DADE COUNTY

MISSOURI

2019 Multi-Jurisdictional

Natural Hazard Mitigation Plan

Approved May 1, 2019

(FEMA APPROVAL LETTER)

U.S. Department of Homeland Security
FEMA Region VII
11224 Holmes Road
Kansas City, MO 64131

FEMA

May 1, 2019

Mr. Ron Walker, Director
State Emergency Management Agency
P. O. Box 116
Jefferson City, Missouri 65102

Subject: Review of the Dade County, Missouri Hazard Mitigation Plan Update

Dear Mr. Walker:

The purpose of this letter is to provide the status of the above referenced Local Hazard Mitigation Plan, pursuant to the requirements of 44 CFR Part 201 - Mitigation Planning and the Local Multi-Hazard Mitigation Planning Guidance. The Local Hazard Mitigation Plan Review Tool documents the Region's review and compliance with all required elements of 44 CFR Part 201.6, as well as identifies the jurisdictions participating in the planning process. FEMA's approval will be for a period of five years effective starting with the approval date indicated below.

Prior to the expiration of the plan the jurisdictions will be required to review and revise their plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval in order to continue to be eligible for mitigation project grant funding.

Plan Name	Date Submitted	Date Approved	Date of Plan Adoption	Date of Plan Expiration	Review Status
Dade County	April 1, 2019	May 1, 2019	October 10, 2018	May 1, 2024	Approved

If you have any questions or concerns, please contact Joe Chandler, Planning Team Lead, at (816) 283-7071.

Sincerely,

Michael Scott
Mitigation Division Director

Dade County Hazard Mitigation Planning Committee

Jurisdictional Representatives

Name	Title	Department	Jurisdiction/Agency /Organization
Randy Daniel	Presiding County Commissioner	Commission	Dade County
Dallas Maxwell	County Commissioner	Commission	Dade County
David Rusch	County Commissioner	Commission	Dade County
Kim Kinder	EMD	Emergency Management	Dade County
Cecil Gass	Supervisor	Road and Bridge	Dade County
Warren Beasley	Trustee	Board of Trustees	Village of Arcola
Carl Robison	Trustee	Board of Trustees	Village of Arcola
Dave Engroff	Mayor	City Council	City of Greenfield
Tim Larkin	Chief of Police	Police Department	City of Greenfield
Andy Miller	Supervisor	Public Works	City of Greenfield
Larry Allen	Mayor	City Council	City of Lockwood
Chad Boehne	Clerk	Administration	City of Lockwood
Doug Helman	Council Member	City Council	City of Lockwood
Barbara Routledge	City Clerk	Administration	City of Lockwood
Kitty Ayres	Chairperson	Board of Trustees	Village of South Greenfield
Bonnie Taylor	Trustee	Board of Trustees	Village of South Greenfield
Konnie Brewer	Mitigation Planner	Administration	City of Everton
Isaac Dodd	Supervisor	Road and Bridge	City of Lockwood
Clay Lasater	Superintendent	Administration	Lockwood R-I Schools
Matt Bushey	Superintendent	Administration	Dadeville R-II Schools
Chris Kell	Superintendent	Administration	Greenfield R-IV Schools
Kenny Snider	Fire Captain	Administration	Lockwood Rural Fire
Gary Banta	Fire Chief	Administration	Dade County R-IV Fire Dept
Lori Sneed	Board Member	Administration	Dadeville Rural Fire Dept

Stakeholder Representatives

Name	Title	Department	Jurisdiction/Agency /Organization
Jill Scheidt	Program Director	Administration	University of Missouri Extension – Dade County
Stanton Rains	Environmental Specialist	Stockton Lake Location	U.S. Army Corps of Engineers
Pamela Allen	Director	Health Department	Dade County
Lori Sneed	Director	Dade County 911	Dade County

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. Dade County, participating jurisdictions and school/special districts developed this multi-jurisdictional local hazard mitigation plan update to reduce future losses from hazard events to the County and its communities and school/special districts. The plan is an update of a plan that was approved on July 31, 2014. 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 Dade County Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that covers the following 11 jurisdictions that participated in the planning process:

- Dade County
- City of Everton
- City of Greenfield
- City of Lockwood
- Village of South Greenfield
- Village of Arcola
- Lockwood R-I School District
- Dadeville R-II School District
- Greenfield R-IV School District
- Dade County R-IV Fire Protection District

Local jurisdictions that did not participate in the 2014 plan, but did in the 2019 plan update are:

- Dadeville Rural Fire Protection District

Local jurisdictions that were invited but did not participate in the Plan include:

- City of Dadeville
- Everton R-III School District
- Dade County Nursing Home District
- Lockwood Fire Protection District

Dade County and the entities listed above developed a Multi-Jurisdictional Hazard Mitigation Plan that was approved by FEMA on July 31, 2014 (hereafter referred to as the *2014 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 Dade County and participating jurisdictions. The MPC updated the risk assessment that identified and profiled hazards that pose a risk to Dade 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 lives and livelihood of the population
2. Preserve and maintain property, infrastructure, and the County's local economies.
3. Ensure continued operation of government and emergency functions during a disaster.

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

44 CFR requirement 201.6(c)(5): The local hazard mitigation plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan. For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

This plan has been reviewed by and adopted with resolutions or other documentation of adoption by all participating jurisdictions and schools/special districts. The documentation of each adoption is included in Appendix D, and a model resolution is included on the following page.

The following jurisdictions participated in the development of this plan and have adopted the multi-jurisdictional plan or pledged to adopt the plan once approved by FEMA.

- Dade County
- City of Everton
- City of Greenfield
- City of Lockwood
- Village of South Greenfield
- Village of Arcola
- Lockwood R-I School District
- Dadeville R-II School District
- Greenfield R-IV School District
- Dade County R-IV Rural Fire Protection District
- Dadeville Rural Fire Protection District

Model Resolution

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

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

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

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

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

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

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

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

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

ADOPTED by a vote of__in favor and____against, and____abstaining, this_day of _____,_____.

By (Sig): _____
Print name: _____

ATTEST:
By (Sig.): _____
Print name: _____

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

1 INTRODUCTION AND PLANNING PROCESS

1.1 PURPOSE

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

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

1.2 BACKGROUND AND SCOPE

As required by 44 CFR §201.6(d)(3), a local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts and changes in priorities, and resubmit it for approval every five (5) years in order to continue to be eligible for mitigation project grant funding. The 2019 Dade County Multi-Jurisdictional Natural Hazard Mitigation Plan, from here on referred to as the Plan, is a revision of the previous five-year update adopted on July 31, 2014, which was the first five year update of the original plan completed in 2005.

The Plan is a major rewrite of the 2014 Plan and reflects changes in priorities and development, and the continued commitment of local governments to mitigate the impact of natural hazards in Dade County. Local jurisdictions that participated in the 2014 Plan and are continuing participation in the 2019 Plan include:

- Dade County
- City of Everton
- City of Greenfield
- City of Lockwood
- Village of South Greenfield
- Village of Arcola
- Lockwood R-I School District
- Dadeville R-II School District
- Greenfield R-IV School District
- Dade County R-IV Fire Protection District

Local jurisdictions that did not participate in the 2014 plan, but did in the 2019 plan update are:

- Dadeville Rural Fire Protection District

Local jurisdictions that were invited but did not participate in the Plan include:

- City of Dadeville
- Everton R-III School District
- Dade County Nursing Home District
- Lockwood Fire Protection District

All jurisdictions received letter and email communications notifying representatives of upcoming meetings and participation requirements. Jurisdictions listed above were not represented during the planning process and did not meet the minimum participation requirements.

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

1.3 PLAN ORGANIZATION

The Plan is organized into five chapters. The 2014 Plan included a chapter dedicated to local jurisdiction capabilities. This information has been incorporated into the Planning Area Profile and Capabilities Chapter. The format of the Plan was changed to conform to the local hazard mitigation plan outline template released by the Missouri State Emergency Management Agency (SEMA) in September, 2017. The Plan chapters include:

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

Table 1.1 summarizes the changes made in the Plan by chapter.

Table 1.1. Changes Made in Plan Update

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

1.4 PLANNING PROCESS

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

The Southwest Missouri Council of Governments (SMCOG) was contracted to facilitate the plan development process. SMCOG staff met with the Dade County EMD during an initial scoping meeting to develop contact information for the area stakeholders and local jurisdiction representatives to establish the Mitigation Planning Committee (MPC). Meeting locations and schedules were discussed, and the most effective way to inform and include the public was determined. Also discussed was previous plan maintenance and any updates made since 2014. It was determined that the document had not been officially updated.

The planning process included the kick-off meeting and four subsequent MPC meetings. SMCOG staff were responsible for producing the draft and final plan update in a FEMA-approvable document, and coordinating with the SEMA and FEMA plan reviews.

Specific information about agenda items for the MPC meetings are presented in Section 1.4.2. SMCOG also assisted in soliciting public involvement in the planning process by providing informational handouts to any interested jurisdiction and creating a community survey. Notification of the MPC meetings on July 16, 2018, August 27, 2018, September 24, 2018, October 15, 2018, and November 26, 2018 were sent via press release to Greenfield Vedette, the newspaper of widest distribution in the County. Meeting dates and items to be discussed for all meetings, including the kick-off meeting on July 16, 2018, were posted on the SMCOG website in advance. Drafts of the Plan were also posted on the website for public comment during the drafting of the Plan and prior to the Plan being submitted for approval. Appendix B provides documentation of the planning process including public involvement solicitations and meeting notices.

The preliminary draft of the plan was posted on the SMCOG website for public review and comment on December 10, 2018. A public notice was published in the Greenfield Vedette seeking public input on the draft plan. A final draft of the Plan was posted on the SMCOG website on February 27, 2019 before the Plan was submitted for SEMA/FEMA approval. On both occasions a press release was sent to the Greenfield Vedette for notification that the Plan was available for public comment. Input from city and county officials was solicited through distribution of drafts of plan elements for discussion and review at scheduled meetings and other communications with individual community representatives and elected officials.

Neighboring jurisdictions 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 B.

Table 1.2 shows the MPC members and the entities they represent, along with their titles.

Table 1.2. Jurisdictional Representatives for Dade County Mitigation Planning Committee

Name	Title	Department	Jurisdiction/Agency /Organization
Randy Daniel	Presiding County Commissioner	Commission	Dade County
Dallas Maxwell	County Commissioner	Commission	Dade County
David Rusch	County Commissioner	Commission	Dade County
Kim Kinder	EMD	Emergency Management	Dade County
Cecil Gass	Supervisor	Road and Bridge	Dade County
Warren Beasley	Trustee	Board of Trustees	Village of Arcola
Carl Robison	Trustee	Board of Trustees	Village of Arcola
Dave Engroff	Mayor	City Council	City of Greenfield
Tim Larkin	Chief of Police	Police Department	City of Greenfield

Andy Miller	Supervisor	Public Works	City of Greenfield
Larry Allen	Mayor	City Council	City of Lockwood
Chad Boehne	Clerk	Administration	City of Lockwood
Doug Helman	Council Member	City Council	City of Lockwood
Barbara Routledge	City Clerk	Administration	City of Lockwood
Kitty Ayres	Chairperson	Board of Trustees	Village of South Greenfield
Bonnie Taylor	Trustee	Board of Trustees	Village of South Greenfield
Konnie Brewer	Mitigation Planner	Administration	City of Everton
Isaac Dodd	Supervisor	Road and Bridge	City of Lockwood
Clay Lasater	Superintendent	Administration	Lockwood R-I Schools
Matt Bushey	Superintendent	Administration	Dadeville R-II Schools
Chris Kell	Superintendent	Administration	Greenfield R-IV Schools
Kenny Snider	Fire Captain	Administration	Lockwood Rural Fire
Gary Banta	Fire Chief	Administration	Dade County R-IV Fire Dept
Lori Sneed	Board Member	Administration	Dadeville Rural Fire Dept
Stakeholders			
Jill Scheidt	Program Director	Administration	University of Missouri Extension – Dade County
Stanton Rains	Environmental Specialist	Stockton Lake Location	U.S. Army Corps of Engineers
Pamela Allen	Director	Health Department	Dade County
Lori Sneed	Director	Dade County 911	Dade County

1.4.1 Multi-Jurisdictional Participation

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

The 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 the degree of modifications. SMCOG collaborated with the local governments in Dade County to assure participation in the planning process and the development of a plan that represents the needs and interests of Dade County and its local jurisdictions. Appendix D contains resolutions for jurisdictions adopting the Plan.

County Commissioners, incorporated communities, public schools, special districts, and various other stakeholders in mitigation planning were invited to a kick-off meeting for the Plan update on

July 16, 2018. 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 in order to be considered a "participant" in the Plan was established at this meeting and include the following:

- Participation in at least two (2) 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;
- Provide documentation to show time donated to the planning effort;
- All participants should formally adopt the mitigation plan prior to submittal to SEMA and FEMA for final approval.

In order to be included in the plan as a participating jurisdiction, each jurisdiction was required to send a representative to two (2) meetings, completion of the data collection questionnaire, complete in-kind time documentation (if applicable), and formally adopt the plan as minimum requirements. Jurisdictions that met the minimum requirements and are considered to have satisfactorily participated in the planning process. In addition to public outreach solicited through SMCOG, each participating jurisdiction was strongly encouraged to seek public input at an open public meeting or through various forms of input solicitation.

Table 1.3 shows the representation of each participating jurisdiction at the planning meetings and the provision of responses to the data collection questionnaire. All jurisdictions participating in the Plan either reviewed or commented on the draft Plan, participated in the update and development of mitigation actions, documented the donation of time, and passed an adoption resolution. Meeting sign-in sheets are located in Appendix B.

Table 1.3. Jurisdictional Participation in Planning Process

Jurisdiction	Kick-off Meeting	Mtg. #2	Mtg. #3	Mtg. #4	Mtg. #5	Data Collection Questionnaire	Documented Donated Time	Adoption Resolution
Dade County	X	X	X	X	X	X	X	X
Everton			X	X		X	X	L
Greenfield	X	X				X	X	X
Lockwood	X		X	X		X	X	X
South Greenfield		X		X	X	X		X
Village of Arcola		X		X		X	X	X
Lockwood R-I School District				X	A	X	X	X
Dadeville R-II	X			X		X	X	X
Greenfield R-IV			X	X		X	X	X
Dade County R-IV Fire Protection District	X		X			X	X	X
Dadeville Rural Fire Protection District	X	X	X			X	X	L

L = letter of intent to adopt
A= Allowed alternate option of phone call meeting

1.4.2 The Planning Steps

FEMA's Local Mitigation Planning Handbook (March 1, 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 sources 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 2013 Local Mitigation Planning Handbook.

Table 1.4 is a summary of how SMCOG staff used the Nine Task Process to develop the update to the Plan.

Table 1.4. 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 October 2017, SMCOG entered into cooperative agreements with SEMA and Dade County to prepare this multi-jurisdictional plan for public entities in Dade County. Discussions on the development of the Dade County Multi-Jurisdictional Natural Hazard Mitigation Plan began on January 17, 2018 with an introductory scoping meeting attended by SMCOG staff, the County Emergency Management Director. 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 dates for five planning committee meetings, beginning with a kick-off meeting on July 16, 2018 to initiate participation of jurisdictions

and public entities in the planning process. The Emergency Management Director (EMD) and SMCOG 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, utility providers, Missouri University Extension staff, EMDs from adjacent counties, and volunteer organizations. A complete list of invitees is in Appendix B.

The MPC met on several occasions from July through November 2018 to collaborate on the development of the Plan update. Participants assisted in data collection; reviewed and revised the Plan's goals 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 phone conversations, letters, and email correspondence in addition to committee meetings. **Table 1.5** shows the meeting schedule and items discussed for MPC meetings.

Table 1.5. Schedule of MPC Meetings

Meeting	Topic	Date
Informational Scoping Meeting	• Discussion of general process of updating the Hazard Mitigation Plan • Prepared planning committee members and reviewed contact list • Planned future dates for planning committee. • Discussed communication with the public, stakeholders, city officials, and other jurisdictions to make aware of hazard mitigation meetings. • Discussed previous plan maintenance and established procedure for future plan maintenance.	January 17, 2018
Kick-off Meeting	• Introduction to hazard mitigation • The planning process • Participation requirements • Options for Public Input • Future meeting dates	July 16, 2018
Planning Meeting #2	• Participation requirements • The planning process – recap • Risk assessment • Mitigation goals and strategies preview • Future meeting dates	August 27, 2018
Planning Meeting #3	• Participation requirements • The planning process – recap • Mitigation strategies: goals and actions • STAPLEE sheet discussion	September 24, 2018
Planning Meeting #4	• Participation requirements • The planning process – recap • Review of actions prioritization and development of action sheets – funding mechanisms & implementation • Future meeting dates	October 15, 2018

Planning Meeting #5	• Participation requirements • The planning process – recap • Action tracker website • Funding and Implementation mechanisms review • Plan adoptions and maintenance	November 26, 2018

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

44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

Options for soliciting public input on the Plan were discussed with the MPC at the kick-off meeting held on July 16, 2018. SMCOG staff explained the importance of public involvement during the planning process. It was determined that SMCOG staff would advertise MPC meetings through press releases to the Greenfield Vedette. In addition, meeting dates and invitations were posted on the SMCOG 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. Press releases were sent to local news publications, and legal notices published in the Greenfield Vedette when the drafts of the Plan were posted to the SMCOG website for public comment on December 10, 2018 and January 9, 2019. A final draft of the plan was posted on the SMCOG website on February 27, 2019 prior to being submitted to SEMA for approval. Copies of affidavit of publication for legal notice, Screen Captures of the SMCOG website, and copies or press releases are included in Appendix B.

It was also discussed at the kick-off meeting that solicitation of public input would be sought by members of the MPC through announcements at gatherings and other public meetings, such as board of aldermen, county commission meetings, board of education meetings, and local emergency planning committee meetings.

The MPC also decided that SMCOG staff would assist in developing an online community survey. The survey was advertised via press release, Dade County Emergency Management, and MPC members providing to residents. Thirty-seven responses were received in the three-week time period the survey was open. A summary of responses to the survey include:

- Sixteen respondents (43%) have been impacted by a disaster;
- 70.3% of respondents believe a drought is highly likely for their community;
- 73% of respondents believe a severe thunderstorm is highly likely for their community;
- Residents were most concerned about the impact of drought, 56.8%, followed by 43.2% extremely concerned about extreme heat;
- Drought and tornado were hazards identified as having a catastrophic impact on respondents communities;
- The top choice for mitigation projects is a tornado safe room construction.

