

Stoddard County Multi-Jurisdictional Hazard Mitigation Plan Update 2023



CONTRIBUTORS

Stoddard County Hazard Mitigation Planning Committee

Jurisdictional Representatives

Name	Title	Department	Jurisdiction/Agency/Organization
Cecil Weeks	County Clerk	Stoddard County	Stoddard County
Greg Mathis	Presiding Commissioner	Stoddard County Commission	Stoddard County
Carol Jarrell	Associate Commissioner	Stoddard County Commission	Stoddard County
Donnie Bohnsack	Police Chief	Police Department	City of Advance
Dorothy Burton	Mayor	City Council	City of Bell City
Jacob Cameron	City Clerk	City Council	City of Bernie
Justin Bell	City Works Supervisor	City Council	City of Bloomfield
David Wyman	City Manager	City Council	City of Dexter
Lucille Mullins	Mayor	City Council	City of Dudley
Jena Mitchell	City Clerk	City Council	City of Essex
Alice Patrick	City Clerk	City Council	City of Puxico
Doug Lowery	Representative	Township	Duck Creek Township
Beau Bishop	Emergency	Emergency Management	Stoddard County
Don Seymore	Emergency	City Council	City of Dexter
Shannon Garner	Superintendent	Public School	Advance R-IV
Matt Asher	Superintendent	Public School	Bell City R-11
Dustin Hicks/Brad Botsch	Superintendent	Public School	Bernie R-X111
Toni Hill/Jason Karnes	Superintendent	Public School	Bloomfield R-XIV
Amy James	Superintendent	Public School	Dexter R-XI
Cindy Crabb	Superintendent	Public School	Puxico R- VIII
Frank Killian	Superintendent	Public School	Richland R-1
Chuck Stratton	Building Mgr	College	N/A

Stakeholder Representatives

Name	Title	Department	Jurisdiction/Agency/Organization
Justin Bell	City Works Supervisor	City of Bloomfield	City of Bloomfield
David Wyman	City Administrator	City of Dexter	City of Dexter
Beau Bishop	Emergency Management Director	Emergency Management	Stoddard County
Don Seymore	Emergency Management	City Council	City of Dexter
Kent Luke	Solid Waste Regional Planner		Bootheel Regional Planning Commission
Samantha Nixon	Administrative Assistant	BAILS	Bootheel Area Independent Living
Robin Hopkins	Director	DHA	Dexter Housing Authority
Alisha Trammell	Director	Dexter Chamber of Commerce	Dexter, Missouri
Amber Childers	Extension Engagement Specialist	MU Extension in Mississippi County	University of Missouri Extension
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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. Stoddard 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 January 14, 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 participated in the planning process:

- Stoddard County, unincorporated
- City of Advance
- City of Bell City
- City of Bernie
- City of Bloomfield
- City of Dexter
- City of Dudley
- City of Essex
- City of Puxico
- Advance R-IV
- Bell City R-II
- Bernie R-XIII
- Bloomfield R-XIV
- Dexter R-XI
- Puxico R-VIII
- Richland R-I
- Three Rivers College

Stoddard County and the entities listed above developed a Multi-Jurisdictional Hazard Mitigation Plan that was approved by FEMA on 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 Stoddard 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	Advance	Bell City	Bernie	Bloomfield	Dexter	Dudley	Essex	Puxico	Unincorporated Stoddard County	Mitigation Category	Hazards Addressed	Address Current Development	De
1.2	Seek grant funds for construction of safe rooms		X	X				X			Structural/ Infrastructure	Tornadoes/Severe Thunderstorm	X	
1.3	Host workshops annually for all residents.				X	X	X	X	X	X	Education and Outreach	Tornadoes/Severe Thunderstorm	X	
1.4	Install emergency generators at critical facilities to include Police Stations; City Hall; EOC; Fire Stations, etc. as FEMA funds become available.	X			X	X	X		X	X	Emergency Services	Multi-Hazard	X	
2.1	Develop design criteria for drainage structures on roads within the county's jurisdiction	X	X	X			X	X	X		Prevention	Flood-Related Hazards		
2.2	Seek grants for flood buyouts, elevation projects. Adopt FIRM and update or adopt floodplain ordinance to meet all NFIP requirements	X		X							Natural Systems	Flood-Related Hazards	X	
2.3	Seek grant funds for flood buyouts, elevation projects, adopt or update floodplain ordinances to meet all NFIP requirements		X		X	X	X	X	X	X	Prevention	Flood-Related Hazards		
2.4	Coordinate with USACE on impacts of levee failure							X		X	Prevention	Flood-Related Hazards	X	
2.6	Education on levee failure	X	X	X	X	X	X	X	X	X	Education and Outreach	Levee Failure	X	
2.7	Education on dam failure	X	X	X	X	X	X	X	X	X	Education and Outreach	Dam Failure	X	
3.2	Designate an Emergency Operations Center and conduct annual coordination exercises	X	X	X	X			X		X	Emergency Services	Earthquake / Geological /Sinkhole	X	
3.3	Co-sponsor with appropriate school boards and earthquake public awareness programs for local schools	X	X			X	X	X	X		Education and Outreach	Earthquake / Geological /Sinkhole	X	
4.1	Adopt "best practices" policy in conjunction with the Soil and Water Conservation Commission	X	X	X	X	X	X	X			Prevention	Drought/Extreme Temp/Wildfire	X	
4.2	Meet with public electric utility companies to develop "best practices" for power conservation	X	X	X	X	X	X	X	X		Prevention	Drought/Extreme Temp/Wildfire	X	
4.3	Sponsor annual safety meeting for all residents									X	Emergency Services	Drought/Extreme Temp/Wildfire	X	
5.2	Meet annually with critical facilities administrators to develop severe winter weather strategies						X	X		X	Prevention	Severe Winter Weather	X	

#	Action	Advance	Bell City	Bernie	Bloomfield	Dexter	Dudley	Essex	Puxico	Unincorporated Stoddard County	Mitigation Category	Hazards Addressed	Address Current Development	De	
5.3	Educate the public utility end user on preventive measures to reduce the risk to property	X	X	X	X	X	X	X	X	X	Education and Outreach	Severe Winter Weather	X		
Total Count of Mitigation Actions		10	10	9	9	9	11	12	9	9					
#	Action	Advance	Bell City	Bernie	Bloomfield	Dexter	Dudley	Essex	Puxico	Unincorporated Stoddard County	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
1.2	Seek grant funds for construction of safe rooms		X	X				X			Structural/Infrastructure	Tornadoes/Severe Thunderstorm	X	X	
1.3	Host workshops annually for all residents.				X	X	X	X	X	X	Education and Outreach	Tornadoes/Severe Thunderstorm	X	X	
1.4	Install emergency generators at critical facilities to include Police Stations; City Hall; EOC; Fire Stations, etc. as FEMA funds become available.	X			X	X	X		X	X	Emergency Services	Multi-Hazard	X		
2.1	Develop design criteria for drainage structures on roads within the county's jurisdiction	X	X	X			X	X	X		Prevention	Flood-Related Hazards		X	X
2.2	Seek grants for flood buyouts, elevation projects. Adopt FIRM and update flood plain ordinance.	X		X							Natural Systems	Flood-Related Hazards	X	X	X
2.3	Seek grant funds for flood buyouts, elevation projects, etc.		X		X	X	X	X	X	X	Prevention	Flood-Related Hazards		X	X
2.4	Coordinate with USACE on impacts of levee failure							X		X	Prevention	Flood-Related Hazards	X	X	X
2.6	Education on levee failure	X	X	X	X	X	X	X	X	X	Education and Outreach	Levee Failure	X	X	X
2.7	Education on dam failure	X	X	X	X	X	X	X	X	X	Education and Outreach	Dam Failure	X	X	X

#	Action	Advance	Bell City	Bernie	Bloomfield	Dexter	Dudley	Essex	Puxico	Unincorporated Stoddard County	Mitigation Category	Hazards Addressed	Address Current Development	De
3.2	Designate an Emergency Operations Center and conduct annual coordination exercises	X	X	X	X		X		X	Emergency Services	Earthquake / Geological /Sinkhole	X	X	
3.3	Co-sponsor with appropriate school boards and earthquake public awareness programs for local schools	X	X			X	X	X	X	Education and Outreach	Earthquake / Geological /Sinkhole	X	X	
4.1	Adopt "best practices" policy in conjunction with the Soil and Water Conservation Commission	X	X	X	X	X	X			Prevention	Drought/Extreme Temp/Wildfire	X	X	
4.2	Meet with public electric utility companies to develop "best practices" for power conservation	X	X	X	X	X	X	X		Prevention	Drought/Extreme Temp/Wildfire	X	X	
4.3	Sponsor annual safety meeting for all residents								X	Emergency Services	Drought/Extreme Temp/Wildfire	X	X	
5.2	Meet annually with critical facilities administrators to develop severe winter weather strategies					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 property	X	X	X	X	X	X	X	X	Education and Outreach	Severe Winter Weather	X	X	
	Total Count of Mitigation Actions	10	10	9	9	9	11	12	9	9				

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	1.6
1.4.2	The Planning Steps	1.8

1.1 PURPOSE

Hazard mitigation is the effort to reduce loss of life and property by lessening the impact of natural disasters. For hazard mitigation to be effective, mitigation actions must be taken prior to disaster, thereby reducing negative impacts to people and property. The purpose of this plan is for the jurisdictions and school districts of Stoddard County to proactively identify their extent of exposure to natural hazards as well as attainable goals and specific actions designed to minimize harm to people and property following a disaster. Furthermore, the exercise of mitigation planning results in a document—such as the current document— which outlines strategies for the implementation of prioritized mitigation actions.

This plan includes nine (9) participating jurisdictions and eight (8) participating school districts that have met all requirements for inclusion. These entities completed requirements with the knowledge that participation would make them eligible for certain FEMA grant programs. Any communities that do not adopt the plan are not eligible for FEMA hazard mitigation grants.

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, March 2013 and FEMA's Local Mitigation Plan Review Guide, October 1, 2011, were consulted by Stoddard County and its participating jurisdictions during the update of its 2019 Stoddard County Hazard Mitigation Plan. The last plan was approved

1/14/19.

1.2 BACKGROUND AND SCOPE

Stoddard 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 Stoddard 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 Stoddard County Plan:

- Stoddard County
- City of Advance
- City of Bell City
- City of Bernie
- City of Bloomfield
- City of Dexter
- City of Dudley
- City of Essex
- City of Puxico
- Advance R-IV
- Bell City R-II
- Bernie R-XIII
- Bloomfield R-XIV
- Dexter R-XI
- Puxico R-VIII
- Richland R-I
- Three Rivers College

Stoddard jurisdictions that were new this year were City of Advance, City of Bernie, and Three Rivers College. All other jurisdictions and school districts were the same as the 2019 plan. Information in this plan will be used to help guide and coordinate mitigation activities for local land use policy and decisions in the future.

1.3 PLAN ORGANIZATION

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

- Chapter 1: Introduction and Planning Process

This section 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 demographic statistics for Stoddard County and its municipalities as well as the disaster response and recovery capabilities found in the county. The section identifies key personnel, organizational leaders, and outlines existing emergency plans. 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 that each hazard will occur. It provides a profile of identified hazards and in explains the impact to the County and its jurisdictions should such hazards occur.

- Chapter 4: Mitigation Strategy

Section four presents the multi-jurisdiction mitigation strategies in response to the risk assessment. This chapter outlines the overall goals to reduce a disaster’s impact, 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:

- Appendix A: Sources

- Appendix B: Planning participation documentation

- Appendix C: Resolutions of adoption

- Appendix D: Questionnaires

- Appendix E: List of Critical Facilities

- Appendix F: Action Plans/STAPLEE worksheets

- Appendix G: Jurisdictional Floodplain Ordinances

The goals adopted for 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 this update.

Table 1.1. Changes Made in Plan Update

Plan Chapter	Changes Made in Plan Update
Chapter 1: Intro and Planning Process	Number of meetings reduced from 4 to 3, updated committee members, created special stakeholder meeting, updated meeting content, integrated new FEMA requirements, updated RiskMAP
Chapter 2: Planning Area Profile and Capabilities	Updated all demographic information using either the 2020 decennial census or 2021 ACS population estimates
Chapter 3: Risk Assessment	Updated all hazard data to the most current year available.
Chapter 4: Mitigation Strategy	Updated STAPLEE sheet and Action Plans for all jurisdictions and school districts.
Chapter 5: Plan Implementation and Maintenance	Maintained the same implementation and maintenance strategy.

1.4 PLANNING PROCESS

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

Stoddard County and Missouri State Emergency Management Agency (SEMA) have contracted with Bootheel Regional Planning & Economic Development Commission (BRPC) to facilitate and manage the update process for the 2023 Stoddard County Hazard Mitigation Plan. BRPC, Stoddard County and its municipalities and school districts participated 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 defined mitigation activities to reduce the impact of natural hazards in their communities.

BRPC'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 is a list of the Mitigation Planning Committee (MPC).

Table 1.2. Stoddard County Mitigation Planning Committee (A1a)

Name	Title	Department	Jurisdiction/Agency/Organization
Cecil Weeks	County Clerk	Stoddard County	Stoddard County
Greg Mathis	Presiding Commissioner	Stoddard County Commission	Stoddard County
Carol Jarrell	Associate Commissioner	Stoddard County Commission	Stoddard County
Donnie Bohnsack	Police Chief	Police Department	City of Advance
Dorothy Burton	Mayor	City Council	City of Bell City
Jacob Cameron	City Clerk	City Council	City of Bernie
Justin Bell	City Works Supervisor	City Council	City of Bloomfield
David Wyman	City Manager	City Council	City of Dexter
Lucille Mullins	Mayor	City Council	City of Dudley
Jena Mitchell	City Clerk	City Council	City of Essex
Alice Patrick	City Clerk	City Council	City of Puxico
Doug Lowery	Representative	Township	Duck Creek Township
Beau Bishop	Emergency	Emergency Management	Stoddard County
Don Seymore	Fire Chief, Emergency Manager	Dexter Fire Department	City of Dexter

Shannon Garner	Superintendent	Public School	Advance R-IV
Matt Asher	Superintendent	Public School	Bell City R-11
Dustin Hicks/Brad Botsch	Superintendent	Public School	Bernie R-X111
Toni Hill/Jason Karnes	Superintendent	Public School	Bloomfield R-XIV
Amy James	Superintendent	Public School	Dexter R-XI
Cindy Crabb	Superintendent	Public School	Puxico R- VIII
Frank Killian	Superintendent	Public School	Richland R-1
Chuck Stratton	Building Mgr	College	N/A

In several cases, more than one individual per jurisdiction participated in the planning meetings. Seeking resolutions for approval of the plan from the jurisdictions' boards was discussed at each planning meeting. The individuals listed comprising the MPC were responsible for presenting information to their boards to seek approval. (A1b) They were also the primary contact who attended meetings, providing data, feedback and information critical for the plan.

Table 1.3 lists the capability of participants in various mitigation categories.

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	✓	✓		✓	✓	✓
Police Chief	✓	✓				✓
City Clerk		✓	✓	✓	✓	
City Clerk		✓	✓	✓	✓	
City Works Supervisor		✓	✓			
City Manager		✓	✓	✓	✓	
Mayor		✓	✓	✓	✓	
City Clerk		✓	✓	✓	✓	
City Clerk		✓	✓	✓	✓	
Representative		✓	✓	✓	✓	
Emergency Management Dir	✓				✓	✓
Emergency Management	✓				✓	✓
Superintendent	✓	✓			✓	
Superintendent	✓	✓			✓	
Superintendent	✓	✓			✓	

Superintendent	✓	✓			✓	
Superintendent	✓	✓			✓	
Superintendent	✓	✓			✓	
Superintendent	✓	✓			✓	
Building Mgr		✓		✓		

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 Development Commission on behalf of Stoddard County Commission and Stoddard County EMA invited each city/village, all school districts and emergency personnel located in Stoddard County to attend a kick-off meeting to discuss the benefits and purpose of a Multi-Jurisdictional plan and most importantly the participation requirements for each jurisdiction and school district wanting to adopt the plan. BRPC published an invitation stating the meeting was open to the public and anyone interested in hazard mitigation was encouraged to attend. BRPC also posted on its Facebook page the date and location of the meeting and encouraged interested individuals and organizations to attend. The availability of a public survey regarding local hazard mitigation was similarly promoted – on the website and on social media.

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 Stoddard 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 in the form of sign in sheets is (A1a) included in *Appendix B: Planning Participation Documentation*.

Jurisdictions that have met the requirements for participating in the plan include Stoddard County (unincorporated), City of Advance, City of Bell City, City of Bernie, City of Bloomfield, City of Dexter, City of Dudley, City of Essex, and City of Puxico. The school districts include Advance R-IV, Bell City R-II, Bernie R-XIII, Bloomfield R-XIV, Dexter R-XI, Puxico R-VIII, Richland R-1 and Three Rivers College.

The planning process included 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 a multi-jurisdictional plan makes sense, and presented a timeline for completion of planning. BRPC staff reviewed all the hazards that impact the county and its municipalities and the group discussed risk assessment. Meeting #2 included reminders of the requirements for each jurisdiction to be part of the final plan, the status of each jurisdiction in completing their requirements, a review of the public survey results, review and acceptance of plan goals, review of disaster declarations from 2019 to present including both agricultural and FEMA declared disasters and a discussion of the next meeting date and next steps. In Meeting #3 the committee once again did a self-check of completion of requirements, introduction of the resolution to be passed by each council or board, a discussion of the impact of hazards on vulnerable populations and updates to mitigation plans. The STAPLEE risk assessment/cost-benefit tool was used by jurisdictions to analyze the feasibility of proposed actions. Those jurisdictions that did not complete their action updates and those not in attendance were granted a little more time to complete their proposed actions. Not all representatives were able to attend all of the meetings so calls and email follow-ups kept each jurisdiction on track to full completion of their parts of the plan update.

The public was involved in the plan update in several ways. First, a public survey was distributed to each jurisdiction and posted on the BRPC website. See Appendix B for results of the survey that were presented at meeting 2. These results were considered by all participants in formulating their actions.

Second, media representatives attended all meetings to report to the public on what occurred during each meeting. Third, BRPC posted the completed draft on its website and sought public comment before its final submission. Fourth, a special stakeholder meeting was hosted to gather further specific input on the plan.

Table 1.4. Jurisdictional Participation in Planning Process

Jurisdiction	Kick-off Meeting	Meeting #2	Meeting #3	Data Collection Questionnaire Response	Update/Develop Mitigation Actions
Stoddard County	x	x	x	x	x
City of Advance	x	x		x	x
City of Bell City	x	x		x	x
City of Bernie		x	x	x	x
City of Bloomfield	x	x		x	x
City of Dexter	x	x	x	x	x
City of Dudley	x		x	x	x
City of Essex	x		x	x	x
City of Puxico	x	x	x	x	x
Duck Creek Township	x	x	x	N/A	x
Advance R-IV	x	x		x	x
Bell City R-II	x	x		x	x
Bernie R-XIII	x	x		x	x
Bloomfield R-XIV	x		x	x	x
Dexter R-XI	x		x	x	x
Puxico R-VIII	x	x		x	x

Richland R-I		x	x	x	x
Three Rivers College	1 on 1	1 on 1	x	x	x

Of note is that Duck Creek township was represented and participated in the planning process but their data is included in the unincorporated Stoddard County data.

1.4.2 The Planning Steps

FEMA’s Local Mitigation Planning Handbook (March 2013), Local Mitigation Plan Review Guide (October 1, 2011), Integrating Hazard Mitigation Into Local Planning: Case Studies and Tools for Community Officials (March 1, 2013), the previous Stoddard County Hazard Mitigation Plan, and 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 1.5 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 January 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. *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 along with a follow up during the kick off meeting to explain the procedure, the need for the data collection, how the data would be used, and to answer any questions the committee may have 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 Stoddard County – one at the Stoddard County Courthouse in Bloomfield and two in the Bootheel Regional Planning Office in Dexter.

Table 1.6. Schedule of MPC Meetings (A1a)

Meeting	Topic	Date
Kick-off Meeting (Stoddard County Commission Chambers)	<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 	2/6/23
Planning Meeting #2 (Bootheel Regional Planning & Economic Development Commission)	<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 Disaster Declarations since 2019 • Discuss Meeting #3 and Next Steps 	3/29/23
Planning Meeting #3 (Bootheel Regional Planning & Economic Development Commission)	<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 	4/26/23
Special Meeting for Stakeholders (Virtual Meeting Hosted Via WebEx)	<ul style="list-style-type: none"> • Overview of Hazard Planning in Stoddard County • Public Input Questions • Open Discussion 	8/17/23

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.

How the public could be involved was a topic discussed during the kick-off meeting held on February 6, 2023 at the Kick-Off Meeting in Bloomfield, Missouri. The Bootheel Regional Planning & Economic Development Commission staff explained the importance of public involvement during the planning process. The mitigation planning committee agreed with a plan to engage the public during the update process. A public survey would be made available on the BRPC website and the link would be emailed to all committee members. BRPC shared the survey link on its Facebook page and encouraged the committee to take the survey and share the link with families and friends. Results of the public survey were analyzed and reviewed by the committee at Meeting #2 so they could consider public input in their mitigation plans – see Meeting Agenda #2 – Appendix B. (A3a) The meetings were posted on the BRPC website and anyone interested in the planning process was invited to attend.

Comments from the public survey were shared with committee members. In general, their feedback was generally aligned with that of the committee members. Their comments regarding needs for the county were wide ranging, but topics that received more than one mention were needed road repairs, the need for warming and/or cooling centers, and needed storm drainage improvements.

The public was given another opportunity to comment. The first rough draft of the plan was posted on the BRPC website and public comment was encouraged.

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 Stoddard County. These groups were included in the emailed invitation to the February 6, 2023 kick-off meeting at the Stoddard County Courthouse. Ideally, national organizations like the Red Cross should come to the table for this exercise, but Stoddard County is too small to have a local chapter. In small communities, local officials wear

multiple hats out of necessity. Often the mayor of a small town is also a business owner or a city clerk is also a member of a neighborhood group or homeowners' association. The agencies and interest groups who were invited to take part in hazard mitigation plan update are listed below represented businesses, volunteer organizations, homeowners' groups, and many more.

- Stoddard County Emergency Management Director
- City of Dexter Emergency Management Director
- Stoddard County Commission
- Bootheel Regional Planning Commission
- Advance R-IV
- Bell City R-II
- Bernie R-XIII
- Bloomfield R-XIV
- Dexter R-XI
- Richland R-I
- Puxico R-VIII
- Three Rivers College – Dexter branch
- Neighboring community resident – Malden (Dunklin Co)
- Neighboring community resident – Ozark Foothills RPC
- BAILS – Bootheel Area Independent Living
- Dexter Housing Authority
- Dexter Chamber of Commerce
- University of Missouri Extension
- Stoddard County Caring Council
- Dexter Fire Department

The Data Collection Questionnaires that all participants completed were the basis for data incorporated into the plan. These documents included a wealth of information on the capabilities of participants, their experience with administering FEMA projects, their critical facilities, and many more items relevant to the plan.

A special meeting was called August 17, 2023 to get additional stakeholder involvement and input on the first draft of the plan. The following were invited to provide comments and to weigh in on relevant hazard mitigation topics:

- Neighboring communities
 - Kent Luke, Malden (Dunklin County), Solid Waste Regional Planner, Bootheel Regional Planning Commission
 - Alan Lutes, Poplar Bluff (Butler County), Executive Director, Ozark Foothills Regional Planning Commission
- Local and regional agencies involved in hazard mitigation activities
 - Dexter Fire Department was invited but did not attend (Hank Trout, Fire Chief)
 - Beau Bishop, Emergency Management Director, Stoddard County – already involved on HMPC
 - Don Seymour, Emergency Management Director, City of Dexter – already involved on HMPC
- Agencies with the authority to regulate development
 - Robin Hopkins, Director - Dexter Housing Authority
- Businesses

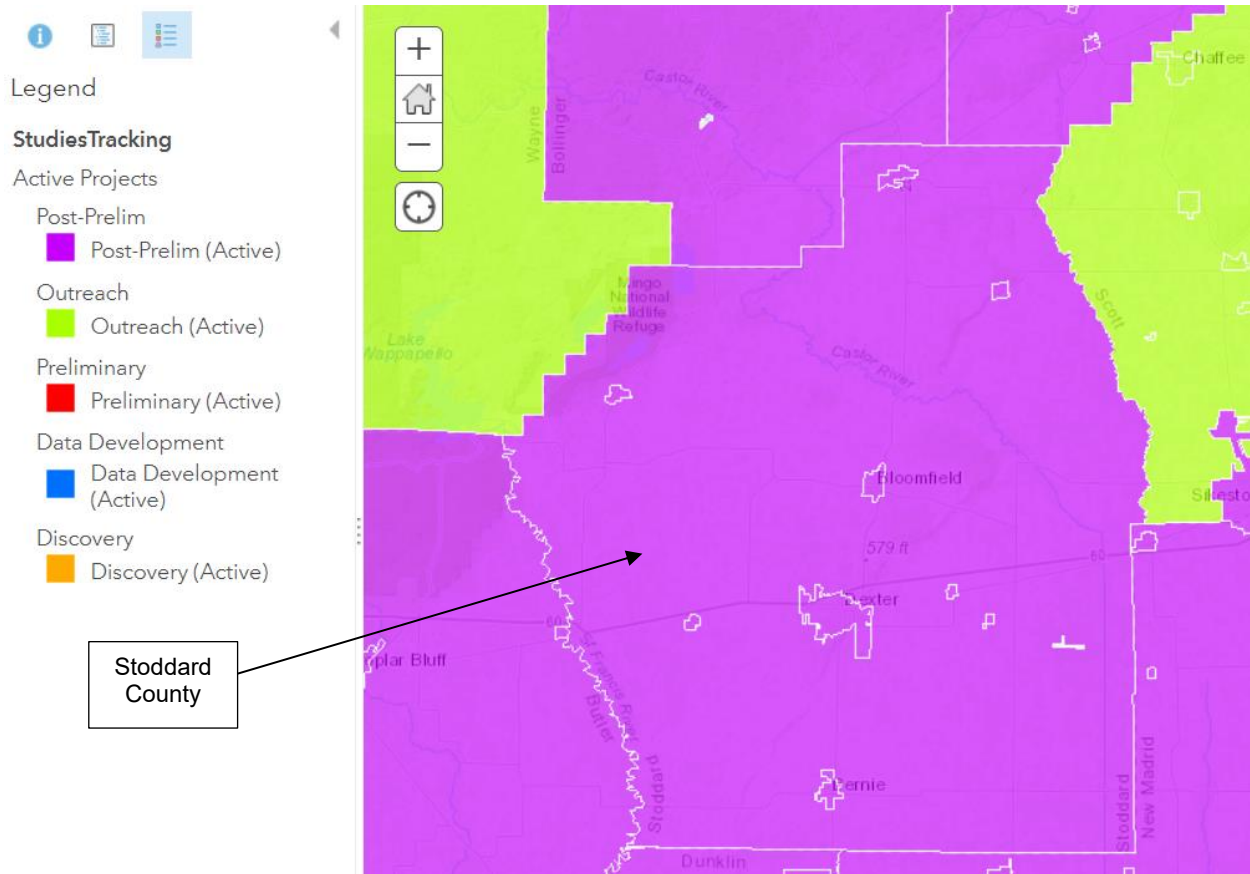
- Alisha Trammell, Executive Director, Dexter Chamber of Commerce
- John Shell – owner, Bud Shell Ford, invited but did not attend
- Academia – All school districts participated in regular meetings as did the community college representative.
- Other private and non-profit interests
 - Amber Childers, Extension Engagement Specialist, University of Missouri Extension
 - Samantha Nixon, Administrative Assistant, Bootheel Area Independent Living
 - Cheryl Bruce, Dunklin/Stoddard County Caring Council, invited but did not attend

These individuals were emailed or called and sent a WebEx meeting invitation to participate in a virtual meeting to express their opinions and give feedback on the plan. Their comments generally aligned with data from the public survey. The group stressed the importance of public awareness and education as a powerful tool in hazard mitigation. Appendix B includes their proof of attendance at the meeting.

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 southeastern portion of the state of Missouri. The map below indicates that Stoddard County is currently in the Post-Prelim (Active) stage. The Post-Prelim stage means 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 represents the current view of Stoddard County and its local jurisdictions. The resources used were (A4a) :

- 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 Stoddard County Hazard Mitigation Plan

Relevant information from the above-listed sources was reviewed by the Community Development Specialists (CDS) as appropriate and included within the updated planning document. Data was either manually entered by the CDS, or “copied and pasted” from the online data source to the document. Sources for each data insertion were cited where appropriate.

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

The planning committee, in their second and third meetings, discussed what hazards would

be reviewed in the plan's Risk Assessment. During Meeting #2, the Emergency Management Director for the county overviewed the Disaster Declarations that have impacted the county since the 2019 plan. During Meeting #2, The committee reviewed the list from the previous plan and compared it with the State Risk Assessment plan and the consensus was that the hazards from the previous plan were representative of the true hazards that faced the county. Each participating jurisdiction completed a Data Collection Questionnaire that BRPC staff reviewed for inclusion in the plan. Chapter 2 includes 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. See also Chapter 3 for additional detail on conclusions drawn from the data reviewed.

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

To accumulate data for assets for jurisdictions there were different resources such as HAZUS, Current Missouri State Mitigation Plan, and the previous Stoddard 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. Jurisdictions collected and reported information on their regulatory, personnel, fiscal and technical capabilities, as well as existing mitigation initiatives via the Data Collection Questionnaire. (These capabilities are detailed in Chapter 2: Planning Area Profiles and Capabilities). All the vulnerability estimates were taken from the 2023 State Plan, as the best and most current 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 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 Stoddard 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.

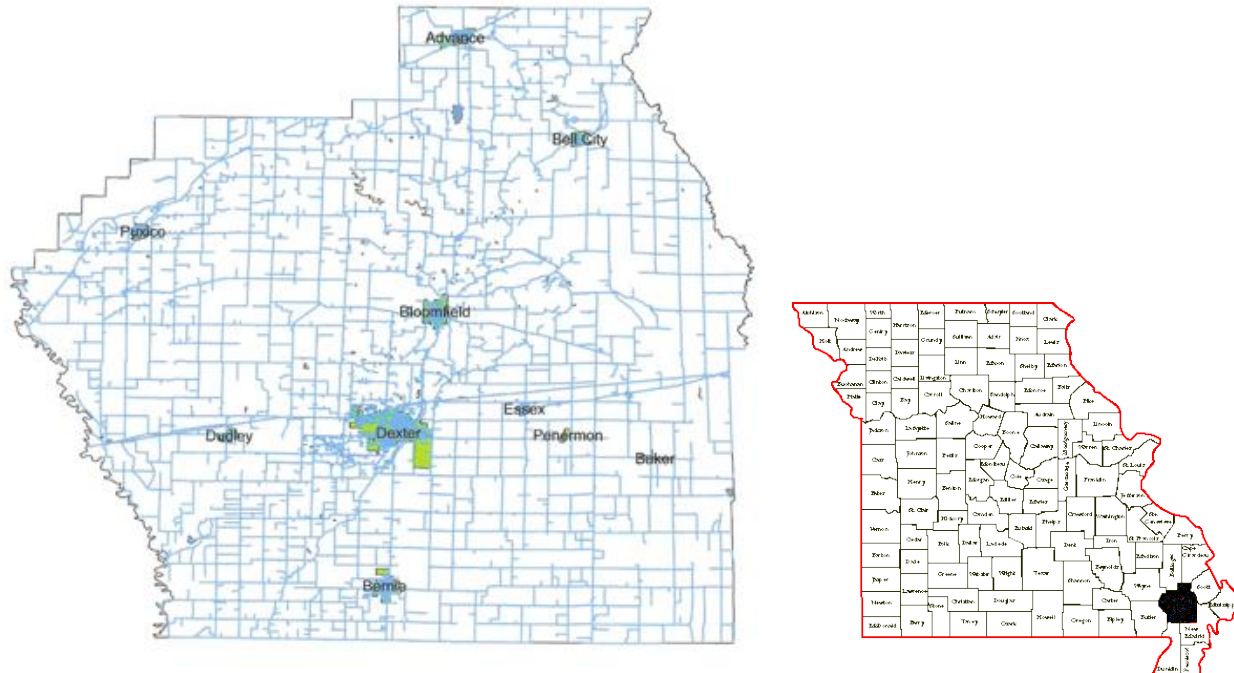
2 PLANNING AREA PROFILE AND CAPABILITIES

2	PLANNING AREA PROFILE AND CAPABILITIES	2.0
2.1	<i>Stoddard County Planning Area Profile.....</i>	<i>2.1</i>
2.1.1	Geography, Geology and Topography.....	2.1
2.1.2	Climate	2.2
2.1.3	Population/Demographics	2.3
2.1.4	History	2.4
2.1.5	Occupations.....	2.4
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2.1.7	FEMA Hazard Mitigation Assistance Grants in Planning Area	2.5
2.1.8	FEMA PA Grants in Planning Area	2.5
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2.2	<i>Jurisdictional Profiles and Mitigation Capabilities</i>	<i>2.5</i>
2.2.1	Stoddard County, Missouri	2.5
2.2.2	City of Advance.....	2.7
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2.2.7	City of Dudley	2.16
2.2.8	City of Essex.....	2.18
2.2.9	City of Puxico	2.20
2.2.10	Summary of Jurisdictional Capabilities.....	2.21

2.1 Stoddard County Planning Area Profile

Stoddard County is bordered by Cape Girardeau, Scott, New Madrid, Dunklin, Butler, Wayne and Bollinger counties. Figure 2.1 is a map of Stoddard County showing cities, villages, and overall location of the County within the state.

Figure 2.1. **Map of Stoddard County**



According to the US Census Bureau, the 2020 population estimate of Stoddard County is 28,672. The current population represents a 4.3% decrease in population from 29,968 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 population as of the 2000 US Census in Stoddard County was 29,705, indicating a decline of 3.5% as compared to 2020.

The median household income for Stoddard County rose 20.9% from \$38,096 in 2017 to \$46,052 in 2021. Median household income in 2000 was \$26,987. The 2021 level is 70.6% higher. Yet, family income in Stoddard County lags far behind the state and national figures of \$61,043 and \$69,021, respectively.

The median house value has increased 21.4% from \$89,700 in 2016 to \$108,900 in 2021. House values in 2021 were much higher than in 2000 when they were \$56,800 for the county, \$89,900 for Missouri and \$119,600 for the nation.

2.1.1 Geography, Geology and Topography

Stoddard County is located in the Southeast part of Missouri, positioned at the top of the Missouri Bootheel. Wayne, Bollinger, and Cape Girardeau Counties are on the northern border. The St. Francis River forms parts of the western boundary. Dunklin and New Madrid Counties border on the

east and south. The City of Bloomfield is the county seat. The county is completely rural, with no urban centers.

According to US Census data, Stoddard County has a land area of 823 square miles (526,720 acres) and water area of 6 square miles (3,712 acres). Of the total land mass, 498,751 acres is farmland per acrevalue.com. Stoddard County is mostly flat land with fertile soil and sand mixture well-suited for crop production. According to the USGS, more than 75% of the area surfaces are clay, silt, sand and gravel that resulted from the Holocene Epoch.

The county crosses two (2) watersheds shown in Figure 2.2.

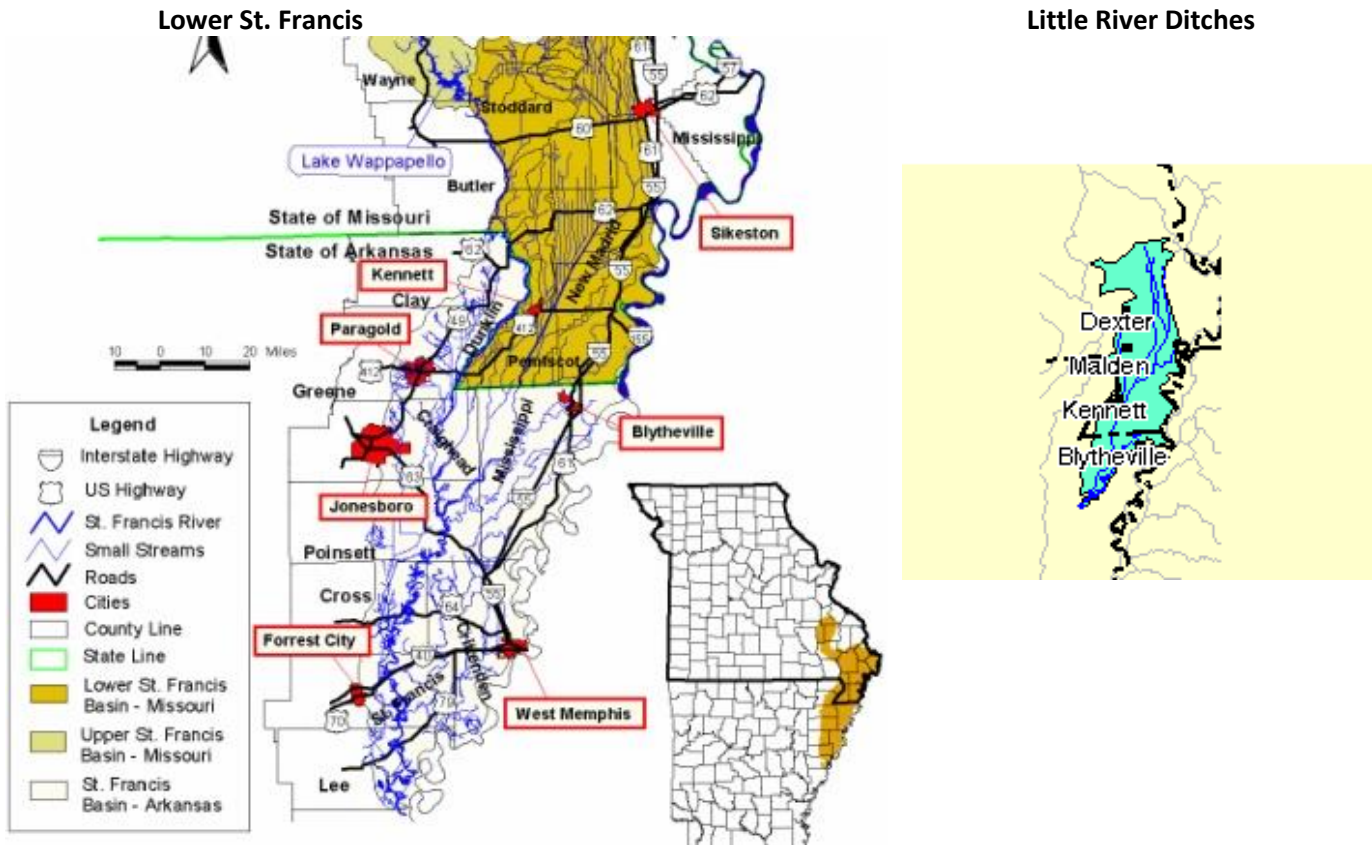


Figure 2.2. Source: [How's My Waterway | US EPA](#)

2.1.2 Climate

Average annual precipitation in Stoddard County was 50.3 inches, according to the High Plains Regional Climate Center. This is higher than precipitation in the U.S. which is 37 inches annually. Of the average precipitation in the county just under ten inches of that was snowfall. The average U.S. city gets twenty-five inches of snow per year. The number of days per year with any measurable precipitation is ninety-seven.

Also, according to the High Plains Regional Climate Center, the average daily temperature in Stoddard County is 58.3 degrees Fahrenheit. The average high in July is 90.09 degrees and the average low is 26.04 degrees in January.

2.1.3 Population/Demographics

Table 2.1. Stoddard County Population 2010-2020 by Community

Jurisdiction	2010 Population	2020 Population	ACS Population 2021	2010-2020 # Change	2010-2020 % Change
Stoddard County unincorp	14,833	13,941	17,786	-892	-6.0%
City of Advance	1,347	1,349	1,454	+2	+0.1%
City of Bell City	448	464	475	+16	+3.6%
City of Bernie	1,958	1,859	1,796	-99	-5.1%
City of Bloomfield	1,933	1,755	2,272	-178	-9.2%
City of Dexter	7,864	7,927	7,947	+63	+0.8%
City of Dudley	232	101	117	-131	-56.5%
City of Essex	472	403	467	-69	-14.6%
City of Puxico	881	873	1,042	-8	-0.9%

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

5.8% of Stoddard County's population is younger than the age of 5, less than Missouri (6.1%) and the U.S. (6.0%). Stoddard County has a comparatively aging population with 20.3% older than 65 years. In Missouri and the U.S, the percentages are 16.9% and 16.0%, respectively.

There are a total of 11,293 households in Stoddard County. The average household size in the county is 2.52 which is similar to the state of Missouri average of 2.46 and slightly below the national average of 2.60.

The University of South Carolina developed an index to evaluate and rank the ability to respond to, cope with, recover from, and adapt to disasters. The index synthesizes twenty-nine socioeconomic variables which research literature suggests contribute to reduction in a community's ability to prepare for, respond to, and recover from hazards. SoVI® data sources include primarily those from the United States Census Bureau. Resulting from the evaluation, a low number means that the county is more resilient to hazard events, while a high number means that the county is less resilient.

