Pettis County Missouri

2024

Hazard Mitigation Plan

CONTRIBUTORS — Pettis County Hazard Mitigation Planning Committee

Jurisdictional Representatives Pettis County Mitigation Planning Committee		
Name	**Title**	**Jurisdiction/Agency/Organization**
Trisha Rooda	EMA	Pettis County/City of Sedalia
Kevin Coughlin	EMA Deputy Director	Pettis County/ City of Sedalia
Israel Baeza	Eastern Commissioner	Pettis County
Noah Shepard	Exec Asst to PC Commission	Pettis County
Nathan Cooley	GIS Planner	Pioneer Trails RPC
Janet Luetjen	Community Planner	Pioneer Trails RPC
Kelvin Shaw	City Administrator	City of Sedalia
James Dove	Mayor	City of Green Ridge
Karen Crafton	City Clerk	City of La Monte
Jeana Steven	Alderman	City of Houstonia
Thresa Eppenauer	Village Clerk	Village of Hughesville
Jonathan Southard	City Superintendent	City of Smithton
Brad Anders	Sheriff	Pettis County
Rodney Edington	Superintendent	Green Ridge R-VIII
Amy Fagg	Superintendent	Pettis County R-V
Ashley Stark	Dir of Safety/Security	Sedalia 200 School District
Todd Misenhelter	Principal	LaMonte School District
Travis Moore	Superintendent	Pettis Co R-12
David Bray	Superintendent	Smithton R-VI

Stakeholder Representation

Stakeholder Representatives Pettis County Mitigation Planning Committee		
Name	**Title**	**Agency/Organization**
Christopher Hess	Mitigation Planner	Pioneer Trails RPC
Martin Meyer	Maintenance	City of Green Ridge
Joseph Turnel	Matc/Green Ridge Fire Dept	City of Green Ridge
Rosie Crosswhite	Alderman	City of Houstonia
Matthew Wirt	Chief of Police	City of Sedalia
Matthew Irwin	Fire Chief	Smithton Fire Department
Cole Williams	Asst. City Superintendent	City of Smithton
Jeana Steven	Alderman	City of Houstonia
Brandon Wallace	Principal	Pettis Co R-12
Ron McNeive	Mayor	City of La Monte
Jonn Cline	Sergeant	Pettis County Sheriff
Austin Parish	Board Member	Village of Hughesville
Richie Simon	Maintenance Director	Sedalia 200 School District
Jennifer Evert	Emergency Mgt Manager	Bothwell Regional Hospital
Bill Taylor	Presiding Commissioner	Pettis County
Erin Matheny	EMA Deputy Director	Pettis County
Dawn Williams	Emergency Planner	Pettis County Health Dept
Kaylene Wheeler	Public Health Manager	Pettis County Health Dept

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Executive Summary

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from natural hazards. Pettis 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 Pettis County and its communities and school/special districts. The plan is an update of a plan that was approved in 2019; hereafter referred to as the 2019 plan. 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 Pettis County Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that covers the following 13 jurisdictions that participated in the planning process:

- Pettis County
- City of Green Ridge
- City of Houstonia
- Village of Hughesville
- City of La Monte
- City of Sedalia
- City of Smithton
- Pettis Co. R-V School District
- Pettis Co. R-XII School District
- Green Ridge R-VIII School District
- Sedalia 200 School District
- Smithton R-VI School District

All local jurisdictions and school districts within Pettis County participated in at least part of the planning process. However, three jurisdictions did not complete the full participation requirements and/or adopt the final FEMA approved plan through resolution thus excluding them from this hazard mitigation plan. The three jurisdictions failing to meet all requirements were City of Smithton, Pettis County R-XII School District, and La Monte R-IV School District.

Pettis County and the entities listed above developed a Multi-Jurisdictional Hazard Mitigation Plan that was approved by FEMA in February 2024 (hereafter referred to as the 2024 Hazard Mitigation Plan). This current planning effort serves to update that previously approved plan.

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

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

1. Protect the Lives and Livelihoods of all Citizens.
2. Ensure continued operation of government and emergency function in a disaster.
3. Preserve and maintain property, infrastructure, businesses, and jurisdiction vitality.
4. Manage growth through sustainable principles and practices

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

Prerequisites

This plan has been reviewed by and adopted with resolutions or other documentation of adoption by all listed 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 following jurisdictions participated in the development of this plan and have adopted the multi-jurisdictional plan:

- Pettis County
- City of Green Ridge
- City of Houstonia
- Village of Hughesville
- City of La Monte
- City of Sedalia
- City of Smithton
- Pettis County R-5 School District
- Pettis County R-12 School District
- Sedalia 200 School District
- Smithton R-6 School District
- Green Ridge R-8 School District

Model Resolution for Adoption

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

A RESOLUTION OF THE (LOCAL GOVERNING BODY /SCHOOL DISTRICT) ADOPTING THE PETTIS COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

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 multijurisdictional 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

Purpose

Every year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities recover from hazard events. Most disasters that occur are predictable and much of the damage caused by these events can be alleviated or even eliminated with proper planning.

The Pettis County Multi-Jurisdiction Natural Hazard Mitigation plan is an effort to reduce the impact of natural hazards on citizens and property, by outlining actions that will mitigate the hazards' effects and break the cycle of repetitive losses due to disasters. Hazard mitigation as defined by the Federal Emergency Management Agency (FEMA) is any action taken to eliminate or reduce the long-term risk to human life and property from natural and technological hazards. Because Missouri is prone to several types of natural disasters, mitigation planning becomes imperative in preventing human and economic loss. Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set and appropriate strategies to lessen impacts are determined, prioritized and implemented.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in future development plans. Proactive mitigation planning will help reduce the cost of disaster response and recovery to the community and its property owners by protecting critical facilities, reducing liability exposure, and minimizing overall community impacts and disruption.

This plan is designed to provide a general blueprint for hazard mitigation activities and is structured to serve as the basis for specific hazard mitigation efforts for multiple hazards. The Pettis County mitigation plan complies with the State Emergency Management Agency and FEMA planning guidance; FEMA regulations, rules, guidelines and checklists; Code of Federal Regulations; and existing Federal and State laws; and such other reasonable criterion as the President/ Governor, Federal/State congresses and SEMA/FEMA may establish in consultation with City/County governments while the plan is being developed.

This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007 (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act). The regulations established the requirements for local hazard mitigation plans are in the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288) The plan also utilized the March 2013 FEMA Local Mitigation Planning Handbook and October 1, 2011 FEMA Local Mitigation Plan Review Guide, as required for plan development. The FEMA approved plan will serve as a prerequisite for grant eligibility. Jurisdictions that did not participate in the planning process and did not adopt the plan are considered ineligible.

1.2 Background & Scope

The Pettis County Natural Hazards Mitigation Plan documents Pettis County's hazard mitigation planning process, identifies relevant hazards and risks, and outlines the strategy the County and participating jurisdictions will use to decrease hazard vulnerability and increase resiliency and sustainability. This plan was updated in 2023/2024, building off the framework of the 2013 and 2018 versions of this plan.

Jurisdictions who participated in the previously approved 2018 plan:

- Pettis County
- City of Green Ridge
- City of Houstonia
- Village of Hughesville
- City of La Monte
- City of Sedalia
- Pettis Co. R-V School District
- Green Ridge R-VIII School District
- Sedalia 200 School District
- Smithton R-VI School District

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in future development plans. Proactive mitigation planning will help reduce the cost of disaster response and recovery to the community and its property owners by protecting critical facilities, reducing liability exposure, and minimizing overall community impacts and disruption.

1.3 Plan Organization

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

Table 1.1

Changes Made in Plan Update	
Chapter 1	Changes made to timeline and representatives
Chapter 2	Changes made to capabilities of jurisdictions and ability to mitigate
Chapter 3	Updated statistics, reviewed hazards, levee failure removed as no levees exist in the county
Chapter 4	Updated Mitigation Strategy to reflect capabilities of Jurisdictions
Chapter 5	Updated procedures of maintenance and implementation to reflect jurisdictions requirements.

1.4 Planning Process

Table 1.2

Jurisdictional Representatives of Pettis County Mitigation Planning Committee		
Name	**Title**	**Jurisdiction/Agency/Organization**
Trisha Rooda	EMA	Pettis County
Kevin Coughlin	EMA Deputy Director	Pettis County
Israel Baeza	Eastern Commissioner	Pettis County
Noah Shepard	Exec Asst to PC Commission	Pettis County
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Travis Moore	Superintendent	Pettis Co R-12
David Bray	Superintendent	Smithton R-VI

Table 1.3 MPC Capability with Six Mitigation Categories

Community Department/ Office	Preventive Measures	Structure and Infrastructure Projects		Natural Resource Protection	Public Information	Emergency Services
		Property Protection	Structural Flood Control Projects			
Regional Planning Commission	X				X	
County EMD	X				X	X
County Commission	X	X	X	X	X	X
County Health Department	X				X	X

1.4.1 Multi-Jurisdictional Participation

The Plan serves as a written document of the planning process. Active participation of local jurisdiction representatives and stakeholders in the hazard mitigation planning process is essential if the Plan is to have value. To be eligible for mitigation funding, local governments must adopt the FEMA-approved update of the Plan. The participation of the local government stakeholders in the planning process is considered critical to successful implementation of this plan. Each jurisdiction that is seeking approval for the Plan must have its governing body adopt the updated plan, regardless of the degree of modifications. PTRPC collaborated with the local governments in Pettis County to assure participation in the planning process and the development of a plan that represents the needs and interests of Pettis County and its local jurisdictions. Appendix C contains resolutions for jurisdictions adopting the Plan. County Commissioners, incorporated communities, public schools and special districts, and various other stakeholders in mitigation planning were invited to a kick-off meeting for the Plan update on August 9, 2023. At this meeting it was explained that the Disaster Mitigation Act (DMA) requires each jurisdiction participating in the planning process officially adopt the plan. The criteria for participation that each jurisdiction must meet to be considered a "participant" in the Plan was established at this meeting and include the following:

- Participation in at least one (1) MPC meetings, by either direct participation or authorized representation;
- Each participating jurisdiction must provide to the MPC sufficient information to support plan development by completion and return of Data Collection Questionnaires and validating/correcting critical facility inventories; v Identification and Cost/Benefit Review of Mitigation Actions;
- Review and comment on plan drafts;
- Provide documentation to show time donated to the planning effort.

To be included in the plan as a participating jurisdiction, each jurisdiction was required to send a representative to one (1) meeting and completion of data collection questionnaire as minimum requirements. If, however, a representative was not able to attend at least two meetings they were encouraged to arrange for a one-to-one meeting with PTRPC staff or contact the PTRPC office to obtain information presented at any of the planning meetings.

Although not required, a set of standards for participation was developed for each jurisdiction to participate in the planning process and account for the variability of resources within each jurisdiction. This set of standards included; identifying and cost/benefit review of mitigation actions, reviewing and commenting on plan draft materials, and providing documentation to show time donated to the planning effort. Jurisdictions that met at least one (1) of the minimum requirements and any combination of additional three standards are considered to have satisfactorily participated in the planning process.

Table 1.4 shows the representation of each participating jurisdiction at the planning meetings and the provision of responses to the Data Collection Questionnaire. All jurisdictions 44 CFR Requirement §201.6(a)(3): Multi-jurisdictional plans may be accepted, as appropriate, if each jurisdiction has participated in the process and has officially adopted the plan. 1.6 participating in the Plan reviewed or commented on the draft Plan, participated in the update/development of mitigation actions, or documented the donation of time. Meeting sign-in sheets are in Appendix B.

Table 1.4 Jurisdiction Participation

Hazard Mitigation Planning Participation by Jurisdiction							
Jurisdiction	Kick-off Meeting	Meeting #2	Meeting #3	Meeting #4	Data Question-naire Complet-ed	Update/Develop Mitigation Actions	Adopted HMP Through Resolution
Pettis County							
City of Green Ridge							
City of Houstonia							
Village of Hughesville							
City of La Monte							
City of Sedalia							
Green Ridge R-VIII							
Pettis Co. R-V							
Sedalia 200							
Smithton R-VI							

1.4.2 Planning Steps

FEMA's Local Mitigation Planning Handbook (March 2013), Local Mitigation Plan Review Guide (October 1, 2011), and Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials (March 1, 2013) were used as the source for developing the Plan update Process. The development of the plan followed the 10-step planning process adapted from FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs. The 10-step process allows the Plan to meet funding eligibility requirements of the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, Community Rating System, and Flood Mitigation Assistance Program. Table 1.4 shows how the CRS process aligns with the Nine Task Process outlined in the 2011 and 2013 Local Mitigation Planning Handbook.

Following **Table 1.5** is a summary of how PTRPC staff used the Nine Task Process to develop the update to the Plan.

Table 1.5

Pettis 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)

In December 2022, PTRPC entered into cooperative agreements with SEMA and Pettis County to prepare this multi-jurisdictional plan for public entities in Pettis County. Discussions on the development of the Pettis County Multi-Jurisdictional Natural Hazard Mitigation Plan began in August 2023 with an introductory scoping meeting attended by PTRPC staff. This meeting was conducted to discuss the timeline for developing the hazard mitigation plan, the planning process, identification of stakeholders and community organizations to include in the planning process and a date for the kick-off meeting for September 20, 2023 to initiate participation of jurisdictions and public entities in the planning process. The PTRPC staff identified prospective participant representatives and stakeholders and a contact list was prepared for mailing an invitation letter to the kick-off Meeting. The list of invitees included local elected officials, municipal government staff, county government staff, emergency services personnel, public school administrators, members from health and social services organizations, and volunteer organizations. A complete list of invitees is in Appendix D.

The MPC met on several occasions from August 2023 through January 2024 to collaborate on the development of the Plan update. Participants assisted in data collection; reviewed and revised the Plan's goals, objectives, and mitigation strategies; and provided reviews and comments on the Plan throughout the update process. Communication with MPC members occurred throughout the planning process through face-to-face meetings, phone interviews, and email correspondence in addition to committee meetings. Table 1.6 shows the meeting schedule and items discussed for MPC meetings.

Table 1.6

Schedule of Hazard Mitigation Meetings		
Meeting	**Topic**	**Date**
Informational Meeting	· Prospective participants and stakeholders identified, contact list to be prepared. · Schedule Kick-Off Meeting, date, time, and location. · Draft invitation letters	8/9/2023
Kick-off Meeting	· Raising awareness for mitigation strategy/ increase county-wide preparedness to natural hazards · The Disaster Mitigation Act of 2000 · Mitigation Planning Process · Local Plan Participation · Project Timeline	9/20/2023
Planning Meeting #2	· Reviewed the resources available in Pettis County as well as hazard identification. · The third phase of the hazard mitigation process was also introduced and discussed. · Discuss actions that were accomplished in regard to hazard mitigation and what goals need to be introduced or revised	11/17/2023
Planning Meeting #3	· Reviewed Questionnaires. · Answered question regarding definitions in mitigation plans. · Discussed actions completed and revised sections.	1/10/2024

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

It was determined meeting dates and invitations were posted on the PTRPC website along with drafts of the Plan for public comment during the drafting stage and prior to submission of the Plan to SEMA for approval. A final draft of the Plan was posted on the PTRPC website starting on February 2024 prior to being submitted to SEMA for approval.

It was also discussed at the kick-off meeting that informal solicitation of public input would be sought by members of the MPC through announcements at gatherings and other public meetings, such as board of alderman and local emergency planning committee meetings. This plan for public involvement did not result in any public comment on the Plan. The reasons for lack of public comment are likely due to lack of effectiveness of legal notices and web postings.

The MPC also decided to use a public survey to get more response from the public. The survey was distributed to all jurisdictions to make available to their residents. An online survey was also made available through SurveyMonkey and a link then posted on the county web site and Pettis Co. EMA social media pages. Eighty-eight survey responses were collected via SurveyMonkey. Paper surveys that were received from the public totaled 124.

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

As stated in Section 1.4, neighboring communities, businesses, academia, and other non-profit interests were notified via email and letters, a notification was sent to adjacent county Emergency Management Directors, Chambers of Commerce, local and regional agencies, such as; OACAC, Health Departments, American Red Cross, Ambulance Districts, and the University of Missouri Extension office. A complete listing of agencies invited to participate in the planning process and what meetings they were invited to attend is included in Appendix D.

Coordination with FEMA Risk MAP Project

After the completion and approval of the 2019 Pettis County mitigation plan, Pettis County and the jurisdictions within have received new and/or updated flood hazard risk products. These include FIRM panels and other documentation, effective November 2023. These new FIRM panels were used to better determine the risk flooding poses to the county and jurisdictions.

Integration of Other Data, Reports, Studies, and Plans

A significant amount of information has been updated and revised based on the review of existing plans, studies, and reports. A few examples of information included are as listed below, a complete list of references can be found in Appendix A.

- Pettis County Emergency Operations Plan
- 2013 Missouri Sate Hazard Mitigation Plan
- 2018 Missouri State Hazard Mitigation Plan
- State department of Natural Resources (DNR)
- National inventory of Dams (NID)
- Missouri Department of Conservation (MDC)
- Local comprehensive plans
- Economic Development Plans
- US Department of Agriculture (USDA)

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

At the second MPC meeting profiles of identified hazards from the 2018 Plan were presented. Storm event data from the National Center for Environmental Information for the five-year period since the adoption of the 2013 Plan were included in the hazard profiles. The presentation incorporated data from studies, reports, and technical information available through internet research. During the process of identifying hazards the MPC reviewed:

- Previous disaster declarations in the county
- Hazards in the most recent State Hazard Mitigation Plan
- Hazards identified in the previously approved hazard mitigation plan.

The MPC was asked to prioritize the identified hazards based on probability of occurrence, human impact, property impact, and likely functional downtime of facilities and businesses. Additional information about the conclusions drawn at this meeting can be found in the Risk Assessment chapter of the Plan.

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

Identified assets in the planning area include population, structures, critical facilities and infrastructure, and other important assets that may be at risk to hazards. The inventory of assets for each jurisdiction was derived from parcel data from the Pettis County Assessor, the Pettis County Structures dataset, local jurisdiction data collection questionnaires, and HAZUS MH 2.2. Potential losses to existing development were estimated based on hazard event scenarios. In most cases the county assessor's appraised improved values were used to estimate structure losses in impacted areas for structure occupancy types. The methodology for estimating losses varies by hazard. Loss estimates are included in each hazard profile of the Risk Assessment chapter.

All loss estimates were either taken from the 2018 State Hazard Mitigation Plan or other best available data sources as appropriate.

Step 6: Set Goals (Handbook Task 6)

The MPC conducted a discussion session during their second meeting to review and update the Plan goals. To ensure that the goals developed for this update were comprehensive and supported State goals, the 2018 State Plan goals were reviewed. The MPC also reviewed the goals from current surrounding county plans.

In the 2018 Plan, the organization of the actions included broad goals and a set of objectives linking the actions to the goals. The MPC opted to keep the goals from the 2018 Plan while removing the objectives. Objectives were removed due to repetitiveness and redundancy. The plan updates goals and objectives area as follows:

Goal 1: Protect the lives and livelihoods of all citizens.
Goal 2: Manage growth through sustainable principles and practices.
Goal 3: Ensure continued operation of government and emergency functions during and after a disaster.
Goal 4: Preserve and maintain property, infrastructure, business, and jurisdiction vitality.

Step 7: Review Possible Mitigation Actions and Activities

The focus of the MPC meeting on September 20, 2023, was update of the mitigation strategy. For a comprehensive range of mitigation actions to consider, the MPC reviewed the following information during the meeting:

- A list of actions proposed in the previous mitigation plan, the current State Plan, and approved plans in surrounding counties,
- Key issues from the risk assessments, including the Problem Statements concluding each hazard profile and vulnerability analysis,
- State priorities established for Hazard Mitigation Assistance grants, and input during meetings, responses to Data Collection Questionnaires.

Jurisdiction representatives on the MPC were encouraged to review the details of the risk assessment vulnerability analysis specific to their jurisdiction. They were also provided a link to the FEMA's publication, Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013).

This document was developed by FEMA as a resource for identification of a range of potential mitigation actions for reducing risk to natural hazards and disasters.

Step 8: Draft an Action Plan

At the final MPC meeting on January 10, 2024, all proposed actions were subjected to a cost/benefit review using a modified STAPLEE scoring method. The STAPLEE scoring method is discussed in the Mitigation Strategy chapter. The method was used to develop a priority score for proposed actions. Several lower scoring actions were discarded. This meeting also included action worksheets to clarify what department or position would be responsible for implementing the action, potential funding sources, timeline, and local planning mechanisms for implementation. The action plans are listed for each jurisdiction in the Mitigation Strategy chapter.

Step 9: Adopt the Plan (Handbook Task 8)

Once the Plan is approved by SEMA and FEMA then the governing body of each jurisdiction must adopt the plan by resolution to be eligible for hazard mitigation assistance. Adoption resolutions will be collected and submitted with the final plan to SEMA and FEMA. Adoption resolutions are included in Appendix C.

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

At the final MPC meeting on January 10, 2024, the MPC developed and agreed upon an overall strategy for plan implementation and for monitoring and maintaining the plan over time. The overall strategy has been updated and is presented in the Plan Maintenance chapter

2 PLANNING AREA PROFILE AND CAPABILITIES

2 PLANNING AREA PROFILE AND CAPABILITIES

2.1 Pettis County Area Profile

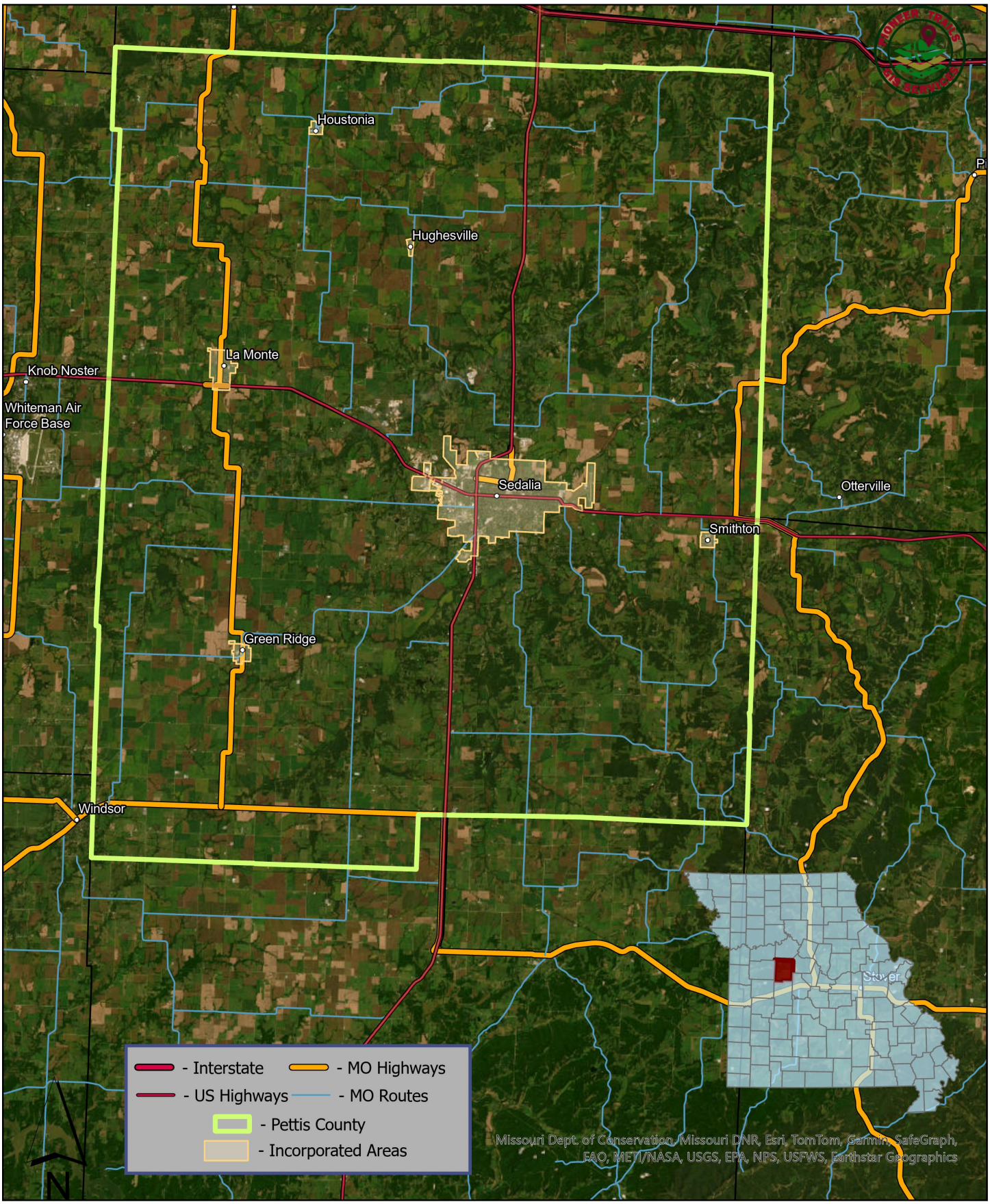
Pettis County is located in west central Missouri and is a neighbor to seven other counties. The population in Pettis County is 42,980, according to the 2020 Census Bureau decennial census. Pettis County population has increased 779 people, +1.8%, since the 2010 census when 42,201 people resided in Pettis County. The population of Pettis County has grown by 8.3% since the 2020 census, with an increase of 3,577 residents. Compared to the population growth of Missouri, from 2010 to 2020, of 2.77%, Pettis County has seen slower growth than Missouri as a whole.

The 2021 American Community Survey 5-Year Estimate (ACS) puts Pettis County's median household income at $51,936. The 2010 ACS 5-Year Estimate shows a median household income for Pettis County to be 37,658. The increase for median household income, $14,278, is a 27.5% increase from the 2010 ACS estimate.

The average estimated home value in Pettis County is $133,900, according to the 2021 ACS estimate. Compared to the average home value in Missouri, $171,800, Pettis County's average home value is 22.06% lower than that of Missouri and 45.32% lower than the national estimated home value of $244,900. Home values have increased from $93,200 in 2010, to the current average $133,900, a 30.39% increase.

Figure 2.1 Pettis County Base Map

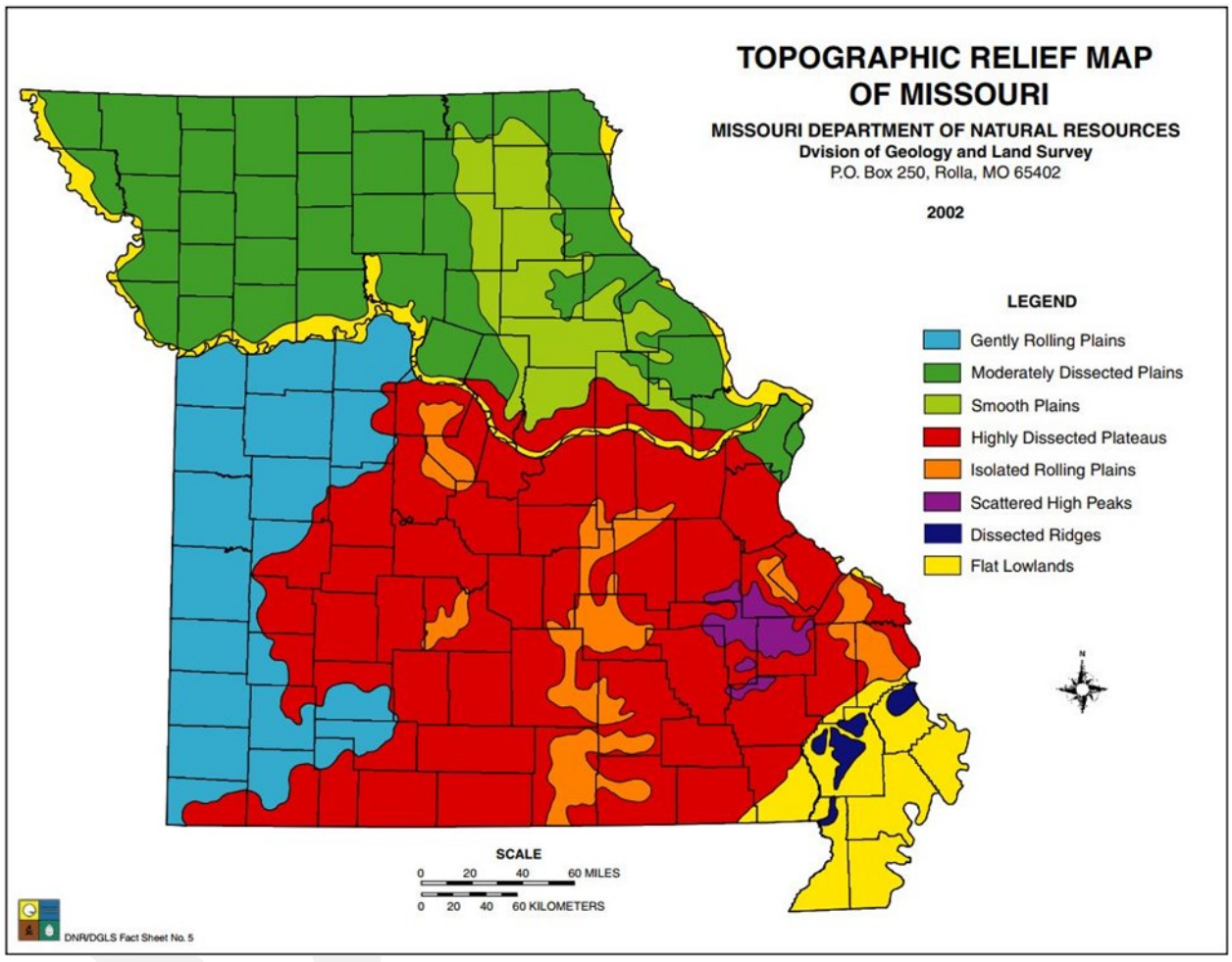
Pettis County Base Map



2.1.1 Geography, Geology and Topography

Pettis County encompasses 682.22 square miles in the rural part of Missouri, 45mi to the east of Kansas City and 20mi south of the Missouri River, and averages 63 people per square mile in 2020. The largest populated area within Pettis County is Sedalia. The Missouri DNR Topographic Relief Map below, figure 2.2, applies to all jurisdictions within Pettis County

Figure 2.2 State Topographic Relief



Soils

There are a total of seven soil associations in Pettis County including the Dockery-Tangle nookLamine Association, Pershing-Green ton-Dockery Association, Hartwell Association, BluelickGoss-Pembroke Association, Maplewood-Paintbrush-Eldon Association, Arispe-MacksburgGreenton Association, Eldon-Paintbrush-Bahner Association.

The Dockery-Tanglenook-Lamine Association landscape association consists of flood plains along streams that dissect the county. This association makes up about 3 percent of the county. It is about 48 percent Dockery solid, 22 percent Tanglenook and similar soils, 18 percent Lamine soils and 12 percent minor soils. Dockery soils are somewhat poorly drained. They are on flood plains adjacent to stream channels. Thanglenook soil is poorly drained. They are on high stream flood plains few feet higher than the adjacent bottom land. Lamine soils are somewhat poorly drained. They are on high stream flood plains a few feet high that the adjacent bottom land.

Pershing-Greenton-Dockery Association landscape consists of branching ridge tops with sloping areas between them that form the beginnings of a dissected drainage pattern. This association makes up about 6 percent of the county. It is about 32 percent Pershing and similar soils, 22 percent Greenton and similar soils, 11 percent Dockery soils, and 35 percent minor soils. Pershing soils are gently sloping and moderately sloping. They formed in loess. They are on ridge tops, side slopes and foot slopes. Greenton soils are moderately sloping and strongly sloping. They formed in a thing mantle of loess underlain by shale and limestone residuum. They are on side slopes. Dockery soils are nearly level. They formed in alluvium. They are on flood plains.

Hartmwell Association landscape consists of long, branching ridge tops and extremely long side slopes that are very gently sloping. Foot slopes below the side slopes are adjacent to small flood plains that converge downward in the landscape toward larger streams. This association makes up about 15 percent of the county. Ti is about 84 percent Hartwell soils and 16 percent minor soils; Hartwell soils are on ridge tops, side slopes and foot slopes.

Bluelick-Goss-Pembroke Association landscape consists of long main ridge tops with numerous lateral side ridges sloping areas between the side ridges. The ridge tops begin a branching pattern of drainage that converges to form small drainage ways connecting with larger streams. Strongly sloping to steep areas with prominent drainage patterns border these bottomland areas. This association makes up about 19 percent of the county. It is about 25 percent Bluelick soils, 22 percent Goss and similar soils, 20 percent Pembroke soils, and 33 percent minor soils. Bluelick soils are gently sloping to strongly sloping. They are comprised of loess in the underlying cherty limestone residuum. They are on ridge tops and side slopes. Goss Soils are moderately steep and steep. They formed in cherty limestone or dolomite residuum. They are on side slopes. Pembroke soils are gently sloping to strongly sloping. They formed in loess. They are on ridge tops, side slopes and foot slopes.

Maplewood-Paintbrush-Eldon Association landscape consists of long main ridge tops with numerous lateral side ridges separated by long side slopes and narrow banking drainage ways. This association makes up about 18 percent of the county. It is about 28 percent Maplewood and similar soils, 26 percent paintbrush and similar soils, 12 percent Eldon and similar soils, and 34 percent minor soils. Maplewood soils are gently sloping and are somewhat poorly drained. They formed in loess and in the underlying cherty limestone and dolomite residuum. They are one ridge tops and side slopes. Eldon soils are moderately sloping and strongly clopping and are well drained. They formed in cherry limestone and dolomite residuum. They are on side slopes.

Arispe-Macksburg-Greenton Association landscape consists of long, broad, branching main ridges with numerous lateral side ridges. Long, concave side slopes between the main ridges begin a pattern of branching drainage that converges to form small flood plains. This association makes up about 32 percent of the county. It is about 52 percent Arispe soils, 25 percent Macksburg soils, 11 percent Greenton Soils, and 12 percent minor soils. Macksburg soils are gently sloping. They formed in loess. They are on ridge tops. Greenton soils are gently sloping and moderately sloping. They formed in a thing mantle of loess and in the underlying limestone and shale residuum. They are on side slopes.

Eldon-Paintbrugh-Bahner Association The landscape of this association consists of long main ridge tops with numerous lateral side ridges. Sloping areas between the side ridges begin a branching pattern of drainage that converges to form small flood plains adjacent to larger streams. Strongly-sloping to steep areas with prominent drainage patterns border these bottomland areas. This association makes up about 7 percent of the county. It is about 48 percent Eldon and similar soils, 20 percent Paintbrush soils, 10 percent Bahner soils, and 22 percent minor soils. Eldon soils are moderately sloping and strongly sloping and are well drained. They are on side slopes. Paintbrush soils are gently sloping and moderately sloping and are moderately well drained. They are on ridge tops and side slopes. Bahner soils are gently sloping and moderately sloping and are moderately well drained. They are on ridge tops and side slopes.

2.1.2 Climate

National Center for Environmental Information data shows Pettis County having a moderate climate where average high temperatures range from 41F in winter, to 86F degrees in the summer. July averages the warmest temperature at 87 degrees. January's average high temperature of 38 degrees makes if the coldest month of the year. Average low temperatures range from 18 to 66 degrees.

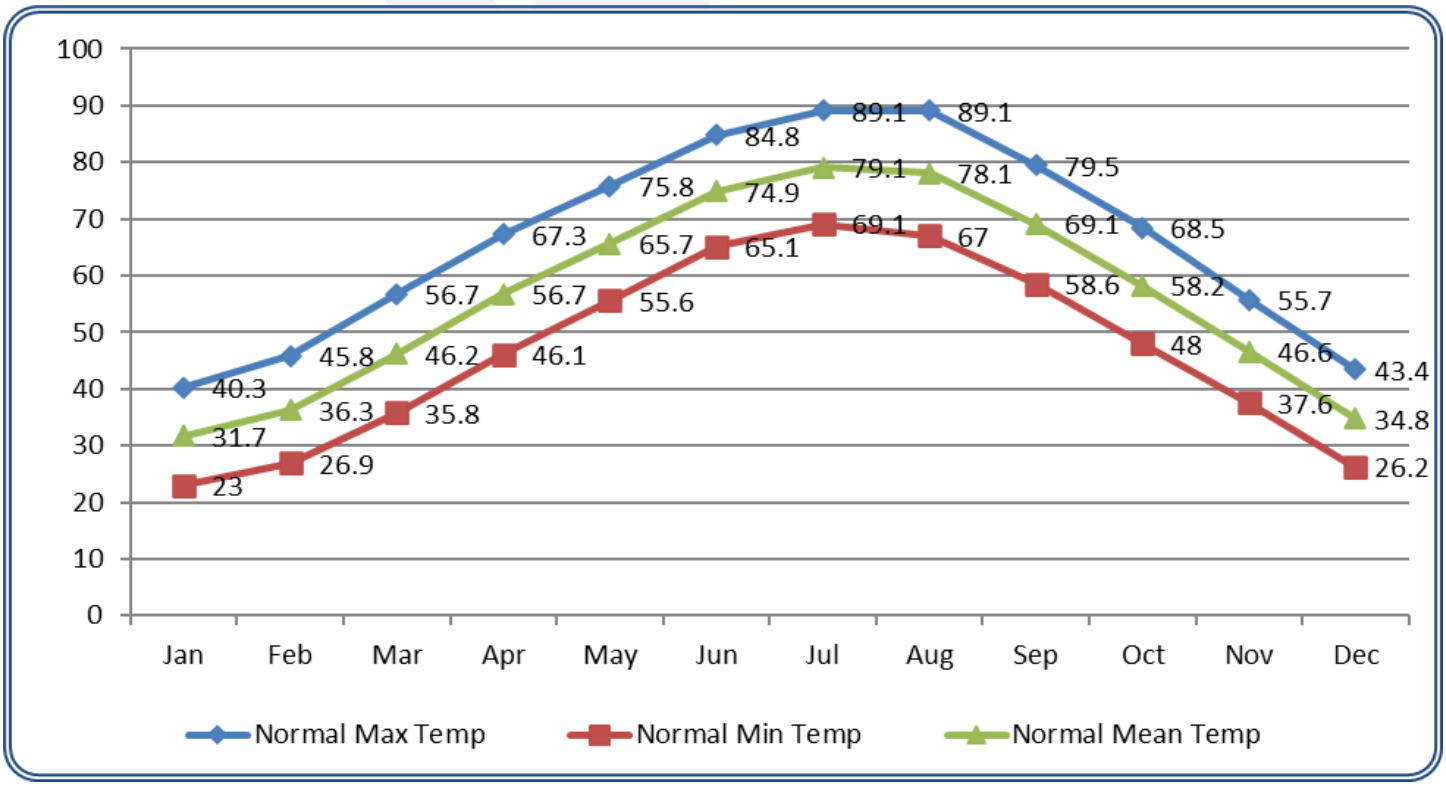
Annual precipitation in Pettis County on average is 44.3 inches. Eighty-six percent of the annual precipitation falls in the form of rain with the summer season averaging the most, 14.36 in, or 36% of the total. Winter precipitation averages 6.1 inches.