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

44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process. (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

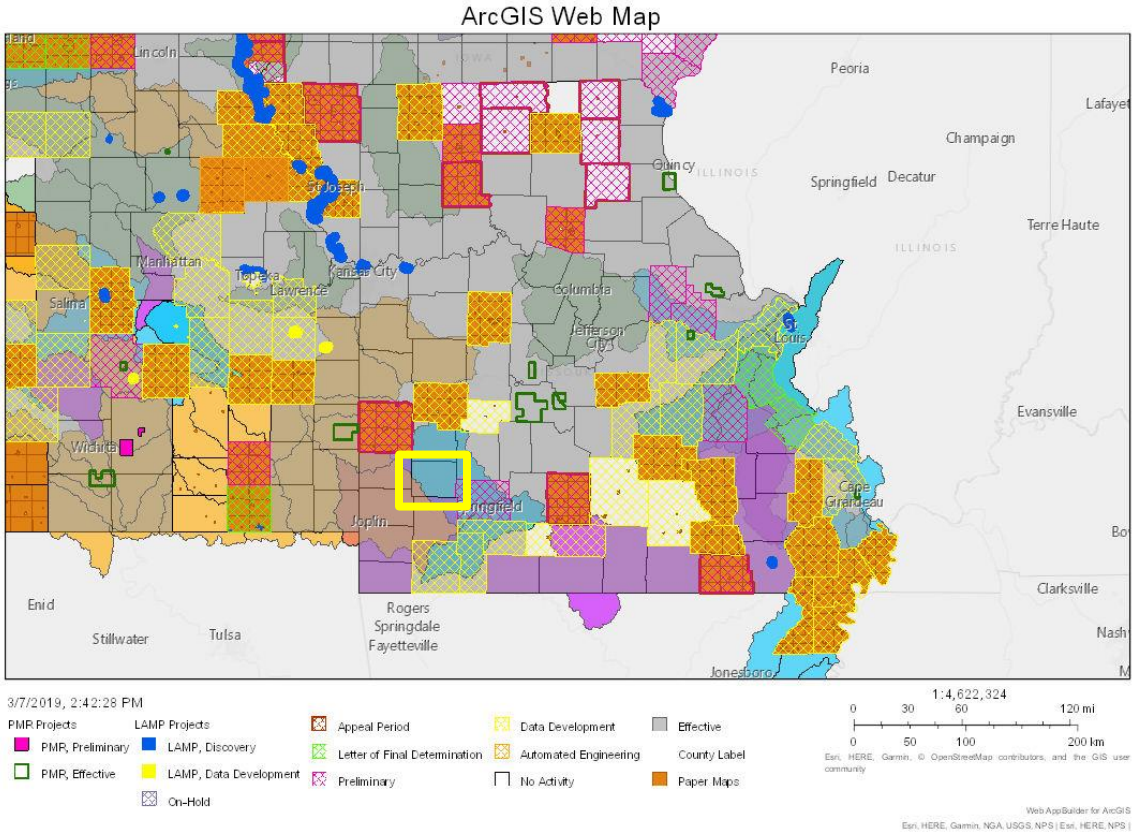
As stated in Section 1.4, neighboring communities, businesses, academia, and other non-profit interests were notified via email and letters. A notification as sent to adjacent county Emergency Management Directors, local and regional agencies, such as: OACAC, Health Departments, and special districts. A complete listing of agencies invited to participate in the planning process and what meetings they were invited to attend is included in Appendix B.

Coordination with FEMA Risk MAP Project

There was no coordination with FEMA RiskMAP projects during the update of this plan, as there were no projects currently underway.

Figure 1.1 displays locations of RiskMAP deployed watersheds and current projects in Missouri. Dade County is outlined in yellow.

Map of RiskMAP projects



Integration of Other Data, Reports, Studies, and Plans

A significant amount of information presented in the Plan has been updated and revised based on the review and incorporation of existing plans, studies, reports, and technical information. Appendix A contains a list of references to plans, studies, reports and technical information to incorporate into hazard profiles, risk assessment, and profile and capability sections. A few examples of information incorporated from the review of existing plans, etc. include:

- 2013/2018 Missouri State Hazard Mitigation Plan
- State Department of Natural Resources (DNR) dam information, the National Inventory of Dams (NID)
- Missouri Department of Conservation (MDC) wildfire statistics
- Wildland/Urban Interface and Intermix areas from the SILVIS Lab - Department of Forest Ecology and Management - University of Wisconsin

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

At the second MPC meeting on August 27, 2018 profiles of identified hazards from the 2014 Plan were presented. Storm event data from the National Centers for Environmental Information for the five year period since the adoption of the 2014 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, and property impact. Additional information about the conclusions drawn 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 Dade County Assessor, the Dade County Structures GIS dataset from MISDIS, local jurisdiction data collection questionnaires, and the U.S. Census. Potential losses to existing development were estimated based on hazard event scenarios. In most cases the county assessor's 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.

Step 6: Set Goals (Handbook Task 6)

The MPC conducted a discussion session during their third meeting on September 24, 2018 to review and update the Plan goals. The MPC also reviewed the goals from current surrounding county plans.

In the 2014 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 2014 Plan and eliminate the objective statements, moving forward with broad goals and specific mitigation actions. Objectives seemed to add a layer of complication and potential confusion. During this update process, the intent was to provide a usable set of actions that each jurisdiction was able to work towards partial or full implementation, and objectives seemed unnecessary.

The Plan update goals are as follows:

Goal 1: Protect lives and livelihood of the population

Goal 2: Preserve and maintain property, infrastructure, and the County's local economies.

Goal 3: Ensure continued operation of government and emergency functions during a disaster.

Step 7: Review Possible Mitigation Actions and Activities

In addition to discussing the overall goals at the September 24, 2018 meeting, the MPC also reviewed mitigation actions from the previous plan and any potential new actions. 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
- Input during meetings
- Responses to Data Collection Questionnaires- where jurisdictions had reported progress made on previous actions
- The FEMA's publication, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013).*

Jurisdiction representatives on the MPC were encouraged to review the details of the risk assessment vulnerability analysis specific to their jurisdiction, and the previously identified mitigation actions prior to the meeting. Representatives were provided a link to the FEMA's publication, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013)* prior to the meeting, but a hardcopy was brought and discussed as well. 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. Additionally, survey responses which identified community support for specific mitigation actions were reviewed and discussed.

During the meeting, few new actions were proposed by the committee, but numerous actions were reworded. Much of the discussion surrounded making actions SMART: specific, measurable, achievable, relevant, and time-bound.

Step 8: Draft an Action Plan

At the third MPC meeting on September 24, 2018, representatives were provided with blank STAPLEE scoring sheet. The method was used to develop a priority score for proposed actions. During the meeting, SMCOG staff provided an overview of scoring criteria and example scoring for an action. MPC members were encouraged to use the STAPLEE scoring to determine which actions applied to their jurisdiction. Actions were eliminated due to non-applicability or low feasibility scores.

At the fourth MPC meeting on October 15, 2018, MPC members who had returned completed STAPLEE sheets prior to the meeting were provided with pre-populated Action sheets. Other MPC members were provided with blank actions sheets to complete. SMCOG staff reviewed the Action sheets in detail and discussed 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)

The final meeting on November 26, 2018 provided a wrap-up and opportunity to answer any questions pertaining to plan adoption. The final plan must be approved by the governing body of each jurisdiction by resolution to be eligible for hazard mitigation assistance. Adoption resolutions are included in Appendix D.

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

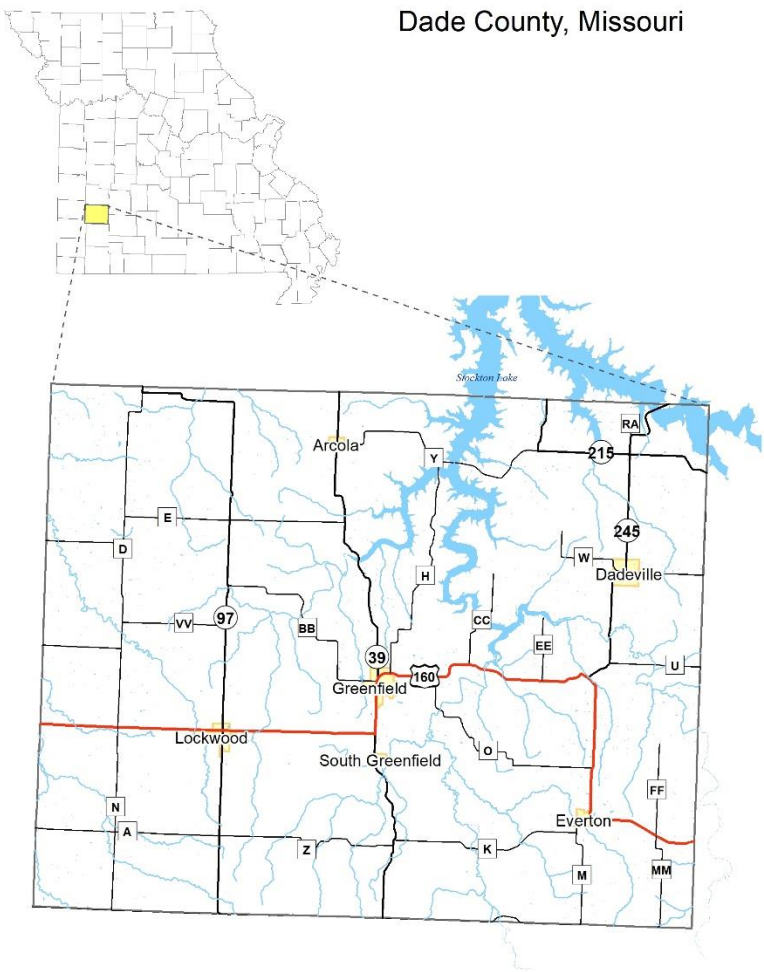
At the final MPC meeting on November 26, 2018, SMCOG staff discussed the FEMA action tracker website for assistance in implementing mitigation actions. The MPC also briefly reviewed potential funding sources for mitigation projects, and the process for reviewing and monitoring the plan. Dade County Emergency Management will be charged with scheduling and staffing annual meetings, and keeping the plan updated. The overall strategy has been updated and is presented in the Plan Maintenance chapter.

2 PLANNING AREA PROFILE AND CAPABILITIES

2.1 DADE COUNTY PLANNING AREA PROFILE

Dade County is located in Southwest Missouri. Counties that border Dade are Barton and Jasper to the west, Cedar to the north, Polk and Greene to the east, and Lawrence to the south. The county covers 506.25 square miles, including 490.01 square miles of land and 16.24 square miles of surface water. Incorporated communities include the villages of Arcola, Dadeville and South Greenfield and the cities of Everton, Greenfield, and Lockwood. Unincorporated settlement areas include Bona in the northeastern corner of the county and Pennsboro is the south central section. Greenfield is the county seat. **Figure 2.1** is a map of Dade County.

Figure 2.1. Map of Dade County



The American Community Survey estimates the 2016 population of Dade County as 7,590. This is a decrease of 3.7% in comparison to the 2010 census population of 7,883. This decrease contrasts with the growth experienced by the state of Missouri and the United States as a whole over the same time period, which were 1.2% and 3.2% respectively.

The median household income (MHI) for Dade County was $37,904, according to 2016 estimates. This is well below the state and national measures of $49,593 and $55,322. The percent change in MHI between 2010 and 2016 was a 30.3% increase, which is right on par with both the state and national growths of 30.7% and 31.7%, respectively.

In Dade County, the median home value was $80,300 in 2016. This is lower than the state of Missouri as a whole ($141,200), and lower than the entire United States ($184,700). However, the median home value for Dade County has risen by 10% since 2010, which is much higher than both Missouri (2.5%) and the United States (-2%).

2.1.1 Geography, Geology and Topography

Dade County includes 490 square miles of land and 16 square miles of water located in southwest Missouri. The majority of residents, about 55%, live in rural areas. The county only has one municipality with a population of over 1,000, which is Greenfield. Greenfield has experienced a 7.7% growth in its population since 2010, rising from 1,371 to 1,476.

Dade County's water system is comprised of two main river basins. The majority of the county is located in the Sac River Basin, which eventually flows to Stockton Lake and the Osage River. The southwest quarter of Dade County lies in the Spring River Basin, which eventually flows into the Grand Lake of the Cherokees in Oklahoma, however, none of the communities in Dade County are located on this river basin.

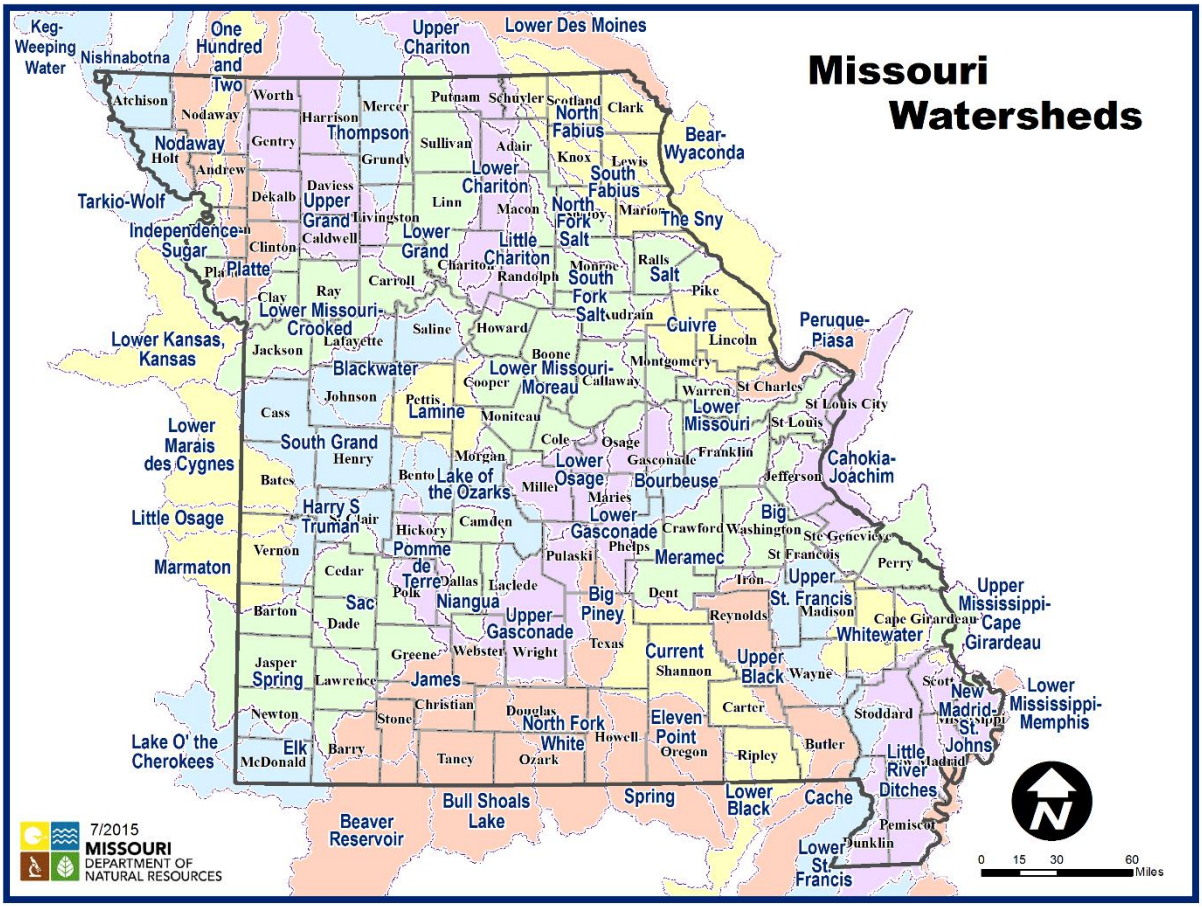
Nearly all of Dade County is situated in the Interior Highlands Physiographic Province of the United States. Most of the county lies on the Springfield Plateau, a subdivision of the Ozarks Plateau physiographic region. The northeastern corner of the county lies on the Salem Plateau subdivision of the Ozarks Plateau. The extreme northwest corner of the county is located on the Osage Plains subdivision of the Central Lowlands Physiographic Province.

Dade County's topography transitions from nearly level to gently rolling plains in the western area to more hilly landscapes in the central and eastern section of the county. The landscape varies in response to the underlying bedrock formations and the process of weathering of the bedrock. Resistant sandstone and/or cherty limestone usually cap the mounds and prairies in the western and southern parts of the county. The slopes below the caps are usually developed on less resistant shale. The bedrock consists mainly of sedimentary rock ranging from Jefferson City dolomite of Ordovician age to sandstone, shale, and conglomerates of Pennsylvanian age.

Several old and geologically inactive faults exist in the county. The most prominent is the Dadeville fault that trends in a southeast-northwest direction. Highway Y crosses the Dadeville fault approximately seven miles west of Bona. Several small faults and folds parallel with the Dadeville fault, but these faults are geologically inactive and pose no seismic risk.

Dade County is covered primarily by the Sac River watershed. **Figure 2.2** provides a map of Missouri Watersheds.

Figure 2.2 Missouri Watersheds



Source: Missouri Department of Natural Resources

2.1.2 Climate

Dade County has a continental climate with mild winters and hot, humid summers. Based on information from the Midwest Regional Climate Center, the Lockwood, MO area has an average annual temperature of 56.8 Fahrenheit. The average high in July is 99 Fahrenheit and the average low in January is 1 Fahrenheit. It averages 44.04 inches of precipitation, with snow accounting for an average of 14.9 inches annually.

2.1.3 Population/Demographics

Table 2.1 provides the total county population and the populations for each city, village, and the unincorporated county for 2000, 2010, and 2016 with the number and percentage change from 2010 to 2016. In terms of percent change, five of the six incorporated communities grew in population. It is estimated that the unincorporated population of the county is 7,590 people. Arcola and Everton have seen the most growth since 2010, increasing by 60% and 17.7% respectively.

Table 2.1. Dade County Population 2000-2016 by Jurisdiction

Jurisdiction	2000 Population	2010 Population	2016 Annual Population Estimate	# Change (2010-2016)	% Change (2010-2016)
Dade County	7,923	7,883	7,590	-333	-4.2%
Village of Arcola	45	55	88	43	60%
City of Everton	322	319	379	57	17.7%
City of Greenfield	1,358	1,371	1,476	118	8.7%
City of Lockwood	989	936	1,114	125	12.6%
Village of South Greenfield	136	90	115	25	27.8%

Source: U.S. Bureau of the Census, Decennial Census, annual population estimates/ 5-Year American Community Survey 2016;

Dade County's most at-risk populations are somewhat on par with state and national averages. Children under 5 in the county, comprising 4.6 percent of the total population, is near the state and national averages of 6.2 and 6.3 percent, respectively. The county has a significantly higher elderly population, or those above the age of 65, at 22.3 percent of the population, compared to 14.9 percent for Missouri and 14.1 percent for the nation. In addition, Dade County's median age is around 8 to 9 years older than the state and national medians, respectively. **Table 2.2** provides the number of Dade County residents within specific age groups and a comparison of percentages with the state of Missouri and the United States.

Table 2.2. Dade County Population Age Composition, Missouri, United States Comparison

Age Group	# of People	Percent	Missouri Percent	United States Percent
Persons under 5 years old	347	4.6%	6.2%	6.2%
Persons 5 to 9 years old	493	6.5%	6.4%	6.4%
Persons 10 to 14 years old	434	5.7%	6.5%	6.5%
Persons 15 to 19 years old	489	6.4%	6.6%	6.7%
Persons 20 to 24 years old	368	4.8%	7.1%	7.1%
Persons 25 to 34 years old	651	8.6%	13.2%	13.6%
Persons 35 to 44 years old	815	10.7%	12.1%	12.7%
Persons 45 to 54 years old	1,067	14.1%	13.5%	13.6%
Persons 55 to 59 years old	709	9.3%	7.0%	6.7%
Persons 60 to 64 years old	528	7.0%	6.1%	5.9%
Persons 65 to 74 years old	916	12.1%	8.6%	8.3%
Persons 75 to 84 years old	536	7.1%	4.7%	4.3%
Persons 85 and older	237	3.1%	2.0%	1.9%
Total	**7,590**	**-**	**-**	**-**
Median Age	**46.9**	**-**	**38.3%**	**37.7%**

The University of South Carolina developed an index to evaluate and rank the ability to respond to, cope with, recover from, and adapt to disasters. The index synthesizes 29 socioeconomic variables which research literature suggests contribute to reduction in a community's ability to prepare for, respond to, and recover from hazards. SoVI ® data sources include primarily those from the United States Census Bureau.

The index is a comparative metric that facilitates the examination of the differences in social vulnerability among counties. SoVI® is a valuable tool for policy makers and practitioners. It graphically illustrates the geographic variation in social vulnerability. It shows where there is

uneven capacity for preparedness and response and where resources might be used most effectively to reduce the pre-existing vulnerability. SoVI® also is useful as an indicator in determining the differential recovery from disasters.

Dade County's SoVI® score is 1.340000033, placing it in the 72.1st percentile when compared to the rest of the nation. This score means that 72.1 percent of the nation is more resilient to hazards and disasters. The main determinants of the score are qualities of the population based on race and class, wealth, elderly residents, Hispanic ethnicity, special needs individuals, Native American ethnicity, and the service industry employment.