The SoVI Score for Stoddard County is reported as .230000004, which ranks the county in the 54th percentile nationally. The score also places Stoddard County at medium risk for hazard vulnerability.

Table 2.2. Unemployment, Poverty, Education and Language Demographics, Stoddard 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)
Stoddard County	8,987	5.4%	17.2%	81.1%	13.6%	1.1%
City of Advance	661	3.5%	13.0%	88.9%	11.9%	2.3%
City of Bell City	184	32.6%	39.9%	66.7%	11.1%	0.0%
City of Bernie	609	1.1%	22.4%	73.0%	13.6%	2.4%
City of Bloomfield	829	9.0%	26.4%	68.9%	11.7%	.3%
City of Dexter	3,235	1.5%	19.9%	81.0%	12.7%	.9%
City of Dudley	56	0.0%	29.9%	82.9%	9.8%	8.9%
City of Essex	262	.8%	21.3%	70.5%	5.2%	0.0%
City of Puxico	474	7.6%	10.2%	88.8%	15.9%	0.0%
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

2.1.4 History

The first permanent settlement in what is now Stoddard County was made around the year 1825. In 1829, the Missouri General Assembly passed an act that defined the boundaries of a new county to be formed out of a part of Wayne County. It was to be named Stoddard County in honor of Captain Amos Stoddard, an agent of the United States Government who received the transfer of the Louisiana Territory. At this time, however, the county was attached to Cape Girardeau County. Stoddard County remained under the jurisdiction of the officials of Cape Girardeau County until January 2, 1835. The territory of the new county, at that time, lay between the St. Francois River and the Little River. In 1835, Bloomfield was chosen as the county seat. By 1922, with most of the timber cut and the swamps drained, agriculture developed into its present importance on the excellent farmland that resulted.

2.1.5 Occupations

Table 2.3 Occupation Statistics, Stoddard 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
Stoddard County	3,434	2,052	2,345	1,680	2,333
City of Advance	239	51	94	101	153
City of Bell City	34	33	38	13	66
City of Bernie	220	96	120	35	121
City of Bloomfield	229	96	79	133	217
City of Dexter	987	525	685	469	520
City of Dudley	11	4	18	7	16
City of Essex	68	69	47	32	44
City of Puxico	186	52	80	57	60

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

2.1.6 Agriculture

According to the 2017 Census of Agriculture, Stoddard County has a total of 792 farms on a total of 475,589 acres of land. The average size of each farm is 600 acres with an average of \$368,572 in product sales. Stoddard County's top crops in acres are soybeans, corn, cotton, rice and wheat. The farming industry employs 1,290 workers. Stoddard County ranks second in Missouri for total agricultural production.

2.1.7 FEMA Hazard Mitigation Assistance Grants in Planning Area

Table 2.4 FEMA HMA Grants in Stoddard County from 1993-2022

Project Type	Sub applicant	Award Date	Project Total
206.2: Safe Room (Tornado and Severe Wind Shelter) - Public Structures	Three Rivers Community College	8/17/2015	\$554,207
206.2: Safe Room (Tornado and Severe Wind Shelter) - Public Structures	Bloomfield School	08/17/2010	\$1,101,078
206.2: Safe Room (Tornado and Severe Wind Shelter) - Public Structures	Puxico School	09-14-2014	\$1,351,750

Source: Missouri State Emergency Management Agency, 2023.

2.1.8 FEMA PA Grants in Planning Area

Table 2.5 FEMA PA Grants in Stoddard County from 1993-2020

Declaration number	Project Type	Project size	Project Total
1412	Road & Bridges	Small	484,307.33
1748	Emergency Protective Measures	Small	21,016.74
1749	Road Washout Repairs	Small	389,136.52
1809	Debris Removal	Small	1,555,094.41
1822	Debris Removal and Road and Streets	Small	1,161,751.13
1980	Road and Street Repair	Small	1,662,363.34
4130	Road System Repair	Small	55,299.64
4250	Road Repair	Small	100,562.37
Total			\$5,429,531.48

Source: Federal Emergency Management Agency, 2021

2.2 Jurisdictional Profiles and Mitigation Capabilities

This section will include individual profiles for each participating jurisdiction. It will also include a discussion of previous mitigation initiatives in the planning area. Gaps and limitations for each participant are addressed as actions in the mitigation strategy when feasible, which in turn expand and improve the capabilities described in Chapter 2. Actions are detailed in Chapter 4: Mitigation Strategy. 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.

2.2.1 Stoddard County, Missouri

Stoddard County's jurisdiction includes all unincorporated areas within the county boundaries. The county government is directed by the County Commission. There are three commissioners, the

Presiding Commissioner and two Associate Commissioners elected to one of two districts. Stoddard County operates as a second-class county. The county government has authority to administer county structures, infrastructures, and finances as well as a master plan, flood-plain regulations and storm water regulations. The three-member County Commission generally is the final authority on county issues. The departments of the county include:

- Board of Commissioners
- County Clerk
- County Coroner
- County Assessor
- County Attorney
- County Collector
- County Recorder
- County Sheriff
- County Treasurer
- Emergency Management
- Public Administrator

Mitigation Initiatives/Capabilities

Staff capabilities to reduce the impact of natural hazards include key officials from the Stoddard County Commission, the County Sheriff’s Department and the County Emergency Management Director (EMD). These key figures aid in planning, response and recovery processes. Using the guidelines established in the Emergency Operations Plan (EOP), Stoddard County will coordinate with other local governments and private organizations to save lives, minimize injuries, protect property, preserve functioning civil government and maintain economic activities essential to the county’s survival and recovery from natural disasters. It is the EMD’s responsibility to develop and maintain the EOP.

Table 2.6 Unincorporated Stoddard County Mitigation Capabilities

Capabilities	Status
Planning Capabilities	
Comprehensive or Land-Use Plan	N
Capital Improvement Plan	N
Transportation Plan / Highway Department	N
Emergency Operations Plan	Y
Local Recovery Plan	N
Debris Management Plan	N
Firewise or other fire mitigation plan	N
Economic Development Plan	Y
Policies/Ordinance	
Zoning Ordinance	N
Building Code	N
Floodplain Ordinance	Y
Drainage/Storm Water Ordinance	N
Drainage Ordinance	N
Site Plan Review Requirements	N
Historic Preservation Ordinance	N
Program	
National Flood Insurance Program (NFIP)	Y

NFIP Community Rating System (CRS)	N
National Weather Service (NWS) Storm Ready	N
Firewise Community Certification	N
Building Code Effectiveness Grading (BCEGs)	N
ISO Fire Rating	N
Public Education/Awareness	N
Mutual Aid Agreements	N
Studies/Reports/Maps	
Critical Facilities Inventory	N
Vulnerable Population Inventory	N
Staff/Department	
Building Code Official/Building Inspector	N
Engineer	N
Development Planner	N
NFIP Floodplain Administrator	Y
Mapping Specialist (GIS)	N
Public Works Official	N
Emergency Management Coordinator	Y
Local Emergency Planning Committee	Y
Sanitation Department	N
Highway/Transportation Department	N
Economic Development Department	N
Housing Department	N
Historic Preservation	N
Non-Governmental Organizations (NGOs)	
American Red Cross	N
Salvation Army	N
Veterans Groups	Y
Local Environmental Organization	N
Homeowner Associations	N
Neighborhood Associations	N
Chamber of Commerce	N
Community Organizations (Lions, Kiwanis, etc.)	Y
Financial Resources	
Apply for Community Development Block Grants	Y
Fund projects thru Capital Improvements funding	N
Authority to levy taxes for specific purposes	Y
Fees for water, sewer, gas, or electric services	N
Impact fees for new development	N
Incur debt through general obligation bonds	N
Incur debt through special tax bonds	N
Incur debt through private activities	N
Withhold spending in hazard prone areas	N

Source: Data Collection Questionnaire, 2023

2.2.2 City of Advance

The City of Advance is the northernmost city in Stoddard County. The city has experienced little population change from 2010 to 2020 with a change of only two residents, from 1,347 to 1,349. Advance is governed by a mayor and four aldermen.

The unemployment rate in Advance is only 3.5% and poverty is approximately 13%. The median household income is \$48,672. Of the 651 housing units, 42.7% were built between 1960 and 1979 and mobile homes make up 8.4% of the homes in the city.

The city of Advance did not participate in the last update of the county-wide multijurisdictional plan. Mitigation activities have been limited due to limited capabilities. The city of Advance carries mutual aid agreements with local governments and law enforcement departments. The city currently has one outdoor warning siren.

The city departments include:

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

Table 2.7. Advance Mitigation Capabilities

Capabilities	Status
Planning Capabilities	
Comprehensive or Land-Use Plan	N
Capital Improvement Plan	N
Transportation Plan / Highway Department	N
Emergency Operations Plan	Y January 2022
Local Recovery Plan	N
Debris Management Plan	N
Firewise or other fire mitigation plan	N
Economic Development Plan	N
Policies/Ordinance	
Zoning Ordinance	Y
Building Code	N
Floodplain Ordinance	Y December 1977
Drainage/Storm Water Ordinance	Y
Drainage Ordinance	Y
Site Plan Review Requirements	Y
Historic Preservation Ordinance	Y
Program	
National Flood Insurance Program (NFIP)	Y
NFIP Community Rating System (CRS)	N
National Weather Service (NWS) Storm Ready	N
Firewise Community Certification	N
Building Code Effectiveness Grading (BCEGs)	N
ISO Fire Rating	4.5
Public Education/Awareness	N
Mutual Aid Agreements	Y
Studies/Reports/Maps	
Critical Facilities Inventory	Y
Vulnerable Population Inventory	N
Staff/Department	
Building Code Official/Building Inspector	James Powers P/T
Engineer	N
Development Planner	N
NFIP Floodplain Administrator	Donnie Bohnsack P/T
Mapping Specialist (GIS)	N
Public Works Official	Dennis Cato P/T
Emergency Management Coordinator	N
Local Emergency Planning Committee	N

Sanitation Department	N
Highway/Transportation Department	N
Economic Development Department	N
Housing Department	N
Historic Preservation	Tina Bailey F/T
Non-Governmental Organizations (NGOs)	
American Red Cross	N
Salvation Army	N
Veterans Groups	N
Local Environmental Organization	N
Homeowner Associations	N
Neighborhood Associations	N
Chamber of Commerce	N
Community Organizations (Lions, Kiwanis, etc.	N
Financial Resources	
Apply for Community Development Block Grants	Y
Fund projects thru Capital Improvements funding	Y
Authority to levy taxes for specific purposes	Y
Fees for water, sewer, gas, or electric services	Y
Impact fees for new development	Y
Incur debt through general obligation bonds	Y
Incur debt through special tax bonds	Y
Incur debt through private activities	N
Withhold spending in hazard prone areas	Y

Source: Data Collection Questionnaire, 2023

2.2.3 City of Bell City

The City of Bell City is located in the northeastern portion of Stoddard County, just south of the Scott County border. The governing body of Bell City consists of the Mayor and four council members. Bell City has experienced an increase of 3.6% in population from the 2010 Census of 448 residents to 464 in the most recent decennial census in 2020. Bell City has a 37.7% unemployment rate and 39.9% of the population is living below poverty level. Bell City has only 202 total housing units. According to 2021 Estimates, 10.6% of the occupied housing units are mobile homes. 47.8% of the homes in Bell City were built between the prior to 1960. The average household size is 2.29 per household. 12.4% of the population is at the age of 65 and over.

The city of Bell City participated in the last update of the county-wide multijurisdictional plan. Mitigation activities have been limited due to limited capabilities. The city of Bell City carries mutual aid agreements with local governments and law enforcement departments. The city currently has one outdoor warning siren.

The city departments include:

- Mayor/ Board of Aldermen
- Fire Department

Table 2.8 City of Bell City 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	
Zoning Ordinance	N
Building Code	Y BOCA Basic
Floodplain Ordinance	Y
Storm Water Ordinance	Y
Drainage Ordinance	Y
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	N
Firewise Community Certification	N
Building Code Effectiveness Grading (BCEGs)	N
ISO Fire Rating	
Public Education/Awareness	N
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	Y
Mapping Specialist (GIS)	N
Public Works Official	Y
Emergency Management Coordinator	Y
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)	
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	
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	N
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	N
Ability to incur debt through private activities	N
Ability to withhold spending in hazard prone areas	N/A

Source: Data Collection Questionnaire 2023

2.2.4 City of Bernie

The City of Bernie is located in southern Stoddard County. The local government consists of a mayor and six city council members. Bernie has experienced a loss of 5.1% in population according to the decennial censuses in 2010 and 2020, decreasing from 1,958 to 1,859 residents. The rate of poverty in Bernie was 22.4%. The unemployment rate was 2.8%. There were 874 total housing units and 41.6% of them were built between 1960 and 1979. Only 0.4% of housing units are mobile homes. The percentage of the population that was 65 and over was 24.9%. The median household income in the city was \$38,274. This data is according to the 2021 American Community Survey 5-year estimates.

The city of Bernie did not participate in the last update of the multijurisdictional plan. The Bernie Fire Department does practice mutual aid with Malden and Dexter, but no formal agreement is in place. The city has three warning signals.

City Departments include:

- City administration
- Fire Department
- Police Department

Table 2.9 City of Bernie Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	Date:
Builder's Plan	Date: N/A
Capital Improvement Plan	Date: N/A
City Emergency Operations Plan	Date: 5/2008
County Emergency Operations Plan	Date: 1/2022
Local Recovery Plan	Date: N/A
County Recovery Plan	Date: N/A
City Mitigation Plan	Date: N/A
County Mitigation Plan	Date: 4/2005
Debris Management Plan	Date: N/A
Economic Development Plan	Date:
Transportation Plan	Date: N/A
Land-use Plan	Date: N/A
Flood Mitigation (FMA) Plan	Date: N/A
Watershed Plan	Date:
Firewise or other fire mitigation plan	Date: N/A
Critical Facilities Plan (mitigation/response/recovery)	Date: N/A
Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	YES
Building Code	Version: YES
Floodplain Ordinance	Date: N/A
Subdivision Ordinance	N/A
Tree Trimming Ordinance	YES
Nuisance Ordinance	YES
Storm Water Ordinance	N/A
Drainage Ordinance	N/A
Site Plan Review Requirements	N/A

Historic Preservation Ordinance	N/A
Landscape Ordinance	N/A
Program	Status Including Date of Document or Policy
Zoning/Land Use Restrictions	YES
Codes Building Site/Design	YES
Hazard Awareness Program	N/A
National Flood Insurance Program (NFIP)	YES
NFIP Community Rating System	N/A
National Weather Service (NWS)	N/A
Firewise Community Certification	N/A
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	Rating: 6S
Economic Development Program	N/A
Land Use Program	N/A
Public Education/Awareness	N/A
Property Acquisition	N/A
Planning/Zoning Boards	YES
Stream Maintenance Program	N/A
Tree Trimming Program	N/A
Engineering Studies for Streams	NO
Mutual Aid Agreements	N/A
Studies/Reports/Maps	Status Including Date of Document or Policy
Hazard Analysis/Risk Assessment (City)	N/A
Hazard Analysis/Risk Assessment (County)	N/A
Evacuation Route Map	N/A
Critical Facilities Inventory	N/A
Vulnerable Population Inventory	N/A
Land Use Map	N/A
Staff/Department	Status Including Date of Document or Policy
Building Code Official	YES P/T
Building Inspector	YES P/T
Mapping Specialist (GIS)	N/A
Engineer	N/A
Development Planner	N/A
Public Works Official	YES P/T
Emergency Management Coordinator	YES P/T
NFIP Floodplain Administrator	N/A
Emergency Response Team	N/A
Hazardous Materials Expert	N/A
Local Emergency Planning Committee	N/A
County Emergency Management Commission	YES
Sanitation Department	YES P/T
Transportation Department	N/A
Economic Development Department	N/A
Housing Department	YES F/T
Historic Preservation	N/A
Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	NO
Salvation Army	NO
Veterans Groups	NO
Local Environmental Organization	NO
Homeowner Associations	YES
Neighborhood Associations	NO
Chamber of Commerce	YES
Community Organizations	YES
Financial Resources	Status Including Date of Document or Policy
Apply for Community Development Block Grants	YES

Fund projects thru Capital Improvements funding	YES
Authority to levy taxes for specific purposes	YES
Fees for water, sewer, gas, or electric services	YES
Impact fees for new development	NO
Incur debt through general obligation bonds	YES
Incur debt through special tax bonds	NO
Incur debt through private activities	NO
Withhold spending in hazard prone areas	NO

Source: Data Collection Questionnaire 2023

2.2.5 City of Bloomfield

The City of Bloomfield is located in the center of Stoddard County. Bloomfield government consists of one Mayor, four (4) council members, and one city clerk. Bloomfield has experienced a 9.2% decrease in population from the 2000 Census of 1,952 residents to the 2020 population estimate of 1,755 residents. 26.4% of the population lives below poverty level. The city of Bloomfield has 821 occupied households with 52.6% of them built before 1980. 6.6% of all the housing units in Bloomfield are mobile homes. 26.2% of the homes have a resident aged 65 and over. The median household income in Bloomfield is \$39,777.

The city of Bloomfield participated in the last update of the county-wide multijurisdictional plan. The city of Bloomfield carries mutual aid agreements with local governments and law enforcement departments. The city has one outdoor warning alert siren.

City departments include:

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

Table 2.10 City of Bloomfield Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	N
Capital Improvement Plan	N
Local Emergency Plan	Y Rev 2022
Local Recovery Plan	N
Economic Development Plan	N
Transportation Plan	N
Debris Management	N
Firewise or other fire mitigation plan	N
Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	N
Building Code	Y BOCA 1970
Floodplain Ordinance	Y November 2002
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
Building Code Effectiveness Grading (BCEGs)	N
ISO Fire Rating	5

Public Education/Awareness	Y – COMMUNITY BETTERMENT ACTIVITIES
Mutual Aid Agreements	Y
Studies/Reports/Maps	Status Including Date of Document or Policy
Critical Facilities Inventory	Y
Vulnerable Population Inventory	N
Staff/Department	Status Including Date of Document or Policy
Building Code Official	Y F/T
Engineer	N
Development Planner	N
NFIP Floodplain Administrator	Y
Mapping Specialist (GIS)	N
Public Works Official	Y F/T
Emergency Management Coordinator	Y F/T
Local Emergency Planning Committee	N
Sanitation Department	N
Transportation Department	N
Economic Development Department	N
Housing Department	Y
Historic Preservation	N
Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	Y
Salvation Army	N
Veterans Groups	N
Environmental Organization	N
Homeowner Associations	N
Neighborhood Associations	N
Chamber of Commerce	Y
Community Organizations (Lions, Kiwanis, etc.)	N
Financial Resources	Is your jurisdiction able to? Yes or No
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	Y
Impact fees for new development	N
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	N
Ability to withhold spending in hazard prone areas	N

Source: Data Collection Questionnaire 2023

2.2.6 City of Dexter

The city of Dexter is located in the center of Stoddard County just off 60 Hwy. The governing body consists of one Mayor, six (6) Council members, and one city clerk. The city employs a city administrator. Dexter has experienced a 0.8% increase in population from the 2010 Census of 7,864 residents to the 2020 census of 7,927. Dexter has an unemployment rate of 1.5% with 19.9% of families living below poverty level. The city has a median household income of \$42,521. The city of Dexter has 3,888 occupied housing units which 4.2% of the units are mobile homes. 39.7% of the homes in Dexter were built between the years of 1960 and 1979. There is an average of 2.46 persons per home with 20.9% of the occupants are of the age 65 years and over.

The city of Dexter participated in the last update of the county-wide multijurisdictional plan. The city of Dexter carries mutual aid agreements with local governments and law enforcement departments. The city has four (4) outdoor warning sirens.

City departments include:

- Mayor/Board of Aldermen
- City Clerk
- Planning/Zoning Board (Park)
- Emergency Response Team
- Public Works Official
- Police Department
- Fire Department

Table 2.11 City of Dexter Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	N/A
Builder's Plan	N/A
Capital Improvement Plan	Y Every year
Local Emergency Plan	Y Every year
Local Recovery Plan	N/A
Local Mitigation Plan	Y Every year
Economic Development Plan	N/A
Transportation Plan	N/A
Land-use Plan	N/A
Flood Mitigation Assistance (FMA) Plan	Y
Watershed Plan	N/A
Firewise or other fire mitigation plan	N
Critical Facilities Plan (Mitigation/Response/Recovery)	N
Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	Y
Building Code	Y Dexter ordinances
Floodplain Ordinance	Y Every year
Subdivision Ordinance	Y
Tree Trimming Ordinance	N
Nuisance Ordinance	Y
Storm Water Ordinance	Y
Drainage Ordinance	Y
Site Plan Review Requirements	Y
Historic Preservation Ordinance	N
Landscape Ordinance	N
Program	Status Including Date of Document or Policy
Zoning/Land Use Restrictions	Y
Codes Building Site/Design	Y
National Flood Insurance Program (NFIP) Participant	Y
NFIP Community Rating System (CRS) Participating Community	N
Hazard Awareness Program	Y
National Weather Service (NWS) Storm Ready	Y
Building Code Effectiveness Grading (BCEGs)	N
Firewise Community Certification	N
ISO Fire Rating	4
Economic Development Program	N
Land Use Program	N
Public Education/Awareness	N
Property Acquisition	N
Planning/Zoning Boards	Y – PARK
Stream Maintenance Program	N
Tree Trimming Program	N
Engineering Studies for Streams (Local/County/Regional)	N

Mutual Aid Agreements	Y
Studies/Reports/Maps	Status Including Date of Document or Policy
Critical Facilities Inventory	N
Hazard Analysis/Risk Assessment (Local)	N
Hazard Analysis/Risk Assessment (County)	N
Evacuation Route Map	N
Vulnerable Population Inventory	N
Land Use Map	Y
Staff/Department	Status Including Date of Document or Policy
Building Code Official	Y
Building Inspector	Y
Mapping Specialist (GIS)	N
Engineer	Y
Development Planner	N
Public Works Official	Y
Emergency Management Coordinator	Y
NFIP Floodplain Administrator	Y
Bomb and/or Arson Squad	N
Emergency Response Team	Y
Hazardous Materials Expert	Y
Local Emergency Planning Committee	N
County Emergency Management Commission	Y
Sanitation Department	Y
Transportation Department	Y
Economic Development Department	Y
Housing Department	N
Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	Y
Salvation Army	N
Veterans Groups	Y
Environmental Organization	N
Homeowner Associations	Y
Neighborhood Associations	Y
Chamber of Commerce	Y
Community Organizations (Lions, Kiwanis, etc.)	Y
Financial Resources	Is your jurisdiction able to? Yes or No
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	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

Source: Data Collection Questionnaire 2023

2.2.7 City of Dudley

The city of Dudley is located in the southwestern portion of Stoddard County just off of Hwy 60. Dudley's government consists of one Mayor and four (4) aldermen, and a city clerk. The small city has experienced a 56.5% decrease in population from the 2010 Census of 232 residents to the 2020 census of 101 residents. There is a 0.0% unemployment rate and 29.9% live below poverty level. The median household income is \$41,250. Dudley has 63 occupied households with 18.5% of them are mobile homes. 7.4% of housing units in Dudley were built between the years of 1960 and 1979. The average household size is 2.5 persons per home. 10.3% of residents are 65 years and over.

The city of Dudley participated in the last update of the county-wide multijurisdictional plan. The city carries mutual aid agreements with local governments and law enforcement departments. They have one outdoor warning signal.

City departments include:

- Mayor/Board of Alderman
- City Clerk
- Volunteer Fire Department

Table 2.12 City of Dudley Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive or Land-Use Plan	N/A
Capital Improvement Plan	N/A
Transportation Plan / Highway Department	N/A
Emergency Operations Plan	Yes January 2022
Local Recovery Plan	N/A
Debris Management Plan	N/A
Firewise or other fire mitigation plan	N/A
Economic Development Plan	N/A
Policies/Ordinance	
Zoning Ordinance	No
Building Code	Yes BOCA basic
Floodplain Ordinance	Yes December 1995
Drainage/Stormwater Ordinance	Yes July 2008
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Program	
National Flood Insurance Program (NFIP)	Y
NFIP Community Rating System	NSFHA Non-Special Flood Hazard Area
National Weather Service (NWS)	N/A
Firewise Community Certification	N/A
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	Rating: 7/7X
Public Education or information programs (i.e.,	N/A
Mutual Aid Agreements	N/A
Studies/Reports/Maps	
Critical Facilities Inventory	N/A
Vulnerable Population Inventory	N/A
Staff/Department	
Building Code Official / Building Inspector	Lucille Mullins, Clifford Temples P/T
Engineer	N/A
Development Planner	N/A
NFIP Floodplain Administrator	Lucille Mullins P/T
Mapping Specialist (GIS)	N/A
Public Works Official	N/A
Emergency Management Coordinator	EMA Director
Local Emergency Planning Committee	N/A
Sanitation Department	N/A
Highway/Transportation Department	N/A
Economic Development Department	N/A
Housing Department	N/A
Historic Preservation	N/A
Non-Governmental Organizations (NGOs)	
American Red Cross	N/A

Salvation Army	N/A
Veterans Groups	N/A
Environmental Organization	N/A
Homeowner Associations	N/A
Neighborhood Associations	N/A
Chamber of Commerce	N/A
Community Organizations (Lions, Kiwanis, etc.)	N/A
Financial Resources	Status Including Date of Document or Policy
Apply for Community Development Block Grants	Yes
Fund projects thru Capital Improvements funding	N/A
Authority to levy taxes for specific purposes	Yes
Fees for water, sewer, gas, or electric services	Yes, Water & Sewer
Impact fees for new development	No
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	N/A
Incur debt through private activities	No
Withhold spending in hazard prone areas	No

Source: Data Collection Questionnaire 2023

2.2.8 City of Essex

The city of Essex is located in the center of Stoddard County just off of Hwy 60. Essex government consists of one Mayor and four (4) council members, and a city clerk. Essex has experienced a 14.6% decrease in population from the 2010 Census of 472 residents to the 2020 census of 403 residents. There is a 0.8% unemployment rate and 21.3% live below poverty level. Essex has 183 occupied households and 11.5% of them are mobile homes. 27.3% of housing units in Essex were built between the years of 1960 and 1979. The average household size is 2.55 persons per home. 13.7% of residents are 65 years and over. This data is from the 2021 5 year estimates of the American Community Survey.

The city of Essex participated in the last update of the county-wide multijurisdictional plan. The city carries mutual aid agreements with local governments and law enforcement departments. The city currently has one outdoor warning siren.

City departments include:

- Mayor/Board of Alderman
- City Clerk
- Police Department
- Volunteer Fire Department

Table 2.13 City of Essex 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
Transportation Plan	N
Land-use Plan	N
Flood Mitigation Assistance (FMA) Plan	N
Firewise or other fire mitigation plan	N

Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	N
Building Code	Y
Floodplain Ordinance	Y
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
Building Code Effectiveness Grading (BCEGs)	N
ISO Fire Rating	
Public Education/Awareness	N
Mutual Aid Agreements	Y
Studies/Reports/Maps	Status Including Date of Document or Policy
Critical Facilities Inventory	Y
Vulnerable Population Inventory	N
Staff/Department	Status Including Date of Document or Policy
Building Code Official	N
Mapping Specialist (GIS)	N
Engineer	N
Development Planner	N
Public Works Official	N F/T
Emergency Management Coordinator	N
NFIP Floodplain Administrator	Y P/T
Local Emergency Planning Committee	N
Sanitation Department	Y F/T
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	Is your jurisdiction able to? Yes or No
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	N
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	N
Ability to withhold spending in hazard prone areas	N

Source: Data Collection Questionnaire 2023

2.2.9 City of Puxico

The city of Puxico is located in the northern portion of Stoddard County just off of Hwy 51. Puxico's government consists of one Mayor and four (4) council members, and a city clerk. Puxico has experienced a 0.9% decrease in population from the 2010 Census of 881 residents to the 2020 census of 873 residents. There is a 4.4% unemployment rate and 10.2% live below poverty level. The median household income is \$51,576. Puxico has 402 occupied households with 2.9% are mobile homes. 27.0% of housing units in Puxico were built between the years of 1960 and 1979. The average household size is 3.17 persons per home. 14.3% of residents are 65 years and over.

The city of Puxico participated in the last update of the county-wide multijurisdictional plan. Since the last update the city has had limited ability for mitigation initiatives. The city carries mutual aid agreements with local governments and law enforcement departments.

City departments include:

- Mayor/Board of Alderman
- City Clerk
- Police Department
- Volunteer Fire Department

Table 2.14 City of Puxico Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	N/A
Capital Improvement Plan	N/A
Local Recovery Plan	N/A
Economic Development Plan	N/A
Transportation Plan	N/A
Firewise or other fire mitigation plan	N/A
Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	N/A
Building Code	N/A
Floodplain Ordinance	Y March 2012
Drainage/Stormwater Ordinance	N/A
Site Plan Review Requirements	N/A
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/A
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	6/6X
Public Education/Awareness	N
Mutual Aid Agreements	Y
Studies/Reports/Maps	Status Including Date of Document or Policy
Critical Facilities Inventory	N/A
Vulnerable Population Inventory	N/A
Staff/Department	Status Including Date of Document or Policy
Building Code Official/Building Inspector	Y By Ordinance – Maintenance Supervisor
Mapping Specialist (GIS)	N/A
Engineer	Y
Development Planner	N/A
Public Works Official	Y Water/Sewer Supt
Emergency Management Coordinator	Y Mayor Rick McLean
NFIP Floodplain Administrator	Y By Ordinance - Mayor
Sanitation Department	N/A

Transportation Department	N/A
Economic Development Department	N/A
Housing Department	N/A
Historic Preservation	N/A
Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	N
Salvation Army	N
Veterans Groups	Y VFW Post, Auxiliary
Environmental Organization	N
Homeowner Associations	N
Neighborhood Associations	N
Chamber of Commerce	N
Community Organizations (Lions, Kiwanis, etc.)	Y Masonic Lodge, Eastern Star, Puhicah Club, Ladies Civic Club
Financial Resources	Is your jurisdiction able to? Yes or No
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	N
Ability to incur debt through general obligation bonds	Y, Vote of the people to approve
Ability to incur debt through special tax bonds	N
Ability to incur debt through private activities	N
Ability to withhold spending in hazard prone areas	N

Source: Data Collection Questionnaire 2023

2.2.10 Summary of Jurisdictional Capabilities

Table 2.15 Mitigation Capabilities Summary Table

CAPABILITIES	Stoddard County	Advance	Bell City	Bernie	Bloomfield	Dexter	Dudley	Essex	Puxico
Planning Capabilities									
Comprehensive Plan	NO	NO	NO	YES	NO	NO	NO	NO	NO
Builder's Plan	NO	NO	NO	NO	NO	NO	NO	NO	NO
Capital Improvement Plan	NO	NO	NO	NO	NO	YES	NO	NO	NO
Local Emergency Plan	YES	YES	YES	YES	YES	YES	YES	NO	NO
County Emergency Plan	YES -	YES	YES	YES	NO	YES	YES	YES	YES
Local Recovery Plan	NO	NO	NO	NO	NO	NO	NO	NO	NO
County Recovery Plan	NO	NO	NO	NO	NO	NO	NO	NO	NO
Local Mitigation Plan	NO	NO	NO	NO	NO	YES	NO	NO	YES
Debris Management Plan	NO	NO	NO	NO	NO	NO	NO	NO	NO
Economic Development Plan	YES	NO	NO	NO	NO	NO	NO	NO	NO
Transportation Plan	NO	NO	NO	NO	NO	NO	NO	NO	NO
Land-use Plan	NO	NO	NO	NO	NO	NO	NO	NO	NO
Flood Mitigation Assistance (FMA) Plan	NO	NO	NO	NO	NO	YES	NO	NO	NO

CAPABILITIES	Stoddard County	Advance	Bell City	Bernie	Bloomfield	Dexter	Dudley	Essex	Puxico
Watershed Plan	NO	NO	NO	NO	NO	NO	NO	NO	NO
Firewise or other fire mitigation plan	NO	NO	NO	NO	NO	NO	NO	NO	NO
Critical Facilities Plan (Mitigation/Response/Recovery)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Policies/Ordinance									
Zoning Ordinance	NO	YES	NO	YES	NO	YES	NO	NO	NO
Building Code	NO	NO	YES	YES	YES	YES	YES	YES	NO
Floodplain Ordinance	YES	YES	YES	NO	YES	YES	YES	YES	YES
Subdivision Ordinance	NO	NO	NO	NO	NO	YES	NO	NO	NO
Tree Trimming Ordinance	NO	NO	NO	YES	NO	NO	NO	NO	NO
Nuisance Ordinance	NO	NO	NO	YES	NO	YES	NO	NO	NO
Storm Water Ordinance	NO	YES	YES	NO	NO	YES	YES	NO	NO
Drainage Ordinance	NO	YES	YES	NO	NO	YES	YES	NO	NO
Site Plan Review Requirements	NO	YES	NO	NO	NO	YES	NO	NO	NO
Historic Preservation Ordinance	NO	YES	NO	NO	NO	NO	NO	NO	NO
Landscape Ordinance	NO	NO	NO	NO	NO	NO	NO	NO	NO
Iowa Wetlands and Riparian Areas Conservation Plan	NO	NO	NO	NO	NO	NO	NO	NO	NO
Program									
Zoning/Land Use Restrictions	NO	NO	NO	YES	NO	YES	NO	NO	NO
Codes Building Site/Design	NO	NO	NO	YES	NO	YES	NO	NO	NO
National Flood Insurance Program (NFIP) Participant	YES	YES	YES	YES	YES	YES	YES	YES	YES
NFIP Community Rating System (CRS) Participating Community	NO	NO	NO	NO	NO	NO	YES	NO	NO
Hazard Awareness Program	NO	NO	NO	NO	NO	YES	NO	NO	NO
National Weather Service (NWS) Storm Ready	NO	NO	NO	NO	NO	YES	NO	NO	NO
Building Code Effectiveness Grading (BCEGs)	NO	NO	NO	NO	NO	NO	NO	NO	NO
ISO Fire Rating	NO	4.5		6S	5	4	7/7X		6/6X
Economic Development Program	YES	NO	NO	NO	NO	NO	NO	NO	NO
Land Use Program	NO	NO	NO	NO	NO	NO	NO	NO	NO
Public Education/Awareness	NO	NO	NO	NO	YES	NO	NO	NO	NO
Property Acquisition	NO	NO	NO	NO	NO	NO	NO	NO	NO
Planning/Zoning Boards	NO	NO	NO	YES	NO	YES	NO	NO	NO

CAPABILITIES	Stoddard County	Advance	Bell City	Bernie	Bloomfield	Dexter	Dudley	Essex	Puxico
Stream Maintenance Program	NO	NO	NO	NO	NO	NO	NO	NO	NO
Tree Trimming Program	NO	NO	NO	NO	NO	NO	NO	NO	NO
Engineering Studies for Streams (Local/County/Regional)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Mutual Aid Agreements	NO	YES	YES	NO	YES	YES	NO	YES	YES
Studies/Reports/Maps									
Hazard Analysis/Risk Assessment (Local)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Hazard Analysis/Risk Assessment (County)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Flood Insurance Maps	NO	NO	NO	NO	NO	NO	NO	NO	NO
FEMA Flood Insurance Study (Detailed)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Evacuation Route Map	NO	NO	NO	NO	NO	NO	NO	NO	NO
Critical Facilities Inventory	NO	YES	NO	NO	YES	NO	NO	YES	NO
Vulnerable Population Inventory	NO	NO	NO	NO	NO	NO	NO	NO	NO
Land Use Map	NO	NO	NO	NO	NO	YES	NO	NO	NO
Staff/Department									
Building Code Official	NO	YES	NO	YES	YES	YES	YES	NO	YES
Building Inspector	NO	YES	NO	YES	NO	YES	YES	NO	YES
Mapping Specialist (GIS)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Engineer	NO	NO	NO	NO	NO	YES	NO	NO	YES
Development Planner	NO	NO	NO	NO	NO	NO	NO	NO	NO
Public Works Official	NO	YES	YES	YES	YES	YES	NO	YES	YES
Emergency Management Coordinator	YES	NO	YES	YES	YES	YES	YES	NO	YES
NFIP Floodplain Administrator	YES	YES	YES	NO	YES	YES	YES	YES	YES
Bomb and/or Arson Squad	NO	NO	NO	NO	NO	NO	NO	NO	NO
Emergency Response Team	NO	NO	NO	NO	NO	YES	NO	NO	NO
Hazardous Materials Expert	NO	NO	NO	NO	NO	YES	NO	NO	NO
Local Emergency Planning Committee	YES	NO	NO	NO	NO	NO	NO	NO	NO
County Emergency Management Commission	YES	YES	YES	YES	YES	YES	YES	YES	YES
Sanitation Department	NO	NO	NO	YES	NO	YES	NO	YES	NO
Transportation Department	NO	NO	NO	NO	NO	YES	NO	NO	NO
Economic Development Department	NO	NO	NO	NO	NO	YES	NO	NO	NO
Housing Department	NO	NO	NO	YES	NO	NO	NO	NO	NO
Planning Consultant	NO	NO	NO	NO	NO	NO	NO	NO	NO
Regional Planning Agencies	YES	YES	YES	YES	YES	YES	YES	YES	YES

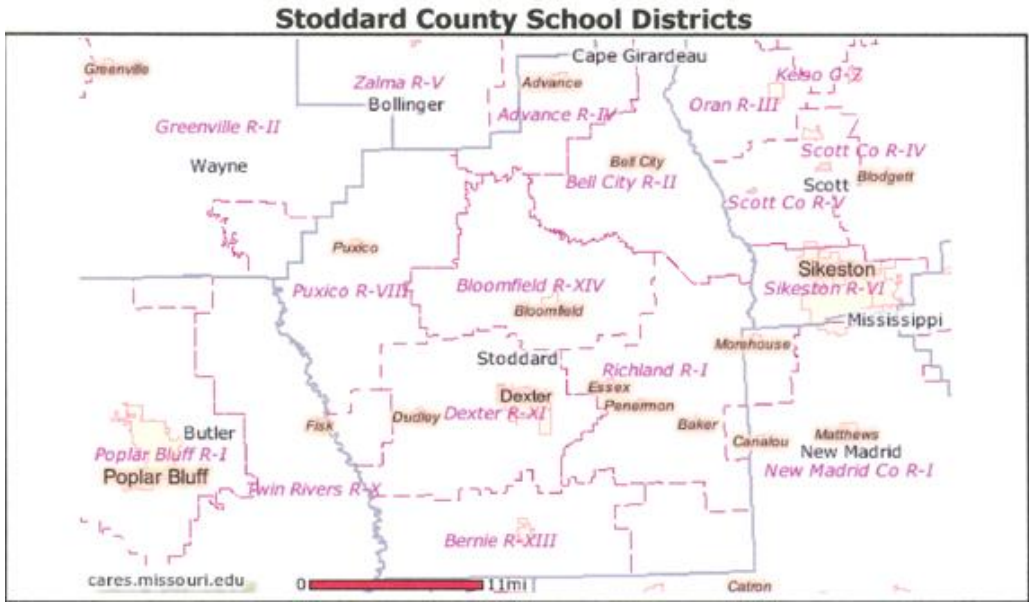
CAPABILITIES	Stoddard County	Advance	Bell City	Bernie	Bloomfield	Dexter	Dudley	Essex	Puxico
Historic Preservation	NO	YES	NO	NO	NO	NO	NO	NO	NO
Non-Governmental Organizations (NGOs)									
American Red Cross	NO	NO	NO	NO	YES	YES	NO	NO	NO
Salvation Army	NO	NO	NO	NO	NO	NO	NO	NO	NO
Veterans Groups	YES	NO	NO	NO	NO	YES	NO	NO	YES
Environmental Organization	NO	NO	NO	NO	NO	NO	NO	NO	NO
Homeowner Associations	NO	NO	NO	YES	NO	YES	NO	NO	NO
Neighborhood Associations	NO	NO	NO	NO	NO	YES	NO	NO	NO
Chamber of Commerce	NO	NO	NO	YES	YES	YES	NO	NO	NO
Community Organizations (Lions, Kiwanis, etc.)	YES	NO	NO	YES	NO	YES	NO	YES	YES
Financial Resources									
Apply for Community Development Block Grants	YES	YES	YES	YES	YES	YES	YES	YES	YES
Fund projects through Capital Improvements funding	NO	YES	NO	YES	YES	YES	NO	YES	YES
Authority to levy taxes for specific purposes	YES	YES	NO	YES	YES	YES	YES	YES	YES
Fees for water, sewer, gas, or electric services	NO	YES	YES	YES	YES	YES	YES	YES	YES
Impact fees for new development	NO	YES	NO	NO	NO	NO	NO	NO	NO
Incur debt through general obligation bonds	NO	YES	NO	YES	YES	NO	YES	YES	YES
Incur debt through special tax bonds	NO	YES	NO	NO	YES	YES	NO	YES	NO
Incur debt through private activities	NO	NO	NO	NO	NO	NO	NO	NO	NO
Withhold spending in hazard prone areas	NO	YES	N/A	NO	NO	NO	NO	NO	NO

Source: Data Collection Questionnaires, 2023

2.2.11 Public School Districts Profiles and Mitigation Capabilities

This section provides general information about participating school districts in the Plan. There are seven school districts based in Stoddard County plus the county is served by one community college. All school districts participated in this Plan. Figure 2.3 is a map of school district boundaries in Stoddard County. As is seen on Figure 2.3, three school districts have small portions of their enrollment that cross over into other counties. Some Advance students reside in Bollinger, some Puxico students reside in Butler and some Richland students reside in New Madrid County. All enrollment listed in the tables below represent all students, not just those who reside in Stoddard County.