*As of this writing (1.17.2024) the data on climate is the most recent data available to us from the website (http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl) which is from 1981-2010 when future data becomes available to us we will implement it in future updates to this plan.

Table 2.1

NCEI Monthly Normal for Sedalia, Pettis County, 1981-2010													
Month:	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Normal Max Temp (°F)	40.3	45.8	56.7	67.3	75.8	84.8	89.1	89.1	79.5	68.5	55.7	43.4	66.4
Normal Min Temp	23	26.9	35.8	46.1	55.6	65.1	69.1	67	58.6	48	37.6	26.2	46.7
Normal Mean Temp	31.7	36.3	46.2	56.7	65.7	74.9	79.1	78.1	69.1	58.2	46.6	34.8	56.5
Normal Precipitation (in)	1.67	1.93	2.61	4.25	4.69	5.09	4.21	3.49	4.11	3.64	3.1	2.32	41.11

Source: http://mrcc.isws.illinois.edu/CLIMATE/Station/Monthly/StnNormals2.jsp



2.1.3 Population/Demographics

Table 2.2

Pettis County Population 2000-2022 by Jurisdiction				
Jurisdiction	**2010 Pop**	**2022 ACS Pop**	**2010-2022 Change**	**2010-2022 % Change**
Pettis Co.- Unincorporated	18,225	18,817	592	3.25%
Green Ridge	476	535	59	12.39%
Houstonia	220	245	25	11.36%
Hughesville	183	152	-31	-16.94%
La Monte	1,140	1,029	-111	-9.74%
Sedalia	21,387	21,767	380	1.78%
Smithton	570	514	-56	-9.82%
Pettis Co. Total	**42,201**	**43,059**	**858**	**2.03%**

Source: U.S. Bureau of the Census, Decennial Census, 2022 ACS 5-year Estimates

Pettis County's most at-risk populations are for the most part, on par with state and national averages. Children under age 5 in the county, comprising 6.5% of the total population, are slightly higher compared to state and national averages of 5.8% and 5.6% respectfully. The county has a slightly higher elderly population, or those above the age of 65, at 15.12% of the population, which is slightly less than Missouri's percentage, 15.52%, but is slightly higher than the national percentage of 14.91%. In addition, Pettis County's median age is 37.9 compared to the national age of 38.8 and the state average at 39.

Pettis County contains 18,563 housing units, 1,975 of which are vacant, at an average household size of 2.56, which is lower than the national average of 2.6, but is greater than the Missouri average, 2.44. Table 2.3 (next page) provides the number of Pettis County residents within specific age groups and a comparison of percentages with the state of Missouri and the United States.

Table 2.3 Pettis County Population Comparison

Pettis County Population Age Composition, Missouri/United States Comparison				
Age Group	**# of People**	**Percent of Population**	**Missouri Percent**	**United States Percent**
Under 5	2,814	6.5%	5.8%	5.6%
5 to 9 years	3,004	7	6.2	6.1
10 to 14 years	3,156	7.3	6.6	6.5
15 to 19 years	2,956	6.9	6.6	6.6
20 to 24 years	2,667	6.2	6.7	6.7
25 to 29 years	2,579	6	6.5	6.7
30 to 34 years	2,678	6.2	6.5	6.8
35 to 39 years	2,738	6.4	6.4	6.6
40 to 44 years	2,416	5.6	5.9	6.1
45 to 49 years	2,331	5.4	5.8	6.1
50 to 54 years	2,418	5.6	6	6.3
55 to 59 years	2,962	6.9	6.9	6.7
60 to 64 years	2,874	6.7	6.7	6.4
65 to 69 years	2,382	5.5	5.7	5.5
70 to 74 years	1,892	4.4	4.6	4.5
75 to 79 years	1,338	3.1	3.2	3
81 to 84 years	893	2.1	2	1.9
85 years and over	882	2.1%	2%	1.9%
Total Population	**42,980**		**6,154,913**	**3,314,496,281**
Median Age (years)	37.9		39	38.8

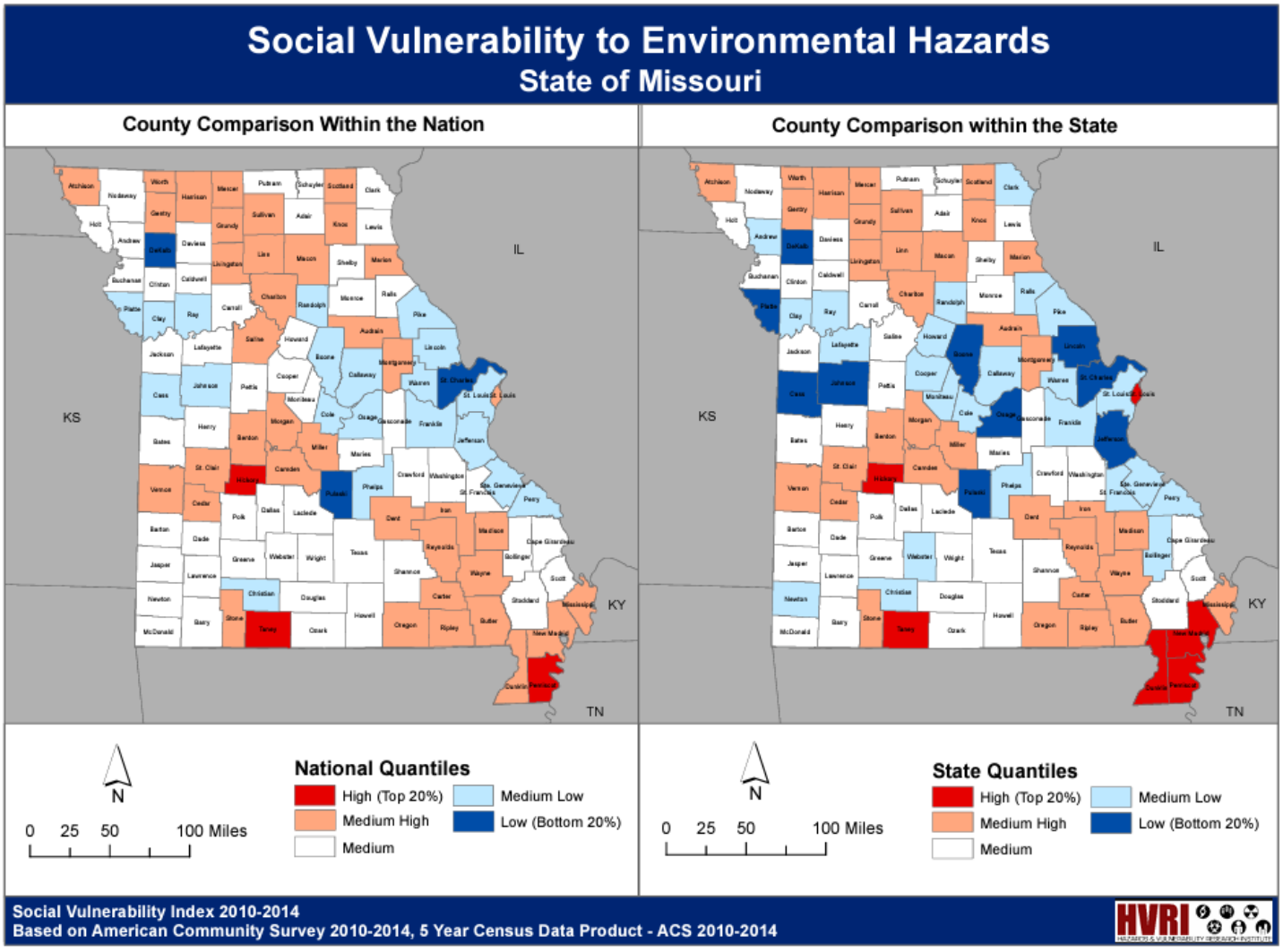
Source: U.S. Census Bureau, 2020 Census

Table 2.4 provides additional demographic and economic indicators for Pettis County, and incorporated communities compared to the state of Missouri and the United States. The county had a lower unemployment rate compared to the United States but was minimally more than Missouri. Pettis County families experiencing poverty was again more than the Missouri or U.S. level, be it only marginally. In terms of education, the percentage of population in the county that is a high school graduate, 87.6%, falls below that of Missouri or the United States, 90.6% and 88.5% respectfully. The percentage of the county population that speak a language other than English in the home, 12.1%, is about double that of Missouri, 6.3%, however, it was considerably less than the United States, 21.5%.

Following table 2.4, Figure 2.3 show the social vulnerability of Pettis County compared to that of the United States and Missouri.

Unemployment, Poverty, Education, and Language Percentage Demographics for Pettis County						
Jurisdiction	**Total in Labor Force**	**Unemployment Rate**	**Percent Families Below Poverty Level**	**Percent Population High School Grad**	**Percent Population Bachelor degree or higher**	**Percent Population Language other than English**
Pettis County	20,345	4.80%	10.00%	87.60%	18.50%	12.10%
Green Ridge	233	2.6	4.5	96.8	31	1.2
Houstonia	159	0	9.1	88.5	34.9	0
Hughesville	119	1.7	14.3	94.2	2.9	2.2
La Monte	548	5.2	21.5	66.9	12.7	37.8
Sedalia	10,401	7.1	12.2	85.4	15.8	13
Smithton	267	4.9	8.3	90.9	7.8	9.1
Missouri	3,090,256	4.5	8.9	90.6	29.9	6.3
United States	165,902,838	5.40%	9.10%	88.50%	32.90%	21.50%

Source: U.S. Census Bureau, 2022 ACS 5-year Estimate



2.1.4 History

Pettis County is one of 115 counties and county equivalent cities in Missouri. Organized in January 26, 1833, it took its name from Spencer Pettis, the third Congressman from Missouri, elected in 1828, when the entire State made but one congressional district. He is remembered for his duel with Major Thomas Biddle, which resulted in the death of both. The Territory of Pettis County was taken from the counties of Cooper and Saline; at one time the southern boundary of Saline County passed through the present city of Sedalia. During the Civil War sentiment was greatly divided and a large number of the arms-bearing people entered one or the other of the contending armies. With the exception of the attack upon Sedalia during the Price raid in 1864, the county saw little of war except the occasional passage of troops. However, the county seat was a large military post and depot. A few of the personal feuds which so greatly marred some other portions of the estate did exist in this County. Pettis County is a strong rural county, but Sedalia was closely tied to the railroad lines passing through it. Those times are almost forgotten, except for the annual Ragtime Festival held to commemorate the partnership in Sedalia of music publisher John Stark and ragtime composer Scott Joplin.

2.1.5 Occupations

Table 2.5 Occupation Statistics

Occupation Statistics, Pettis County Missouri					
Jurisdiction	**Management, Business, Science, & Arts Occupations**	**Service Occupations**	**Sales & Office Occupations**	**Natural Resource Construction & Maintenance Occupations**	**Production, Transportation & Material Moving Occupation**
Pettis County	37.90%	18.30%	18.70%	11.10%	24.00%
Green Ridge	34.10%	13.60%	17.10%	8.10%	27.10%
Houstonia	57.10%	25.60%	5.10%	3.80%	8.30%
Hughesville	24.20%	5.50%	18.70%	9.90%	41.80%
La Monte	18.10%	21.80%	11.00%	16.70%	32.40%
Sedalia	23.60%	21.00%	19.40%	9.70%	26.30%
Smithton	28.80%	16.90%	18.70%	12.40%	23.20%

Source: U.S. Census, 2022 American Community Survey, 5-year Estimates.

2.1.6 Agriculture

According to the United States Department of Agriculture (USDA) 2017 Agricultural Census, there were 1,259 farms covering 389,329 acres in Pettis County. The average farm size was 309 acres, which was slightly larger than the average farm size in Missouri at 285 acres, with a market value of $239,127,000 agricultural products sold. The average market value of products sold per farm was $189,934. Of the total, 64.5% was from livestock sales and 35.5% came from crop sales.

2.1.7 FEMA Hazard Mitigation Assistance (HMA) Grants in Planning Area

FEMA PA Grants in Pettis County 1993-2023				
Disaster Declaration	Project Type	Project Size	Applicant	Project Total
1635				
1635				
1635				
1635				
1635				
1635				
1635				
1635				
1980				

2.2 Jurisdictional Profiles and Mitigation Capabilities

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

2.2.1 Unincorporated Pettis County

Pettis County is classified as a 4th class county. Its county seat is Sedalia. The County is governed by a three-member County Commission, led by the presiding Commissioner. The County government is divided into the following departments and divisions: Assessor's Office, Auditor's Office, Circuit Court Clerk, County Clerk, County Commission, Public Administrator's Office, Prosecuting Attorney's Office, Recorder, Sheriff's Department, and Treasurer's Office. The county and its cities collaborate on numerous issues such as infrastructure, law enforcement, and emergency services. MoDOT and the county and cities collaborate concerning transportation issues. The Missouri Department of Conservation (MDC) and local firefighters work together to safeguard the county's forested areas.

Mitigation Initiatives/Capabilities

Staff capabilities to mitigate the impact of natural hazards include the County Commission and the Pettis County/ Sedalia Emergency Management Agency. The Pettis County / City of Sedalia Emergency Management Agency is responsible for developing and updating annually a Pettis County/City of Sedalia Emergency Operation Plan which lays a framework that will allow Pettis County and the City of Sedalia to save lives, minimize injuries, protect property and the environment, preserve functioning civil government, and maintain economic activities essential to the survival and recovery from natural and manmade disasters. This plan was developed through the collaborative efforts of the Pettis County/City of Sedalia Emergency Management Agency, other governmental and private entities throughout Pettis County and the city of Sedalia.

Table 2.6 is based on data that have been collected by distribution of the Data Collection Questionnaire to each of the participating communities.

Table 2.6

Pettis County, Unincorporated Mitigation Capabilities	
Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	N/A
County Emergency Operations Plan	Yes, 12/2016
Local Recovery Plan	N/A
County Recovery Plan	Yes, 12/2016
City Mitigation Plan	N/A
County Mitigation Plan	Yes, 2/2013
Debris Management Plan	Yes, 12/2016
Economic Development Plan	No
Transportation Plan	Yes, 12/2016
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	Yes
Watershed Plan	Yes, 2004
Firewise or other fire mitigation plan	N/A
Critical Facilities Plan (Mitigation/Response/ Recovery)	N/A
Policies/Ordinance	
Zoning Ordinance	No
Building Code	No
Floodplain Ordinance	Yes
Subdivision Ordinance	No
Tree Trimming Ordinance	No
Nuisance Ordinance	No
Storm Water Ordinance	No
Drainage Ordinance	No
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Landscape Ordinance	No
Program	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
Hazard Awareness Program	No
National Flood Insurance Program	Yes, CID 290823
Community Rating System (CRS) program under the National Flood Insurance Program (NFIP)?	NO
National Weather Service (NWS) Storm Ready Certi-fication	Yes, 2015
Firewise Community Certification	N/A
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	N/A
Economic Development Program	Yes

Land Use Program	No
Public Education/Awareness	Yes
Property Acquisition	No
Planning/Zoning Boards	No
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/ Regional)	No
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	N/A
Hazard Analysis/Risk Assessment (County)	Yes
Evacuation Route Map	Yes
Critical Facilities Inventory	Yes
Vulnerable Population Inventory	No
Land Use Map	Yes
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	Yes
Engineer	No
Development Planner	No
Public Works Official	Yes
Emergency Management Coordinator	Yes
NFIP Floodplain Administrator	Yes
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	Yes
Local Emergency Planning Committee	Yes
County Emergency Management Commission	Yes
Sanitation Department	No
Transportation Department	Yes
Economic Development Department	Yes
Housing Department	No
Historic Preservation	Yes
Non-Governmental Organizations (NGOs)	
American Red Cross	Yes
Salvation Army	Yes
Veterans Groups	Yes
Local Environmental Organization	No
Homeowner Associations	Yes
Neighborhood Associations	Yes
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, etc.	Yes

Financial Resources	
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	No
Impact fees for new development	Yes
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activities	Yes
Withhold spending in hazard prone areas	Yes

2.2.2 City of Green Ridge

The City of Green Ridge is located to the southeast of Sedalia and has a Mayor/5-person City Council local government. The population of Green Ridge has seen a 48% increase from 2000 to 2016 according the U.S. Census Bureau.

- One outdoor warning siren
- FEMA storm shelter
- Zoning Ordinance
- Nuisance Ordinance
- Zoning/Land use restrictions
- ISO fire rating of six

The City of Green Ridge's population of 65 and older accounts for 12% of the total. Housing structures built in 1939 and before account for 15.3%, and mobile homes accounting for 2.2%.

Table 2.7 is based on the Data Collection Questionnaire received jurisdiction.

Table 2.7

City of Green Ridge Mitigation Capabilities	
Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	No
County Emergency Operations Plan	N/A
Local Recovery Plan	No
County Recovery Plan	N/A
City Mitigation Plan	Yes
County Mitigation Plan	Yes
Debris Management Plan	No
Economic Development Plan	No
Transportation Plan	No
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
Firewise or other fire mitigation plan	No
Critical Facilities Plan (Mitigation/Response/Recovery)	No

Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	No
Hazard Awareness Program	No
National Flood Insurance Program	No
Community Rating System (CRS) program under the National Flood Insurance Program (NFIP)?	No
National Weather Service (NWS) Storm Ready Certification	No
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	Rating: 6
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	Yes
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	No
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	No
Hazard Analysis/Risk Assessment (County)	N/A
Evacuation Route Map	No
Critical Facilities Inventory	No
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	Yes
Emergency Management Coordinator	No
NFIP Floodplain Administrator	No
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	No
County Emergency Management Commission	Yes
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	No
Historic Preservation	No

Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	Yes
Local Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, etc.	No
Financial Resources	
Apply for Community Development Block Grants	Yes
Fund projects thru Capital Improvements funding	No
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

2.2.3 City of Houstonia

The City of Houstonia is situated in the northwest corner of Pettis County. The local government is by mayor/city council. Houstonia has seen a 19.6% decline In population since 2000 according to the U.S. Census Bureau.

- Two outdoor warning sirens
- FEMA approved storm shelter

The City of Houstonia's population of 65 and older accounts for 10.7% of the total. Housing structures built in 1939 and before accounts for 35.6%, and has 19.5% of the housing structures being mobile homes.

Table 2.8 is based on the Data Collection Questionnaire received from jurisdiction.

City of Houstonia Mitigation Capabilities	
Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	No
County Emergency Operations Plan	N/A
Local Recovery Plan	No
County Recovery Plan	N/A
City Mitigation Plan	Yes
County Mitigation Plan	Yes
Debris Management Plan	No
Economic Development Plan	No

Transportation Plan	No
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
Firewise or other fire mitigation plan	No
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	No
Building Code	No
Floodplain Ordinance	No
Subdivision Ordinance	No
Tree Trimming Ordinance	No
Nuisance Ordinance	No
Storm Water Ordinance	No
Drainage Ordinance	No
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Landscape Ordinance	No
Program	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
Hazard Awareness Program	No
National Flood Insurance Program	No
Community Rating System (CRS) program under the National Flood Insurance Program (NFIP)?	No
National Weather Service (NWS) Storm Ready Certification	No
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	N/A
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	No

Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	No
Hazard Analysis/Risk Assessment (County)	N/A
Evacuation Route Map	No
Critical Facilities Inventory	No
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	No
Emergency Management Coordinator	No
NFIP Floodplain Administrator	No
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	No
County Emergency Management Commission	No
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	No
Historic Preservation	No
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	No
Local Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.	No
Financial Resources	
Apply for Community Development Block Grants	Yes
Fund projects thru Capital Improvements funding	No
Authority to levy taxes for specific purposes	No
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	Yes
Incur debt through private activities	Yes
Withhold spending in hazard prone areas	Yes

2.2.4 Village of Hughesville

The Village of Hughesville is located in the northcentral region of the county between Sedalia and Houstonia. The Census Bureau shows the population of Hughesville has increased by 5.4% since 2000 to 184 in 2016.

- 1 Outdoor warning siren

The Village of Hughesville's population of 65 and older accounts for 16.8% of the total. Housing structures built in 1939 and before accounts for 14.3%, and 19% of the housing structures are of the mobile home type

Table 2.9 is based on the Data Collection Questionnaire received from jurisdiction.

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

Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	Yes
Hazard Awareness Program	No
National Flood Insurance Program	No
Community Rating System (CRS) program under the National Flood Insurance Program (NFIP)?	No
National Weather Service (NWS) Storm Ready Certification	No
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	No
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Stream Maintenance Program	Yes
Tree Trimming Program	Yes
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	No
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	No
Hazard Analysis/Risk Assessment (County)	No
Evacuation Route Map	No
Critical Facilities Inventory	No
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	Yes
Emergency Management Coordinator	No
NFIP Floodplain Administrator	No
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	No
County Emergency Management Commission	No
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	No
Historic Preservation	No

Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	No
Local Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.	No
Financial Resources	
Apply for Community Development Block Grants	No
Fund projects thru Capital Improvements funding	No
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	No
Incur debt through special tax bonds	No
Incur debt through private activities	No
Withhold spending in hazard prone areas	No

2.2.5 City of La Monte

The City of La Monte is situates along Highway 50 to the west of Sedalia. La Monte has a mayor and four person city council style of local government and a population that is slowly increasing. Since 2000, La Monte's population has increased by 5.9%, according the U.S. Census Bureau.

- 1 Outdoor warning siren
- FEMA Approved Storm Shelter
- Significant English as a Second language population

The City of La Monte's population of 65 and older accounts for 10.5% of the total. Housing structures built in 1939 and before account for 4.7% of the total, with 4.7% of the housing structures are mobile homes.

Table 2.10 is based on the Data Collection Questionnaire received from jurisdiction.

City of La Monte Mitigation Capabilities	
Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	No
County Emergency Operations Plan	N/A
Local Recovery Plan	No
County Recovery Plan	N/A
City Mitigation Plan	Yes
County Mitigation Plan	Yes
Debris Management Plan	No
Economic Development Plan	No

Transportation Plan	No
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
Firewise or other fire mitigation plan	No
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	Yes
Building Code	No
Floodplain Ordinance	Yes
Subdivision Ordinance	Yes
Tree Trimming Ordinance	Yes
Nuisance Ordinance	Yes
Storm Water Ordinance	Yes
Drainage Ordinance	Yes
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Landscape Ordinance	Yes
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	Yes
Hazard Awareness Program	Yes
National Flood Insurance Program	Yes
Community Rating System (CRS) program under the National Flood Insurance Program (NFIP)?	No
National Weather Service (NWS) Storm Ready Certification	No
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	Rating: 7
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	Yes
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	No
Hazard Analysis/Risk Assessment (County)	N/A
Evacuation Route Map	No
Critical Facilities Inventory	Yes
Vulnerable Population Inventory	Yes
Land Use Map	No

Staff/Department	
Building Code Official	No
Building Inspector	Yes
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	Yes
Emergency Management Coordinator	Yes
NFIP Floodplain Administrator	No
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	No
County Emergency Management Commission	Yes
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	No
Historic Preservation	No
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	Yes
Local Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.	Yes
Financial Resources	
Apply for Community Development Block Grants	No
Fund projects thru Capital Improvements funding	No
Authority to levy taxes for specific purposes	No
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	No
Incur debt through general obligation bonds	No
Incur debt through special tax bonds	No
Incur debt through private activities	No
Withhold spending in hazard prone areas	No

2.2.6 City of Sedalia

The City of Sedalia is centrally located in Pettis County and serves as the county seat. Overseeing the local government in Sedalia is a Mayor and 8-person City Council. The Census Bureau shows the population of Sedalia has increased by 5.4% since 2000 to 21,489 in 2016.

- 18 Outdoor sirens, four of which are located on the Missouri State Fair grounds.
- Comprehensive Plan
- Economic Development plan
- Watershed plan
- Zoning ordinance
- NFIP participate
- Land us program

The City of Sedalia's population of 65 and older accounts for 15% of the total population. Housing structures built in 1939 and before account for 27.7% of the total, with 1.1% of the housing structures being mobile homes.

Table 2.11 is based on the Data Collection Questionnaire received from jurisdiction.

City of Sedalia Mitigation Capabilities	
Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	Yes, 10/1/2012
Builder's Plan	No
Capital Improvement Plan	Yes, 3/20/2017
City Emergency Operations Plan	Yes, 10/1/2012
County Emergency Operations Plan	Yes, 10/1/2012
Local Recovery Plan	Yes, 10/1/2012
County Recovery Plan	Yes, 10/1/2012
City Mitigation Plan	Yes, 10/1/2012
County Mitigation Plan	Yes, 10/1/2012
Debris Management Plan	Yes, 12/1/2016
Economic Development Plan	Yes, 8/15/2016 need copy
Transportation Plan	Yes, 2016
Land-use Plan	Yes, 2008
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	Yes, 2013, need copy
Firewise or other fire mitigation plan	N/A
Critical Facilities Plan (Mitigation/Response/Recovery)	Yes, 10/1/2012

Policies/Ordinance	
Zoning Ordinance	Yes
Building Code	Version: 2015
Floodplain Ordinance	Yes, 2014
Subdivision Ordinance	Yes
Tree Trimming Ordinance	Yes
Nuisance Ordinance	Yes
Storm Water Ordinance	Yes
Drainage Ordinance	Yes
Site Plan Review Requirements	Yes
Historic Preservation Ordinance	Yes
Landscape Ordinance	Yes
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	Yes
Hazard Awareness Program	Yes
National Flood Insurance Program	Yes, CID: 290283
Community Rating System (CRS) program under the National Flood Insurance Program (NFIP)?	N/A
National Weather Service (NWS) Storm Ready Certification	Yes
Firewise Community Certification	N/A
Building Code Effectiveness Grading (BCEGs)	Class 9
ISO Fire Rating	Rating: 3
Economic Development Program	Yes
Land Use Program	Yes
Public Education/Awareness	Yes
Property Acquisition	No
Planning/Zoning Boards	Yes
Stream Maintenance Program	Yes
Tree Trimming Program	Yes
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	Yes, need copy
Hazard Analysis/Risk Assessment (County)	Yes, need copy
Evacuation Route Map	Yes
Critical Facilities Inventory	Yes, need copy
Vulnerable Population Inventory	No
Land Use Map	Yes, need copy

Staff/Department	
Building Code Official	Yes, FT
Building Inspector	Yes, FT
Mapping Specialist (GIS)	Yes, PT
Engineer	Yes, Contract
Development Planner	Yes, FT
Public Works Official	Yes, FT
Emergency Management Coordinator	Yes, PT
NFIP Floodplain Administrator	Yes, PT
Bomb and/or Arson Squad	Bomb-- No Arson-- Yes
Emergency Response Team	Yes, FT
Hazardous Materials Expert	Yes, FT
Local Emergency Planning Committee	Yes, PT
County Emergency Management Commission	Yes, PT
Sanitation Department	Yes, FT
Transportation Department	Yes, FT
Economic Development Department	Yes, PT
Housing Department	Yes, FT
Historic Preservation	Yes, PT
Non-Governmental Organizations (NGOs)	
American Red Cross	Yes
Salvation Army	Yes
Veterans Groups	Yes
Local Environmental Organization	Yes
Homeowner Associations	Yes
Neighborhood Associations	Yes
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, etc.	Yes
Financial Resources	
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	Yes
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activities	Yes
Withhold spending in hazard prone areas	Yes

2.2.6 City of Smithton

The City of Smithton is located to the east of Sedalia, just off of Highway 50. Smithton has seen its population increase by 8.9% since 2000, according to the U.S. Census Bureau. A mayor and city council make up the local government in Smithton.

- One outdoor warning siren
- FEMA approved storm shelter
- Zoning ordinance
- Floodplain ordinance
- Planning/Zoning boards

The City of Smithton's population of 65 and older accounts for 8.4% of the total population. Housing structures built in 1939 and before account for 19.5% of the total, with 9.5% of the housing structures being mobile homes.

Table 2.12 is based on the Data Collection Questionnaire received from jurisdiction.

City of Smithton Mitigation Capabilities	
Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	Yes
Builder's Plan	Yes
Capital Improvement Plan	Yes
City Emergency Operations Plan	No
County Emergency Operations Plan	N/A
Local Recovery Plan	No
County Recovery Plan	N/A
City Mitigation Plan	Yes
County Mitigation Plan	Yes
Debris Management Plan	No
Economic Development Plan	No
Transportation Plan	No
Land-use Plan	Yes
Flood Mitigation Assistance (FMA) Plan	Yes 1997
Watershed Plan	No
Firewise or other fire mitigation plan	No
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	Yes
Building Code	No
Floodplain Ordinance	Yes
Subdivision Ordinance	Yes
Tree Trimming Ordinance	No
Nuisance Ordinance	Yes
Storm Water Ordinance	No
Drainage Ordinance	No
Site Plan Review Requirements	Yes
Historic Preservation Ordinance	No
Landscape Ordinance	Yes

Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	Yes
Hazard Awareness Program	No
National Flood Insurance Program	Yes
Community Rating System (CRS) program under the National Flood Insurance Program (NFIP)?	Yes, 10, PW error, was 6
National Weather Service (NWS) Storm Ready Certification	No
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	N/A
Economic Development Program	No
Land Use Program	Yes
Public Education/Awareness	No
Property Acquisition	Yes
Planning/Zoning Boards	Yes
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	Yes, need copy
Mutual Aid Agreements	No
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (City)	No
Hazard Analysis/Risk Assessment (County)	N/A
Evacuation Route Map	No
Critical Facilities Inventory	No
Vulnerable Population Inventory	No
Land Use Map	Yes, need copy
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	Yes, FT
Emergency Management Coordinator	Yes, PT
NFIP Floodplain Administrator	Yes, PT
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	No
County Emergency Management Commission	No
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	No
Historic Preservation	No

Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	No
Local Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.	No
Financial Resources	
Apply for Community Development Block Grants	Yes
Fund projects thru Capital Improvements funding	Yes
Authority to levy taxes for specific purposes	No
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

2.2.7 Special Districts

Sewer and Water Facilities

Table 2.14

Pettis County Water/Sewer Facilities		
Jurisdiction	**Municipal Water**	**Municipal Sewer**
Green Ridge	Yes	Yes
Houstonia	No	Yes
Hughesville	No	Yes
La Monte	Yes	Yes
Sedalia	Yes	Yes
Smithton	No	Yes

Source: Data Collection Questionnaires, 2018

Pettis County has one public water and sewer district that is shared among parts of Johnson, Pettis, and Saline counties. This district coves roughly the northwest quarter of Pettis County. The county continues to improve its ability to service residents and businesses with public water and sewer.

Electricity and Natural Gas

Electricity is provided to residents of Pettis County by one of four providers. The majority of Pettis County is covered by Kansas City Power & Light Greater Missouri Operations (KCP&L GMO) and KCP&L, the remaining areas are covered by Union cooperative with a small section covered by Ameren UE.

Solid Waste Disposal

Solid waste disposal in Pettis County is collected by either WCA Waste Corporation or Ditzfeld Container & Trash Service. Solid waste is then transported to the Central Missouri Landfill, located near Sedalia, MO.

Law Enforcement

The Pettis County Sheriffs' department, led by Sheriff Kevin Bond, is responsible for law enforcement at the county level and works with communities that lack the resources for their own police department. Jurisdictions that employ their own police department are Sedalia, La Monte, Green Ridge, and Smithton.

Emergency Medical Services

Emergency medical services in Pettis County are provided by Pettis County Ambulance District. The Pettis County Ambulance District covers all of Pettis County and employs about 70 professionals and operates 11 ambulances from three stations across Pettis County.

Fire Protection

Fire Protection for Pettis County is provided by seven departments, some funded by due and other funded by collected taxes.

Departments funded through a tax are:

- Pettis County Fire Protection District (6 stations)
- Sedalia Fire
- La Monte Fire

Departments funded through dues include:

- Green Ridge
- Houstonia
- Hughesville
- Lake Creek

Table 2.15

Pettis County Fire Protection District Stations	
Station Number	**Address**
1	1601 Clarendon Rd, Sedalia
2	5600 McVey, Sedalia
3	Hwy BB, Longwood
4	Hwy O, Beaman
5	23739 Hwy V, Sedalia
6	28013 kemp Rd., Sedalia

Source: pettiscofire.com, 2018

Emergency Services (E-911)

E-911 service calls in Pettis County are received by the Pettis County Sheriff's Office 9-1-1 Center. The Pettis County Sheriff's Office 9-1-1 Center is the Public Safety Answering Point (PSAP) for Pettis County Missouri. The Pettis County Sheriff's Office 9-1-1 Center provide emergency dispatch services for all of Pettis County, Missouri, outside the city limits of Sedalia. Sedalia services are dispatched through the City of Sedalia Operations Support Bureau.