Table 2.3. Unemployment, Poverty, Education, and Language Percentage Demographics, Dade County, Missouri

Jurisdiction	Total in Labor Force	Percent of Population Unemployed	Percent of Families Below the Poverty Level	Percentage of Population (High School graduate)	Percentage of Population (Bachelor's degree or higher)	Percentage of population with spoken language other than English
Dade County	3,570	8.2%	13.3%	86.5%	14.9%	3.5%
Arcola	42	9.5%	10.7%	82.6%	31.0%	0.0%
Everton	153	17%	19.0%	86.7%	9.5%	0.0%
Greenfield	569	9.7%	19.8%	81.0%	11.8%	2.7%
Lockwood	480	6.7%	10.7%	85.2%	15.2%	2.6%
South Greenfield	29	27.6%	53.8%	60.2%	2.0%	0.0%
Missouri	3,053,100	6.6%	10.8%	88.8%	27.6%	6.0%
United States	160,860,555	7.1%	11.0%	87.0%	30.3%	21.1%

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

2.1.4 History

Dade County was part of the area claimed by France until purchased by the United States in 1803 as part of the Louisiana Purchase. The area was first inhabited by the Sac, Delaware and Osage Indians; the Osage ceded the territory in 1808. The first settlers arriving in the early 1830s from Kentucky and Tennessee found fertile prairie soils, walnut timber, wild game, and rivers and creeks which provided drinking water for their animals.

Dade County was created on January 29, 1841 from Barry County territory and was named after Major Francis L. Dade who was killed in the Seminole Wars; Greenfield was named the county seat (Aldrich, Dade County Soil Survey, p. 10). Growth of the cities was stimulated by railroad construction in 1881. The Kansas City, Fort Scott & Gulf Railroad was constructed through the southern part of the county, running through the communities of Everton, South Greenfield and Lockwood. The construction of a rail spur from the main line to Greenfield was privately financed by Greenfield residents and businessmen. The Greenfield Northern Railroad solidified Greenfield's position as the county seat. Dade County's economy began to expand and diversify following construction of the railroad.

Mining of coal, zinc, iron, lead and silica contributed to a population boom in the late 1800s as investors and workers migrated to the county. However, mining ceased in the early 1900s and population declined as mining boom towns such as Corry faded away. Agriculture dominated the local economy during the early 1900s. Chief crops produced in the county were oats, wheat corn and

fruits. Animal production included dairy and beef cattle, horses, poultry and sheep. The dairy industry was strong through the 1940s but beef cattle became more dominant through the latter part of the century.

Dade County's landscape changed significantly in the early 1960s with the construction of Stockton Dam on the Sac River in Cedar County and the creation of Stockton Lake. Nearly 26,000 acres of land in Cedar, Dade and Polk counties were inundated with the formation of Stockton Lake. The U.S. Army Corps of Engineers (USACE) maintains a policy of limiting access to federal lands and Stockton Lake to only power generation, flood control and recreational purposes, and there is minimal commercial and residential development around the lake area in Dade County. While Stockton Lake is a popular attraction for fishing and water sports, it has not been a major catalyst for diversifying the Dade County economy to the extent experienced by other counties in Southwest Missouri with USACE maintained lakes in their jurisdictions (Stone and Taney counties-Table Rock Lake).

2.1.5 Occupations

Occupation information for the Dade County labor force comes from the American Community Survey 5-year estimates 2011 - 2015. Management, Business, Science, and Arts Occupations includes education and healthcare practitioner and technician occupations among others. Service Occupation includes healthcare support and protective services, such as firefighters and law enforcement in addition to food preparation and personal care services. The other occupation classifications are well defined. **Table 2.4** contains occupation statistics for the incorporated cities and the county as a whole.

Arcola has the highest percentages of management, business, science, and arts occupations while Everton has the highest percentage of service occupations. Sales and office occupations account for the fewest occupations in Dade County overall. Only 1.9% of the county is involved in this category, however, 57.1% of South Greenfield jobs are in this sector. Production, transportation, and material moving occupations are highest in Lockwood.

Table 2.4. Occupation Statistics, Dade County, Missouri

Place	Management, Business, Science, and Arts Occupations	Service Occupations	Sales and Office Occupations	Natural Resources, Construction, and Maintenance Occupations	Production, Transportation, and Material Moving Occupations
Dade County	40.9%	18.8%	1.9%	17.6%	20.8%
Arcola	60.5%	0.0%	13.2%	10.5%	15.8%
Everton	13.4%	28.3%	22.0%	11.8%	24.4%
Greenfield	27.1%	26.1%	18.5%	8.2%	20.1%
Lockwood	25.0%	9.8%	17.2%	14.5%	33.5%
South Greenfield	9.5%	14.3%	57.1%	0.0%	19.0%

Source: U.S. Census, 2011-2015 American Community Survey, 5-year Estimates.

2.1.6 Agriculture

According to the United States Department of Agriculture (USDA) 2012 Agricultural Census, there were 734 farms covering 245,554 acres in Dade County. The average farm size was 335 acres, which was over the average farm size in Missouri at 285 acres, with an average market value of

$94,661 of agricultural products sold. Of the total, about 47.9% was from crop sales while the other 52.1% came from livestock, poultry, and their products. Wheat for grain was the largest type of farm activity with 1,228,242 bushels harvested. Dade County is ranked 54 in Missouri for total value of agricultural products sold. In addition, 53% of principal operators reported a primary occupation of something other than farming. According to the 2016 ACS, 13.3% of the workforce worked in agriculture-related and agribusiness jobs.

2.1.7 FEMA Hazard Mitigation Assistance (HMA) Grants in Dade County

According to FEMA data, there have been no hazard mitigation assistance grants for jurisdictions within Dade County.

2.1.8 FEMA Public Assistance (PA) Grants in Dade County

Since 2002, jurisdictions in Dade County have received over $5 million in public assistance due to natural hazard damages. Table 2.5 shows all public assistance payouts received by jurisdiction and for project type since 2002. Data was retrieved from the FEMA public assistance dataset.

Table 2.5. FEMA PA Grants in County from 2002-2017

Disaster Declaration	Project Type	Project Size	Applicant	Project Total
4317	Roads & Bridges – Tier 1	Small	Dade County	$85,485.25
4317	Roads & Bridges – Tier 7	Small	Dade County	$44,044.25
4317	Roads & Bridges – Tier 5	Small	Dade County	$32,386.63
4317	Roads & Bridges – Tier 6	Small	Dade County	$34,963.41
4317	Roads & Bridges – Tier 8	Small	Dade County	$16,645.48
4317	Roads & Bridges – Tier 2	Small	Dade County	$117,646.25
4317	Roads & Bridges – Tier 9	Small	Dade County	$5,592.75
4317	Road Damage	Small	Village of South Greenfield	$14,717.04
4317	Roads & Bridges – Tier 3	Small	Dade County	$91,938.25
4317	Culvert Repair	Small	Dade County	$6,876.52
4317	Roads Repair	Small	Dade County	$27,731.03
4317	Roads & Bridges – Tier 10	Small	Dade County	$21,150.25
4250	Road Damage	Small	Dade County	$24,270
4250	Road Damage	Small	Dade County	$28,995
4250	Road Damage	Small	Dade County	$35,055.20
4250	Road Damage	Small	Dade County	$5,693
4250	Road Damage	Small	Dade County	$56,647.01
4250	Road Damage	Small	Dade County	$19,400
4250	Road Damage	Small	Dade County	$7,433.9
4250	Road Damage	Small	Dade County	$5,413.10
4250	Road Damage	Small	Dade County	$19,132
4250	Road Damage	Small	Dade County	$7,168
4250	Road Damage	Small	Dade County	$11,100
4250	Road Damage	Small	Dade County	$14,200
4250	Road Damage	Small	Dade County	$77,598.84
4250	Road Damage	Small	Dade County	$36,292
4250	Road Damage	Small	Dade County	$27,904.17
4250	Road Damage	Small	Dade County	$117,066.14
4238	Road Repair	Small	Dade County	$6,125.78
4238	Road Repair	Small	Dade County	$16,804.50
4238	Road Repair	Small	Dade County	$8,199.90
4238	Road Repair	Small	Dade County	$6,945.84
4238	Road Repair	Small	Dade County	$3,683.20
4238	Road Repair	Small	Dade County	$3,600
4238	Road Repair	Small	Dade County	$16,185.72

4238	Road Repair	Small	Dade County	$12,174.12
4238	Road Repair	Small	Dade County	$10,633.43
4238	Road Repair	Small	Dade County	$66,543.20
4238	Road Repair	Small	Dade County	$4,481.95
4238	Road Repair	Small	Dade County	$15,214
4238	Road Repair	Small	Dade County	$51,472.50
4238	Road Repair	Small	Dade County	$36,018.45
4144	Road Damage	Small	Dade County	$35,257.54
4144	Road Damage	Small	Dade County	$14,051
4144	Roads & Bridges	Small	Dade County	$61,420.40
4144	Recreation	Small	Dade County	$34,149.12
4144	Roads & Bridges	Small	Dade County	$22,701.50
4144	Roads & Bridges	Small	Dade County	$35,002.34
4144	Roads & Bridges	Small	Dade County	$32,376.05
4144	Road Damage	Small	Dade County	$53,945.92
4144	Roads & Bridges	Small	Dade County	$17,174.74
4144	Road Damage	Small	Dade County	$28,950
4144	Road Damage	Small	Dade County	$28,005.10
4144	Road Damage	Small	Dade County	$56,220.95
4144	Road Damage	Small	Dade County	$64,139.09
4144	Road Repair	Small	Dade County	$27,652.84
4144	Road Repair	Small	Dade County	$48,131.36
4144	Road Repair	Small	Dade County	$13,493.20
4144	Road Repair	Small	Dade County	$12,122.62
4144	Road Repair	Small	Dade County	$1,094.69
4144	Road Repair	Small	Dade County	$33,643.38
4144	Road Damage	Small	Dade County	$50,311.57
4144	Road Damage	Small	Dade County	$23,820
4144	Road Repair	Small	Dade County	$22,728.38
4144	Road Repair	Small	Dade County	$10,019.27
4144	Road Repair	Small	Dade County	$59,694.80
1961	Snow Removal	Small	City of Lockwood	$3,702.83
1961	Snow Removal	Small	City of Greenfield	$5,556.15
1961	Emergency Operations Center	Small	Dade County	$1,330.65
1961	Snow Removal	Small	City of Everton	$1,861.71
1961	Snow Removal	Small	Dade County	$26,098.37
1961	Donated Resources	Small	Dade County	$8,649.40
1847	Debris Removal	Small	Dade County	$1,496
1847	Debris Removal	Small	Dade County	$5,825
1847	Debris Removal	Small	Dade County	$3,897
1847	Debris Removal	Small	Dade County	$6,259.05
1847	Debris Removal	Small	Dade County	$31,899.50
1847	Protective Measures	Small	Dade County	$3,980
1847	Road Damages	Small	Dade County	$1,495.20
1847	Road Damages	Small	Dade County	$2,785.04
1847	Debris Removal	Small	Dade County	$4,254.52
1847	Debris Removal	Small	Dade County	$1,284
1847	Road Repair	Small	Dade County	$6,101.48
1847	Debris Removal	Small	Dade County	$2,069.20
1847	Road Repair	Small	Dade County	$3,931.08
1847	Road Repair	Small	Dade County	$5,555.93
1847	Road Damages	Small	Dade County	$1,865.12
1847	Road Repair	Small	Dade County	$3,211.57
1847	Road Damages	Small	Dade County	$2,478.12
1847	Road/Culvert/Shoulder Damages	Small	Dade County	$21,966.52
1847	Debris Removal	Small	Dade County	$1,840
1847	Donated Resources	Small	Dade County	$10,920.20
1749	Road/Culvert Damages	Small	Dade County	$1,300.70
1749	Bridge Guiderail Damages	Small	Dade County	$2,225

1749	Debris Removal	Small	Dade County	$3,210
1749	Donated Resources	Small	Dade County	$1,070
1749	Road Washouts	Small	Dade County	$15,033.33
1749	Road/Culvert/Scouring Damages	Small	Dade County	$1563.28
1749	Road Washout	Small	Dade County	$3,566.60
1749	Road Washout	Small	Dade County	$19,684.23
1749	Road Washout	Small	Dade County	$16,842.99
1749	Road Washout	Small	Dade County	$8,143.19
1749	Road Washout	Small	Dade County	$31,726
1749	Culvert Replacement	Small	Dade County	$1,079.70
1749	Road/Culvert Washout	Small	Dade County	$18,815.88
1749	Road Washout	Small	Dade County	$9,440.75
1749	Roads & Culvert Washout	Small	Dade County	$11,069.45
1749	Road Washout	Small	Dade County	$10,489.25
1749	Road Washout	Small	Dade County	$9,126.25
1749	Road Washout	Small	Dade County	$12,448.25
1749	Road Washout	Small	Dade County	$12,378.70
1749	Road Washout	Small	Dade County	$13,867.50
1749	Roads & Culvert Washout	Small	Dade County	$10,849.91
1749	Road Washout	Small	Dade County	$1,826.30
1749	Road Washout	Small	Dade County	$4,668.75
1749	Road Washout	Small	Dade County	$5,680.25
1749	Roads & Culvert Washout	Small	Dade County	$22,276.25
1749	Road Washout	Small	Dade County	$11,146.42
1749	Roads & Culvert Washout	Small	Dade County	$13,835.25
1749	Road Washout	Small	Dade County	$4,658.10
1749	Road Washout	Small	Dade County	$15,933.40
1749	Road Washout	Small	Dade County	$45,953.80
1749	Road Washout	Small	Dade County	$6,920.94
1749	Road Washout	Small	Dade County	$16,379.48
1749	Road Washout	Small	Dade County	$3,400
1736	Debris Removal	Small	Dade County	$22,038.92
1728	Road Erosion	Small	Dade County	$49,438.96
1728	Road Washout	Small	Dade County	$32,026.60
1728	Road Erosion	Small	Dade County	$19,735.55
1728	Road Washout	Small	Dade County	$5,380.55
1728	Road Washout	Small	Dade County	$6,302
1728	Road Damages	Small	Dade County	$23,468.13
1728	Road Damages	Small	Dade County	$22,450
1728	Road Washout	Small	Dade County	$5,361.80
1728	Road Washout	Small	Dade County	$6,126.90
1728	Debris Removal	Small	Dade County	$2,520
1728	Road Damage	Small	Dade County	$24,360
1728	Road Washout	Small	Dade County	$16,929.15
1728	Road Erosion	Small	Dade County	$24,203.10
1728	Road Washout	Small	Dade County	$1,863.50
1728	Road Washout	Small	Dade County	$3,315
1728	Road Washout	Small	Dade County	$3,614.50
1728	Road Washout	Small	Dade County	$38,713.80
1728	Road Damages	Small	Dade County	$35,595
1728	Road Washout	Small	Dade County	$2,172.50
1728	Road Washout	Small	Dade County	$7,621
1728	Road Washout	Small	Dade County	$7,116.50
1728	Road Damages	Small	Dade County	$31,257.50
1728	Road Washout	Small	Dade County	$9,729
1728	Road Washout	Small	Dade County	$5,777.50
1728	Road Washout	Small	Dade County	$10,843.50
1728	Road Washout	Small	Dade County	$3,727
1728	Road Washout	Small	Dade County	$48,733.50

1728	Road Washout	Small	Dade County	$57,984
1728	Road Washout	Small	Dade County	$8,794.34
1728	Debris Removal	Small	Dade County	$5,625
1728	Road Washout	Small	Dade County	$8,950
1728	Road Washout	Small	Dade County	$13,520
1728	Road Washout	Small	Dade County	$16,830.18
1728	Road Washout	Small	Dade County	$16,270
1728	Culverts Washout	Small	Dade County	$1,750
1728	Road Washout	Small	Dade County	$58,270
1728	Road Washout	Small	Dade County	$4,315
1728	Road Washout	Small	Dade County	$1,800
1728	Road Washout	Small	Dade County	$10,880
1728	Road/Culvert Damage	Small	Dade County	$8,790
1728	Road Washout	Small	Dade County	$10,160
1728	Road/Culvert Washout	Small	Dade County	$9,680
1728	Road Washout	Small	Dade County	$1,932.33
1728	Bridge Approach	Small	Dade County	$9,315
1728	Park Road/Fence Damages	Small	Dade County	$2,321.38
1728	Bridge Approach	Small	Dade County	$3,565.50
1728	Road Washout	Small	Dade County	$31,768.60
1728	Road Washout	Small	Dade County	$9,746
1728	Road Washout	Small	Dade County	$43,013.99
1728	Road Washout	Small	Dade County	$4,398
1728	Road Washout	Small	Dade County	$20,596
1728	Road Washout	Small	Dade County	$2,790
1728	Road Washout	Small	Dade County	$11,910
1728	Culvert Cleaning/Replacement	Small	Dade County	$6,048.40
1728	Road Washout	Small	Dade County	$27,660
1728	Road Washout	Small	Dade County	$3,797.30
1728	Road Washout	Small	Dade County	$33,645.86
1728	Road Washout	Small	Dade County	$25,492
1728	CMP Replacement	Small	Dade County	$5,692.29
1728	Road Washout	Small	Dade County	$7,229.53
1728	Road Washout	Small	Dade County	$2,450
1728	Road Washout	Small	Dade County	$18,061.32
1728	Debris Removal	Small	Dade County	$2,950
1728	Road Washout	Small	Dade County	$29,448
1728	Road Washout	Small	Dade County	$38,333.06
1728	Road Washout	Small	Dade County	$34,857.58
1728	Road Washout	Small	Dade County	$27,205
1728	Bridge Approach Damages	Small	Dade County	$6,000
1728	Road Washout	Small	Dade County	$36,184.20
1728	CMP Replacement	Small	Dade County	$5,850
1728	Road/Culvert Washout	Small	Dade County	$22,625.80
1676	Protective Measures	Small	City of Lockwood	$1,696.67
1676	Public Utilities	Small	City of Lockwood	$19,077.10
1676	Debris Removal	Small	City of Lockwood	$25,908.98
1676	Debris Removal	Small	Village of South Greenfield	$3,962.00
1676	Emergency Protective Measures	Small	City of Everton	$8,218.33
1676	Debris Removal	Small	City of Everton	$28,500
1676	Donated Resources	Small	City of Everton	$4,586.36
1676	Donated Resources	Small	City of Lockwood	$2,144.94
1676	Debris Removal	Small	Township of Rock Prairie	$18,743
1676	Emergency Protective Measures	Small	City of Greenfield	$7,118.36
1676	Debris Removal	Small	City of Greenfield	$34,791.39
1676	Debris Removal	Small	Dade County Emergency Manager	$5,025
1676	Debris Removal	Small	Dade County Emergency	$1,614.05
1676	Debris Removal	Small	Dade County Emergency Manager	$7,888
1676	Debris Removal	Small	Dade County Emergency Manager	$10,952.15

1676	Public Buildings and Facilities	Small	City of Greenfield	$1,000
1676	Debris Removal	Small	Dade County Emergency Manager	$1,150
1676	Debris Removal	Small	Dade County Emergency Manager	$5,077.38
1676	Debris Removal	Small	Dade County Emergency Manager	$12,500
1676	Public Buildings and Facilities	Small	City of Greenfield	$1,000
1676	Debris Removal	Small	Dade County Emergency Manager	$2,090
1676	Debris Removal	Small	Dade County Emergency Manager	$10,157.25
1676	Emergency Protective Measures	Small	Dade County Emergency Manager	$4,290.14
1676	Emergency Protective Measures	Small	Dade County Emergency Manager	$2,938.26
1676	Donated Resources	Small	City of Greenfield	$1,678.37
1676	Public Buildings and Facilities	Small	Dade County Emergency Manager	$5,000
1676	Debris Removal	Small	Dade County Emergency Manager	$48,170.13
1676	Donated Resources	Small	Dade County Emergency Manager	$11,511.27
1676	Donated Resources	Small	Village of South Greenfield	$1,173.17
1412	Road Repair	Small	Dade County	$4,712.57
1412	Road Washouts	Small	Dade County	$43,066.10
1412	Flood Generated Road Washouts	Small	Dade County	$19,737.50
1412	Road Damage	Small	Dade County	$47,746.39
1412	Road Repair	Small	Dade County	$19,717
1412	Transformer Damage	Small	City of Lockwood	$2,711.87
1412	Road Repair	Small	Dade County	$4,589.32
1412	Road Damage	Small	Dade County	$18,892.14
1412	Road Repair	Small	Dade County	$4,677
1412	Road Repair	Small	Dade County	$13,284.70
1412	Road Damage	Small	Dade County	$11,867.15
1412	Road Damage	Small	Dade County	$41,815.40
1412	Road Damage	Small	Dade County	$15,500
1412	Golf Course Damage	Small	City of Lockwood	$6,494.62
1412	Road Damage	Small	Dade County	$49,934.30
1412	Road Damage	Small	Dade County	$13,329.26
1412	Road Repairs	Small	Dade County	$51,511.50
1412	Road Damage	Large	Dade County	$63,279.36
1412	Road Damage	Small	Dade County	$32,010
1412	Contents Damage	Small	City of Lockwood	$5,359.59
1412	Road Damage	Small	Dade County	$48,930
1412	Road Damage	Small	Dade County	$19,642.56
1412	Road Damage	Small	Dade County	$30,017.65
1412	Road Damage	Small	Dade County	$11,940
1412	Damage Roads	Small	Dade County	$40,500
1412	Road Damage	Small	Dade County	$51,042
1412	Road Damage	Small	Dade County	$32,694
1412	Road Damage	Small	Dade County	$4,800
1412	Road Damage	Small	Dade County	$49,130
1412	Road Damage	Small	Dade County	$10,120
1412	Road Damage	Small	Dade County	$46,270
1412	Road Damage	Small	Dade County	$14,652
1412	Road Damage	Small	Dade County	$40,259.50
1412	Road Repair	Small	Dade County	$15,659.13
1412	Road Damage	Small	Dade County	$8,300
1412	Road Damage	Small	Dade County	$21,187.50
1412	Road & Drainage Ditch Cleanup	Small	Dade County	$8,868.15
1412	Road Damage	Small	Dade County	$38,431.70
1412	Road Damage	Small	Dade County	$25,439.50
1412	Road Damage	Small	Dade County	$11,029.60
1412	Road Damage	Small	Dade County	$33,500
1412	Road Damage	Small	Dade County	$45,298
1412	Road Damage	Large	Dade County	$220,291.45
1412	Road Damage	Small	Dade County	$30,868.64
1412	Road Damage	Small	Dade County	$18,345

1412	Road and Drain Ditch Repair	Small	Dade County	$2,892.72
1412	Road Damage	Small	Dade County	$15,597.50
1412	Road Damage	Small	Dade County	$8,340
1412	Low Water Crossing Damage	Small	Dade County	$2,108
Total				$5,416,937.25

Source: Federal Emergency Management Agency, 12/10/18

2.2 JURISDICTIONAL PROFILES AND MITIGATION CAPABILITIES

This section includes profiles for each participating jurisdiction. In those summaries are previous mitigation initiatives and the capabilities of each jurisdiction. The unincorporated county is profiled first, followed by the incorporated communities, the special districts, and public school districts.