Figure 2.3. Stoddard County School Districts



All Advance School District buildings are located on 201 School Street Advance, MO 63730. Table 2.9 provides building and enrollment information.

Table 2.16 Advance R-IV School District Buildings and Enrollment Data, 2023

District Name	Building Name	Building Enrolment
Advance R-IV	Advance High School	187
Advance R-IV	Advance Elementary School	249

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

Advance R-IV Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves 436 students approximately by 48 teachers and staff. District departments include:

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

Advance is in the process of completing a school emergency plan. The school has NOAA weather radios and a FEMA safe room and conduct yearly drills. Table 2.20 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

All Bell City R-II School District are located at 25254 Walnut St. Bell City, MO 63735. Table 2.17 provides building and enrollment information.

Table 2.17 Bell City R-II School District Buildings and Enrollment Data, 2023

District Name	Building Name	Building Enrolment
Bell City R-II	Bell City High	96
Bell City R-II	Bell City Elementary	124

Bell City R-II Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves 220 students with approximately 33 teachers and staff. District departments include:

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

Bell City R-II is equipped with NOAA weather radios and the school performs periodic drills for inclement weather.

Bernie School District buildings are located in two locations. The High School is located at 516 W Main and Bernie Elementary is located at 121 S Spiker. Table 2.11 provides building and enrollment information.

Table 2.18 Bernie R-XIII School District Buildings and Enrollment Data, 2023

District Name	Building Name	Building Enrolment
Bernie R-XIII	Bernie High School	237
Bernie R-XIII	Bernie Elementary	303

Bernie R-XIII Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves 540 students approximately 54 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. Administration modified the tornado safety areas to be safer than in the previous emergency plan. Table 2.20 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts

All Bloomfield School District buildings are located at 505 Court St. Bloomfield, MO 63825. Table 2.19 provides building and enrollment information.

Table 2.19 Bloomfield R-XIV School District Buildings and Enrollment Data, 2023

District Name	Building Name	Building Enrolment
Bloomfield R-XIV	Bloomfield High School	197
Bloomfield R-XIV	Bloomfield Middle School	176
Bloomfield R-XIV	Bloomfield Elementary	245

Bloomfield R-XIV Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves 618 students approximately 77 teachers and staff. District departments include:

- Transportation
- Cafeteria Services
- Custodial Services
- Health Services

- Central Office

Bloomfield Schools have NOAA weather radios and a tornado safe room. Table 2.20 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

Dexter School District buildings are located at 3 different locations. Dexter High is located at 1101 AW Grant St. Dexter, mo 63841. T.H. Hill Middle School is located at 1107 Brown Pilot Lane Dexter, MO 63841. Central Elementary is located at 1213 Central Drive Dexter, MO 63841. Table 2.20 provides building and enrollment information

Table 2.20 Dexter R-XI School District Buildings and Enrollment Data, 2023

District Name	Building Name	Building Enrolment
Dexter R-XI	Dexter High	602
Dexter R-XI	TH Middle School	423
Dexter R-XI	Central Elementary	1,026

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

Dexter R-XI Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves 2,051 students approximately 192 teachers and staff. District departments include:

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

Dexter Schools conduct quarterly hazard drills. They also have NOAA weather radios and conduct professional development of staff members. Table 2.20 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

All Puxico School District buildings are located at 481 N Bedford St. Puxico MO 63960. Table 2.21 provides building and enrollment information.

Table 2.21 Puxico R-VIII School District Buildings and Enrollment Data, 2023

District Name	Building Name	Building Enrolment
Puxico R-VIII	Puxico High School	205
Puxico R-VIII	Puxico Jr. High	174
Puxico R-VIII	Puxico Elementary	398

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

Puxico Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves 777 students approximately 100 teachers and staff. District departments include:

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

The Puxico Schools have NOAA weather radios and they have a FEMA storm shelter with a generator.

All Richland School District buildings are located at 24456 State Highway 114 Essex, MO 63846. Table 2.22 provides building and enrollment information,

Table 2.22 Richland R-I School District Buildings and Enrollment Data, 2023

District Name	Building Name	Building Enrolment
Richland R-I	Richland High	120
Richland R-I	Richland Elementary	146

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

Richland R-I Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves 266 students approximately 36 teachers and staff. District departments include:

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

Each year Richland School provides trainings for staff and students in case of any type of emergency for the Elementary and High School. Table 2.20 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

Three Rivers College – Dexter is a branch of Three Rivers College in Poplar Bluff in Butler County. It had only 21 students enrolled as of the Spring 2023 semester. The Poplar Bluff campus has a FEMA safe room, but the Dexter campus does not. The college provides annual training on dealing with emergency situations of all types with students and staff.

Table 2.23 Summary of Mitigation Capabilities – Stoddard County School Districts

Capability	Advance R-IV	Bell City R-II	Bernie R-XIII	Bloomfield R-XIV	Dexter R-XI	Puxico R-VIII	Richland R-I	Three Rivers
Planning Elements								
Master Plan/ Date	N	N	Y	Y	N	Y 23	Y 8/22	Y 7/20
Capital Improvement	N	Y 11/22	N	Y	N	Y 23	Y 11/22	Y 1/23
School Emergency Plan / Date	Y In process	Y 8/22	Y	Y	Y	Y annual	Y 8/22	Y 1/23
Weapons Policy/Date	Y	N	Y	Y	Y 3/10	Y	Y 9/14	Y 1/23
Personnel Resources								
Full-Time Building Official (Principal)	Y	Y	Y	Y	Y	Y	Y	Y
Emergency Manager	N	Y	N	Y	Y	Y	Y	Y
Grant Writer	N	Y	N	N	Y	N	N	N
Public Information Officer	N	Y	N	Y	Y	N	Y	Y
Financial Resources								
Capital Improvements	Y	Y	Y	Y	Y	Y	Y	Y
Local Funds	Y	Y	Y	Y	Y	Y	Y	Y
General Obligation Bonds	N	N	Y	Y	Y	Y	Y	Y
Special Tax Bonds	N	N	Y	Y	N	N	N	N
Private Activities/Donations	Y	N	Y	N	Y	Y	N	Y
State And Federal Funds/Grants	Y	N	Y	Y	Y	Y	Y	Y
Capability								
Fire Evacuation Training	Y	Y	Y	Y	Y	Y	Y	Y

Tornado Sheltering Exercises	Y	Y	Y	Y	Y	Y	Y	Y
Public Address/ Emergency Alert System	Y	Y	Y	Y	Y	Y	Y	Y
NOAA Weather Radios	Y	Y	N	Y	Y	Y	Y	N
Lock-Down Security Training	Y	Y	Y	Y	Y	Y	Y	Y
FEMA Tornado Shelter/Saferoom	Y	N	N	Y	N	Y	N	Y main
Campus Police	N	N	N	N	2 SROs	N	SRO	DPS

Data Collection Questionnaires, 2023

3 RISK ASSESSMENT

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Problem Statement	3.111
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Hazard Profile	3.112
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Problem Statement	3.120
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Hazard Profile	3.121
Vulnerability	3.124
Problem Statement	3.125

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 Stoddard 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 Stoddard 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 Stoddard County Multi-Jurisdictional Local Hazard Mitigation Plan. The eleven natural hazards of prime concern for Missouri and Stoddard County were:

- Flooding (Riverine and Flash);
- Levee Failure;
- Dam Failure;
- Earthquake;
- Land Subsidence/Sinkholes;
- Drought;
- 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 Stoddard County. Each of the disaster

events affected multiple counties; estimated damages reflect total losses to all counties. 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 Stoddard 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 Stoddard 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 Stoddard County, Missouri, 1965-Present

Disaster Number	Declaration Date	Description	Individual Assistance (IA) Public Assistance (PA)
Major Disaster Declarations			
372	4/19/1973	HEAVY RAINS, TORNADOES & FLOODING	N/A
579	4/21/1979	TORNADOES, TORRENTIAL RAIN & FLOODING	N/A
995	7/9/1993	SEVERE STORMS & FLOODING	N/A
1006	12/1/1993	SEVERE STORMS, TORNADOES, AND FLOODING	N/A
1412	5/6/2002	SEVERE STORMS, TORNADOES AND FLOODING	PA - \$35,299,777.93
1463	5/6/2003	SEVERE STORMS, TORNADOES, AND FLOODING	IA - \$8,779,157.72 PA - \$19,562,866.28
1635	4/5/2006	SEVERE STORMS, TORNADOES, AND FLOODING	IA - \$2,611,696.48 PA - \$16,319,372.80
1748	3/12/2008	SEVERE WINTER STORMS AND FLOODING	PA - \$10,068,998.77
1749	3/19/2008	SEVERE STORMS AND FLOODING	IA - \$13,924,227.09 PA - \$26,045,574.54
1809	11/13/2008	SEVERE STORMS, FLOODING, AND A TORNADO	IA - \$6,869,983.55 PA - \$8,529,243.13
1822	2/17/2009	SEVERE WINTER STORM	PA - \$135,879,596.08
1980	5/9/2011	SEVERE STORMS, TORNADOES, AND FLOODING	IA - \$37,115,639.63 PA - \$161,525,436.57
4130	7/18/2013	SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING	PA - \$9,033,804.83
4250	1/21/2016	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	IA - \$13,175,523.43 PA - \$37,348,088.35
4451	7/9/2019	SEVERE STORMS, TORNADOES, AND FLOODING	IA - \$7,477,718.54 PA - \$79,107,190.85

Disaster Number	Declaration Date	Description	Individual Assistance (IA) Public Assistance (PA)
Major Disaster Declarations			
4452	7/9/2020	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	PA - \$8,732,292.36
4490	3/26/2020	COVID-19 PANDEMIC	IA - \$65,840,939.01 PA - \$627,842,441.86
Emergency Declarations			
3232	9/10/2005	HURRICANE KATRINA EVACUATION	PA - \$1,816,226.90
3281	12/12/2007	SEVERE WINTER STORMS	N/A
3303	1/30/2009	SEVERE WINTER STORM	N/A
3317	2/3/2011	SEVERE WINTER STORM	N/A
3374	1/2/2016	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	N/A
3482	3/13/2020	COVID-19	N/A

Source: Federal Emergency Management Agency, N/A – Not Available
<https://www.fema.gov/data-visualization-summary-disaster-declarations-and-grants>
<https://www.fema.gov/disasters/state-tribal-government>

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 (2010, 2013, 2018 and 2023)
- Previously approved Stoddard 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);
- Stoddard County Comprehensive Plans to the extent available
- Stoddard County Emergency Management
- Stoddard County Flood Insurance Rate Map, FEMA

- Stoddard 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 review of the hazards in the State Plan as well as the disaster declaration history, the HMPC agreed on eleven 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

	Flooding (River and Flash)	Levee Failure	Dam Failure	Earthquake	Land Subsidence/ Sinkholes	Drought	Extreme Temperatures	Severe Thunderstorm	Severe Winter Weather	Tornado	Wildfire
Stoddard County	X	X	X	X	X	X	X	X	X	X	X
Cities and/or Villages											
Advance	X	X	X	X		X	X	X	X	X	
Bell City	X	X		X		X	X	X	X	X	X
Bernie	X	X		X		X	X	X	X	X	
Bloomfield	X	X		X		X	X	X	X	X	X
Dexter	X	X		X	X	X	X	X	X	X	X
Dudley				X		X	X	X	X	X	
Essex	X	X		X		X	X	X	X	X	
Puxico	X	X		X		X	X	X	X	X	X
Schools and Special Districts											
Advance R-IV	X	X		X		X	X	X	X	X	
Bell City R-II	X	X		X		X	X	X	X	X	X
Bernie R-XIII	X	X		X		X	X	X	X	X	
Bloomfield R-XIV	X	X		X		X	X	X	X	X	X
Dexter R-XI	X	X		X	X	X	X	X	X	X	X
Puxico R-VIII	X	X		X		X	X	X	X	X	X
Richland R-I	X	X		X		X	X	X	X	X	
Three Rivers College	X	X		X		X	X	X	X	X	X

Land subsidence/sinkholes are included as a hazard to address the mining industry within the County; and wildfire is included to address the noted wildfire urban interface areas, as mapped by the SILVIS Lab, and the historic wildfire data provided by the Missouri Department of Conservation.

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. Stoddard County is 829 square miles and 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 hazards that do vary somewhat across the planning area include flooding, levee failure, dam failure, earthquake, land subsidence/sinkholes, and wildfire. In 3.4, Hazard Profiles, Vulnerability, and Problem Statements, the Geographic Location section discusses how the hazard varies among jurisdictions across the planning area in terms of location. The Previous Occurrences section lists the best available data on where past events have occurred and the associated losses

to specific jurisdictions (B1d). The Vulnerability section identifies structures and estimates potential losses by jurisdiction where data is available and hazard areas are identified. Section 3. 2, Assets at Risk, describes critical facilities and other community assets by jurisdiction.

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 small population decreases in the county, but the margin of error for those changes is significant in relation to the overall population. Therefore, the estimated changes in population cannot be depended upon to assess risk. Regardless, the communities in Stoddard 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 Census Bureau data. Building counts and building exposure values are based on parcel data provided by the State of Missouri Geographic Information Systems (GIS) database. 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 city. Table 3.4 that follows provides the building value exposures for the county and each city in the planning area broken down by usage type. Table 3.5 provides the building count total for the county and each city in the planning area broken out by building usage types (residential, commercial, industrial, and agricultural).

Table 3.3. Maximum Population and Building Exposure by Jurisdiction

Jurisdiction	2020 Decennial Census	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
Advance	1,349	841	\$90,454,000	\$55,127,000	\$145,581,000
Bell City	464	297	\$35,237,000	\$15,004,000	\$50,242,000
Bernie	1,859	1036	\$102,281,000	\$57,114,000	\$159,395,000

Bloomfield	1,755	1162	\$110,060,000	\$63,935,000	\$173,995,000
Dexter	7,927	4141	\$453,307,000	\$289,752,000	\$743,059,000
Dudley	101	205	\$14,892,000	\$9,288,000	\$24,180,000
Essex	403	300	\$27,929,000	\$16,300,000	\$44,229,000
Penermon	122	49	\$2,975,000	\$1,454,000	\$4,429,000
Puxico	873	518	\$56,748,000	\$35,952,000	\$92,700,000
Unincorporated Stoddard Cnty	13,819	21,130	\$1,018,927,000	\$496,957,420	\$1,547,114,000
Totals	28,672	29,679	\$1,912,811,000	\$1,072,114,000	\$2,984,925,000

Source: U.S. Bureau of the Census, Decennial Census population data ; 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/Exposure by Usage Type

Jurisdiction	Agriculture	Commercial	Education	Government	Industrial	Residential	Total
Advance	\$40,611	\$12,433,334	\$2,354,897	\$1,152,762	\$5,645,030	\$68,827,369	\$90,454,000
Bell City	\$26,188	\$3,820,405	\$4,371,700	\$0	\$0	\$27,018,706	\$35,237,000
Bernie	\$101,187	\$7,611,284	\$2,654,359	\$1,461,773	\$3,579,122	\$86,873,274	\$102,281,000
Bloomfield	\$95,331	\$15,536,638	\$0	\$1,606,696	\$0	\$92,821,336	\$110,060,000
Dexter	\$140,792	\$91,324,247	\$4,029,016	\$986,136	\$14,185,389	\$342,641,421	\$453,307,000
Dudley	\$106,552	\$1,086,753	\$0	\$487,001	\$894,309	\$12,317,385	\$14,892,000
Essex	\$33,803	\$3,766,891	\$0	\$506,411	\$0	\$23,621,894	\$27,929,000
Penermon	\$23,994	\$0	\$0	\$0	\$0	\$2,951,006	\$2,975,000
Puxico	\$66,260	\$14,430,109	\$695,259	\$1,021,024	\$0	\$40,535,346	\$56,748,000
Unincorporated Stoddard Cnty	\$2,398,612	\$3,519,657	\$169,581	\$311,298	\$2,934,500	\$92,558,351	\$101,892,000
Totals	\$22,465,783	\$198,703,270	\$16,151,921	\$10,730,439	\$53,583,639	\$1,611,175,948	\$1,912,811,000

Source: Missouri Outreach Folders, All Hazards Risk Data, calculation

Table 3.5. Building Counts by Usage Type

Jurisdiction	Agriculture	Commercial	Education	Government	Industrial	Residential	Total
Advance	19	30	3	2	16	771	841
Bell City	11	8	5			273	297
Bernie	55	21	4	3	12	941	1036
Bloomfield	46	39		3		1074	1162
Dexter	74	249	6	2	45	3765	4141
Dudley	61	3		1	3	137	205

Essex	19	10		1		270	300
Penermon	15					34	49
Puxico	34	38	1	2		443	518
Unincorporated Stoddard County	10,360	76	2	5	76	10.612	21,130
Totals	10,694	473	21	19	155	18,320	29,679

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 Jurisdiction-Public School Districts

Public School District	Enrollment	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
Advance R-IV	435	6	\$13,810,793	\$2,167,500	\$15,978,293
Bell City R-II	220	7	\$11,765,282	\$3,251,234	\$15,016,516
Bernie R-XIII	457	12	\$17,755,330	\$2,937,178	\$20,692,508
Bloomfield R-XIV	618	4	\$23,988,496	12,507,229	\$36,495,725
Dexter R-XI	2,048	9	\$150,181,524	\$9,225,483	\$159,407,007
Puxico R-VIII	777	14	\$28,067,412	\$4,810,382	\$32,877,794
Richland R-I	276	7	\$17,059,778	\$3,149,273	\$2,952,857
Three Rivers College in Dexter	21	N/A	N/A	N/A	N/A
Totals	4,852	59	\$262,628,615	\$38,048,279	\$300,676,894

Source: <http://mcds.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx>, HMPC Data Collection Questionnaires from Public School Districts

3.2.2 Critical and Essential Facilities and Infrastructure

As part of the update to the Stoddard 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 E. This was created in 2023 by Stoddard County Emergency Management.

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

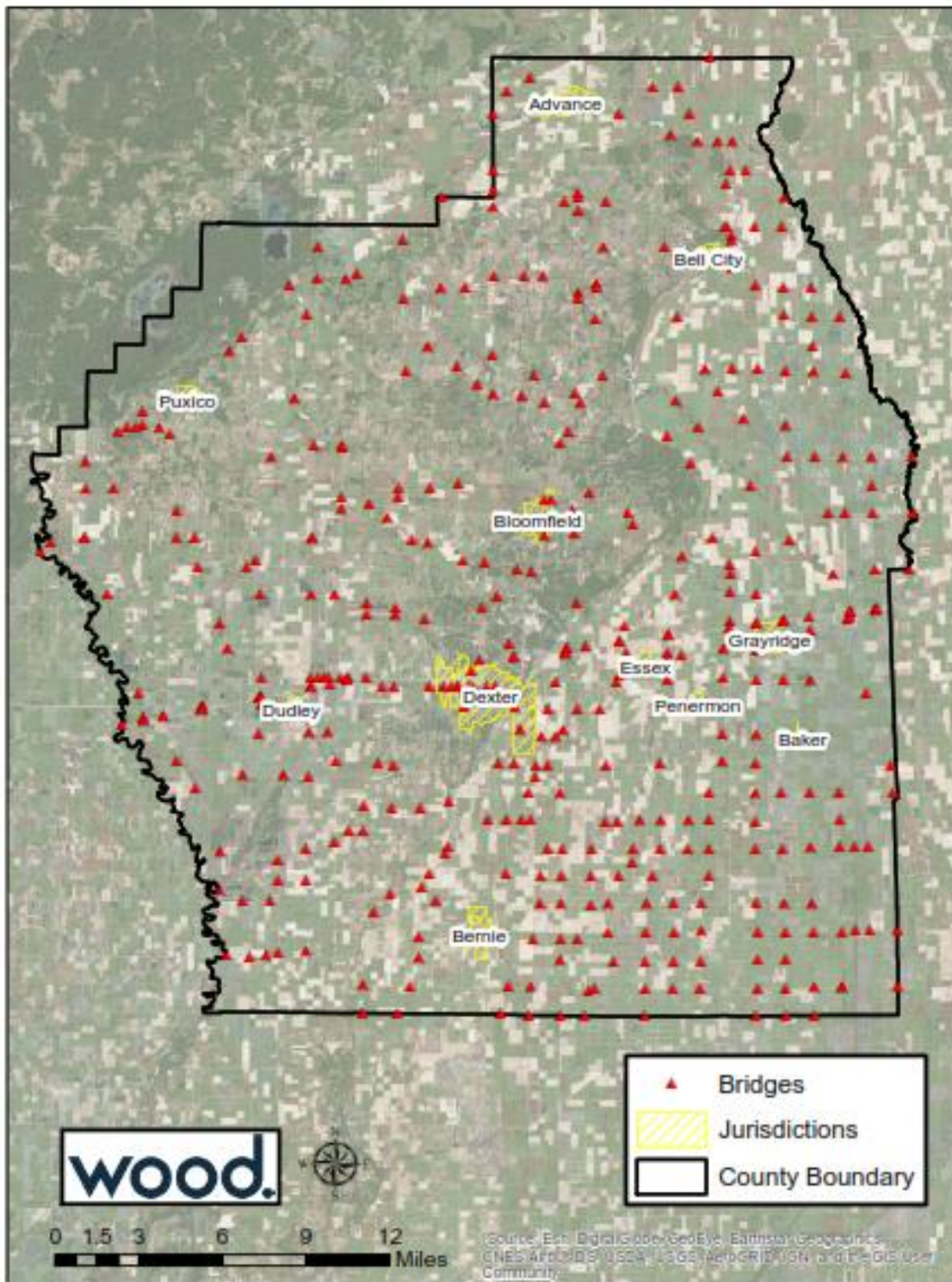
Jurisdiction	Airport Facility	Childcare Facility	Emergency Operations	Fire Service	Government	Hospital/Health Care	Nursing Homes	Police Station	School Facilities	Tier II Facility	TOTAL
Advance		2		1	1	1	1		2	5	13
Bell City		2		1	1				2		6
Bernie		3		1	1				2	5	12
Bloomfield		2		2	5	2	1	1	4		17
Dexter	1	12	1	2	3	5	3		5	7	39
Dudley		1		1	1					2	5
Essex				1	1					1	3
Penermon											0
Puxico		5		1	2	1	1		4	1	15
Unincorporated Stoddard County						1	1		2	4	8
Totals	1	27	1	10	15	10	7	1	21	25	118

Source: Data Collection Questionnaires 2023, Stoddard County Emergency Management

Figure 3.1 illustrates the locations of bridges in the planning area included in the National Bridge Inventory data set. For 2023, the NBI data set identified 435 bridges within Stoddard County, 187 in good condition, 231 in fair condition and 17 in poor condition.

There are 221 scour critical bridges in Missouri, according to the 2023 State Hazard Mitigation Plan. Of those, three are located in Stoddard County. 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. Stoddard County 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 Stoddard County.

Table 3.8. Threatened and Endangered Species in Stoddard County

Common Name	Scientific Name	Status
Gray Bat	Myotis grisescens	Endangered
Indiana Bat	Myotis sodalis	Endangered
Northern Long-Eared Bat	Myotis septentrionalis	Endangered
Tri-colored Bat	Perimyotis subflavus	Proposed Endangered
Alligator Snapping Turtle	Macrochelys temminckii	Proposed Threatened
Rabbitsfoot	Quadrula cylindrica cylindrica	Threatened
Snuffbox Mussel	Epioblasma triquetra	Endangered
Western Fanshell	Cyprogenia aberti	Proposed Threatened
Monarch Butterfly	Danaus plexippus	Candidate

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

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 parks and conservation areas in the planning area and also includes local parks if available.

Table 3.9. Parks in Stoddard County

Park / Conservation Area	Address	City
Aquilla Access	CR 223	Bloomfield
Crowleys Ridge Conservation Area	CR 237	Bloomfield
Dexter City Lake	W. Castor Street	Dexter
Duck Creek Conservation Area	204 MO-51	Puxico

Holly Ridge Conservation Area	CR 527	Bloomfield
Oak Ridge Conservation Area	Old Highway 60	Dudley
Otter Slough Conservation Area	7001 County Rd 675	Dexter
East Park	500 Fairground Dr.	Dexter

Source: <http://mdc7.mdc.mo.gov/applications/moatlas/AreaList.aspx?txtUserID=guest&txtAreaNm=s>

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 Stoddard County that are on the National Register of Historic Places.

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

Property	Address	City	Date Listed
Dexter Gymnasium	Jct. of Park Lane and Fannetta St.	Dexter	8/8/01
Henry Miller House	106 Cape Rd	Bloomfield	05/18/18
Mingo National Wildlife Refuge	Restricted	Puxico	5/12/75
Rich Woods Archeological Site	Restricted	Bernie	1/25/71
Stoddard County Courthouse	Prairie and Court Sts	Bloomfield	9/18/84

Source: Missouri Department of Natural Resources – Missouri National Register Listings by County [Stoddard County National Register Listings | Missouri State Parks \(mostateparks.com\)](#)

Economic Resources: Table 3.11 identifies major non-government employers in the planning area. The Tyson production facility announced it will close in late 2023.

Table 3.11. Major Non-Government Employers in Stoddard County

Employer Name	Main Locations	Product or Service	Employees
Faurecia	Dexter	Automotive	140
Tyson (Closing 10/23)	Dexter	Chicken	700
McDonald's	Dexter	Fast Food	50
Cypress Point	Dexter	Skilled Nursing Facility	75
Republic Services	Dexter	Trash Removal	55
Wal-Mart	Dexter	Retail	218
Bud Shell Ford	Dexter	Automotive Retailer	54
SEMO Electric Cooperative	Dexter	Utility Company	64
Saint Francis Healthcare	Dexter	Medical Clinic	150
Southeast Health	Dexter	Hospital, Medical Clinic	200
WW Wood Products	Dudley	Kitchen Cabinets	1200
Nestle Purina	Rural Bloomfield	Pet Products	500
Holloway Distributing	Puxico	Wholesale Food	200

Source: Data Collection Questionnaires, Interviews of MPC members – Stoddard County 2023

Agriculture: Agriculture-related jobs in Stoddard County constitute approximately 6.6% of total employment within the county. The top crops in acres are rice, soybeans, corn, cotton and wheat. Stoddard County ranks second in Missouri for total agricultural production.

Table 3.12. Agriculture-Related Jobs in Stoddard County

	Unpaid	1 Worker	2 Workers	3-4 workers	5-9 workers	10 or more workers
# of Farms	333	74	70	60	33	11
# of Workers	668	74	140	205	195	167

Source: Census of Agriculture 2017, County Data

As of 2017, 248 farms in Stoddard County reported having a total of 781 workers across all farms reporting such. Numbers far exceed neighboring agricultural counties. Butler had a total of 420, New Madrid had 588 and Scott had 447. Using both 2017 ACS 5-Year Estimates and 2017 USDA data, the percentage farm-related jobs comprising the total workforce in each county was much higher in Stoddard County than nearby counties: Stoddard 6.2%, Butler 1.2%, New Madrid 4.1% and Scott 1.5%. Stoddard County ranks second in Missouri in agricultural production.

3.3 LAND USE AND DEVELOPMENT

3.3.1 Development Since Previous Plan Update

Since 2010, Stoddard County has decreased in population by 4.3% (1,296 persons) and decreased in the number of housing units also by less than 1-percent (19 units) according to the 2020 Decennial Census. Table 3.12 and Table 3.13 present this data by jurisdiction.

Table 3.13. County Population Growth, 2010 to 2020

Jurisdiction	2010 Population	2020 Population	2010-2020 # Change	2010-2020 % Change
Stoddard County	29,968	28,672	-1,296	-4.3%
City of Advance	1,347	1,349	+2	+0.1%
City of Bell City	448	464	+16	+3.6%
City of Bernie	1,958	1,859	-99	-5.1%
City of Bloomfield	1,933	1,755	-178	-9.2%
City of Dexter	7,864	7,927	+63	+0.8%
City of Dudley	232	101	-131	-56.5%
City of Essex	472	403	-69	-14.6%
City of Puxico	881	873	-8	-0.9%

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

Population growth or decline is generally accompanied by increases or decreases in the number of housing units. Table 3.14 depicts the change in numbers of housing units in the planning area from 2010 to 2021.

Table 3.14. Change in Housing Units, 2010-2021

Jurisdiction	Housing Units 2010	Housing Units 2021	2010-2021 # Change	2010-2021 % Change
Advance	552	651	99	17.9%
Bell City	210	202	-8	-3.8%
Bernie	913	874	-39	-4.3%
Bloomfield	944	821	-123	-13.0%
Dexter	3,721	3,888	167	4.5%
Dudley	111	63	-48	-43.2%
Essex	263	183	-80	-30.4%
Puxico	441	402	-39	-8.8%
Unincorporated Stoddard County	6,432	6,318	-114	-1.8%
Totals	13,633	13,402	-185	-1.4%

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

City of Advance – reports that development in the city has been primarily residential. The development is not in hazard areas or floodplains.

City of Bell City – no new development occurred since the previous HMP.

City of Bernie – mentions that there have been some new homes and businesses developed in the jurisdiction, but none of them have been in flood plains or hazard areas.

City of Bloomfield – no new developments reported.

City of Dexter – has had numerous developments since the last HMP. They list: residential - Gill Family Properties and commercial – Rally’s, Arby’s, Rick Shipman Construction, Scooter’s Coffee, Domino’s Pizza, Bollinger HVAC, Hurricane Car Wash, Allen’s Auto Shop and Ozark Food. None of these new additions are in the floodplain or in known hazard areas.

City of Dudley – no new developments were reported during the last five-year period.

City of Essex – no development was reported in the recent past.

City of Puxico – Puxico reported a new residential development called Arrowhead Estates – a subdivision and the Midway restaurant that includes a mercantile and ice cream shop. Neither of these are in the floodplain or in known hazard areas.

Unincorporated Stoddard County – no new development is planned. The trend seems to be that new developments are aware of floodplain hazards in the county and are doing their best to mitigate those hazards by following the proper standards set forth by the county or not developing in hazard areas.

3.3.2 Future Land Use and Development (B2b)

Several manufacturing and other businesses have located to Stoddard County. Educational facilities, such as Three Rivers College, have been established in the County. The estimated trend is that agricultural and agricultural related industry will be a large part of the Stoddard County economy. While the county does not anticipate a major increase in population, growth and county populations should remain stable.

It is also estimated that future land use will continue to show small increases in farm production and new business and residential development. Property values and assessed valuations while increasing every two years (10% average) will likely show slight gains in the future. Population estimates are trending toward little future growth in the county. Construction costs have increased recently, in part due to the COVID-19 pandemic that disrupted production of materials. To understand trends over the past 10 years, the following data is for single-family new construction building permits granted by the City of Dexter.

- 2013: 20 buildings, average cost: \$99,600
- 2014: 16 buildings, average cost: \$188,734
- 2015: 17 buildings, average cost: \$158,653
- 2016: 16 buildings, average cost: \$108,939
- 2017: 8 buildings, average cost: \$140,625
- 2018: 10 buildings, average cost: \$118,500
- 2019: 8 buildings, average cost: \$118,125
- 2020: 2 buildings, average cost: \$67,000
- 2021: 6 buildings, average cost: \$223,000
- 2022: 1 buildings, average cost: \$ 250,000

Future development plans as reported on Data Collection Questionnaires are below.

City of Advance – No major developments are planned within the next five years.

City of Bell City – No new developments are planned in the next five years.

City of Bernie – New facilities and infrastructure planned are a new City Hall and improvements to North Allen Street.

City of Bloomfield – No new developments are planned in the next five-year period.

City of Dexter – In the coming five-year period, a new wastewater plant is planned.

City of Dudley – No new developments are planned for the near future.

City of Essex – no development is planned in the near future according to the Essex Data Collection Questionnaire.

City of Puxico – Future developments include repaving streets and repairing drainage areas.

Unincorporated Stoddard County – no new development is reported.

School District's Future Development

A review of Data Collection Questionnaires submitted by school districts indicated that some schools have planned improvements. Advance R-IV hopes to build a bus garage on school grounds. Bell City R-II is researching building an entire new school for its district. Bernie R-XIII plans no new buildings or improvements for the next five years. Bloomfield R-XIV is planning to build a bus garage and add an addition to their high school ag shop. Dexter R-XI plan a high school locker room renovation in the next five years. Puxico R-VIII hopes to replace their aging elementary school building. Richland R-1 plans to build a new multipurpose gym building. None of the improvements are planned in hazard areas and none of the schools foresee any significant enrollment fluctuation.

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 **Error! Reference source not found.** 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: (B2b)** 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. (B2a) 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 2018 State Hazard Mitigation Plan Update. Data to support the vulnerability assessment was collected from the following sources

- Written descriptions of assets and risks provided by participating jurisdictions;
- Existing plans and reports;
- 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 and dam failure is discussed in Section 3.4.2 and Section 3.4.3 respectively. 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.

Each county plan must describe participation in the NFIP for each participant, as applicable, in accordance with NFIP regulatory requirements. The following information must be provided for each participant.

- Adoption of NFIP minimum floodplain management criteria via local regulation.
- Adoption of the latest effective Flood Insurance Rate Map (FIRM), if applicable.
- Implementation and enforcement of local floodplain management regulations to regulate and permit development in SFHAs.
- Appointment of a designee or agency to implement the addressed commitments and requirements of the NFIP.
- Description of how participants implement the substantial improvement/substantial damage provisions of their floodplain management regulations after an event.

Geographic Location

Figure 3.2 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. These are the areas that are at risk of riverine flooding. The map was created using the effective Flood Insurance Rate Map (FIRM) database for Stoddard County. The FIRM database is the digital, geospatial version of the flood hazard information shown on the published paper FIRMs. The FIRM database depicts flood risk information and supporting data used to develop the risk data. The following flood zones are noted on the FIRM:

- Zone A – Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
- Zone AH – Areas with a 1% annual chance of shallow flooding, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
- Zone X - Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods.

The Table below provides the number of riverine flood events by location as recorded by the NCEI for the 26-year period between 1995 and 2022 within Stoddard County and its incorporated cities.

Table 3.15. NCEI Stoddard County Flood Events Summary, 1993 to 2022 (B2c)

Location	# of Events
Bloomfield	1
Dexter	3
Dudley	3
Puxico	3
Stoddard County, unincorporated	11
- Unincorporated County, Zone - 3	
- Unincorporated County, Countywide – 1	
- Unincorporated County, Asherville - 2	
- Unincorporated County, Mingo – 1	
- Unincorporated County, Shover – 2	
- Unincorporated County, Maulsby – 1	
- Unincorporated County, Aquilla - 1	

Source: National Centers for Environmental Information, Date

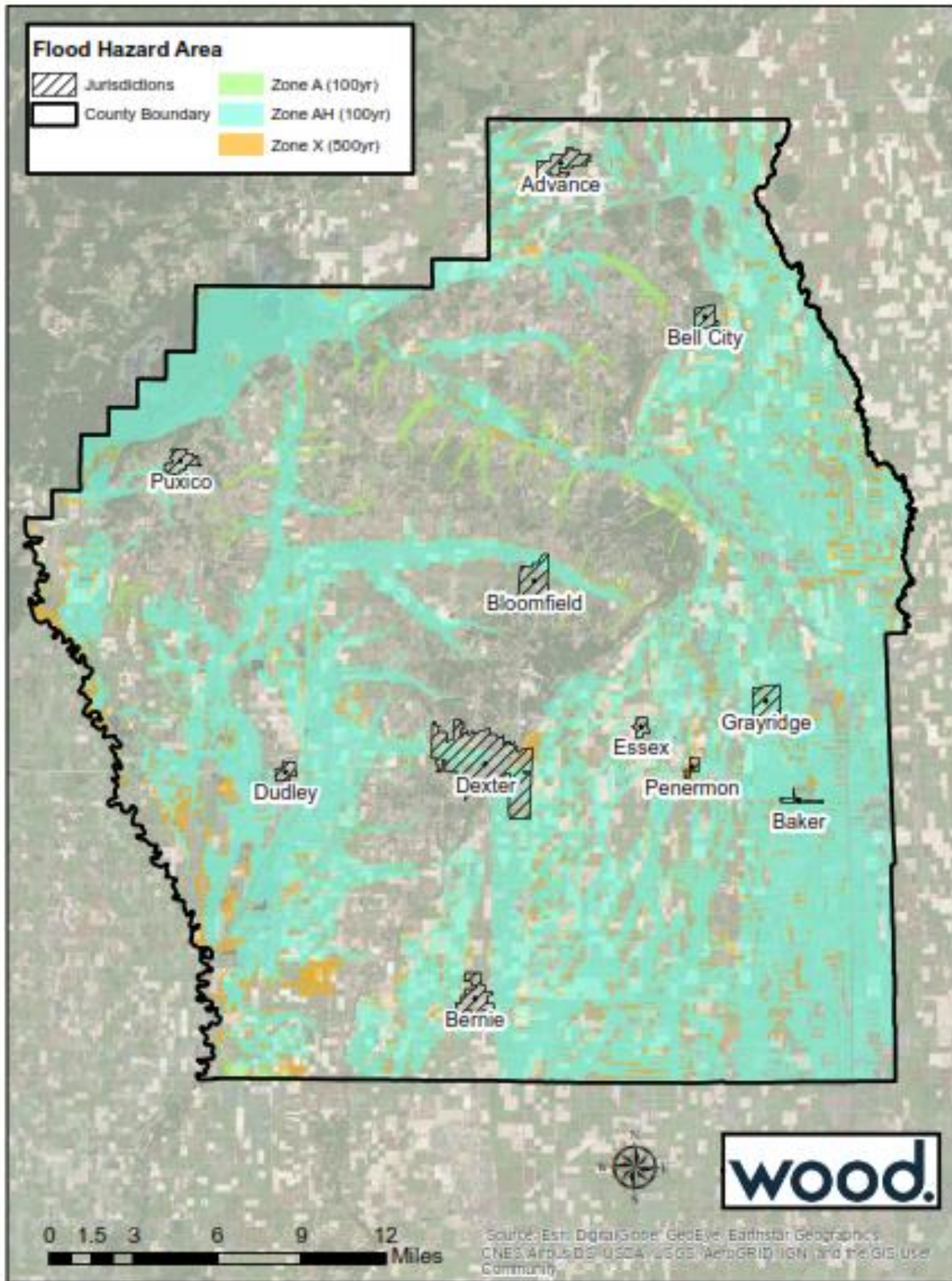
Flash floods occur in SFHA (Special Flood Hazard Areas) and in low-lying areas in the planning area. They also occur in areas without adequate drainage to carry away the amount of water that falls during intense rainfall events. Table 3.16 summarizes the number of flash flood events during a 20-year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

Table 3.16. NCEI Stoddard County Flash Flood Events Summary, 1993 to 2022 (B2c)

Location	# of Events
Advance	3
Bernie	1
Dexter	4
Dudley	2
Essex	2
Puxico	3
Stoddard County, unincorporated	17
- Unincorporated County, Aid - 2	
- Unincorporated County, Swinton - 2	
- Unincorporated County, Countywide – 8	

Location	# of Events
- Unincorporated County, Brownwood - 1	
- Unincorporated County, Idalia – 1	
- Unincorporated County, Painton – 1	
- Unincorporated County, Dale – 1	
- Unincorporated County, Powe - 1	

Figure 3.2. Stoddard County 1-Percent Annual Chance Floodplain



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.

Table 3.17 details NFIP participation for the communities in the planning area and includes the number of policies in force, amount of insurance in force, the number of paid losses and total payments for each jurisdiction, where applicable. None of the communities in the county is sanctioned. The unincorporated portion of the county has incurred the most losses, followed by the City of Advance. Their total claims were \$849,336 and \$49,631, respectively.

National Flood Insurance Program (NFIP) Participation

Table 3.17 provides details on participation in the National Flood Insurance Program, as well as flood insurance policies, claims, and floodplain management programs. All jurisdictions participate in NFIP.