The Pettis County Sheriff's Office 9-1-1 Center dispatch's for the following law enforcement and fire department agencies:

- Pettis County Sheriff's Office
- Green Ridge Police Department
- La Monte Police Department
- Missouri State Highway Patrol – Local Pettis County Troopers
- Smithton Police Department
- Pettis County Fire Department
- Green Ridge Fire Department
- Houstonia Fire Department
- Hughesville Fire Department
- Lake Creek Fire Department
- La Monte Fire Department
- Smithton Fire Department

2.2.8 Public School Profiles and Mitigation Capabilities

Table 2.16

School District: Green Ridge R-VIII		
Building Name	**Address**	**Enrollment**
Green Ridge High	401 W Pettis St., Green Ridge	181
Green Ridge Elementary	401 W Pettis St., Green Ridge	187

Source: School data questionnaire, mcds.dese.mo.gov

Table 2.17

School District: La Monte R-IV		
Building Name	**Address**	**Enrollment**
La Monte High	301 S. Washington, La Monte	129
La Monte Elementary	201 S. Washington, La Monte	177

Source: School data questionnaire, mcds.dese.mo.gov

Table 2.18

School District: Pettis Co. R-V		
Building Name	**Address**	**Enrollment**
Northwest High	16215 Highway H, Hughesville	164
Northwest Elementary	407 W Tuck, Houstonia	153

Source: School data questionnaire, mcds.dese.mo.gov

Table 2.19

School District: Pettis Co. R-XII		
Building Name	**Address**	**Enrollment**
Pettis Co. R-XII Elementary	22675 Depot Road, Sedalia	114

Source: School data questionnaire, mcds.dese.mo.gov

Table 2.20

School District: Sedalia 200		
Building Name	**Address**	**Enrollment**
Smith-Cotton High	2010 Tiger Pride Boulevard, Sedalia	1478
Smith-Cotton Junior High	312 East Broadway, Sedalia	1131
Sedalia Middle School	2205 S Ingram, Sedalia	384
Heber Hunt Elementary	600 S Warren, Sedalia	413
Parkview Elementary	1901 S New York, Sedalia	468
Horace Mann Elementary	1100 W 16th, Sedalia	260
Skyline Elementary	2505 W 32nd St., Sedalia	489
Washington Elementary	610 S Engineer, Sedalia	199
Early Childhood Center	2255 S Ingram, Sedalia	226

Source: School data questionnaire, mcds.dese.mo.gov

Table 2.21

School District: Smithton R-VI		
Building Name	**Bldg Address**	**Bldg Enrollment**
Smithton High	505 S Myrtle, Smithton	250
Smithton Elementary	506 S Myrtle, Smithton	294

Figure 2.3 – Pettis County School Districts

Pettis County School Districts

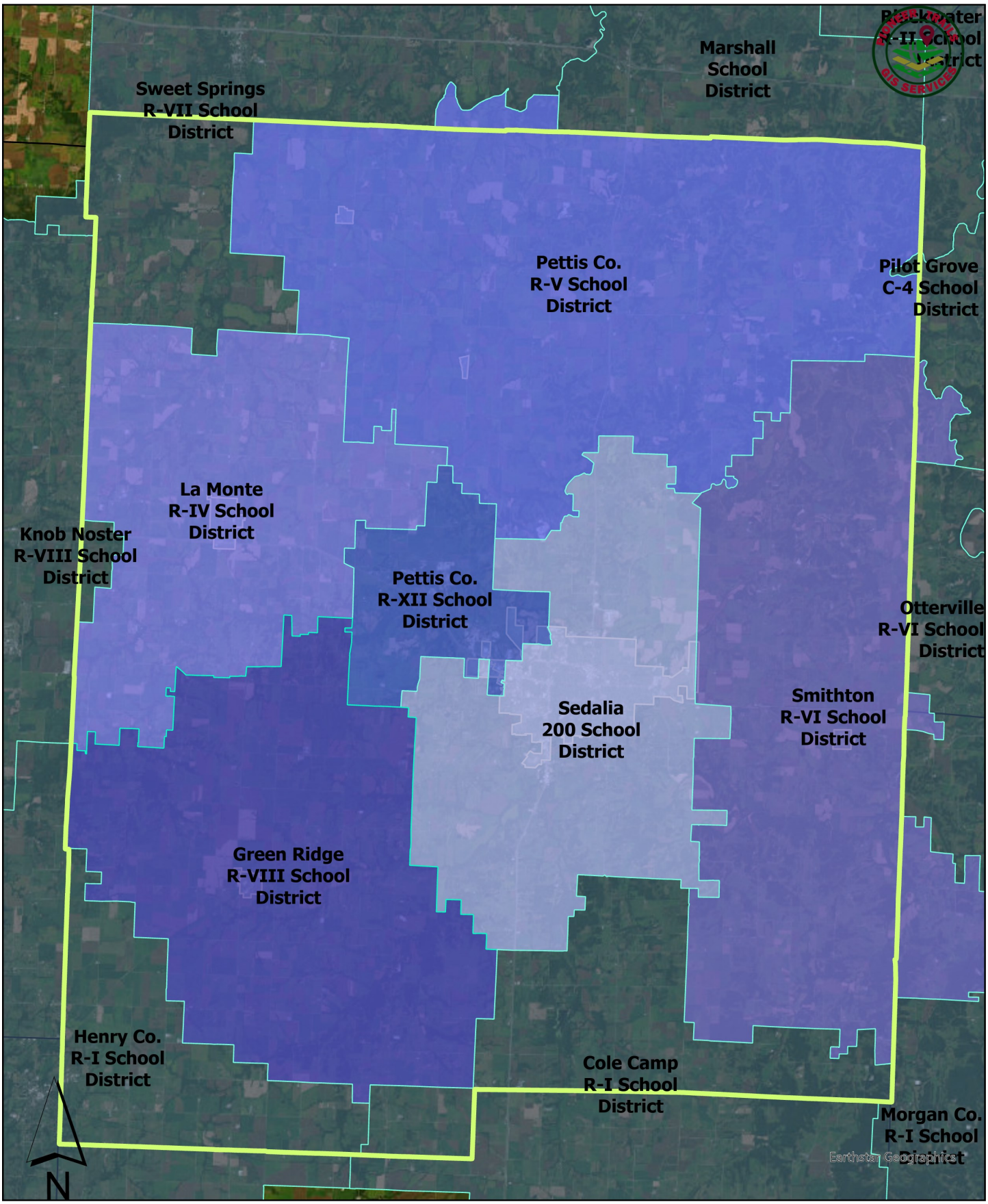


Table 2.22

Summary of Pettis County School District Capabilities						
Capability	**Green Ridge R-VIII**	**La Monte R-IV**	**Pettis Co. R-V**	**Pettis Co. R-XII**	**Sedalia 200**	**Smithton R-VI**
Planning Elements						
Master Plan			No			
Capital Improvement Plan	No, in progress	No	No	No		No
School Emergency Plan	Yes, 2016	Yes, 2016	Yes	Yes		Yes
Shelter in place protocols	Yes		Yes	Yes		Yes
Evacuation protocols	Yes	Yes, 2016	Yes	Yes		Yes
Weapons Policy	Yes, 2017	Yes, 2016	Yes	Yes		Yes
Personnel Resources						
Full-time building official (i.e. Principal)	Yes	Yes	Yes	Yes		Yes
Emergency Manager	Yes	Yes	No	No		No
Grant Writer	No	No	No	No		No
Public Information Officer	Yes	No	No	No		No
Financial Resources						
Capital improvements project funding	Yes	No	No	Yes		No
Local funds	Yes	No	Yes	Yes		No
General obligation bonds	Yes	No	No	No		No
Special tax bonds	Yes	No	No	No		No
Private activities/donations	Yes	No	No	Yes		No
State and federal funds	Yes	No	Yes	Yes		No
Additional Capabilities						
Public Address/Emergency Alert System	Yes	Yes	No	Yes	Yes	Yes
NOAA weather radio in buildings?	Yes	Yes	Yes	Yes	Yes	Yes
FEMA Tornado Shelter/Saferoom	Yes	Yes	Yes	Yes	Yes	Yes
Campus police/Resource Officer	No	No	No	No	Yes	No

Source: School data questionnaire, 2018

3 RISK ASSESSMENTS

3 RISK ASSESSMENT

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

This is an update of the Pettis County Hazard Mitigation Plan adopted in February 2019. According to the U.S. Census Bureau 2022 ACS 5-year population estimates, the population of Pettis Count increased from 42,201 in 2010 to 43,059 at the time of the 2022 population estimate.

Since 2019, Pettis County has remained a class 4 county in Missouri. According to Missouri Revised statutes (RSMO 48.020), "All counties which have attained the second classification prior to August 13, 1988, and which would otherwise return to the third classification after August 13, 1988, because of changes in assessed valuation shall remain a county in the second classification and shall operate under the laws of this state applying to the second classification.."

This chapter is divided into four main parts:

Section 3.1 Hazard Identification- identifies the hazards that threaten the planning area and provides a factual basis for elimination of hazards from further consideration;

Section 3.2 Assets at Risk- provides the planning area's total exposure to natural hazards, considering critical facilities and other community assets at risk;

Section 3.3 Future Land Use and Development- discusses areas of planned future development

Section 3.4 Hazard Profiles and Vulnerability Analysis- provides more detailed information about the hazards impacting the planning area.

For each hazard, there are three sections:

1) Hazard Profile provides a general description and discusses the threat to the planning area, the geographic location at risk, potential severity/magnitude/extent, previous occurrences of hazard events, probability of future occurrence, risk summary by jurisdiction, impact of future development on the risk;
2) Vulnerability Assessment further defines and quantifies populations, buildings, critical facilities, and other community/school or special district assets at risk to natural hazards;
3) Problem Statement briefly summarizes the problem and develops possible solutions.

3.1 Hazard Identification

The Plan profiles all natural hazards that can affect Pettis County. The natural hazards that can affect the county have been identified in the 2019 Pettis County Plan and the 2018 Missouri State Plan. Natural hazards are naturally occurring climatological, hydrological or geologic events that have a negative effect on people and the built environment. Natural hazards identified in the 2011 Pettis County Plan included:

- Dam Failure
- Drought
- Earthquakes
- Extreme Heat
- Wildfire
- Flooding (Flash and River)
- Land Subsidence/ Sinkholes
- Thunderstorm/High Winds/Lightning/Hail
- Tornado
- Winter Weather/Snow/Ice/Sever Cold

No new natural hazards have been identified since the adoption of the previous plan. The 2013 Missouri State Plan combines severe cold from severe winter weather hazard and heatwave into an extreme temperature hazard. The Plan will follow the 2013 Missouri State Plan and incorporate this change. The 2013 Missouri State Plan also addresses human-caused and technological hazards; however, these will not be included in this plan update.

3.1.1 Review of Existing Mitigation Plans

In Missouri, local plans customarily include only natural hazards, as only natural hazards are required by federal regulations to be included. The MPC was informed that they may decide to include technological hazards and human-caused threats in the plan, although this is not required by federal regulations. The MPC determined to include only natural hazards. The MPC agreed that human-caused and technological hazards are addressed in a Regional Homeland Security Oversight Committee (RHSOC) Threat and Hazard Identification Risk Assessment (THIRA) and that including only natural hazards would meet the needs of local entities participating in the plan update.

3.1.2 Review of Disaster Declaration History

From 1990 to present, Pettis County has experienced severe storms, tornadoes, flooding, an ice storm and severe winter storms. All of these natural hazard events triggered federal 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. If the disaster is so severe that both the local and state governments' capacities are exceeded; a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

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

Table 3.1

FEMA Disaster Declarations that include Pettis County, Missouri, 1990-Present			
Disaster Number	**Description**	**Declaration Date/Incident Period**	**Individual Assistance (IA) / Public Assistance (PA)**
4490	Biological	26 March, 2020	PA
3482	Biological	13 March, 2020	PA
4238	Severe storms, tornadoes, straight-line winds, & flooding	7 August, 2015	PA
1980	Severe storms, tornadoes & flooding	9-May-11	IA / PA
1961	Severe winter storm & snowstorm	23 March 2011 / 31 Jan-5 Feb 2011	PA
1773	Severe storms & flooding	25 June 2008 / 1 June-13 Aug 2008	PA
1635	Severe storms, tornadoes & flooding	5 April 2006 / 30 Mar-3 April 2006	IA / PA
1631	Severe storms, tornadoes & flooding	16 March 2006 / 8 Mar-13 Mar 2006	IA / PA
1403	Ice storm	6 February / 29 Jan-13 Feb 2002	IA / PA
995	Flooding & severe storm	9 July 1993 / 10 June-25 Oct 1993	IA / PA

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

3.1.3 Additional Research Sources

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

The additional sources of data on locations and past impacts of hazards in Pettis County include:

- Missouri Hazard Mitigation Plans (2013 and 2018)
- Pettis County Hazard Mitigation Plan (2019)
- Federal Emergency Management Agency (FEMA)
- Missouri Department of Natural Resources (MDNR)
- National Drought Mitigation Center Drought Reporter
- US Department of Agriculture's (USDA) Risk Management Agency Crop Insurance
- Statistics
- National Agricultural Statistics Service

- Data Collection Questionnaires completed by each jurisdiction.
- State of Missouri GIS data
- Environmental Protection Agency
- Flood Insurance Administration
- Hazards US (HAZUS)
- Missouri Department of Transportation
- Missouri Division of Fire Marshal Safety
- Missouri Public Service Commission
- National Fire Incident Reporting System (NFIRS)
- National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCIE);
- Pipeline and Hazardous Materials Safety Administration
- County and local Comprehensive Plans to the extent available
- County Emergency Management
- County Flood Insurance Rate Map, FEMA
- Flood Insurance Study, FEMA
- SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin 3.7
- U.S. Army Corps of Engineers
- U.S. Department of Transportation
- United States Geological Survey (USGS)
- Various articles and publications available on the internet
    - U.S. Army Corps of Engineers
    - U.S. Department of Transportation
    - United States Geological Survey (USGS)
    - Various articles and publications available on the internet

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 August 2017, 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. Note that injuries and deaths caused by a storm event are reported on an area-wide basis. When reviewing a table resulting from an NCEI search by county, the death or injury listed in connection with that county search did not necessarily occur in that county.

3.1.4 Hazards Identified

The natural hazards that can possibly or have affected Pettis County are profiled below. All hazards do not affect every jurisdiction participating in the Plan. Table 3.2 provides a summary of the jurisdictions that may be affected by each hazard. An "**X**" in the table indicates that jurisdictions are affected by the hazard, and a "**-**" indicates the hazard is not applicable to that jurisdiction.

Table 3.2

Hazards Identified for Each Jurisdiction										
Jurisdiction	**Flooding (Flash & Ravine)**	**Severe Thunderstorms**	**Tornadoes**	**Severe Winter Weather**	**Extreme Temperatures**	**Drought**	**Earthquake**	**Wildfire**	**Land Subsidence / Sinkholes**	**Dam Failure**
Unincorporated Pettis Co	X	X	X	X	X	X	X	X	X	X
City of Green Ridge	X	X	X	X	X	X	X	X	-	-
Town of Houstonia	X	X	X	X	X	X	X	X	-	-
Village of Hughesville	X	X	X	X	X	X	X	X	-	-
City of La Monte	X	X	X	X	X	X	X	X	-	-
City of Sedalia	X	X	X	X	X	X	X	X	X	-
City of Smithton	X	X	X	X	X	X	X	X	-	-
Pettis Co. R-V	X	X	X	X	X	-	X	X	-	-
Green Ridge R-VIII	X	X	X	X	X	-	X	X	-	-
Sedalia 200	X	X	X	X	X	-	X	X	-	-
Pettis Co. R-XII	X	X	X	X	X	-	X	X	-	-
La Monte R-IV	X	X	X	X	X	-	X	X	-	-

3.1.5 Multi-Jurisdictional Risk Assessment

The risk assessment assesses each participating jurisdiction's vulnerability to each hazard that can affect the planning area. Many of the hazards identified in the risk assessment have the same probability of occurrence throughout the planning area. The hazards that vary across the planning area in terms of risk include dam failure, flood, and wildland fire. These differences are detailed in each hazard profile under geographic location and vulnerability.

Pettis County's climate is mostly uniform. With an average population increase of about 2.03%, since 2010, building construction within urban areas has increased as well. Population estimates show that Pettis County is growing and should continue to in the future. Growth management will need to be utilized in urban areas. Growth mitigation capabilities of each jurisdiction are profiled in section 2.2.1.

Naturally, the urbanized areas of Pettis County have a greater density of important assets, which are more vulnerable to weather-related hazards. This increase in vulnerability, however, can be mitigated through updated building codes and code enforcement as well as land use planning. These capabilities and resources to mitigate the impact of natural hazards vary across jurisdictions in the planning area. These differences will be discussed in greater detail in the vulnerability sections of each hazard.

3.2 Assets at Risk

This section assesses the planning area population, structures, critical facilities and infrastructure, and other important assets that may be at risk to hazards. The inventory of assets for each jurisdiction were derived from parcel data from the Pettis County Assessor, the Pettis County Structures dataset downloaded from Missouri Spatial Data information Service (MSDIS), local jurisdiction data collection questionnaires, and HAZUS MH 2.2. Minimal development has occurred in Pettis County since the previous update.

3.2.1 Total Exposure of Population and Structures

Unincorporated County and Incorporated Cities

In the following three tables, population data is based on 2022 ACS 5-year estimate data. Building counts and building exposure values are based on parcel data provided by the Pettis County Assessor. Contents exposure values were calculated by factoring a multiplier to the building exposure values based on usage type. The multipliers were derived from the HAZUS MH 2.1 and are defined below in Table 3.3. Land values have been purposely excluded from consideration because land remains following disasters, and subsequent market devaluations are frequently short term and difficult to quantify. Another reason for excluding land values is that state and federal disaster assistance programs generally do not address loss of land (other than crop insurance). It should be noted that the total valuation of buildings is based on county assessors' data which may not be current. In addition, government owned properties are usually taxed differently or not at all, and so may not be an accurate representation of true value. Note that public school district assets and special districts assets are included in the 3.10 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. Finally, Table 3.5 provides the building count total for the county and each city in the planning area broken out by building usage types (residential, commercial, industrial, and agricultural).

Table 3.3

Maximum Population & Parcel Exposure by Jurisdiction					
Jurisdiction	**2016 Population ACS Est.**	**Parcel Count**	**Parcel Exposure ($)**	**Contents Exposure ($)**	**Total Exposure ($)**
Pettis County (Unincorporated)	18,130	15,097	$838,534,770	$495,912,200	$1,334,446,970
Green Ridge	498	246	$10,067,170	$5,554,105	$15,621,275
Houstonia	221	145	$3,976,750	$1,667,160	$5,643,910
Hughesville	184	109	$3,827,120	$2,133,270	$5,960,390
La Monte	1,131	493	$19,296,970	$12,193,260	$31,490,230
Sedalia	21,489	10,234	$628,913,520	$523,592,545	$1,152,506,065
Pettis County Totals	**41,653**	**26,324**	**1,504,616,300**	**1,041,052,540**	**2,545,668,840**

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

Parcel Values/Exposure by Usage Type				
Jurisdiction	**Residential ($)**	**Commercial ($)**	**Agriculture ($)**	**Total Exposures**
Pettis County (Unincorporated)	$752,201,890	$79,684,790	$190,305,550	$1,022,192,230
Green Ridge	$9,910,380	$883,140	$21,310	$10,814,830
Houstonia	$3,165,800	$72,970	$11,290	$3,250,060
Hughesville	$3,961,100	$149,480	$3,240	$4,113,820
La Monte	$19,207,700	$2,416,950	$172,460	$21,797,110
Sedalia	$536,370,650	$254,601,810	$805,410	$791,777,870
Pettis County Totals	**1,324,817,520**	**337,809,140**	**191,319,260**	**1,853,945,920**

Source: Parcel Count and Parcel Exposure, Pettis County Assessor's Office Database

Table 3.5

Parcel Count by Usage Type				
Jurisdiction	**Residential**	**Commercial**	**Agricultural**	**Total**
Pettis County (Unincorporated)	7,612	420	7,065	15,097
Green Ridge	218	18	10	246
Houstonia	136	6	3	145
Hughesville	99	9	1	109
La Monte	423	50	20	493
Sedalia	9,107	1,049	78	10,234
Pettis County Totals	**17,595**	**1,552**	**7,177**	**26,324**

Source: Parcel Count and Parcel Exposure, Pettis County Assessor's Office Database

Even though schools and special districts' total assets are included in the tables above, additional discussion is needed, based on the data that is available from the districts' completion of the Data Collection Questionnaire and district maintained websites. The number of enrolled students at the participating public school districts is provided in Table 3.6 below. Additional information includes the number of buildings, building values (building exposure) and contents value (contents exposure). These numbers will represent the total enrollment and building count for the public school districts regardless of the county in which they are located. Not all questionnaires received had completed information. Questionnaires can be found in appendix E.

Table 3.6

School District Enrollment and Building Exposure					
School District	**Enrolment**	**Building Count**	**Building Exposure ($)**	**Contents Exposure ($)**	**Total Exposure ($)**
Green Ridge R-VIII	368	2	13,549,296	2,277,079	15,826,375
La Monte R-IV	306	2	17,302,235	1,938,267	19,240,502
Pettis Co. R-V	317	2	13,203,782	2,741,728	16,044,510
Pettis Co. R-XII	114	1	8,209,501	1,647,931	9,857,432
Sedalia 200	5,048	9	253,599,932	24,247,825	278,037,757
Smithton R-VI	544	2	19,337,718	3,450,629	22,788,347

Source: apps.dese.mo.gov; Data Questionnaires 2023

3.2.2 Critical and Essential Facilities and Infrastructure

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

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

Table 3.7 includes a summary of the inventory of critical and essential facilities and infrastructure in the planning area. The list was compiled from the Data Collection Questionnaire as well as other internet-based publications. Questionnaires can be found in appendix E.

Table 3.7

Inventory of Critical/Essential Facilities & Infrastructure by Jurisdiction																					
Jurisdiction	**Airport**	**Bus Facility**	**Communications Tower**	**Electric Power Facility**	**Emergency Operations**	**Fire Service**	**Government**	**Housing**	**Shelters**	**Hwy. Bridge**	**Hospital/Health Care**	**Military**	**Natural Gas Facility**	**Nursing Home**	**Police Station**	**Potable Water Facility**	**Rail**	**Sanitary Pump Stations**	**School Facilities**	**Storm water Pump Stations**	**Tier II Chemical Facility**	**Wastewater Facility**
Pettis County	--	X	--	--	--	X	X	--	--	--	--	--	--	--	X	--	--	--	X	X	--	--
Green Ridge	--	--	--	--	--	X	X	--	--	X	--	--	X	--	X	--	--	X	X	--	--	X
Houstonia	--	--	--	--	--	X	X	--	--	--	--	--	--	--	--	--	--	X	X	--	--	X
Hughesville	--	--	--	--	--	X	X	--		--	--	--	--	--	--	--	--		X			
La Monte	--	--	--	--	--	X	X	--	--	--	--	--	--	--		--	--		X			
Sedalia	X	X	X		X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X
Smithton					X	X	X												X			
Totals	**1**	**2**	**1**		**2**	**7**	**7**	**1**	**1**	**2**	**1**		**2**	**1**	**3**		**1**	**2**	**7**	**2**	**1**	**2**

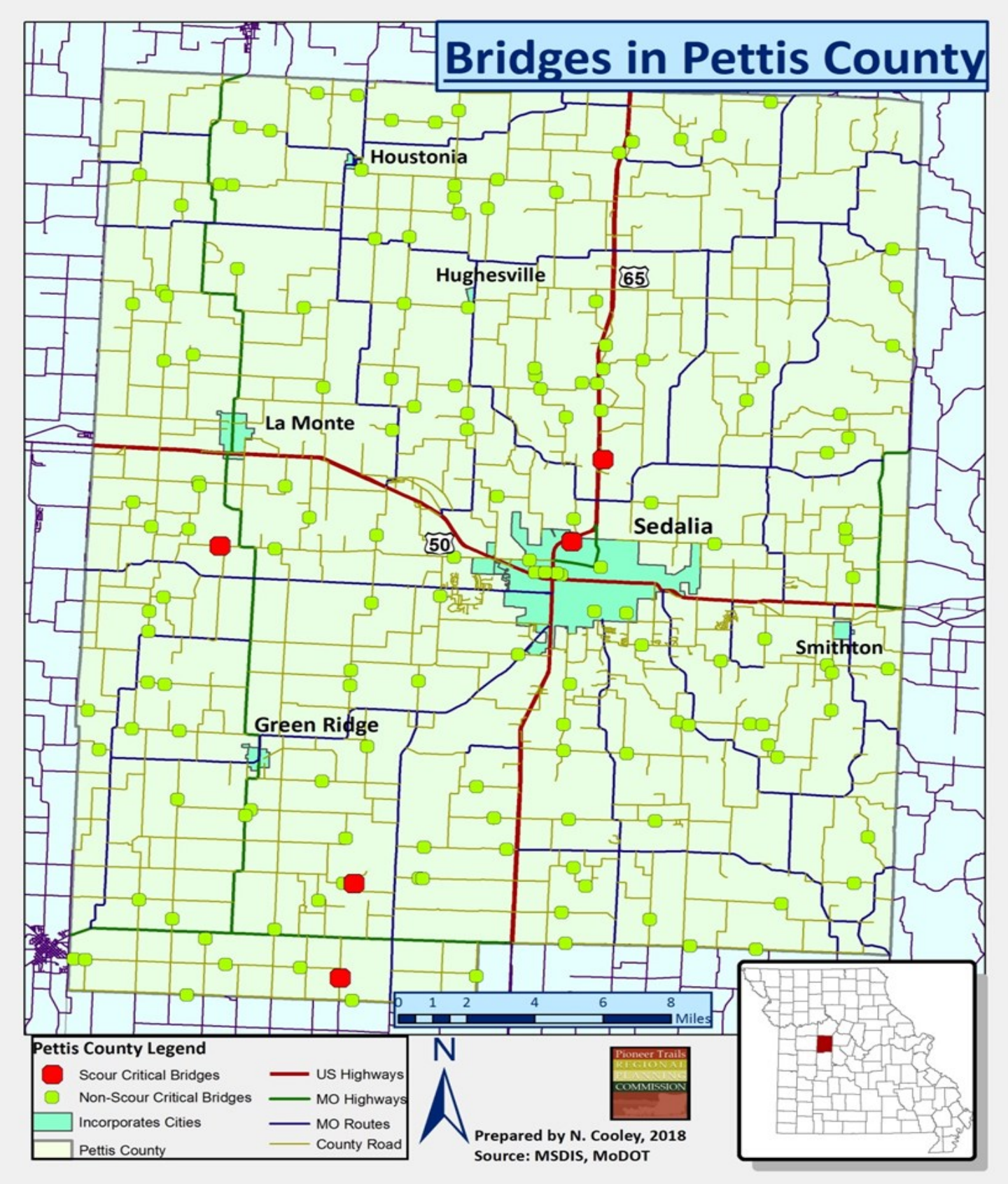
Pettis County has numerus bridges throughout the county with a total count of 238 bridges. In the county there are 25 poor rated bridges with a total of 53 bridges being designated as being structurally deficient. Table 3.8 gives more information on bridges in Pettis County. Figure 3.1 displays the locations of the bridges in Pettis County.

Table 3.8

Bridges of Pettis County					
	Total	Good Rating	Fair Rating	Poor Rated	Structurally Deficient
Pettis County	238	104	109	25	53 (22.3%)

Structurally Deficient (SD): This term was previously defined in https://www.fhwa.dot.gov/bridge/0650dsup.cfm as having a condition rating of 4 or less for Item 58 (Deck), Item 59 (Superstructure), Item 60 (Substructure), or Item 62 (Culvert), OR having an appraisal rating of 2 or less for Item 67 (Structural Condition) or Item 71 (Waterway Adequacy) *Beginning with the 2018 data archive*, this term will be defined in accordance with the Pavement and Bridge Condition Performance Measures final rule, published in January of 2017, as a classification given to a bridge which has any component [Item 58, 59, 60, or 62] in Poor or worse condition [code of 4 or less].

Figure 3.1


Bridges in Pettis County
Houstonia
Hughesville
65
La Monte
Sedalia
50
Smithton
Green Ridge
0 1 2 4 6 8
Miles
N
Pettis County Legend
Scour Critical Bridges
Non-Scour Critical Bridges
Incorporates Cities
Pettis County
US Highways
MO Highways
MO Routes
County Road
Pioneer Trails
REGIONAL
PLANNING
COMMISSION
Prepared by N. Cooley, 2018
Source: MSDIS, MoDOT

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 damage is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- The presence of natural resources can reduce the impacts of future natural hazards, such as wetlands and riparian habitats which help absorb floodwaters.
- Losses to economic assets like these (e.g., major employers or primary economic sectors) could have severe impacts on a community and its ability to recover from disaster.

Threatened and Endangered Species:

Table 3.9 shows Federally Threatened, Endangered, Proposed and Candidate Species in the county.

Table 3.9

Endangered/Threatened Species in Pettis County		
Common Name	**Scientific Name**	**Status**
Gray Bat	Myotis grisescens	Endangered
Indiana Bat	Myotis sodalis	Endangered
Northern Long-eared Bat	Myotis septentrionalis	Threatened
Mead's Milkweed	Asclpias meadii	Threatened

Source: https://ecos.fws.gov/ipac/location/WHPFTFXKZFBFRPAAPTDGQGGIE4/resources#endangered-species

Natural Resources:

The Missouri Department of Conservation (MDC) provides a database of lands the MDC owns, leases, or manages for public use. Table 3.10 provides the names and locations of parks and conservation areas in the planning area.

Table 3.10

Conservation Areas in Pettis County		
Conservation Area Name	**Address**	**Closest City**
Bothwell Lodge SHS	19349 Bothwell State Park Road	Sedalia
Perry Memorial CA	NE 1200 Rd JOCO	Concordia
Pinhook Access	Pin Hood Rd	Sedalia
State Fair Grounds	HWY 65 & 16th Street	Sedalia
J. N. Turkey Kearn Memorial Wildlife Area	SE 1201 Rd JOCO	Green Ridge
Hartwell CA	Route AA	Green Ridge
Burns Tract	Hope Dale Rd	Green Ridge
W. R. Kearn Memorial CA	S Hope Dale Rd	Green Ridge
Bryson's Hope CA	S Hope Dale Rd	Green Ridge
Grandfather Prairie CA	W Mather Rd	Sedalia
Friendlt Prairie CA	W Manila Rd	Sedalia
Paint Brush Paririe CA	E Manila Rd	Sedalia
Drovers Prairie CA	S Hoffman Rd	Sedalia
Kahrs-Boger Park	S Route M	Sedalia
Parks in Pettis County		
Park Name	**Address**	**Jurisdiction**
Liberty Park	3rd Street and HWY 65	Sedalia
Centennial Park	16th Street & New York	Sedalia
Housel Park	Howard and Hurley streets	Sedalia
Hubbard Park	Johnson and Missouri streets	Sedalia
Kata Park	24th Street and Grand	Sedalia
Vermont Park	Vermont and 14th Street	Sedalia
Clover Dell Park	West 32nd Street	Sedalia

Historic Resources:

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

Properties in Pettis County listed in the National Register of Historic Places are listed in Table 3.11

Table 3.11

National Register of Historic Places in Pettis County		
Property	**Location**	**Date Listed**
Bois d'Arc Cooperative Dairy Farm Historic District	Hughesville vicinity	9/27/1991
Building at 217 W Main Street	W Main St, Sedalia	10/24/1996
G and G Veterinary Hospital	W Main St, Sedalia	4/15/2011
Gentry, William H., House	Sedalia vicinity	11/14/1997
Harris House	W 6th St, Sedalia	7/10/1979
Heard, John T. and Lillian, House	W Broadway, Sedalia	4/15/2011
Hillview Cooperative Dairy Farm Historic District	Hughesville vicinity	9/27/1991
Hotel Bothwell	E 4th St., Sedalia	9/8/1989
Hubbard, C. C., High School	N Osage Ave., Sedalia	7/3/1997
Jones, Henry, Farmstead	Sedalia vicinity	12/3/2008
McVey School	Sedalia vicinity	10/14/1999
Missouri, Kansas and Texas Railroad Depot	E 3rd St., Sedalia	3/28/1979
Missouri/Sedalia Trust Co.	S Ohio, Sedalia	3/29/1983
Missouri State Fairgrounds Historic District	Sedalia	6/28/1991
Osage Farms Type 315:13 Government Farmhouse	Hughesville vicinity	9/27/1991
Osage Farms Unit No. 1 Historic District	Hughesville vicinity	9/27/1991
Osage Farms Unit No. 25 Historic District	Hughesville vicinity	9/27/1991
Osage Farms Unit No. 26 Historic District	Hughesville vicinity	9/27/1991
Osage Farms Unit No. 30 Historic District	Hughesville vicinity	9/27/1991
Osage Farms Unit No. 31 Historic District	Hughesville vicinity	9/27/1991
Osage Farms Unit No. 41 Historic District	Houstonia vicinity	9/27/1991
Osage Farms Unit No. 43 Historic District	Hughesville vicinity	9/27/1991
Osage Farms Unit No. 5 and No. 6 Historic District	Houstonia vicinity	9/27/1991
Osage Farms Unit No. 8 and No. 9 Historic District	Houstonia vicinity	9/27/1991
Sedalia Commercial Historic District	Sedalia	updated 2/14/17
Sedalia Public Library	Sedalia	1/10/1980
Thomson, Gen. David, House	Hughesville vicinity	10/4/1982
Yount, Thomas & Mildred, House	Sedalia	12/12/2022

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

Economic Resources:

Table 3.12 shows major non-government employers in the planning area.

Table 3.12

Major Non-Government Employers in Pettis County	
Employer Name	**Average Employees**
Tyson Foods	1000+
Sedalia 200 School District	500+
Bothwell Regional Health Center	500+
Waterloo Industries	250+
State Fair Community College	250+
Wal-Mart	250+
Duke Manufacturing	250+
Maxion Wheels	250+
Inter-State Studios	250+
Four Seasons Living Center	250+
Gardener Denver	250+
Fall River Health & Safety	100+
Center for Human Services	100+
WireCo World Group	100+
Pittsburgh Corning	100+
General Cable	100+
Woods Supermarket	100+
Menards	100+
Green Ridge School District	65+

Agriculture-Related Jobs in Pettis County:

Pettis county agriculture plays a big part in the county's economy. Pettis County was the number eleventh county in Missouri for Total Market Value sold in 2012. Pettis was also number six in the value of the livestock sold, with poultry and eggs making up about 69% of the revenue totaling an estimated $122,542,000 and crop sales, $54,467,000, making up the remaining 31%. **Table 3.13** shows more information on agriculture in Pettis County.

Table 3.13

Pettis County	2012	2017	% Change
Number of Farms	1,311	1,259	-3.97%
Land in Farms	419,697	389,329	-7.24%
Average Farm Size	320	309	-3.44%
Market Value of Products Sold ($)			
Crop Sales	54,467,000	84,855,000	55.79%
Livestock Sales	122,542,000	154,272,000	25.89%
Total	177,010,000	239,127,000	35.09%
Average per Farm	135,019	189,934	40.67%
Government Payments ($)			
Government Payments	5,117,000	5,057,000	-1.17%
Average Payment per Farm	7,661	9,524	24.32%

Source: https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/2/table/1/state/MO/county/159/year/2017/

3.3 Land Use and Development

3.3.1 Development since Previous Plan Update

Table 3.14

Pettis County Population 2010-2022 by Jurisdiction				
Jurisdiction	**2010 Pop**	**2022 ACS Pop**	**2010-2022 Change**	**2010-2022 % Change**
Pettis Co.- Unincorporated	18,225	18,817	592	3.25%
Green Ridge	476	535	59	12.39%
Houstonia	220	245	25	11.36%
Hughesville	183	152	-31	-16.94%
La Monte	1,140	1,029	-111	-9.74%
Sedalia	21,387	21,767	380	1.78%
Smithton	570	514	-56	-9.82%
Pettis Co. Total	42,201	43,059	858	2.03%

Source: U.S. Bureau of the Census, Decennial Census; 2022 ACS 5-year Estimates

Population growth or decline is generally accompanied by increases or decreases in the number of housing units. Increases in population add to the built environment and increase risk and exposure to hazard events, the same correlation can be found with a decline in population as well.

Table 3.15

Pettis County Change in Housing Units, 2010-2022				
Jurisdiction	**Housing units 2010**	**Housing units 2022 ACS**	**2010-2022 ACS # Change**	**2010-2022 ACS % Change**
Pettis County	18,249	18,562	313	1.72%
Green Ridge	194	214	20	10.31%
Houstonia	95	179	84	88.42%
Hughesville	75	67	-8	-10.67%
La Monte	456	415	-41	-8.99%
Sedalia	9,979	9,967	-12	-0.12%
Smithton	224	223	-1	-0.45%

Source: U.S. Census Bureau, 2022 ACS 5-year Estimates

Pettis County has seen an increase in population and in the number of housing units. There was only community that saw a fall in both population and housing units. Green Ridge, Hughesville and Smithton all saw housing units decline but the population rose. New development in Sedalia, a steel mill, will minimally increase the jurisdictions' vulnerability to identify assets.

City of Green Ridge

The City of Green Ridge is a rural community of about 535 residents, 2022 ACS estimate, an increase from 2010. While the Green Ridge population has grown, 12.3%, the number of housing units has increased by 10.31%. Minimal development has occurred since the last plan update.

City of Houstonia
The City of Houstonia is the second smallest community included in this plan, population 245, and has seen an increase in population and housing units. Although the 2022 ACS estimate shows a large increase in housing units, actual additional housing units is far less. With both of the previous factors increasing, development has been negligible despite any growth.

Village of Hughesville
The Village of Hughesville has an estimated population of 152, the largest decrease, 16.94% since 2010. Concurrently, the number of housing units has seen a slight decrease from 75 to 67. No new development has happened since the last plan.

City of La Monte
Since the 2010 census, the City of La Monte, the second largest jurisdiction, has experienced a population decrease of almost 10%, from 1140 to 1029. La Monte also saw the number of housing units decline, 8.99% with units totaling 415 in the 2022 ACS estimate. A decline in housing units corresponds with a slightly smaller vulnerability to hazards. No large projects are currently planned that would increase La Monte's vulnerability.

City of Sedalia
Sedalia is the largest urbanized city in Pettis County and has experienced a steady population increase but has recently seen a slower rate of growth. From 2010 to 2022, Sedalia saw a population increase of 1.78% and totaling 380 new residents. The number of housing units in Sedalia has decreased but by only 0.12% while the population grew slightly. Total housing units in 2010 was 9,979, compared to the 2022 ACS estimate of 9,967, decreased about 12 units. Two projects planned within the next five years include a new police station and regional sewage lift station. These assets, mainly the police station project increase the overall vulnerability for Sedalia since the last mitigation plan.

Smithton
The City of Smithton has experienced a decline in population and housing. However, housing units in Smithton have declined by a total of one unit and the population decreased 9.82%, for a total of 59 residents. With no major development or population growth, there has not been an increase in the cities vulnerability.

School District Future Development

Green Ridge R-VIII

La Monte R-IV

Pettis County R-V

Pettis County R-XII

Sedalia 200

Smithton R-VI

3.3.2 Future Land Use & Development

Table 3.16

Building Permits Issued by the City of Sedalia by Year								
Year	All Permits	Single Family	Apartment/ Duplex	Commercial	Industrial	Signs	Commercial Addition/ Repair	Dwelling Addition/ Repair
2023								
2022								
2021								
2020								
2019								
2018								
2017								

Source: Sedalia completed questionnaire, 2023.

3.4 Hazard Profiles, Vulnerability, and Problem Statements

Each hazard will be analyzed individually in a hazard profile in section 3.1.4. The profile will consist of a general hazard description, location, severity/magnitude/extent, previous events, future probability, a discussion of risk variations between jurisdictions, and how anticipated development could impact risk. At the end of each hazard profile will be a vulnerability assessment, followed by a summary problem statement.

Hazard Profiles: The level of information presented in the profiles will vary by hazard based on the information available. With each update of this plan, new information will be incorporated to provide better evaluation and prioritization of the hazards that affect the planning area. Detailed profiles for each of the identified hazards include information categorized as follows:

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

Geographic Location: This section describes the geographic location of the hazard in the planning area. Where available, use maps to indicate the specific locations of the planning area that are vulnerable to the subject hazard. For some hazards, the entire planning area is at risk.

Severity/Magnitude/Extent: This includes information about the severity, 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. Severity, magnitude, and extent can also include the speed of onset and the duration of hazard events. Describing the severity/magnitude/extent of a hazard is not the same as describing its potential impacts on a community. Severity/magnitude/extent defines the characteristics of the hazard regardless of the people and property it affects.

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

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

Changing Future Conditions Considerations: In addition to the probability of future occurrences, changing future considerations should also be considered, including the ling-term changes in weather and climate on the identified hazard.

Vulnerability Assessments

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

The Missouri Hazard Mitigation Viewer includes a Map Viewer with a legend of clearly labeled features, a north arrow, a base map that is either aerial imagery or a street map, risk assessment data symbolized the same as in the 2018 State Plan for easy reference, search and query capabilities, ability to zoom to county level data and capability to download PDF format maps. The Missouri Hazard Mitigation Viewer can be found at this link: http://bit.ly/MoHazardMitigationPlanViewer2018.

The vulnerability assessments in the Pettis County plan will also be based on:

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

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

Vulnerability Overview: The plan must provide an overall summary of each jurisdiction's vulnerability to the identified hazards. The overall summary of vulnerability identifies structures, systems, populations, or other community assets as defined by the community that are susceptible to damage and loss for hazard events.

Potential Losses to Existing Development: For each participating jurisdiction, the plan must describe the potential impacts of the hazard. Impact means the consequences of the 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. For example, impacts could be described by referencing historical disaster impacts and/or an estimate of potential future losses.