2.1.1 Unincorporated Dade County

Dade County's jurisdiction includes all unincorporated areas within the county boundaries. Dade County is classified as a Class III county in Missouri and is governed by a three-member Commission, consisting of a presiding commissioner, a western commissioner, and an eastern commissioner. Commissioners serve four year terms.

The County's elected governing body; the Board of County Commissioners directs the general administration of County Government. The Commission sets broad operating policies, enacts ordinances and establishes budgets as mandated by State law. The County enters into contracts with other public agencies to ensure the smooth flow of services including law enforcement, construction and maintenance of public roads and bridges, and the operations of county offices, equipment and services. The 2010 population of Dade County was 7,883, with the 2016 estimate of 7,590 equating to a 4.2% decrease in population.

The departments or staff of the County government include:

- Board of Commissioners
- Emergency Management Coordinator
- NFIP Floodplain Administrator
- County Assessor
- County Recorder
- County Treasurer
- County Sheriff
- County Health Department

Mitigation Initiatives/Capabilities

- County Mitigation Plan

Table 2.6 provides information on Unincorporated Dade County's mitigation capabilities based on the Data Collection Questionnaire.

Table 2.6. Unincorporated Dade County Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	N/A

County Emergency Operations Plan	Yes
Local Recovery Plan	N/A
County Recovery Plan	No
City Mitigation Plan	N/A
County Mitigation Plan	Yes; currently updating
Debris Management Plan	N/A
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
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	No
Building Code	No
Floodplain Ordinance	Yes; 3.21.11
Subdivision Ordinance	No
Tree Trimming Ordinance	No
Nuisance Ordinance	No
Stormwater 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 (NFIP)	Yes
NFIP Community Rating System (CRS) program	No
National Weather Service (NWS) Storm Ready	Yes
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	6

Capabilities	Status Including Date of Document or Policy
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 (Local)	N/A
Hazard Analysis/Risk Assessment (County)	No
Flood Insurance Maps	Yes
FEMA Flood Insurance Study (Detailed)	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	No
Emergency Management Director	Yes; part-time
NFIP Floodplain Administrator	Yes; part-time
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	Yes; part-time
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	Yes; part-time
Community Organizations (Lions, Kiwanis, etc.)	Yes; part-time

Capabilities	Status Including Date of Document or Policy
Local Funding Availability	
Apply for Community Development Block	No
Fund projects through Capital	No
Authority to levy taxes for a specific purpose	No
Fees for water, sewer, gas, or electric services	No
Impact fees for new development	No
Ability to incur debt through general obligation bonds	No
Ability to incur debt through special tax bonds	No
Ability to incur debt through private activities	No
Withhold spending in hazard prone areas	No

Source: Data Collection Questionnaire, 2018

2.1.2 Village of Arcola

The Village of Arcola is located in the northern part of Dade County. The Village is governed by a five member board of Village Trustees led by the Chairman. The 2010 population of Arcola was 55, with the 2016 estimate of 88 equating to a 60% increase in population. However, estimates for small communities often have a high margin of error. Due to the small size of the community, Arcola has very limited staff and mitigation capabilities.

The departments or staff of the Village government include:

- Board of Trustees

Mitigation Initiatives/Capabilities

- Designated public shelter

Table 2.7 provides information on the Village of Arcola's mitigation capabilities based on the Data Collection Questionnaire.

Table 2.7. Village of Arcola Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
Local Emergency Plan	No
County Emergency Plan	N/A
Local Recovery Plan	No
County Recovery Plan	N/A
Local Mitigation Plan	No
County Mitigation Plan	Yes, currently updating
Local Mitigation Plan (PDM)	No
County Mitigation Plan (PDM)	N/A
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
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recovery)	No
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
Capability	
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Landscape Ordinance	No
Iowa Wetlands and Riparian Areas Conservation Plan	No
Debris Management Plan	No
Program	
Zoning/Land Use Restrictions	No

Capability	Status Including Date of Document or Policy
Codes Building Site/Design	No
National Flood Insurance Program (NFIP) Participant	Yes
NFIP Community Rating System (CRS) Participating Community	No
Hazard Awareness Program	No
National Weather Service (NWS) Storm Ready	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	5
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	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 (Local)	No
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	No
FEMA Flood Insurance Study (Detailed)	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	No
Emergency Management Coordinator	No
NFIP Floodplain Administrator	Yes
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
Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.	Yes, Lions
Local Funding Availability	
Ability to apply for Community Development Block Grants	No

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

Source: Data Collection Questionnaire, 2018

2.1.3 City of Everton

Everton is located in the southeastern part of the county. Everton is a 4th class city with a Mayor-Board of Aldermen form of government with eight aldermen. The 2010 population was 319, which was a decrease from 2000. However, the 2016 estimate is 379, which equates to a 17.7% increase from 2010.

The departments or staff of Everton include:

- Board of Aldermen
- City Clerk
- Building Code Official
- City Engineer (contracted)
- Development Planner
- Public Works Official
- NFIP Coordinator
- Local Emergency Planning Committee
- Sanitation Department

Mitigation Initiatives/Capabilities

- 3 outdoor warning sirens

Table 2.8 provides information on the City of Everton's mitigation capabilities based on the Data Collection Questionnaire.

Table 2.8. City of Everton Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
Local Emergency Plan	No
County Emergency Plan	N/A
Local Recovery Plan	No
County Recovery Plan	N/A
Local Mitigation Plan	No
County Mitigation Plan	Yes, updating
Local Mitigation Plan (PDM)	No
County Mitigation Plan (PDM)	No
Economic Development Plan	No
Transportation Plan	No

Capability	Status Including Date of Document or Policy
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
Firewise or other fire mitigation plan	No
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	No
Building Code	No
Floodplain Ordinance	Yes
Subdivision Ordinance	No
Tree Trimming Ordinance	Yes
Nuisance Ordinance	Yes
Storm Water Ordinance	No
Drainage Ordinance	No
Capability	
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Landscape Ordinance	No
Iowa Wetlands and Riparian Areas Conservation Plan	No
Debris Management Plan	No
Program	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
National Flood Insurance Program (NFIP) Participant	Yes
NFIP Community Rating System (CRS) Participating Community	No
Hazard Awareness Program	Working on
National Weather Service (NWS) Storm Ready	Yes
Building Code Effectiveness Grading (BCEGs)	Yes
ISO Fire Rating	Unknown
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 (Local)	No
Hazard Analysis/Risk Assessment (County)	No
Flood Insurance Maps	No
FEMA Flood Insurance Study (Detailed)	No
Evacuation Route Map	Yes
Critical Facilities Inventory	No
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	Yes
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	Yes
Development Planner	Yes
Public Works Official	Yes

Capability	Status Including Date of Document or Policy
Emergency Management Coordinator	Yes
NFIP Floodplain Administrator	Yes
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	Yes
County Emergency Management Commission	No
Sanitation Department	Yes
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
Environmental Organization	Yes
Homeowner Associations	Yes
Neighborhood Associations	Yes
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, etc.	Yes
Local Funding Availability	
Ability to apply for Community Development Block Grants	Yes
Ability to fund projects through Capital Improvements funding	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	No
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	Yes
Ability to withhold spending in hazard prone areas	Yes

Source: Data Collection Questionnaire, 2018

2.1.4 City of Greenfield

The City of Greenfield is located in central Dade County and serves as the county seat. It is a 4th class city with a Mayor-Board of Aldermen structure. There are four aldermen and a Mayor. Greenfield's 2010 population was 1,371, which was a slight increase from 2000. The 2016 estimate is 1,476 which equates to an 8.7% increase from 2010.

City departments and staff include:

- Board of Aldermen
- City Clerk
- Building Code Official (part-time)
- Building Inspector (part-time)
- Public Works Official
- NFIP Floodplain Administrator

Mitigation Initiatives/Capabilities

- County Emergency Management Commission
- 2 outdoor warning sirens

Table 2.9 provides information on the City of Greenfield's mitigation capabilities based on the Data Collection Questionnaire.

Table 2.9. City of Greenfield Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
Local Emergency Plan	No
County Emergency Plan	N/A
Local Recovery Plan	No
County Recovery Plan	N/A
Local Mitigation Plan	No
County Mitigation Plan	Yes, updating
Local Mitigation Plan (PDM)	No
County Mitigation Plan (PDM)	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
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	Yes ORD 411.010; Special Economic Redevelopment
Building Code	IBC 2012
Floodplain Ordinance	Yes
Subdivision Ordinance	No
Tree Trimming Ordinance	Yes ORD 710.010; Regulation & Procedures Tree Trimming
Nuisance Ordinance	Yes ORD 505.030 / 215.010; Public Nuisance
Storm Water Ordinance	Yes Ord 210.750; Discharge in storm water
Drainage Ordinance	Yes Ord 700.020; Drainage Area
Capability	
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Landscape Ordinance	No
Iowa Wetlands and Riparian Areas Conservation Plan	No
Debris Management Plan	No
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	Yes
National Flood Insurance Program (NFIP) Participant	Yes
NFIP Community Rating System (CRS) Participating Community	No
Hazard Awareness Program	No
National Weather Service (NWS) Storm Ready	No
Building Code Effectiveness Grading (BCEGs)	Yes
ISO Fire Rating	Unknown
Economic Development Program	Yes
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Stream Maintenance Program	Yes
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	No

Capability	Status Including Date of Document or Policy
Mutual Aid Agreements	Yes ORD 220.050 / 220.060; Mutual Aid Agreement
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	No
Hazard Analysis/Risk Assessment (County)	No
Flood Insurance Maps	No
FEMA Flood Insurance Study (Detailed)	No
Evacuation Route Map	No
Critical Facilities Inventory	No
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	Yes (Part time)
Building Inspector	Yes (Part time)
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	Yes (Full time)
Emergency Management Coordinator	No
NFIP Floodplain Administrator	Yes
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	Yes
Salvation Army	No
Veterans Groups	Yes
Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, etc.	Yes
Local Funding Availability	
Ability to apply for Community Development Block Grants	Yes
Ability to fund projects through Capital Improvements funding	No
Authority to levy taxes for a specific purpose	No
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	No
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	No
Ability to withhold spending in hazard prone areas	No

Source: Data Collection Questionnaire, 2018

2.1.5 City of Lockwood

Lockwood is located in the southwestern portion of the county. Lockwood is a 4th class city with a Mayor-Board of Aldermen form of government, with four aldermen. The 2010 population was 936, a slight decrease from the 2000 population of 989. The 2016 population estimate was 1,114 which would be a 12.6% increase since 2010.

Lockwood City departments and staff include:

- Board of Aldermen
- City Clerk
- Public Works Official
- NFIP Floodplain Administrator

Mitigation Initiatives/Capabilities

- 1 outdoor warning siren

Table 2.10 provides information on the City of Lockwood's mitigation capabilities based on the Data Collection Questionnaire.

Table 2.10. City of Lockwood Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
Local Emergency Plan	No
County Emergency Plan	Yes, included with County
Local Recovery Plan	No
County Recovery Plan	N/A
Local Mitigation Plan	Yes
County Mitigation Plan	Yes, updating
Local Mitigation Plan (PDM)	No
County Mitigation Plan (PDM)	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
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	No
Building Code	Yes Chp 500 Section 500.010-500.230 Ord. No. A-289 (1-9)
Floodplain Ordinance	Yes
Subdivision Ordinance	No
Tree Trimming Ordinance	Yes
Nuisance Ordinance	Yes Chp. 215 Section 215.010-215.140 Ord No. A-285
Storm Water Ordinance	No
Drainage Ordinance	Yes Section 710.210/CC 1977 98.210, Section 710.200-710.290
Capability	
Site Plan Review Requirements	N/A
Historic Preservation Ordinance	No
Landscape Ordinance	No
Iowa Wetlands and Riparian Areas Conservation Plan	No
Debris Management Plan	No
Program	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	Yes Chp 500 Section 500.010-500.230 Ord. No. A-289 (1-9)

Capability	Status Including Date of Document or Policy
National Flood Insurance Program (NFIP) Participant	Yes
NFIP Community Rating System (CRS) Participating Community	No
Hazard Awareness Program	No
National Weather Service (NWS) Storm Ready	Yes
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	Unknown
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Stream Maintenance Program	No
Tree Trimming Program	Yes
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	No
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	No
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	No
FEMA Flood Insurance Study (Detailed)	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 (Full time)
Emergency Management Coordinator	No
NFIP Floodplain Administrator	Yes
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	Yes American Legion
Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, etc.	Yes Optimist Club, Lions
Local Funding Availability	
Ability to apply for Community Development Block Grants	Yes
Ability to fund projects through Capital Improvements funding	Yes

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

Source: Data Collection Questionnaire, 2018

2.1.6 Village of South Greenfield

The Village of South Greenfield is located in the southern portion of the county. As a Village, South Greenfield is governed by a Board of Trustees with a Chairperson. The 2010 population of South Greenfield was 90 people, a substantial decrease from 136 in 2000. The 2016 estimate is 115, which would be roughly a 27.8% increase from 2010.

Village of South Greenfield departments and staff include:

- Board of Trustees
- Sanitation Department

Mitigation Initiatives/Capabilities

- 1 outdoor warning siren

Table 2.11 provides information on the Village of South Greenfield's mitigation capabilities based on the Data Collection Questionnaire.

Table 2.11. Village of South Greenfield Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
Local Emergency Plan	No, in progress
County Emergency Plan	Yes, included with County
Local Recovery Plan	No
County Recovery Plan	N/A
Local Mitigation Plan	No
County Mitigation Plan	N/A, with Dade Co.
Local Mitigation Plan (PDM)	No
County Mitigation Plan (PDM)	No
Economic Development Plan	No
Transportation Plan	No
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No, reviewing bridges
Watershed Plan	No
Firewise or other fire mitigation plan	No, with Dade Co.
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	
Zoning Ordinance	No
Building Code	No
Floodplain Ordinance	No

Capability	Status Including Date of Document or Policy
Subdivision Ordinance	No
Tree Trimming Ordinance	No
Nuisance Ordinance	No
Storm Water Ordinance	No
Drainage Ordinance	No
Capability	
Site Plan Review Requirements	N/A
Historic Preservation Ordinance	No
Landscape Ordinance	No
Iowa Wetlands and Riparian Areas Conservation Plan	N/A
Debris Management Plan	N/A
Program	
Zoning/Land Use Restrictions	N/A
Codes Building Site/Design	N/A
National Flood Insurance Program (NFIP) Participant	No
NFIP Community Rating System (CRS) Participating Community	N/A
Hazard Awareness Program	No
National Weather Service (NWS) Storm Ready	No
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	9
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Stream Maintenance Program	No
Tree Trimming Program	Yes, electric company does trimming
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	No
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	Not Sure
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	No
FEMA Flood Insurance Study (Detailed)	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	No
Emergency Management Coordinator	No
NFIP Floodplain Administrator	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	No
County Emergency Management Commission	Yes
Sanitation Department	Yes
Transportation Department	No
Economic Development Department	No
Housing Department	No
Historic Preservation	No

Capability	Status Including Date of Document or Policy
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	No
Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, etc.	No
Local Funding Availability	
Ability to apply for Community Development Block Grants	N/A
Ability to fund projects through Capital Improvements funding	N/A
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	No
Ability to incur debt through general obligation bonds	No
Ability to incur debt through special tax bonds	No
Ability to incur debt through private activities	No
Ability to withhold spending in hazard prone areas	No

Source: Data Collection Questionnaire, 2018

2.1.7 Summary of Jurisdictional Capabilities

Table 2.12. Mitigation Capabilities Summary Table

CAPABILITIES	Uninc. Dade County	Village of Arcola	City of Everton	City of Greenfield	City of Lockwood	Village of South Greenfield
Planning Capabilities						
Comprehensive Plan	No	No	No	No	No	No
Builder's Plan	No	No	No	No	No	No
Capital Improvement Plan	No	No	No	No	No	No
Local Emergency Plan	N/A	No	No	No	No	No, in progress
County Emergency Plan	Yes	N/A	N/A	N/A	Yes, included with County	Yes, included with County
Local Recovery Plan	N/A	No	No	No	No	No
County Recovery Plan	No	N/A	N/A	N/A	N/A	N/A
Local Mitigation Plan	N/A	No	No	No	Yes	No
County Mitigation Plan	Yes; currently updating	Yes, currently updating	Yes, updating	Yes, updating	Yes, updating	N/A, with Dade Co.
Local Mitigation Plan (PDM)	N/A	No	No	No	No	No
County Mitigation Plan (PDM)	N/A	N/A	No	No	No	No
Debris Management Plan	N/A	N/A	N/A	N/A	N/A	N/A
Economic Development Plan	No	No	No	No	No	No
Transportation Plan	No	No	No	No	No	No
Land-use Plan	No	No	No	No	No	No
Flood Mitigation Assistance (FMA) Plan	No	No	No	No	No	No, reviewing bridges
Watershed Plan	No	No	No	No	No	No
Firewise or other fire mitigation plan	No	No	No	No	No	No, with Dade Co.
School Mitigation Plan	N/A	N/A	N/A	N/A	N/A	N/A
Critical Facilities Plan (Mitigation/Response/Recovery)	No	No	No	No	No	No
Policies/Ordinance						
Zoning Ordinance	No	No	No	Yes ORD 411.010; Special Economic Redevelopment Zone	No	No

