with a focus on all natural hazards	X	X	X	X	X	Education Outreach and Prevention	Tornadoes/Severe Thunderstorm			
1.3	Apply for funding for a FEMA safe room.		X	X		X	Prevention	Tornadoes/Severe Thunderstorm	X	X	
1.4	Upkeep of all EAS equipment as FEMA funds are available.					X	Emergency Services	Multi-Hazard	X	X	
2.1	Adopt roadway drainage design policy referencing MoDot Engineering Policy Guide "748 Hydraulics and Drainage".	X	X	X	X	X	Prevention	Flood-Related Hazards	X	X	X
2.2	Create program to clean and maintain current drainage systems	X	X	X	X	X	Prevention	Flood-Related Hazards	X	X	X
2.3	Perform a flood study to highlight localized problem areas in each jurisdiction. Use results to create mitigation actions to alleviate the problem areas.	X	X	X	X	X	Prevention	Flood-Related Hazards		X	X
2.4	Raise county road elevation above the base flood elevation to prevent repeated washout					X	Prevention	Flood-Related Hazards	X	X	X
2.5	Upgrade city drainage systems			X			Prevention	Flood-Related Hazards	X	X	X
2.6	Implementation of NFIP requirements to reduce flood risks within special flood hazard areas by adopting new NFIP Maps	X	X	X	X	X	Education and Outreach	Flood-Related Hazards	X	X	X
2.7	Provide Levee Failure Education to Public through distribution of information from the USACE	X	X	X	X	X	Education and Outreach	Flood-Related Hazards	X	X	X
3.1	Adopt additional building codes for new construction or improvements of any critical facilities to reflect the NEHRP Seismic Provisions.	X	X	X	X		Prevention	Earthquake / Geological / Sinkhole		X	
3.2	Designate an Emergency Operations Center and conduct annual coordination exercises					X	Emergency Services	Earthquake / Geological /Sinkhole	X	X	

#	Action	Matthews	Morehouse	New Madrid (City)	Portageville	New Madrid County (Unincorporated)	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
3.3	Co-sponsor with appropriate school boards and earthquake public awareness programs to create brochures on earthquake awareness and distribute to libraries, courthouse, city hall and school classrooms and offices.	X	X	X	X	X	Education and Outreach	Earthquake / Geological /Sinkhole	X	X	
3.5	Inform parents of school children regarding crisis plan and how it affects their students in case of disaster.					X	Education/ Outreach / Emergency Services	Earthquake / Geological /Sinkhole	X	X	
3.6	Adopt current USDA karst maps to identify areas most at risk of sinkhole development					X	Education and Outreach	Earthquake / Geological /Sinkhole	X	X	
3.7	Educate public on sinkhole warning signs to prevent property damage and/or injuries/death					X	Education and Outreach	Earthquake / Geological /Sinkhole	X	X	
4.1	Adopt "best practices" policy in conjunction with the Soil and Water Conservation Commission during periods of drought. Print information in brochures and distribute to public.	X	X	X	X	X	Prevention	Drought/Extreme Temp/Wildfire	X	X	
4.2	Adopt "best practices" policy in conjunction with the Public Electric Utility Companies during periods of heatwave. Print information in brochures and distribute them to public.	X	X	X	X		Prevention	Drought/Extreme Temp/Wildfire	X	X	
4.3	Take actions during periods of extreme heat to safeguard the health of students and staff by altering school activities.					X	Emergency Services	Drought/Extreme Temp/Wildfire	X	X	
4.4	Establish Cooling Centers in local jurisdictions					X	Prevention	Drought/Extreme Temp/Wildfire	X	X	
5.1	Create an emergency snow route map for county road system and coordinate snow removal activities with state and local officials in September of each year.					X	Prevention	Severe Winter Weather	X	X	
5.2	Meet annually with critical facilities administrators to develop severe winter weather strategies	X	X	X	X	X	Prevention	Severe Winter Weather	X	X	
5.3	Educate the public utility end user on preventive measures to reduce the risk to life and property	X	X	X	X	X	Education and Outreach	Severe Winter Weather	X	X	
5.4	Develop school policies to protect students and staff during severe winter weather such as meeting with officials to set priorities for snow removal and cancelling classes					X	Prevention	Severe Winter Weather	X	X	

#	Action	Matthews	Morehouse	New Madrid (City)	Portageville	New Madrid County (Unincorporated)	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
5.5	Purchase generator by applying for funding if needed.	X			X		Prevention	Severe Winter Weather	X	X	
5.6	Establish Warming Centers in local jurisdictions					X	Prevention	Severe Winter Weather	X	X	
	Total Count of Mitigation Actions	14	14	15	14	23					

Table 4.4. Mitigation Action Matrix – School Districts

#	Action	Gideon 37 School District	New Madrid Co. R School District	Portageville School District	Risco R II School District	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
1.2	Host safety workshops and seek funding for storm sirens with a focus on all natural hazards	X			X	Education Outreach and Prevention	Tornadoes/Severe Thunderstorm			
1.3	Apply for funding for a FEMA safe room.		X	X	X	Prevention	Tornadoes/Severe Thunderstorm	X	X	
2.2	Create program to clean and maintain current drainage systems	X	X	X	X	Prevention	Flood-Related Hazards	X	X	X
2.3	Perform a flood study to highlight localized problem areas in each jurisdiction. Use results to create mitigation actions to alleviate the problem areas.		X	X		Prevention	Flood-Related Hazards		X	X
2.7	Provide Levee Failure Education to students and families by distributing information from the USACE	X	X	X	X	Education and Outreach	Flood-Related Hazards	X	X	X
3.1	Adopt additional building codes for new construction or improvements of any critical facilities to reflect the NEHRP Seismic Provisions.				X	Prevention	Earthquake / Geological / Sinkhole		X	