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

Hazard Summary by Jurisdiction: For hazard risks that vary by jurisdiction, this section will provide an overview of the variation and the factual basis for that variation. For example, a community that has adopted more recent building codes and constructed safe rooms would be less vulnerable to the impact of tornados.

Problem Statements

Each hazard analysis must conclude with a summary of the problems created by the hazard in the planning area, and possible ways to resolve those problems. Include jurisdiction-specific information in those cases where the risk varies across the planning area. The focus of the problem statements sub-section is to synthesize the "problems" revealed through the risk assessment and then through the process of updating the mitigation strategy, develop mitigation actions that are aimed at "solving" the identified problems. Problem statements should be as specific as possible; relating to specific jurisdictions as well as specific assets or areas of the planning area that are problematic. This will in turn prompt development of specific mitigation actions.

3.4.1 Flooding (Flash & Ravine)

Hazard Profile

Hazard Description

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

Flooding caused by dam and levee failure is discussed in Section 3.4.1 and Section 3.4.8 respectively. It will not be addressed in this section.
A flash flood occurs when water levels rise at an extremely fast rate as a result of intense rainfall over a brief period, sometimes combined with rapid snowmelt, ice jam release, frozen ground, saturated soil, or impermeable surfaces. Flash flooding can happen in Special Flood Hazard Areas (SFHAs) as delineated by the National Flood Insurance Program (NFIP), and can also happen in areas not associated with floodplains.

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

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

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

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

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

Geographic Location

The follow figures show the 100-year floodplain around and critical facilities within the jurisdictions in Pettis County. **Figures 3.2-7** detail the floodplain around incorporated areas while **Figures 3.8-13** show critical facilities for each jurisdiction.

Figure 3.??

Pettis County Flood Hazard Area

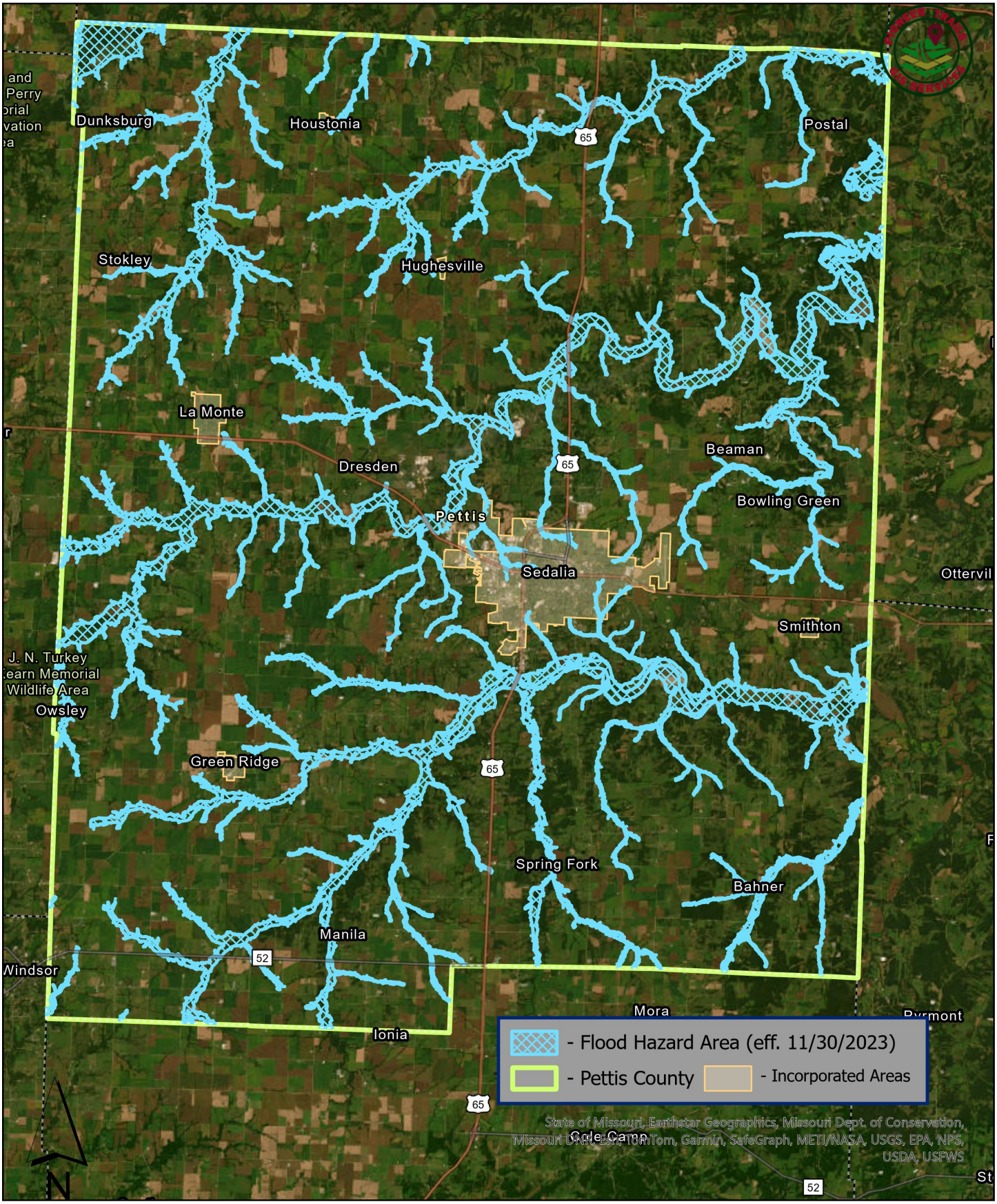


Figure 3.??

Flood Hazard Area - Green Ridge

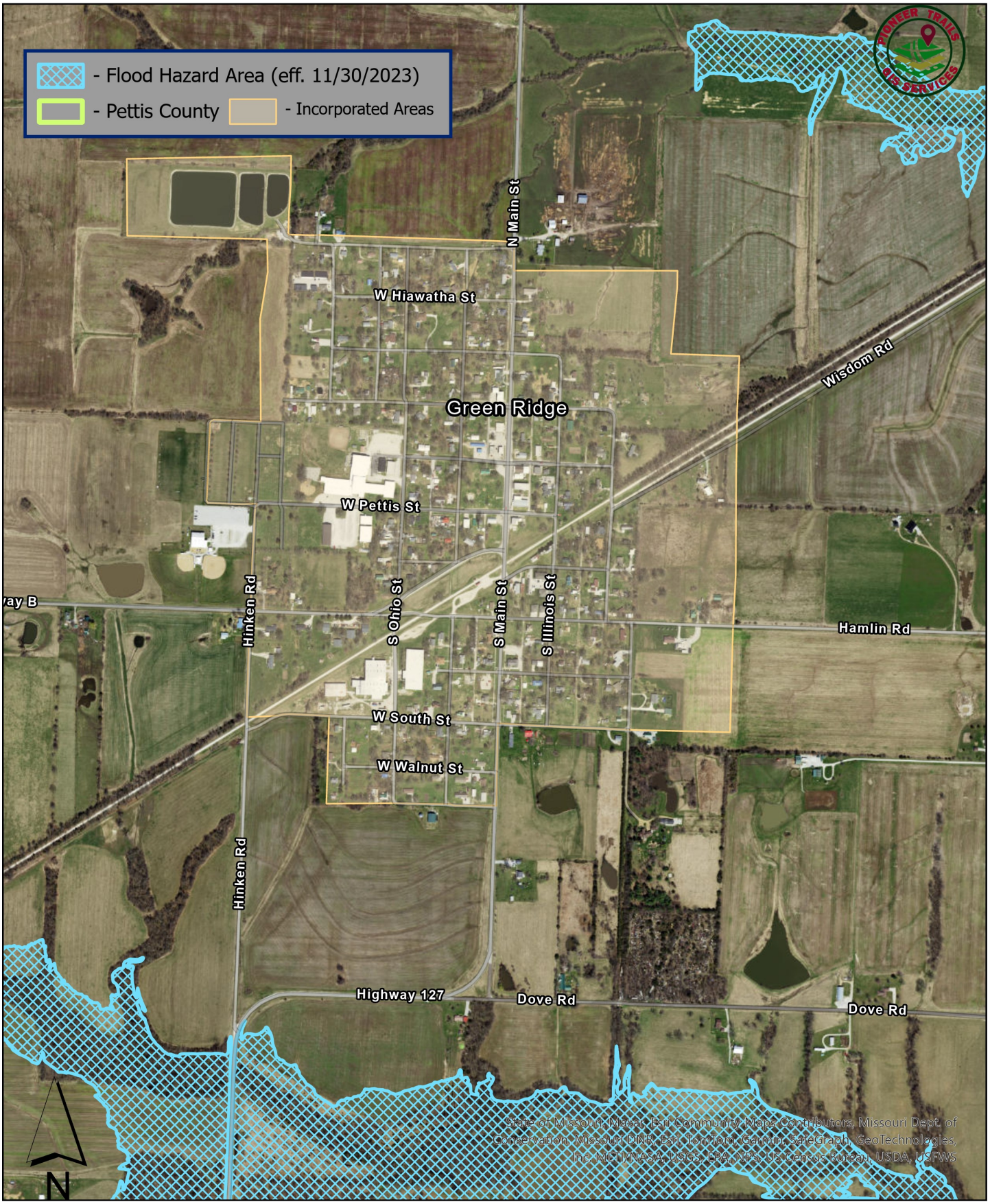


Figure 3.??

Flood Hazard Area - Houstonia

Figure 3.??

Flood Hazard Area - Hughesville

Figure 3.??

Flood Hazard Area - La Monte

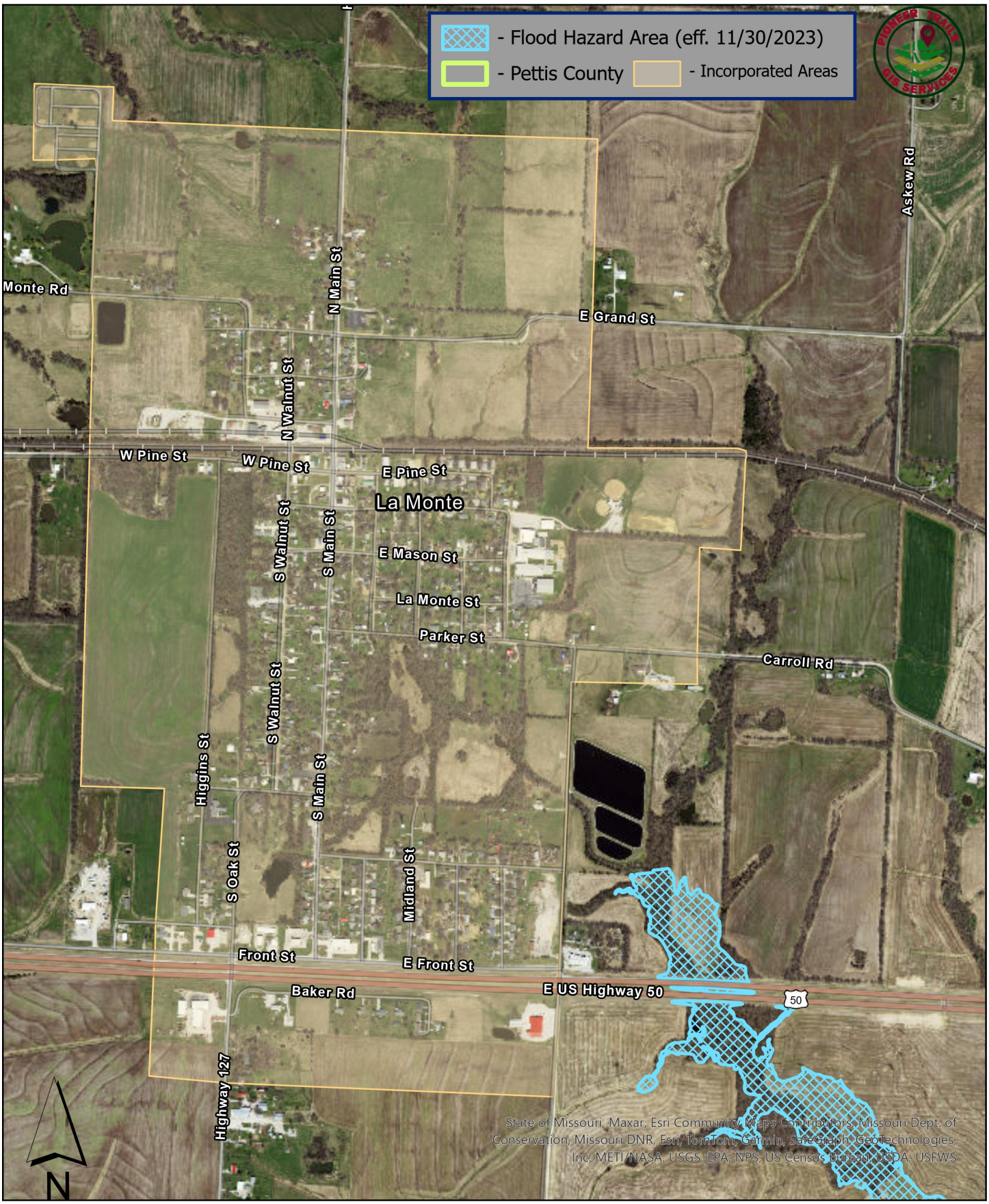


Figure 3.??

Flood Hazard Area - Sedalia

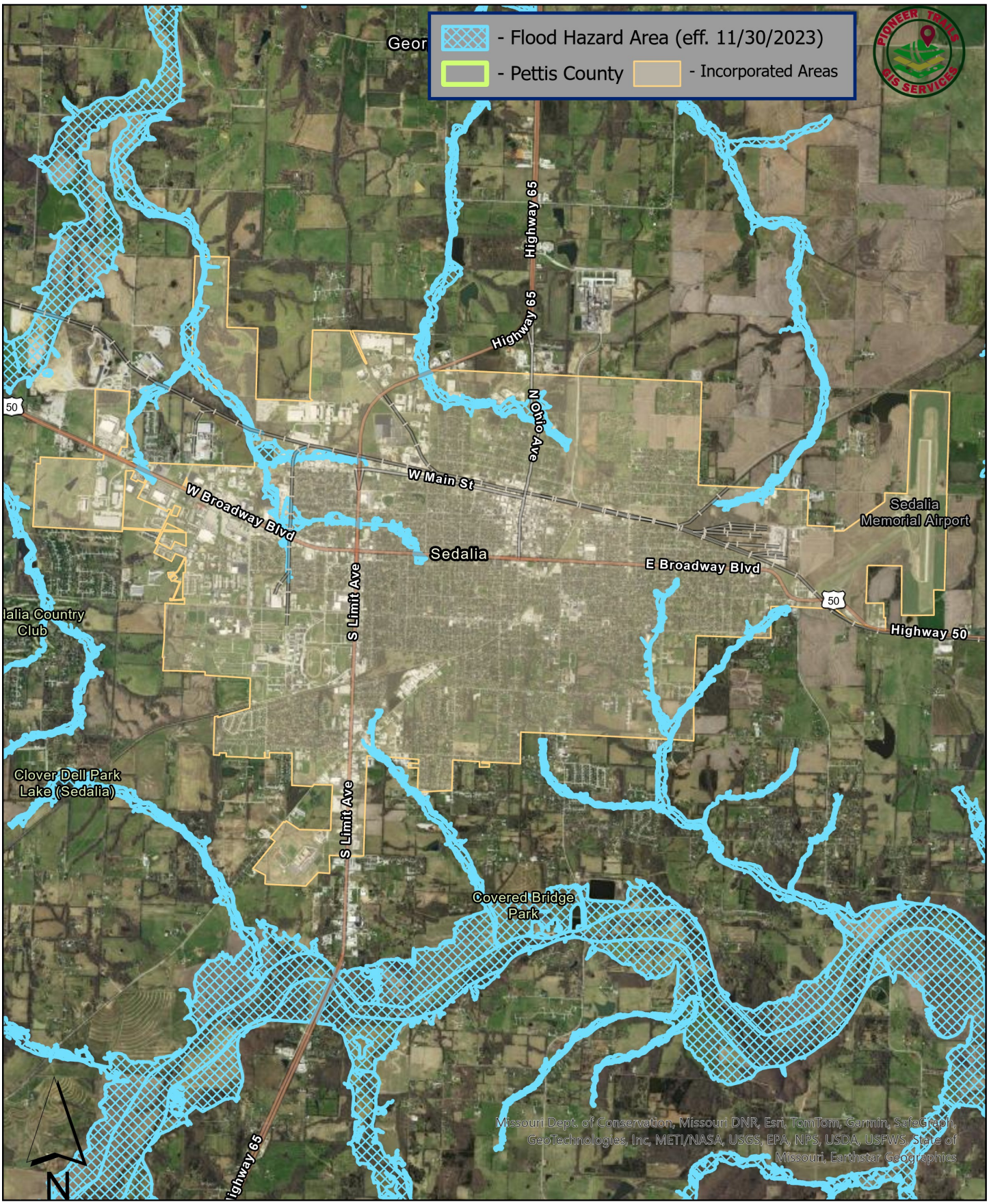


Figure 3.??

Flood Hazard Area - Smithton

Table 3.17

Pettis County NCEI Flooding Events by Location, 1996-2017		
Location		**# of Event Days**
Pettis County		5
Pettis County (unincorporated)	Route O was closed at Muddy Creek due to water running over the road. 12/28/2015	1
Green Ridge	Heavy rain from slow moving thunderstorms resulted in a foot of water building over Highway 127 and Route B. 6/28/1997	1
Sedalia	Heavy rains resulted in numerous areas of street flooding, Highway 50 closed both directions. 7/30/1998	1
	Highway 50 near Sedalia under 2 feet of water. 8/7/1999	1
	Extensive street flooding throughout Sedalia. 7/11/2000	1

Source: National Climatic Data Center

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

Table 3.18

Pettis County NCEI Flash Flooding Events by Location, 1996-2023		
Location		**# of Event Days**
Pettis County		30
Green Ridge	Highway 127 flooded by heavy rain, 1/12/2005	1
	Heavy rain led to flooding of HWY 127, 1.5 ft deep,7/11/2010	1
	Heavy rain led to flooding of HWY 127 south of Green Ridge, 1.5 ft deep,9/28/2019	1
Houstonia	Multiple roads flooded due to heavy rain, 4/10/2001	1
	Route T near Heaths Creek was flooded due to heavy rain, 8/1/2016	1
Hughesville	Several feet of water over road, near the intersection of Highway D and McGruder Road, 5/20/2013	2
La Monte	Heavy rain led to flooding of Hwy 65 north of Sedalia & Hwy 50 west of LaMonte, 7/21/1996	1
	Route Y was closed for flash flooding, 8/1/2016	1
	Highway 50 closed at La Monte due to high water, 8/1/2016	1
Sedalia	Heavy rain toped Hwy 50 and intersection of Wilkerson & Park, 6/20/1998	1
	Heavy rain caused widespread flooding of streets & intersections, 7/26/1998	1
	County and State roads flooded by heavy rain, 6/4/2001	1
	Water over road on Highway 50 west of Sedalia due to heavy rains, 1/4/2005	1
	Oak Grove Lane, Yeater, Gottschalk, Butterbaugh Ford, and Pinhook closed for high water, 6/29/2007	1
	Two to three feet of water was reported over the road at Highway 50 and Center, 9/12/2008	1
	Multiple roads flooded due to heavy rain, 6/15/2009	1
	Sheriff's office reported several roads in Sedalia covered with water, 9/28/2019	1

Location		# Event Days
Smithton	Several inches of water reported flowing over local roads, 7/2/2015	1
Unincorporated Pettis County	Widespread flooding closed numerous roads in and around Sedalia, including US Highways 50 and 65, 5/26/2000	1
	O highway and Buggertown road reported flooded over, 5/10/2003	1
	Flooding was reported across the intersection of HWY 65 and State Route BB, 6/10/2007	1
	Several feet of water was reported over Rieckhoff Road near State Highway T, 5/20/2013	1
	Eight inches of water was reported on Highway M, south of McGee Road, 8/7/2013	1
	Highway T was closed due to several culvert washouts, 4/3/2014	1
	Water topped highway D east of Highway 127, 4/2/2014	1
	Water was running over Highway 65 north of Sedalia, 8/1/2016	1
	Route B near Bryson Road was flooded due to heavy rain, 8/1/2016	1
	Highway 127 as closed near the South Fork of the Blackwater River due to flooding, 8/1/2016	1
	Route D was closed near the South Fork of the Blackwater River, 8/1/2016	1

Severity/Magnitude/Extent

Missouri has a long and active history of flooding over the past century, according to the 2010 State Hazard Mitigation Plan. Flooding along Missouri's major rivers generally results in slow-moving disasters. River crest levels are forecast several days in advance, allowing communities downstream sufficient time to take protective measures, such as sandbagging and evacuations. Nevertheless, floods exact a heavy toll in terms of human suffering and losses to public and private property. By contrast, flash flood events in recent years have caused a higher number of deaths and major property damage in many areas of Missouri.

Flooding presents a danger to life and property, often resulting in injuries, and in some cases, fatalities. Floodwater itself can interact with hazardous materials. Hazardous materials stored in large containers could break loose or puncture because 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. Floodwater can also cause erosion, undermining roadbeds. In some instances, steep slopes that are saturated with water may cause mud or rockslides onto roadways. This damage can cause costly repairs for state, county, and city road and bridge maintenance departments, see Figure 3.1 for bridges in planning area. When sewer back-up occurs, this can result in costly clean-up for home and business owners as well as present a health hazard.

National Flood Insurance Program (NFIP) Participation

The minimum standards for communities in the NFIP program for flood plain management criteria for flood prone areas are as follows under 44 CFR 60.3:

When the Federal Insurance Administrator has designated areas of special flood hazards (A zones) by the publication of a community's FHBM or FIRM, but has neither produced water surface elevation data nor identified a floodway or coastal high hazard area, the community shall:

(1) Require permits for all proposed construction and other developments including the placement of 3.35 manufactured homes, within Zone A on the community's FHBM or FIRM;

(2) Require the application of the standards in paragraphs (a) (2), (3), (4), (5) and (6) of this section to development within Zone A on the community's FHBM or FIRM;

(3) Require that all new subdivision proposals and other proposed developments (including proposals for manufactured home parks and subdivisions) greater than 50 lots or 5 acres, whichever is the lesser, include within such proposals base flood elevation data;

(4) Obtain, review, and reasonably utilize any base flood elevation and floodway data available from a Federal, State, or other source, including data developed pursuant to paragraph (b)(3) of this section, as criteria for requiring that new construction, substantial improvements, or other development in Zone A on the community's FHBM or FIRM meet the standards in paragraphs (c)(2), (c)(3), (c)(5), (c)(6), (c)(12), (c)(14), (d)(2) and (d)(3) of this section;

(5) Where base flood elevation data are utilized, within Zone A on the community's FHBM or FIRM:

(i) Obtain the elevation (in relation to mean sea level) of the lowest floor (including basement) of all new and substantially improved structures, and

(ii) Obtain, if the structure has been floodproofed in accordance with paragraph (c)(3)(ii) of this section, the elevation (in relation to mean sea level) to which the structure was floodproofed, and

(iii) Maintain a record of all such information with the official designated by the community under § 59.22 (a)(9)(iii)

NFIP Participant Requirement Status Tables

Table 3.25 provides details on NFIP participation for the communities in the planning area. **Table 3.26** contains the number of policies in force, amount of insurance in force, number of closed losses, and total payments for each jurisdiction, where applicable. The time represented by the data is for closed losses.

Table 3.25

NFIP Participation in Pettis County					
Community ID #	**Community Name**	**NFIP Participant (Y/N/Sanctioned)**	**Initial FIRM Identified**	**Current Effective Map Date**	**Regular Emergency Program Entry Date**
290701B	City of La Monte	Y	11/20/2023	(NSFHA)	8/24/1984
290823B	Pettis County	Y	5/1/1994	11/30/2023	5/1/1994
290823B	City of Sedalia	Y	9/18/1985	11/30/2023	9/18/1985
290526B	City of Smithton	Y	11/30/2023	(NSFHA)	9/10/1984
290575B	City of Houstonia	Y	11/30/2023	11/30/2023 (M)	11/30/2023
--	City of Green Ridge	N	--	--	--
--	Village of Hughesville	N	--	--	--

Source: www.fema.gov/cis/MO.html

Table 3.26

Pettis County NFIP Policy & Claim Statistics as of 11-30-2017				
Community Name	**Total Losses**	**Open Losses**	**Closed Losses**	**Total Payments**
Pettis County	6	5	0	$197,291.95
Sedalia	31	17	0	$49,062.03

Source: bsa.nfipstat.fema.gov/reports/1040.htm#29

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 0 repetitive loss properties.

A Severe Repetitive Loss (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.

Table showing any repetitive loss properties

Previous Occurrences

Table 3.27

NCEI Pettis County Riverine Flooding Events Summary, 2010-2023					
Year	**Number of Occurrences**	**# of Deaths**	**# of Injuries**	**Property Damage**	**Crop Damage**
2023	0	0	0	0	0
2022	0	0	0	0	0
2021	0	0	0	0	0
2020	0	0	0	0	0
2019	0	0	0	0	0
2018	0	0	0	0	0
2017	0	0	0	0	0
2016	0	0	0	0	0
2015	**1**	0	0	0	0
2014	0	0	0	0	0
2013	0	0	0	0	0
2012	0	0	0	0	0
2011	0	0	0	0	0
2010	0	0	0	0	0
Total:	**1**	**0**	**0**	**0**	**0**

Source: National Climatic Data Center, accessed on 1/20/2023

Table 3.28

NCEI Pettis County Flash Flooding Events Summary, 2010-2023					
Year	**Number of Occurrences**	**# of Deaths**	**# of Injuries**	**Property Damage**	**Crop Damage**
2023	0	0	0	0	0
2022	0	0	0	0	0
2021	0	0	0	0	0
2020	0	0	0	0	0
2019	2	0	0	0	0
2018	0	0	0	0	0
2017	0	0	0	0	0
2016	7	0	0	0	0
2015	1	0	0	0	0
2014	2	0	1	0	0
2013	3	0	0	0	0
2012	0	0	0	0	0
2011	0	0	0	0	0
2010	1	0	0	0	0
Total:	**16**	**0**	**1**	**0**	**0**

Source: National Climatic Data Center, accessed on 1/20/2023

Table 3.?? Pettis County Crop Insurance Paid 2014-2023 for Listed Cause of Loss

Cause of Loss	Year	2014	2015	2016	2017	2018
Flooding	Wheat					
	Corn		27,535.00	7,057.00	888.00	
	Soybean	2,808.00	62,931.00	81,725.06	10,256.00	
	Sorghum					
	TOTAL: ($)	**2,808.00**	**90,466.00**	**88,782.06**	**11,144.00**	**0.00**

Year	2019	2020	2021	2022	2023	**Total: ($)**
Wheat	11.50					**11.50**
Corn	4,708.00		12,963.00			**53,151.00**
Soybean	2,151.50	1,912.00	18,513.00			**180,296.56**
Sorghum						**0.00**
TOTAL: ($)	**6,871.00**	**1,912.00**	**31,476.00**	**0.00**	**0.00**	**233,459.06**

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

Probability of Future Occurrence

There have been 24 occurrences of flooding in Pettis County from 2002 to 2022 in the NCEI storm event database. Out of hose, 23 of them were flash floods and 1 of them were riverine flood events. Using the past 20-year period of record this equates to 1.15 flash floods a year and less than one riverine flood per year. Due to this there is a 100% probability of a flash flood occurrence in any given year, ravine floods are far less common in the planning area and have a probability of 0.05% chance for occurrence a year.

Changing Future Conditions Considerations

Future development could impact flash and riverine flooding in the planning area. Development in low-lying areas near rivers and streams or where interior drainage systems are not adequate to provide drainage during heavy rainfall events will be at risk of flash flooding. Future development would also increase impervious surfaces causing additional water run-off and drainage problems during heavy rainfall events.

It is likely (66-100% probability) that the frequency of heavy precipitation or the proportion of total rainfall from heavy falls will increase in the 21st century across the globe. More specifically, it is "very likely" (90-100% probability) that most areas of the United States will exhibit an increase of at least 5% in the maximum 5-day precipitation by late 21st century. If departure from normal with respect to increased precipitation intensity continues globally, frequency of floods in Johnson County are likely to increase as well.

Vulnerability

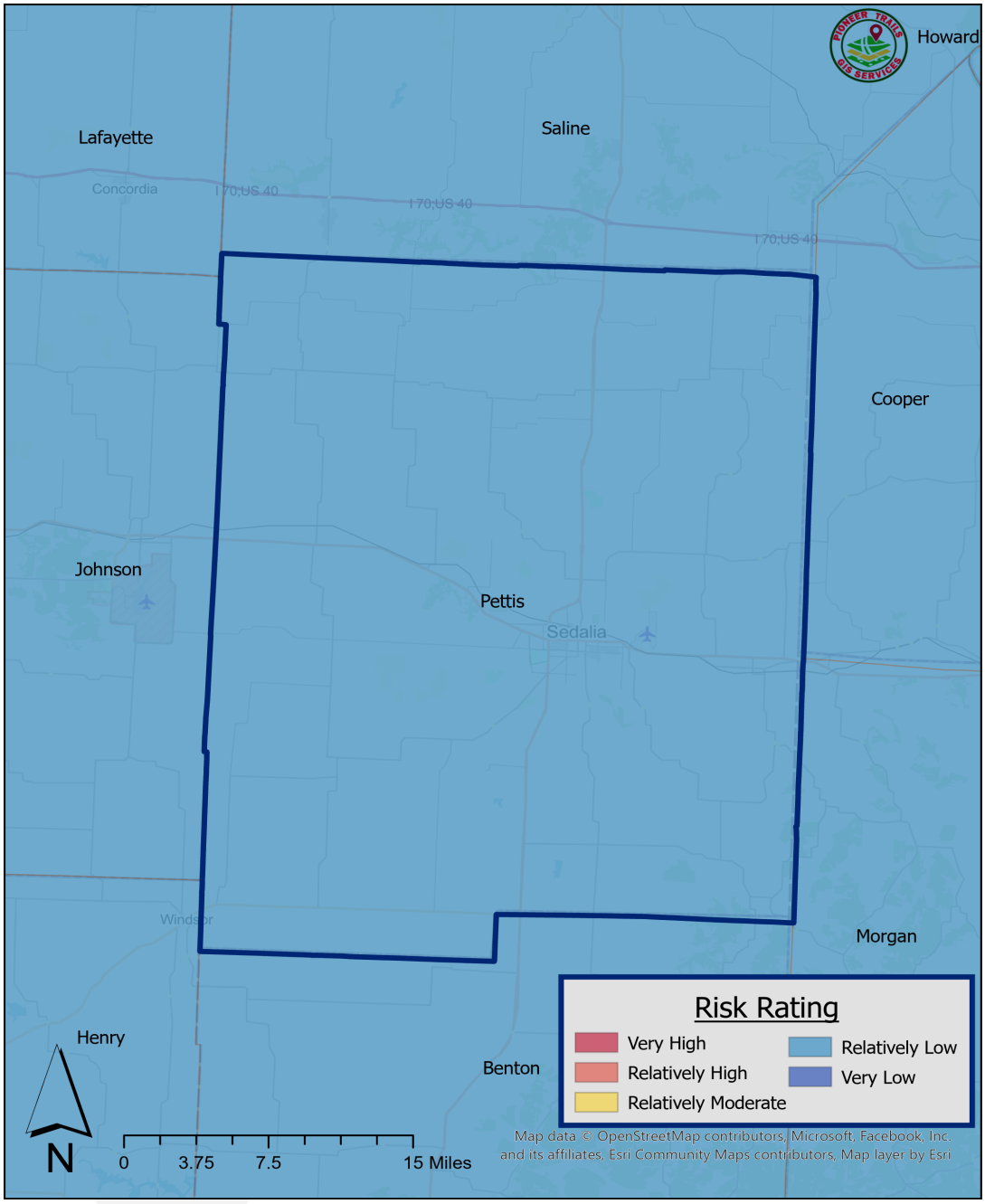
Vulnerability Overview

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

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

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

FEMA National Risk Index -- Riverine Flooding



Source: FEMA National Risk Index, Hazard Rating

Potential Losses to Existing Development

Future development could impact flash and riverine flooding in the planning area. Development in low-lying areas near rivers and streams or where interior drainage systems are not adequate to provide drainage during heavy rainfall events will be at risk of flash flooding. Future development would also increase impervious surfaces causing additional water run-off and drainage problems during heavy rainfall events.

It should be noted that all these 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 as evidenced by previous occurrences**.** The greatest impact of flooding is in the unincorporated part of the county. Due to the topography and many streams in the county, numerous low water crossings are damaged and create a significant hazard to public safety during flood events

Hazard Summary by Jurisdiction

Pettis County received updated FEMA Flood Service products since the last approved plan on November 30, 2023. Additional areas of flood hazard area were identified with some of those areas identified falling within incorporated areas.

Unincorporated Pettis County: The greatest impact of flooding is in the unincorporated part of the county, due to the topography and many streams in the county. Numerous low water crossings could be damaged and create a significant hazard to public safety during flood events.

Green Ridge: Green Ridge has no flood zones within the jurisdiction. This area is mostly residential and has little development. If damages were to occur from an event it can be expected to occur to private property.

Houstonia: Only the extreme southeast corner of the Houstonia is located in a flood zone, which covers agricultural land that has no development.

Hughesville: Hughesville has no flood zones within the jurisdiction. This area is mostly residential and has little development. If damages were to occur from an event it can be expected to occur to private property.

La Monte: La Monte has no flood zones within the jurisdiction. This area is mostly residential and has some development. If damages were to occur from an event it can be expected to occur to private property.

Sedalia: Although Sedalia is located along the division of two drainage basins there are a number of finger like flood zones within the incorporated area. Most of these zone are found in the residential area where damages would largely affect private property. The largest flood zone is located in the northwest part of Sedalia. During an event this area could expect a combination of private and commercial property damage occur.

Smithton: Smithton has no flood zones within the jurisdiction. This area is mostly residential and has little development. If damages were to occur from an event it can be expected to occur to private property.

Problem Statement

Floods are frequent events and have the potential to costly through damages and fatal to residents in the county. Participation in the NFIP enables residents to purchase flood insurance. Street flooding in incorporated areas can be addressed through storm water management projects and enforce storm water management regulations.

3.4.2 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. Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, affecting both life and property. Dam failure can be caused by any of the following:

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

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

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

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

The Missouri Dam and Reservoir Safety Council Rules and Regulations uses three classes of downstream environmental zone used when considering permits. The downstream environment zone is the area below the dam that would become inundated should the dam fail. Inundation is defined as water two feet or more over the submerged ground outside of the stream channel. These classes are based on the number of structures and types of development contained within the inundation area as presented in Table 3.29. The downstream environment zone classification is also used to prescribe the frequency of inspection.

Table 3.29

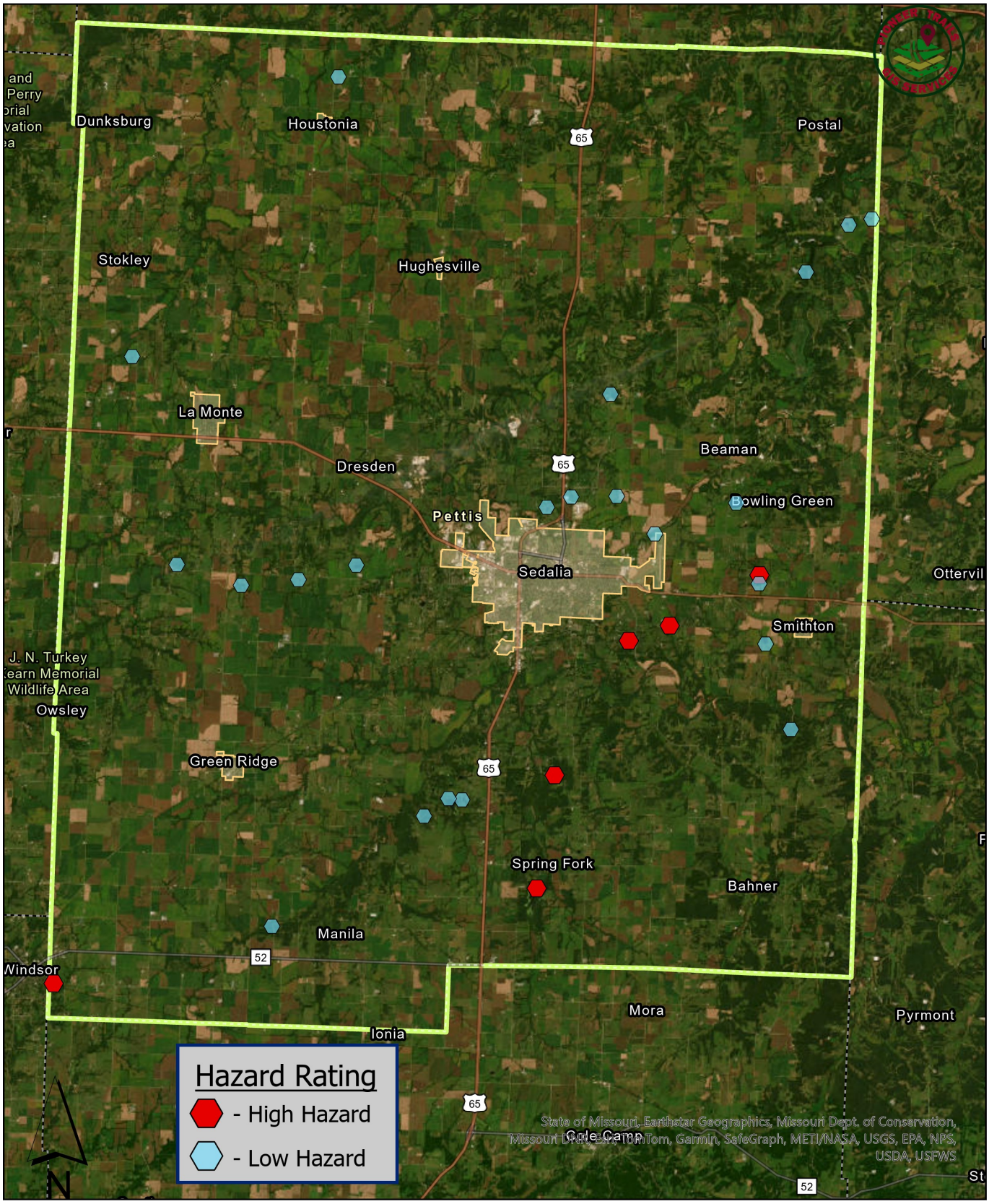
MoDNR Dam Hazard Classification Definitions	
Hazard Class	**Definition**
Class I	The area downstream from the dam that would be affected by inundation contains ten (10) or more permanent dwellings or any public building. Inspection of these dams must occur every two years.
Class II	The area downstream from the dam that would be affected by inundation contains one to nine 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 I or Class II dams. Inspection of these dams must occur once every five years.