CAPABILITIES	Uninc. Dade County	Village of Arcola	City of Everton	City of Greenfield	City of Lockwood	Village of South Greenfield
Building Code	No	No	No	IBC 2012	Yes Chp 500 Section 500.010-500.230 Ord. No. A-289 (1-9)	No
Floodplain Ordinance	Yes; 3.21.11	Yes	Yes	Yes	Yes	No
Subdivision Ordinance	No	No	No	No	No	No
Tree Trimming Ordinance	No	No	Yes	Yes ORD 710.010; Regulation & Procedures Tree Trimming	Yes	No
Nuisance Ordinance	No	No	Yes	Yes ORD 505.030 / 215.010; Public Nuisance	Yes Chp. 215 Section 215.010-215.140 Ord No. A-285	No
Storm Water Ordinance	No	No	No	Yes Ord 210.750; Discharge in storm water	No	No
Drainage Ordinance	No	No	No	Yes Ord 700.020; Drainage Area	Yes Section 710.210/CC 1977 98.210, Section 710.200-710.290	No
Site Plan Review Requirements	No	No	No	No	N/A	N/A
Historic Preservation Ordinance	No	No	No	No	No	No
Landscape Ordinance	No	No	No	No	No	No
Iowa Wetlands and Riparian Areas Conservation Plan	N/A	No	No	No	No	N/A
Debris Management Plan	N/A	N/A	No	No	No	N/A
Program						
Zoning/Land Use Restrictions	No	No	No	Yes	No	N/A

CAPABILITIES	Uninc. Dade County	Village of Arcola	City of Everton	City of Greenfield	City of Lockwood	Village of South Greenfield
Codes Building Site/Design	No	No	No	Yes	Yes Chp 500 Section 500.010-500.230 Ord. No. A-289 (1-9)	N/A
National Flood Insurance Program (NFIP) Participant	Yes	Yes	Yes	Yes	Yes	No
NFIP Community Rating System (CRS) Participating Community	Yes	No	No	No	No	N/A
Hazard Awareness Program	No	No	Working on	No	No	No
National Weather Service (NWS) Storm Ready	Yes	No	Yes	No	Yes	No
Firewise Community Certification	No	No	N/A	N/A	N/A	N/A
Building Code Effectiveness Grading (BCEGs)	No	N/A	Yes	Yes	N/A	N/A
ISO Fire Rating	6	5	Unknown	Unknown	Unknown	9
Economic Development Program	No	No	No	Yes	No	No
Land Use Program	No	No	No	No	No	No
Public Education/Awareness	No	No	No	No	No	No
Property Acquisition	No	No	No	No	No	No
Planning/Zoning Boards	No	No	No	No	No	No
Stream Maintenance Program	No	No	Yes	Yes	No	No
Tree Trimming Program	No	No	Yes	No	Yes	Yes, electric company does trimming
Engineering Studies for Streams (Local/County/Regional)	No	No	No	No	No	No
Mutual Aid Agreements	No	No	No	Yes ORD 220.050 / 220.060; Mutual Aid Agreement	No	No
Studies/Reports/Maps						
Hazard Analysis/Risk Assessment (Local)	N/A	No	No	No	No	Not Sure
Hazard Analysis/Risk Assessment (County)	No	N/A	No	No	N/A	N/A
Flood Insurance Maps	Yes	No	No	No	No	No
FEMA Flood Insurance Study (Detailed)	No	No	No	No	No	No
Evacuation Route Map	No	No	Yes	No	No	No
Critical Facilities Inventory	No	No	No	No	No	No
Vulnerable Population Inventory	No	No	No	No	No	No
Land Use Map	No	No	No	No	No	No

CAPABILITIES	Uninc. Dade County	Village of Arcola	City of Everton	City of Greenfield	City of Lockwood	Village of South Greenfield
Staff/Department						
Building Code Official	No	No	Yes	Yes (Part time)	No	No
Building Inspector	No	No	No	Yes (Part time)	No	No
Mapping Specialist (GIS)	No	No	No	No	No	No
Engineer	No	No	Yes	No	No	No
Development Planner	No	No	Yes	No	No	No
Public Works Official	No	No	Yes	Yes (Full time)	Yes (Full time)	No
Emergency Management Coordinator	Yes; part-time	No	Yes	No	No	No
NFIP Floodplain Administrator	Yes; part-time	Yes	Yes	Yes	Yes	No
Emergency Response Team	No	No	No	No	No	No
Hazardous Materials Expert	No	No	No	No	No	No
Local Emergency Planning Committee	Yes; part-time	No	Yes	No	No	No
County Emergency Management Commission	No	No	No	Yes	No	Yes
Sanitation Department	No	No	Yes	No	No	Yes
Transportation Department	No	No	No	No	No	No
Economic Development Department	No	No	No	No	No	No
Housing Department	No	No	No	No	No	No
Historic Preservation	No	No	No	No	No	No
Non-Governmental Organizations (NGOs)						
American Red Cross	No	No	No	Yes	No	No
Salvation Army	No	No	No	No	No	No
Veterans Groups	No	No	No	Yes	Yes American Legion	No
Environmental Organization	No	No	Yes	No	No	No
Homeowner Associations	No	No	Yes	No	No	No
Neighborhood Associations	No	No	Yes	No	No	No
Chamber of Commerce	Yes; part-time	No	Yes	Yes	Yes	Yes
Community Organizations (Lions, Kiwanis, etc.	Yes; part-time	Yes, Lions	Yes	Yes	Yes Optimist Club, Lions	No
Financial Resources						
Apply for Community Development Block Grants	No	No	Yes	Yes	Yes	N/A

CAPABILITIES	Uninc. Dade County	Village of Arcola	City of Everton	City of Greenfield	City of Lockwood	Village of South Greenfield
Fund projects through Capital Improvements funding	No	No	Yes	No	Yes	N/A
Authority to levy taxes for specific purposes	No	No	Yes	No	Yes	Yes
Fees for water, sewer, gas, or electric services	No	Yes, water fees	Yes	Yes	Yes	Yes
Impact fees for new development	No	No	No	No	Yes	No
Incur debt through general obligation bonds	No	No	Yes	Yes	Yes	No
Incur debt through special tax bonds	No	No	Yes	Yes	Yes	No
Incur debt through private activities	No	No	Yes	No	No	No
Withhold spending in hazard prone areas	No	No	Yes	No	No	No

Source: Data Collection Questionnaire, 2018

2.1.8 Dade County Rural Fire Protection District

The Dade County Rural Fire Protection District has an elected board comprised of 3 members voted for by the citizens within their respective districts. The Fire Protection District covers approximately 170 square miles. The Fire Protection District has only volunteer members and no paid employees. The Fire Protection District utilizes the Dade County Mitigation Plan.

The District has the authority to

- Levy taxes for a specific purpose

2.1.9 Dadeville Rural Fire Protection District

The Dadeville Rural Fire Protection District has an elected board of comprised of 3 members voted for by the citizens within their respective districts. The Fire Protection District covers approximately 50 square miles. The fire district has only volunteer members and no paid employees. The Dadeville Rural Fire Protection District works with the Dadeville School District to conduct fire safety education at local schools. The Fire Protection District utilizes the Dade County Mitigation Plan and participates in the County Emergency Management Committee and the Local Emergency Planning Committee on the County level. Past or ongoing projects or programs designed to reduce disaster losses include:

- Public Education/Awareness Campaign
- Mutual Aid Agreements

The District has the authority to

- Levy taxes for a specific purpose
- Incur debt through general obligation bonds
- Incur debt through special tax bonds
- Incur debt through private activities

Mitigation Initiatives/Capabilities

- 1 outdoor warning siren
- 1 community storm shelter

2.1.10 Public School District Profiles and Mitigation Capabilities

This section provides general information about the participating school districts in the plan. There are six school districts in the county, but only four with facilities located in Dade County. Three districts participated in this plan update. Stockton County R-I participated in the Cedar County Hazard Mitigation Planning process, and Ash Grove R-IV participated in the Greene County Hazard Mitigation Planning process. Figure 2.3 is a map of school district boundaries in Dade County. Table 2.16 displays enrollment data for Dade County school district facilities.

Figure 2.1. Dade County School Districts

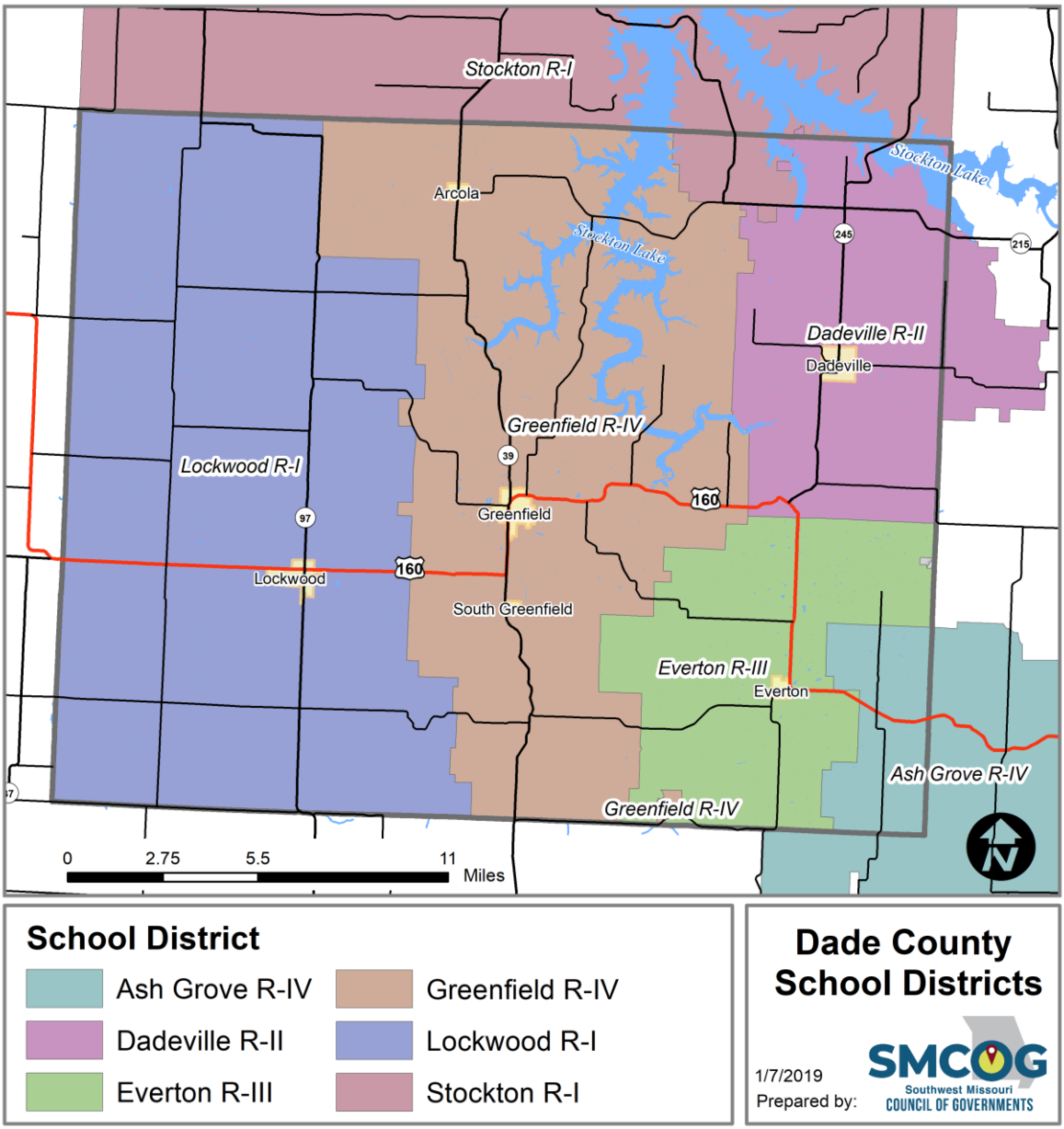


Table 2.13. School District Buildings and Enrollment Data, 2018

District Name	Building Name	Building Enrolment
Dadeville R-II	Dadeville Elementary	90
Dadeville R-II	Dadeville Sr. High	64
Greenfield R-IV	Greenfield Elementary	253
Greenfield R-IV	Greenfield High	203
Lockwood R-I	Lockwood Elementary	132
Lockwood R-I	Lockwood Middle	75
Lockwood R-1	Lockwood High	131

Source: http://mcds.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx, 2018

Table 2.14. Summary of Mitigation Capabilities- Dadeville, Greenfield, and Lockwood School Districts

Capability	Dadeville R-II	Greenfield R-IV	Lockwood R-I
Planning Elements			
Master Plan/ Date	Yes	Yes	No
Capital Improvement Plan/Date	No	Yes	No
School Emergency Plan / Date	Yes	Yes	Yes
Weapons Policy/Date	Yes	Yes	Yes
Personnel Resources			
Full-Time Building Official (Principal)	Yes	Yes	Yes
Emergency Manager	Yes	Yes	Yes
Grant Writer	No	Yes	No
Public Information Officer	Yes	Yes	Yes
Financial Resources			
Capital Improvements Project Funding	Yes	Yes	No
Local Funds	Yes	Yes	Yes
General Obligation Bonds	Yes	Yes	Yes
Special Tax Bonds	No	Unknown	Yes
Private Activities/Donations	Yes	Yes	Yes
State and Federal Funds/Grants	Yes	Yes	Yes
Other			
Public Education Programs	N/A	N/A	N/A
Privately or Self- Insured?	N/A	N/A	N/A
Fire Evacuation Training	N/A	N/A	N/A
Tornado Sheltering Exercises	N/A	N/A	N/A
Public Address/Emergency Alert System	N/A	N/A	N/A
NOAA Weather Radios	N/A	N/A	N/A
Lock-Down Security Training	N/A	N/A	N/A
Mitigation Programs	N/A	N/A	N/A
Tornado Shelter/Saferoom	N/A	N/A	N/A
Campus Police	N/A	N/A	N/A

Source: Data Collection Questionnaire, 2018

3 RISK ASSESSMENT

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

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

This is an update of the previous Dade County Hazard Mitigation Plan adopted in July of 2014. According to the U.S. Census Bureau 2016 ACS 5-year population estimate, the population of Dade County shrunk by a few hundred people to 7,590 from 7,883 at the time of the 2010 decennial census.

This chapter is divided into four main parts:

- **Section 3.1 Hazard Identification** identifies the hazards that threaten the planning area and provides a factual basis for elimination of hazards from further consideration;
- **Section 3.2 Assets at Risk** provides the planning area's total exposure to natural hazards, considering critical facilities and other community assets at risk;
- **Section 3.3 Land Use and Development** discusses development that has occurred since the last plan update and any increased or decreased risk that resulted. This section also discusses areas of planned future development and any implications on risk/vulnerability;
- **Section 3.4 Hazard Profiles and Vulnerability Analysis** provides more detailed information about the hazards impacting the planning area. For each hazard, there are three sections: 1) Hazard Profile provides a general description and discusses the threat to the planning area, the geographic location at risk, potential Strength/Magnitude/Extent, previous occurrences of hazard events, probability of future occurrence, risk summary by jurisdiction, impact of future development on the risk; 2) Vulnerability Assessment further defines and quantifies populations, buildings, critical facilities, and other community/school or special district assets at risk to natural hazards; and 3) Problem Statement briefly summarizes the problem and develops possible solutions.

3.1 HAZARD IDENTIFICATION

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

The Plan profiles all natural hazards that can affect Dade County. The natural hazards that can affect the county have been identified in the 2014 Dade County Plan and the 2018 Missouri State Plan. Natural hazards are naturally occurring climatological, hydrological, or geologic events that have a negative effect of people and the built environment. Natural hazards identified include:

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

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

3.1.1 Review of Existing Mitigation Plans

The Plan profiles all natural hazards that affect Dade County. The hazards identified in the 2014 Dade County Plan are identified in the 2013 Missouri State Plan. The State Plan also includes levee failure. Levee failure was excluded from the mitigation planning process as there are no mapped levees nor associated levee protected areas within or immediately upstream of Dade County.

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

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

In Missouri, local plans customarily include only natural hazards, as only natural hazards are required by federal regulations to be included. It was determined to include only natural hazards. The MPC Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type…of all natural hazards that can affect the jurisdiction. The MPC agreed that human-caused and

technological hazards are addressed in a Regional Homeland Security Oversight Committee (RHSOC) Threat and Hazard Identification Risk Assessment (THIRA) and that including only natural hazards would meet the needs of local entities participating in the plan update.

3.1.2 Review Disaster Declaration History

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

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

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

Since 1990, Dade County has experienced seventeen (17) hazard events that triggered federal declarations. The most recent occurred on June 2, 2017.

Table 3.1 lists the federal FEMA disaster declarations that included Dade County from 1990 to 2017.

Table 3.1. FEMA Disaster Declarations that included Dade County, Missouri, 1990-2017

Disaster Number	Description	Declaration Date Incident Period	Individual Assistance (IA) Public Assistance (PA)
4317	Severe Storms, Tornadoes, Straight-line Winds,	June 2, 2017	Public Assistance
4250	Severe Storms, Tornadoes, Straight-line Winds, Flooding	January 21, 2016	Public Assistance
4238	Severe Storms, Tornadoes, Straight-line Winds, Flooding	August 7, 2015	Public Assistance
4414	Severe Storms, Straight-line Winds, Flooding	September 6, 2013	Public Assistance
1961	Severe Winter Storm, Snowstorm	March 23, 2011	Public Assistance
3317	Severe Winter Storm	February 3, 2011	Individual & Public Assistance

1847	Severe Storms, Tornadoes, Flooding	June 19, 2009	Individual & Public Assistance
3303	Severe Winter Storms	January 30, 2009	Individual & Public Assistance
1749	Severe Storms, Flooding	March 19, 2008	Public Assistance
1736	Severe Winter Storms	December 27, 2007	Public Assistance
3281	Severe Winter Storms	December 12, 2007	Individual & Public Assistance
1728	Severe Storms, Flooding	September 21, 2007	Public Assistance
1676	Severe Winter Storms, Flooding	January 15, 2007	Public Assistance
3232	Hurricane Katrina Evacuation	September 10, 2005	Individual & Public Assistance
1463	Severe Storms, Tornadoes,	May 6, 2003	Individual & Public Assistance
1412	Severe Storms, Tornadoes, Flooding	May 6, 2002	Individual & Public Assistance
1253	Severe Storms, Tornadoes, Flooding	October 14,1998	Public Assistance
995	Severe Storms, Flooding	July 9, 1993	Individual & Public Assistance

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

3.1.3 Research Additional Sources

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

- Missouri Hazard Mitigation Plans (2013 and 2018)
- Previously approved planning area Hazard Mitigation Plan (2014)
- Federal Emergency Management Agency (FEMA)
- Missouri Department of Natural Resources (MDNR)
- National Drought Mitigation Center Drought Reporter
- US Department of Agriculture's (USDA) Risk Management Agency Crop Insurance Statistics
- National Agricultural Statistics Service (Agriculture production/losses)
- Data Collection Questionnaires completed by each jurisdiction
- State of Missouri GIS data
- Environmental Protection Agency
- Flood Insurance Administration

- Hazards US (HAZUS)
- Missouri Department of Transportation
- National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI);
- Pipeline and Hazardous Materials Safety Administration
- County and local Comprehensive Plans to the extent available
- County Emergency Management
- County Assessors Data
- County Flood Insurance Rate Map, FEMA
- SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin
- U.S. Army Corps of Engineers
- United States Geological Survey (USGS)

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 2018, 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.