Table 3.17. Community Participation in the National Flood Insurance Program in Stoddard County, 2022

Jurisdiction	Status Date – Participating Regular Since	Floodplain Management Ordinance In Place	CRS Participant (Y/N)/ Class	Effective FIRM Date	Policies in Force	Insurance in Force (\$)	Number Paid Losses	Total Losses Paid (\$)	Responsible for Floodplain Regs in SFHAs	Responsible for Floodplain Admin
Advance	06/15/1978	X	N	07/01/1987	8	\$623,000	8	\$49,631	Donnie Bohnsack	Donnie Bohnsack
Bell City	08/19/1985	X	N	07/01/1987	N/A	N/A	N/A	N/A	Dorothy Burton	Dorothy Burton
Bernie	07/17/1986	X	N	07/01/1987	1	\$250,000	N/A	N/A	James H Tilmon	James H Tilmon
Bloomfield	08/05/1986	X	N	07/01/1987	7	\$1,080,000	3	\$32,967	Justin Bell	Justin Bell
Dexter	06/01/1982	X	N	07/01/1987	49	\$8,444,000	4	\$17,585	Bud Lawrence	Bud Lawrence
Dudley	09/13/2001	X	N	07/01/1987	N/A	N/A	N/A	N/A	Lucille Mullins	Lucille Mullins
Essex	08/04/1983	X	N	07/01/1987	N/A	N/A	N/A	N/A	Angela Malloy	Angela Malloy
Puxico	07/17/1986	X	N	07/01/1987	1	\$500,000	2	\$4,665	Ricky McLean	Ricky McLean
Unincorporated Stoddard County	07/01/1987	X	N	07/01/1987	76	\$8,429,000	71	\$849,336	Beau Bishop	Stoddard Co Emergency Management Agency

Source: Information from the NFIP Community Status Book and from members of the Stoddard County Hazard Mitigation Planning Committee.

Most jurisdictions have floodplain ordinances and they are included in Appendix G. Each jurisdiction has addressed specific NFIP requirements regarding their substantial damage/substantial improvement provisions and development in the SFHA as illustrated in Table 3.18.

Table 3.18. Jurisdiction Approach to NFIP Compliance for Damage, Improvement, Development in SFHA

Jurisdiction	Substantial Damage/Substantial improvement Provisions	Development in SFHA
Advance	Ordinance p 301	Ordinance p 303
Bell City	Ordinance Section 6a	Ordinance Section 7a-d
Bernie	Action 2.2	Action 2.2
Bloomfield	Ordinance is inadequate – Action 2.3	Ordinance is inadequate – Action 2.3
Dexter	Ordinance Section 415.060	Ordinance Section 415.030
Dudley	Ordinance Article IV	Ordinance Article III
Essex	Action 2.3	Action 2.3
Puxico	Ordinance Article II, Section 410.040	Ordinance Article IV, Section 410.120 – 410.160
Unincorporated Stoddard County	Ordinance Article IV, Section A, G	Ordinance Article III, Section A-D

Source: Jurisdictional Floodplain Ordinances, Action Plans

The following are FIRMs for each NFIP participant in Stoddard County.

Figure 3.3. City of Advance FIRM

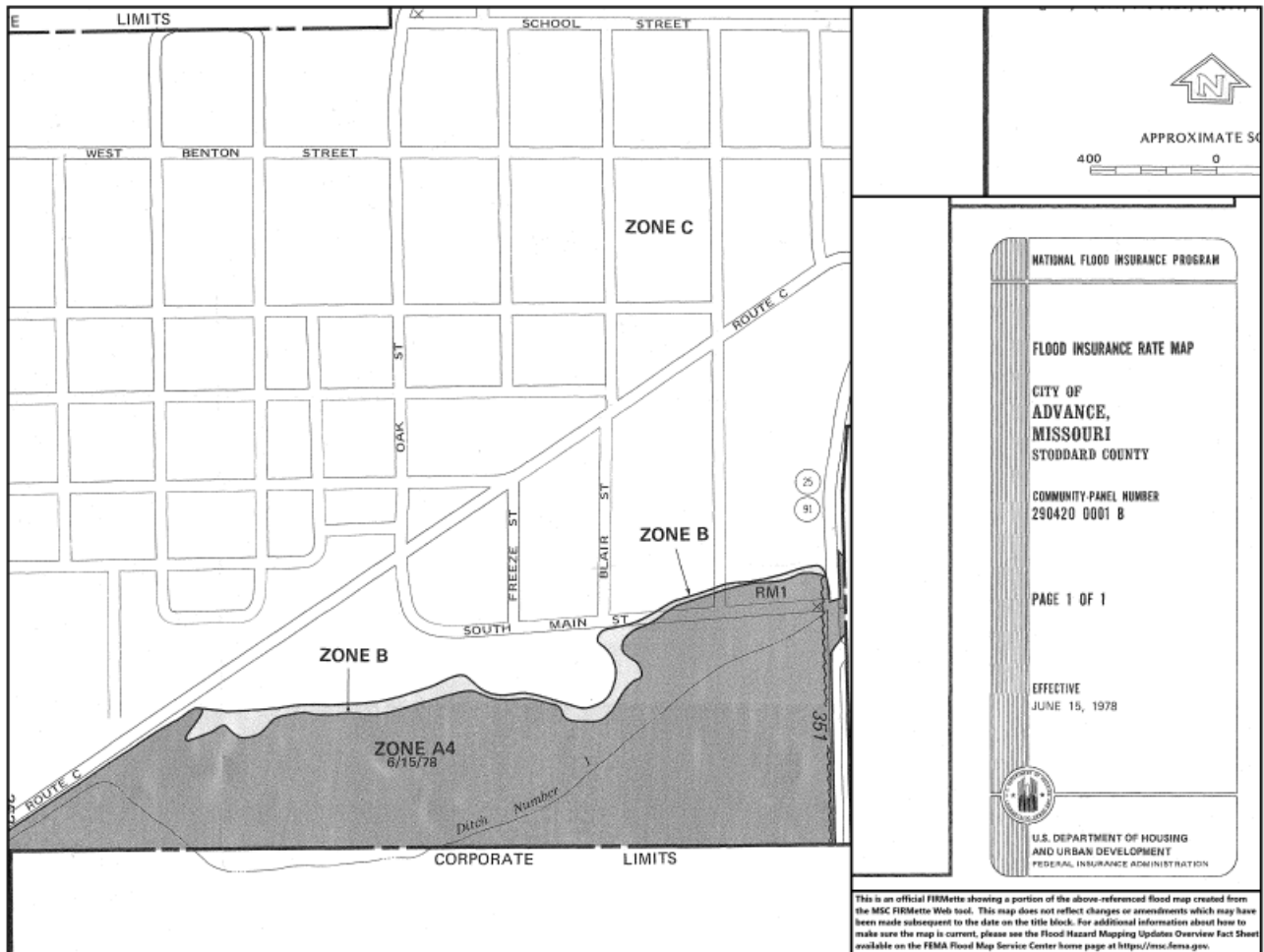
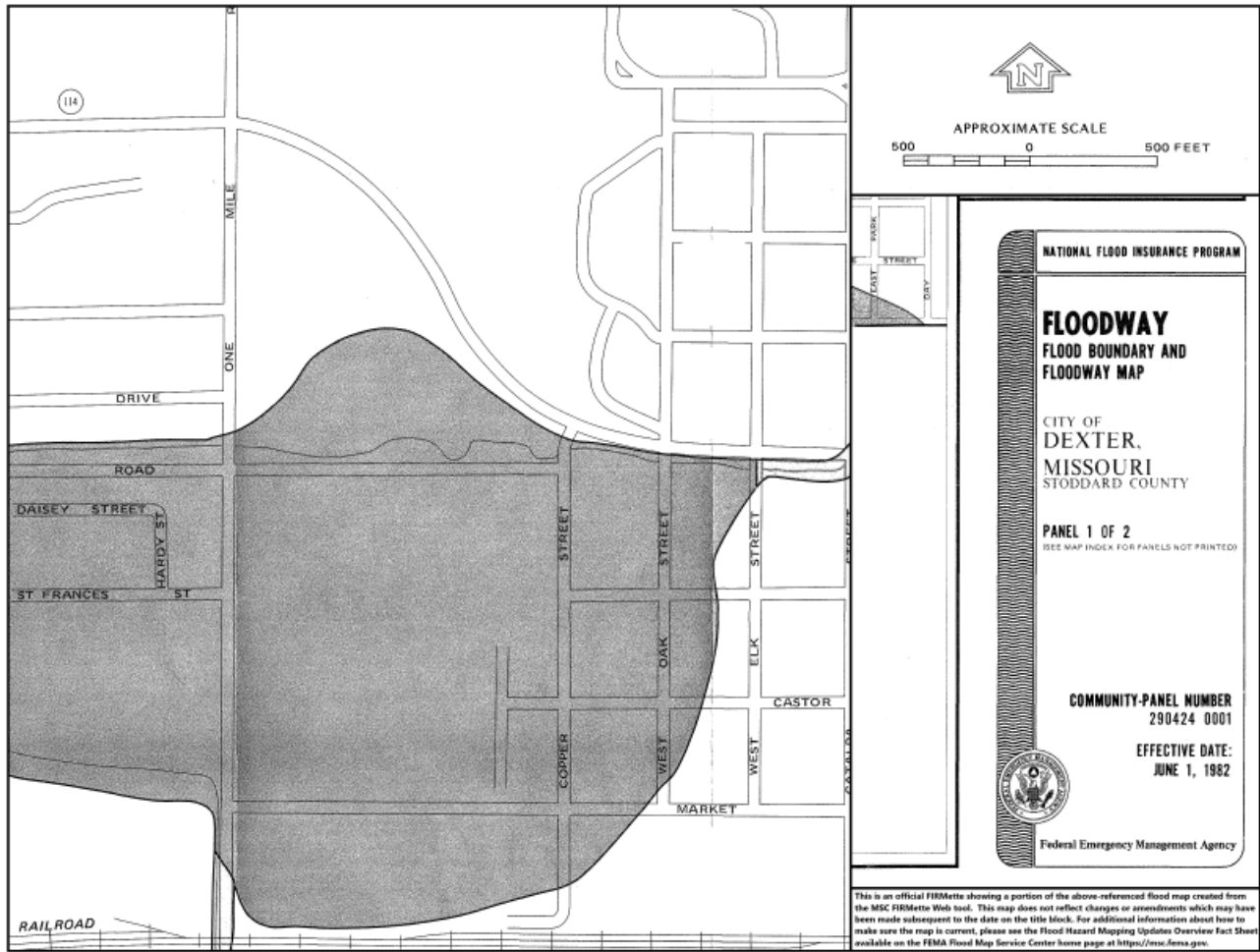
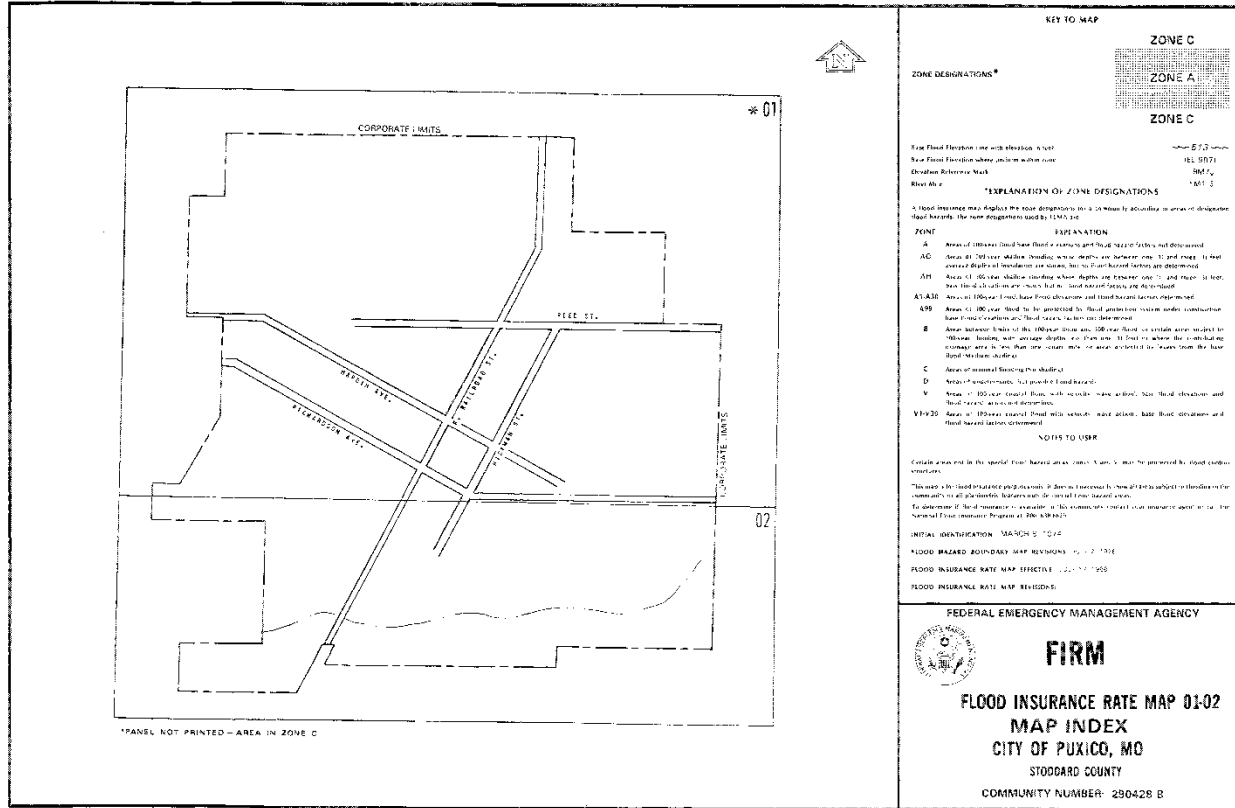


Figure 3.6. City of Dexter



There is no FIRM available for the City of Dudley or City of Essex.

Figure 3.7. City of Puxico



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, jurisdictions included in the planning area have a combined total of 9 repetitive loss properties. As of 2023, 0 properties have been mitigated, leaving 9 un-mitigated repetitive loss properties.

Table 3.19. Stoddard County Repetitive Loss Properties

Jurisdiction	# of Properties Unmitigated	Type of Property	# Mitigated	Building Payments	Content Payments	Total Payments	Average Payment	# of Losses
Bloomfield	1	Residential	0	\$26,320		\$26,320	13,160	2
Unincorporated Stoddard County	11	Residential	0	\$398,278	\$52,872	\$451,150	27,377	25

Source: Missouri SEMA as of 7/12/23

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 are no severe repetitive loss properties within Stoddard County.

Previous Occurrences

Flood events, as reported in the NOAA (National Oceanic and Atmospheric Administration) storm events database were reviewed. There were 34 flood events in the Planning Area between 2003 and 2022. Of these 34, 19 were reported as flash food events and 15 were reported as riverine events.

In addition, Stoddard County has been included in 15 Presidential disaster declarations that included flooding between 1973 and 2022. Historical accounts of flooding events are recorded below. Sources include the NOAA database, FEMA, local news, and planning committee member accounts.

Table 3.20. NCEI Stoddard 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
2007	1	0	0	\$0	0
2008	2	0	0	\$10,000	0
2009	1	0	0	\$100,000	0
2011	5	0	0	\$300,000	0
2013	1	0	0	\$3,000	0
2014	1	0	0	\$0	0
2017	2	0	0	\$100,000	0
2019	1	0	0	\$10,000	0
2020	2	0	0	0	0
2021	2	0	0	0	0
Total	19	0	0	\$523,000	0

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

Table 3.21. NCEI Stoddard County Riverine Flood Events Summary, 2003 to 2022

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
2008	1	0	0	\$1,800,000	0
2009	2	1	0	\$0	0
2011	3	0	0	\$4,050,000	0
2013	1	0	0	\$0	0
2014	1	0	0	\$0	0
2015	1	0	0	\$0	0
2016	2	0	0	\$0	0
2017	2	0	0	\$20,000	0
2019	1	0	0	0	0
2022	1	0	0	0	0
Total	15	1	0	\$5,870,000	0

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

Noted historic events include the following:

- **03/18/2008** - Major flooding occurred, causing a number of road closures. Numerous roads were underwater. West of Advance, the community of Greenbrier was flooded by the Castor River. Water was three and a half feet deep inside a church in Greenbrier, about six inches higher than the flood of 1982. The 1982 flood was considered the worst in memory for longtime local residents. A business was sandbagged in Puxico. A pickup truck was swept off

a street in Dexter. Another hard-hit town was Advance, where at least a few homes were flooded when diversion channel ditches overflowed. Two water rescues were conducted, including one on Highway N near Bell City. Countywide, at least 33 homes were damaged, and 12 others were destroyed.

- **05/01/2009** - Two people were evacuated by boat from their flooded residence near Puxico. Flash flooding of Dexter Creek inundated a lumber company in Dexter. Offices in the front of the main building were damaged. Other businesses near Highway 25 were affected by flooding. Some homes in west Dexter were flooded. Across the county, many roads and streets were flooded. Water was over State Highways E and F. The roads were not passable. Farms between Bernie and Dexter were partly flooded. A spotter just west of Dexter measured 3.24 inches in 24 hours.
- **04/24/2011** - Widespread heavy rainfall from 13 to 18 inches with locally higher amounts occurred during the last week of April. This excessive rainfall caused most creeks and small rivers to flood for an extended period of time. Numerous roads were flooded and closed, including some major state highways in each county. A number of road washouts were reported across southeast Missouri. Bridges were washed out, including three in Stoddard County alone. Some homes were sandbagged or evacuated, and there were reports of people trapped in their homes due to flooded access roads. Water rescues were conducted due to motorists driving into flooded areas. Some schools cancelled or delayed classes due to the large number of inaccessible homes. Some of the creeks and rivers that caused damaging floods included Mingo Creek at Puxico.
- **04/26/2011** - A breach in the Jenkins Basin levee flooded thousands of acres in northern and eastern Stoddard County. The Bell City area was affected. Firefighters evacuated a small number of residents by boat.
- **05/01/2011** - Widespread flooding continued from April into May across southeast Missouri. Following excessive rain in April, a final dose of heavy rain came between April 30 and May 2. Numerous rounds of showers and thunderstorms produced additional average rainfall amounts of 4 to 6 inches. Between 9 and 22 inches of rain fell across the region between April 22 and May 3. Most creeks and streams flooded for an extended period of time. Some of the flooding was major. Numerous roads were flooded and closed, including some major state highways in each county. About 150 state roads were closed in southeast Missouri at the peak of the flooding. A number of road washouts were reported across southeast Missouri. One concrete bridge was washed out on County Road 410 in Stoddard County. Some homes were sandbagged or evacuated across southeast Missouri, and there were reports of people trapped in their homes due to flooded access roads. Water rescues were conducted due to motorists driving into flooded areas. Some schools cancelled or delayed classes due to the large number of inaccessible homes. In the Puxico area of Stoddard County, Mingo Creek continued to flood. A water rescue was conducted in the area.
- **05/05/2017** - A band of showers and isolated thunderstorms with torrential rain remained nearly stationary for several hours from Cape Girardeau southwest across the Dexter area. The band of heavy rain was associated with a slow-moving low-pressure system over Tennessee. The heavy rain was roughly coincident with the deformation zone on the northwest side of the 500 mb closed low.

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 34 records of flooding, 15 flood and 19 flash flood events over a 20-year period. That equates to a probability of .75 for flood events and .95 for flash flood events. The average number of any type of flood event calculates to 1.70 per year.

Changing Future Conditions Considerations and the Impact of Climate Change

According to the 2018 Missouri State Hazard Mitigation Plan, “over the last half century, average annual precipitation in most of the Midwest has increased by 5 to 10 percent. Rainfall during the four wettest days of the year has increased about 35 percent, and the amount of water flowing in most streams during the worst flood of the year has increased by more than 20 percent.” If this increased precipitation intensity continues, the frequency of flooding within the planning area is likely to increase. 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. Per the state plan, “Communities already prone to flooding should be prepared for a potential increase in facility closures and/or damages, as well as an increase in public demand for flood response and assistance.”

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 Stoddard 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 3.19 and 3.20 above illustrate the dollars in damage incurred from riverine and flash floods in the county for the past 20 years.

Impact of Previous and Future Development

Future development could impact flash and riverine flooding in Stoddard 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 to 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 growth occurring in the jurisdictions of Advance, Bell City, and Dexter. Residents in these growth areas should be wary of development within the special flood hazard areas. Fortunately, the communities experiencing the most development pressures all participate in the National Flood Insurance Program. Therefore, flood risk should not be increasing; assuming that floodplain ordinances are being effectively implemented and wise use of floodplains is being encouraged.

Additionally, in planning future development, jurisdictions in the planning area should avoid development in low-lying areas near rivers and streams or where interior drainage systems are not adequate to provide drainage during heavy rainfall events. 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 3.22. 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 Stoddard County. The county is so large that flooding will vary by jurisdiction. No educational facilities are located within the 100-year floodplain. School districts face the same risk as the city or county in which they are located. The following is a hazard summary by jurisdiction.

Stoddard County – the unincorporated portion of the county has experienced 17 flash flood and 11 riverine flood events in the past 30 years scattered throughout the county.

City of Advance – has experienced 3 flash flood events in the past 30 years and listed one of those as an historic hazard event.

City of Bell City – is less susceptible to flooding than the remainder of the county illustrated by zero flooding events in the past 30 years.

City of Bernie – like Bell City, Bernie is not susceptible to flooding, only facing 1 flood (flash) in the past 30 years.

City of Bloomfield – Bloomfield, on higher ground than other portions of the county has only experienced 1 flood in the past counting period and it was riverine. The county courthouse is located in Bloomfield and could be considered a critical facility because of its control over county water systems and county law enforcement.

City of Dexter – due to more concentration of people and structures the city has experienced more combined flooding events than any other jurisdiction with 4 flash flood and and 3 riverine flood events in the past 30 years.

City of Dudley – since 1993, the very small town of Dudley experienced 2 flash flood and 3 riverine flood events.

City of Essex – Essex is not in the path of recent riverine floods, only experiencing 3 flash floods since 1993.

City of Puxico – the town has suffered 3 riverine and 3 flash floods over the reporting period in part due to its proximity to Mingo Creek.

Problem Statement

- The jurisdictions of Advance, Bloomfield, Dexter, Puxico, and Unincorporated Stoddard County had the greatest number and value of flood claims. One mitigation strategy might be to set design standards for drainage structures near affected areas. Another strategy would be to continue to implement NFIP recommendations for reducing the possibility of flooding.
- The jurisdictions of Bloomfield, and Unincorporated Stoddard County have identified repetitive loss structures. Preparing a repetitive loss analysis for the areas surrounding the repetitive loss structures could assist in defining the flood hazard issue and developing mitigation actions. Acquisition of the repetitive loss structures is also a potential mitigation action.

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 Stoddard County, there are three levees shown on the NLD and two outside the county that could potentially have impact:

- Castor River Levee System
- Jekins Basin Levee
- Little River Drainage District Levee of Missouri

- Stoddard County Levee 1
- Stoddard County Levee 2

Figure 3.4 presents the location of these levees within Stoddard County. Figure 3.5 presents areas protected by levee systems.

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

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

A few levee failures have occurred in Stoddard County. Noted accounts include:

- **March 30, 1975** - the levees of the Channel broke near the unincorporated community of Avert in Stoddard County. Avert is 6 miles northeast of Bloomfield. County roads were flooded, and several homes were inundated by the floodwaters.
- **March 30, 2008** - After 14 inches of rain, the Southeast Missourian reported Stoddard County levee breaches. There were four breaches of the levee along the Castor Levee at Highway Y near the Nestle Purina plant. Three of the breaches were approximately 12 feet in length and the fourth approximately 25 feet across.
- **April 26, 2011** - a breach in the Jenkins Basin levee flooded thousands of acres in northern and eastern Stoddard County.

Figure 3.8. NLD Levee Locations within Stoddard County

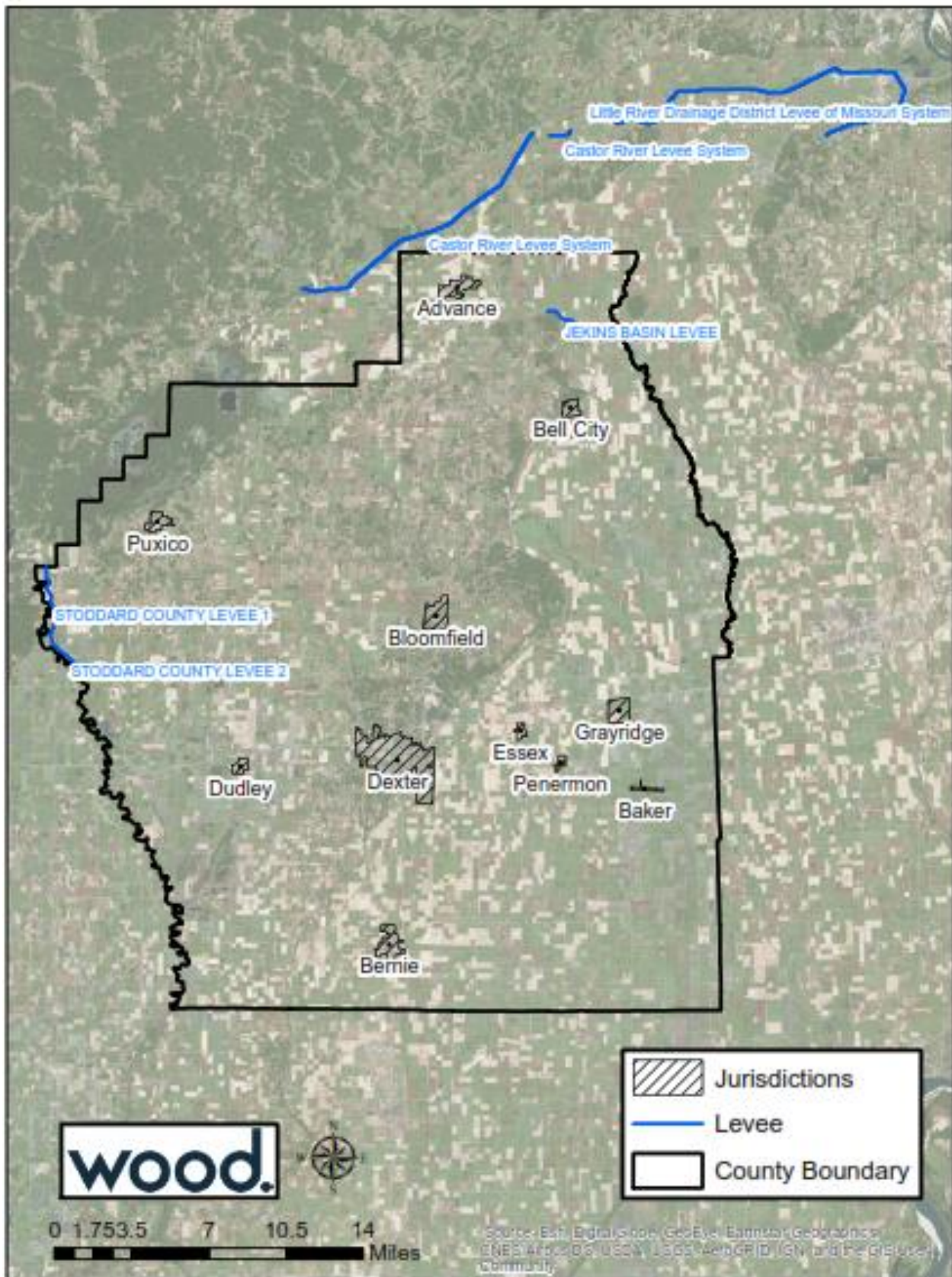
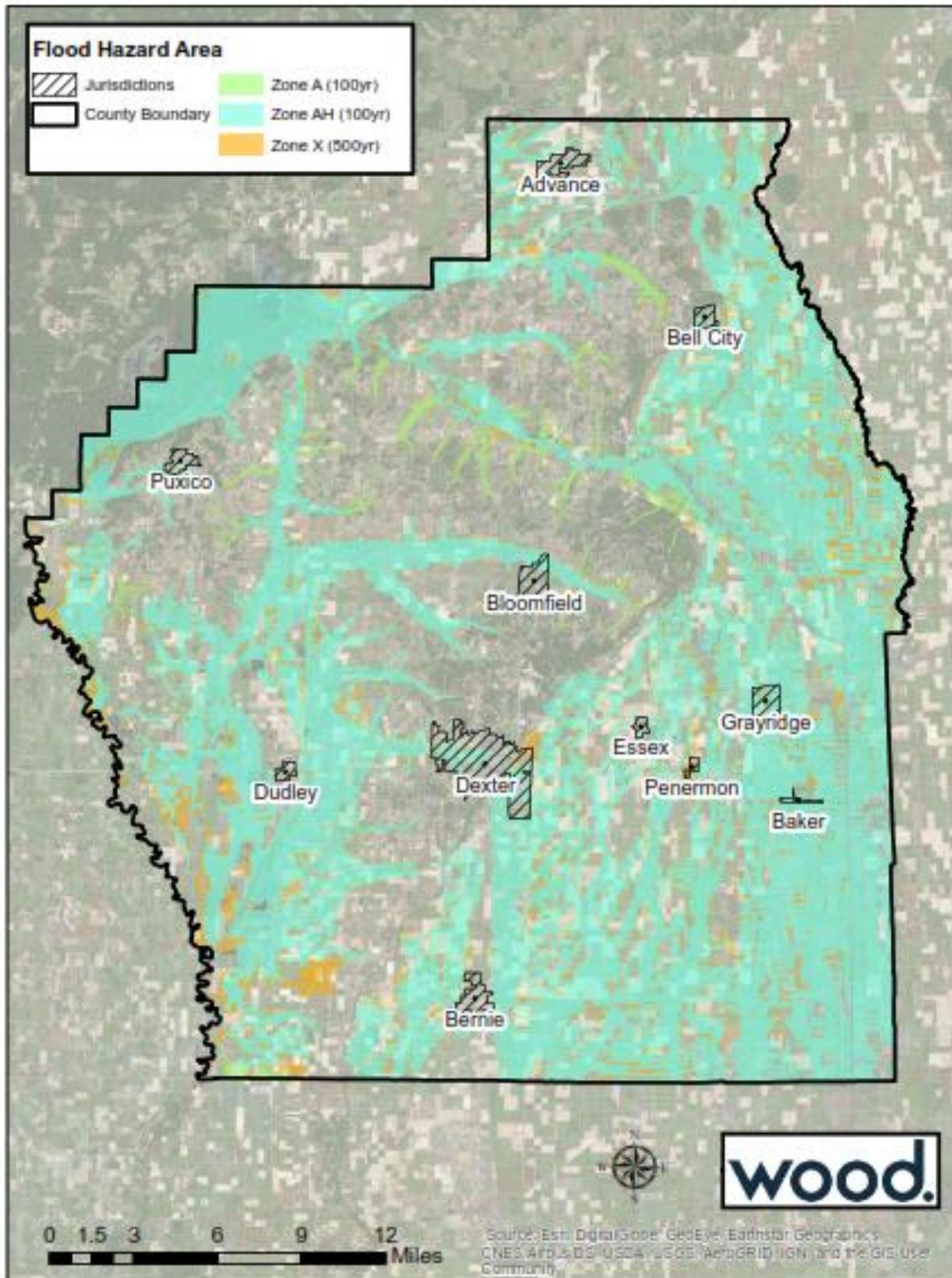


Figure 3.9. Mapping Areas Protected by Levee Systems within Stoddard County – (Zone A and Zone AH)



Probability of Future Occurrence

The USACE Levee Safety Action Classification for the Castor River Levee System and Little River Drainage District Levee of Missouri System and the Commerce, MO to St. Francis River System as low - likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in low risk. They were both last assessed in 2017. The probability of a levee/dam failure event is 3/48 or 6.25% in any given year.

The Jekins Basin Levee, Stoddard County Levee 1, and Stoddard County Levee 2 have not been screened as of mid-2023.

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. Furthermore, aging levee infrastructure and a lack of regular maintenance (including checking for seepage and removing trees, roots and other vegetation that can weaken a levee) coupled with more extreme weather events may increase risk of future levee failure.

Vulnerability

Vulnerability Overview

The USACE regularly inspects levees within its Levee Safety Program to monitor their overall condition, identify deficiencies, verify that maintenance is taking place, determine eligibility for federal rehabilitation assistance (in accordance with P.L. 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. **Figure 3.10** defines the three ratings.

Figure 3.10. 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 levees in Stoddard County that were rated unacceptable.

Potential Losses to Existing Development

Levee failure in Stoddard County that occurs every 100 years has the potential of impacting approximately 50 to 60% of the land mass of the county by visual assessment of Figure 3.5. Most of the land vulnerable to levee failure is in the unincorporated portion of the county, but several communities are also at risk. The 2020 population of the county was 28,672, signifying that approximately 17,203 individuals are vulnerable to levee failure.

Similarly, if 60% of structures are also at risk, the loss from multiple levee failures could amass losses of up to \$1,790,955,000 based on total building and contents exposure.

Impact of Previous and Future Development

According to the population and housing unit trend analysis, there is growth occurring in the jurisdictions of Advance, Bell City and Dexter. These communities should be aware of the levee failure hazard. Per Figure 3.5 above, all three communities are in or very near levee protected areas.

EMAP Consequence Analysis

Table 3.23. 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

Nearly all communities in Stoddard 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. One exception is Richland School District. It is included in the Stoddard County summary.

Stoddard County – the county overall has just three levees within its boundaries. There are levees to the north that could impact the county – Castor River and Little River Drainage Levee. All levees are illustrated in Figure 3.4.

City of Advance – has the greatest risk of impact by a levee breach because of levees to the north and has experienced general flooding in the past.

City of Bell City – is less susceptible to flooding than the remainder of the county and although it is near levee protected areas, it is not within them.

City of Bernie – like Bell City, Bernie has not been susceptible to flooding in the recent past and no levee protected areas fall within the city limits.

City of Bloomfield – Bloomfield’s northern half lies within an unprotected levee area.

City of Dexter – has the largest land mass of any city in the county and a large portion is in a levee protected area. Critical health care facilities and nursing homes are located here that could be at risk.

City of Dudley – since 1993, the very small town of Dudley experienced 2 flash flood and 3 riverine flood events. The city is surrounded by areas that are in the path of potential levee failure.

City of Essex – Like Dudley, Essex is very small and is also surrounded by areas susceptible to levee failure.

City of Puxico – most of the town lies outside the path of levee failure, but the town is near Mingo Creek that occasionally floods.

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.

- A large portion of Stoddard 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.

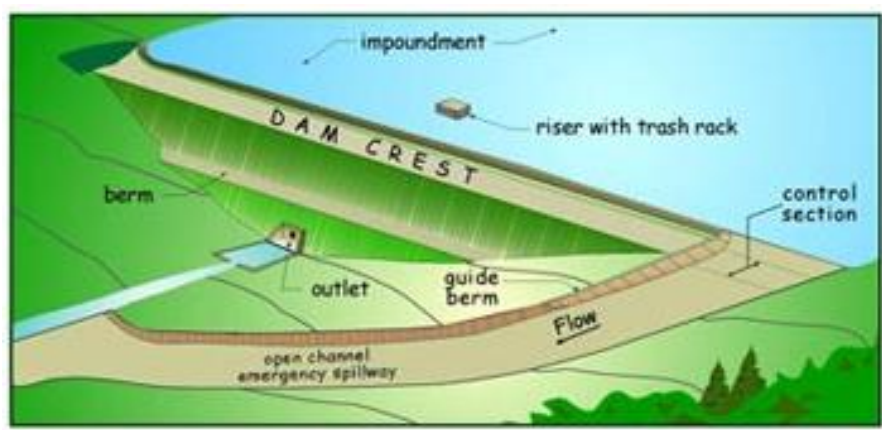
3.4.3 Dam Failure

Hazard Profile

Hazard Description

A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams are typically constructed of earth, rock, concrete, or mine tailings. A dam failure is the collapse, breach, or other failure resulting in downstream flooding. Figure 3.7 below shows the components of a typical dam.

Figure 3.11. Dam Components



Source: ONDR Division of Water Resources

A dam impounds water in the upstream area, referred to as the reservoir. The amount of water impounded is measured in acre-feet. An acre-foot is the volume of water that covers an acre of land to a depth of one foot. As a function of upstream topography, even a very small dam may impound or detain many acre-feet of water. Two factors influence the potential severity of a full or partial dam failure: the amount of water impounded, and the density, type, and value of development and infrastructure located downstream.

The failure of dams could result in injuries, loss of life, or damage to property, the environment, and the economy. Dams often serve multiple purposes, one of which may be flood control. Severe flooding and other storms can increase the potential that dams will be damaged and fail as a result of the physical force of the flood waters or overtopping.

Dams are usually engineered to withstand a flood with a computed risk of occurrence. If a larger flood occurs, then that structure will likely be overtopped. If during the overtopping, the dam fails or is washed out, the water behind is released as a flash flood. Failed dams can create floods that are catastrophic to life and property, in part because of the tremendous energy of the released water.

Dam failures can result from any one or a combination of the following causes:

1. Overtopping: Inadequate spillway design, debris blockage of spillways or settlement of the dam crest.
2. Piping: Internal erosion caused by embankment leakage, foundation leakage and deterioration of pertinent structures appended to the dam.

3. Erosion: Inadequate spillway capacity causing overtopping of the dam, flow erosion, and inadequate slope protection.
4. Structural Failure: Caused by an earthquake, slope instability or faulty construction.

The Missouri Department of Natural Resources (MoDNR) oversees the state's dam safety program primarily through permitting and inspection of dams. MoDNR has identified 29 dams within Stoddard County, none of which are regulated by the State. In Missouri, dams are categorized and regulated according to their hazard classification:

Table 3.24. MoDNR Dam Hazard Classification Definitions

Hazard Class	Definition
Class I	The area downstream from the dam that would be affected by inundation contains ten (10) or more permanent dwellings or any public building. Inspection of these dams must occur every two years.
Class II	The area downstream from the dam that would be affected by inundation contains one (1) to nine (9) permanent dwelling, or one (1) or more campgrounds with permanent water, sewer and electrical services or one (1) or more industrial buildings. Inspection Of these dams must occur once every three years.
Class III	The area downstream from the dam that would be affected by inundation does not contain any of the structures identified for Class 1 or Class 2 dams. Inspection of these dams must occur once every five years.

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

Of the 29 identified dams in Stoddard County, six are Class 1; five are Class 2; and 18 are Class 3.

The U.S. Army Corps of Engineer's National Inventory of Dams (NID) also includes all regulated and unregulated dams for all types of dam owners (federal, state, local, or private) that fall into one of the three following categories:

Table 3.25. NID Dam Hazard Classification Definitions

Hazard Class	Definition
High Hazard	Loss of at least one human life is likely if the dam fails
Significant Hazard	Possible loss of human life and likely significant property or environmental destruction.
Low Hazard	Equal or exceed 25 feet in height and exceed 15 acre-feet in storage Equal or exceed 50-acre feet storage and exceed 6 feet in height. Do not meet the criteria for high or significant hazard.

Source: National Inventory of Dams

Of the 28 NID identified dams, 11 are high hazard and 17 are low hazard dams. There are no federally-regulated dams within Stoddard County.

Geographic Location

Dams Located Within the Planning Area

Table 3.26 provides the names, locations and other pertinent information for all dams within the planning area. **Figure 3.12** provides a location of all the dams within the planning area.