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

Pettis County has two dams that fall into the Class I category; they are Spring Fork Lake Dam and the Windsor Farrington Park Lake Dam. These are shown in more detail in Figures 3.14, sling with all dams in the County.

Figure 3.14

Pettis County Dams



Dams in the NID are classified according to hazard potential, an indicator of the consequences of dam failure. A dam's hazard potential classification, presented in Table 3.30, does not indicate its condition. Dams assigned the high hazard potential classification are those where failure will potentially result in loss of human life. Significant hazard potential are those dams where failure results in no probable loss of human life but can cause economic loss. Dams assigned the low hazard potential classification are those where failure or results in no probable loss of human life and low economic or environmental losses. Losses are principally limited to the owner's property.

Table 3.30 Dam Hazard Classification

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

Source: National Inventory of Dams

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

Geographic Location

There are a total of 28 dams in Pettis County recorded by the National Inventory of Dams (NID) database. Out of the 28 dams only two are regulated, the Spring Fork Dam and Windsor Farrington Park Lake Dam. Of the twenty-eight dams in Pettis, six are classified as a high hazard dam according to the NID, Windsor Farrington Park Lake, Hermora Lake, Rubydo Lake, Hayes Lake, Spring Fork Lake, and Daum Lake dams. Information regarding the Blackburn Pond can be found in Table 3.31.

Table 3.31

High Hazard Dams in Pettis County								
Dam Name	**Emergency Action Plan (EAP)**	**Dam Height (Ft)**	**Max Storage (Acre-Ft)**	**Last Inspection Date**	**River**	**Nearest Downstream City**	**Distance To Nearest City (Miles)**	**Dam Owner**
Daum Lake		25	201	N/A		Clinton	12	Harold Daum
Hayes Lake		20	16	N/A		--	--	Private
Hermora Lake		26	209	N/A		Otterville	6	Dick G Mansees
Rubydo Lake		20	86	N/A		Redbird	14	Dick G Mansees
Spring Fork Lake		43	3104	8/26/2014		Sedalia	7	City of Sedalia
Windsor Farrington Park Lake		26	209	7/16/1980				

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

Figures 3.15 & 3.16 show a closer view of each Class I hazard dam.

Spring Fork Dam Failure

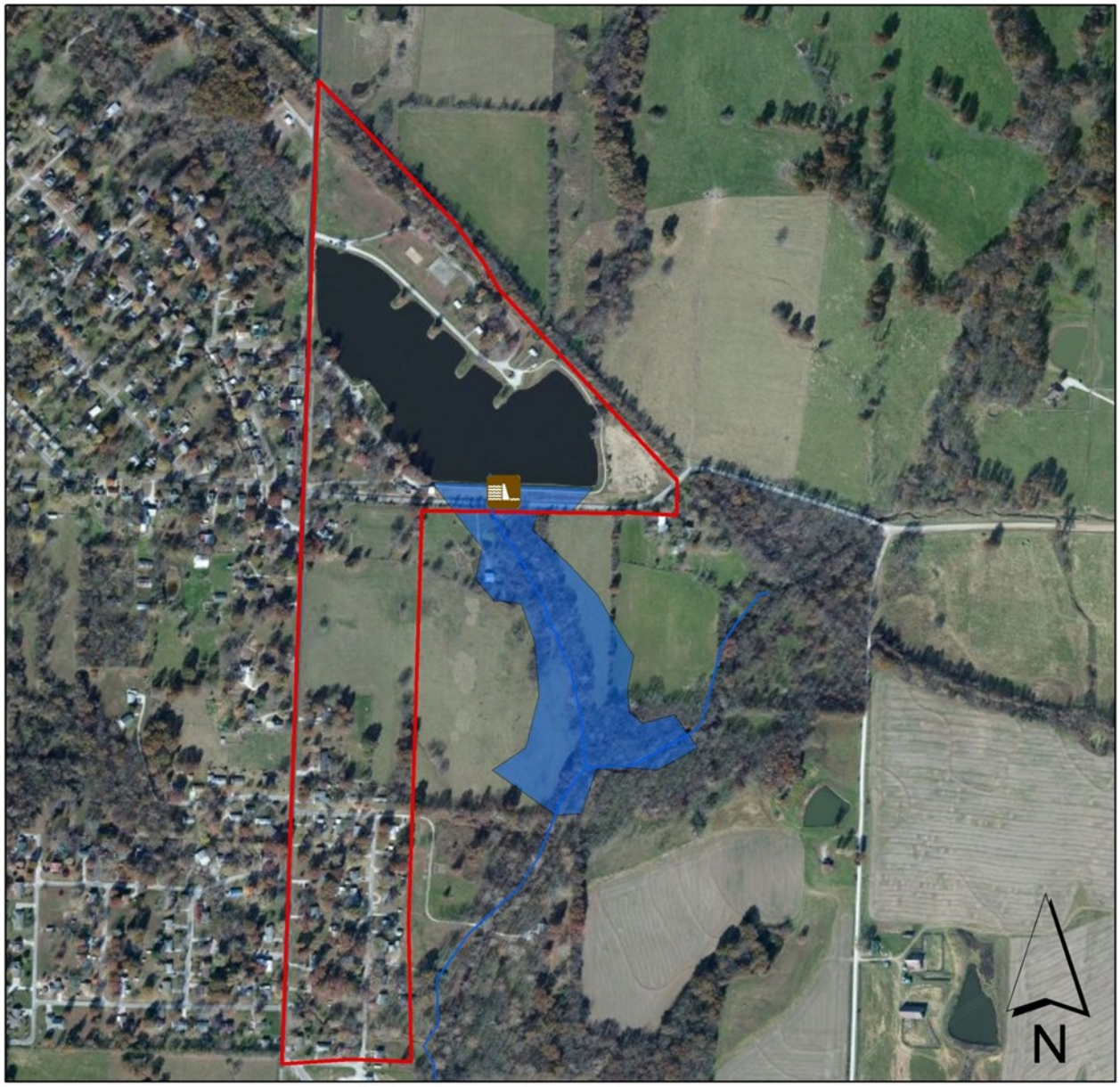
Legend

- Regulated Dams
- Dams
- Rivers
- Dam Failure

Pioneer Trails RPC Geospatial Services

Pioneer Trails
REGIONAL
PLANNING
COMMISSION

Windsor Farrington Park Dam



0 0.04 0.08 0.16 0.24 0.32 Miles

Legend
Dams
Rivers
Pettis City Outline
Dam Failure

Pioneer Trails RPC Geospatial Services

Pioneer Trails REGIONAL PLANNING COMMISSION

Severity/Magnitude/Extent

The impact on the downstream community, dependent upon what is downstream, could be very serious. The adverse impacts of future dam failures affecting Pettis County at the high hazard level are shown below. Intersecting almost all the issues above is the issue of public education about dams. The ordinary citizen is unaware that the beautiful lakes on which he or she boats, skis or fishes are only there because of manmade dams. Developers build in dam break flood inundation areas knowing nothing about the potential that an upstream dam has, to cause devastation should it fail. In fact, some developers and zoning officials are completely unaware of dams within their community. Even if citizens understand and are aware of dams, they still can be overly confident in the infallibility of these manmade structures. Living in dam break flood-prone areas is a risk. Many dam owners do not realize their responsibility and liability toward the downstream public and environment.

The adverse impacts of future dam failures affecting Pettis County at the high hazard level are shown below.

Without mitigation measures:		With mitigation measures:	
Life	Catastrophic	Life	Negligible
Property	Catastrophic	Property	Negligible
Emotional	Catastrophic	Emotional	Negligible
Financial	Catastrophic	Financial	Negligible

Comments: One large dam holding back a high volume of water could destroy life and property for several miles downstream.

It can be stated that the severity/magnitude of dam failure would be similar in some cases to the impacts associated with flood events (see the flood hazard vulnerability analysis and discussion). Based on the hazard class definitions, failure of any of the High Hazard/Class I dams could result in a serious threat of loss of human life, serious damage to residential, industrial, or commercial areas, public utilities, public buildings, or major transportation facilities. Catastrophic failure of any high hazard dams has the potential to result in greater destruction due to the potential speed of onset and greater depth, extent, and velocity of flooding. Note that for this reason, dam failures could flood areas outside of mapped flood hazards.

Previous Occurrences

There is no record of a dam failure within Pettis County over the 26-year period from 1975 to 2001. Seventeen dam failures were recorded in the state of Missouri for the same period. This does not include the Taum Sauk failure in 2005 or the Moon Valley Lake Dam failure in 2008 since the comprehensive data collected by Stanford University was not updated past 2001. According to this data, the annual probability calculates to a 65% (17/26 = 0.65 or 65%) probability in any given year for at least one dam failure event somewhere in the State of Missouri. However, with over 5,000 dams in the State, this translates to an overall low probability per dam structure.

Probability of Future Occurrence

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

Changing Future Conditions Considerations

Studies have been conducted to investigate the impact of climate change scenarios on dam safety. Dam failure is already tied to flooding and the increased pressure flooding places on dams. The impacts of changing future conditions on dam failure will most likely be those related to changes in precipitation and flood likelihood. Changing future conditions projections suggest that precipitation may increase and occur in more extreme events, which may increase risk of flooding, putting stress on dams and increasing likelihood of dam failure. The safety of dams for the future climate can be based on an evaluation of changes in design floods and the freeboard available to accommodate an increase in flood levels. The results from the studies indicate that the design of 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

Vulnerability to dam Failure in Pettis County is limited to structures and critical facilities located in dam inundation zones. A failure at the Spring Fork Lake dam would not cause a large amount of damage due to the area downstream being farms and woodlands. If the failure happened during the growing season damage could occur to crops planted in the farmland in the inundation area. If the Winsor Farrington Park Lake dam were to experience a break, minimal property damage would be incurred as only one structure lies within the inundation area. The remainder of the inundated area is either wooded or farmland or pastures. No school district facilities are located within inundation areas or downstream environments form existing dams. No critical facilities are located within inundated areas also.

Impact of Previous and Future Development

It is possible that future development will occur in the downstream environment of dams within the county; however, no major development is expected due to the slow growth of Pettis County and its jurisdictions.

Hazard Summary by Jurisdiction

Pettis County, Sedalia, and the City of Green Ridge are the only jurisdictions in the county vulnerable to dam failure. Failure would cause little to no critical facility damage and would result mostly in crop and personal property damage. No school district facilities are located within inundation areas or downstream environments form existing dams.

Problem Statement

Out of the six high risk dams located in Pettis County, none are located in the direct vicinity of a jurisdiction, but risk is higher to those living around these structures. Residents near a Class I or Class II hazard dams should become familiar with the dam's emergency action plans, if available. Emergency plans written for dams include procedures for notification and coordination with local law enforcement and other governmental agencies, information on the potential inundation area, plans for warning and evacuation, and procedures for making emergency repairs.

3.4.3 Drought

Hazard Profile

Hazard Description

Drought is generally defined as a condition of moisture levels significantly below normal for an extended period 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 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 are also out of phase with impacts in other economic sectors.

- Agricultural drought focuses 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.

  Data sources: http://www.drought.unl.edu/

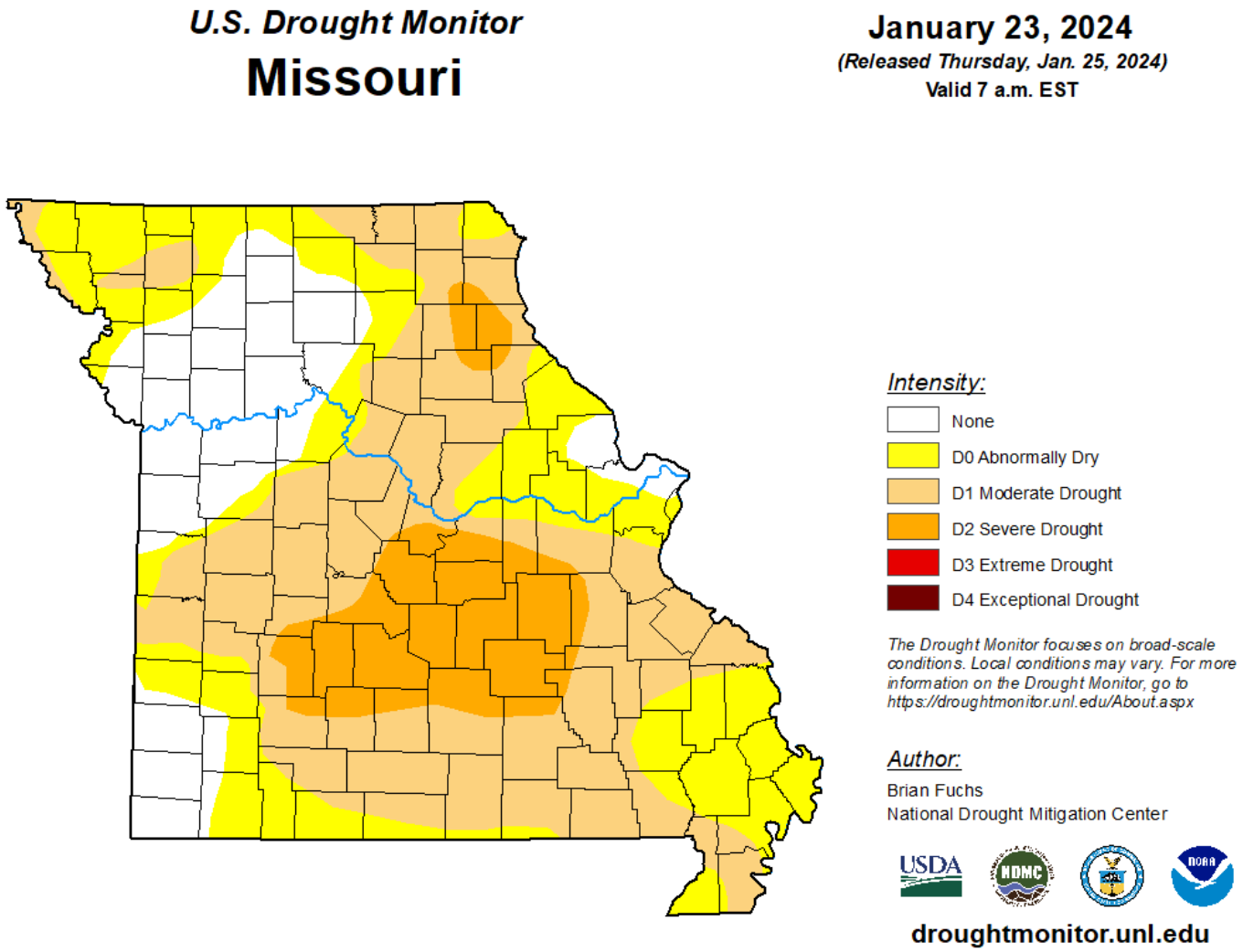
Geographic Location

Droughts are regional climatic events that can impact large areas and multiple counties. The entire county is at risk of the impacts of drought. However, drought most directly impacts the agricultural sector, so areas within the county where there is extensive agricultural land use can experience significant impacts. The major agricultural activity in the county is livestock, which accounts for 69% of sales. Due to the large number of livestock, and their needs, in the region, an extreme drought can have a devastating effect if water supplies run short in an extended drought period.

Severity/Magnitude/Extent

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

Figure 3.17 – Drought Monitor Map



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

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

- Phase I: Advisory Phase—Requires a drought monitoring and assessment system to provide enough lead time for state and local planners to take appropriate action;

- Phase II: Drought Alert—When the PDSI reads -1.0 to -2.0, and stream flows, reservoir levels, and groundwater levels are below normal over a several month period, or when the Drought Assessment Committee (DAC) determines that Phase II conditions exist based on other drought determination methods;

- Phase III: Conservation Phase—When the PDSI reads -2.0 to -4.0, and stream flows, reservoir levels, and groundwater levels continue to decline, along with forecasts indicating an extended period of below-normal precipitation, or when the DAC determines that Phase III conditions exist based on other drought determination models;

- Phase IV: Drought Emergency—When the PDSI is lower than -4.0, or when the DAC determines that Phase IV conditions exist based on other drought determination methods.

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

Green Ridge, Smithton, La Monte, Houstonia, and Hughesville all rely on wells. These communities could have problems with public water in the event of a long-term drought. The impact of drought on deeper public wells would not be significant unless the drought was of such severity to reduce groundwater levels.

Previous Occurrences
Table 3.28

Pettis County Previous Drought Occurrence	
4/1/2000- 4/30/2001	April 2000 was the driest on record in the state of Missouri, according to the Midwestern Climate Center.
7/1/2012- 7/31/2012	Dry conditions, which started in the spring, intensified during the month of July. Drought conditions expanded across Missouri, with D2 conditions at the beginning of the month, increasing to D3 conditions by the end of the month.
8/1/2012- 8/31/2012	Dry conditions, which started in the spring, intensified during the month of August. Drought D2 and D3 conditions at the beginning of the month, increased to D3 and D4 conditions by the end of the month.
9/1/2012- 9/30/2012	The remnants of Hurricane Isaac brought some much-needed relief to drought conditions across the area, on the 1st of September. This helped improve drought conditions from D4 and D3 to D3 and D2.
10/1/2012- 10/31/2012	Drought D1 to D2 conditions prevailed across the county. Sedalia received 4.60 inches of rain.
1/1/2013- 1/31/2013	Moderate to severe D1 to D2 drought conditions prevailed across the county.
7/1/2018- 9/30/2018	The abnormally dry summer continued into and through July for Pettis County. The Drought Monitor put the county in D2 and maintained it into August. Conditions held at D2 during the month of September, but the impacts and losses of several crops were already felt across the region.
7/19/2022- 11/29/2022	A severe lack of rain along a narrow corridor, generally tracing the Missouri River east of Kansas City caused a declaration of severe drought (D2) for Pettis County. August saw little relief. The drought conditions continued into and through September. Significant precipitation deficits continued into October with severe to extreme drought persisting through the month. Significant precipitation deficits yielded D2 drought conditions continuing into November before improving to D1 or better by November 29th.
5/2/2023- 10/31/2023	By mid to late spring the area became deficit of normal rainfall by several inches, resulting in a declaration of severe (D2) drought. By May 9, extreme (D3) was declared due to the ongoing dry conditions. After 2 months of relatively dry conditions portions of Missouri were brought into extreme drought conditions. By the middle of July exceptional (D4) drought was declared in these counties but the month ended with an extreme drought (D3). Extreme Drought (D3) persisted through the month of August in Pettis County. Pettis County experienced extreme drought for the vast majority of September and October, with conditions improving slightly to severe drought by the end of October.

Table 3.?? Pettis County Crop Insurance Paid 2014-2023 for Listed Cause of Loss

Cause of Loss	Year	2014	2015	2016	2017	2018
Drought	Wheat				543.00	35,577.95
	Corn		24,004.00	2,518.20		495,591.36
	Soybean		336,897.08	13,580.00	6,870.00	1,387,127.00
	Sorghum		4,665.00			3,461.00
	TOTAL: ($)	**0.00**	**365,566.08**	**16,098.20**	**7,413.00**	**1,921,757.31**

Year	2019	2020	2021	2022	2023	**Total: ($)**
Wheat				17,949.00	66,219.70	**120,289.65**
Corn		19,567.50	1,693,975.00	5,704,770.00	7,488,997.00	**15,429,423.06**
Soybean		58,427.60	1,083,528.80	1,504,135.00	4,566,426.00	**8,956,991.48**
Sorghum						**8,126.00**
TOTAL: ($)	**0.00**	**77,995.10**	**2,777,503.80**	**7,226,854.00**	**12,121,642.70**	**24,514,830.19**

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

Probability of Future Occurrence

Over the 20-year record period, 2004-2023, Saline County was in drought for 19 months of the total of 240 months in the record period. The calculated risk percent from the number of months of drought and total number of months in the record period equates to the annual average percentage of 7.92% probability of drought occurrence in the county. Over the past 10-year period, the annual drought probability is 11.67%, 14 months of drought out of 120 months total.

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

Changing Future Conditions Considerations

A new analysis, performed for the Natural Resources Defense Council, examined the effects of climate change on water supply and demand in the contiguous United States. The study found that more than 1,100 counties will face higher risks of water shortages by mid-century as a result of climate change. Two of the principal reasons for the projected water constraints are shifts in precipitation and potential evapotranspiration (PET). Climate models project decreases in precipitation in many regions of the U.S., including areas that may currently be described as experiencing water shortages of some degree.
The Natural Resources Defense Council developed a new water supply sustainability index. The risk to water sustainability is based on the following criteria:

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

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

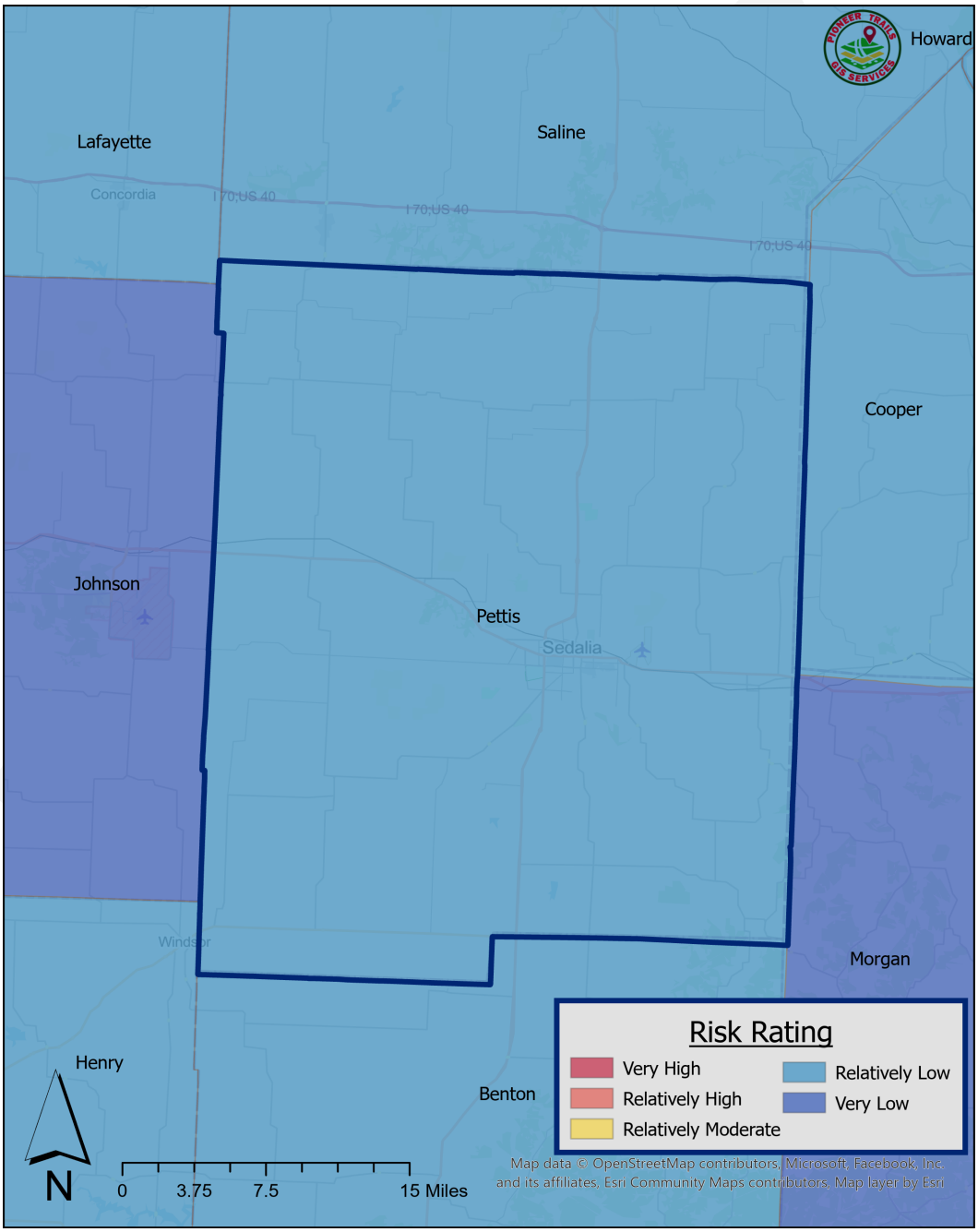
Vulnerability

Vulnerability Overview

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

Figure 3.??

FEMA National Risk Index -- Drought



Source: FEMA National Risk Index, Hazard Rating

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.

Impact of Previous and Future Development

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

Hazard Summary by Jurisdiction

Although the probability of drought is the same for the entire county, farming and livestock enterprises in the unincorporated parts of the county would feel the greatest impact. These impacts are mitigated somewhat by the purchase of crop insurance. No major waterways travel through Pettis County, leaving jurisdictions to rely on groundwater for all their water needs. Communities are susceptible to water shortages due to groundwater reduction; other communities with no source are more at risk of extreme water shortages in the event of a drought. School and special districts would be the least impacted by drought; however, those districts in communities with single source wells or none may experience water shortages prior to those in larger communities.

Problem Statement

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

Unincorporated Pettis County is at most risk from drought due to the high concentration of crops and livestock. With a total of $239,127,000 in sales in 2017 according to the 2017 Ag Census, large droughts would negatively affects the overall economy of the region. Farmers should be encouraged to obtain and review existing. crops to ensure policies to maintain proper coverage in the event of a drought. Efforts should also be made by the surrounding jurisdictions to educate its residents and farmers on proper and safe irrigation methods to minimize the depletion of water sources.

3.4.4 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

There are no specific locations for future occurrences, as the threat is county wide.

Severity/Magnitude/Extent

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

Tornado magnitude is classified according to the EF- Scale, Table 3.29, (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 3.30) 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 3.29 Enhanced F Scale for Tornado Damage

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

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

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center. 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 or damage is located online at www.spc.noaa.gov/efscale/ef-scale.html.

Table 3.30

Enhanced Fujita Scale			
Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF0	65-85	53.50%	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	31.60%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.70%	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	3.40%	Severe. Entire stores of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	0.70%	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. The lead time for actual tornado warnings is about 30 minutes. Tornadoes have been known to change paths very rapidly, thus limiting the time in which to take shelter. Tornadoes may not be visible on the ground if they occur after sundown or due to blowing dust or driving rain and hail.

Previous Occurrences

Table 3.31 shows NCEI reported tornado events and damages since 1993 in the planning area. Prior to that date, only destructive tornadoes were recorded. It is necessary to go back as far as possible because of the random and intermittent nature of tornado events. Consult the event narratives for descriptions of notable storm events and include the information in the plan.

There are limitations to the use of NCEI tornado data that must be noted. For example, one tornado may contain multiple segments as it moves geographically. A tornado that crosses a county line or state line is considered a separate segment for the purposes of reporting to the NCEI.

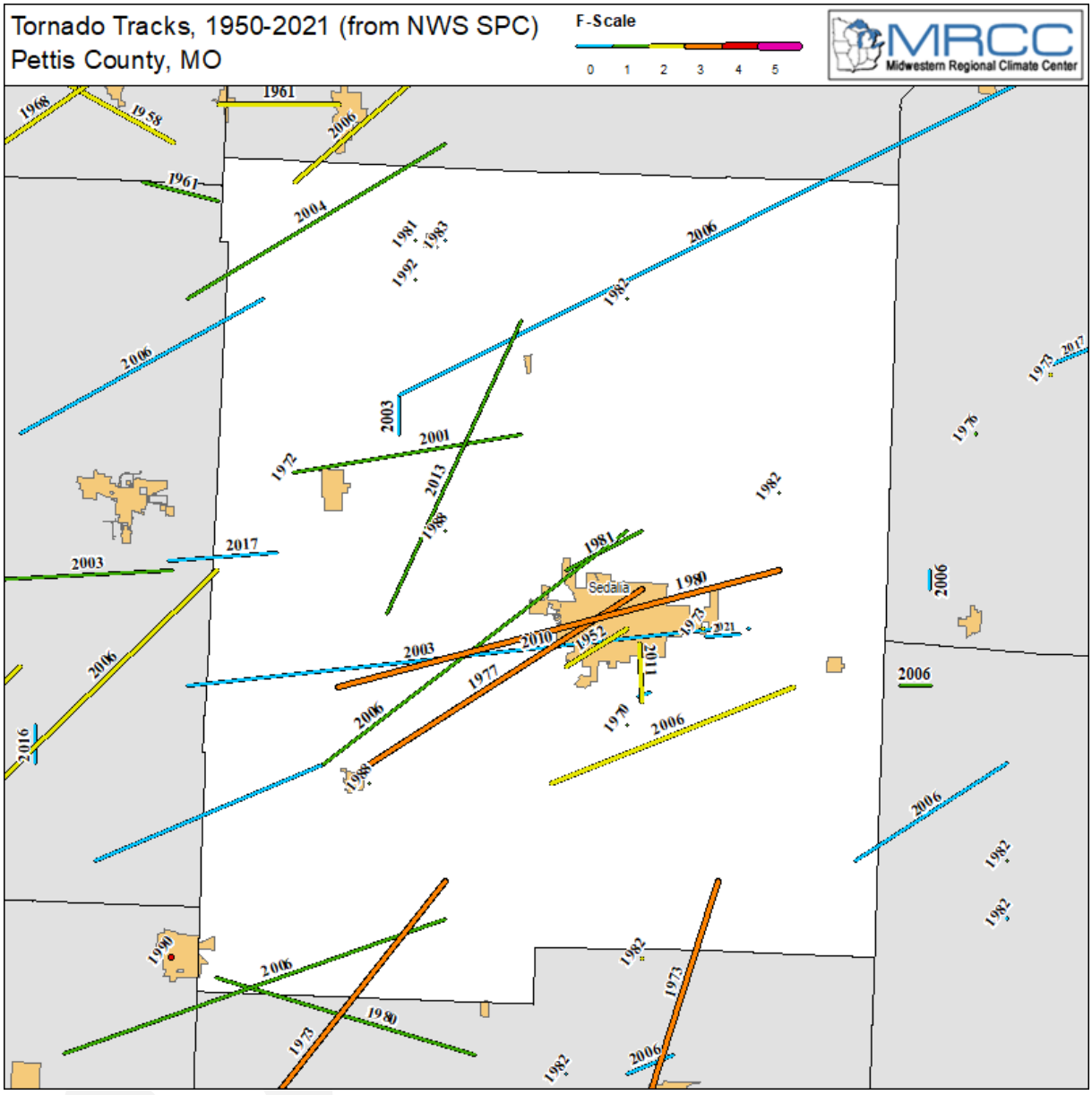
Also, a tornado that lifts off the ground for less than 5 minutes or 2.5 miles is considered a separate segment. If the tornado lifts off the ground for greater than 5 minutes or 2.5 miles, it is considered a separate tornado. Tornadoes reported in Storm Data and the Storm Events Database is in segments.

Table 3.31

Recorded Tornadoes in Pettis County , 2000 – 2023							
Location	**Date**	**Time**	**Magnitude**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**
Sedalia	10/24/2021	15:54	EF0	0	0	$0.00	$0.00
La Monte	3/6/2017	21:13	EF0	0	0	$0.00	$0.00
La Monte	5/20/2013	15:57	EF1	0	0	$20,000.00	$0.00
Pettis Co.	5/25/2011	11:52	EF0	0	0	$0.00	$0.00
Sedalia	5/25/2011	11:22	EF2	0	20	$4,000,000.00	$0.00
Sedalia	5/20/2010	17:46	EF0	0	0	$8,000.00	$0.00
Hughesville	9/12/2008	16:44	EF0	0	0	$5,000.00	$0.00
Green Ridge	3/30/2006	20:24	F1	1	0	$450,000.00	$0.00
La Monte	3/12/2006	20:57	F2	0	0	$0.00	$0.00
Houstonia	3/12/2006	20:07	F2	0	0	$0.00	$0.00
Green Ridge	3/12/2006	16:12	F2	1	6	$2,500,000.00	$0.00
Pettis Co.	3/12/2006	15:57	F1	0	0	$0.00	$0.00
La Monte	3/12/2006	15:49	F0	0	0	$0.00	$0.00
Sedalia	3/9/2006	0:19	F0	0	0	$5,000.00	$0.00
Houstonia	10/29/2004	18:16	F1	0	0	$300,000.00	$0.00
Sedalia	5/6/2003	13:55	F0	0	2	$2,000.00	$0.00
La Monte	5/4/2003	18:35	F0	0	0	$5,000.00	$0.00
Smithton	5/30/2001	18:38	F1	0	0	$0.00	$0.00
La Monte	4/10/2001	16:45	F1	0	0	$50,000.00	$0.00
Totals				**2**	**28**	**$7,345,000.00**	**$0.00**

Source: National Climate Data Center, http://www.NCEI.noaa.gov/stormevents

Figure 3.18 Pettis County Tornado Events Map



Source: https://mrcc.purdue.edu/files/gismaps/tornadotracks/29159_Pettis.png

Probability of Future Occurrence

According to the NCEI storm records, there have been 12 tornado events from 2002 to 2023. Based on the past occurrences of tornadoes in Pettis County, there is a 60% probability that the county will experience a tornado in any given year.

Changing Future Conditions Considerations

Scientists do not know how the frequency and severity of tornadoes will change. Research published in 2015 suggests that changes in heat and moisture content in the atmosphere, brought on by a warming world, could be playing a role in making tornado outbreaks more common and severe in the U.S. The research concluded that the number of days with large outbreaks has been increasing since the 1950s and that densely concentrated tornado outbreaks are on the rise. It is notable that the research shows that the area of tornado activity is not expanding, but rather the areas already subject to tornado activity are seeing the more densely packed tornadoes. Because Missouri experiences on average around 39.6 tornadoes a year, such research is closely followed by meteorologists in the state.

Vulnerability

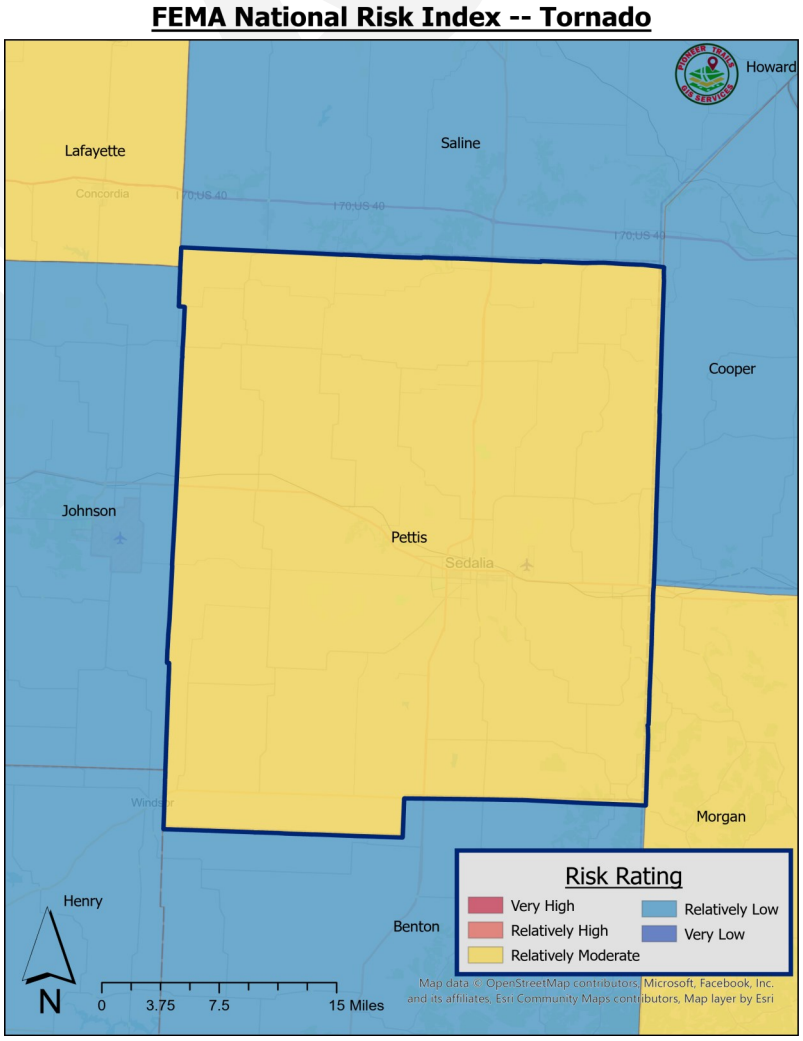
Vulnerability Overview

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

Figure 3.18 Tornado Alley

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

Figure 3.??



Potential Losses to Existing Development

During the 24-year period from 2000 to 2023, a total of $7,345,000 in property losses equates to $306,042 in average annual losses in the county. The most common tornado events recorded in the county are EF0 and EF1 magnitude events. One of the 19 tornado events on record, the highest magnitude tornado recorded was an EF2. There were also some F2 magnitude tornadoes recorded in the NCEI data.

Previous and Future Development

During the 24-year period from 1993 to 2017, a total of $7,345,000 in property losses were incurred. This equates to $306,042 in average annual losses in the county. This value indicates that potential future losses in the county will remain moderately low. Future development and any increase in population will increase exposure to damage; however not much is expected in the future.