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

3.1.4 Hazards Identified

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

Table 3.2. Hazards Identified for Each Jurisdiction

Jurisdiction	Dam Failure	Drought	Earthquake	Extreme Temperatures	Flooding (River and Flash)	Land Subsidence/Sinkholes	Severe Winter Weather	Thunderstorm/Lightning/Hail/High Wind	Tornado	Wildfire
Dade County	x	x	x	x	x	x	x	x	x	x
Village of Arcola	-	x	x	x	-	-	x	x	x	x
City of Everton	-	x	x	x	x	x	x	x	x	x
City of Greenfield	-	x	x	x	x	x	x	x	x	x
City of Lockwood	-	x	x	x	x	-	x	x	x	-
Village of South Greenfield	-	x	x	x	x	x	x	x	x	x
Schools and Special Districts										
Dade County Rural Fire Protection District	-	x	x	x	x	x	x	x	x	x
Dadeville Rural Fire Protection District	-	x	x	x	x	x	x	x	x	x
Lockwood R-I	-	x	x	x	x	-	x	x	x	-
Dadeville R-II	-	x	x	x	x	x	x	x	x	x
Greenfield R-IV	-	x	x	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 may affect Dade County. Many of the hazards identified in the risk assessment have the same probability of occurrence throughout Dade County. The hazards that vary across Dade County in terms of risk include dam failure, flash flood, grass or wildland fire, river flood, and sinkholes/land subsidence. These differences are detailed in each hazard profile under geographic location and vulnerability.

Dade County has a continental climate with mild winters and hot summers. The Cities of Greenfield and Lockwood are the most urbanized, experiencing more construction and development than most other portions of the county. Naturally, the urbanized areas of Dade County have a greater density of important assets, which are more vulnerable to weather-related hazards. These communities plan to continue to grow and expand City boundaries, which will increase vulnerability to natural hazards. This increase in vulnerability, however, can be mitigated through updated building codes and code enforcement, as well as land use planning.

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

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

3.2 ASSETS AT RISK

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

3.2.1 Total Exposure of Population and Structures

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

Unincorporated County and Incorporated Cities

In the following three tables, population data is based on 2016 ACS data. Building counts and building exposure values are based on parcel data provided by the State of Missouri Geographic Information Systems (GIS) database and Dade County Assessor.

Contents exposure values were calculated by factoring a multiplier to the building exposure values based on usage type. The multipliers were derived from the Hazus and are defined below in **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 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). To accommodate for mixed-use parcels, the data has been based on the lowest class of use for each parcel (e.g. residential-agricultural mixture is considered residential). Dade County assessor data does not recognize any parcel in the county as industrial, though a small amount of buildings in Greenfield and Lockwood are identified as industrial in Missouri structure point data. Assessor data classifies these parcels as commercial. Estimates below consolidate commercial and industrial values.

Table 3.3. Maximum Population and Building Exposure by Jurisdiction

Jurisdiction	2016 Annual Population Estimate	Building Count	Building Exposure ($)	Contents Exposure ($)	Total Exposure ($)
Village of Arcola	101	70	$351,030	$198,575	$549,605
City of Everton	335	232	$1,176,830	$630,665	$1,807,495
City of Greenfield	1,385	842	$10,977,680	$8,203,490	$19,181,170
City of Lockwood	1,248	597	$6,342,490	$4,351,150	$10,693,640
Village of South Greenfield	131	82	$347,970	$179,130	$527,100
Unincorporated Dade County	4,381	5,287	$44,813,750	$28,070,795	$72,884,545
Totals	7,581	7,110	$64,009,750	$41,633,805	$105,643,555

Source: U.S. Bureau of the Census, Annual population estimates/ 5-Year American Community Survey 2017; Building Count and Building Exposure, Missouri GIS Database from SEMA Mitigation Management; Contents Exposure derived by applying multiplier to Building Exposure based on Hazus MH 2.1 standard contents multipliers per usage type as follows: Residential (50%), Commercial (100%), Industrial (150%), Agricultural (100%). For purposes of these calculations, government, school, and utility were calculated at the commercial contents rate.

Table 3.4. Building Values/Exposure by Usage Type

Jurisdiction	Residential	Commercial	Industrial	Agricultural	Total
Village of Arcola	$304,910	$22,290	$0	$23,830	$351,030
City of Everton	$1,092,330	$68,730	$0	$15,770	$1,176,830
City of Greenfield	$5,548,380	$5,415,680	$0	$13,620	$10,977,680
City of Lockwood	$3,982,680	$2,288,930	$0	$70,880	$6,342,490
Village of South Greenfield	$337,680	$6,250	$0	$4,040	$347,970
Unincorporated Dade County	$33,485,910	$1,804,900	$0	$9,522,940	$44,813,750
Totals	$44,751,890	$9,606,780	$0	$9,651,080	$64,009,750

Source: Missouri GIS Database, SEMA Mitigation Management Section

Table 3.5. Building Counts by Usage Type

Jurisdiction	Residential Counts	Commercial Counts	Industrial Counts	Agricultural Counts	Building Other Counts	Total
Village of Arcola	49	4	0	10	7	70
City of Everton	186	19	0	9	18	232
City of Greenfield	642	98	0	20	82	842
City of Lockwood	450	82	0	11	54	597
Village of South Greenfield	73	2	0	2	5	82
Unincorporated Dade County	2,714	36	0	2,270	267	5,287
Totals	4,114	241	0	2,322	433	7,110

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

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).

Table 3.6. Population and Building Exposure by Jurisdiction-Public School Districts

Public School District	Enrollment	Building Count	Building Exposure ($)	Contents Exposure ($)	Total Exposure ($)
Dadeville-II	548	1	$4,550,986.10	$642,724.42	$5,193,710.52
Greenfield R-IV	1,808	8	$22,482,595	$5,806,454	$28,289,049
Lockwood R-I	1,304	2	$13,990,000	$2,710,000	$16,700,000

Source: http://mcds.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx.

3.2.2 Critical and Essential Facilities and Infrastructure

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

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

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 the following sources:

- 2018 Missouri State Hazard Mitigation Plan and Hazard Mitigation Viewer http://bit.ly/MoHazardMitigationPlanViewer2018
- Hazus contains an inventory of critical facilities that can be exported for each jurisdiction.

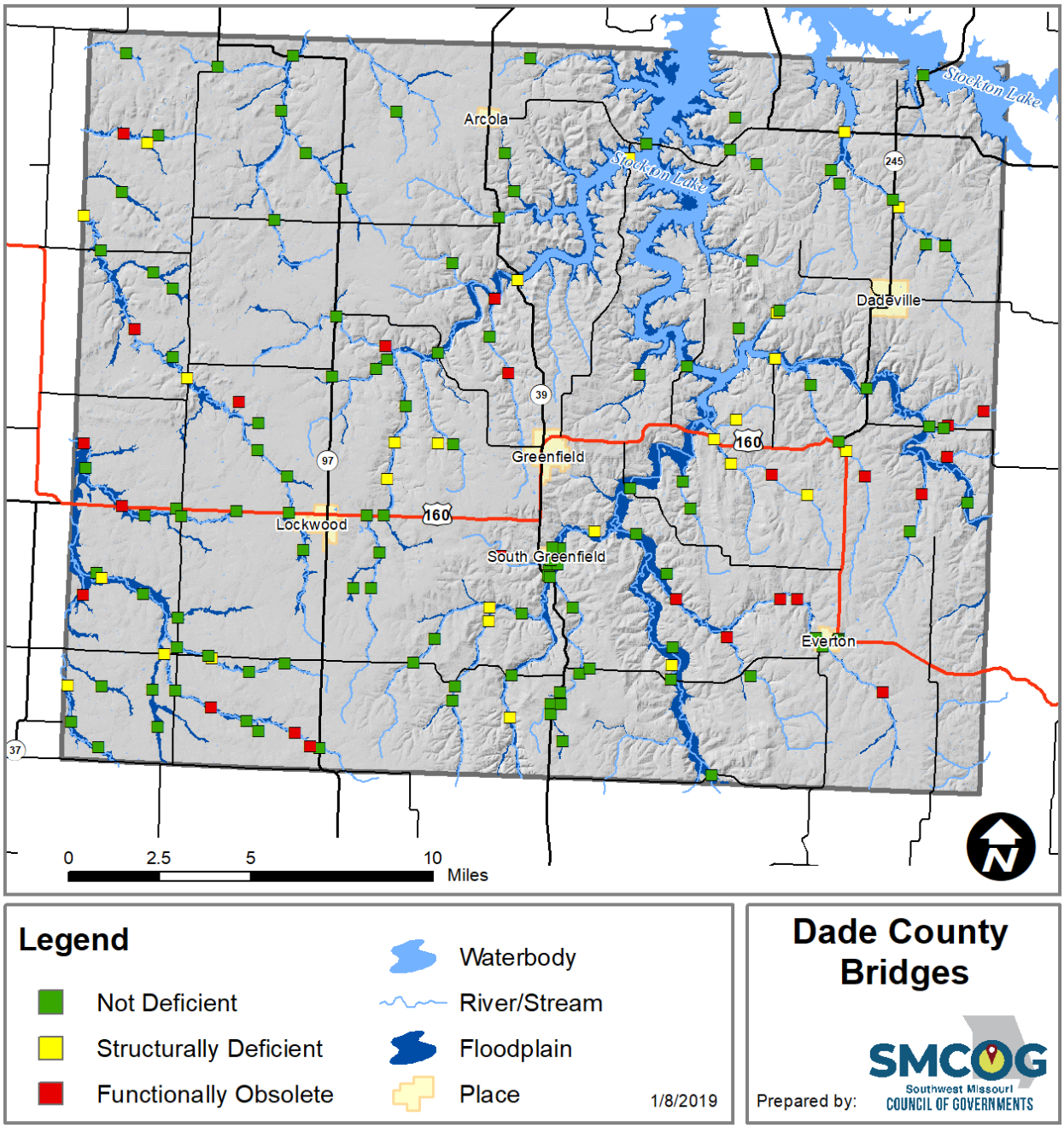
Table 3.7. Inventory of Critical/Essential Facilities and Infrastructure by Jurisdiction

Jurisdiction	Airport Facility	Bus Facility	Childcare Facility	Communications Tower	Electric Power Facility	Emergency Operations	Fire Service	Government	Housing	Shelters	Highway Bridge	Hospital/Health Care	Military	Natural Gas Facility	Nursing Homes	Police Station	Potable Water Facility	Rail	Sanitary Pump Stations	School Facilities	Stormwater Pump Stations	Tier II Chemical Facility	Wastewater Facility	TOTAL
Village of Arcola	-	-	-	-	-	-	1	-	86	-	-	-	-	-	-	-	1	-	-	-	-	-	-	88
City of Everton	-	-	-	-	-	-	1	1	594	-	1	-	-	-	1	-	1	-	1	1	-	-	1	602
City of Greenfield	-	-	1	-	-	1	1	2	1107	-	-	3	-	-	5	2	2	-	-	3	-	-	1	1,128
City of Lockwood	-	-	2	-	-	1	1	2	767	-	-	1	-	-	3	1	5	-	2	4	-	-	1	790
Village of South Greenfield	-	-	-	-	-	-	-	1	207	-	-	-	-	-	-	-	1	-	-	-	-	-	2	211
Dade County	-	-	-	-	-	-	1	-	1454	-	160	-	-	-	-	-	-	19	-	1	-	-	-	1,635
Totals	0	0	3	0	0	2	5	6	4,215	0	161	4	0	0	9	3	10	19	3	9	0	0	5	4,454

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

Figure 3.1 is a map that shows the locations of bridges in Dade County included in the National Bridge Inventory (NBI) data set. The NBI data contains a "scour index", which is a number indicating the vulnerability of a bridge to scour during a flood. Bridges with a scour index between 1 and 3 are considered "scour critical", or a bridge with a foundation determined to be unstable for the observed or evaluated scour condition. According to NBI information, there are no scour critical bridges identified in Dade County. The map shows the NBI's classification of each bridge based on structure status.

Figure 3.1. Dade County Bridges



3.2.3 Other Assets

Assessing the vulnerability of the planning area to disaster also requires data on the natural, historic, cultural, and economic assets of the area. This information is important for many reasons.

- These types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- Knowing about these resources in advance allows for consideration immediately following a hazard event, which is when the potential for damages is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- The presence of natural resources can reduce the impacts of future natural hazards, such as wetlands and riparian habitats which help absorb floodwaters.
- Losses to economic assets like these (e.g., major employers or primary economic sectors) could have severe impacts on a community and its ability to recover from disaster.

Threatened and Endangered Species: **Table 3.8** displays Federally Threatened, Endangered, Proposed and Candidate Species in the county.

Table 3.8. Threatened and Endangered Species in Dade County

Common Name	Scientific Name	Status
Gray Bat	Myotis grisescens	Endangered
Indiana Bat	Myotis sodalist	Endangered
Northern Long-eared Bat	Myotis septentrionalis	Threatened
Ozark Cavefish	Amblyopsis rosae	Threatened
Neosho Mucket	Lampsilis rafinesqueana	Endangered
Mead's Milkweed	Asclepias meadii	Threatened
Missouri Bladderpod	Physaria filiformis	Threatened

Source: U.S. Fish and Wildlife Service, http://www.fws.gov/midwest/Endangered/lists/missouri-cty.html;

Natural Resources: The Missouri Department of Conservation (MDC) maintains a database of lands the MDC owns, leases, or manages for public use. **Table 3.9** provides the names and locations of parks and conservation areas in Dade County.

Table 3.9. Parks in Dade County

Park / Conservation Area	Address	City
Corry Flatrocks CA	451 N. Dade 191	Dadeville
Corry Branch Glade CA	550 E Dade 76	Greenfield
Fiddlers Ford CA	380 E Dade 138	South Greenfield
Horse Creek Prairie CA	Intersection of W Dade 122/N Dade 51	Lockwood
Indigo Prairie CA	W. Dade 142 near S. Dade 101	Lockwood
Niawathe CA	1010 N. Dade 61	Lockwood
Shelton CA	453 N Dade 61	Lockwood
Sloan CA	255 W. US Highway 160	Lockwood
Stony Point CA	900 Rt. D	Lockwood
Hulston Mill Park	20 Hulston Mill Way	Everton
South Park	902 Spruce St.	Lockwood
Dye's Park	9 Everton Park Circle	Everton
Dadeville Park	145 Margaret Speight Dr.	Dadeville

Greenfield City Park	420 O'Hara St.	Greenfield
North Park	106 Locust St.	Lockwood
Sand Mountain CA	570 N Dade 171	Greenfield
Fox Tract CA	340 E Dade 74	Greenfield
Dilday's Mill	Intersection of Rt. K and Old Mill Ln, at Turnback Creek	South Greenfield

Source: http://mdc7.mdc.mo.gov/applications/moatlas/AreaList.aspx?txtUserID=guest&txtAreaNm=s and Dade County 911

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.

There are three registered historic properties in Dade County. However, only one, the Greenfield Opera House, is still standing. **Table 3.10** provides the historic properties in Dade County.

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

Property	Address	City	Date Listed
Dilday Mill			
Greenfield Opera House Building	315 W Water St	Greenfield	12/10/98
Washington Hotel	2 S Main St		10/16/02

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

Economic Resources: Major non-government employers in Dade County are provided in **Table 3.11**.

Table 3.11. Major Non-Government Employers in Dade County

Employer Name	Main Locations	Product or Service	Employees
Pennington Seed, INC	Greenfield	Support Activities for Crop	200
Prairie Mountain, INC	Lockwood	Printing and Related Support Activities	104
Good Shepard Nursing Home	Lockwood	Healthcare	90
Frickenschmidt Foods	Lockwood	Food Packing	50
Meeks	Lockwood	Construction Supplies	35
MFA	Lockwood	Agriculture	25

Source: Data Collection Questionnaires; Missouri Department of Economic Development

Agriculture: Agriculture is a significant industry in Dade County with nearly 250,000 acres of farmland in 2012. **Table 3.12** provides a summary of the agriculture-related jobs in Dade County.

Table 3.12. Agriculture-Related Jobs in Dade County

Category	2007	2012	Percent Change
Number of Farms	883	734	-17%
Land in Farms	276,229 acres	245,554 acres	-11%
Average Size of Farms	313 acres	335 acres	7%
Market Value of Products Sold			

Crop Sales	N/A	$33,252,000 (48%)	N/A
Livestock Sales	N/A	$36,229,000 (52%)	N/A
Total	N/A	$69,481,000	N/A
Average Per Farm	$5,968	$8,077	35%
Government Payments	$1,534,000	$1,656,000	8%

Source: USDA Census of Agriculture: https://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Missouri

3.3 Land Use and Development

3.3.1 Development Since Previous Plan Update

Dade County has overall experienced slight population decline since 2000 and 2010. It is likely that this trend continued since the previous plan update. Some communities have seen minimal new construction or development, but as a whole Dade County and the incorporated jurisdictions have had minimal development since the previous plan update in 2014.

Table 3.13 shows building permits issues since 2014. According to census data, building permits issued since 2014 were limited. Only Greenfield and Lockwood require building permits for new construction. Since the previous plan, only 3 permits were issued.

Table 3.13. Building Permits Issues 2014-2017

Year	Building Permits Issued	Location
2014	0	N/A
2015	0	N/A
2016	1	Greenfield
2017	2	Greenfield

https://www.census.gov/construction/bps/

Table 3.14 provides the population growth statistics for all participating jurisdictions in Dade County, as well as the county as a whole. Note: data in this table is also in **Table 2.1** in Chapter 2.

Table 3.14. Dade County Population Growth, 2010-2016

Jurisdiction	2000 Population	2010 Population	2016 Annual Population Estimate	# Change (2010-2016)	% Change (2010-2016)
Dade County	7,923	7,883	7,590	-333	-4.2%
Village of Arcola	45	55	88	43	60%
City of Everton	322	319	379	57	17.7%
City of Greenfield	1,358	1,371	1,476	118	8.7%
City of Lockwood	989	936	1,114	125	12.6%
Village of South Greenfield	136	90	115	25	27.8%

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

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.

Table 3.15 provides the change in numbers of housing units in Dade County from 2010 to 2016. The totals for 2016 were taken from the American Community Survey 2012-2016 five-year estimates. It should be noted that there is a margin of error associated with these values.

Table 3.15. Change in Housing Units, 2010-2016

Jurisdiction	Housing Units 2000	Housing Units 2010	Housing Units 2016	# Change (2010-2016)	2010-2016 % Change
Dade County	3,758	3,965	3,924	-41	-1%
Village of Arcola	31	53	50	-3	-5.7%
City of Everton	159	168	179	11	6.5%
City of Greenfield	731	709	722	13	1.8%
City of Lockwood	468	451	533	82	18.2%
Village of South Greenfield	59	46	62	16	34.8%

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

From the 2010 US Census to the 2016 American Community Survey, Dade County has seen a declining population. The population has decreased about 4.2% since 2010, and the rate of growth is not expected to change drastically in the near future. The number of housing units in the county has decreased by 1% in the same time period. **Figures 3.2 and 3.3** are population density maps depicting block group population at the time of the 2010 census and the 2016 ACS, respectively. Each dot on the maps represents 20 people. The maps display much of the population as small groups of people.