#	Action	Gideon 37 School District	New Madrid Co. R I School District	Portageville School District	Risco R II School District	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
3.3	Co-sponsor with appropriate school boards and earthquake public awareness programs to create brochures on earthquake awareness and distribute to libraries, courthouse, city hall and school classrooms and offices.	X	X	X	X	Education and Outreach	Earthquake / Geological /Sinkhole	X	X	
3.4	Designate a School Emergency Operations Center and conduct quarterly coordination exercises with school and local emergency management officials.	X	X	X		Education/ Outreach / Emergency Services	Earthquake / Geological /Sinkhole	X	X	
3.5	Inform parents of school children regarding crisis plan and how it affects their students in case of disaster.	X	X	X		Education/ Outreach / Emergency Services	Earthquake / Geological /Sinkhole	X	X	
4.3	Take actions during periods of extreme heat to safeguard the health of students and staff by altering school activities.	X	X	X	X	Emergency Services	Drought/Extreme Temp/Wildfire	X	X	
5.4	Develop school policies to protect students and staff during severe winter weather such as meeting with officials to set priorities for snow removal and cancelling classes	X	X	X	X	Prevention	Severe Winter Weather	X	X	
	Total Count of Mitigation Actions	8	9	9	8					

5 PLAN MAINTENANCE PROCESS

5 PLAN MAINTENANCE PROCESS	5.1
<i>5.1 Monitoring, Evaluating, and Updating the Plan.....</i>	<i>5.1</i>
5.1.1 Responsibility for Plan Maintenance	5.1
5.1.2 Plan Maintenance Schedule	5.2
5.1.3 Plan Maintenance Process.....	5.2
<i>5.2 Incorporation into Existing Planning Mechanisms</i>	<i>5.3</i>
<i>5.3 Continued Public Involvement</i>	<i>5.4</i>

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 a standing committee, with oversight by the county emergency management agency and the Bootheel Regional Planning Commission. The MPC is responsible for maintenance needs. Maintenance includes ensuring participation from jurisdictions, including school and special districts, to:

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

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

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

5.1.2 Plan Maintenance Schedule

The MPC agrees to meet annually and after a state or federally declared hazard event as appropriate to monitor progress and update the mitigation strategy. The Regional Planner of BRPC will be responsible for initiating the plan reviews and will invite members of the MPC to the meeting. The planner from BRPC will complete an annual progress report and distribute via e-mail to the list of stakeholders to continue public involvement.

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

5.1.3 Plan Maintenance Process

Progress on the proposed actions can be monitored by evaluating changes in vulnerabilities identified in the plan. The MPC 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.

To best evaluate any changes in vulnerability resulting from the 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. The Bootheel Regional Planning Commission will check on the status of progress of actions on an annual basis with the person or organization designated to oversee the action. The designated entity will provide input on whether the action as implemented meets the defined objectives and is likely to be successful in reducing risk.
- If the action does not meet identified objectives, the jurisdictional MPC (or designated responsible entity) member will determine necessary remedial action, making any required modifications to the plan.

Changes will be made to the plan to remedy actions that have failed or are not considered feasible. Feasibility will be determined after a review of action consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring of this plan. Updates to the plan will be accomplished as those overseeing actions report changes to Bootheel Regional Planning Commission in its annual review. Changes will be approved by the New Madrid County Commission and the governing boards of the participating jurisdictions.

5.2 Incorporation into Existing Planning Mechanisms

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

Where possible, plan participants, including school and special districts, will use existing plans and/or programs to implement hazard mitigation actions. Those existing plans and programs were described in Section 2.2 of this plan. Based on the capability assessments of the participating jurisdictions, communities in New Madrid 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:

- The 2019 New Madrid County Hazard Mitigation Plan;
- General or master plans of participating jurisdictions;
- Ordinances of participating jurisdictions;
- New Madrid County 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 MPC members involved in updating these existing planning mechanisms will be responsible for integrating the findings and actions of the mitigation plan, as appropriate. The MPC is also responsible for monitoring this integration and incorporation of the appropriate information into the five-year update of the multi-jurisdictional hazard mitigation plan.

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

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

Table 5.1 Planning Mechanisms Identified for Integration of Hazard Mitigation Plan

Jurisdiction	Planning Mechanisms
New Madrid County	Comprehensive Plan Future Growth Plan Watershed Plan
Incorporated Jurisdictions	Zoning and Building Policy
School Districts	School Emergency Plan Master Plan

5.3 Continued Public Involvement

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

The hazard mitigation plan update process provides an opportunity to publicize success stories resulting from the plan’s implementation and seek additional public comment. Information about the annual reviews will be posted in the local newspaper as well as on the Bootheel Regional & Economic Planning Commissions website following each annual review of the mitigation plan. When the MPC reconvenes for the five-year update, it will coordinate with all stakeholders participating in the planning process. Included in this group will be those who joined the MPC after the initial effort, to update and revise the plan. A 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 and social media. A special effort will be made to include representation on the MPC of those who are underserved or vulnerable or those who serve those social groups.