Hazard Summary by Jurisdiction

Although tornado events are area-wide hazard, communities with a greater percentage of structures built prior to 1939, or the high concentration of mobile homes, are considered to be more vulnerable to the impact of high wind and hail damage.

Table 3.32 Vulnerable Housing Units

Jurisdiction	% of Housing Built 1939 or Earlier	% of housing is mobile home
Pettis County	15.9	5.3%
Green Ridge	7.9	8.9%
Houstonia	28.5	10.6%
Hughesville	20.9	19.4%
La Monte	14.7	2.9%
Sedalia	21.1	1.1%
Smithton	17	4.5%

Source: U.S. Census Bureau, 2022 ACS 5-year Estimate

Problem Statement

Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 miles per hour and damage paths can be more than one mile wide and 50 miles long. Significant tornado events in Saline County have resulted in two deaths, 28 injuries, and $7,345,000 in property damage over the last 24 years. Information in the 2013 State Plan indicates that Saline County has a low vulnerability to tornados based on frequency of occurrence and previous damages.

The risk of property damage, injury, and death in the county can be mitigated by Constructing FEMA saferooms in facilities that house vulnerable populations such as nursing homes government buildings, and schools. Additionally, identifying safe refuge areas in public buildings, nursing homes, and other facilities that house vulnerable populations that do not have a safe room will lower the vulnerability. Retrofitting school district facilities with protective filming of windows and installation of blast proof doors will provide more protection for students and staff at school facilities. Additional warnings and alerts will also provide the public and schools with more time to take cover during tornado. Cities can adopt or update and enforce IBC 2012 building codes that include construction techniques such as roof tie down straps to mitigate damage to future development

3.4.5 Severe Thunderstorm — Including High Winds, Lightning, Hail

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 and tornadoes (discussed separately).

High Winds

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

Lightning

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

Hail

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

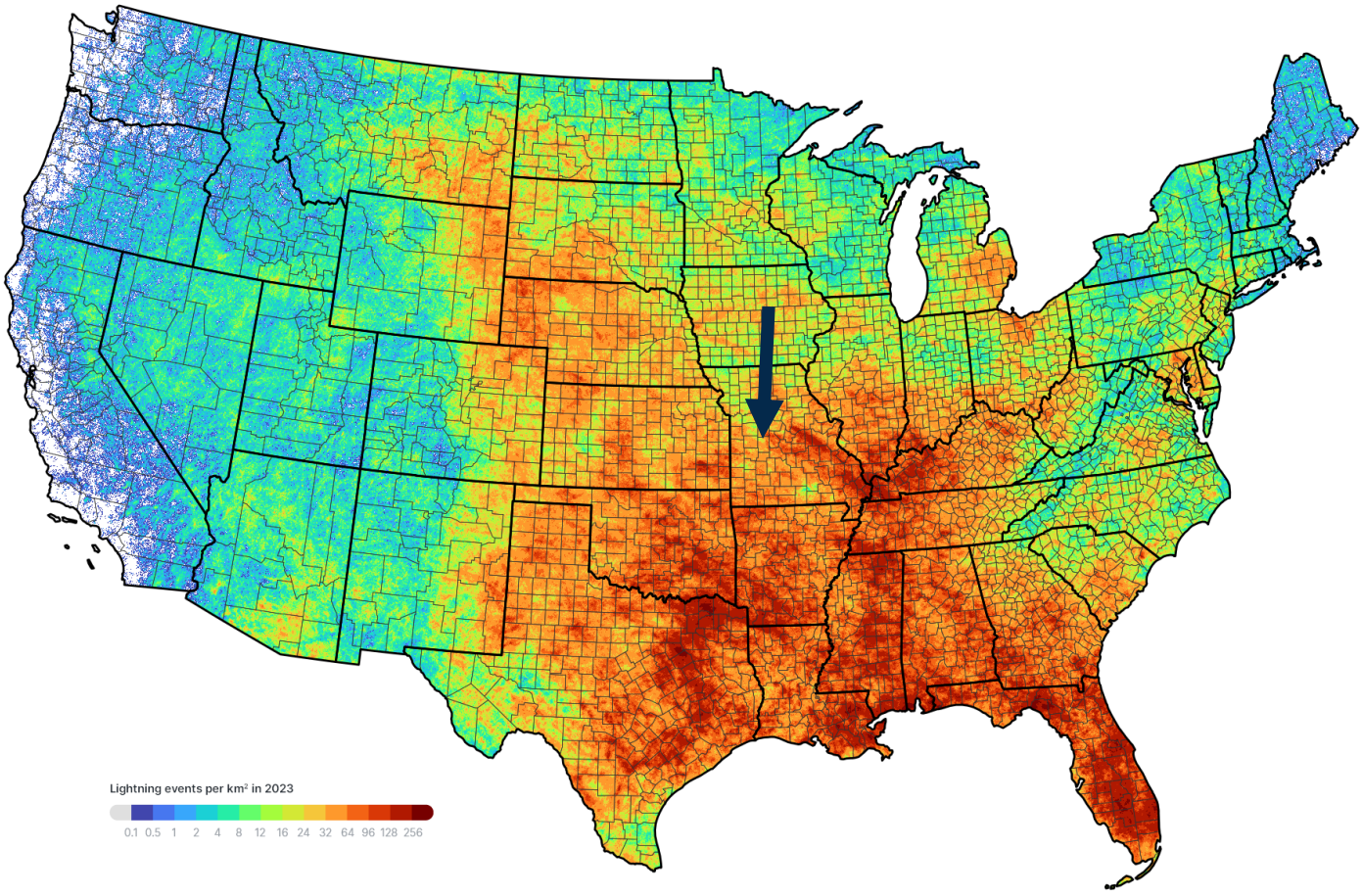
At the time when the updraft can no longer support the hailstone, it will fall to the earth. For example, a ¼" diameter or pea sized hail requires updrafts of 24 miles per hour, while a 2 ¾" diameter or baseball sized hail requires an updraft of 81 miles per hour. According to the NOAA, the largest hailstone in diameter recorded in the United States was found in Vivian, South Dakota on July 23, 2010. It was eight inches in diameter, almost the size of a soccer ball. Soccer-ball-sized hail is the exception, but even small pea-sized hail can do damage.

Geographic Location

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

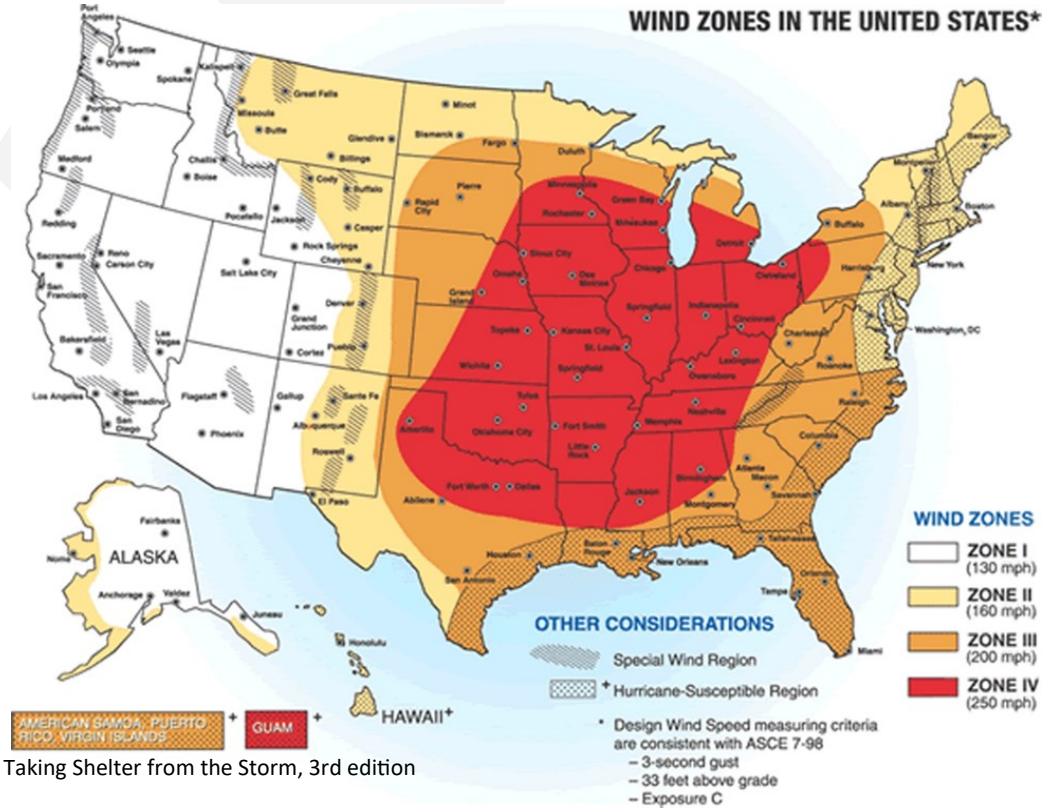
Figure 3.19 shows lightning frequency in the state, followed by **Figure 3.20** showing wind zones in the United States. Pettis County spans multiple flash-density zones and could see from 4-8 flashes and possible winds of 250 mph.

Figure 3.19 VAISALA Xweather Annual Lightning Report 2023—Lightning Density



Source: https://www.xweather.com/annual-lightning-report

Figure 3.20



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

Severity/Magnitude/Extent

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

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

Most lightning 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 damages to crop if fields or forested lands are set on fire. Communications equipment and warning transmitters and receivers can also be knocked out by lightning strikes.

Based on information provided by the Tornado and Storm Research Organization (TORRO), **Table 3.32** below describes typical damage impacts of the various sizes of hail.

Table 3.32 Hailstorm Intensity Scale

Tornado & Strom Research Organization Hailstorm Intensity Scale				
Intensity Category	**Diameter (mm)**	**Diameter (inches)**	**Size Description**	**Typical Damage Impacts**
Hard Hail	9-May	0.2-0.4	Pea	No damage
Potentially Damaging	15-Oct	0.4-0.6	Mothball	Slight general damage to plants/crops
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	Squash ball	Widespread glass damage, vehicle bodywork damage
Destructive	41-50	1.6-2.0	Golf ball	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	Severe roof damage, risk of serious injuries
Destructive	76-90	3.0-3.5	Softball	Severe damage to aircraft bodywork
Super Hailstorm	91-100	3.6-3.9	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Super Hailstorm	>100	4.0+	Melon	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

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

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

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

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

Previous Occurrences

The tables below (**Tables 3.33** through **Table 3.35**) summarize past crop damages as indicated by crop insurance claims for the years of 2012 to 2023. The tables illustrate the magnitude of the impact on the planning area's agricultural economy. There were no recorder crop insurance claims caused by lightning in the same time period.

Table 3.?? Pettis County Crop Insurance Paid 2014-2023 for Listed Cause of Loss

Cause of Loss	Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total: ($)
Excess Moisture/Rain	Wheat	21,993.00	1,180,263.97	42,125.50			65,522.92	76,687.00	307,855.00	21,141.50		**1,715,588.89**
	Corn	11,818.20	2,370,129.47	53,163.72	193,756.16		921,841.10	275,774.50	2,289,214.50	144,221.00	40,633.00	**6,300,551.65**
	Soybean	33,871.00	5,655,091.60	144,976.94	187,819.40	44,850.00	461,317.50	120,526.40	724,142.20	140,814.00	29,643.00	**7,543,052.04**
	Sorghum	3,093.00	41,518.00	1,044.00			850.00	881.00	8,979.00			**56,365.00**
	TOTAL: ($)	**70,775.20**	**9,247,003.04**	**241,310.16**	**381,575.56**	**44,850.00**	**1,449,531.52**	**473,868.90**	**3,330,190.70**	**306,176.50**	**70,276.00**	**15,615,557.58**
Hail	Wheat	6,841.00		3,755.00								**0.00**
	Corn										7,063.50	**77,162.71**
	Soybean	155,075.59		1,713.00			13,709.00				4,920.00	**32,756.00**
	TOTAL: ($)	**161,916.59**	**0.00**	**5,468.00**	**0.00**	**0.00**	**13,709.00**	**0.00**	**0.00**	**0.00**	**11,983.50**	**49,241.50**
Wind/Excess Wind	Corn					42,196.00			104,369.00		169,821.50	**381,965.71**
	Soybean		7,685.00						1,069.00			**1,069.00**
	TOTAL: ($)	**0.00**	**7,685.00**	**0.00**	**0.00**	**42,196.00**	**0.00**	**0.00**	**105,438.00**	**0.00**	**169,821.50**	**282,323.00**

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

Probability of Future Occurrence

Limitations to the use of NCEI reported lightning events include the fact that only lightning events that result in fatality, injury and/or property and crop damage are in the NDCD.

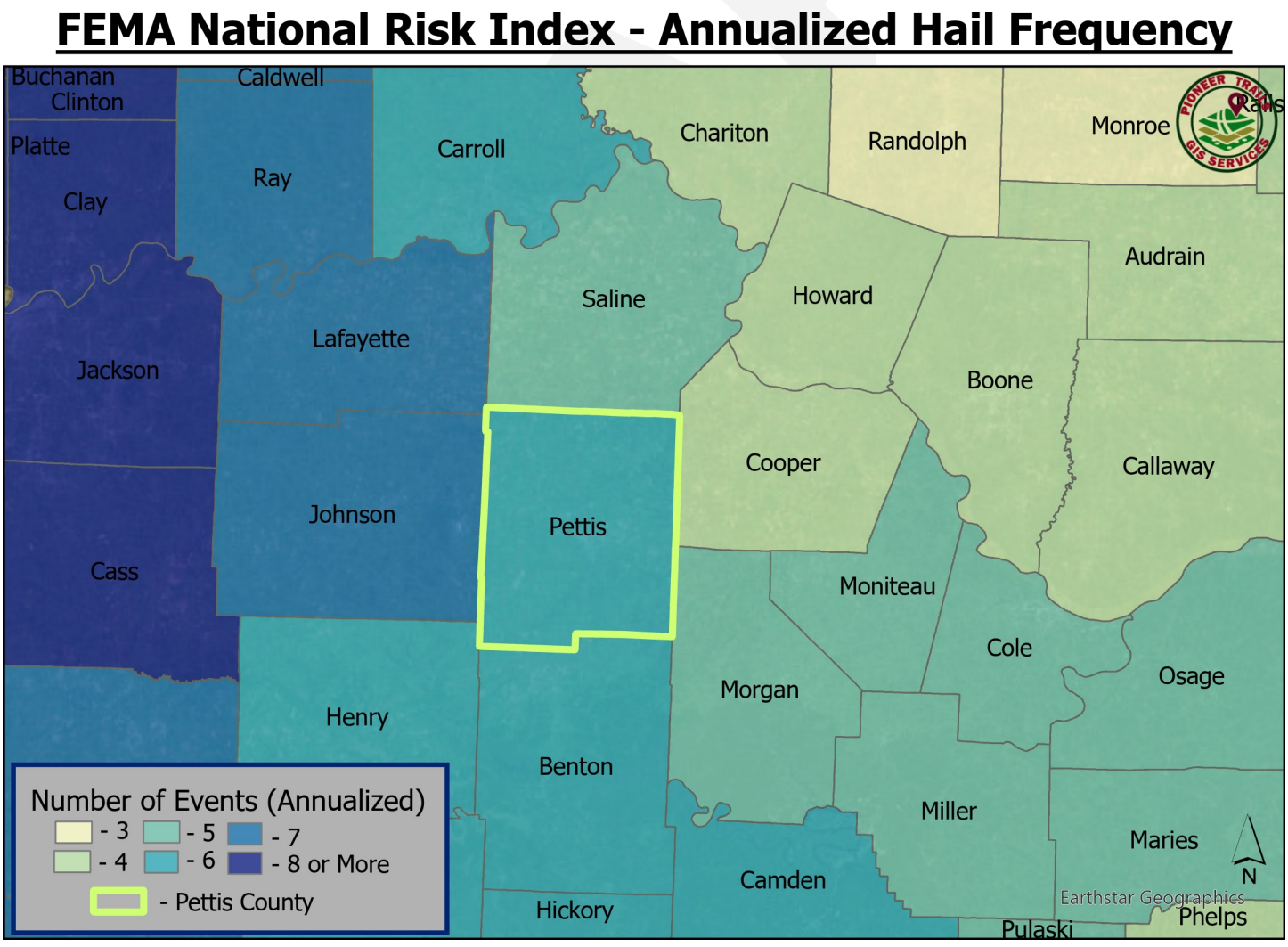
No Damages have been reported in Pettis County for high wind, thunderstorm winds, lightning, or hail events per the NCEI database, for the years ranging from 2012 through 2023.

The probability for lightning events cannot be determined due to the lack of data and incidents available through the NCEI.

There have been 59 Thunderstorm Wind event days over a 20-year period reported to the NCEI from 1/2002 –12/2023. This averages out to 2.15 events in any given year for a 100% probability of occurrence. There have been 62 Hail events reported to the NCEI over the same 20-year period, averaging 3.1 events per year for a 100% probability of occurrence. There has been one occurrence of High Winds in Pettis County over the 20-year period, this gives a 5% chance of occurrence of an event any given year.

Figure 3.21 is based on hailstorm data from the FEMA National Risk Index. It shows the annualized frequencty of hailstorm occurrence based on number of reports per year. Annual average hail events in Pettis County is six, with neighboring counties averaging four to seven events per year.

Figure 3.21 FEMA Hail Risk



Changing Future Conditions Considerations

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

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

Vulnerability

Vulnerability Overview

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

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

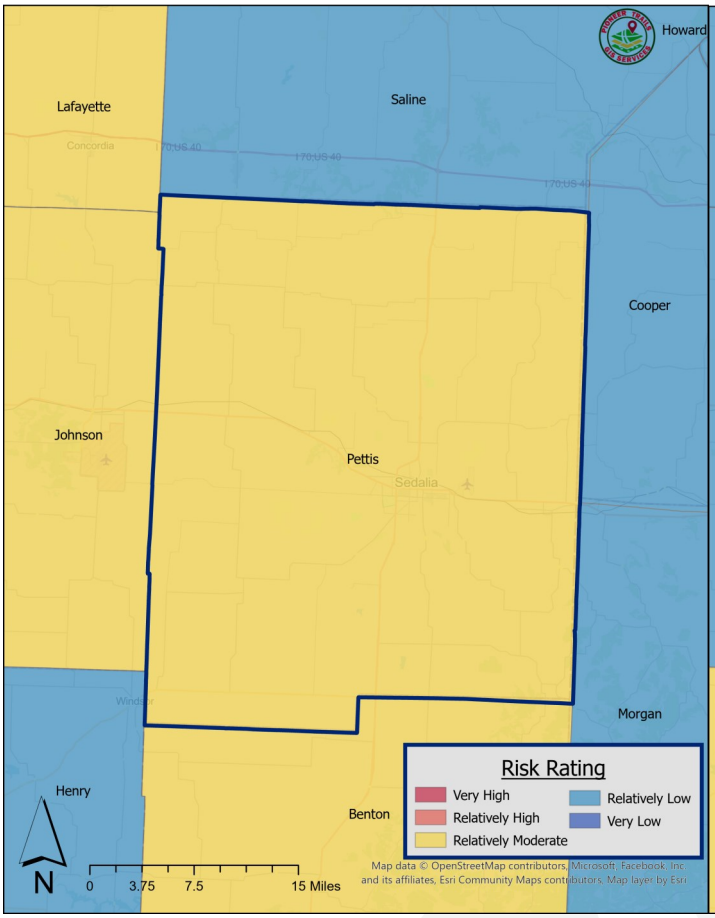
Most lightning damage occurs to electronic equipment located inside buildings. But structural damage can also occur when a lightning strike causes a building fire. In addition, lightning strikes can cause damage to crops, if fields or forested lands are set on fire. Communications equipment and warning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

http://www.vaisala.com/en/products/thunderstormandlightningdetectionsystems/Pages/NLDN.aspx and
http://www.lightningsafety.noaa.gov/

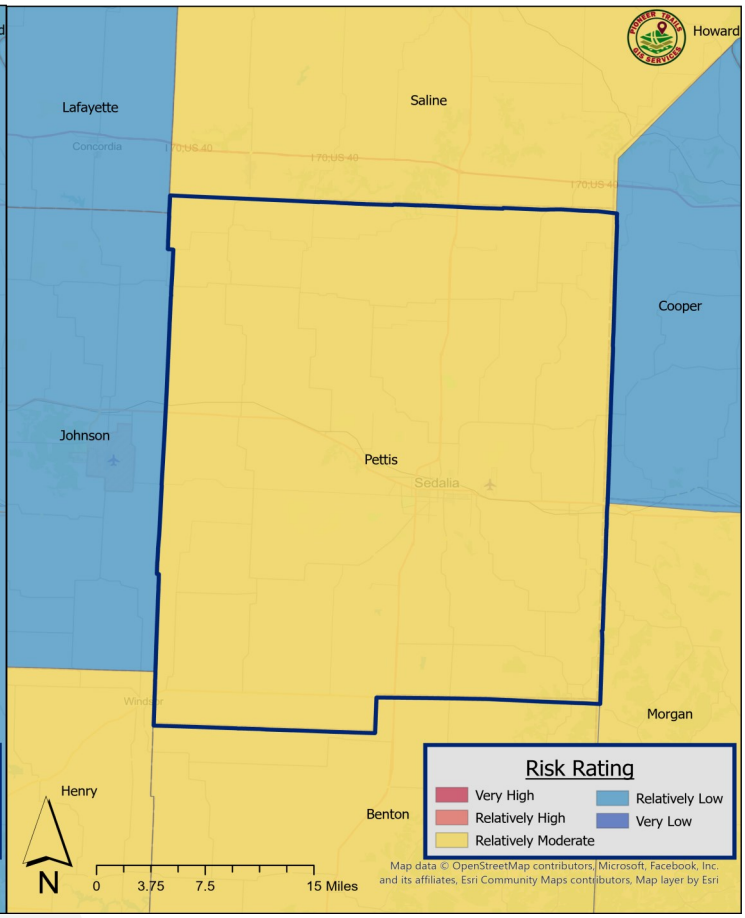
Thunderstorms, high wind, hail, and lightning pose varying risks for jurisdictions in Pettis County. Downbursts resulting from thunderstorms can be just as damaging as an EF-1 tornado. Thunderstorm winds and high winds have resulted in no injuries or deaths in Pettis County and have created no property or crop damage. Poorly built structures, barns, outbuildings are more vulnerable to the impact of high winds during thunderstorms. Both high winds and hail can damage roofs. Hail can also damage crops and dent cars and trucks. Total hail damage recorded in the NCEI database for Pettis County from 2002 – 2023 was none, as recorded events did not cause any damages. Lightning can cause wildfires and structural fires, damage electrical utilities causing power outages, and sometimes fatalities. Pettis County has seen no lighting events cause property damage during the period of 2012-2023.

Figures 3.?? - 3.??

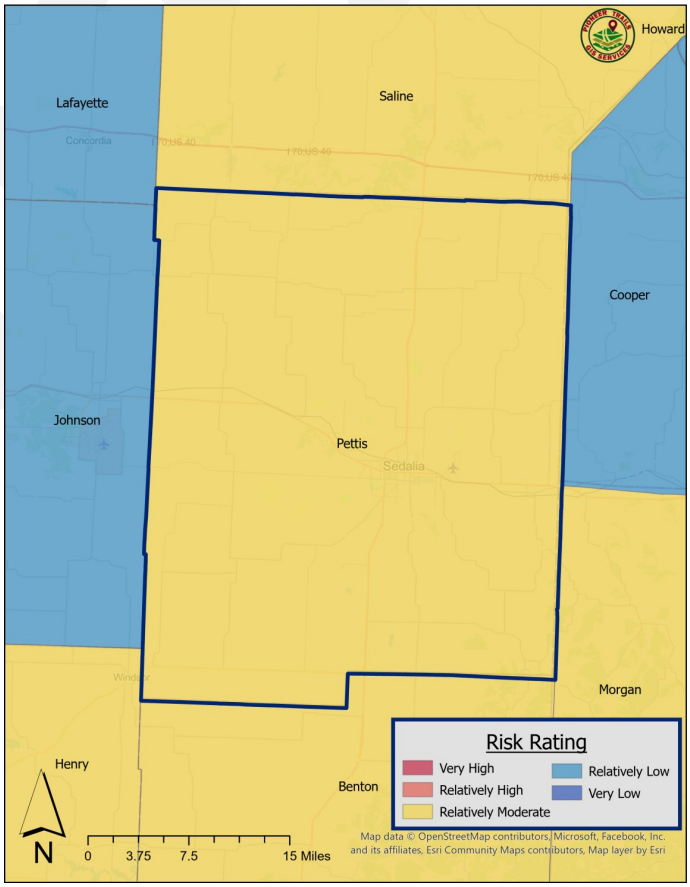
FEMA National Risk Index -- Lightning Strikes



FEMA National Risk Index -- High Winds



FEMA National Risk Index -- High Winds



Potential Losses to Existing Development

The average annual loss determined from historical losses for thunderstorms, high wind, hail and lightning are indicators of the potential losses to existing development. High wind events in the County have damaged critical facilities, schools, local governments, and private property. Potential annual losses throughout the county are: thunderstorm - $19,300 hail - $111,111, high winds -$3,361 and lightning -< $2,222.00.

Previous and Future Development

Growth in Pettis County is occurring at a slow rate, with rural Pettis County currently seeing the most growth in terms of population and housing built. Additional development in these areas results in the exposure of more households and businesses vulnerable to damages from high winds, hail, and lightning.

Hazard Summary by Jurisdiction

Although thunderstorms/high winds/lightning/hail events are area-wide, demographics of jurisdictions with high percentages of housing built before 1939 are susceptible, along with mobile homes.

Table 3.36 Vulnerable Housing Units

Jurisdiction	% of Housing Built 1939 or Earlier	% of housing is mobile home
Pettis County	15.9	5.3%
Green Ridge	7.9	8.9%
Houstonia	28.5	10.6%
Hughesville	20.9	19.4%
La Monte	14.7	2.9%
Sedalia	21.1	1.1%
Smithton	17	4.5%

Source: U.S. Census Bureau, 2022 ACS 5-year Estimate

Problem Statement

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

The risk of property damage, injury, and death in the county can be mitigated by identifying safe refuge areas in public buildings, nursing homes and other facilities that house vulnerable populations that do not have a safe room. Retrofitting school district facilities with protective filming of windows and installation of blast proof doors will provide more protection for students and staff at school facilities. Additional warnings and alerts will also provide the public and schools with more time to take cover during high wind events. Education and hazard awareness programs in public schools would also increase public safety in the event of severe thunderstorm events.

3.4.6 Severe Winter Weather

Hazard Profile

Hazard Description

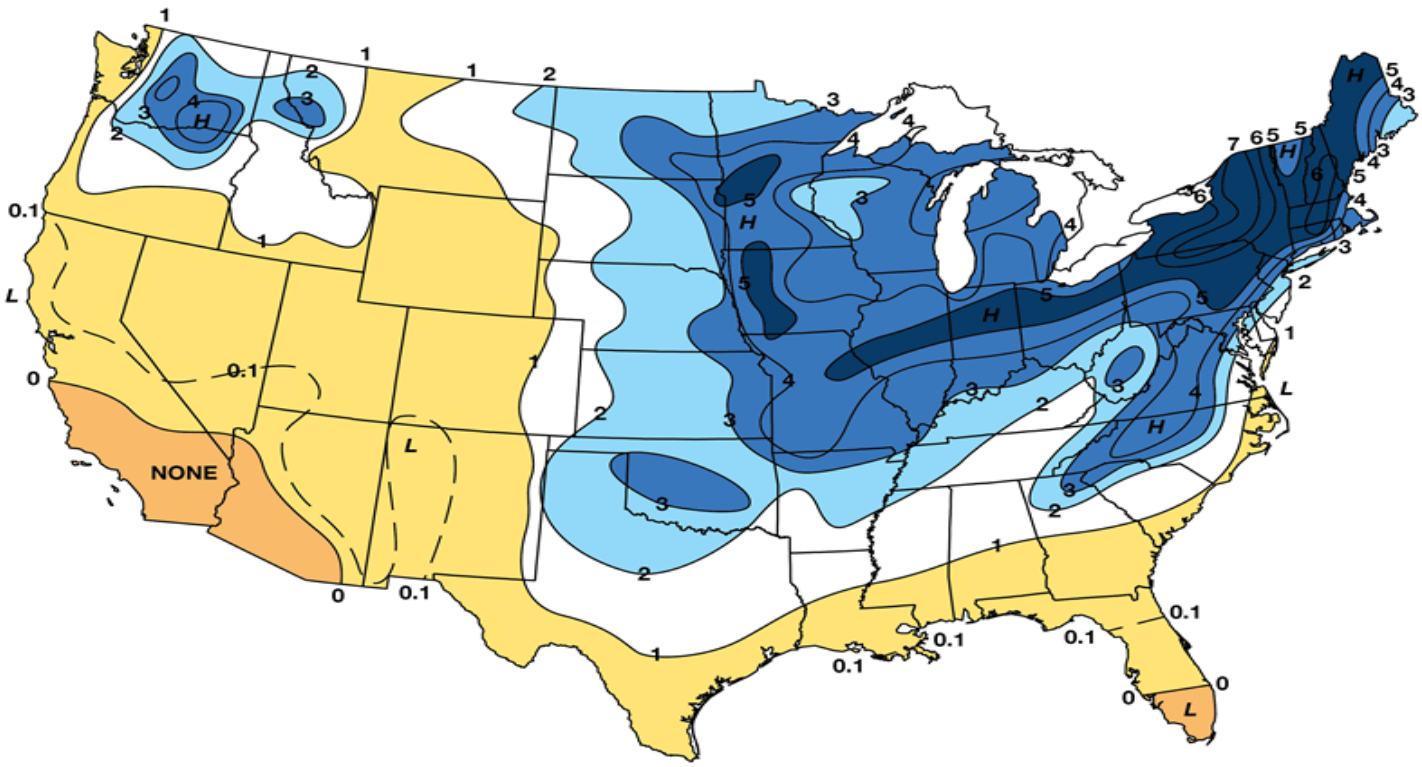
A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. The National Weather Service describes different types of winter storm events as follows.

- **Blizzard**—Winds of 35 miles per hour or more with snow and blowing snow reducing visibility to less than ¼ mile for at least three hours.
- **Blowing Snow**—Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- **Snow Squalls**—Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- **Snow Showers**—Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- **Freezing Rain**—Measurable rain that falls onto a surface with a temperature below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing-rain events are short lived and occur near sunrise between the months of December and March.
- **Sleet**—Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects.

Geographic Location

The entire county is vulnerable to heavy snow, ice, extreme cold temperatures, and freezing rain. **Figure 3.22** depicts the average number of hours per year with freezing rain. Pettis County is in a zone that can expect 9 – 12 hours of freezing rain per year

Figure 3.22 Freezing Rain Days



The average annual number of days with freezing rain, based on 1948-2000 data. *From Changnon and Karl, 2003.*

Severity/Magnitude/Extent

Severe winter storms include extreme cold, heavy snowfall, ice, and strong winds which can push the wind chill well below zero degrees in the planning area. Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. Ice can also become a problem on roadways if the air temperature is high enough that precipitation falls as freezing rain rather than snow.

For severe weather conditions, the National Weather Service issues some or all 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 downing of 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 Pettis County Winter Weather Events Summary, 2002-2023					
Type of Event	**Number of Occurrences**	**# of Deaths**	**# of Injuries**	**Property Damage**	**Crop Damage**
Blizzard	2	0	0	0	0
Cold/Wind Chill	1	0	0	0	0
Extreme Cold/ Wind Chill	4	0	0	0	0
Frost/Freeze	1	0	0	0	0
Heavy Snow	6	0	0	0	0
Ice Storm	6	0	0	$105,000	0
Winter Storm	17	0	0	$8,000	0
Winter Weather	5	0	0	0	0
Total	**42**	**0**	**0**	**$113,000**	**0**

Source: NCEI, data accessed 1/5/2024

Table 3.38 Notable Winter Event in Pettis County

Notable Winter Storm Events In Pettis County		
Event	**Date**	**Narrative**
Blizzard	2/1/2011	Blizzard conditions were observed across the county, with frequent wind gusts up to 45 mph, visibilities less than 1/4 of a mile, and heavy snow of up to 21.3 inches, measured in Sedalia. Travel was nearly impossible, with the blowing and drifting snow, and the very low visibilities.
Cold/Wind Chill	1/6/2014	A polar plunge of arctic air slammed into Kansas, bringing wind chill values to around 30 degrees below zero for the morning of January 6.
Heavy Snow	2/4-5/2014	A major winter storm trekked through Kansas and Missouri on February 4 and 5. By the time the storm finished it dropped around 6-10 of snow across the entire area. Northerly winds on the back side of this system gusted up to 30 mph and produced substantial blowing and drifting. Many areas reported drifts of 2 to 3 feet.
Ice Storm	1/30/2002	A long-lived major ice and snow storm blasted much of northwest, northern and central Missouri from late Tuesday, January 29th, until Thursday, January 31st. Ice accumulations of over an inch were observed from the Kansas City metropolitan area, east and north through Moberly Missouri. At one point 409,504 total customers were without electrical power in the CWA, with some residents without power up to two weeks. For the Kansas City area, the ice storm was ranked as the worst ever.

Source: NCEI, data accessed 1/5/2024

Table 3.?? Pettis County Crop Insurance Paid 2014-2023 for Listed Cause of Loss

	Year	2014	2015	2016	2017	2018
Cold Wet Weather	Wheat		38,060.54	6,946.99		2,559.15
	Corn		3,201.00		25,091.00	
	Soybean		24,374.00		3,126.60	
	TOTAL: ($)	**0.00**	**65,635.54**	**6,946.99**	**28,217.60**	**2,559.15**
Cold Winter	Wheat	149,653.57	13,836.70	2,644.44		82,339.58
	Corn	2,672.80				
	Soybean	3,432.10				
	TOTAL: ($)	**155,758.47**	**13,836.70**	**2,644.44**	**0.00**	**82,339.58**
Freeze	Wheat	11,883.05		1,038.36		3,094.00
	TOTAL: ($)	**11,883.05**	**0.00**	**1,038.36**	**0.00**	**3,094.00**

	Year	2019	2020	2021	2022	2023	**Total: ($)**
Cold Wet Weather	Wheat	16,768.87			28,672.00		**138,448.42**
	Corn	56,189.00	9,892.00	276,620.00	37,202.00		**788,098.00**
	Soybean			450.00	8,723.00		**45,846.60**
	TOTAL: ($)	**72,957.87**	**9,892.00**	**277,070.00**	**74,597.00**	**0.00**	**972,393.02**
Cold Winter	Wheat	40,864.52		18,399.00	117,626.00	17,534.00	**654,855.33**
	Corn						**2,672.80**
	Soybean						**3,432.10**
	TOTAL: ($)	**40,864.52**	**0.00**	**18,399.00**	**117,626.00**	**17,534.00**	**660,960.23**
Freeze	Wheat					54,083.80	**178,266.81**
	TOTAL: ($)	**0.00**	**0.00**	**0.00**	**0.00**	**54,083.80**	**178,266.81**

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

Winter storms, cold, frost and freeze take a toll on crop production in the planning area. **Table 3.39** showed the USDA's Risk Management Agency payments for insured crop losses in the planning area as a result of cold conditions and snow from 2014 to 2023.

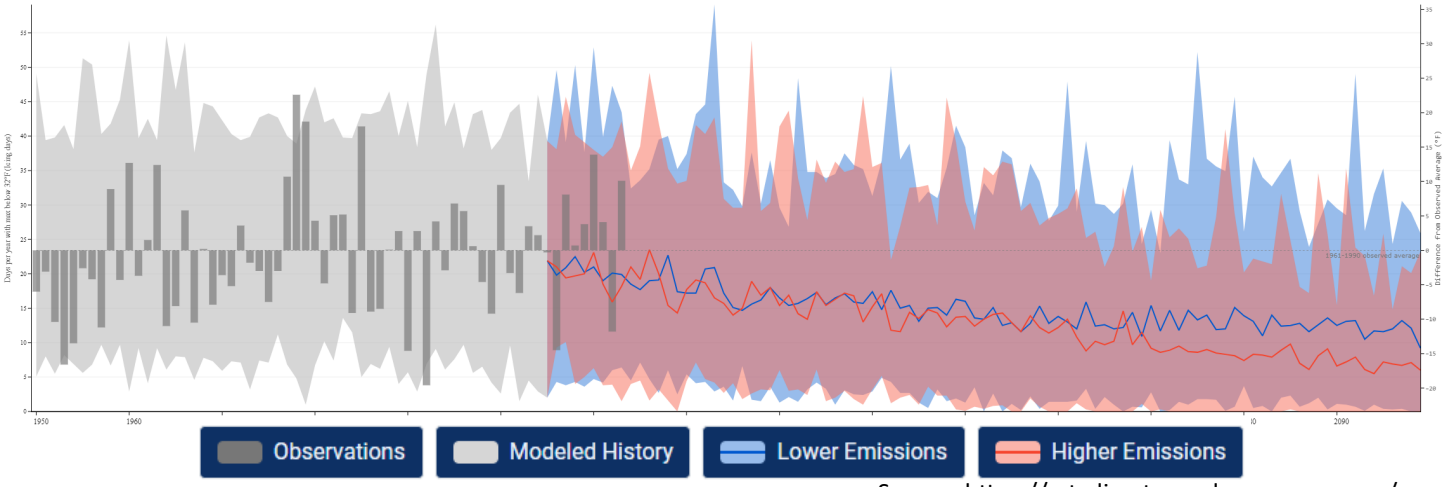
Probability of Future Occurrence

The probability for all of the different types of winter weather are included as one probability, since one storm generally includes multiple types of events. There were 42 severe winter weather events in Pettis County from 2012 to 2023. This equates to a 100% probability of occurrence in any given year in the planning area.