Figure 3.2. Dade County Population Density (2010)

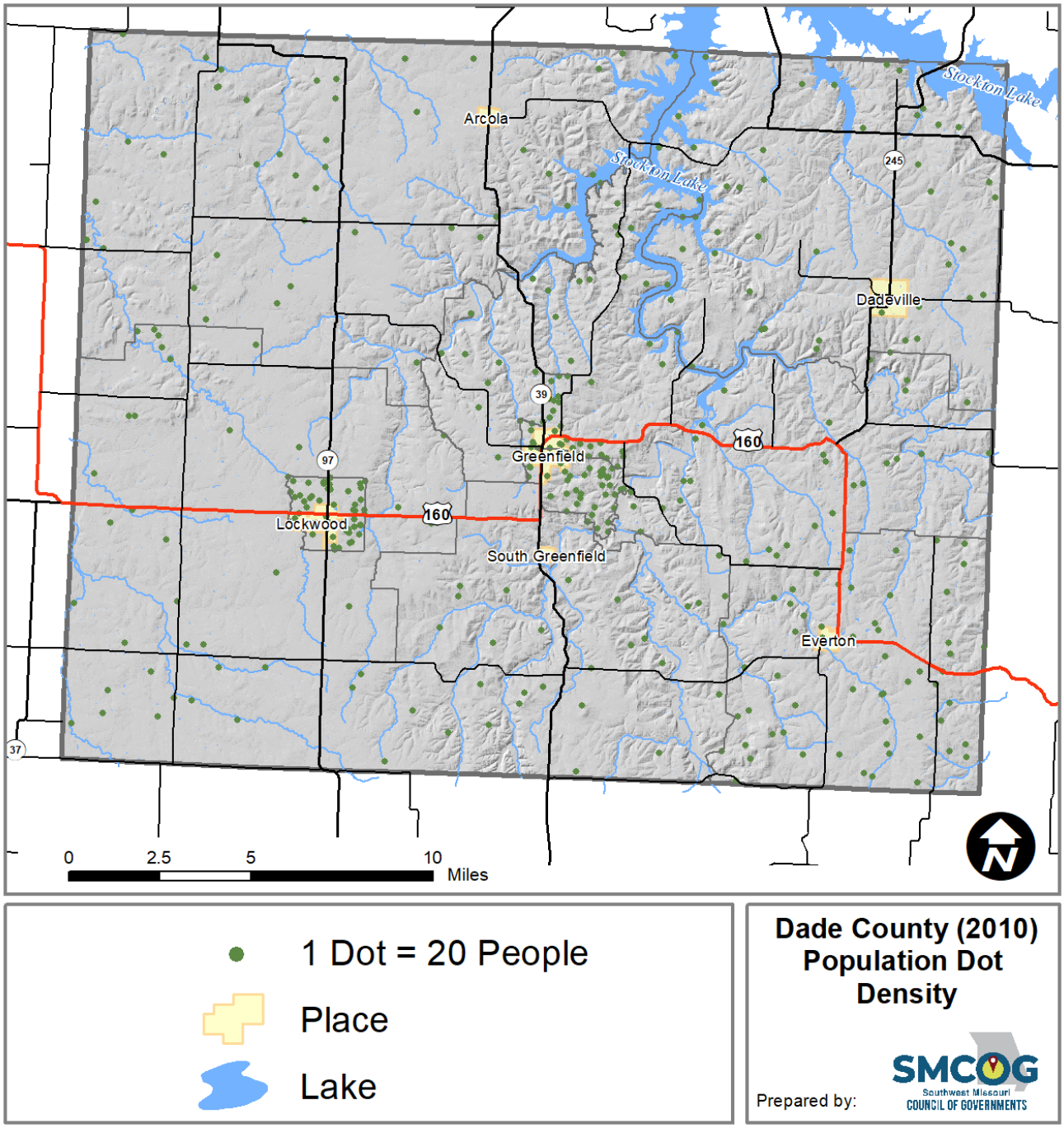
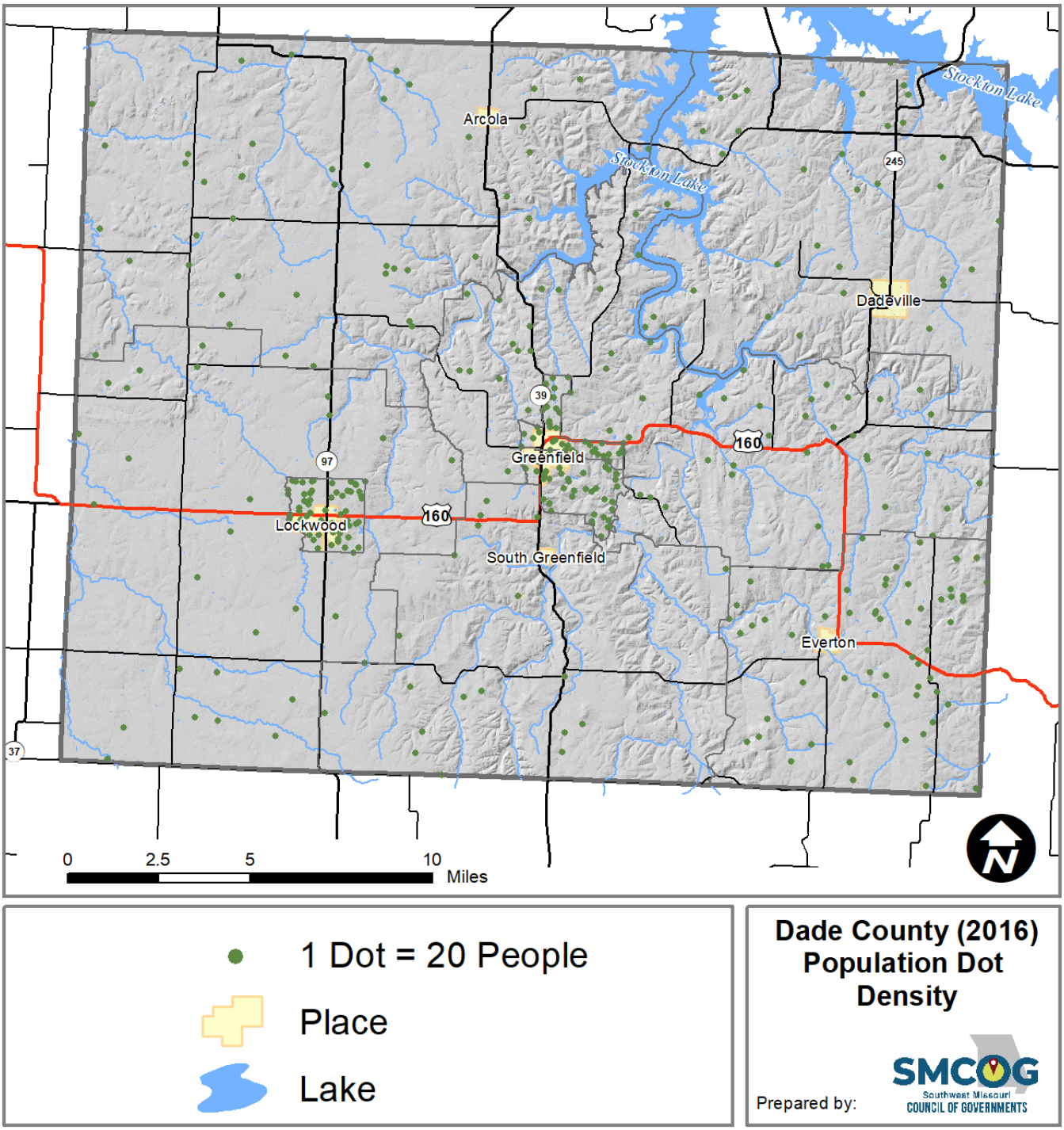


Figure 3.3. Dade County Population Density (2016)



Dade County communities have, overall, experienced varying degrees of growth and decline since the previous plan update. According to 2016 U.S. census estimates Dade County as a whole has declined in population but most incorporated jurisdictions have increased in population. However, those estimates have a higher margin of error for smaller communities and population decline seen from 2000 to 2010 may be more reflective of trends. None of the participating jurisdictions have seen substantial development since the previous plan update. A summary of each jurisdiction is provided below.

Unincorporated Dade County

Unincorporated Dade County experienced no substantial changes in development since the previous plan. No changes have increased the community's vulnerability.

Village of Arcola

The Village of Arcola has experienced no substantial changes in development since the previous plan. No changes have increased the community's vulnerability.

City of Everton

The City of Everton experienced no substantial changes in development since the previous plan. No changes have increased the community's vulnerability.

City of Greenfield

The City of Greenfield experienced minimal changes in development since the previous plan. A new Dollar General store was constructed in 2015 but building codes were followed and the structure is not located in the floodplain. Within the city limits, the Greenfield School District constructed an elementary school gymnasium since the last plan update. This construction was an addition to the elementary school and building codes were followed. The risk of damage from fire, tornado, severe storm, or earthquake is inherent, though the construction was not located within a floodplain. Consequently, the community's vulnerability has slightly increased.

City of Lockwood

The City of Lockwood saw the construction of two industrial facilities since the last plan update: the Lockwood Packing Plant and Prairie Mountain Manufacturing. Neither facility is located within a floodplain, though the risk of damage from fire, tornado, severe storm, or earthquake is inherent, and has slightly increased the community's vulnerability.

Village of South Greenfield

The Village of South Greenfield experienced no substantial changes in development since the previous plan. No changes have impacted the community's vulnerability.

Dadeville R-II School District

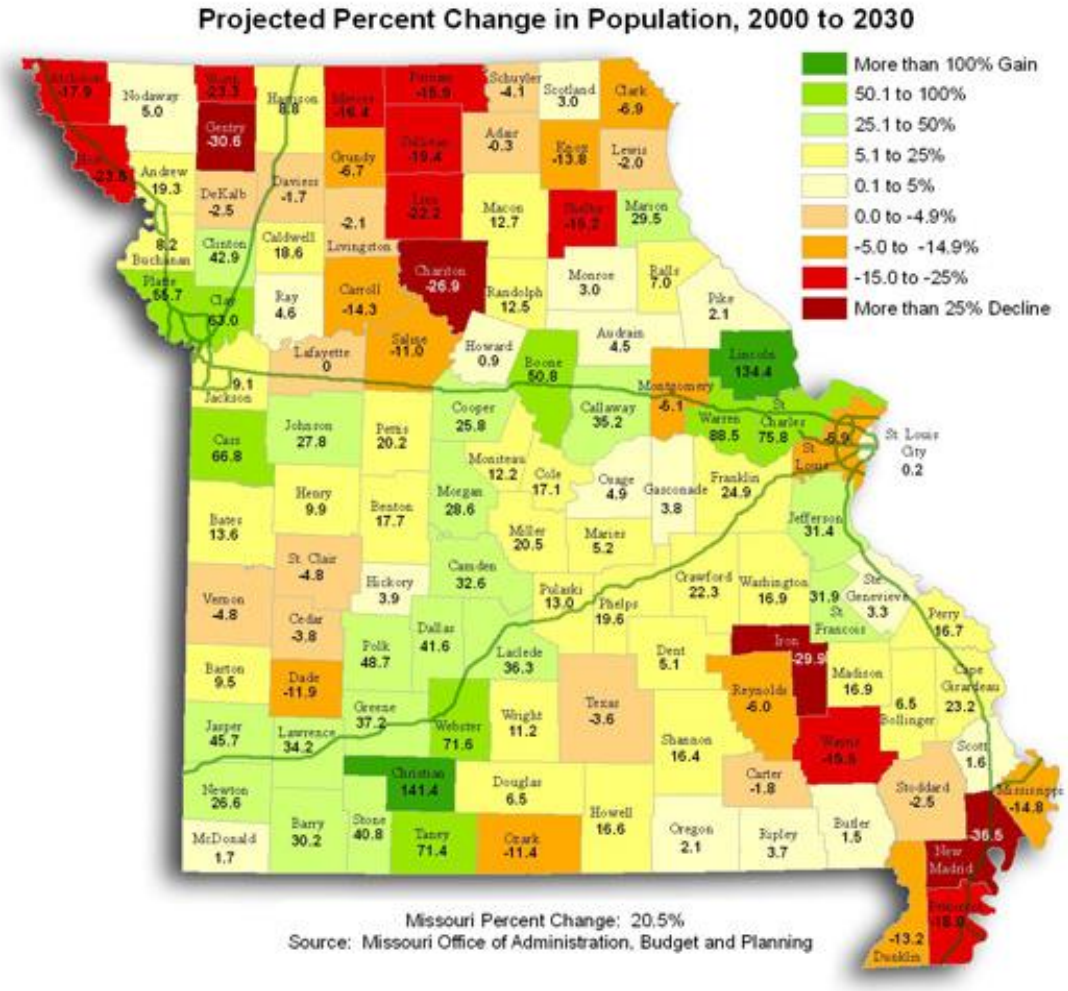
The Dadeville R-II School District has constructed four new classrooms as an addition to an existing building since the last plan update. The risk of damage from fire, tornado, severe storm, or earthquake is inherent, though the construction was not located within a floodplain. Consequently, the district's vulnerability has slightly increased.

3.3.2 Future Land Use and Development

Dade County is expected to see a decline in population in the next decade. The Missouri Office of Administration, Budget and Planning has projected that Dade County will see an 11.9% decrease in population by 2030. **Figure 3.4** shows the expected population change for each county in the state of Missouri. Dade County is expected to see the greatest population decline for counties in Southwest Missouri. The county does not have a comprehensive plan or any land use controls other than the floodplain ordinance. The floodplain coordinator does enforce the floodplain ordinance when necessary.

This decline can be attributed to migration from unincorporated to incorporated land, emigration from Dade County, and a declining birth rate, or a combination of the three. Though housing construction will slow with a declining population, the existing stock will reflect peak population levels, meaning population decline may not lower the hazard risk in Dade County, but it will also not increase risk.

Figure 3.4. Projected Percent Change in Population, 2000 to 2030



The remaining discussion in this section provides future growth and development information, where available, relative to each participating jurisdiction. Much of the information included is from the community data collection questionnaires, or where incomplete questionnaires were returned presumptions were made for future development based on past trends.

Village of Arcola

The Village of Arcola currently has no plans for future development, nor does it have a comprehensive plan to show the location and types of anticipated land uses. Based on trends from the U.S. Census and ACS data, the Village of Arcola has experienced a moderate increase in population since 2000. Despite the estimated growth, the total number of housing units in the Village of Arcola has decreased by 5.7% (a total of three housing units) since 2010. If the estimates were to accurately represent population growth within the village, it can be assumed that the housing stock will also grow, leading to an increased hazard risk to both life and property relative to the previous plan update information. It should be noted that there are no identified floodplains in the Village of Arcola boundaries, so any new development would be at minimal flooding risk.

City of Everton

The City of Everton currently has no plans for future development, nor does it have a comprehensive plan to show the location and types of anticipated land uses. Based on trends from the U.S. Census

and ACS data, the City of Everton has experienced a slight increase in population since 2000. If continued, this growth will directly affect the housing stock, leading to a slightly increased hazard risk to both life and property relative to the previous plan update information. Everton will continue to enforce the NFIP ordinance so as to minimalize the potential impact of flooding.

City of Greenfield

The City of Greenfield currently has no plans for future development, nor was a comprehensive plan provided. Based on trends from the U.S. Census and ACS data, the City of Greenfield has experienced a moderate increase in population since 2000. If continued, this growth will directly affect the housing stock, leading to a slightly increased hazard risk to both life and property relative to the previous plan update information.

City of Lockwood

The City of Lockwood plans to construct a new building for storage of city maintenance equipment and supplies. This building will replace the aging building that is currently used for this purpose. Aside from this, the City of Lockwood does not currently anticipate further development, nor does it have a comprehensive plan to show the location and types of anticipated land uses. Based on trends from the U.S. Census and ACS data, the City of Lockwood has experienced a slight increase in population since 2000. If continued, this growth will directly affect the housing stock, leading to a slightly increased hazard risk to both life and property relative to the previous plan update information. Lockwood will continue to enforce the NFIP ordinance in order to minimize future risk from flooding.

Village of South Greenfield

The Village of South Greenfield currently has no plans for future development, nor does it have a comprehensive plan to show the location and types of anticipated land uses. Based on trends from the U.S. Census and ACS data, the Village of South Greenfield has experienced a slight increase in population since 2000. If continued, this growth will directly affect the housing stock, leading to a slightly increased hazard risk to both life and property relative to the previous plan update information.

School District's Future Development

Dadeville R-II School District

The Dadeville R-II School District does not have plans for future development. Safe rooms have been installed that are capable of holding students and faculty only, though the district has expressed interest in constructing a community shelter if granted funds. The district expects an increase of approximately 20% in enrollment over the next five years.

Greenfield R-IV School District

The Greenfield R-IV School District does not anticipate any future developments, renovations, employment growth or decline, facility improvements, or significant changes in enrollment over the next five years. The district uses the basements of both school buildings as safe rooms.

Lockwood R-I School District

The Lockwood R-I School District does not anticipate any future developments aside from improvement of facility rooves, nor does it expect a significant change in enrollment over the next five years. The district does not currently have a safe room due to lack of funding, though it has expressed interest in constructing one in the near future.

Special District's Future Development

Dade County Rural Fire Protection District

The Dade County Rural Fire Protection District does not anticipate any future construction, bonds, renovation, service district growth or decline, employment growth or decline, or facility improvements. Any new development in the district boundaries may increase vulnerability. This district's facilities do not include a safe room.

Dadeville Rural Fire Protection District

The Dadeville Rural Fire Protection District does not anticipate any future construction, bonds, renovation, service district growth or decline, employment growth or decline, or facility improvements. However, any new development in the district boundaries may increase vulnerability. This district's facilities do not include a safe room.

3.4 HAZARD PROFILES, VULNERABILITY, AND PROBLEM STATEMENTS

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

Hazard Profiles

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

Each hazard identified in Section **3.1.4** will be profiled individually in this section. The level of information presented in the profiles will vary by hazard based on the information available. With each update of this plan, new information will be incorporated to provide better evaluation and prioritization of the hazards that affect the planning area. Detailed profiles for each of the identified hazards include information categorized as follows:

- **Hazard Description:** This section consists of a general description of the hazard and the types of impacts it may have on a community or school/special district.
- **Geographic Location:** This section describes the geographic areas in the planning area that are affected by the hazard. Where available, use maps to indicate the specific locations of the planning area that are vulnerable to the subject hazard. For some hazards, the entire planning area is at risk.
- **Strength/Magnitude/Extent:** This includes information about the strength, magnitude, and extent of a hazard. For some hazards, this is accomplished with description of a value on an established scientific scale or measurement system, such as an EF2 tornado on the Enhanced Fujita Scale. Strength, magnitude, and extent can also include the speed of onset and the duration of hazard events. Describing the strength/magnitude/extent of a hazard is not the same as describing its potential impacts on a community. Strength/magnitude/extent defines the characteristics of the hazard regardless of the people and property it affects.
- **Previous Occurrences:** This section includes available information on historic incidents and their impacts. Historic event records form a solid basis for probability calculations.
- **Probability of Future Occurrence:** The frequency of recorded past events is used to estimate the likelihood of future occurrences. Probability was determined by dividing the number of recorded events by the number of years of available data and multiplying by 100. This gives the percent chance of the event happening in any given year. For events occurring more than once annually, the probability is reported as 100% in any given year, with a statement of the average number of events annually. For hazards such as drought that may have gradual onset and extended duration, probability is based on the number of months in drought in a given time-period and expressed as the probability for any given month to be in drought.
- **Changing Future Conditions Considerations:** Changing future conditions are also considered, including the effects of long-term changes in weather patterns and climate on identified hazards.

Vulnerability Assessments

Requirement §201.6(c)(2)(ii) :[The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Requirement §201.6(c)(2)(ii)(A) :The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

Requirement §201.6(c)(2)(ii)(B) :[The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Requirement §201.6(c)(2)(ii): (As of October 1, 2008) [The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged in floods.

Following the hazard profile for each hazard will be the vulnerability assessment. The vulnerability assessment further defines and quantifies populations, buildings, critical facilities, and other community assets at risk to damages from natural hazards. The vulnerability assessments are based on the best available data, including data that was collected for the 2018 State Hazard Mitigation Plan Update.

The vulnerability assessments in this Dade County plan are also based on:

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

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

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

- **Potential Losses to Existing Development:** Includes the types and numbers of building and critical facilities.

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

anticipated future development in the county, and how that would impact hazard risk in Dade County.

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

Problem Statements

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

3.4.1 Flooding (Riverine and Flash)

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.1, Page 3.80 **https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf**
- Watershed map, Environmental Protection Agency, https://cfpub.epa.gov/surf/locate/index.cfm
- FEMA Map Service Center, Digital Flood Insurance Rate Maps (DFIRM) for all jurisdictions, if available, msc.fema.gov/portal
- NFIP Community Status Book, http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book
- NFIP claims status, BureauNet, http://bsa.nfipstat.fema.gov/reports/reports.html
- Flood Insurance Administration—Repetitive Loss List (this must be requested from the State Floodplain Management agency or FEMA)
- National Centers for Environmental Information, Storm Events Database, http://www.NCEI.noaa.gov/stormevents/
- USDA Risk Management Agency, Insurance Claims, https://www.rma.usda.gov/data/cause
- FEMA Data Visualization Tool, https://www.fema.gov/data-visualization-floods-data-visualization

Hazard Profile

Hazard Description

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

Flooding caused by dam failure is discussed in Section 3.4.2. 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 highly probable, yet generally unpredictable nature of flash flooding in Dade County.