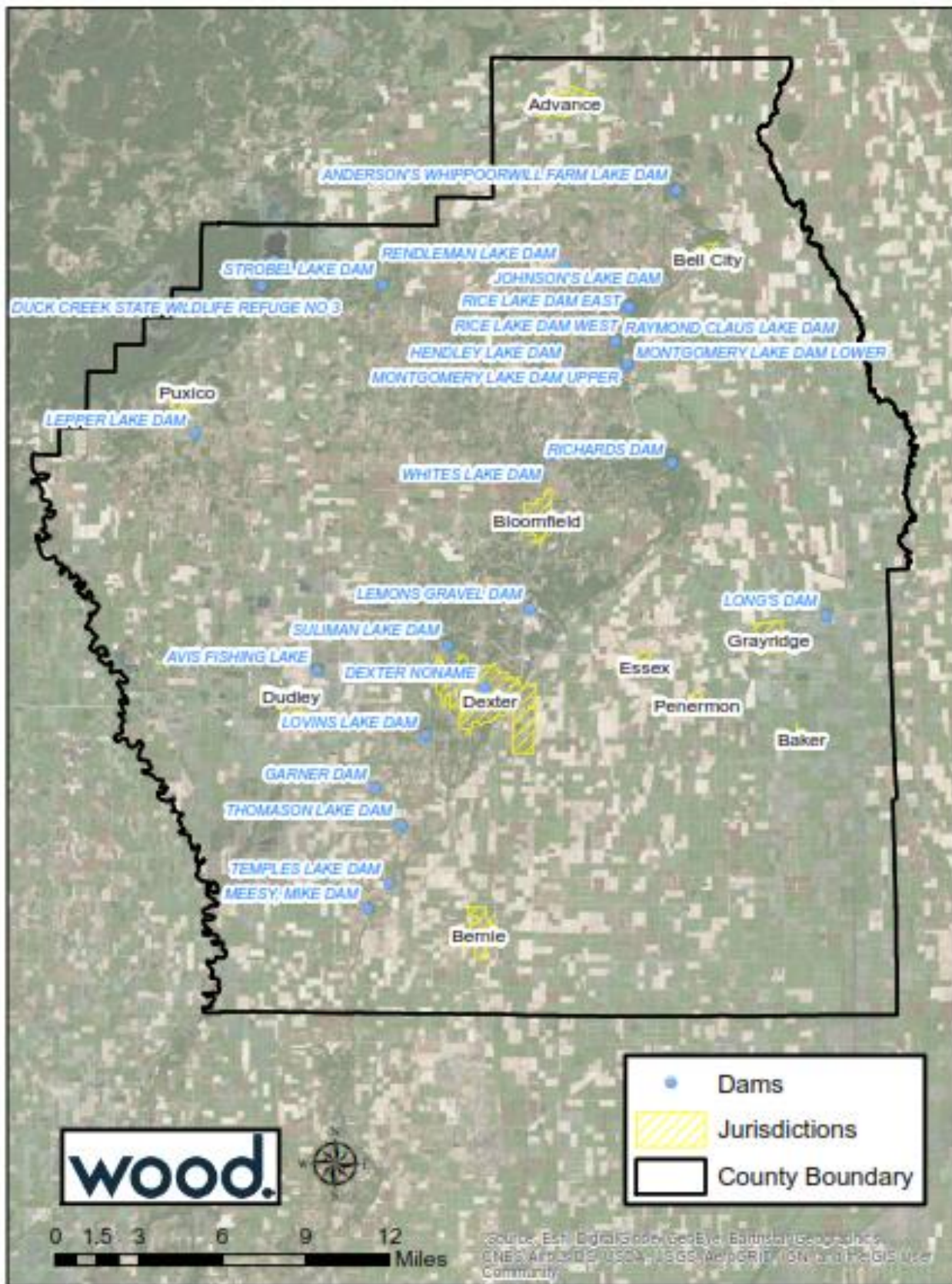
Table 3.26. Dams within the Stoddard County Planning Area

Dam Name	Emergency Action Plan (EAP/AP)	Dam Height (Ft)	Normal Storage (Acre-Ft)	Last Inspection Date	River	Nearest Downstream City	Distance To Nearest City (Miles)	Dam Owner
ANDERSON'S WHIPPOORWILL FARM LAKE DAM	NR	24	385		-TR-DITCH NO 1	BELL CITY	3	CURTIS ANDERSON
AVIS FISHING LAKE	NR	10	56		-LICK CREEK	ST FRANCIS,ARK	-	WALTER AVIS
BARTLETT'S FISHING LAKE DAM	NR	20	107	12/5/1980	TR-DUDLEY MAIN DITCH-CANE CK	DEXTER	0	JOE VINSON
BILL SILLIMAN DAM	NR	29	63		TR-DUDLEY MAIN DITCH	ST FRANCIS,ARK.	-	BILL SILLIMAN
DEXTER NONAME	NR	30	31		-TR-DRAINAGE CANAL	DEXTER	0.1	-
DUCK CREEK STATE WILDLIFE REFUGE NO 2	NR	8	3082	10/8/1980	TR-DUCK CREEK	KINDER	1	MO DEPT OF CONSERVATION
DUCK CREEK STATE WILDLIFE REFUGE NO 3	NR	8	725	10/9/1980	TR-DUCK CREEK	KINDER	1	MO DEPT OF CONSERVATION
DUCK CREEK-STATE WILDLIFE REFUGE-# 1	NR	10	9855	5/22/1979	CASTOR RIVER	KINDER	1	MO DEPT OF CONSERVATION
GARNER DAM	NR	17	113		-TR-MISSOURI RIVER	NONE	-	ROBERT GARNER
HENDLEY LAKE DAM	NR	14	82		-TR-CASTOR RIVER	CLINES ISLAND	8	JOE H HENDLEY
JOHN COWAN DAM	NR	27	36		-TR-POPLAR BRANCH	AVERT	-	JOHN A COWAN
JOHNSON'S LAKE DAM	NR	20	60		-TR-WOLF CREEK	BAKER	-	ELBERT JOHNSON
LARRY BROWN	NR	17	146		-DELAWARE CREEK	AID	-	LARRY BROWN
LEMONS GRAVEL DAM	NR	20	21		TRIB BLACKSHIRE CREEK	-	4	-
LEPPER LAKE DAM	NR	29	93		-TR-TURKEY CREEK	PUXICO	1	OLSIE D LEPPER
LONG'S DAM	NR	8	8		N/A	N/A	N/A	N/A
LOVINS LAKE DAM	NR	24	64		-TR-CANE CREEK	ST FRANCIS,ARK	30	GEORGE D LOVINS
MEESY, MIKE DAM	NR	26	26		-TR-LITTLE RIVER DD	BERNIE	-	MIKE MEESY
MONTGOMERY LAKE DAM LOWER	NR	28	75		-TR-CASTOR RIVER	CLINES ISLAND	6	JOE MONTGOMERY
MONTGOMERY LAKE DAM UPPER	NR	26	42		-TR-CASTOR RIVER	CLINES ISLAND	6	JOE MONTGOMERY
RAYMOND CLAUS POND	NR	30	67		-(DRY WATER COURSE)	CLINES ISLAND	-	RAYMOND CLAUS
RENDELMAN LAKE DAM	NR	20	86		-TR-WOLF CREEK	BAKER	30	CHARLES RENDELMAN
RICE LAKE DAM EAST	NR	26	111		-WOLF CREEK	AOUILLA	5	BERNARD RICE
RICE LAKE DAM WEST	NR	20	86		-WOLF CREEK	AOUILLA	5	BERNARD RICE
RICHARDS DAM	NR	20	108	1/21/1981	TR-WILLIAMS CREEK	CLINES ISLAND	-	MIKE RICHARDS
STROBEL LAKE DAM	NR	10	198		-TR-CASTOR RIVER	LEORA	1	LARRY STROBEL
TEMPLES LAKE DAM	NR	26	125	5/21/1979	TR MAIN DITCH-LITTLE RIVER	BERNIE	0	KEN TEMPLES
THOMASON LAKE DAM	NR	18	125		TR-FISH SLOUGH-ST FRANCIS RIV	PYLETOWN	0	JOSEPH A THOMASON
WHITES LAKE DAM	NR	27	130	5/18/1979	LINK CREEK	GRAYRIDGE	16	ED EUBANKS

Sources: Missouri Department of Natural Resources, <https://dnr.mo.gov/geology/wrc/dam-safety/damsinmissouri.htm> and National Inventory of Dams, http://nid.usace.army.mil/cm_apex/f?p=838:12.
 NR = Not Required; N/A = Not Available

The dams are not regulated by the State and inundation areas are not available.

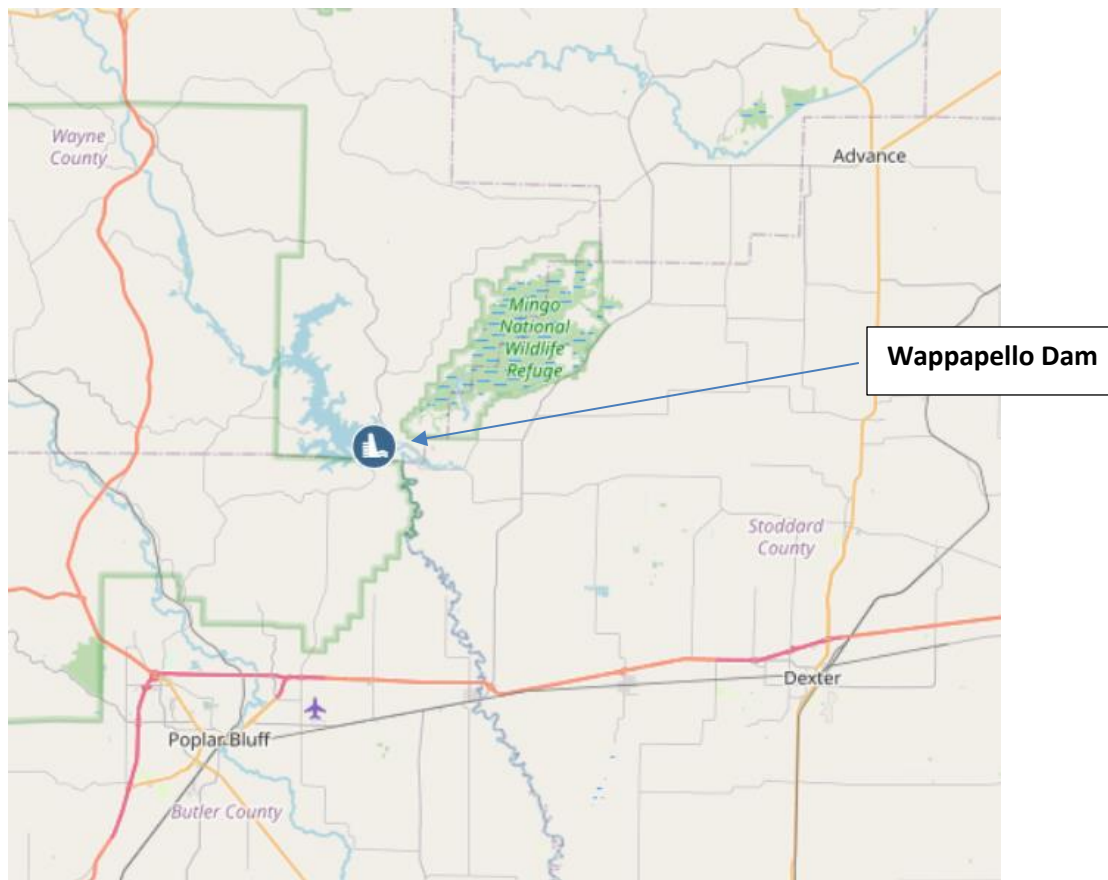
Figure 3.12. Dam Locations in Stoddard County



Upstream Dams Outside the Planning Area

Located upstream of Stoddard County is Wappapello Lake Dam located on the St. Francis River in Wayne County, Missouri. The dam and reservoir are owned and operated by the US Army Corps of Engineers. The dam is 114 ft high with a storage area of 8,400 acre-feet. This is a Class 1, high hazard dam. **Figure 3.13** depicts the location of the dam. The inundation area extends into Stoddard County. Additional details are provided within the vulnerability assessment regarding the assets that would be impacted by a dam failure.

Figure 3.13. Upstream Dam Locations Outside Stoddard County



Source: [National Inventory of Dams \(army.mil\)](http://nationalinventoryofdams.army.mil)

Strength/Magnitude/Extent

The strength/magnitude of dam failure would be similar in some cases to flood events (see the flood hazard vulnerability analysis and discussion). The strength/magnitude/extent of dam failure is related to the volume of water behind the dam as well as the potential speed of onset, depth, and velocity. Note that for this reason, dam failures could flood areas outside of mapped flood hazards.

Although there have been no documented failures of state-regulated dams in the planning area and the probability of failure is low, if failure were to occur at a high hazard dam, there is a high probability for loss of life or substantial economic loss in excess of what would naturally occur downstream of the dam. Data is not available to specifically address potential magnitude of failure in quantitative terms. However, two dams – Duck Creek Wildlife Refuge #1 inside the county and Wappapello Lake Dam outside the county store the greatest quantity of acre-feet of water with 9,855 and 8,400, respectively. If additional development occurs in downstream areas where inundation would occur, the severity of

failure would also increase.

Previous Occurrences

There has not been a noted dam failure within Stoddard County.

Probability of Future Occurrence

With no previous occurrences, the probability is unlikely for dam failure within Stoddard County.

It should be noted that within Missouri, historical dam failures and incidents include events from all hazard classes and all dams (whether regulated or un-regulated). Failures and incidents for regulated dams that have higher inspection frequencies should be less probable. The non-regulated dams do not have a regular inspection schedule nor requirement.

Changing Future Conditions Considerations and the Impact of Climate Change

Studies have been conducted to investigate the impact of climate change scenarios on dam safety. Dam failure is already tied to flooding and the increased pressure flooding places on dams. The impacts of changing future conditions on dam failure will most likely be those related to changes in precipitation and flood likelihood. Changing future conditions projections suggest that precipitation may increase and occur in more extreme events, which may increase the risk of flooding, putting stress on dams and increasing likelihood of dam failure. The 2023 Missouri Hazard Mitigation Plan points out that studies conclude that dam failure probability will increase in the future climate.

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

Vulnerability

Vulnerability Overview

According to the US Army Corps (USACE) of Engineers NID (National Inventory of Dams) there are 28 dams in Stoddard County and none are regulated by the state or by the USACE. Of these 28 dams, 11 have been classified as high hazard and 17 as low hazard. The Wappapello Lake Dam upstream is also a high hazard, federally-regulated dam. School districts vulnerable to dam inundation are in the path of dams with very low storage, posing minimal threat. Dams fail on an individual basis, meaning that when one dam fails, not all dams fail. Any vulnerability will be limited to those persons and structures located within the inundation zone of the failed dam. Therefore, vulnerability of the county to one dam failing is minimal.

Potential Losses to Existing Development

Besides Wappapello Dam outside the county, there are no other regulated dams. The 28 dams located within the county are mainly privately owned, with a few owned by the Missouri Department of Conservation. The three largest dams are the Duck Creek dams located on Castor River and Duck Creek. These dams far exceed the storage acres/ft of the remaining dams. If one or all of them failed, their impact would not be great since they are located in a recreational area with sparse population. However, per the 2023 Missouri Hazard Mitigation Plan, if any high hazard dam were to fail in the

state, there would likely be loss of life. There are no structures in Stoddard County in the inundation area of a state-regulated dam.

Impact of Previous and Future Development

According to the population and housing unit trend analysis, there is generally not significant development and growth occurring in unincorporated Stoddard County. The county is rural and sparsely populated. However, the City of Dexter has seen a slight increase in housing units over the past decade. Any development within the inundation area will increase the risk to the dam failure hazard.

EMAP Consequence Analysis

Table 3.27. EMAP Impact Analysis: Dam 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. Regulatory waivers may be needed locally. Fulfillment of some contracts may be difficult. Impact may reduce deliveries.
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 primarily adversely affect dam owner and local entities.

Hazard Summary by Jurisdiction

The only jurisdiction vulnerable to a dam failure is the unincorporated county. None of the incorporated towns, school districts, or water districts in Stoddard County are vulnerable to damage caused by dam failure.

Problem Statement

- Development is not currently increasing within the inundation areas.
- No critical facilities or educational buildings are located within the inundation areas.
- The USACE considers Wappapello Dam to be a high-risk dam among its more than 700 dams because of the risk associated with the potential for backwards erosion piping in the cohesionless foundation soil. USACE has implemented interim risk reduction measures and/or long-term risk reduction measures to reduce this risk.

- With the inundation area of Wappapello Lake Dam extending into Stoddard County, coordination with the USACE to review the emergency action plan is recommended.
- It is important that residents downstream from the dam within Unincorporated Stoddard County are aware of the potential consequences should the dam breach, not perform as intended, or experience major spillway/gated outlet flows.

3.4.4 Earthquakes

Hazard Profile

Hazard Description

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

Geographic Location

Stoddard County is at risk to earthquakes because of its proximity to the New Madrid seismic zone. The New Madrid Seismic Zone (NMSZ) extends from west-central Mississippi northward past Cape Girardeau, Missouri. The center of this seismic zone is in New Madrid, Missouri, which is located in neighboring New Madrid County, approximately 35 miles southeast of the City of Dexter. It is the major source of seismic activity east of the Rocky Mountains. Although activity in the New Madrid Seismic Zone is less frequent than that along the West Coast, when tremblers do occur, the destruction covers more than 20 times the area of an equivalent West Coast earthquake because of the underlying geology. The largest earthquake in the continental United States, according to the U.S. Geological Survey (USGS), occurred on the New Madrid fault in 1811 and 1812.

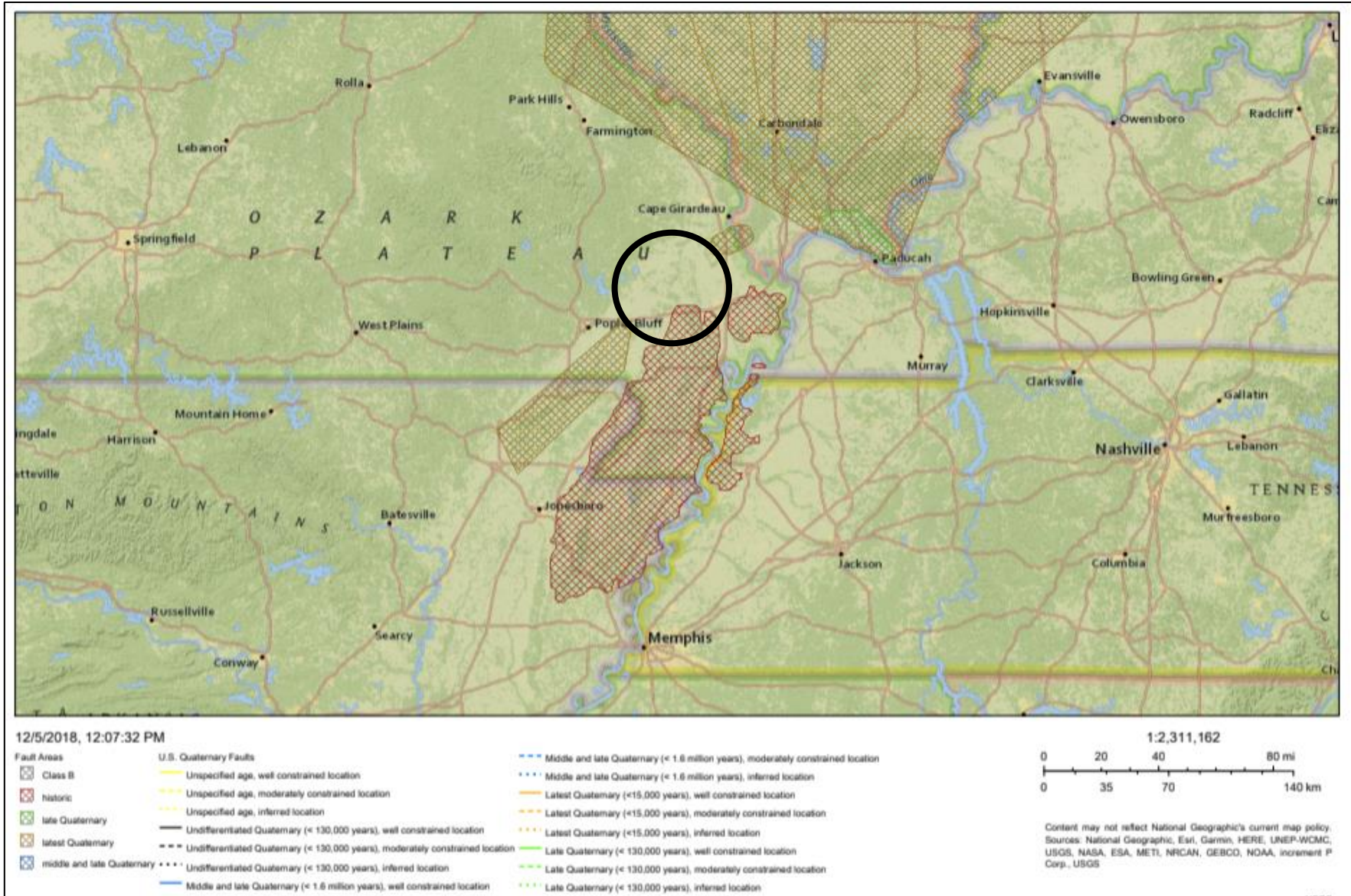
- A series of New Madrid Seismic Zone earthquakes occurred during the winter of 1811 and 1812. The three largest 1811-1812 earthquakes, estimated to have a magnitude of 7 or 8, destroyed several settlements along the Mississippi River, caused minor structural damage as far away as Cincinnati, Ohio, and St. Louis, Missouri, and were felt as far away as Hartford, Connecticut, Charleston, South Carolina, and New Orleans, Louisiana. In the New Madrid region, the earthquakes dramatically affected the landscape. Landslides, fissures, subsidence, sand blows, and uplifts were noted. One such uplift related to faulting near New Madrid temporarily forced the Mississippi River to flow backwards. In addition, the earthquakes liquefied subsurface sediment over a large area and at great distances resulting in ground fissuring and violent venting of water and sediment.

Additionally, the following quaternary fault has been identified in Stoddard County:

- Western Lowlands liquefaction features

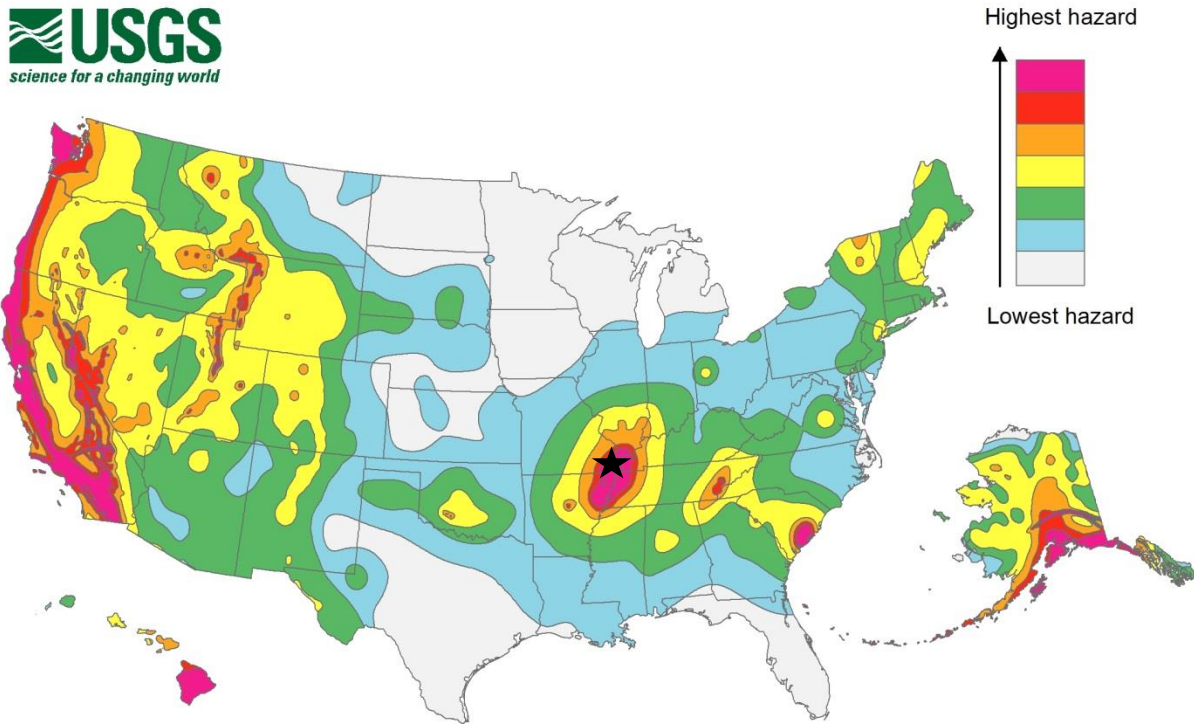
Figure 3.14 presents the location of Stoddard County relative to the New Madrid seismic zone (red hatching) and noted quaternary faults (orange hatching). Figure 3.11 presents the location of Stoddard County relative to a seismic hazard map of the United States, with Stoddard County located within the category of highest hazard.

Figure 3.14. US Quaternary Faults, Stoddard County (Black Circle)



Source: <https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf>

Figure 3.15. United States Seismic Hazard Map, Stoddard County (Black Star)



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.

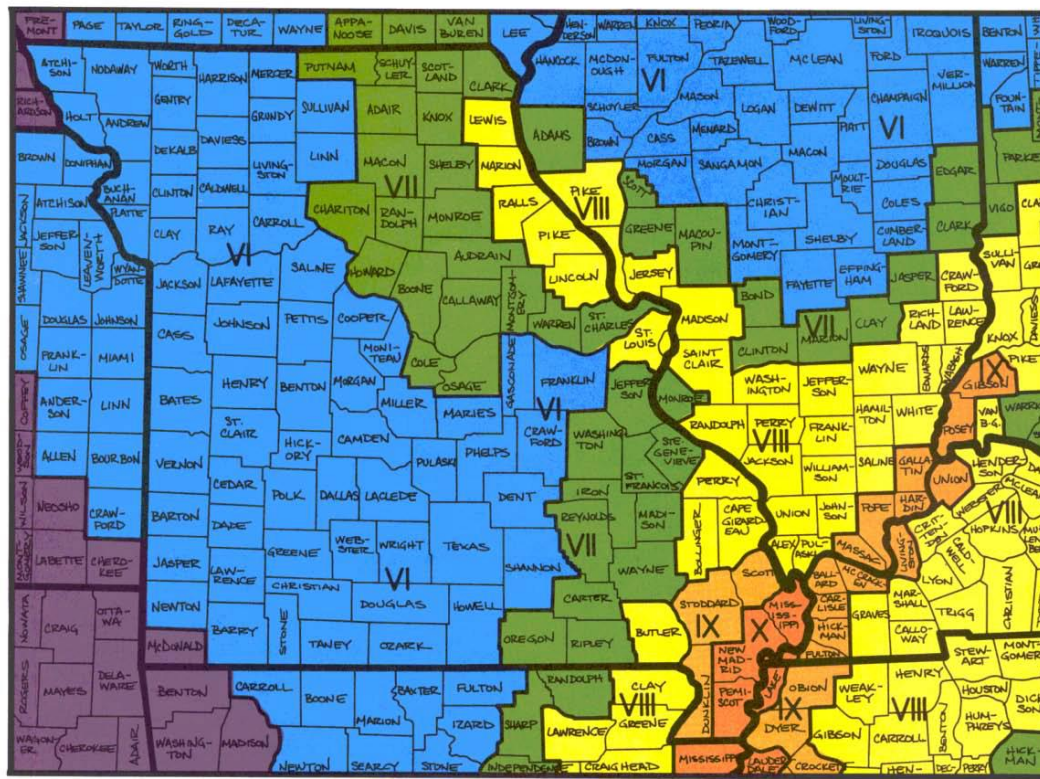
Modified Mercalli Intensity Scale

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

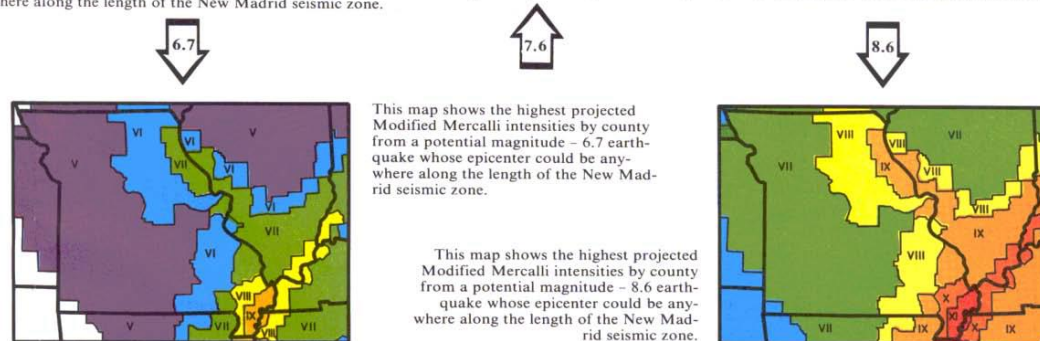
Modified Mercalli (MM) Intensity Scale. It was developed in 1931 and is composed of 12 increasing levels of intensity. They range from imperceptible shaking to catastrophic destruction, and each of the twelve levels is denoted by a Roman numeral. The scale does not have a mathematical basis but is based on observed effects. Its use gives the layman a more meaningful idea of the severity.

Figures 3.16 and 3.17 present the impact zones of the New Madrid Fault for a potential magnitude 7.6 earthquake based upon the Modified Mercalli Intensity Scale. Stoddard County lies in impact zone IX with most buildings suffering damage. Houses that are not bolted down move off their foundations. Some underground pipes are broken. The ground cracks conspicuously. Reservoirs suffer severe damage.

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



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



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

Figure 3.17. Projected Earthquake Intensities

MODIFIED MERCALLI INTENSITY SCALE

- I People do not feel any Earth movement.
- II A few people might notice movement.
- III Many people indoors feel movement. Hanging objects swing.
- IV Most people indoors feel movement. Dishes, windows, and doors rattle. Walls and frames of structures creak. Liquids in open vessels are slightly disturbed. Parked cars rock.
- V Almost everyone feels movement. Most people are awakened. Doors swing open or closed. Dishes are broken. Pictures on the wall move. Windows crack in some cases. Small objects move or are turned over. Liquids might spill out of open containers.
- VI Everyone feels movement. Poorly built buildings are damaged slightly. Considerable quantities of dishes and glassware, and some windows are broken. People have trouble walking. Pictures fall off walls. Objects fall from shelves. Plaster in walls might crack. Some furniture is overturned. Small bells in churches, chapels and schools ring.
- VII People have difficulty standing. Considerable damage in poorly built or badly designed buildings, adobe houses, old walls, spires and others. Damage is slight to moderate in well-built buildings. Numerous windows are broken. Weak chimneys break at roof lines. Cornices from towers and high buildings fall. Loose bricks fall from buildings. Heavy furniture is overturned and damaged. Some sand and gravel stream banks cave in.
- VIII Drivers have trouble steering. Poorly built structures suffer severe damage. Ordinary substantial buildings partially collapse. Damage slight in structures especially built to withstand earthquakes. Tree branches break. Houses not bolted down might shift on their foundations. Tall structures such as towers and chimneys might twist and fall. Temporary or permanent changes in springs and wells. Sand and mud is ejected in small amounts.
- IX Most buildings suffer damage. Houses that are not bolted down move off their foundations. Some underground pipes are broken. The ground cracks conspicuously. Reservoirs suffer severe damage.
- X Well-built wooden structures are severely damaged and some destroyed. Most masonry and frame structures are destroyed, including their foundations. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, and lakes. Railroad tracks are bent slightly. Cracks are opened in cement pavements and asphalt road surfaces.
- XI Few if any masonry structures remain standing. Large, well-built bridges are destroyed. Wood frame structures are severely damaged, especially near epicenters. Buried pipelines are rendered completely useless. Railroad tracks are badly bent. Water mixed with sand, and mud is ejected in large amounts.
- XII Damage is total, and nearly all works of construction are damaged greatly or destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move. Lakes are dammed, waterfalls formed and rivers are deflected.

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

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JEFFERSON CITY, MO 65102
Telephone: 573-526-9100

Previous Occurrences

Previous occurrences of earthquakes with a magnitude greater than 2.5 within and near Stoddard County include the following:

- 1981-12-27 - M 2.7 - 9km SSE of Benton, Missouri
- 1988-03-11 - M 2.6 - 7km NW of Sikeston, Missouri
- 1989-07-24 - M 2.5 - 4km SSE of Scott City, Missouri
- 1990-09-26 - M 4.8 - 4km SE of Chaffee, Missouri
- 1990-09-27 - M 2.8 - 5km E of Chaffee, Missouri
- 2010-08-05 - M 2.8 - 7km WNW Bernie, Missouri
- 2021-09-07 - M 4.3 - 10km NW of Bloomfield, 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, one earthquake per year is large enough to be felt in the area.

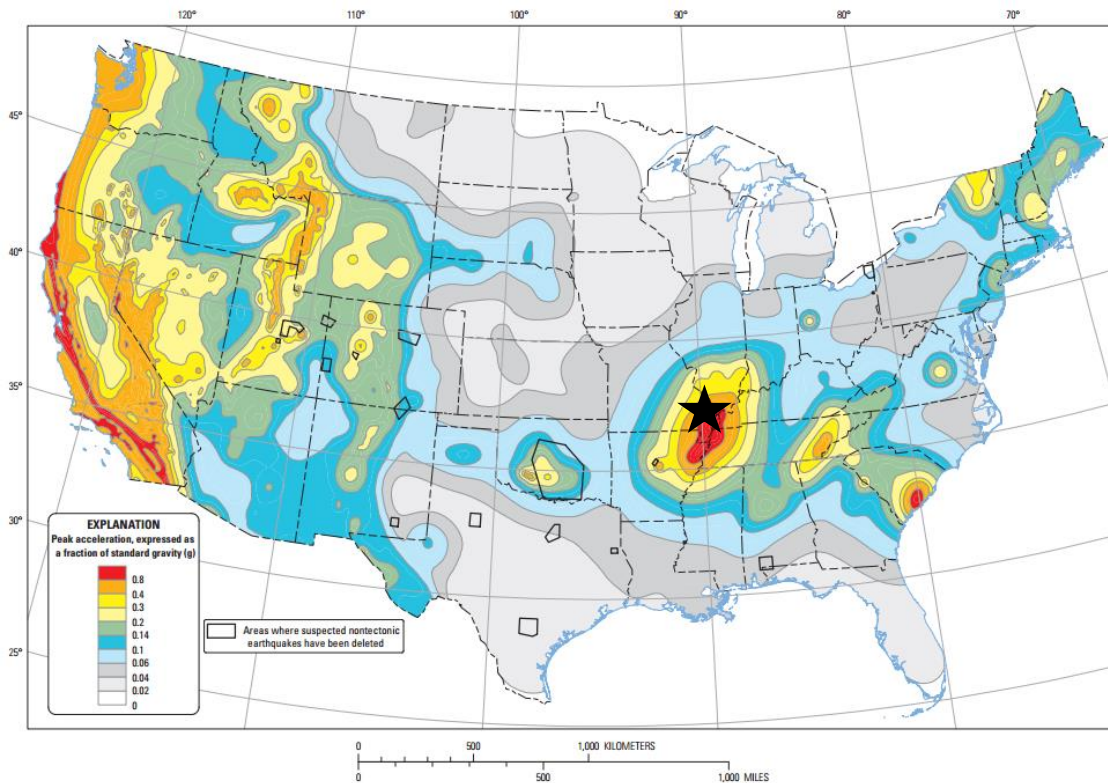
Probability of Future Occurrence

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 3.18, 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 3.18, for the given probability of exceedance, two percent, the locations shaken more frequently will have larger ground motions. Stoddard County is located within the red zone representing the largest peak acceleration of 0.8% g.

Figure 3.18. 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 Stoddard 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 Stoddard 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 with mostly 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 tactic 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 12.2% of homeowners in Stoddard County in 2022 had earthquake coverage as compared with 30.6% 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.

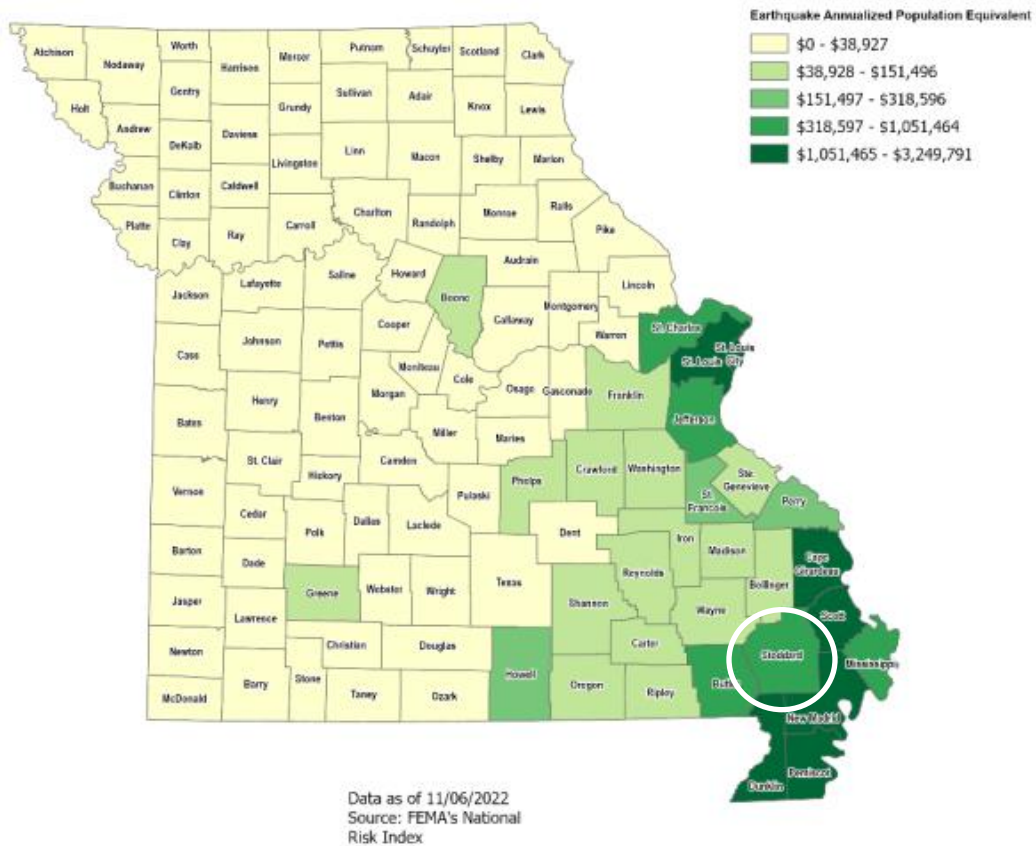
Potential Losses to Existing Development

Annualized Loss Scenario

Per the 2023 Missouri Hazard Mitigation Plan, large earthquake impact on Stoddard 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 3.19 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. Stoddard County is circled in white.

Figure 3.19. FEMA National Risk Index Annualized Loss Scenario – Missouri Population Equivalence Stoddard County (White Circle)

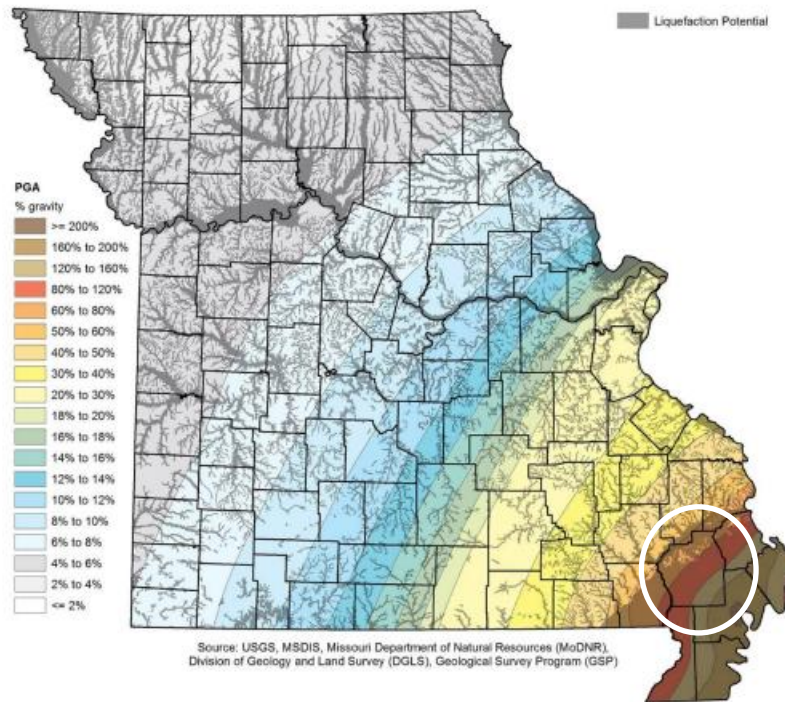


Source: 2023 Missouri State Hazard Mitigation Plan

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 3.20 presents the ground shaking and liquefaction potential for this scenario. The southeastern portion of the county includes some of the most likely area to experience liquefaction.