Changing Future Conditions Considerations

A shorter overall winter season and fewer days of extreme cold may have both positive and negative indirect impacts. Warmer winter temperatures may result in changing distributions of native plant and animal species and/or an increase in pests and non-native species. Warmer winter temperatures will result in a reduction of lake ice cover. Reduced lake ice cover impacts aquatic ecosystems by raising water temperatures. Water temperature is linked to dissolved oxygen levels and many other environmental parameters that affect fish, 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.

Figure 3.23 Pettis County Days with Maximum Temperature Below 32 Degrees through 2090



Source: https://crt-climate-explorer.nemac.org/

Vulnerability

Vulnerability Overview

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

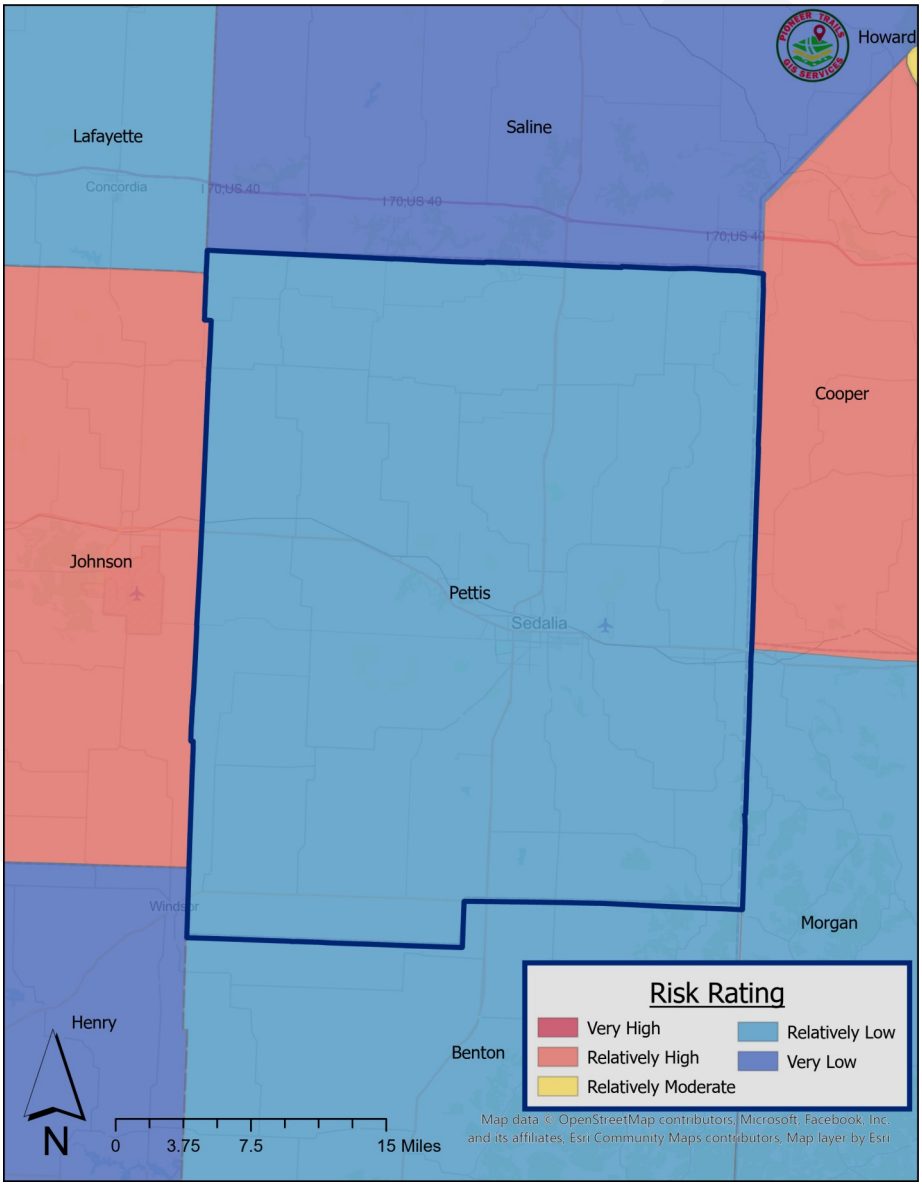
Buildings with overhanging tree limbs are more vulnerable to damage during winter storms when limbs fall. Businesses experience loss of income because of closure during power outages. In general, heavy winter storms increase wear and tear on roadways though the cost of such damages is difficult to determine. Businesses can experience loss of income because of 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 damage 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 during winter storms. Public safety hazards include the 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 because of loss of power is $126 per person per day of lost service.

Figure 3.??

FEMA National Risk Index -- Winter Weather



Source: FEMA National Risk Index, Hazard Rating

Potential Losses to Existing Development

During the 20-year period from 2002 to 2023, a total of three events caused $113,000 in property damage losses. This number, equally distributed over the 20-year period, puts estimated losses at $5,650 on average for annual losses countywide. With 42 recorded events in the 20-year period there would be a 100% chance that a severe wither weather event will occur within Pettis County.

Previous and Future Development

Increased development and any resulting increase in population will increase exposure to damage from severe winter weather; however not much growth is expected. Future commercial development can expect functional downtime and decreased revenues during periods of severe winter weather. Road construction in the county will increase the need for snow removal and salt to keep transportation lifelines open during periods of severe winter weather.

Hazard Summary by Jurisdiction

Severe winter weather can cause power outages and put structures at risk of fires when individuals in homes resort to fuel heaters. The risk of extreme cold deaths and frostbite varies among segments of the populations. People over 65, those living below the poverty level, and Mobile home parks or areas with high density populations have an increased vulnerability to severe winter weather.

Table 3.40

Jurisdiction	% of population below the Poverty Level	% Population over 65 years of age	% Mobile Home Housing Units
Pettis County	14.80%	17.00%	5.30%
City of Green Ridge	9%	11%	8.90%
City of Houstonia	6.90%	18.40%	10.60%
Village of Hughesville	19.10%	11.80%	19.40%
City of La Monte	24.90%	12.90%	3%
City of Sedalia	17.60%	17.10%	1.10%
City of Smithton	9.00%	8.40%	4.50%

Source: U.S. Census Bureau, 2022 5-year ACS Estimates

Problem Statement

Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. People over 65 and those living in poverty have an increased risk of hypothermia and frostbite due to extreme cold and wind chill.

Providing heating and cooling centers in the county would be beneficial to the population as a good percentage live in poverty. These facilities, which could be advertised online or through the news, would provide individuals who are at risk refuge from periods of extreme cold. Public works departments and road districts can develop snow removal plans and maintain adequate snow removal equipment and salt to quickly open roads after periods of heavy snow and freezing rain. The County and cities can work with local electric providers to develop vegetation management programs in rights of way to minimize damages to falling tree limbs laden with ice resulting from ice storms to minimize power outages throughout the county.

3.4.7 Extreme Temperatures

Hazard Profile

Hazard Description

Extreme temperature events, both hot and cold, can impact human health and mortality, natural ecosystems, agriculture and other economic sectors. The remainder of this section profiles extreme heat. Extreme cold events are profiled in combination with Winter Storm in Section 3.4.11. 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 3.24 uses both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

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

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

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

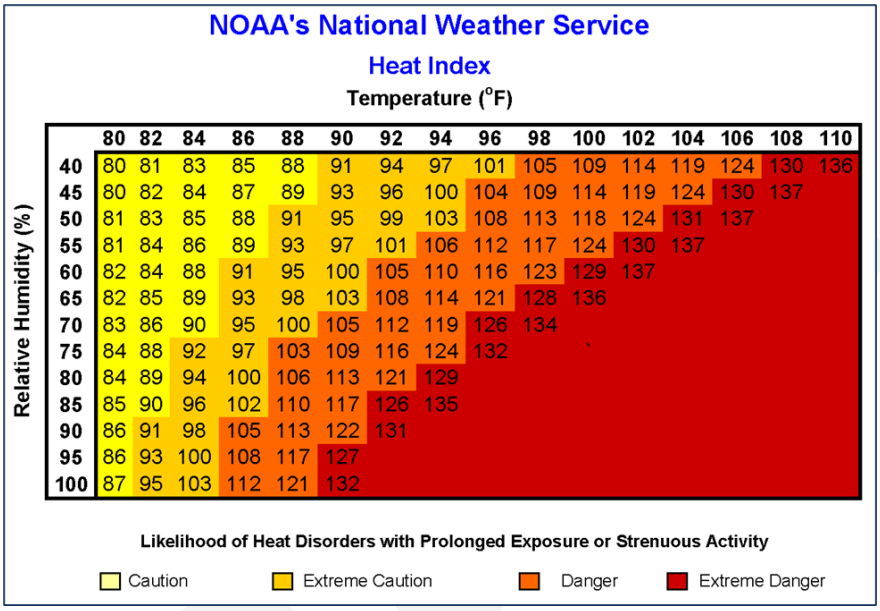
Geographic Location

Extreme heat is an area-wide hazard event, and the risk of extreme heat does not vary across the planning area. Temperatures can vary locally. Figure 3.2? can be applied to any jurisdiction in Pettis County.

Severity/Magnitude/Extent

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

Figure 3.2?

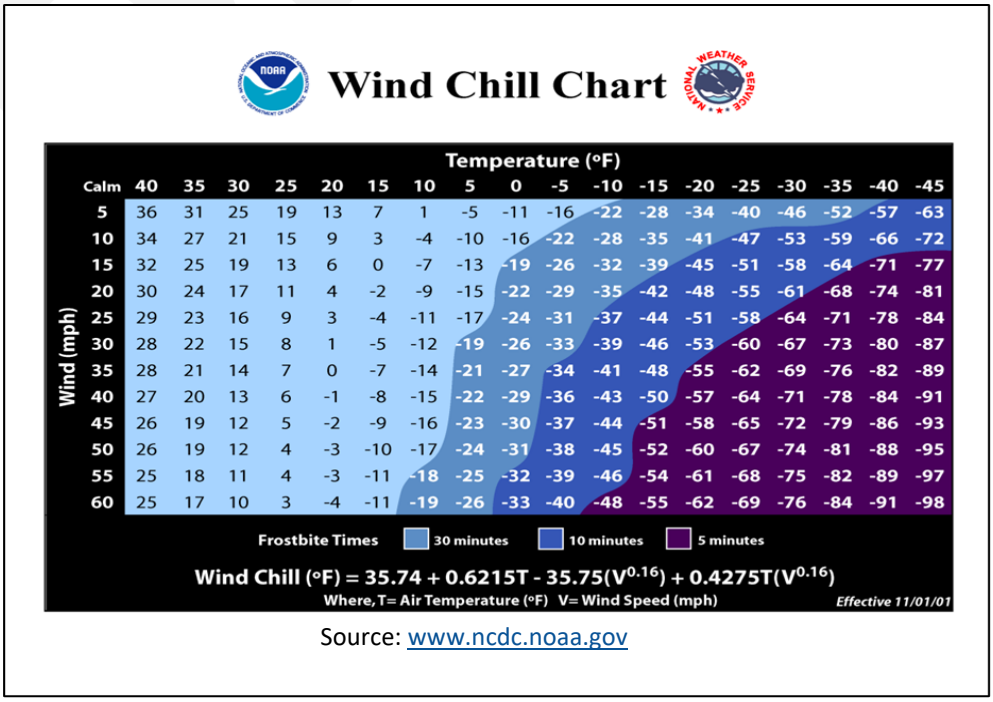


Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Source: http://www.nws.noaa.gov/om/heat/heat-images/heatindexchart.png

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. Figure 3.26 can be applied to any jurisdiction in Pettis County.

Figure 3.2?



Wind (mph)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Source: www.ncdc.noaa.gov

Previous Occurrences

Table 3.41

NCEI Pettis County Winter Weather Events Summary, 2002-2023					
Type of Event	**Number of Occurrences**	**# of Deaths**	**# of Injuries**	**Property Damage**	**Crop Damage**
Blizzard	2	0	0	0	0
Cold/Wind Chill	1	0	0	0	0
Extreme Cold/Wind Chill	4	0	0	0	0
Frost/Freeze	1	0	0	0	0
Heavy Snow	6	0	0	0	0
Ice Storm	6	0	0	$105,000	0
Winter Storm	17	0	0	$8,000	0
Winter Weather	5	0	0	0	0
Total	**42**	**0**	**0**	**$113,000**	**0**

Source: NCEI, data accessed 1/5/2024

Winter storms, cold, frost and freeze take a toll on crop production in the planning area. Table 3.?? showing the USDA's Risk Management Agency payments for insured crop losses in the planning area as a result of cold conditions and snow from 20124 to 2023.

Table 3.??

Crop Insurance Claims Paid in Pettis County 2014-2023			
Year	Crop Type	Cause of Loss	Insurance Paid
2023	Wheat/Corn	Cold Winter/Freeze	$71,618
2022	Wheat/Corn/Soybean/ Sorghum	Cold Winter/Cold Wet Weather	$192,223
2021	Wheat/Soybean/ Sorghum	Cold Winter/Cold Wet Weather	$295,469
2020	Corn	Cold Wet Weather	$9,892
2019	Wheat/Corn	Cold Winter/Cold Wet Weather	$113,822
2018	Wheat	Cold Winter/Cold Wet Weather/Freeze	$87,993
2017	Corn/Soybean	Cold Wet Weather	$28,218
2016	Wheat	Cold Winter/Cold Wet Weather/Freeze	$10,630
2015	Wheat/Corn/Soybean	Cold Winter/Cold Wet Weather	$79,472
2014	Wheat/Corn/Soybean	Cold Winter/Freeze	$167,642
		Total:	**$889,337**

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

Extreme heat can cause stress to crops and animals. According to USDA Risk Management Agency, losses to insurable crops during the 10-year time period from 2014 to 2023 were $1,028,797.37. Extreme heat can also strain electricity delivery infrastructure overloaded during peak use of air conditioning during extreme heat events. Another type of infrastructure damage from extreme heat is road damage. When asphalt is exposed to prolonged extreme heat, it can cause buckling of asphalt-paved roads, driveways, and parking lots.

From 1988-2022, there were 169 fatalities in Missouri attributed to summer heat. This translates to an annual average of 5 deaths. During the same period, zero deaths were recorded in the planning area, according to NCEI data. The National Weather Service stated that among natural hazards, no other natural disaster—not lightning, hurricanes, tornadoes, floods, or earthquakes—causes more deaths.

Table 3.43

NCEI Pettis County Heat Events Summary, 2002-2023					
Type of Event	**Number of Occurrences**	**# of Deaths**	**# of Injuries**	**Property Damage**	**Crop Damage**
Excessive Heat	2	0	0	0	0
Heat	7	0	0	0	0
Total	**9**	**0**	**0**	**$0**	**$0**

Source: NCEI, data accessed 1/5/2024

Table 3.44 Crop loss heat related

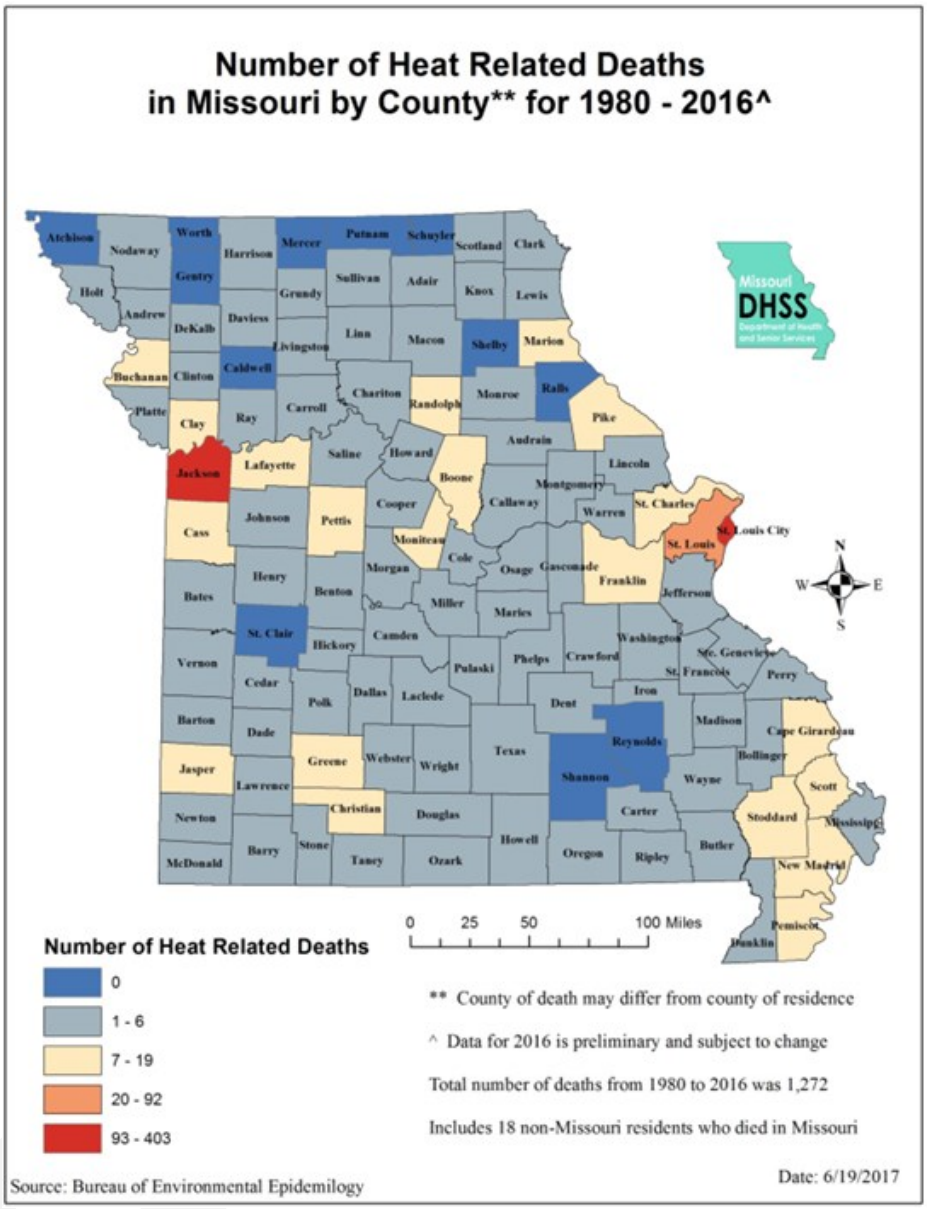
Crop Insurance Claims Paid in Pettis County 2014-2023			
Year	Crop Type	Cause of Loss	Insurance Paid
2023	Soybean	Heat	$10,660
2022	Corn/Soybean	Heat	$98,833
2021	Corn	Heat	$112,591
2020			
2019	Corn	Heat	$203,331
2018			
2017			
2016	Soybean	Heat	$1,646
2015			
2014			
		Total:	**$427,061**

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

Probability of Future Occurrence

The probability for all of the different types of winter weather is included as one probability, since one storm generally includes multiple types of events. There were 42 severe winter weather and 9 extreme heat events in Pettis County from 2002 to 2023. This equates to a 100% probability of occurrence in any given year in the planning area.

Figure 3.27

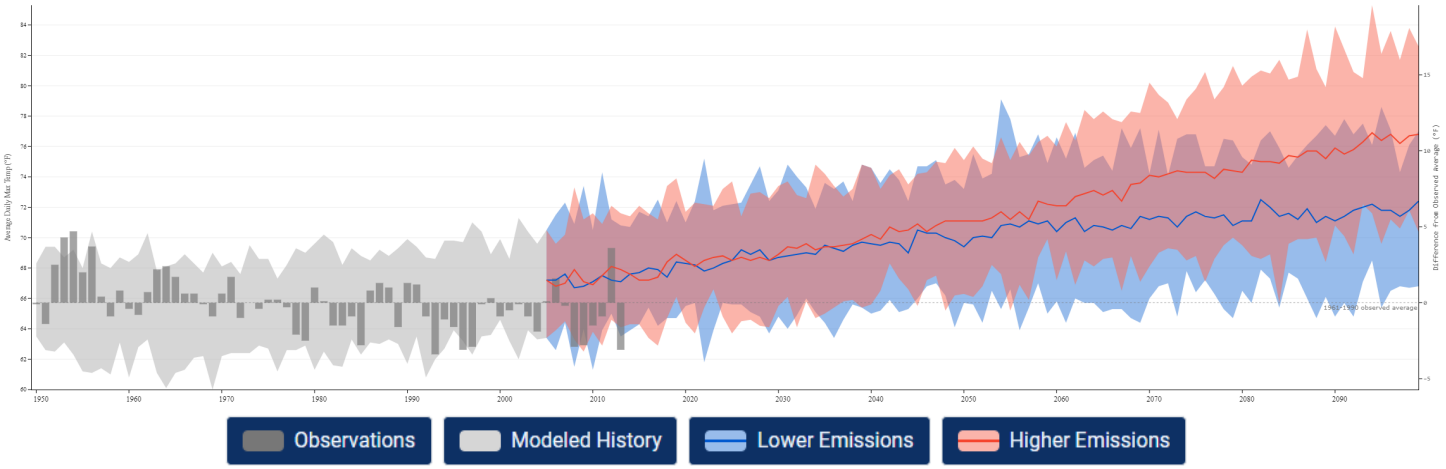


Changing Future Conditions Considerations

Under a higher emissions pathway, historically unprecedented warming is projected by the end of the century. Even under a pathway of lower greenhouse gas emissions, average annual temperatures are projected to exceed historical record levels most likely by the middle of the 21st century. For example, in southern Missouri, the annual maximum number of consecutive days with temperatures exceeding 95 degrees F is projected to increase by up to 20 days. Temperature increases will cause future heat waves to be more intense, a concern for this region which already experiences hot and humid conditions. Extreme heat is a concern for urban areas such as St. Louis and Kansas City, where the urban heat island effect raises summer temperatures. If the warming trend conditions, future heat waves are likely to be more intense, and cold wave intensity is projected to decrease. The impacts of extreme heat events are experienced most acutely by the elderly and other vulnerable populations. High temperatures are exacerbated in urban environments, a phenomenon known as the urban heat island effect, which in turn tends to have higher concentrations of vulnerable populations. Higher demand for electricity as people try to keep cool amplifies stress on power systems and may lead to an increase in the number of power outages. Atmospheric concentrations of ozone occur at higher air temperatures, resulting in poorer air quality, while harmful algal blooms flourish in warmer water temperatures, resulting in poorer water quality.

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

Figure 3.28 Annual Maximum Temperature Predictions to 2090



Source: https://crt-climate-explorer.nemac.org/

Vulnerability

Vulnerability Overview

High humidity, which often accompanies heat in Missouri, can make the effects of heat even more harmful. While heat-related illness and death can occur from exposure to intense heat in just one afternoon, heat stress on the body has a cumulative effect. Consequently, the persistence of a heat wave increases the threat to public health. The people most at risk are children under five years of age and adults over the age of 65 as well as people who work outdoors, people who are overweight, and people who are ill or on certain medications. In agricultural areas, the exposure of farm workers, as well as livestock, to extreme temperatures is a major concern. **Table 3.45** lists typical symptoms and health impacts due to exposure to extreme heat.

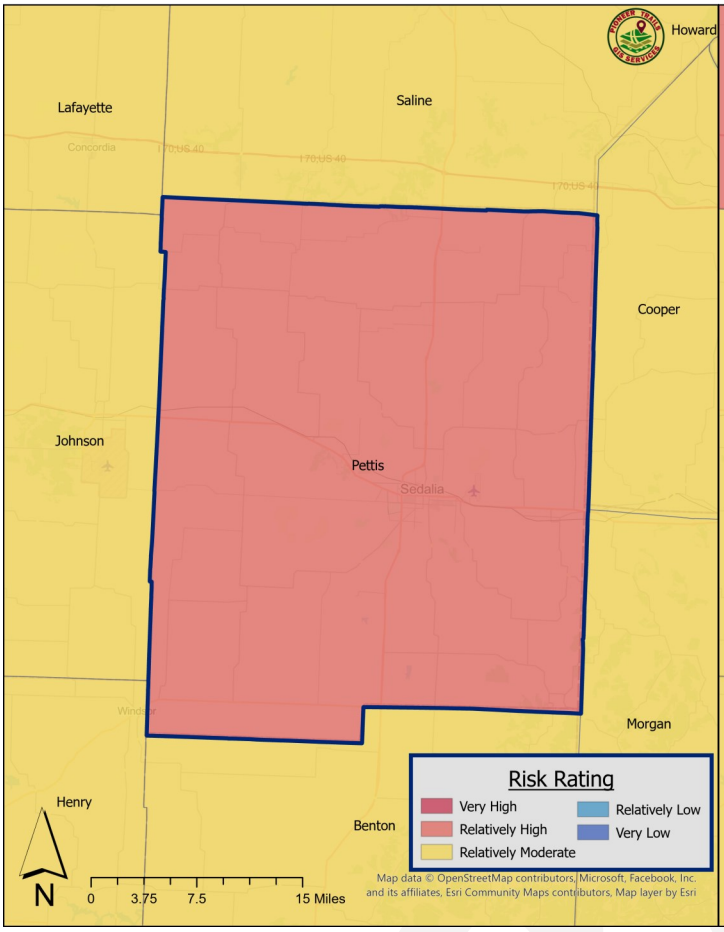
Table 3.45

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

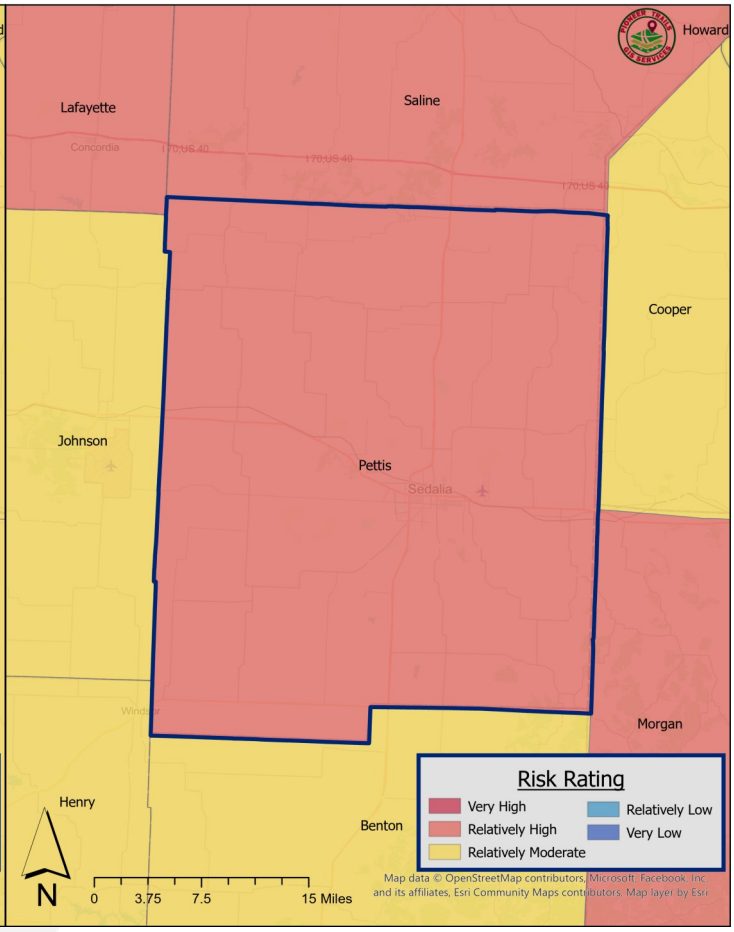
Source: National Weather Service Heat Index Program, www.weather.gov/os/heat/index.shtml

Table 3.45

FEMA National Risk Index -- Extreme Heat



FEMA National Risk Index -- Extreme Cold Temperatures



Source: FEMA National Risk Index, Hazard Rating

Potential Losses to Existing Development

During the 20-year period of 2002-2023 two winter weather events caused damage of $113,000 to property, equally distributed over the 20-years gives and estimated loss on average of $5650 of annual losses. Based on information in the 2018 Plan and DHSS, four to seven heat related deaths may occur within Pettis County over the next 13 years.

Impact of Future Development

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

Hazard Summary by Jurisdiction

Those at greatest risk for heat-related illness and deaths include children up to five years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. To determine jurisdictions within the planning area with populations more vulnerable to extreme heat, demographic data was obtained from the 2010 Census on population percentages in each jurisdiction comprised of those under age 5 and over age 65. Data was not available for overweight individuals and those on medications vulnerable to extreme heat. **Table 3.46** 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. All Schools in the planning area have proper air-conditioning/heating and follow proper procedures in the event of extreme temperature.

Table 3.46

Pettis County Population Under Age 5 and Over Age 65				
Jurisdiction	**Population Under 5 yrs.**	**Under 5 yrs. %**	**Population 65 yrs. or more**	**65+ %**
Pettis County*	2,913	6.8%	7,326	17.0%
Green Ridge	32	6.0%	61	11.4%
Houstonia	8	3.3%	45	18.4%
Hughesville	9	5.9%	18	11.8%
La Monte	123	12.0%	133	12.9%
Sedalia	1,666	7.7%	3,712	17.1%
Smithton	36	7.0%	43	8.4%

Source: U.S. Census Bureau, 2022 5-year ACS Estimates, (*) includes entire population of each city or county

Problem Statement

Older and younger segments of the population are more vulnerable to the impact of extreme heat. In addition, people living below the poverty level may be more vulnerable during periods of extreme heat due to a lack of air conditioning or utilities in their homes. Institutionalized populations, such as those living in nursing homes, become more vulnerable to extreme heat due to power outages. To help reduce the risk of death, heating and cooling centers should be promoted and known to the public, especially to those who have young children or are over the age of 65. Collaborating with local community organizations to continue to donate fans and offer weatherization programs would mitigate the impact on vulnerable populations in the county.

3.4.8 Earthquakes

Hazard Profile

Hazard Description

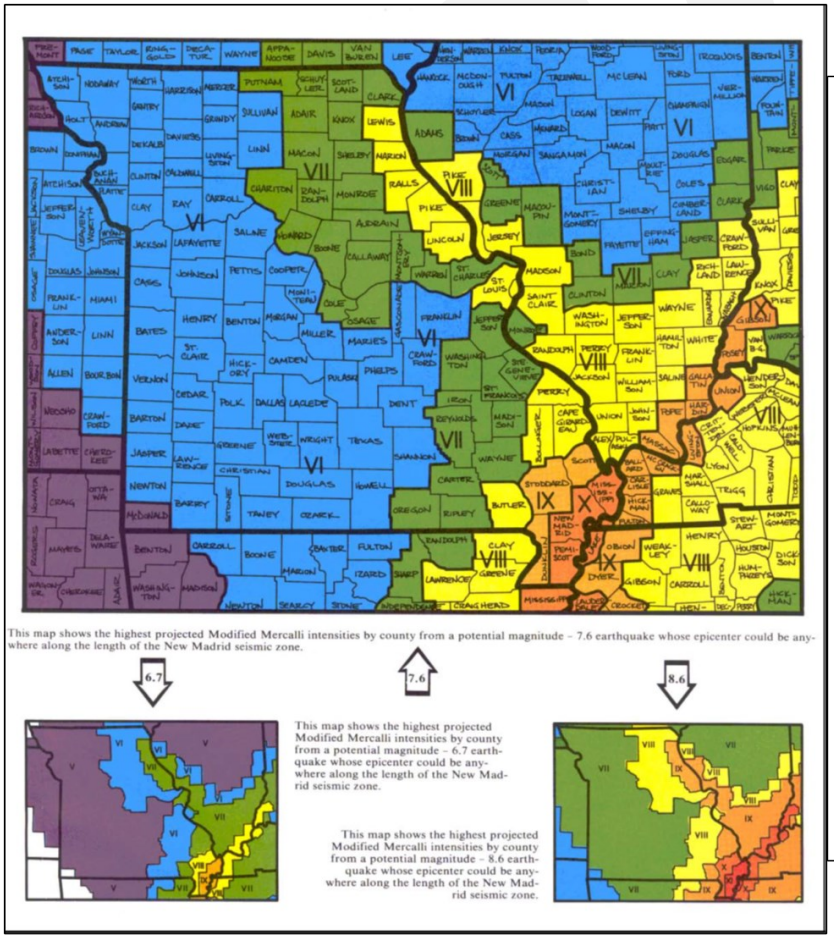
An earthquake is a sudden motion or trembling that is caused by a release of energy accumulated within or along the edge of the earth's tectonic plates. Earthquakes occur primarily along fault zones and tears in the earth's crust. Along these faults and tears in the crust, stresses can build until one side of the fault slips, generating compressive and shear energy that produces the shaking and damage to the built environment. The 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 energy to buildings and other structures on the earth's surface.

Geographic Location

The greatest hazard to Pettis County comes from the New Madrid Seismic Zone situated in southeast Missouri. The potential of high magnitude earthquakes occurring along the New Madrid fault presents risk that does not vary across the planning area. The Nemaha uplift in central Kansas is also prone to seismic activity; however, the center of the Humbolt fault zone near the Nemaha Uplift only produces lower magnitude seismic events do to its distance from Pettis County Missouri.

Figure 3.29 shows the highest projected Modified Mercalli intensities by county from a potential magnitude 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid Seismic Zone. The secondary maps in Figure 3.6 show the same regional intensities for 6.7 and 8.6 earthquakes, respectively.

Figure 3.29 New Madrid Earthquake Impact Zones



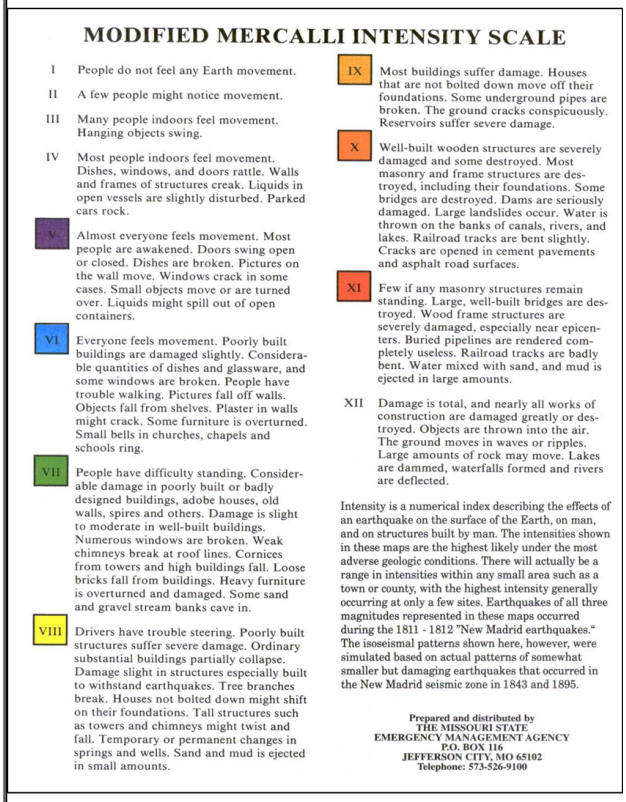
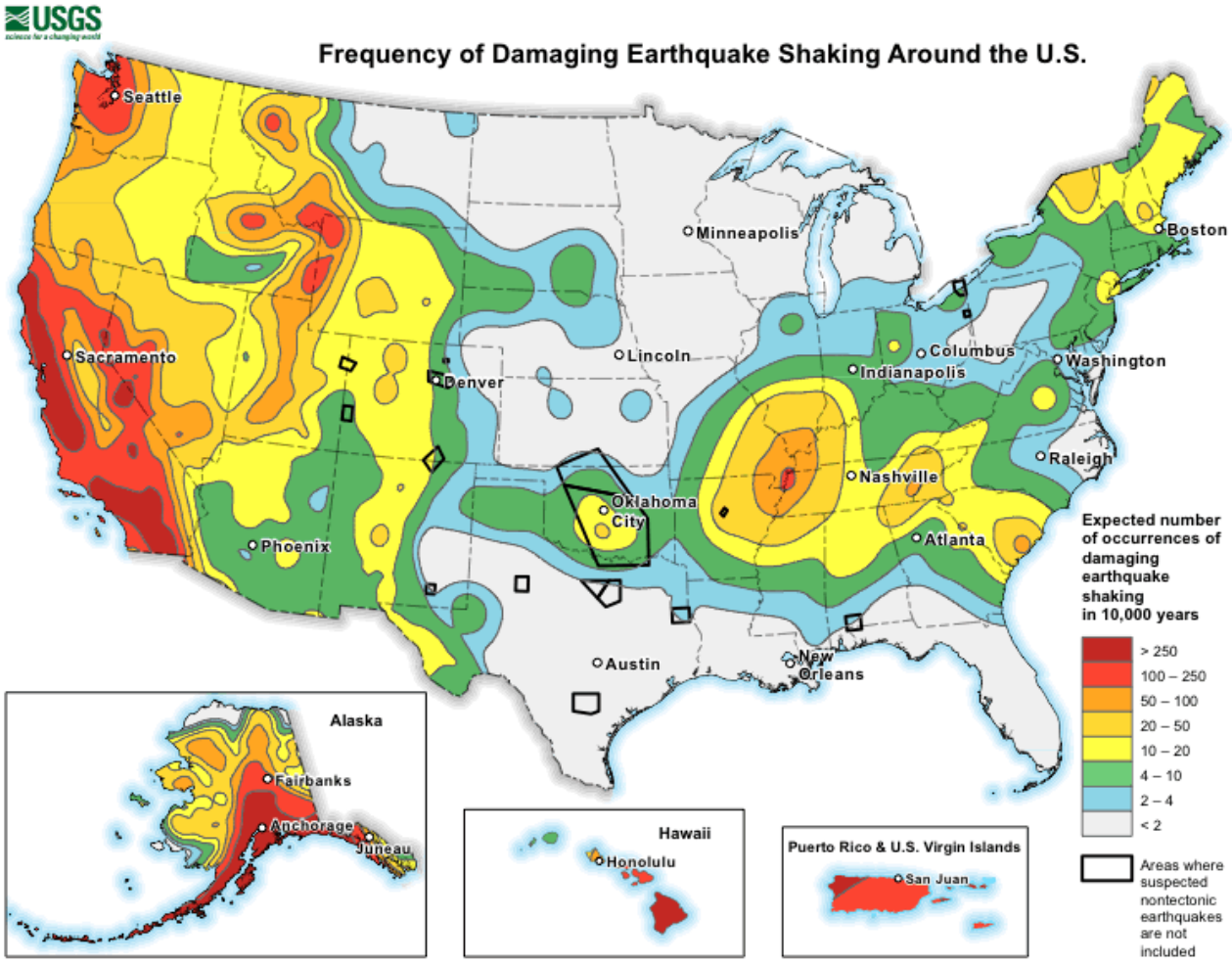


Figure 3.30 illustrates seismicity in the United States.