Figure 3.20. Hazus Earthquake 2% Probability of Exceedance in 50-Years – Ground Shaking and Liquefaction Potential, Stoddard County (White Circle)



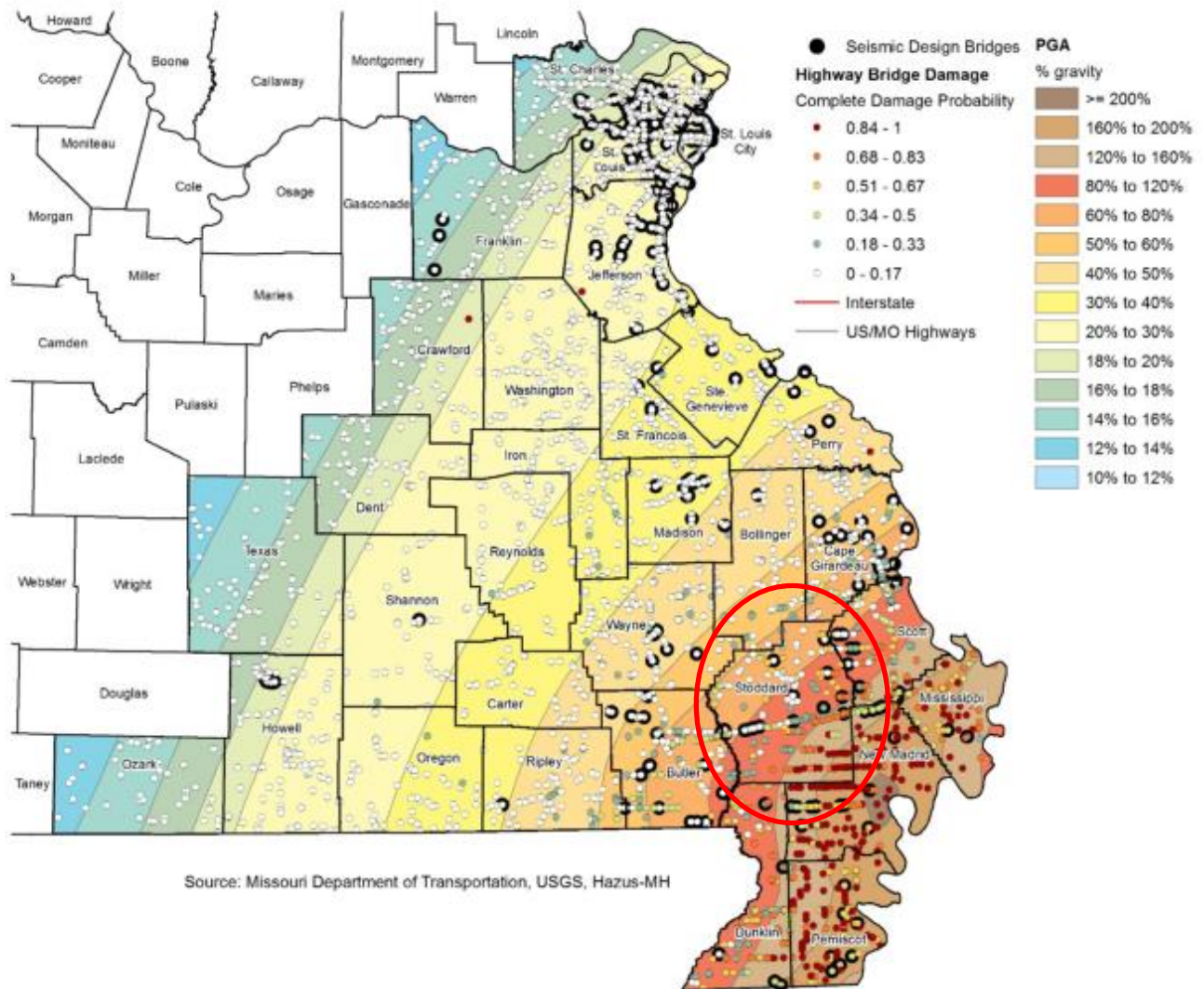
Source: 2023 Missouri State Hazard Mitigation Plan

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 Stoddard County. For Stoddard County, there were 188 bridges identified by MDOT. Of these 188, 19% are expected to have no damage; 14% are expected to have slight damage; 10% are expected to have moderate damage; 17% are expected to have extensive damage; and 41% are expected to be completely damaged, see Figure 3.21.

For Stoddard County, hazardous materials storage facilities are calculated to have heavy to very heavy damage, see Figure 3.22.

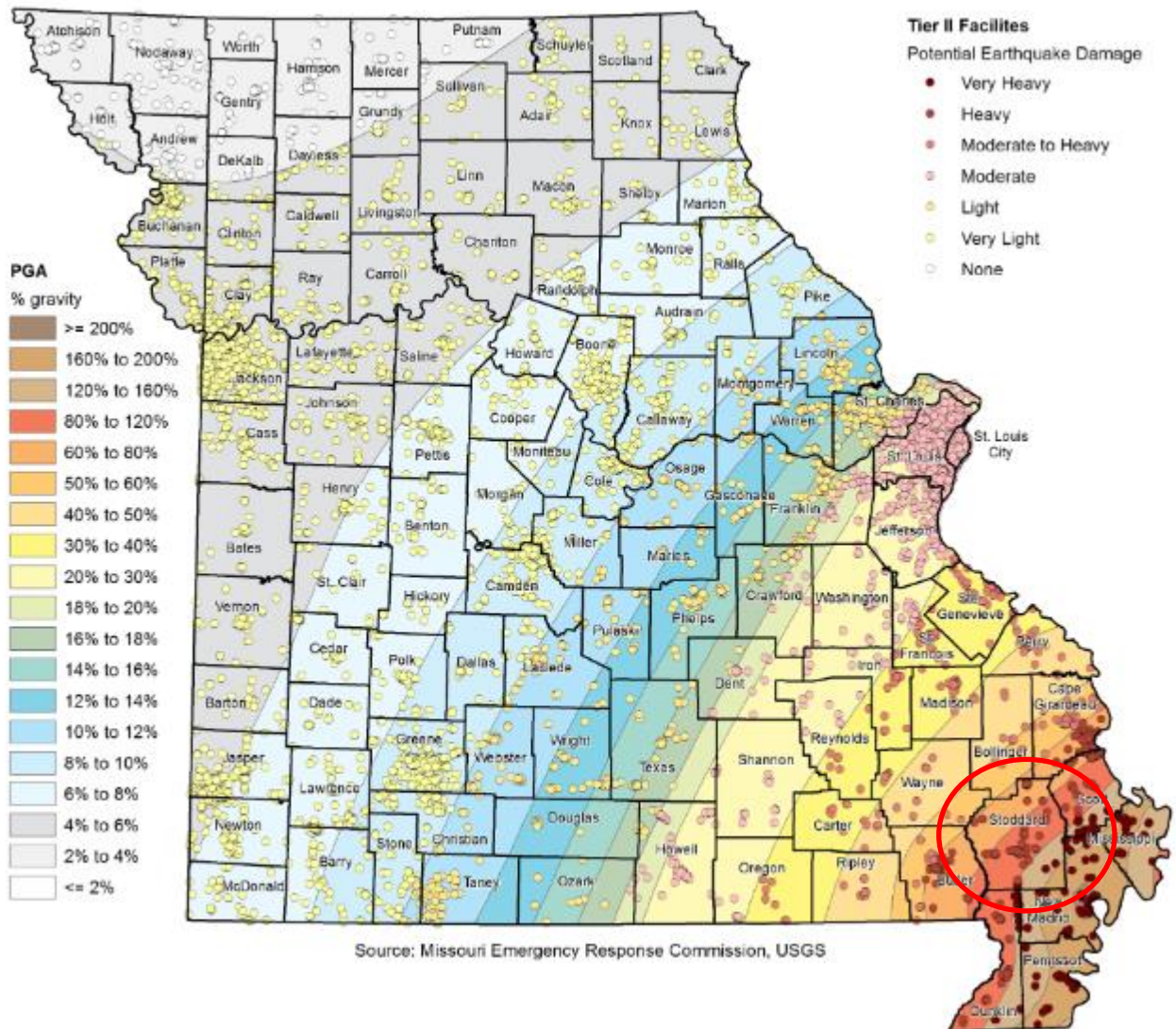
Critical Facilities with greater than 50% complete damage probability may include: all fire and police departments, all nursing facilities, all medical facilities and all schools.

Figure 3.21. Map of Bridge Damage Probability, Stoddard County (Red Circle)



Source: 2018 Missouri State Hazard Mitigation Plan

Figure 3.22. Map of Hazardous Materials Facility Damage Potential, Stoddard County (Red Circle)



Source: 2018 Missouri State Hazard Mitigation Plan

Impact of Previous and Future Development

According to population trends analysis, there is generally not significant development and growth occurring in Stoddard County. The exception to this is Advance, Bell City and Dexter which experienced limited population growth from 2010 to 2020. 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 Stoddard County should be built to account for potential earth shaking and earthquake impacts.

EMAP Consequence Analysis

Table 3.28. 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, damage 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 3.29 for a summary of the age of each jurisdiction's buildings.

Table 3.29. Housing Units Built in 1939 or Earlier

Jurisdiction	Built 1939 or earlier #	Built 1939 or earlier %
Stoddard County	406	6.5%
City of Advance	35	5.1%
City of Bell City	8	9.8%
City of Bernie	81	17.6%
City of Bloomfield	183	5.7%
City of Dexter	220	3.7%
City of Dudley	2	31.1%
City of Essex	57	17.9%
City of Puxico	57	8.9%

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

Dudley appears most at risk for earthquake damage due to nearly one-third of its housing being built prior to 1939. Dexter, although it has much newer housing, it is also susceptible due to its quantity of housing.

Problem Statement

- As identified within a high hazard area for earthquakes, seismic-resistant building codes are recommended throughout Stoddard County.
- It is estimated 41% of bridges within Stoddard 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.

3.4.5 Land Subsidence/Sinkholes

Hazard Profile

Hazard Description

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

Land subsidence occurs slowly and continuously over time, as a general rule. On occasion, it can occur abruptly, as in the sudden formation of sinkholes. Sinkhole formation can be aggravated by flooding.

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

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

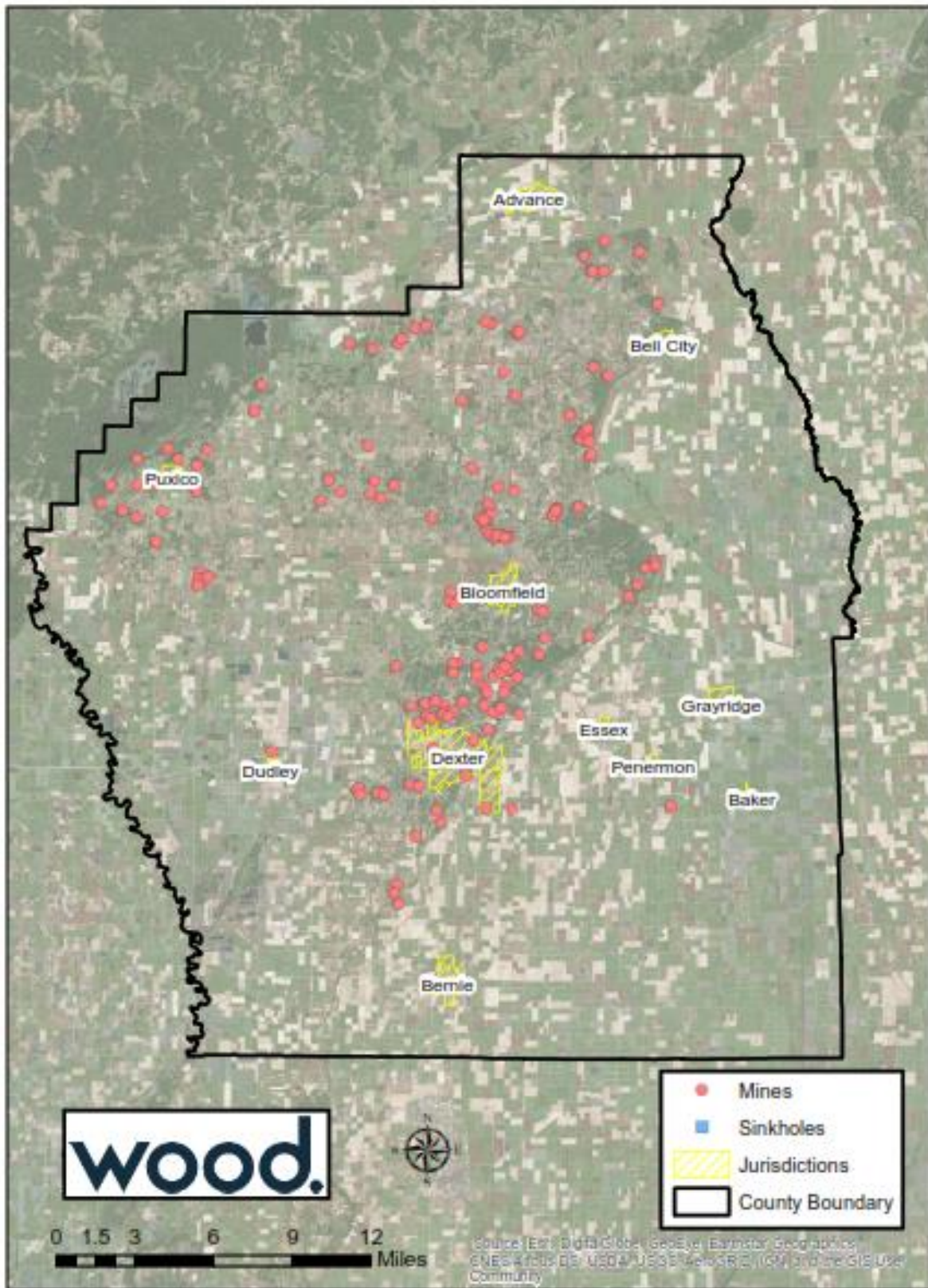
Geographic Location

According to the U.S. Geological Survey (USGS), the most damage from sinkholes tends to occur in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania. Fifty-nine percent of Missouri is underlain by thick, carbonate rock that makes Missouri vulnerable to sinkholes. Sinkholes occur in Missouri on a relatively frequent basis. Most of Missouri’s sinkholes occur naturally in the State’s karst regions (areas with soluble bedrock). They are a common geologic hazard in southern Missouri. The Missouri Department of Natural Resources, Division of Geology and Land survey has identified no sinkholes and 165 mines within Stoddard County, see Figure 3.23.

Strength/Magnitude/Extent

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

Figure 3.23. Sinkholes and Mines, Stoddard County



Previous Occurrences

As noted in the 2023 State Plan, sinkholes are a regular occurrence in Missouri, but rarely are they of any significance. There have been no notable events in Stoddard County.

Probability of Future Occurrence

With no records of previous event dates in the planning area, the probability of future occurrence cannot be calculated.

Changing Future Conditions Considerations and the Impact of Climate Change

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

Vulnerability

Vulnerability Overview

The number of sinkholes and mines per jurisdiction is provided in the table below. According to the 2018 Missouri State Hazard Mitigation Plan, Stoddard County had vulnerability ratings of Low and Low-medium for sinkholes and mine subsidence, respectively.

Table 3.30. Number of Sinkholes and Mines per Jurisdiction, Stoddard County

Jurisdiction	# of Sinkholes	# of Mines
Dexter	0	6
Unincorporated Stoddard County	0	159
Total	0	165

Potential Losses to Existing Development

There have been no sinkholes reported near populations or developments and no sinkhole events reported in the county. Therefore, the potential loss to existing development due to a sinkhole event is very low and not expected.

Impact of Previous and Future Development

The community of Dexter has noted some growth in new housing units since 2019. Growth within this community and in unincorporated portions of the county should be cautious of construction near mining areas. There are no reported sinkholes to avoid.

EMAP Consequence Analysis

Table 3.31. EMAP Impact Analysis: Land Subsidence/Sinkholes

Subject	Detrimental Impacts
Public	Localized impact expected to be moderate to light for incident areas and 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 moderate to light for incident areas and moderate to light for other areas affected by the sinkhole.
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

The building count and exposure to sinkholes and mining is less than 1% of the total building count for all jurisdictions within Stoddard County. For those jurisdictions without identified sinkholes or mining areas, the probability is noted as unlikely. School districts are included in their corresponding jurisdictions.

Problem Statement

- Land subsidence and sinkholes could potentially impact less than 1% of the buildings within Stoddard County. While the hazard is not a high priority, those mining areas near residential structures within Dexter and Unincorporated Stoddard County should be monitored.

3.4.6 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.

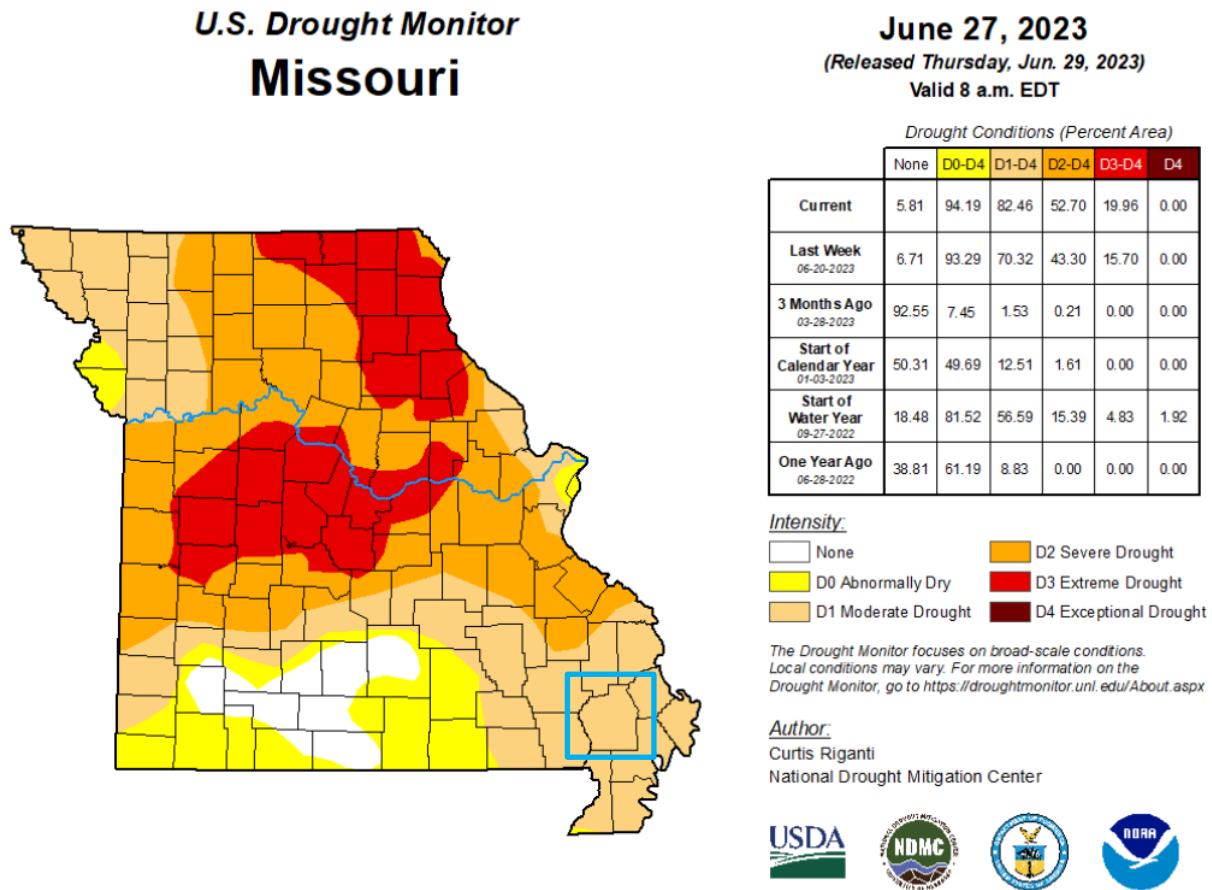
- Meteorological drought is defined in terms of the basis of the degree of dryness (in comparison to some “normal” or average amount) and the duration of the dry period. A meteorological drought must be considered as region-specific since the atmospheric conditions that result in deficiencies of precipitation 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 Stoddard County planning area; however, the agricultural sector typically experiences the most direct impacts from drought. According to the USDA’s 2017 Census of Agriculture, Stoddard County contained 792 farms which covered 475,589 acres of land or 90.3 percent of the county’s total land area. It should be noted that the total number of farms and land in farms estimates declined by more than 100 farms but increased in acreage from the 2012 Census estimate indicating that smaller farms are selling out to larger corporate farms that may have more capacity to irrigate. Although there is some new development in the county, it is very limited and will not lessen the impact of drought on agriculture.

Figure 3.24 shows the U.S. Drought Monitor Map for the State of Missouri as of June 27, 2023. The location of Stoddard County is indicated on the map by the blue square. As of this time, the Stoddard County planning area is experiencing moderate 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 3.24. U.S. Drought Monitor Map of Missouri on June 27, 2023



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 28 drought events in Stoddard 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 3.32.

Table 3.32. NCEI Stoddard County Drought Events Summary, 2003 through 2022

Event Dates	Months in Drought	Event Description
09/2004	1	This was the driest September on record for southeast Missouri.
06/2005 – 08/2005	3	The drought status of southeast Missouri went from moderate to severe during June. June was the fourth consecutive month of below normal rainfall in southeast Missouri. These conditions continued to worsen, reaching the severe to extreme category over most of southeast Missouri in early July. Drought conditions eased considerably during early and mid-August as thunderstorm activity increased to typical levels for mid-summer.
08/2007 – 09/2007	2	Severe drought conditions that developed over southeast Missouri in August persisted through September. Soil moisture in the top 12 inches of soil was 20 to 50 percent below normal. This greatly affected agriculture. 99 percent of the pasture land across southeast Missouri was rated poor or very poor. \$2,050,000 in crop damages were reported in September.
07/2010 – 01/2011	7	Severe drought developed over a few counties near the Mississippi River. Drought conditions expanded and worsened across southeast Missouri during the month of October. Extreme drought developed over a few counties near the Missouri Bootheel. Outdoor fire danger became very high at times. Drought conditions worsened across southeast Missouri during the first half of November, then improved with heavy rainfall on the 24th and 25 th . Severe to extreme drought conditions lingered through the winter into January.
05/2012 – 01/2013	9	One of the warmest and driest Mays on record worsened the rare spring drought over southeast Missouri. By the end of June, all of southeast Missouri except for the Perryville and Van Buren areas was upgraded to extreme drought. Fire danger increased to the point where bans on outdoor burning were implemented in parts of southeast Missouri. There was slight improvement in long-term drought conditions during the month of November. Rainfall was below normal during the month, but this deficit was partially offset by low evaporation rates caused by unseasonably cool air.
11/2016	1	Severe drought conditions spread into extreme southeast Missouri, southeast of a line from Cape Girardeau to Poplar Bluff. A heavy rainfall event late in the month brought some improvement in the drought.
7/11/22 – 12/1/22	5	Extreme drought conditions developed over parts of the Ozark foothills of southeast Missouri. Crops showed signs of stress. Some farmers were feeding hay to supplement where pastures were struggling. Fire danger increased. Between 40 and 60 percent of topsoil moisture was considered short or very short. Monthly rainfall was one to 2.5 inches below normal across much of the drought area. The drought continued ranging from extreme to severe and finally ended after crops were harvested.

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 Stoddard County. Table 3.33 summarizes the number of impacts reported by category and the years impacts were reported for each category. Note that the Drought Impact Reporter assigns multiple categories to each impact.

Table 3.33. Drought Impacts Reported for Stoddard County from 2013 through 2022

Category	Impacts	Years Reported
Agriculture	7	2022, 2018, 2017, 2013
Plants & Wildlife	4	2022, 2018, 2017
Relief, Response & Restrictions	4	2022, 2018
Water Supply & Quality	2	2022, 2018

Source: Drought Impact Reporter, <http://droughtreporter.unl.edu>

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

- **Jul-Dec 2022** - Missouri governor signed executive order concerning drought actions.
- **Oct 2018** - High nitrate levels in some baled cornstalks in Missouri.
- **Aug 2018** – Hay, water relief for some Missouri farmers as rains helped lessen the impact of the 2018 drought.
- **July 2018** – Missouri senators sought relief for Missouri farmers and ranchers due to drought conditions. The dry conditions caused hay production to be down, resulting in necessary cattle sales.
- **June-Sept 2018** – Grazing variances result from drought conditions.
- **April 2017** – Missouri farmers were warned that forages under stress from the winter drought and warm spring might set seed heads early.
- **Jan-May 2013** – The U.S. Department of Agriculture began declaring counties as primary and secondary disaster areas related to drought.

According to the USDA’s Risk Management Agency (RMA), between 2013-2022, the sum of claims paid for crop damage resulting from drought in Stoddard County was \$4,843,330, or an average of \$484,333 in losses every year. Losses were greatest in 2012, when 16,366 acres of corn, cotton, grain sorghum, rice, soybeans, and wheat were affected, resulting in \$2,855,216 in crop losses. Losses were also significant in 2010, when \$1,189,429 in losses were claimed on 9,104 acres of corn, cotton, grain sorghum, and soybeans. Table 3.34 summarizes the agricultural losses due to drought reported in the RMA system.

Table 3.34. Crop Losses Resulting from Drought in Stoddard County, 2013-2022

Year	Commodity Affected	Determined Acres	Indemnity Amount
2013	Corn, Soybeans	329.16	\$50,654
2014	Soybeans	300.69	\$38,764
2015	Corn, Soybeans	178.03	\$22,855
2016	Corn, Cotton, Soybeans	1,155.43	\$48,588
2017	Corn, Soybeans, Wheat	1,552.62	\$178,011
2018	Corn, Soybeans	411.34	\$51,907
2019	Corn, Cotton, Soybeans	1,551.81	\$108,389
2020	Corn, Soybeans	286.95	\$64,444

Year	Commodity Affected	Determined Acres	Indemnity Amount
2021	Corn, Soybeans	481.81	\$38,279
2022	Corn, Soybeans	4,793.41	\$834,601
TOTAL		32,870.66	\$4,843,330

Source: USDA Risk Management Agency

Probability of Future Occurrence

Based on data from NCEI, Stoddard County has experienced approximately 28 months of severe drought or worse during the 120-month period from 2013 through 2022. This equates to a 23 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.

The drought events summarized in Table 3.32 total 28 total months of drought during the 20 year (240 months) period of measurement. That equates to a 11.7% probability of drought in Stoddard County in any given month. The timing of a drought is not predictable, but long-range outlooks and predicted impacts of climate change could indicate an increased chance of drought conditions.

Changing Future Conditions Considerations and the Impact of Climate Change

The U.S. Climate Resilience Toolkit's modeled data projects that Stoddard County could experience an increase in average daily maximum temperature of between five and ten degrees Fahrenheit on average from 1990 to 2090. As discussed in the 2018 Missouri State Hazard Mitigation Plan, higher temperatures may fuel increases in evaporation rates, which could increase the intensity of naturally occurring droughts in the future. Additionally, the number of heavy rainfall events is predicted to increase, yet the overall precipitation amount is not expected to change. These changes suggest that the region will experience an increase in the average number of dry days between rain events, which also increases the likelihood of drought.

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.

Stoddard County already faces high risk of future water shortages without climate change; with climate change the risk of water shortages will be extreme.

Vulnerability

Vulnerability Overview

According to county level data from the 2018 Missouri State Hazard Mitigation Plan, Stoddard County has a drought vulnerability rating of High. The state plan notes that most of southern Missouri is less vulnerable to drought due to the abundant groundwater resources in the area. However, Stoddard County has a medium-high rating for social vulnerability and drought occurrence and a high rating for crop exposure.

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, Stoddard County and all its jurisdictions were assigned a drought vulnerability classification of high.

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. Stoddard 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, Stoddard County has experienced an average of \$484,333 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. In addition, increases in population 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 3.35. 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 Stoddard 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 as a result of drought in Stoddard County affect agriculture; plants and wildlife; and relief, response, and restrictions services. 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. 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 as a result of 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 2020 American Community Survey was used to determine 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 3.36 below summarizes vulnerable populations in the participating jurisdictions.

Table 3.36. Stoddard County Population Younger than Age 5 and Older than Age 65

Jurisdiction	Younger than 5	Older than 65	% of Total Population
Stoddard County	1084	2492	14.5%
City of Advance	81	327	28.1%
City of Bell City	15	59	15.6%
City of Bernie	95	447	30.2%
City of Bloomfield	92	459	24.3%
City of Dexter	610	1664	28.6%
City of Dudley	5	12	14.5%
City of Essex	12	64	16.3%
City of Puxico	86	149	22.6%

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

Problem Statement

- Stoddard 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 for a secondary water source and review of local ordinance/regulation for inclusion of water-use restrictions during periods of drought.
- Stoddard County has a high level of crop exposure. Possible solutions include encouraging farmers to purchase crop insurance and educating farmers on drought-resistant farming practices.

3.4.7 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 3.25 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.

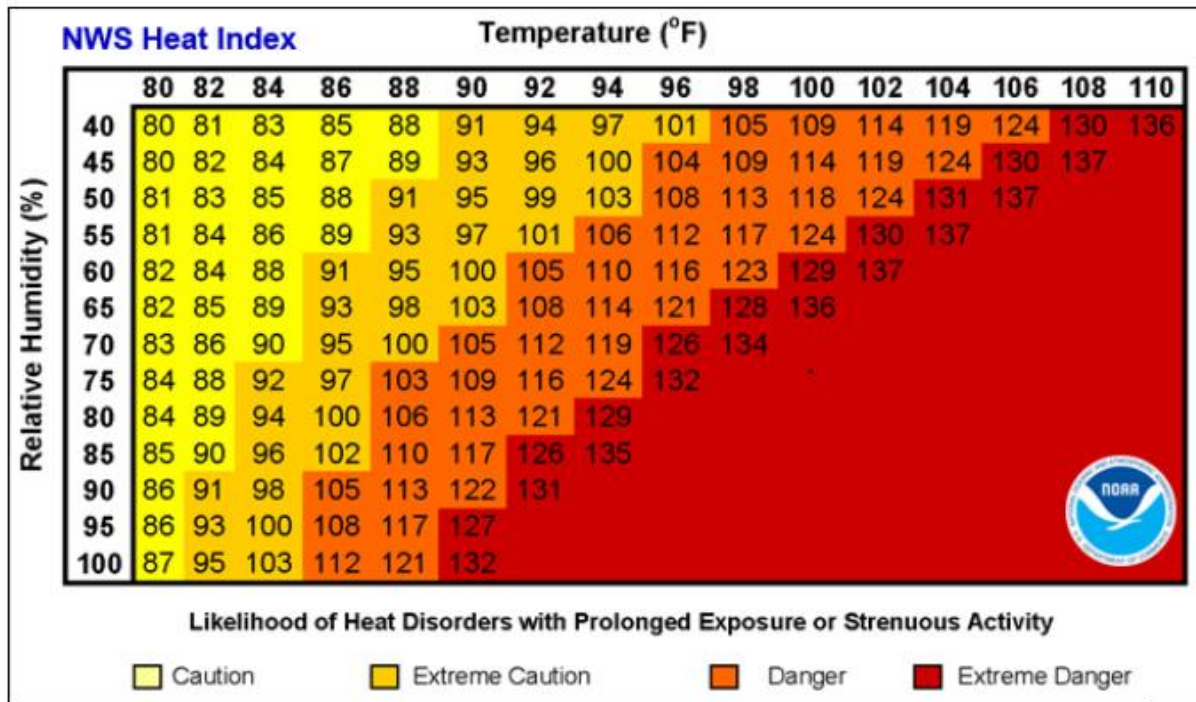
Geographic Location

Extreme temperatures are area-wide events. The entire planning area is subject to extreme 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 3.25. Heat Index (HI) Chart



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

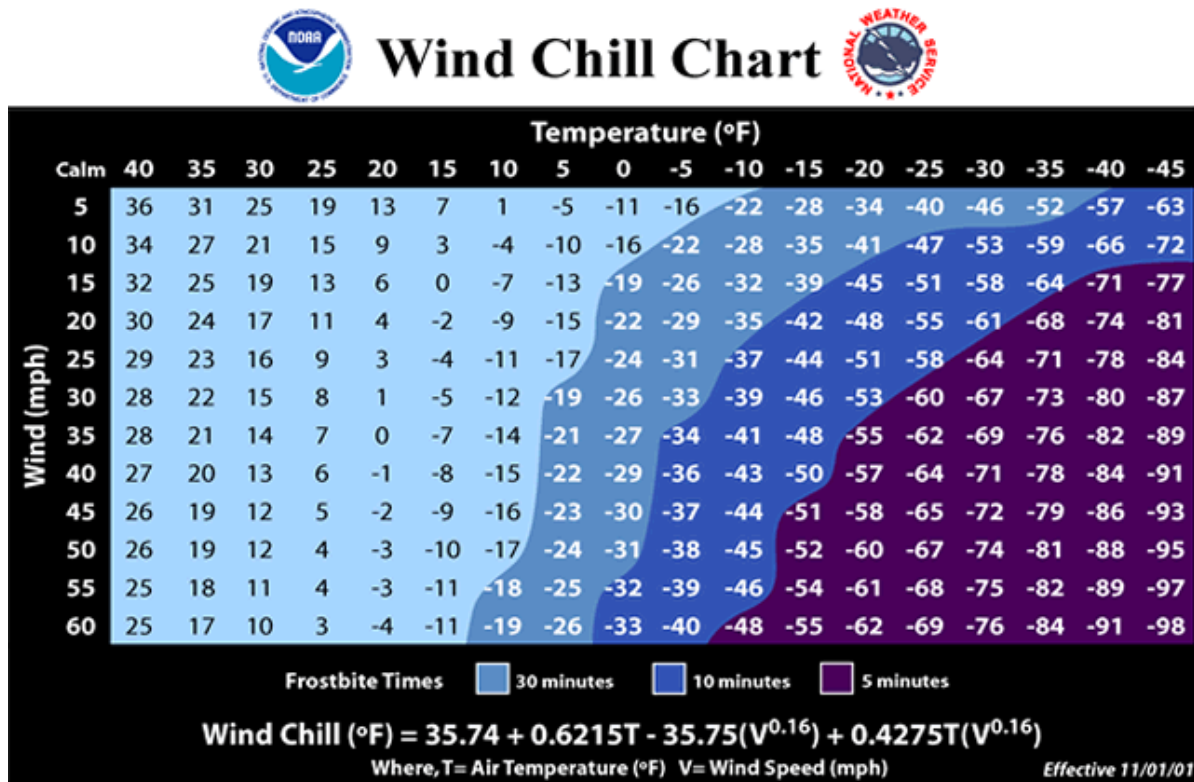
Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. The shaded zone above 105°F corresponds to a HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

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 3.26. 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 73 recorded events related to extreme heat and 49 events related to extreme cold. These events are summarized in the table below. Although NCEI reports do not indicate any deaths directly resulting from these events, conditions may have resulted in related deaths. Event narratives indicating significant impacts in Stoddard County are summarized below.

Table 3.37. NCEI Stoddard County Extreme Temperature Recorded Events Summary, 2003-2022

Event Type	Event Count	Injuries	Deaths	Property Damage	Crop Damage
Extreme Heat-Related Events	73	0	0	\$30,000	\$0
<i>Heat</i>	53	0	0	\$30,000	\$0
<i>Extreme Heat</i>	20	0	0	\$0	\$0
Extreme Cold Related Events	49	0	0	\$0	\$3,030,000
<i>Cold/Wind Chill</i>	8	0	0	\$0	\$0
<i>Extreme Cold/Wind Chill</i>	2	0	0	\$0	\$0
<i>Frost/Freeze</i>	39	0	0	\$0	\$3,030,000
Total	122	0	0	\$30,000	\$3,030,000

- **June 22, 2009** – A building dome of high pressure aloft was responsible for near record high temperatures. Combined with high humidity, the heat index soared to between 105 and 110 degrees on the afternoon of the 6/22 and again on the afternoon of the 6/23. Actual air temperatures reached the mid to upper 90s both days. The heat caused some concrete

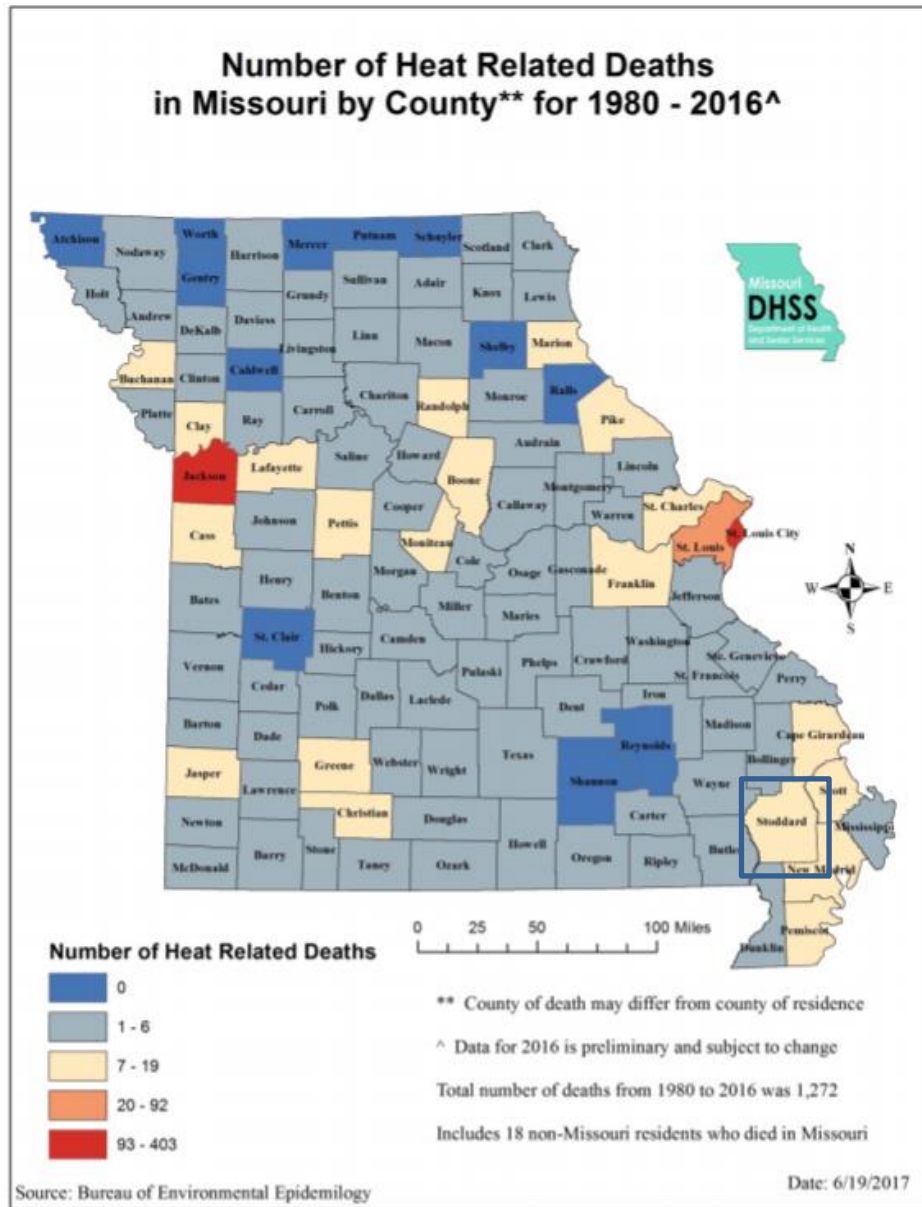
roadways to buckle. The Dexter office of the Missouri Department of Transportation reported 26 incidents of highway concrete joints expanding and rupturing. Three of them were on U.S. Highway 60 west of Dexter in Stoddard County. Three others were on Highway 25 in the Dexter and Bloomfield areas.

- **June 20, 2010** – High temperatures reached the mid to upper 90s during this four-day streak of high heat indices. The heat caused a few instances where pavement buckled on state highways, as well as several streets in Poplar Bluff. There were several pavement blowups on Highway 25 between Dexter and Bloomfield. A medical clinic reported an increase in heat-related illnesses. A manufacturing plant in Poplar Bluff dismissed its 260 workers early due to the high heat and humidity. High humidity produced heat indices locally around 105 degrees on some afternoons. While one county reached the 105-degree threshold for a Heat Advisory each afternoon, most reached it only once or twice. A strong upper-level ridge remained quasi-stationary from the Tennessee Valley to the southern Plains through the period of heat. Dry weather associated with the ridge, combined with the heat, caused farmers to begin irrigating their fields earlier than usual.
- **September 5, 2012** – The heat index rose above 105 degrees for several hours across parts of southeast Missouri, mainly along and west of a line from Dexter to New Madrid. The heat index peaked at 112 degrees at Poplar Bluff. Actual high temperatures were in the lower to mid 90s. Southeast Missouri was on the northern periphery of a strong mid-level ridge that extended from west to east across the southern states.
- **February 19, 2015** – Record-breaking cold and brisk winds combined to produce dangerously low wind chills. Bitterly cold wind chills from 10 to 20 below zero were observed across southeast Missouri. Southeast Missouri had not seen a cold stretch of this magnitude this late in the season since 1960.
- **July 8, 2022** - A prolonged heat wave gripped southeast Missouri for several days. From the 7/4 to 7/8, peak afternoon heat indices ranged from 103 to 119 degrees. The hottest day in southeast Missouri was the 7/5, when the heat index peaked between 111 and 119. During this heat wave, a sprawling 500 mb high covered most of the southern states from the southern Plains to the southern Appalachian Mountains. Beneath this large 500 mb high, daily high temperatures frequently soared to near 100 degrees. There were two heat-related fatalities in nearby New Madrid County.
- **December 22-24, 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 over 25 years across the region. The most extreme wind chills were from the evening of the 12/22 to the morning of the 12/23, but wind chills as late as the morning of 12/24 were often below minus 10. Actual air temperatures only reached single digits above zero on 12/23, which followed morning lows around 5 below. Peak wind gusts of 35 to 50 mph were observed during this event as well. The extreme cold was indirectly responsible for a number of structure fires caused by supplemental heating sources, such as space heaters. There were numerous reports of frozen water pipes that burst and flooded homes and other buildings. Despite relatively light traffic, there were numerous traffic mishaps. The Missouri Highway Patrol in southeast Missouri responded to 80 stranded motorists, 33 non-injury crashes, and 4 injury crashes during the winter storm.

Source: High Plains Regional Climate Center

Figure 3.27, 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. Stoddard County (indicated by the blue square) experienced between 7 and 19 deaths during this time.

Figure 3.27. 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 3.38.

Table 3.38. Crop Insurance Claims Paid in Stoddard County from Extreme Heat and Hot Winds, 2013-2022

Year	Commodity Affected	Determined Acres	Indemnity Amount
2013	Corn	169.5046	\$47,782
2014	Corn, Soybeans	568.0732	\$135,244
2016	Corn, Cotton, Rice, Soybeans	4768.4523	\$488,559
2017	Soybeans	1410.199	\$101,169
2018	Corn, Cotton, Rice, Soybeans	1770.3543	\$191,035
2019	Corn, Soybeans	1056.215	\$95,449
2020	Grain Sorghum, Soybeans	452.9	\$12,443
2021	Corn, Soybeans	238.6308	\$13,897
2022	Corn, Cotton	3947.936	\$997,597
Totals		14382.2652	\$2,083,155

Extreme cold and frost have also caused crop damage. According to USDA RMA, losses to insurable crops due to cold wet weather and cold winter during the 10-year time period from 2013 through 2022 were more than \$6 million. See detail in Table 3.39.

Table 3.39. Crop Insurance Claims Paid in Stoddard County from Extreme Cold and Cold Wet Weather, 2013-2022

Year	Commodity Affected	Determined Acres	Indemnity Amount
2013	Corn, Cotton, Rice, Wheat	17020.9709	\$4,273,166
2014	Corn, Soybeans	1013.8181	\$96,334
2015	Corn, Cotton, Rice, Wheat	4167.487	\$1,529,300
2016	Corn, Cotton, Rice, Soybeans	3402.3031	\$109,812
2017	Rice	149.17	\$1,711
2018	Rice, Wheat	1289.1707	\$46,459
2019	Wheat	96.79	\$2,401
2020	Corn, Cotton, Rice, Soybeans	986.5595	\$121,831
2021	Corn, Rice, Soybeans, Wheat	548.3025	\$63,597
2022	Corn, Rice Wheat	872.2502	\$199,326
Totals		29546.822	\$6,443,937

Probability of Future Occurrence

NCEI records report that Stoddard County has experienced 73 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 49 extreme cold related events, which equates to an annual average of 2.5 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 highly likely to occur in Stoddard 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 Stoddard County, the average number of days with a maximum temperature above 100 degrees Fahrenheit may 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 2018 Missouri State Hazard Mitigation Plan, Stoddard County has a vulnerability rating of Medium High for extreme heat and extreme cold. This scoring is based on the total population, the percentage of the population over 65, the likelihood of occurrence, and social vulnerability. Stoddard County has a medium high rating for social vulnerability and a medium 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 3.40 lists typical symptoms and health impacts due to exposure to extreme heat.

Table 3.40. 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 and 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.

Stoddard County’s crop exposure is high, with more than 90 percent of the county’s total land area in use for agriculture. Over the timeframe from 2013 - 2022, Stoddard County has experienced an average of \$208,316 in crop losses annually due to extreme heat and \$644,394 in annual losses due to extreme cold.

Based on Missouri Bureau of Environmental Epidemiology data for heat-related deaths, Stoddard County has experienced at least 7 heat-related deaths over a 37-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 the growing population.

EMAP Consequence Analysis

Table 3.41. 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 3.42** 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 3.42. Stoddard County Population Under Age 5 and Over Age 65

Jurisdiction	Population Under 5 yrs (%)	Population 65 yrs and over (%)
Stoddard County	5.8	19.7
Advance	5.6	22.4
Bell City	3.2	12.4
Bernie	5.3	24.9
Bloomfield	4.0	20.2
Dexter	7.7	20.9
Dudley	1.5	10.3
Essex	2.6	13.7
Puxico	8.3	14.3

Source: <https://data.census.gov> of each city or county

Problem Statement

- Dexter and Puxico have the highest proportion of residents under 5 years old and Advance, Bernie, Bloomfield and Dexter have 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.
- Stoddard 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.

3.4.8 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 3.4.10**).

High Winds

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

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 $\frac{1}{4}$ " diameter or pea-sized hail requires updrafts of 24 miles per hour, while a $2\frac{3}{4}$ " diameter or baseball-sized hail requires an updraft of 81 miles per hour. According to the NOAA, the largest hailstone in diameter recorded in the United States was found in Vivian, South Dakota on July 23, 2010. It was eight inches in diameter, almost the size of a soccer ball. Soccer-ball-sized hail is the exception 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

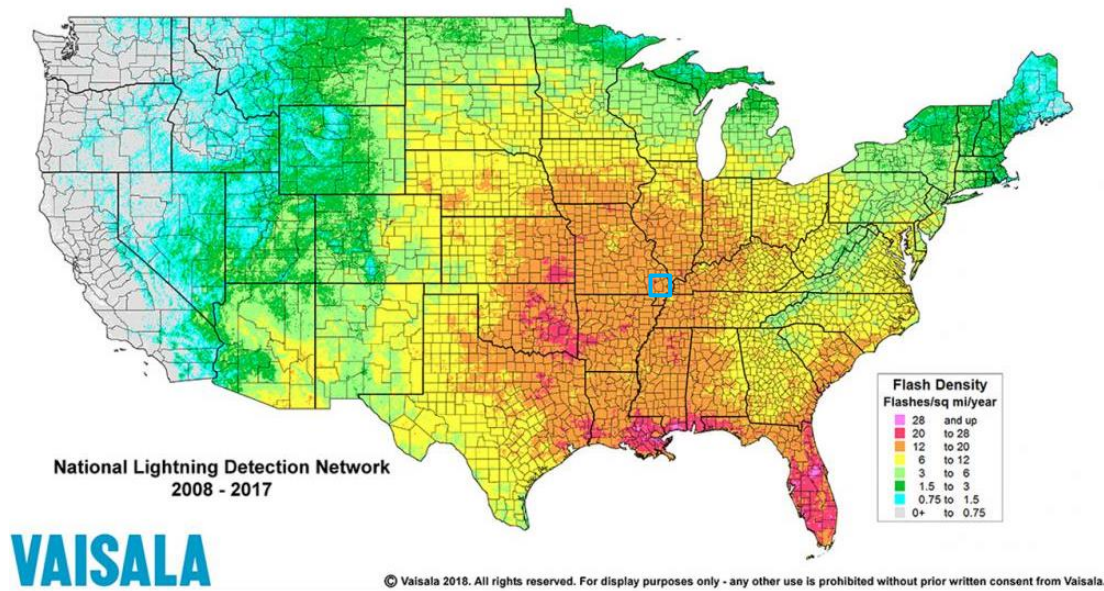
vibrations and creating the sound of thunder.

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 3.28 shows lightning frequency in the state and nation. Stoddard 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.

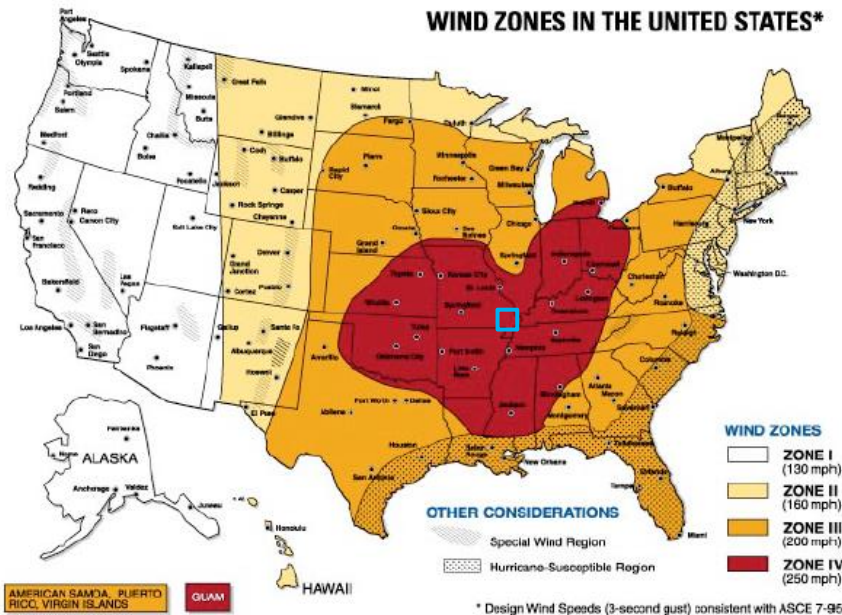
Figure 3.28. Location and Frequency of Lightning in Missouri



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

Figure 3.29 shows wind zones in the United States. Stoddard 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 3.29. 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 3.43** below describes typical damage impacts of the various sizes of hail.

Table 3.43. Tornado and Storm Research Organization Hailstorm Intensity Scale

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

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

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

The onset of thunderstorms with lightning, high wind, and hail is generally rapid. Duration is less than six hours and warning time is generally six to twelve hours. Nationwide, lightning kills 75 to 100 people each year. Lightning strikes can also start structural and 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 3.44 summarizes the 74 unique thunderstorm wind events reported during this 20-year period. Across all impacted areas, the events caused 1 death, 6 injuries, and an estimated \$2,695,000 in property damages.

Table 3.44. NCEI Stoddard County Thunderstorm Wind Events Summary, 2003 – 2022

Dates	Magnitude	Deaths	Injuries	Property Damages
2/3/2003	52	0	0	\$15,000
4/16/2003	61	0	0	\$35,000
5/4/2003	70	0	0	\$0
5/10/2003	50	0	0	\$0
5/30/2004	50	0	0	\$0
6/12/2004	50	0	0	\$0
7/6/2004	50	0	0	\$5,000
7/23/2004	52	0	0	\$0
8/24/2004	55	0	0	\$20,000
8/26/2005	52	0	0	\$50,000
11/28/2005	50	0	0	\$0
3/9/2006	52	0	0	\$20,000
4/2/2006	70	1	1	\$400,000
6/1/2006	56	0	1	\$71,000
9/27/2006	50	0	0	\$4,000
4/3/2007	65	0	2	\$35,000
10/18/2007	52	0	0	\$70,000
1/8/2008	61	0	0	\$5,000
5/31/2008	52	0	0	\$3,000
7/8/2008	52	0	0	\$4,000
7/19/2008	61	0	0	\$80,000
12/27/2008	61	0	0	\$40,000
4/9/2009	52	0	0	\$1,000
6/26/2009	52	0	0	\$5,000
7/4/2009	56	0	0	\$70,000
8/4/2009	56	0	0	\$50,000
4/7/2010	61	0	0	\$20,000
4/23/2011	61	0	0	\$100,000

Dates	Magnitude	Deaths	Injuries	Property Damages
5/25/2011	78	0	0	\$70,000
6/27/2011	56	0	0	\$30,000
8/7/2011	61	0	0	\$20,000
1/22/2012	52	0	0	\$15,000
3/2/2012	61	0	0	\$10,000
6/11/2012	61	0	0	\$20,000
7/26/2012	61	0	0	\$50,000
9/6/2012	56	0	0	\$25,000
1/29/2013	52	0	0	\$20,000
4/10/2013	70	0	0	\$300,000
10/31/2013	52	0	0	\$10,000
5/9/2014	61	0	0	\$10,000
7/1/2014	52	0	0	\$10,000
7/23/2014	56	0	0	\$45,000
7/27/2015	61	0	0	\$15,000
12/23/2015	52	0	0	\$6,000
5/9/2016	56	0	0	\$20,000
7/6/2016	61	0	0	\$40,000
3/1/2017	70	0	0	\$40,000
5/27/2017	70	0	0	\$65,000
3/16/2018	61	0	0	\$95,000
5/17/2018	52	0	0	\$2,000
6/26/2018	61	0	0	\$35,000
6/28/2018	55	0	0	\$0
7/16/2018	61	0	0	\$10,000
2/7/2019	78	0	0	\$250,000
5/21/2019	87	0	0	\$50,000
5/29/2019	56	0	0	\$50,000
6/23/2019	65	0	0	\$50,000
3/2/2020	56	0	0	\$4,000
5/3/2020	87	0	0	\$50,000
9/12/2020	52	0	0	\$4,000
4/9/2021	52	0	0	\$3,000
4/28/2021	52	0	0	\$15,000
5/4/2021	56	0	0	\$5,000
7/9/2021	52	0	0	\$5,000
8/8/2021	56	0	0	\$6,000
2/22/2022	52	0	0	\$1,000
3/30/2022	56	0	0	\$2,000
5/15/2022	61	0	0	\$15,000
5/21/2022	52	0	0	\$3,000
6/26/2022	65	0	2	\$45,000
7/7/2022	56	0	0	\$2,000
7/16/2022	52	0	0	\$1,000
7/27/2022	52	0	0	\$3,000
8/26/2022	65	0	0	\$65,000
Total		1	6	\$2,695,000

Source: NCEI, data accessed July 5, 2023

- April 2, 2006** – A 42-year-old man was killed when his mobile home was overturned in the Circle City area, which is just north of U.S. Highway 60 east of Dexter. His 12-year-old son was slightly injured. The mobile home was rolled and became pinned against a large tree. A National Weather Service site survey indicated that straight-line winds from 70 to 80 MPH were responsible for a path of widespread damage from Dexter eastward to Circle City, which is almost to the county line. In Dexter, considerable damage occurred. Numerous trees were blown down, and many roofs were damaged. The city received nearly 150 calls concerning downed trees. Trees fell on at least three cars and two trucks. Just in the three Dexter city parks, about a dozen trees were down. Power was out in parts of Dexter for up to two days.

Part of the roof of a convenience store was blown off, and a storage shed was destroyed. Two vehicles at the convenience store were damaged by the roof. Dexter city hall sustained minor damage. An amateur radio antenna was bent 90 degrees. In Essex, which is between Dexter and Circle City, several homes and businesses had sections of shingles blown off. Some trees were snapped or uprooted. About 250,000 dollars damage occurred to agricultural equipment and machinery at two agribusinesses near Essex.

- **April 3, 2007** – Numerous trees, power lines, and about 10 utility poles were blown down along Highway 25. A utility pole struck a vehicle travelling on the highway. A passenger in the vehicle sustained minor injuries and was transported to a local hospital. Twenty spans of 3,400-volt electrical lines were down on the road and vehicles. Other vehicles were blown off the highway. A second person was transported to a local hospital with minor to moderate injuries, and an unspecified number of others sought their own treatment. The highway was shut down overnight and reopened the next morning. Numerous outbuildings, barns, and sheds were damaged in this rural farming area. One person reported seeing irrigation pipes blown into fields and roofs off structures.
- **April 10, 2013** – Scattered damage consisted of uprooted trees and broken tree limbs. Dozens of homes sustained loss of shingles or other minor damage. A barn was levelled. Numerous sheds were damaged or destroyed. A business in Puxico lost its roof. Windows were blown out, and a tree was snapped in half in Puxico. The damage path width was four miles. Peak winds were estimated near 80 mph.
- **February 7, 2019** - A line of strong to severe thunderstorms developed early in the morning from western Arkansas into south central Missouri ahead of a strong cold front. This line of storms intensified as it moved east-northeast across the mid Mississippi Valley later in the morning. This line of storms was the final round of heavy rain, which capped a very wet couple of days that resulted in rain totals of 2 to 4 inches. Isolated higher amounts up to near 5 inches were reported Although instability was weak, very strong winds aloft facilitated bowing line segments accompanied by damaging winds resulting in \$250,000 in damages in Stoddard County.
- **May 3, 2020** - Numerous reports of wind damage and an isolated tornado accompanied a squall line of thunderstorms that moved rapidly east-southeast. The relatively compact but organized and vigorous convective system maintained intensity as it progressed east to the Mississippi River. Just south of Brownwood, a car was flipped several times by high winds. Nearby, a tree was blown down across County Road 216 east of BB Highway. From Dexter to Bernie, trees were snapped. In Bernie, shingles were blown off a roof and branches were down.
- **June 26, 2022** - A long-lived thunderstorm cluster moved east-southeast during the morning hours across the mid-Mississippi Valley. These storms moved into an axis of greater instability over southeast Missouri, contributing to an uptick in intensity. Wind damage was observed in portions of Wayne and Stoddard Counties. Rather weak wind shear limited the duration and areal extent of the severe storms. A power pole was snapped in Puxico and numerous large branches and a few trees were down from Puxico northeast toward Advance. Significant damage was reported across northern Stoddard County, including the Advance and Bell City areas.

Table 3.45 summarizes the 4 unique high wind events reported during this 20-year period. Across all impacted areas, the events caused an estimated \$8.613 million in property damages and \$5 million in crop damages.

Table 3.45. NCEI Stoddard County High Wind Events Summary, 2003 – 2022

Dates	Magnitude	Deaths	Injuries	Property Damages	Crop Damages
1/29/2008	78	0	0	\$1,500,000	\$0
9/14/2008	57	0	0	\$7,100,000	\$5,000,000
2/11/2009	50	0	0	\$10,000	\$0
12/20/2012	52	0	0	\$3,000	\$0
Total		0	0	\$8,613,000	\$5,000,000

Source: NCEI, data accessed July 5, 2023

- January 29, 2008** – At the Dexter airport in Stoddard County, a number of planes were blown around and damaged. Over a dozen planes received major damage, and about 33 of 36 hangars were damaged. Some hangars were destroyed. The roof of the airport restaurant was blown off. A concrete block building used to repair aircraft was demolished. Considerable roof damage occurred to homes and businesses across the Dexter area. Numerous trees were down in Bloomfield, and a few landed on vehicles and houses. A window was blown out of the courthouse in Bloomfield. A communications tower was blown down.
- December 20, 2012** – A strong low-pressure system tracked northeast across the St. Louis area into northern Illinois. Strong west winds developed behind a cold front that swept across southeast Missouri. West winds were sustained from 20 to 35 mph, with frequent gusts from 45 to 55 mph. Measured peak wind gusts included: 49 mph at the Cape Girardeau airport and the Doniphan fire weather site, and 48 mph at the Poplar Bluff airport. An unofficial wind gust of 58 mph was measured in Doniphan. Shingles were blown off a roof in Bernie in Stoddard County. Some minor tree damage was reported at scattered locations.
- Table 3.46** summarizes the 26 unique hail events that included hail of at least 1 inch in diameter reported during this 20-year period. These events caused \$42,000 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 3.46. NCEI Stoddard County Hail Events Summary, 2003 – 2022

Dates	Magnitude (Diameter, inches)	Deaths	Injuries	Property Damages
4/4/2003	1.75	0	0	\$0
5/14/2003	1.75	0	0	\$0
4/2/2006	1.75	0	0	\$0
4/8/2006	1	0	0	\$0
4/30/2006	1.75	0	0	\$10,000
5/25/2006	2.75	0	0	\$2,000
9/27/2006	1	0	0	\$0
2/20/2007	1.5	0	0	\$0
5/3/2007	1	0	0	\$0
4/22/2008	1	0	0	\$0
6/9/2008	1	0	0	\$0
6/30/2009	3	0	0	\$30,000
4/9/2011	1	0	0	\$0
4/24/2011	1	0	0	\$0
4/30/2011	1	0	0	\$0
6/25/2011	1	0	0	\$0
1/22/2012	1	0	0	\$0
8/3/2012	1	0	0	\$0
4/3/2014	1	0	0	\$0

Dates	Magnitude (Diameter, inches)	Deaths	Injuries	Property Damages
3/9/2017	1	0	0	\$0
4/3/2018	1.75	0	0	\$0
7/20/2018	1	0	0	\$0
7/31/2018	1	0	0	\$0
4/8/2020	1	0	0	\$0
4/9/2021	1	0	0	\$0
7/17/2022	1	0	0	\$0
Total		0	0	\$42,000

Source: NCEI, data accessed November 29, 2018

- **May 24, 2000** – Golf ball size hail fell near 1.5 miles west of Dexter, and dime-size hail fell just west of Bernie.
- **April 2, 2006** – A swath of large hail occurred across northern Stoddard County. Golf ball size hail fell three miles east of Puxico along Highway PP. Quarter size hail occurred two miles south of Swinton.
- **March 9, 2017** – Hailstones measuring 3 inches in diameter were photographed by an observer east of Bloomfield. Vehicles received considerable damage. Golf-ball size hail was reported north of Bloomfield.
- **April 3, 2018** – An organized outbreak of severe thunderstorms occurred. The thunderstorm produced a swath of large hail across the Dexter area. The hailstones ranged from the size of quarters to golf balls.

Table 3.47 summarizes the three unique lightning events reported during this 20-year period. The events caused an estimated \$22,000 in property damage.

Table 3.47. NCEI Stoddard County Lightning Events Summary, 2003 – 2022

Dates	Magnitude	Deaths	Injuries	Property Damage
11/18/2003	n/a	0	0	\$0
8/4/2004	n/a	0	0	\$20,000
8/3/2011	n/a	0	0	\$2,000
Total		0	0	\$22,000

Source: NCEI, data accessed July 5, 2023

- **November 18, 2003** – A commercial building was destroyed by a fire that was believed to have been started by lightning. Two discount stores were located in the building on Highway 25.
- **August 4, 2004** – Two lightning strikes caused damage. The first strike set fire to a furniture store in Bernie, completely destroying the building. A second strike just northwest of Dexter took the lives of two horses. The horses were apparently standing under a tree when they were struck. Bark was peeled off the tree in strips from the trunk to the very top.
- **August 3, 2011** – A tree in the yard of a home was struck by lightning. The bolt splintered the large tree in half, shooting wood as far as 70 feet.

Table 3.48 and **Table 3.49** summarize past crop damages due to high winds and hail as indicated by crop insurance claims. In total, high winds and hail caused \$1,687,410 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 3.48. Crop Insurance Claims Paid in Stoddard County from High Winds, 2013-2022.

Crop Year	Crop Name	Cause of Loss Description	Determined Acres	Insurance Paid
2013	Soybeans	Wind/Excess Wind	448.12	\$53,613
2014	Corn, Rice	Wind/Excess Wind	2824.70	\$186,012
2015	Rice	Wind/Excess Wind	389.50	\$23,116
2016	Corn, Rice, Soybeans	Wind/Excess Wind	2409.33	\$157,659
2017	Cotton, Rice	Wind/Excess Wind	597.88	\$257,839
2018	Rice	Wind/Excess Wind	0	\$81,107
2019	Rice	Wind/Excess Wind	287.58	\$124,921
2020	Rice	Wind/Excess Wind	0	\$78,145
2021	Rice, Soybeans	Wind/Excess Wind	1597.13	\$455,135
2022	Rice, Popcorn	Wind/Excess Wind	601.94	\$72,821
Total			9156.18	\$1,490,367

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

Table 3.49. Crop Insurance Claims Paid in Stoddard County from Hail, 2013-2022.

Crop Year	Crop Name	Cause of Loss Description	Determined Acres	Insurance Paid
2014	Soybeans	Hail	80.60	\$2,424
2017	Cotton	Hail	43.73	\$21,765
2018	Cotton, Soybeans	Hail	592.33	\$44,347
2019	Cotton	Hail	485.05	\$128,507
Total			1207.71	\$197,043

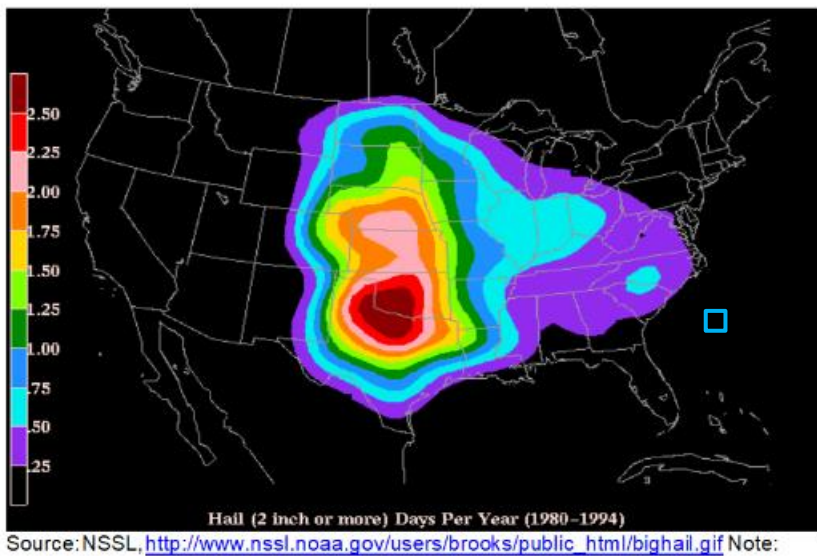
USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/data/cause>

Probability of Future Occurrence

Severe weather events are highly likely to occur in Stoddard County. According to storm events data reported by NCEI, Stoddard County has experienced 74 thunderstorm wind events, 4 high wind events, 26 significant hail events, and 3 lightning strikes resulting in reported damages in the past 20 years. Based on this historical data, the Stoddard County planning areas is likely to average 3.7 thunderstorm wind events and 1.3 severe hail events annually. The annual probability of high wind and lightning events is 20 percent and 15 percent, respectively.

Figure 3.30 shows severe hail frequency across the United States. Stoddard County, indicated by the blue square, averages between 2-4 days annually with hail over 1.00 inch in diameter.

Figure 3.30. 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 discussed in the 2018 Missouri State Hazard Mitigation Plan, warm, moist air near the surface is a key ingredient of “convective available potential energy” or CAPE. Increases in CAPE resulting from temperature and moisture increases may make the atmosphere more conducive to the development of severe storms. Conversely, warming in the arctic may result in less wind shear in the mid-latitudes, making storms less likely. More research is needed to fully understand the implications of climate change on severe storms.

Vulnerability

Vulnerability Overview

The 2018 Missouri State Hazard Mitigation Plan assigns Stoddard County a vulnerability rating of Medium. 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. Stoddard County has medium vulnerability scores for social vulnerability and percentage of mobile homes and 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 lead to flooding are discussed in the flooding hazard profile. Hailstorms cause damage to property, crops, and the environment, and can injure and even kill livestock. In the United States, hail causes more than \$1 billion in damage to property and crops each year. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are also commonly damaged by hail. Hail has been known to cause injury to humans, occasionally fatal injury.

In general, assets 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 2003 through 2022, 107 unique severe weather events impacted Stoddard County and caused an estimated \$11,372,000 in property damage. Note that damage estimates are for the entire area reported as affected by an event and therefore may overestimate actual damage. Based on this estimate, Stoddard County experiences an average annual property loss of \$568,600.

The USDA’s RMA also reports crop losses as a result of hail and wind. Based on the \$1,687,410 in reported crop insurance claims from 2013 through 2022, Stoddard County experiences an average annual crop loss of \$168,741 due to severe thunderstorms, wind and hail.

Using these historic losses as an indicator of potential future loss, Stoddard County may experience an average of \$737,341 in losses due to severe thunderstorms annually.

Impact of 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 3.50. 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.

Subject	Detrimental Impacts
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 3.51 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.

Table 3.51. Housing Vulnerability Indicators by Stoddard County Jurisdiction, 2021

Jurisdiction	Housing built before 1939 (%)	Manufactured homes (%)
Stoddard County	7.8	8.8
Advance	7.9	7.7
Bernie	9.8	0.4
Bell City	3.3	8.6
Bloomfield	17.6	6.0
Dexter	5.7	4.2
Dudley	2.7	13.7
Essex	21.2	10.0
Puxico	15.2	1.7

Source: US Census Bureau, American Community 2013-2017 Survey 5-Year Estimates

Problem Statement

- Severe thunderstorm events are highly likely to continue occurring in Stoddard 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.

3.4.9 Severe Winter Weather

Hazard Profile

Hazard Description

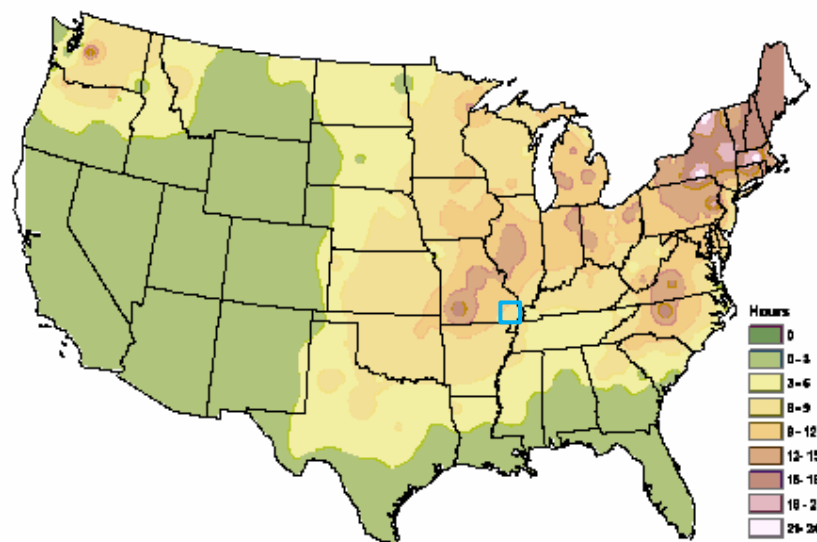
A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, and heavy snowfall. Note that extreme cold temperatures may also accompany winter storms and are addressed in **Section** Error! Reference source not found.. The National Weather Service describes 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 Stoddard County is vulnerable to heavy snow, ice, extreme cold temperatures and freezing rain. **Figure 3.31** depicts the average number of hours per year with freezing rain occurring across the United States. Stoddard County, indicated by the blue square, averages between 3-6 hours of freezing rain per year.

Figure 3.31. 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 73 winter storm-related events for the period from 2003 through 2022, summarized in **Table 3.52**. According to these records, events have resulted in \$20,300,000 in property damages across all impacted areas. No deaths or injuries were recorded.

Table 3.52. NCEI Stoddard County Winter Weather Events Summary, 2003-2022

Type of Event	Start Date	# of Deaths	# of Injuries	Property Damages
Winter Storm	1/16/2003	0	0	\$0
Winter Weather	1/22/2003	0	0	\$0
Heavy Snow	2/6/2003	0	0	\$0
Heavy Snow	2/5/2004	0	0	\$0
Winter Storm	12/22/2004	0	0	\$0
Winter Weather	12/8/2005	0	0	\$0
Winter Weather	2/18/2006	0	0	\$0
Winter Weather	2/19/2006	0	0	\$0
Winter Weather	2/1/2007	0	0	\$0
Winter Weather	2/3/2007	0	0	\$0
Winter Storm	2/11/2008	0	0	\$500,000
Ice Storm	2/21/2008	0	0	\$0
Winter Storm	3/7/2008	0	0	\$0
Winter Storm	12/15/2008	0	0	\$0
Winter Weather	12/16/2008	0	0	\$0
Winter Weather	12/18/2008	0	0	\$0
Winter Weather	12/23/2008	0	0	\$0

Type of Event	Start Date	# of Deaths	# of Injuries	Property Damages
Winter Weather	1/5/2009	0	0	\$0
Winter Storm	1/26/2009	0	0	\$19,700,000
Heavy Snow	2/28/2009	0	0	\$0
Winter Weather	1/6/2010	0	0	\$0
Heavy Snow	1/29/2010	0	0	\$0
Winter Weather	2/8/2010	0	0	\$0
Winter Weather	12/15/2010	0	0	\$0
Winter Weather	1/17/2011	0	0	\$0
Winter Weather	1/20/2011	0	0	\$0
Winter Weather	2/4/2011	0	0	\$0
Winter Weather	2/7/2011	0	0	\$0
Winter Weather	2/9/2011	0	0	\$0
Winter Weather	11/28/2011	0	0	\$0
Winter Weather	2/13/2012	0	0	\$0
Winter Storm	12/25/2012	0	0	\$0
Winter Weather	12/28/2012	0	0	\$0
Ice Storm	2/21/2013	0	0	\$100,000
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	\$0
Winter Weather	11/16/2014	0	0	\$0
Winter Weather	1/11/2015	0	0	\$0
Winter Weather	1/15/2015	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	\$200,000
Winter Weather	2/28/2015	0	0	\$0
Winter Weather	3/1/2015	0	0	\$0
Winter Storm	3/4/2015	0	0	\$0
Winter Weather	1/19/2016	0	0	\$0
Winter Weather	1/21/2016	0	0	\$0
Winter Weather	2/14/2016	0	0	\$0
Winter Weather	1/5/2017	0	0	\$0
Winter Weather	1/13/2017	0	0	\$0
Heavy Snow	1/15/2018	0	0	\$0
Winter Weather	2/6/2018	0	0	\$0
Winter Weather	2/11/2018	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	1/11/2019	0	0	\$0
Heavy Snow	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 Weather	1/6/2022	0	0	\$0
Winter Storm	2/2/2022	0	0	\$0
Winter Storm	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	\$20,300,000

Source: NCEI, data accessed July 5, 2023

The following event narratives for events with significant impacts on Stoddard County were reported in

NCEI:

- **February 1, 2007** – The light snowfall event that began on the evening of January 31 continued into the early morning hours of Feb. 1. Around an inch of snow fell, mainly along and northwest of a line from Cape Girardeau to Poplar Bluff. Roads were slick and hazardous. Several vehicle accidents resulted in injuries. The most serious accident involved a school bus that slid through an intersection and struck an embankment and guy wire. Two children received minor injuries in the accident, which occurred three miles west of Dexter on County Road 624.
- **February 11, 2008** – Low pressure developed over the southern Plains, spreading widespread heavy precipitation across southeast Missouri. At the same time, high pressure over the upper Ohio Valley produced a cold easterly wind flow. The result was a crippling ice storm. Around one inch of ice caused extensive damage across much of southeast Missouri. Thunder accompanied the wintry precipitation at times. Numerous trees and power lines were brought down, knocking out power to many thousands of homes. Power outages lasted up to a week. Recovery efforts were hampered by a large number of trees blocking roads. The governor requested federal disaster assistance for Cape Girardeau, Bollinger, Butler, Scott, Stoddard, and Wayne Counties. Numerous vehicle accidents were reported. The Missouri Highway Patrol reported 35 to 40 collisions in southeast Missouri, not including motorists who slid off the roads.
- **January 26, 2009** - This prolonged, major winter storm was termed the worst in decades for southeast Missouri. Locally 1.5 to 2 inches of ice accumulated south of a line from Poplar Bluff to Dexter to Benton. This resulted in catastrophic damage to trees, power lines, and utility poles in places such as Dexter, Sikeston, Charleston, and New Madrid. A utility company serving much of the region reported this was the most damaging event in the history of the company. More than 145 miles of high-voltage transmission lines were down in that company's area alone. A utility manager stated that ice accumulation made high voltage lines five inches in diameter. This was sufficient to bring down the two-pole structures with crossarms that carry transmission lines. At least 6,000 power poles in southeast Missouri were replaced after being snapped or downed. One utility company briefed the governor that restoration of its facilities would cost 80 million dollars. Nearly 100 percent of residents lost power. Power was restored to most residents of cities and larger towns in 5 to 9 days, but the last rural residents went three weeks without power. Both cell and landline phone services were out for a few days in many places. Downed trees and limbs blocked numerous roads. Thirteen state roads were closed one week after the storm. Tree limbs landed on vehicles and punctured some house roofs. In the hardest hit areas from Charleston to Sikeston to Dexter, very few trees were not damaged. A few fatalities were indirectly caused by the storm. In Advance, a 78-year-old man perished in a house fire likely started by an alternative heat or light source. A number of people throughout the region were injured in slips and falls. The National Guard assisted local and state agencies with recovery efforts, including door-to-door welfare checks in rural areas. Emergency shelters were opened for those without heat. Water supplies were interrupted in some towns where water towers could not be replenished by pumps. Gas was difficult to find for a few days due to a combination of power outages and high demand. A dusk-to-dawn curfew was imposed for a few days in some cities, including Dexter and Sikeston. Some structure fires were sparked by alternative heating, lighting, and cooking devices. Numerous traffic accidents occurred during the first several hours of the storm, sending several people to medical clinics. Several metal buildings and carports collapsed in northern Stoddard County. Law enforcement officials were forced to patrol in their personal four-wheel drive vehicles, since roads were not passable to cars. Phone service was disrupted in some areas.
- **February 21, 2013** – Damaging ice accumulations from one-quarter to one-half inch brought

down tree limbs over most of southeast Missouri. Short bursts of heavy sleet and freezing rain occurred in thunderstorms. The heaviest ice accumulations and most widespread power outages occurred along and west of a line from Dexter (in Stoddard County) to Marble Hill (in Bollinger County).

- **February 2, 2014** – From 4 to 6 inches of snow fell across parts of southeast Missouri, generally along and south of a line from Poplar Bluff to Dexter to central Scott County. The snow was mixed with some sleet in all of the affected areas. Numerous vehicles slid off roadways as temperatures dropped and roads became treacherous. Specific accumulations included 6 inches in Dudley and 5 inches in Bernie. In the wake of an arctic cold front, very cold air invaded southeast Missouri from the north.
- **March 4, 2015** – A winter storm produced 4 to 10 inches of snow across southeast Missouri. Rain gradually changed over to snow during the day. A few hours of sleet and freezing rain occurred during the transition from rain to snow. Up to three-quarters of an inch of sleet accumulated, followed by snow. The snow fell heavily during the evening, accumulating at the rate of an inch-and-a-half per hour and reducing visibility below one-half mile. Specific snowfall reports included 9 inches near Dexter. During the transition to sleet and freezing rain, some thunder and lightning was observed. North winds gusted up to 25 mph, causing some drifting of the snow. Drifts were locally up to two feet deep. Numerous traffic accidents occurred. In Stoddard County, U.S. Highway 60 was blocked by a crash involving two tractor-trailers and a sport utility vehicle. The state highway patrol reported 32 stranded vehicles and 27 crashes even before the storm was over. Schools were closed for the remainder of the week in most counties. Some of the coldest air ever recorded in the month of March invaded southeast Missouri the day after the snowstorm, hampering snow removal efforts. The low temperature was 8 below zero at Cape Girardeau on March 6. This was the first below-zero reading in the month of March since records began there in 1960.
- **February 6, 2018** - Around one-tenth of an inch of ice glazed surfaces across southeast Missouri. Near the onset of precipitation, a period of sleet was reported. Most of the precipitation fell in the form of freezing rain. Thunder and lightning accompanied the wintry precipitation during the evening hours. Automated observing stations at the Cape Girardeau and Poplar Bluff airports measured 0.13 and 0.08 inch of ice accretion, respectively. Most of the icing was on trees, power lines, and elevated surfaces during the precipitation. After the precipitation ended, temperatures fell through the 20's, causing icy spots to develop even on paved surfaces. On U.S. Highway 60 in Stoddard County, one person was moderately injured when her vehicle overturned on the ice.
- **December 8, 2018** - A low pressure system moved east across Mississippi and Alabama, spreading a wintry mix into extreme southern parts of southeast Missouri. Most of the impacts were felt south of U.S. Highway 60, especially from southern Butler County to New Madrid County. The primary type of precipitation was freezing rain, which glazed surfaces with up to one-tenth inch of ice. Roads became slick and hazardous, including Interstate 55. The Missouri State Highway Patrol reported a couple of accidents with injuries in Stoddard and New Madrid Counties.
- **February 15, 2019** - A low pressure system tracked east-northeast from the lower Mississippi Valley to the Carolinas. On the north side of this low, widespread sleet, snow, and freezing rain occurred on the afternoon and evening of 2/15. The snow was mixed with sleet. Nearly one-quarter inch of ice glazed trees and power lines in the Bootheel. Because ground temperatures remained above freezing for much of the event, the main impact was on elevated surfaces such as trees. An isolated power outage was reported in southern Stoddard County.
- **January 27, 2021** - Snow began in southeast Missouri during the early to mid morning hours.

Highest amounts were focused across the Ozark Foothills of southeast Missouri, aided by the earlier start time of the snow and colder air and ground temperatures. Roads were snow-covered and slippery. The snow fell at the rate of 1 to 1.5 inches an hour at Dudley in Stoddard County.

Winter storms can take a toll on crop production in Stoddard County. **Table 3.53** shows the USDA's Risk Management Agency payments for insured crop losses in the planning area as a result of cold conditions and snow for the past 10 years. From 2013 through 2022, Stoddard County has experienced \$7,353,115 in crop losses due to severe winter weather.

Table 3.53. Crop Insurance Claims Paid in Stoddard County as a Result of Cold Conditions and Snow, 2013-2022

Crop Year	Crop Name	Cause of Loss Description	Determined Acres	Insurance Paid (\$)
2013	Corn, Cotton, Rice, Wheat	Cold Wet Weather	17024.87	\$4,273,189
2014	Corn, Cotton, Rice, Soybeans, Wheat	Cold Wet Weather	5412.24	\$857,761.5
2014	Wheat	Cold Winter	1131.90	\$153,513
2014	Soybeans, Wheat	Other (Snow, Lightning, etc.)	206.20	\$21,703
2015	Corn, Cotton, Rice, Wheat	Cold Wet Weather	4393.12	\$1,473,997
2016	Corn, Cotton, Rice, Soybeans	Cold Wet Weather	2854.00	\$95,152
2017	Rice	Cold Wet Weather	149.17	\$1,711
2018	Wheat	Freeze	142.10	\$34,283
2018	Wheat, Rice	Cold Wet Weather	1147.07	\$46,459
2019	Wheat	Cold Wet Weather	96.79	\$2,401
2020	Corn, Cotton, Rice, Soybeans	Cold Wet Weather	986.56	\$121,831
2021	Wheat	Frost	223.4	\$8,192
2021	Corn, Rice, Soybeans	Cold Wet Weather	548.30	\$63,597
2022	Corn, Rice, Wheat	Cold Wet Weather	872.25	\$199,326
Total			36,334.97	\$7,353,115

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

Probability of Future Occurrence

According to NCEI historical storm events data for 2003 through 2022, there have been 73 winter storm related events in Stoddard County, including 6 heavy snow events, 2 ice storm events, 19 winter storm events, and 46 winter weather events. This equates to an average of 3.7 winter storm-related events annually.