Figure 3.30 US Seismic Map



Source: United States Geological Survey

Severity/Magnitude/Extent

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

Richter Magnitude Scale

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

Modified Mercalli Intensity Scale

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

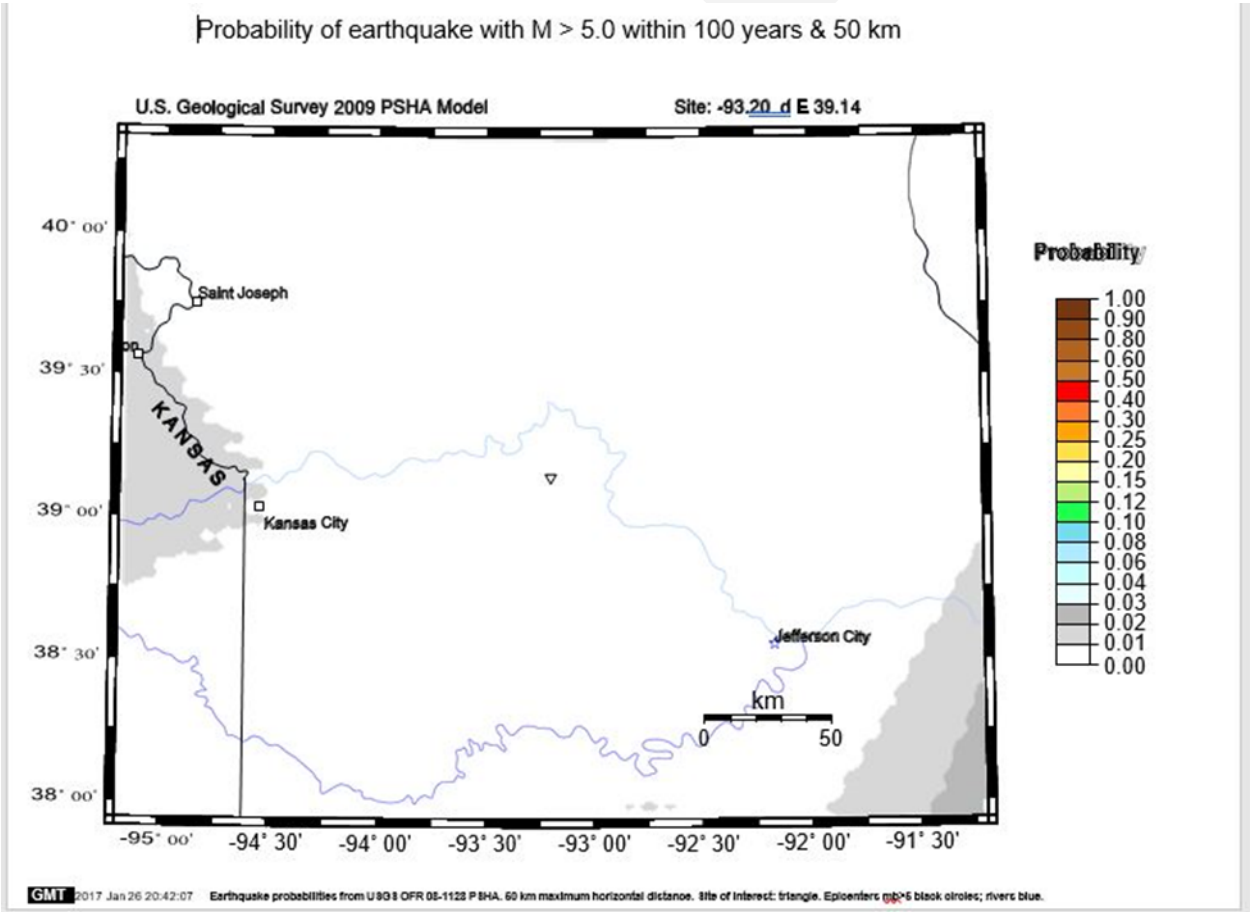
Previous Occurrences

There is no Historical record of an earthquake occurrence in Pettis County.

Probability of Future Occurrence

Without a historical record of earthquakes in Pettis County it is not possible to calculate a precise probability of earthquake occurrences. According to the United States Geological Survey, Pettis County's probability of receiving an earthquake of 5.0 or higher is at 0%.

Figure 3.31



Source: https://geohazards.usgs.gov/eqprob/2009/index.php

Changing Future Conditions Considerations

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.

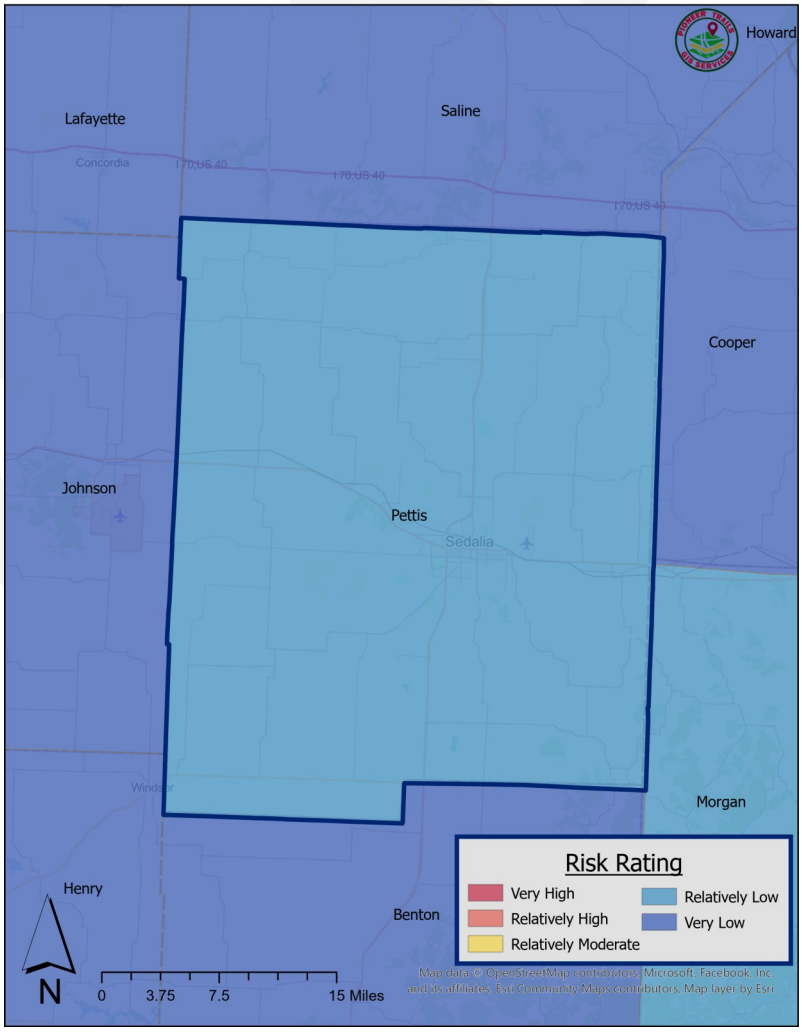
Vulnerability

Vulnerability Overview

Ground shaking is the most damaging effect from earthquakes. Ground shaking will impact all structures and critical infrastructure such as roads and electrical transmission systems. The greatest earthquake risk to Pettis County is the New Madrid fault in the boot-heel region of Missouri. A 7.6 magnitude earthquake would result in poorly built buildings damaged slightly; considerable quantities of dishes, glassware and windows are broken; people having trouble walking; pictures falling off walls; objects falling from shelves; plaster in walls cracking; and furniture overturned. Damage to structures will occur but will vary depending on the quality of construction. In addition, some underground utilities may be damaged. Some injuries may occur, but fatalities are unlikely.

Figure 3.??

FEMA National Risk Index -- Earthquake



Source: FEMA National Risk Index, Hazard Rating

Potential Losses to Existing Development

Table 3.47

Table 3.48

Table 3.49

Impact of Future Development

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

Hazard Summary by Jurisdiction

Earthquake intensity is not likely to vary greatly throughout the planning area; the risk of occurrence is the same throughout. However, damages will differ where there are variations in the planning area based on percentage of structures built prior to 1939. It should be noted that school districts with facilities constructed prior to 1939 could suffer more damage than newer facilities.

Table 3.50 Vulnerable Housing

Jurisdiction	% of Housing Built 1939 or earlier
Pettis County	15.9%
Green Ridge	7.9%
Houstonia	28.5%
Hughesville	20.9%
La Monte	14.7%
Sedalia	21.1%
Smithton	17%

Source: U.S. Census Bureau, 2022 5-year Estimates

Problem Statement

Based on likely damage from a 7.6 magnitude earthquake along the New Madrid fault, older poorly built structures will suffer slight damage. Potential damages to future development can be mitigated by adopting and enforcing at least IBC 2012 building codes. Updating and enforcing building codes throughout Pettis County would mitigate the impact on future development from an earthquake event.

Although earthquake events in the planning area have a low probability, they cannot be entirely ruled out. Jurisdictions with the greatest concentration of housing built in 1939 or earlier stand the greatest risk from this hazard. Houstonia, with a 28.5% density of houses built in this timeframe, is most at risk for damage and loss of life. Sedalia and Hughesville also have a concentration above 20%, with 21.1% and 20.9% respectively. These jurisdictions are encouraged to adopt and enforce IC 2012 building codes, and to retrofit existing buildings for compliancy.

3.4.9 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 because of subsurface void spaces created over time due to the erosion of subsurface limestone (karst).

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

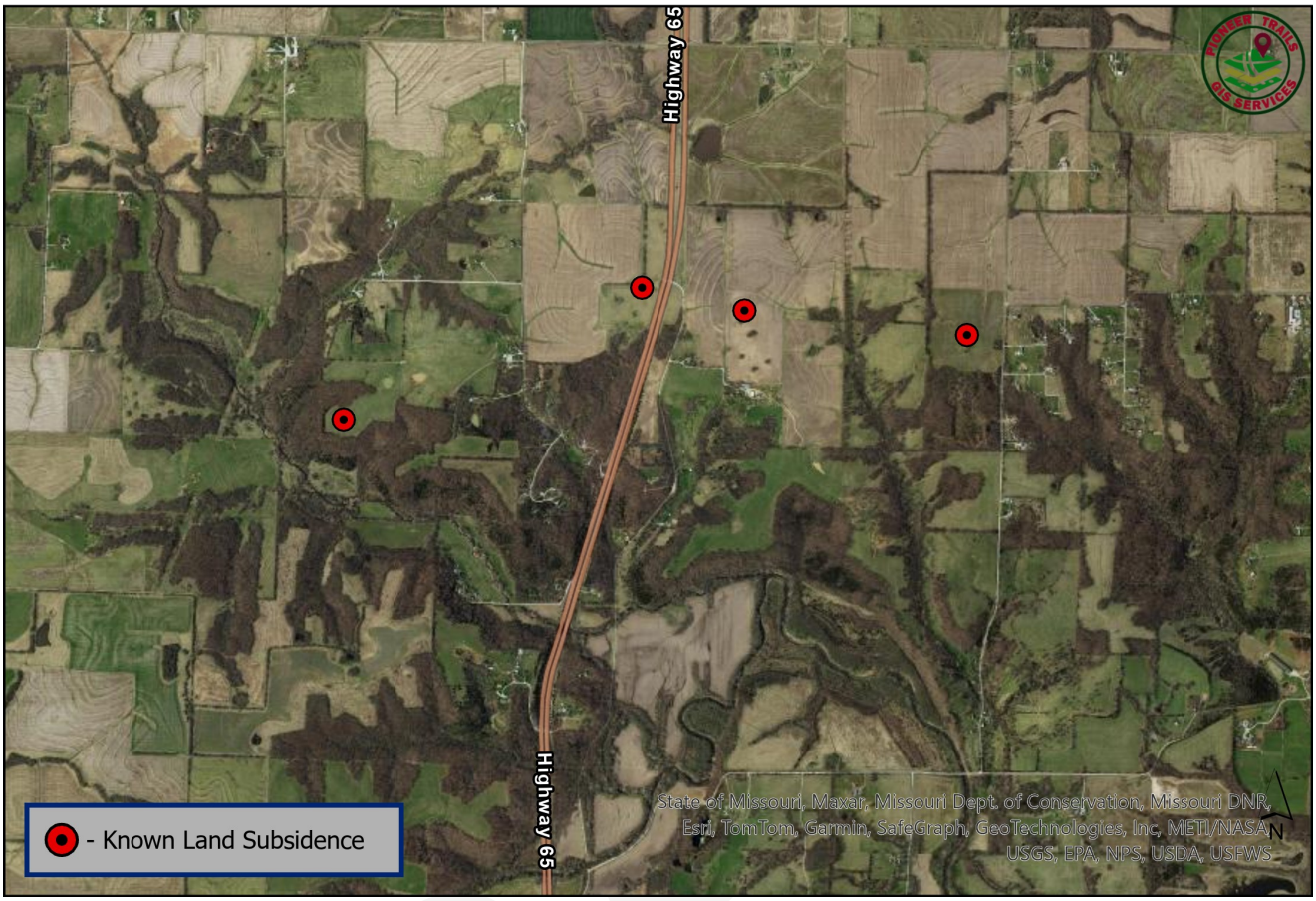
In the case of sinkholes, the rock below the surface is rock that has been dissolving by circulating groundwater. As the rock dissolves, spaces and caverns form, and ultimately the land above the space collapses. In Missouri, sinkhole problems are usually a result of surface materials above openings 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 frequent basis. Most of Missouri‘s sinkholes occur naturally in the State‘s karst regions (areas with soluble bedrock). They are a common geologic hazard in southern Missouri, but also occur in the central and northeastern parts of the State. Missouri sinkholes have varied from a few feet to hundreds of acres and from less than one to more than 100 feet deep. The largest known sinkhole in Missouri encompasses about 700 acres in western Boone County southeast of where Interstate 70 crosses the Missouri River. Sinkholes can also vary in shape like shallow bowls or saucers whereas others have vertical walls. Some hold water and form natural ponds.

Geographic Location

Figures 3.32-3.34 show the locations of known land subsidence areas. All locations occur in a rural area of Pettis County.

Land Subsidence - North of Sedalia



Land Subsidence - Northeast of Sedalia

Severity/Magnitude/Extent

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

Previous Occurrences

Sinkholes are a regular occurrence in Missouri, but rarely are events of any significance. Despite the regular occurrences, there have been no major recent documented occurrences of sinkholes opened in Pettis County.

Probability of Future Occurrence

The probability cannot be calculated due to the lack of information regarding known sinkhole events in Pettis County.

Changing Future Conditions Considerations

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

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

Potential Losses to Existing Development

No existing development is at risk of damage. Sinkhole occurrence is likely to affect farmland and personal property in all jurisdictions.

Impact of Previous and Future Development

Future development over abandoned mines and in areas of known risk to sinkhole formation in the planning area will increase vulnerability to this hazard. Population and development in these areas will increase exposure to sinkhole occurrence. There are currently no regulations prohibiting construction over or near known sinkholes. Future development may also change storm runoff patterns and cause expansion or formation of sinkholes.

Hazard Summary by Jurisdiction

The risk of sinkhole damage for individual communities and school districts is limited to the amount of exposure of buildings and infrastructure. Some parts of the county are more at risk for potential sinkhole formations than other areas. There are no jurisdictions with existing structures that are at risk of sinkholes. It is unlikely that schools, and special districts, will be affected by sinkholes due to the localized nature of their exposure. All jurisdictions listed in the plan are vulnerable to unidentified sinkholes.

Problem Statement

It is likely that more sinkholes will occur as development occurs within the county. Sinkholes can be remediated with fill material. Once a sinkhole has been remediated building should be prohibited at the site. Existing sinkholes can expand if surface runoff erodes the edges of the sinkhole. Storm water runoff should be diverted away from known sinkholes. The county and jurisdictions should adopt regulations prohibiting construction at least 30 feet from known sinkholes. Information about identifying potential sinkhole formation and promoting Missouri FAIR plan sinkhole insurance can be included in public outreach and hazard awareness programs. Undeveloped land that is in a sinkhole risk area can be used for park space or other recreational purposes.

3.4.10 Wildfire

Hazard Profile

Hazard Description

The fire incident types for wildfires include: 1) natural vegetation fire, 2) outside rubbish fire, 3) special outside fire, and 4) cultivated vegetation, crop fire.

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

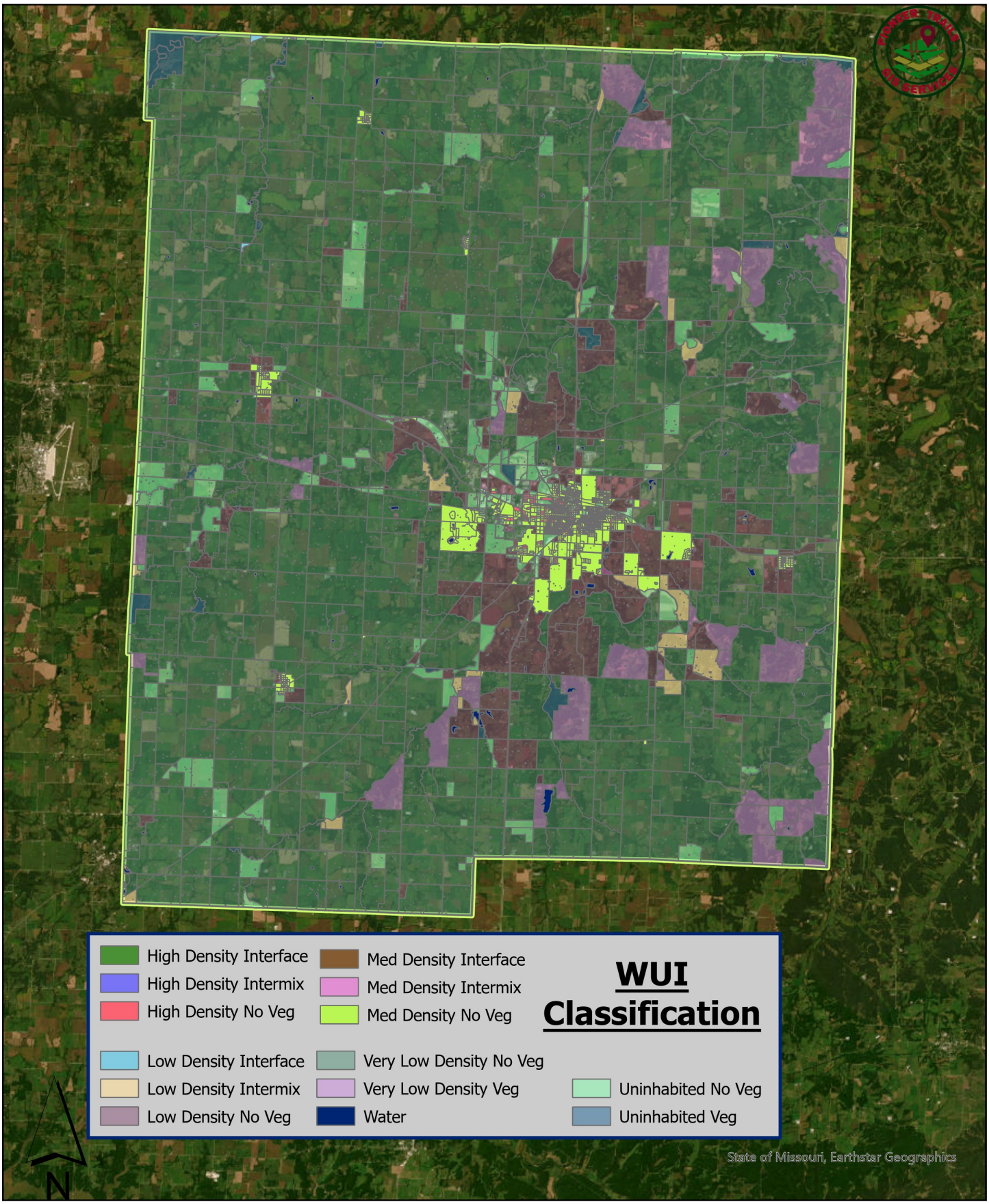
Most of Missouri fires occur during the spring season between February and May. The length and severity of both structural and wildland fires depend largely on weather conditions. Spring in Missouri is usually characterized by low humidity, and high winds. These conditions result in higher fire danger.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

Geographic Location

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

Figure 3.??

Pettis County Wildland Urban Interface



Severity/Magnitude/Extent

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

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

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

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

Previous Occurrences

Table 3.51

MDC Reported Wildfires 2012-2023		
Year	**Number of Fires**	**Acres Burned**
2023	31	58.27
2022	13	280.42
2021	15	66.28
2020	9	6.77
2019	5	6.47
2018	23	782.93
2017	25	126
2016	12	184.8
2015	24	117
2014	13	64.5
2013	6	16.01
2012	19	347
Totals:	**195**	**2056.45**

Source: https://mdc12.mdc.mo.gov/Applications/MDCFireReporting

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

Probability of Future Occurrence

The probability of future occurrence for a wildfire of any size is 100% as there have been 195 fires reported over the past 10-year period. We can then conclude that the average total acres affected by wildfire, in any given year, would be 205.65 and an average of 19.5 occurrences.

Changing Future Conditions Considerations

Higher temperatures and changes in rainfall are unlikely to substantially reduce forest cover in Missouri, although the composition of trees in the forests may change. More droughts would reduce forest productivity, and changing future conditions are also likely to increase the damage from insects and diseases. But longer growing seasons and increased carbon dioxide concentrations could more than offset the losses from those factors. Forests cover about one-third of the state, dominated by oak and hickory trees. As the climate changes, the abundance of pines in Missouri's forests is likely to increase, while the population of hickory trees is likely to decrease 0. Higher temperatures will also reduce the number of days prescribed burning can be performed. Reduction of prescribed burning will allow for growth of under-story vegetation – providing fuel for destructive wildfires. Drought is also anticipated to increase in frequency and in-tensity during summer months under projected future scenarios. Drought can lead to dead or dying vegetation and landscaping material close to structures which creates fodder for wildfires within both the urban and rural settings.

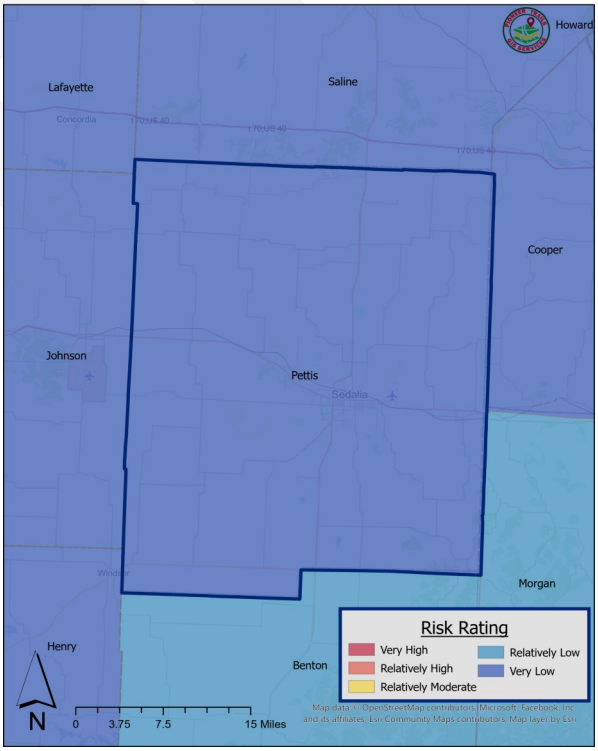
Vulnerability

Vulnerability Overview

Wildfires occur throughout wooded and open vegetation areas of Missouri They can occur any time of the year, but mostly occur during long, dry hot spells. Any small fire, if not quickly detected and suppressed, can get out of control. Most wildfires are caused by human carelessness or negligence. However, some are precipitated by lightning strikes and in rare instances, spontaneous combustion. Structures and people in WUI areas in the county and cities are more vulnerable to the impact of wildfires due to the level of fuel mixed with structures, but all jurisdictions are vulnerable within the county. Pettis County Statistical Data for Wildfire vulnerability shows an annual average of 1-19 wildfire events according to Missouri Department of Conservation. The average can be applied to all jurisdictions.

Table 3.52

FEMA National Risk Index -- Wildfire



Source: FEMA National Risk Index, Hazard Rating

Table 3.??

National Risk Index Wildfire Exposure Pettis County	
Population	4129
Building Value	931,379,350.53
Agriculture Value	39,230,067.29
Total Exposure:	**970,609,417.82**
Impacted Area (sq mi)	74.79

Source: FEMA Risk Index Table Data, 2024

Potential Losses to Existing Development

Due to the nature of wildfires, all existing developments are vulnerable to damage or loss. Pettis County is rural and is mostly covered in wooded areas or farmland which is more susceptible to wildfires since fires can burn for substantial amounts of time before being reported. As development progresses, structures and property become more vulnerable in the county.

Impact of Future Development

It is anticipated that there will be future development in WUI areas throughout unincorporated areas of the county. Future growth in WUI areas of the county will increase the risk and exposure to wildfires. It is expected that WUI development in cities will be mitigated by development regulations reducing the risk to wildfire hazard.

Hazard Summary by Jurisdiction

The vulnerability across the jurisdictions for wildland fires does not vary greatly. Absent demographic factors or other variations in housing construction, risk of structural fire probably does not vary greatly across the planning area.

Without mitigation measures:
Life:.....negligible
Property:.....negligible
Emotional: .....negligible
Financial: .....negligible

With mitigation measures:
Life: ..... negligible
Property:..... negligible
Emotional: ..... negligible
Financial:..... negligible

Problem Statement

Wildfire events can destroy, damage, and threaten structures in hazard prone areas. The unincorporated part of the county has the highest risk and exposure to wildfires. County officials and the fire department can promote fire resistant construction materials and landscape design techniques to mitigate the risk to wildfire in future development. Information about these materials and techniques are included in the MDC publication, Living with Wildfire. Including this information in education and awareness programs for the public may potentially mitigate wildfire damage in the county.
Unincorporated Pettis County is at the most risk from wildfire due to the high concentration of crops and livestock. With a total of $10,525,938,000 in sales in 2017 according to the 2017 Ag Census, wildfires would negatively affect the overall economy of the region. Farmers should be encouraged to obtain and review existing crop insurance policies to maintain proper coverage in the event of a wildfire. Efforts should also be made by the surrounding jurisdictions to educate its residents and farmers about the risk of wildfires encroaching and spreading to more developed areas.

4 MITIGATION STRATAGY

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 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. e following definitions are taken from FEMA's *Local Hazard Mitigation Review Guide (October 1, 2012)*.

Mitigation Goals are general guidelines that explain what you want to achieve. Goals are long-term policy statements and global visions that support the mitigation strategy. The goals address the risk of hazards identified in the plan.

Mitigation Actions are specific actions, projects, activities, or processes taken to reduce or eliminate long-term risk to people and property from hazards and their impacts. Implementing mitigation actions helps achieve the plan's mission and goals.

4.1 Goals

This planning effort is an update to Pettis County's existing hazard mitigation plan approved by FEMA in 2024. Therefore, the goals from the 2018 Pettis County Hazard Mitigation Plan were reviewed to see if they were still valid, feasible, practical, and applicable to the defined hazard impacts. The MPC conducted a discussion session during their second meeting to review and update the plan goals. To ensure that the goals developed for this update were comprehensive and supported State goals, the current State Hazard Mitigation Plan goals were reviewed. The MPC also reviewed the goals from current surrounding county plans.

Pettis County's Mitigation goals were derived from conferences with county commissioners, emergency management director, jurisdiction stakeholder, as well as the key planning documents (i.e. Emergency Operations Plan). These meetings were conducted during the development of the Pettis County Hazard Mitigation Plan.

Four main goals:

- Goal 1: Protect the lives and livelihoods of all citizens.
- Goal 2: Manage growth through sustainable principles and practices.
- Goal 3: Ensure continued operation of government and emergency functions during and after a disaster.
- Goal 4: Preserve and maintain property, infrastructure, business, and jurisdiction vitality.

4.2 Identification and Analysis of Mitigation Actions

During the third MPC meeting, the results of the risk assessment update were provided to the MPC members for review and the key issues were identified for specific hazards. Changes in risk since adoption of the previously approved plan were discussed. The second meeting concluded with the distribution of a list of possible mitigation actions to prompt discussions within and among the jurisdictions. The list included actions from the previously approved plan. Actions from the previous plan include on-going actions and actions upon which progress had not been made. The MPC discussed SEMA's identified funding priorities and the types of mitigation actions generally recognized by FEMA. Actions were sent with jurisdictional representatives to discuss selection with communities, reasoning for non-selection was not part of the planning process and was left for jurisdictional governments to decide.

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

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

- A list of actions proposed in the previous mitigation plan, the current State Plan, and approved plans in surrounding counties,
- Key issues from the risk assessments, including the Problem Statements concluding each hazard profile and vulnerability analysis,
- State priorities established for Hazard Mitigation Assistance grants, and
- Public input during meetings, responses to Data Collection Questionnaires, and other efforts to involve the public in the plan development process.

For the fourth meeting, individual jurisdictions, including school and special districts, developed final mitigation strategy for submission to the MPC. They were encouraged to review the details of the risk assessment vulnerability analysis specific to their jurisdiction. They were also provided a link to the FEMA's publication, Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013). This document was developed by FEMA as a resource for identification of a 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. 4.3 range of potential mitigation actions for reducing risk to natural hazards and disasters.

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

- Completed, with a description of the progress,
- Not Started/Continue in Plan Update, with a discussion of the reasons for lack of progress,
- In Progress/Continue in Plan Update, with a description of the progress made to date or
- Deleted, with a discussion of the reasons for deletion

Based on the status updates, there were ?? deleted actions and ?? continuing actions.

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

Table 4.1

Previous Actions Status Summary			
Jurisdiction	**Completed Actions**	**Continuing Actions (ongoing or modify)**	**Deleted Actions**
Pettis County			
Green Ridge			
La Monte			
Houstonia			
Hughesville			
Sedalia			
Smithton			
Green Ridge R-VIII			
La Monte R-IV			
Pettis County R-V			
Pettis County R-XII			
Sedalia 200			
Smithton R-VI			

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

Table 4.2

Completed and Deleted Actions from the Previous Plan	
Completed Actions	**Completion Details (date, amount, funding source)**
Deleted Actions	**Reason for Deletion**

4.3 Implementation of Mitigation Actions

Jurisdictional MPC members were encouraged to meet with others in their community to finalize the actions to be submitted for the updated mitigation strategy. Throughout the MPC consideration and discussion, emphasis was placed on the importance of a benefit-cost analysis in determining project priority

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

FEMA's STAPLEE methodology was used to assess the costs and benefits, overall feasibility of mitigation actions, and other issues impacting project. During the prioritization process, the MPC used worksheets to assign scores.

The worksheets posed questions based on the STAPLEE elements as well as the potential mitigation effectiveness of each action. Scores were based on the responses to the questions as follows:

Definitely YES = 3 points

Maybe yes = 2

Probably no = 1

Definitely NO = 0

The following questions were asked for each proposed action.

S: Is the action socially acceptable?

T: Is the action technically feasible and potentially successful?

A: Does the jurisdiction have the administrative capability to successfully implement this action?

P: Is the action politically acceptable?

L: Does the jurisdiction have the legal authority to implement the action?

E: Is the action economically beneficial?

E: Will the project have an environmental impact that is either beneficial or neutral? (score "3" if positive and "2" if neutral)

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

Upon identification of the Johnson County mitigation actions, each individual action was qualitatively analyzed to consider if each action represented an overall cost or benefit in terms of each of the STAPLEE criteria. The standardized values were then summed and divided, creating an average priority score for all actions relative to every other action. The average priority scores for all actions were then collapsed into three classes of high, medium, and low. This method for prioritizing and reviewing mitigation actions sought to place a strong emphasis on evaluating their costs and benefits in relation to one another. Consideration was given to using one of the review tools described in How-To Guide 137 (FEMA 386-5): Using Benefit-Cost Review in Mitigation Planning in conjunction with the prioritization method. However, it was determined that conducting a review would require information and time that was not available. The STAPLEE and simple scores method was selected because of its clear emphasis on a cost-benefit review and strength in establishing a baseline for a more qualitative review.

The final scores are listed below in the analysis of each action. The worksheets are attached to this plan as Appendix E. 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**, followed by a sample action worksheet, **Figure 4.2**.

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 **Evaluation Rating** Definitely YES = 3 Maybe YES = 2 Probably NO = 1 Definitely NO = 0		**Score**
S: Is it **Socially** Acceptable		
T: Is it **Technically** feasible and potentially successful?		
A: Does the jurisdiction have the **Administrative** capacity to execute this action?		
P: Is it **Politically** acceptable?		
L: Is there **Legal** authority to implement?		
E: Is it **Economically** beneficial?		
E: Will the project have either a neutral or positive impact on the natural **Environment**?		
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)		
High Priority (30+ points)	**Medium Priority (25 - 29 points)**	**Low Priority (<25 points)**
Completed by (Name, Title, Phone Number)		

Figure 4.2 Blank 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.

INSERT ACTION MATRIX

INSERT ACTON WORKSHEETS

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 Plan Maintenance Process

5.1 Monitoring, Evaluating, and Updating the Plan

5.1.1 Responsibility for Plan Maintenance

The MPC is not a standing committee, and therefore responsibility for maintenance of the plan actions is delegated to individuals or entities as indicated in section 4 of the plan. These entities are responsible for seeing that the actions which they have put in the plan are eventually implemented, if possible. These individuals or entities (or an appointed representative thereof) will meet annually as a "plan maintenance committee" with the Johnson County Commission to evaluate the implementation of various actions within their jurisdiction. They will also meet after any major disaster event. These individuals will maintain vigilant monitoring of multi-objective, cost-share, and other funding opportunities to help their community or school district implement the plan's recommended actions for which no current funding exists and keep the concept of mitigation in the forefront of decision making by identifying plan recommendations when other goals, plans, and activities overlap, influence, or directly affect increased vulnerability to disasters.

Like the planning committee, the maintenance committee is an advisory body and can only make recommendations to county, city, town, or district elected officials. Its primary duty is to see the plan successfully carried out and to report to the community governing boards and the public on the status of plan implementation and mitigation opportunities.

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

5.1.2 Maintenance Schedule

The MPC (or designated responsible entity) agrees to meet annually and after a state or federally declared hazard event as appropriate to monitor progress and update the mitigation strategy. The Pettis County Emergency Management Director will be responsible for initiating the plan reviews and will invite members of the MPC (or other designated responsible entities) to the meeting.

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

5.1.3 Maintenance Process

Progress on the proposed actions can be monitored by evaluating changes in vulnerabilities identified in the plan. The MPC, and other designated responsible entities, 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 because 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 Pettis County Board of Commissioners and the governing boards of the other participating jurisdictions.

5.2 Incorporation into Existing Planning Mechanisms

For the most part the participating jurisdictions did not incorporate the previously approved mitigation plan into other planning mechanisms due to the other plans already being approved.

Where possible, plan participants, including school and special districts, will use existing plans and/or programs to implement hazard mitigation actions. Those existing plans and programs were described in Section 2 of this plan. Based on the capability assessments of the participating jurisdictions, communities in Pettis 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:

- Pettis County Emergency Operations Plan
- School Emergency Plans
- School Master Plans
- Capital improvements project funding
- Participation in the NFIP
- Zoning and planning restrictions
- Economic Development programs
- Capital Improvement plans
- Comprehensive plans
- Zoning ordinances
- Building codes
- Subdivision codes
- Storm water ordinances
- Hazard awareness programs
- Floodplain ordnances

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 (or designated responsible entities) are also responsible for monitoring this integration and incorporation of the appropriate information into the five-year update of the multijurisdictional hazard mitigation plan.

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

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

Table 5.1

Planning Mechanisms Identified for Integration of Hazard Mitigation Plan			
Jurisdiction	**Planning Mechanisms**	**Integration Process from Previous Plan**	**Integration Process for Current Plan**
Pettis County	County Emergency Plan	County Commission	County Commission
	County Recovery Plan		
	County Mitigation Plan		
	Debris Management Plan	Emergency Management Director	Emergency Management Director
	Watershed Plan		
	Floodplain Ordinance		
Green Ridge	Zoning Ordinance	City Ordinance	City Ordinance
Houstonia		City Ordinance	City Ordinance
Hughesville			
La Monte			
Sedalia	Comprehensive Plan	Local Emergency Planning Committee	Local Emergency Planning Committee
	Capital Improvement Plan		
	City Operations Plan		
	Local Recovery Plan	Emergency Management Director	Emergency Management Director
	City Mitigation Plan		
	Economic Development Plan		
	Land-use Plan	Economic Development Planner	Economic Development Planner
	Watershed Plan		
	Zoning Ordinance		
Smithton	Comprehensive Plan	City Ordinance	City Ordinance
	Capital Improvement Plan		
	Land-use Plan		
	Zoning Ordinance		

5.3 Continued Public Involvement

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 Pettis County website following each annual review of the mitigation plan. When the MPC reconvenes for the five-year update, it will coordinate with all stakeholders participating in the planning process. Included in this group will be those who joined the MPC after the initial effort, to update and revise the plan. Public notice will be posted, and public participation will be actively solicited, at a minimum, through available website postings and press releases to local media outlets, primarily newspapers.