Changing Future Conditions Considerations and the Impact of Climate Change

Per the 2018 Missouri State Hazard Mitigation Plan, “a shorter overall winter season and fewer days of extreme cold may have both positive and negative indirect impacts. Warmer winter temperatures may result in changing distributions of native plant and animal species and/or an increase in pests and non-native species. Warmer winter temperatures will result in a reduction of lake ice cover. Reduced lake ice cover impacts aquatic ecosystems by raising water temperatures. Water temperature is linked to dissolved oxygen levels and many other environmental parameters that affect fish, plants and other animal populations. A lack of ice cover also leaves lakes exposed to wind and evaporation during a time of year when they are normally protected. As both temperature and precipitation increase during the winter months, freezing rain will be more likely. Additional wintertime precipitation in any form will contribute to saturation and increase the risk and/or severity of spring flooding. A greater proportion of wintertime precipitation may fall as rain rather than snow.

Vulnerability Overview

The 2018 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. Stoddard County was rated High for likelihood of occurrence and Medium for both social vulnerability and 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 2003 through 2022, Stoddard County has averaged \$1,015,000 annually in property losses as a result of winter weather.

Based on data from the USDA's RMA from 2013 through 2022, Stoddard County averages \$735,032 per year in crop losses due to winter weather conditions.

Overall, Stoddard County can expect an average of \$1,750,032 in annual losses due to severe winter weather.

Impact of Previous and Future Development

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

EMAP Consequence Analysis

Table 3.54. 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 American Community 2017-2021 Survey -Year Estimates Dudley, Dexter and Bernie are the only incorporated jurisdictions with buildings with 10 or more units. The percentage of manufactured and/or mobile homes by jurisdiction is discussed below within information on vulnerability.

Stoddard County – The unincorporated portion of the county is likely to experience 3-4 winter weather events per year. Damages are not anticipated to be as significant within jurisdictions. This is due solely to the low population density of the county—34.8 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 8.8% of housing in the county is manufactured homes.

Advance – While the City of Advance is also likely to experience an average of 3.7 winter weather events per year, its vulnerability to damage from these types of events is considerably lower than its neighboring cities. This is because the city's population density is low and it has no buildings with 10 or more units. Manufactured homes make up 7.7% of housing in the city.

Bernie – The City of Bernie is also likely to experience 3 to 4 winter weather events per year and its vulnerability to damage from these types of events is about the same as the remainder of the planning area. Only 1.3% of buildings are 10 or more units. Bernie has a very small percentage of manufactured homes at 0.4%

Bell City – The city has a comparatively high rate of manufactured homes in the city – 8.6% but no building complexes with 10 or more units. The city, like the county, will experience about 3-4 winter weather events annually.

City of Bloomfield – has no buildings with 10 or more units and 6.0% of the homes are

manufactured. That makes it unlikely to experience extensive damage due to winter weather. It will experience 3 to 4 winter weather events each year.

City of Dexter – as the largest and most densely populated town in the county, Dexter has a greater vulnerability to winter weather events than small neighboring towns. It will experience 3.7 winter weather events on average each year. Dexter does have 1.9% of concentrated populations in buildings with 10 or more units. Only 4.2% of its housing is manufactured homes. The population density in the city is 1,099 per square mile.

City of Dudley – this small city has the highest percentage of manufactured homes in the county at 13.7%. It has 4.1% buildings with 10 or more units, making it vulnerable to winter weather, snow and ice that will occur 3 to 4 times each year.

City of Essex – is somewhat vulnerable to winter weather events because 10% of its homes are manufactured. It has no buildings with 10 or more units. It will experience 3.7 winter weather events each year.

City of Puxico – is vulnerable to winter weather events that occur in Stoddard County. Only 1.7% of its homes are manufactured and it has no buildings with 10 or more units, but it does have population density of 1,310 per square mile because the town is only .67 square miles. It will average 3 to 4 winter weather events annually.

Advance School District – lies within the City of Advance and has the same vulnerability to severe winter weather as the city.

Bell City School District – lies within the City of Bell City and has the same vulnerability to severe winter weather as the city.

Bernie R-XIII School District – lies within the City of Bernie and has the same vulnerability to severe winter weather as the city.

Dexter R-XI School District – lies within the City of Dexter and has the same vulnerability to severe winter weather as the city.

Puxico R-VIII School District – lies within the City of Puxico and has the same vulnerability to severe winter weather as the city.

Richland R-1 School District – is located on a county road outside of the City of Essex and has vulnerability similar to Essex and the unincorporated portion of the county.

Problem Statement

- Stoddard County is highly 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.

3.4.10 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.

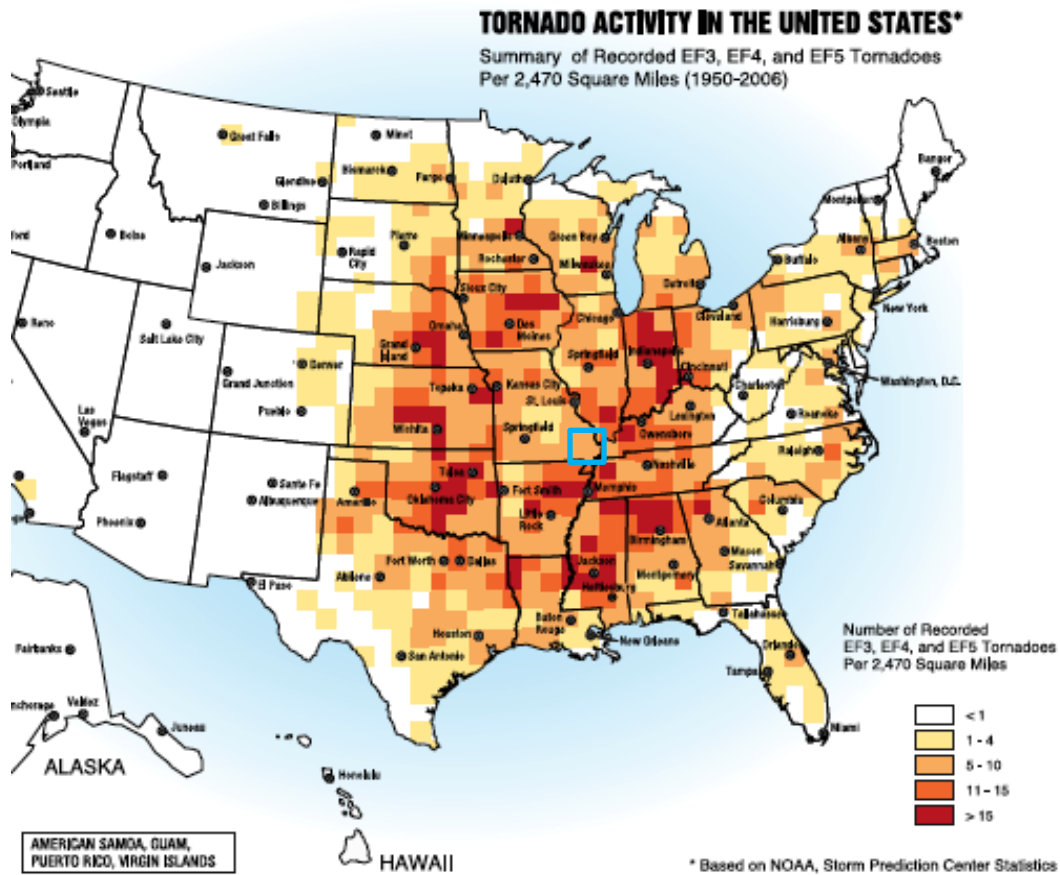
A typical tornado can be described as a funnel-shaped cloud that is “anchored” to a cloud, usually a cumulonimbus that is also in contact with the earth’s surface. This contact on average lasts 30 minutes and covers an average distance of 15 miles. The width of the tornado (and its path of destruction) 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 Stoddard County planning area. Figure 3.32 illustrates the average tornado activity across the United States from 1950 to 2006. Stoddard County, indicated by the blue square, is in an area that experiences an average of 5 to 10 tornadoes per 2,470 square miles annually.

Figure 3.32. 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 3.55**) attempts to rank tornadoes according to wind speed based on the damage caused. This update to the original F Scale was implemented in the U.S. on February 1, 2007.

Table 3.55. 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 3.56**. 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 3.56. 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 3.57 lists NCEI reported tornado events and damages since 1993 in the Stoddard 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 Stoddard County across 19 different days between 1993 and 2022. These events caused 1 death and an estimated \$5,978,000 in property damage.

Table 3.57. Recorded Tornadoes in Stoddard County, 1993 – 2022

Date	Beginning Location	Ending Location	Length (miles)	Width (yards)	F/EF Rating	Death	Injury	Property Damage
3/5/1996	Idalia	Circle City	6	75	F1	0	0	\$75,000
4/19/1996	Bernie	Bernie	0.6	50	F1	0	0	\$700,000
6/17/1997	Essex	Essex	0.2	30	F0	0	0	\$0
1/21/1999	Essex	Essex	0.2	30	F0	0	0	\$0
1/21/1999	Dexter	Dexter	0.5	80	F1	0	0	\$50,000
4/24/2002	Dudley	Dudley	0.1	40	F0	0	0	\$0
4/24/2002	Bloomfield	Bloomfield	0.1	20	F0	0	0	\$0
3/9/2006	Dexter	Dexter	1.2	175	F1	0	0	\$900,000
5/3/2007	Dexter	Essex	3.54	30	EF0	0	0	\$0
1/8/2008	Idalia	Birds Corner	4.78	120	EF1	0	0	\$250,000
2/5/2008	Shover	Bernie	9.63	100	EF1	0	0	\$150,000
4/23/2011	Dexter	Dexter	0.52	80	EF0	0	0	\$50,000
2/29/2012	Asherville	Bell City	19.96	700	EF3	1	0	\$150,000
2/29/2012	Bell City	Himmel	4.07	75	EF1	0	0	\$150,000
4/10/2013	Dudley	Dudley	1.53	50	EF0	0	0	\$40,000
10/31/2013	Bernie	Essex	14.25	100	EF1	0	0	\$75,000
10/31/2013	Essex	Demmittville	1.93	100	EF2	0	0	\$800,000
4/3/2014	Dale	Asherville	7.43	75	EF1	0	0	\$8,000
10/13/2014	Acorn Ridge	Kinder	7.35	75	EF1	0	0	\$50,000
3/9/2017	Dale	Asherville	2.28	75	EF1	0	0	\$75,000
3/9/2017	Powe	Maulsby	11.17	250	EF1	0	0	\$400,000
3/9/2017	La Valle	La Valle	0.73	100	EF0	0	0	\$20,000
4/3/2018	Demmittville	Charter Oak	4.49	100	EF0	0	0	\$35,000
6/21/2018	Demmittville	Charter Oak	4.51	200	EF0	0	0	0
7/10/2021	Dexter	Dexter Junct	5.8	175	EF2	0	0	\$2,000,000
Total						1	0	\$5,978,000

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

The following event narratives were reported by NCEI.

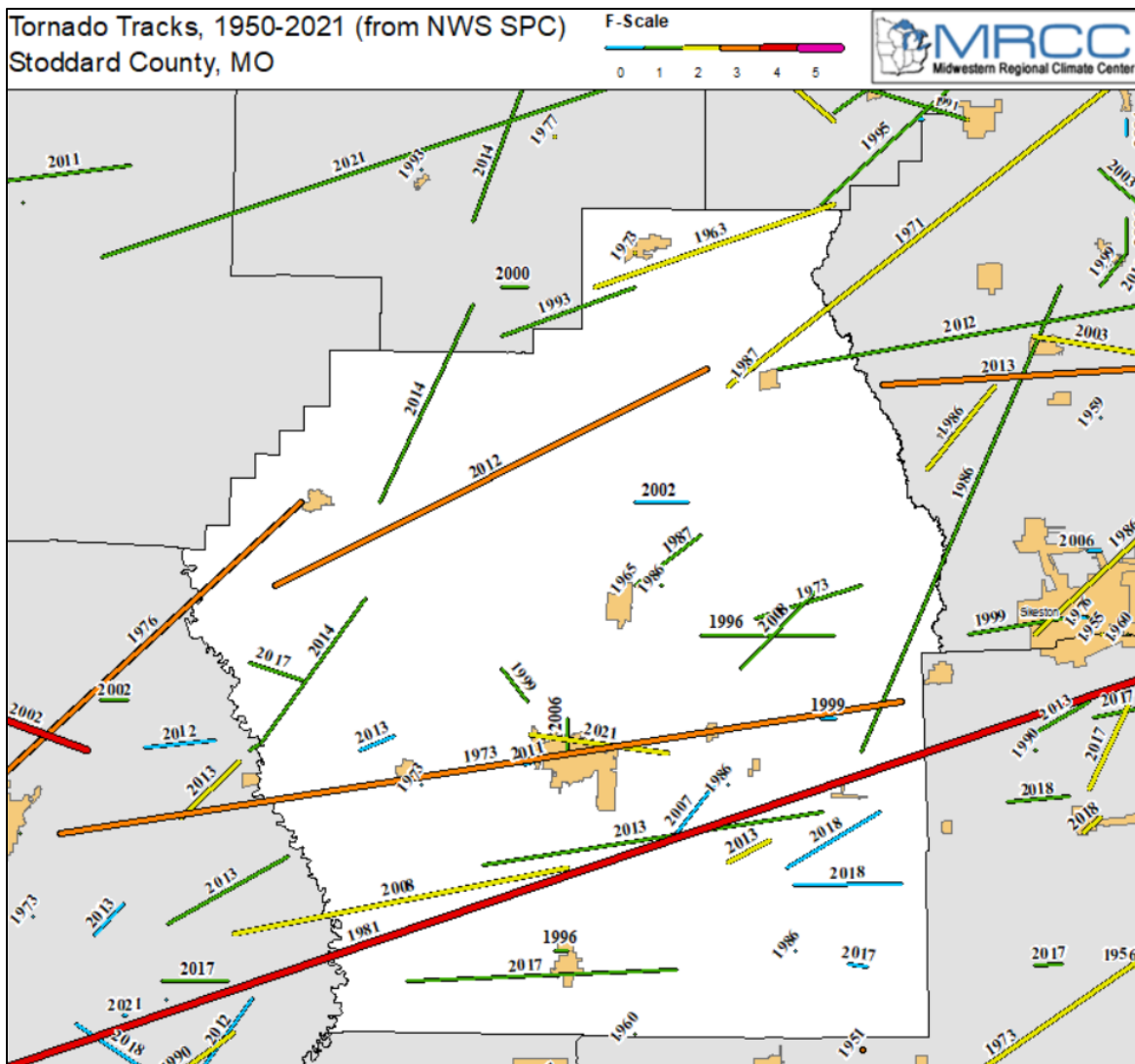
- January 21, 1999** – The brief tornado touchdown overturned a mobile home, causing extensive damage. A tool shed was blown away, utility poles were down, and trees were uprooted. Top winds were estimated near 80 MPH.

- March 9, 2006** – The tornado nearly paralleled U.S. Route 60 in a commercial district just north of downtown Dexter. At the beginning of the damage path, a Wal-Mart store and a car dealership were struck. The Wal-Mart sustained significant damage to its roof and auto shop bay doors. Between the Wal-Mart and the car dealership, light standards anchored by concrete three feet into the ground were pulled out. At the car dealership, about 50 cars were damaged by wind-blown debris and hail, with windows broken. At a mobile home dealership, an unsecured mobile home trailer was turned on its side and pushed next to another trailer. A church lost its steeple and 4 to 6 feet of its roof, and brick fascia was damaged. A second church near Highway 60 sustained damage to the upper portions of the front wall. A restaurant next to the church sustained structural damage when the upper portion of a wall was blown in. Two residences received moderate damage, and a heavy equipment shed was blown down. A motel reported that eight units lost parts of their roofs. Several billboards on Highway 60 were heavily damaged. A utility pole was snapped off. Peak winds were estimated near 80 MPH. Much of the damage occurred underneath the location of a funnel cloud that was photographed by a citizen. The condensation portion (or visible portion) of the funnel cloud was not touching ground in the photo. A second weaker and shorter-lived vortex touched down within a mile to the north-northwest, causing relatively slight damage to a few structures.
- January 8, 2008** – One house was heavily damaged. The roof was partially torn off the house, and debris was thrown 100 to 200 yards. Three outbuildings and an equipment shed were destroyed. A trailer was thrown about 75 yards. Approximately ten power poles were snapped in half. Windows of vehicles were broken by debris. A few large trees were snapped. A pump house was blown into a propane tank, causing a propane leak. There were two eyewitness accounts of a funnel cloud. Peak winds were estimated at 110 mph. The average path width was about 100 yards.
- February 5, 2008** – The tornado continued eastward from Butler County into western Stoddard County. As it moved through a wildlife refuge close to the county line, trees were damaged. Along County Road 670, a metal barn was destroyed and thrown several hundred yards into a field. A wagon was thrown approximately 150 yards. On County Road 651, a concrete silo was destroyed while an empty grain truck right next to the silo was not damaged. The tornado continued northeast and damaged mainly trees and 14 power poles before it lifted near Highway 25.
- February 29, 2012** – Over 50 structures were damaged, almost half of which were completely destroyed. Most of the structures were mobile homes, barns, and outbuildings. Houses sustained mainly minor damage, but one site-built home was seriously damaged and another was destroyed. Peak winds were estimated near 140 mph. The average path width was 550 yards.
- March 9, 2017** – Peak winds were estimated near 95 mph in this tornado that occurred northwest of Dudley. The most intense damage was on Highway 51, where a residence lost doors and windows, the roof was damaged, and large trees were blown down. A nearby large barn lost a wall and portion of the metal roof. Roofing debris consisting of shingles and tin was deposited at a residence near the end of the track, about a mile east of Highway 51. This residence lost a few shingles, outbuildings were damaged, and cedar trees were pushed over. Near the beginning of the damage track, a large tree landed on a well-built garage, and a gazebo was blown about 100 yards.
- July 10, 2021** - The tornado first touched down along Highway AD, just north of the interchange with U.S. Highway 60. The tornado then tracked east-southeast across Highways 60 and 25 through the city of Dexter. At least 150 homes were damaged. At least one home sustained major loss of roof decking, and a half dozen or less homes had major damage mainly due to fallen trees. Most damage was loss of shingles and siding and fascia. Several

mobile homes were heavily damaged or destroyed. One mobile home was flipped on its roof. Several garages were blown from their foundations. A few large buildings sustained major damage, including major loss of roof structures. A hospital sustained major damage with several windows blown in, ceiling panels blown down, and one attached structure blown away from the hospital. Several vehicles at the hospital had their windows blown out or were otherwise damaged from flying debris. Hundreds of trees were uprooted or snapped. Peak winds were estimated near 120 mph.

Figure 3.33 maps historic tornado events that impacted Stoddard County according to mapping produced by the Midwestern Regional Climate Center (MRCC). These events resulted in 1 death.

Figure 3.33. Stoddard County Map of Historic Tornado Events



Source: Midwestern Regional Climate Center [29207 Stoddard.png \(800x800\) \(purdue.edu\)](https://www.mrcc.purdue.edu/29207_Stoddard.png)

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 Error! Reference source not found.** as part of the Thunderstorms, High Wind, Hail and Lightning hazard. There are no crop losses reported by RMA for tornadoes in Stoddard 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, Stoddard 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

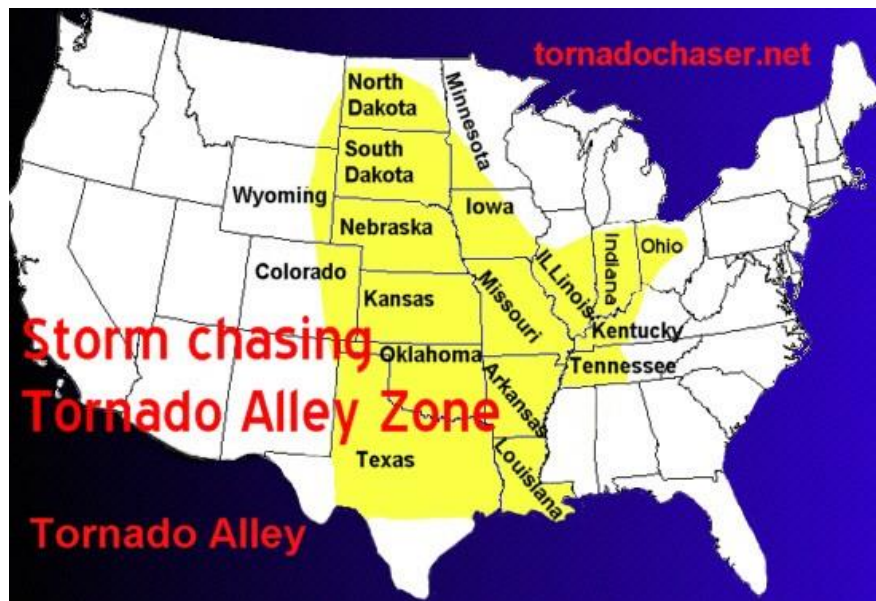
Scientists do not know how the frequency and severity of tornadoes will change. As reported in the Fourth National Climate Assessment, some research suggests that tornado activity has become more variable, concluding that the number of days with large outbreaks have been increasing since the 1950s and that densely concentrated tornado outbreaks are on the rise. The 2018 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

Stoddard 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 3.34. Tornado Alley in the U.S.



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

The 2018 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. Based on a rating of Medium for social vulnerability and mobile home presence and a rating of High for likelihood of occurrence, the State plan rates Stoddard County’s overall vulnerability at Medium.

Potential Losses to Existing Development

Of the 25 tornado segments reported by NCEI that hit Stoddard County from 1993 through 2022, 10

were F0/EF0, 12 were F1/EF1, 2 were an EF2, and 1 was an EF3. There was \$5,978,000 in property damage reported from these events, which equates to an average annual loss of \$199,267 due to tornadoes.

Impact of Previous and Future Development

Although Stoddard 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 3.58 shows the impact analysis of tornadoes.

EMAP Consequence Analysis

Table 3.58. 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. Stoddard County Unincorporated, Dexter and Bloomfield have the greatest number of buildings constructed prior to 1939, making them more vulnerable to tornado damage. Communities that have adopted building codes may also be less vulnerable to damages. Housing vulnerability related to structure age was detailed in **Table 3.29**. 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 3.59** illustrates the number and percentage of mobile homes in each jurisdiction.

Table 3.59. Mobile Homes in Stoddard County

Jurisdiction	Number of Mobile Homes	Percentage of Mobile Homes
Advance	58	8.4
Bell City	22	10.6
Bernie	3	.4
Bloomfield	54	6.6
Dexter	121	3.8
Dudley	10	18.5
Essex	21	11.5
Puxico	12	2.9
Unincorporated Stoddard County	694	14.3
TOTAL	995	8.8

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 Stoddard 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 tornados. A possible solution is to provide public outreach and/or conduct inspections to ensure the proper tie downs are installed on mobile homes.

3.4.11 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 of 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.

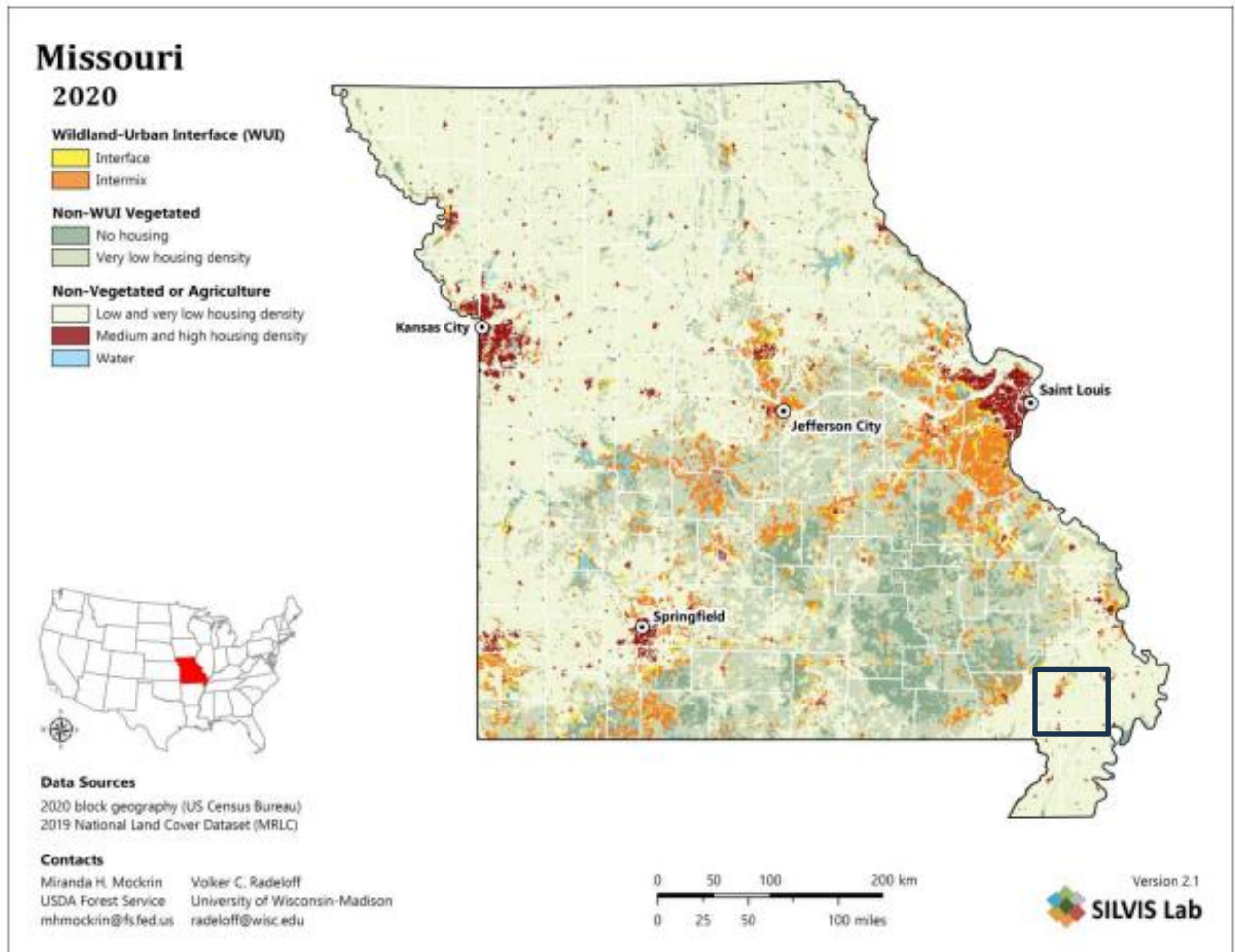
Stoddard County is predominately classified as non-vegetated or agricultural with noted pockets of WUI intermix areas and medium to high density housing in it larger communities. See Figure 3.35. Stoddard County is marked by a black rectangle.

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 Stoddard 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, Stoddard 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 3.35. WUI Areas in Missouri, 2020



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

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 fire fighters suppress fires safely.

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

There have been 17 wildfire events since 2004 that have burned more than 50 acres. These 16 events resulted in 12 threatened residences; 8 threatened outbuildings; 1 damaged residence; 1 destroyed outbuilding; and 4 personal injuries. There were no fatalities.

Previous Occurrences

According to the Missouri Department of Conservation, there were approximately 637 noted wildfires within Stoddard County between 2004 and 2022. Seventeen of them burned 50 or more acres. There were no additional data records for the school districts within Stoddard County.

Wildfire events burning more than 50 acres have included the following:

- April 9, 2022 – 123 acres - Paged for brush fire at 21473 County Road 525. The brush fire had gotten out of control and spread to nearby woods. The flames in the woods were extinguished.
- November 18, 2016 – 60 acres - Land owner burning debris, caught wooded area and an open field on fire. Mutual aid received from Dudley Fire and Bloomfield Fire.
- July 19, 2013 – 50 acres - paged for mutual aid with Puxico fire dept for field fire on County Road 284
- July 19, 2013 – 50 acres - Paged as mutual aid for Puxico for a combine fire in a field, arrived on scene to find a wheat field burning, using 2 brush trucks, extinguished fire
- July 25, 2012 – 50 acres - Mutual aid to Bernie Fire Dept.
- August 30, 2011 – 50 acres
- August 14, 2010 – 50 acres - Homeowner burned trash, left then came back to find the shed on fire along with a boat. Heat from fire melted siding on the house. Fire spread to a field and wooded area. Mutual aid was called from Dudley fire dept. for manpower and a brush unit.
- July 3, 2009 – 50 acres - Controlled burn of harvested wheat field by farmer.
- March 20, 2009 – 50 acres - Originally dispatched as in Dexter response area, upon arrival on scene it was discovered to be in Bloomfield area. They were contacted and also responded, and Dexter started first attack then stayed as a mutual aid company.
- September 17, 2007 – 50 acres - Dexter FD was called to assist MDC with a controlled burn on MDC property north of Dexter.
- August 28, 2007 – 50 acres - Fire was out however the landowner found one tree that was hot. He proceeded to cut it down, broke his chain and left to get to get another, tree fell while he was gone and caught unburned brush on fire.
- August 23, 2007 – 180 acres - Dexter Fire was called as the 5th department, 4th mutual aid department. Fire was reported to have started when a combine caught fire. In final report was 4 corn fields and 1 wooded area.
- March 7, 2007 – 65 acres - Land owner contacted fire dept for standby while the field burned off.
- June 15, 2006 – 85 acres
- October 4, 2004 – 50 acres
- September 20, 2004 – 50 acres
- September 20, 2004 – 250 acres

Probability of Future Occurrence

With 637 wildfires noted within Stoddard County between 2004 and 2022, the likelihood of occurrence can be calculated to average 33 wildfire events per year. With the total acreage burned during this same period as 3,642.7 acres, the annual average acreage burned can be calculated as 192 acres burned per year and the average event can be calculated as 5.8 acres. The most common known cause noted was debris. This information came from the Missouri Department of Conservation Wildfire Reporting database.

Changing Future Conditions Considerations and the Impact of Climate Change

Higher temperatures and changes in rainfall are unlikely to substantially reduce forest cover in Stoddard County, although the composition of trees in the forests may change. More droughts would reduce forest productivity, and changing future conditions are also likely to increase the damage from insects and diseases.

But longer growing seasons and increased carbon dioxide concentrations could more than offset the losses from those factors. As the climate changes, the abundance of pines in Stoddard County is likely to increase, while the population of hickory trees is likely to decrease.

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

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 Stoddard County was 192 acres. This average was based on 637 wildfires occurring in the county between 2004 and 2022. The total acreage burned during this nineteen-year time period was 3,643 acres. Per the data, the county was in the lower category for number of fires per year when compared to other counties in the state. The average burn per wildfire is 5.8 acres.

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 is some WUI area in Stoddard County as can be seen in Figure 3.31 above. 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 2018 Missouri State Hazard Mitigation Plan, there are 20,394.53 acres of land located within WUI areas in the county. Within those WUI areas are 1,788 structures, valued at \$303,704,533, and 3,758 persons vulnerable to wildfire. When categorized by type, the majority of structures at risk were determined to be residential (1,540 structures valued at \$261,597,455). The breakdown of the properties in the planning area determined vulnerable to wildfire is as follows:

- Agricultural, 92 structures valued at \$372,875;
- Commercial, 99 structures valued as \$28,032,950;
- Educational, 2 structures valued at \$5,707,913;
- Government, 2 structures valued at \$2,626,000;
- Industrial, 53 structures valued at \$5,367,339; and,

- Residential, 1,540 structures valued at \$261,597,455.

Impact of Previous and Future Development

The communities of Advance, Bell City, and Dexter have experienced slight population growth since 2010. In addition, Dexter has noted growth in housing units since 2010. Growth within these communities should be cautious of construction within the WUI interface and intermix areas.

EMAP Consequence Analysis

Table 3.60. 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

The building count and exposure to wildfire are less than 15% of the total building count for all jurisdictions within Stoddard County. For those jurisdictions without identified wildfire urban interface or intermix areas, the probability is noted as unlikely. School district risk is based upon their corresponding jurisdiction.

Because the county is 90% agricultural which is open and unpopulated, the risk to human life is minimal. The largest jurisdiction, Dexter, is at greatest risk of the damage of a wildfire.

Problem Statement

- One educational building in Puxico is noted as located within a WUI area. In fact, the jurisdiction of Puxico is almost entirely mapped as a WUI area. This area should be vigilant in prohibition of smoking.
- Less than 15% of Stoddard County parcels are located within the identified WUI areas. Jurisdictions with housing growth, Dexter, should note the location of WUI areas and inform residents of wildfire protection measures for new structures.

- There are seven fire departments within Stoddard County: Advance, Bell City, Bernie, Bloomfield, Dexter, Dudley and Essex. The departments should confirm mutual aid agreements with neighboring counties; 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 (October 1, 2012)*.

- **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 Stoddard 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 *2018 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/high winds, hail and lightning.
2. Minimize property damage due to flooding, levee failure, and dam failure.
3. Minimize injuries and property damage due to seismic and/or geological events.
4. Minimize the impact to natural and human resources caused by drought, extreme temperatures, and wildfire.
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 were 2 completed actions, 130 continuing actions (either ongoing or modified), and 3 deleted actions.

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
Advance	0	0	9	0
Bell City	9	0	10	0
Bernie	0	0	9	0
Bloomfield	9	0	9	1
Dexter	8	0	9	0
Dudley	11	0	11	0
Essex	13	0	13	0
Penermon	0	N/A	N/A	N/A
Puxico	9	1	9	1
Unincorporated Stoddard County	8	0	8	0
Advance R-IV	9	0	9	0
Bell City R-II	9	0	9	0
Bernie R-XIII	9	0	9	0
Bloomfield R-XIV	9	0	8	1
Dexter R-XI	9	0	9	0
Puxico R-VIII	9	0	9	0
Richland R-I	9	0	9	0
Three Rivers College	0	1	3	0
Total	197	2	152	3

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
3.3	Public awareness for earthquake and other geological events. Post earthquake shelter planning should look at alternate facilities and consider options for relocating people out of the hardest hit areas.	Bloomfield (City)	The reason for the deletion is unknown.
3.6	Reduce the potential damage to school facilities from future seismic events	Bloomfield R-XIV	The reason for the deletion is unknown.
4.1	Minimize the impact to natural and human resources caused by drought and/or heat wave.	Puxico (city)	The action primarily applied to farmers and city personnel did not believe it was applicable to the City of Puxico.

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 2018 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.

All jurisdictions in the county, except for Pendermon, participated in the mitigation strategy 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	Advance	Bell City	Bernie	Bloomfield	Dexter	Dudley	Essex	Puxico	Unincorporated Stoddard County	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
1.2	Seek grant funds for construction of safe rooms		X	X				X			Structural/Infrastructure	Tornadoes/Severe Thunderstorm	X	X	
1.3	Host workshops annually for all residents.				X	X	X	X	X	X	Education and Outreach	Tornadoes/Severe Thunderstorm	X	X	
1.4	Install emergency generators at critical facilities to include Police Stations; City Hall; EOC; Fire Stations, etc. as FEMA funds become available.	X			X	X	X		X	X	Emergency Services	Multi-Hazard	X		
2.1	Develop design criteria for drainage structures on roads within the county's jurisdiction	X	X	X			X	X	X		Prevention	Flood-Related Hazards		X	X
2.2	Seek grants for flood buyouts, elevation projects. Adopt FIRM and update or adopt floodplain ordinance to meet all NFIP requirements	X		X							Natural Systems	Flood-Related Hazards	X	X	X
2.3	Seek grant funds for flood buyouts, elevation projects, adopt or update floodplain ordinances to meet all NFIP requirements		X		X	X	X	X	X	X	Prevention	Flood-Related Hazards		X	X
2.4	Coordinate with USACE on impacts of levee failure							X		X	Prevention	Flood-Related Hazards	X	X	X
2.6	Education on levee failure	X	X	X	X	X	X	X	X	X	Education and Outreach	Levee Failure	X	X	X
2.7	Education on dam failure	X	X	X	X	X	X	X	X	X	Education and Outreach	Dam Failure	X	X	X
3.2	Designate an Emergency Operations Center and conduct annual coordination exercises	X	X	X	X			X		X	Emergency Services	Earthquake / Geological /Sinkhole	X	X	
3.3	Co-sponsor with appropriate school boards and earthquake public awareness programs for local schools	X	X			X	X	X	X		Education and Outreach	Earthquake / Geological /Sinkhole	X	X	
4.1	Adopt "best practices" policy in conjunction with the Soil and Water Conservation Commission	X	X	X	X	X	X	X			Prevention	Drought/Extreme Temp/Wildfire	X	X	
4.2	Meet with public electric utility companies to develop "best practices" for power conservation	X	X	X	X	X	X	X	X		Prevention	Drought/Extreme Temp/Wildfire	X	X	
4.3	Sponsor annual safety meeting for all residents									X	Emergency Services	Drought/Extreme Temp/Wildfire	X	X	
5.2	Meet annually with critical facilities administrators to develop severe winter weather strategies						X	X		X	Prevention	Severe Winter Weather	X	X	

#	Action	Advance	Bell City	Bernie	Bloomfield	Dexter	Dudley	Essex	Puxico	Unincorporated Stoddard County	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
5.3	Educate the public utility end user on preventive measures to reduce the risk to property	X	X	X	X	X	X	X	X	X	Education and Outreach	Severe Winter Weather	X	X	
	Total Count of Mitigation Actions	10	10	9	9	9	11	12	9	9					

Table 4.4. Mitigation Action Matrix – School Districts

#	Action	Advance R-IV	Bell City R-II	Bernie R-XIII	Bloomfield R-XIV	Dexter R-XI	Puxico R-VIII	Richland R-I	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
1.2	Seek grant funds for construction of safe rooms	X	X	X		X		X	Structure/ Infrastructure	Tornadoes/Severe Thunderstorm	X	X	
1.3	Host workshops annually for all residents.	X	X	X	X	X	X	X	Education and Outreach	Tornadoes/Severe Thunderstorm	X	X	
2.5	Alter bus routes and school schedule to accommodate flooded bus routes, inform parents of effects of school day due to flooding.	X	X	X	X	X	X	X	Prevention	Flood-Related Hazards	X	X	X
2.6	Educate on impacts on the school community caused by levee failure	X	X	X	X	X	X	X	Education and outreach	Levee Failure	X	X	X
2.7	Educate on impacts on the school community caused by dam failure	X	X	X	X	X	X	X	Education and outreach	Dam Failure	X	X	X
3.2	Designate an EOC and conduct quarterly exercises	X	X	X	X	X	X	X	Emergency Services	Earthquake / Geological /Sinkhole	X	X	
3.5	Inform parents of crisis plan and how it affects their students in case of a disaster	X	X	X	X	X	X	X	Education and Outreach	Earthquake / Geological /Sinkhole	X	X	
3.6	Retrofit existing school building for structural stability during earthquake events as FEMA funds become available.						X		Structure/ Infrastructure	Earthquake / Geological /Sinkhole	X		
4.4	Adjust the school and activity schedule in the event of extreme temperatures.	X	X	X	X	X	X	X	Emergency Services	Drought/Extreme Temp/Wildfire	X	X	

#	Action	Advance R-IV	Bell City R-II	Bernie R-XIII	Bloomfield R-XIV	Dexter R-XI	Puxico R-VIII	Richland R-I	Mitigation Category	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
5.4	Update the School Crisis Plan to protect students and staff during severe winter weather, such as meeting with officials to set priorities for snow removal, canceling classes and informing parents when road conditions are dangerous	X	X	X	X	X	X	X	Prevention	Severe Winter Weather	X	X	
	Total Count of Mitigation Actions	9	9	9	8	9	9	9					

5 PLAN MAINTENANCE PROCESS

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

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, the Regional Planning Commission and Local Emergency Operations Committee. The MPC is responsible for maintenance of the plan. Maintenance includes ensuring participation from jurisdictions, including school 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.

In order to best evaluate any changes in vulnerability as a result of plan implementation, the

participating jurisdictions will adopt the following process:

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

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

5.2 Incorporation into Existing Planning Mechanisms

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

Where possible, plan participants, including school and special districts, will use existing plans and/or programs to implement hazard mitigation actions. Those existing plans and programs were described in Section 2.2 of this plan. Based on the capability assessments of the participating jurisdictions, communities in Stoddard County will continue to plan and implement programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through the following plans:

- General or master plans of participating jurisdictions;
- Ordinances of participating jurisdictions;
- Stoddard 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 Stoddard 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.

0 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
Pemiscot 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. 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.