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 watershed characteristics, modeling techniques, monitoring, and advanced warning systems, has increased the warning time for flash floods.

Geographic Location

Riverine flooding is most likely to occur in Special Flood Hazard Areas (SFHAs) where the 100-year floodplain has been mapped. Areas surrounding the southern arms of Stockton Lake as well as the Sac River and its branches are at the greatest risk of impact from riverine and flash floods, though several areas throughout Dade County contain numerous creeks and streams with the potential to flood.

According to NCEI storm event data from 1999-2018, there were 36 flash flood events and 7 flood events recorded in the county. These events are typically regional in nature; however, flash floods can be contained to one area, specifically portions of highways or roads. **Figure 3.5** through **Figure 3.10** are mapped SFHAs for participating jurisdictions and unincorporated Dade County, with critical facilities identified.

Figure 3.5. Dade County SFHAs with Critical Facilities

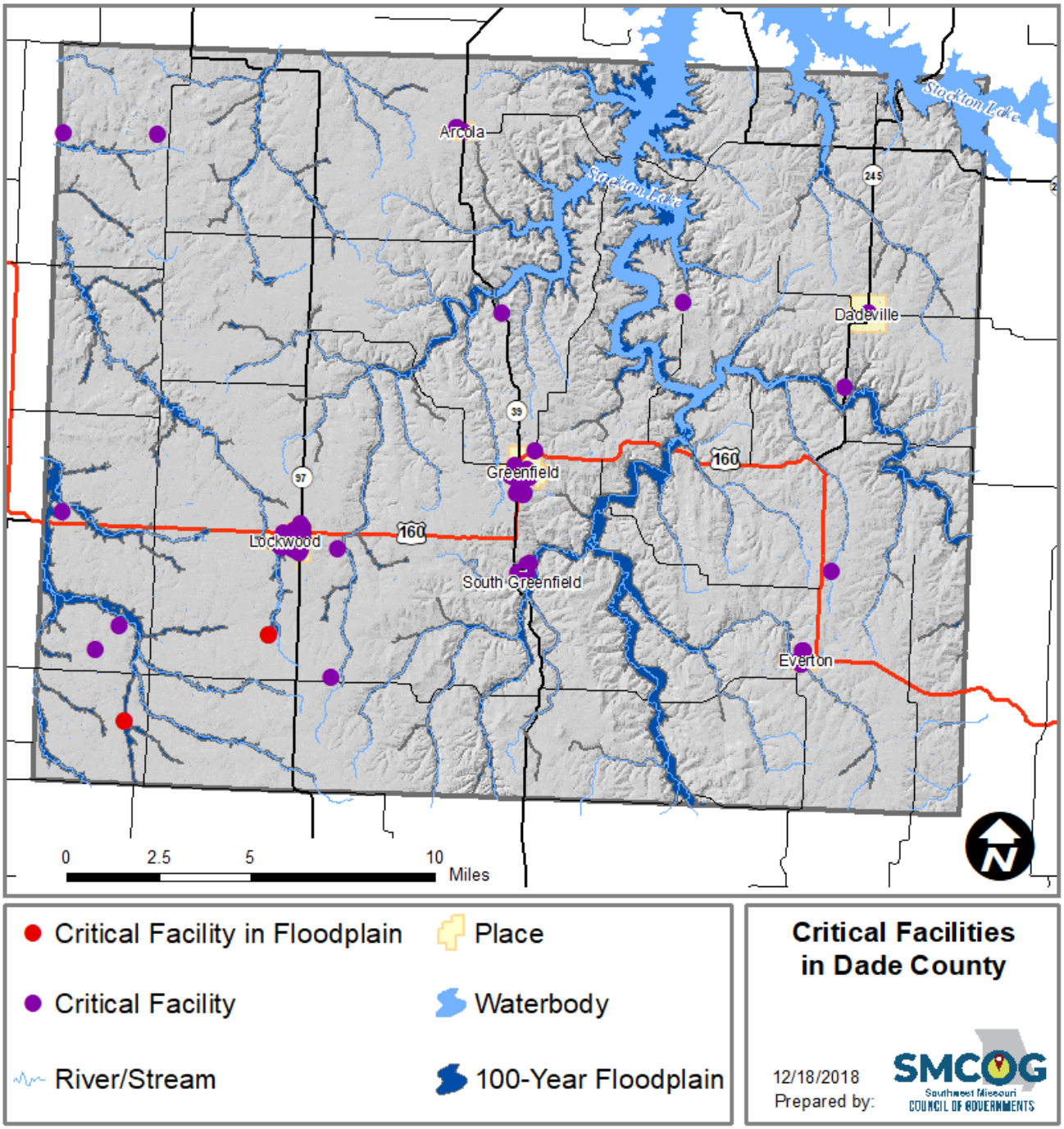


Figure 3.6. Village of Arcola SFHAs with Critical Facilities

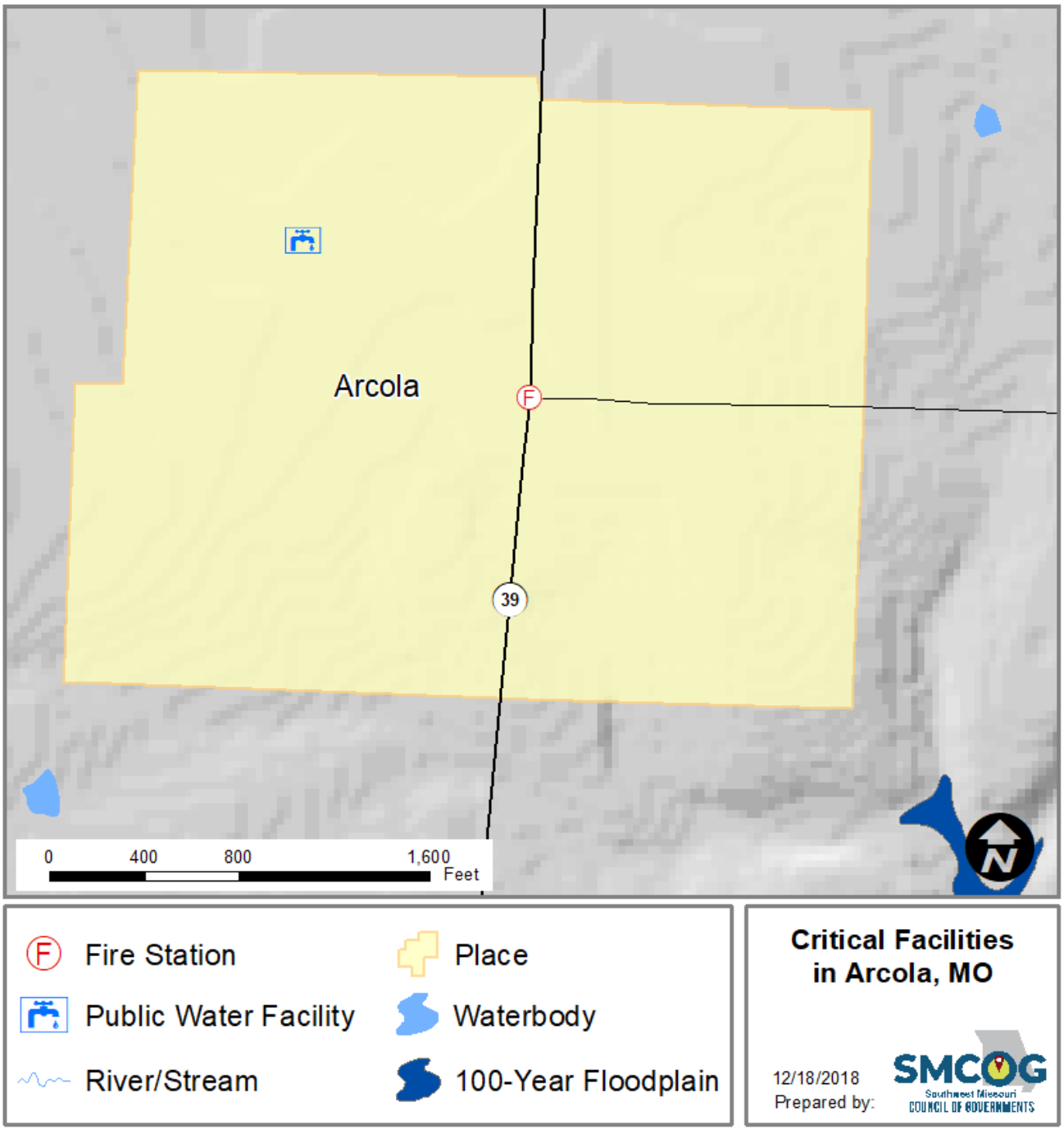


Figure 3.7. City of Everton SFHAs with Critical Facilities

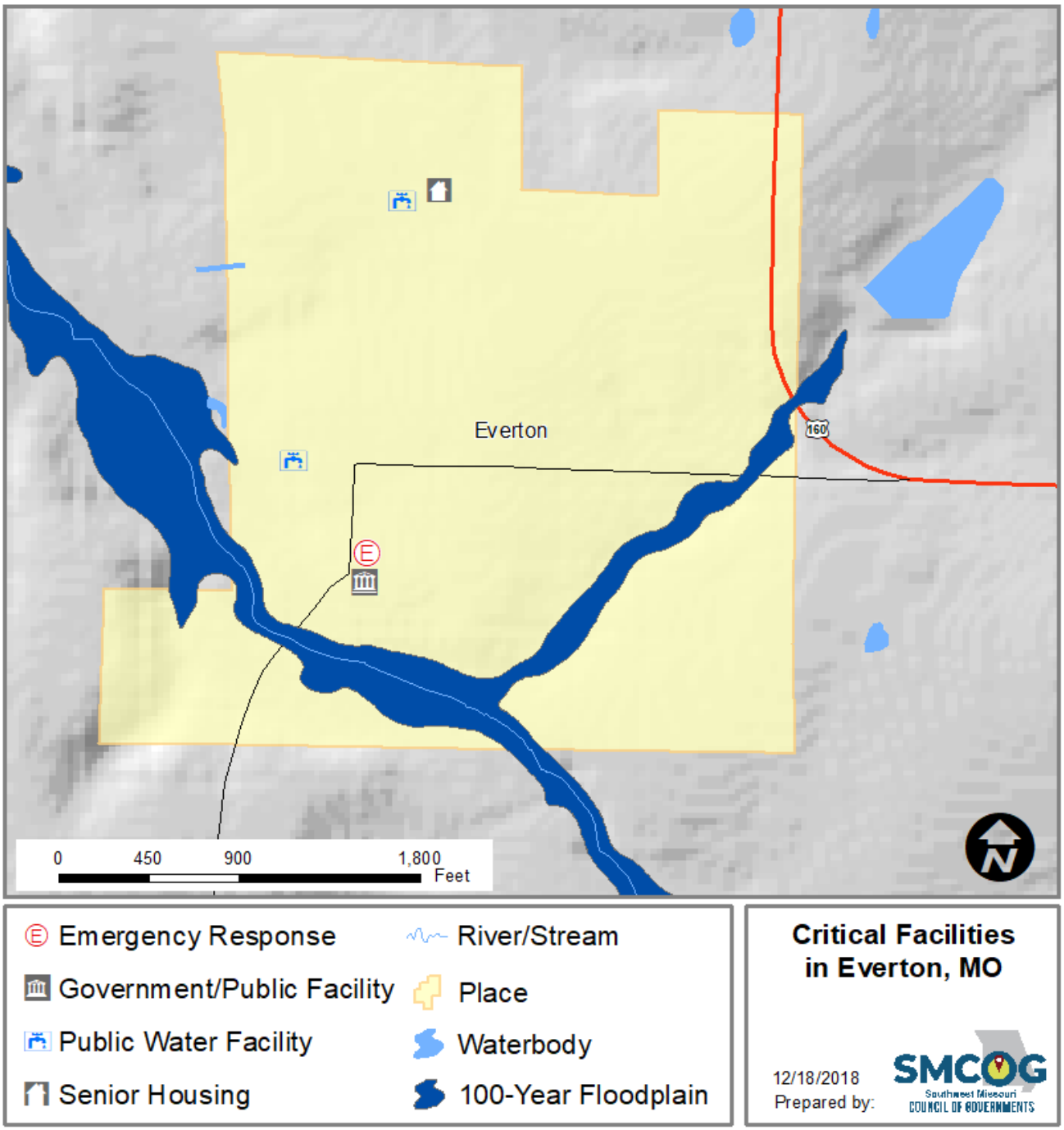


Figure 3.8. City of Greenfield SFHAs with Critical Facilities

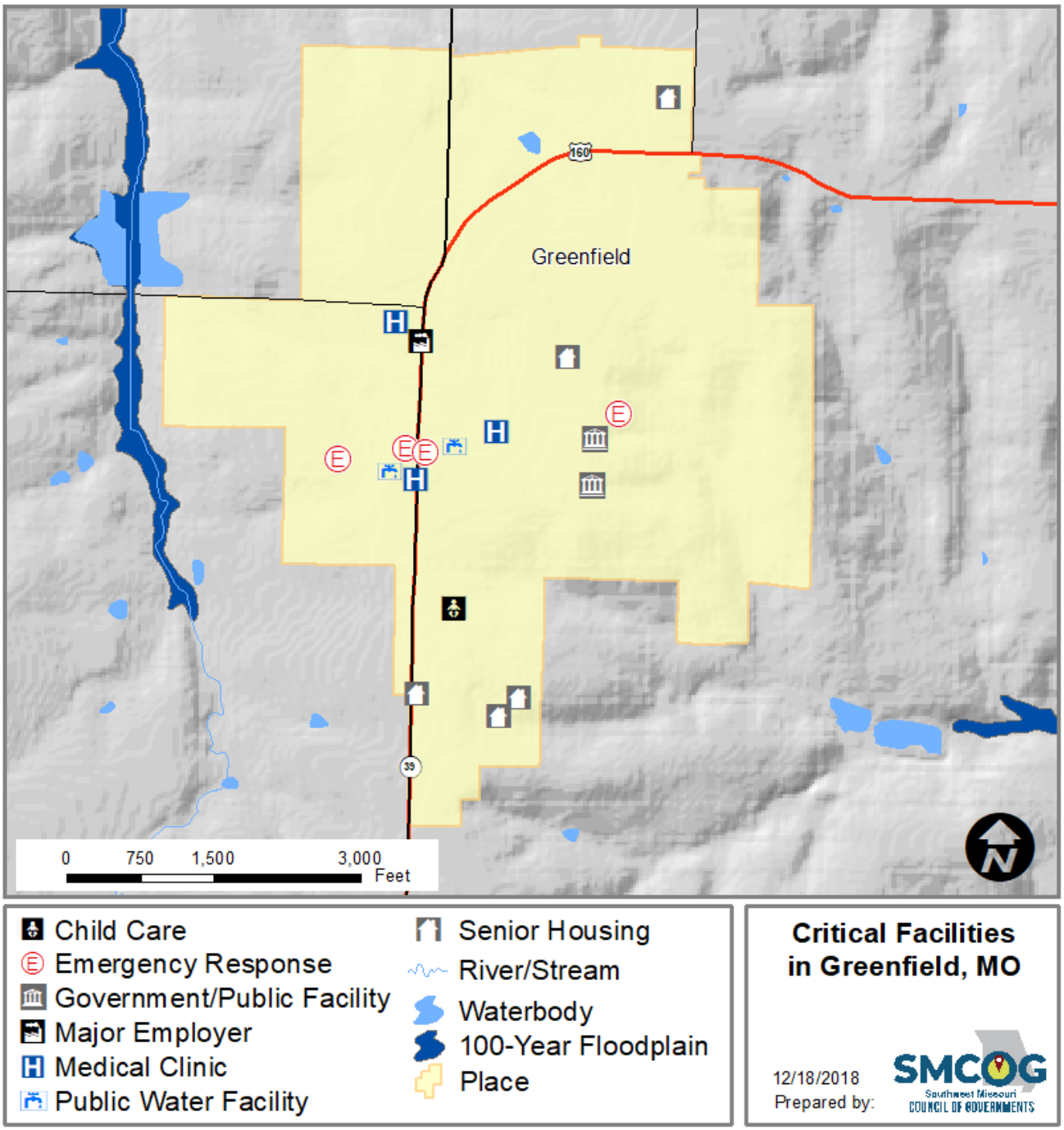


Figure 3.9. City of Lockwood SFHAs with Critical Facilities

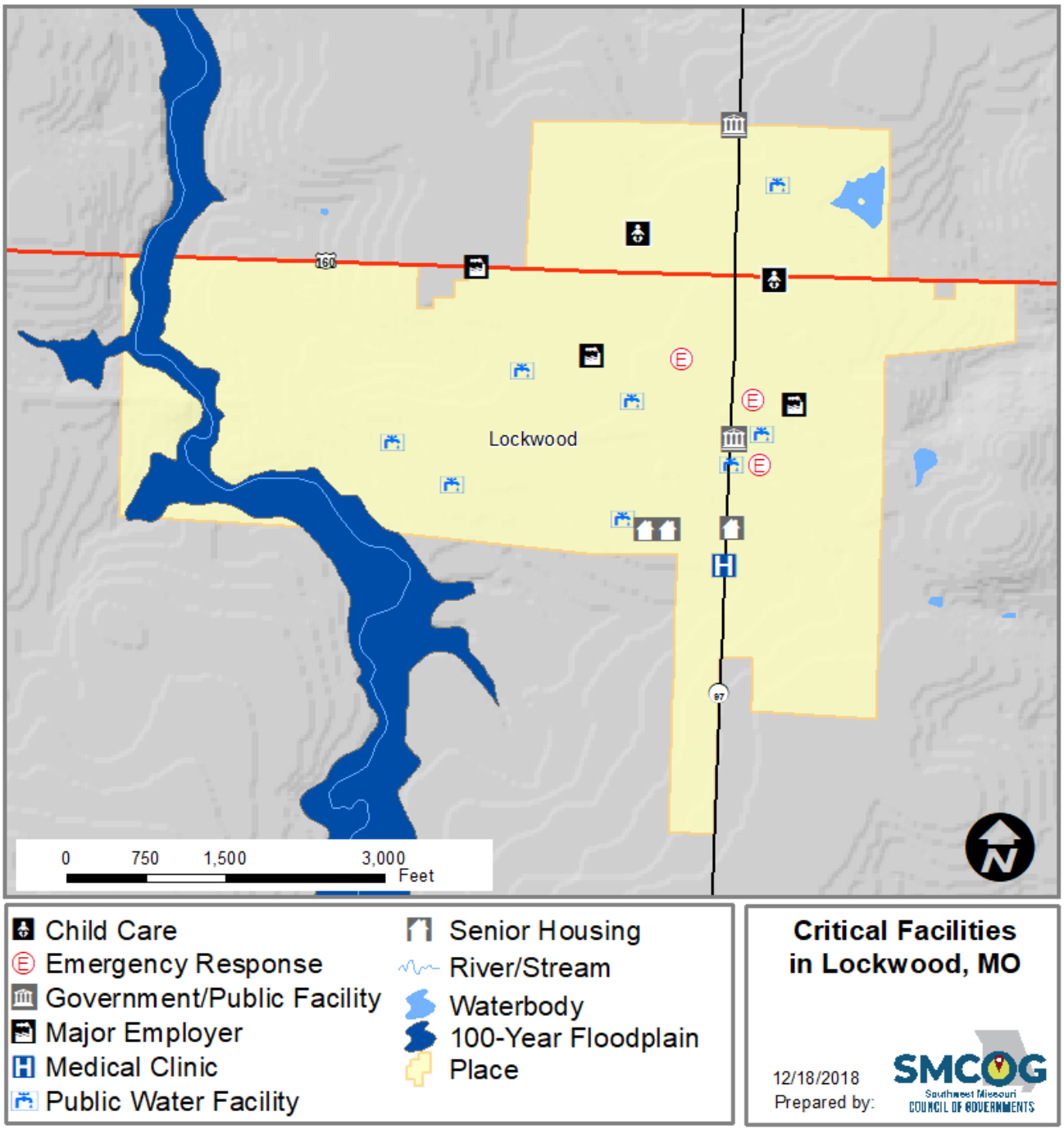
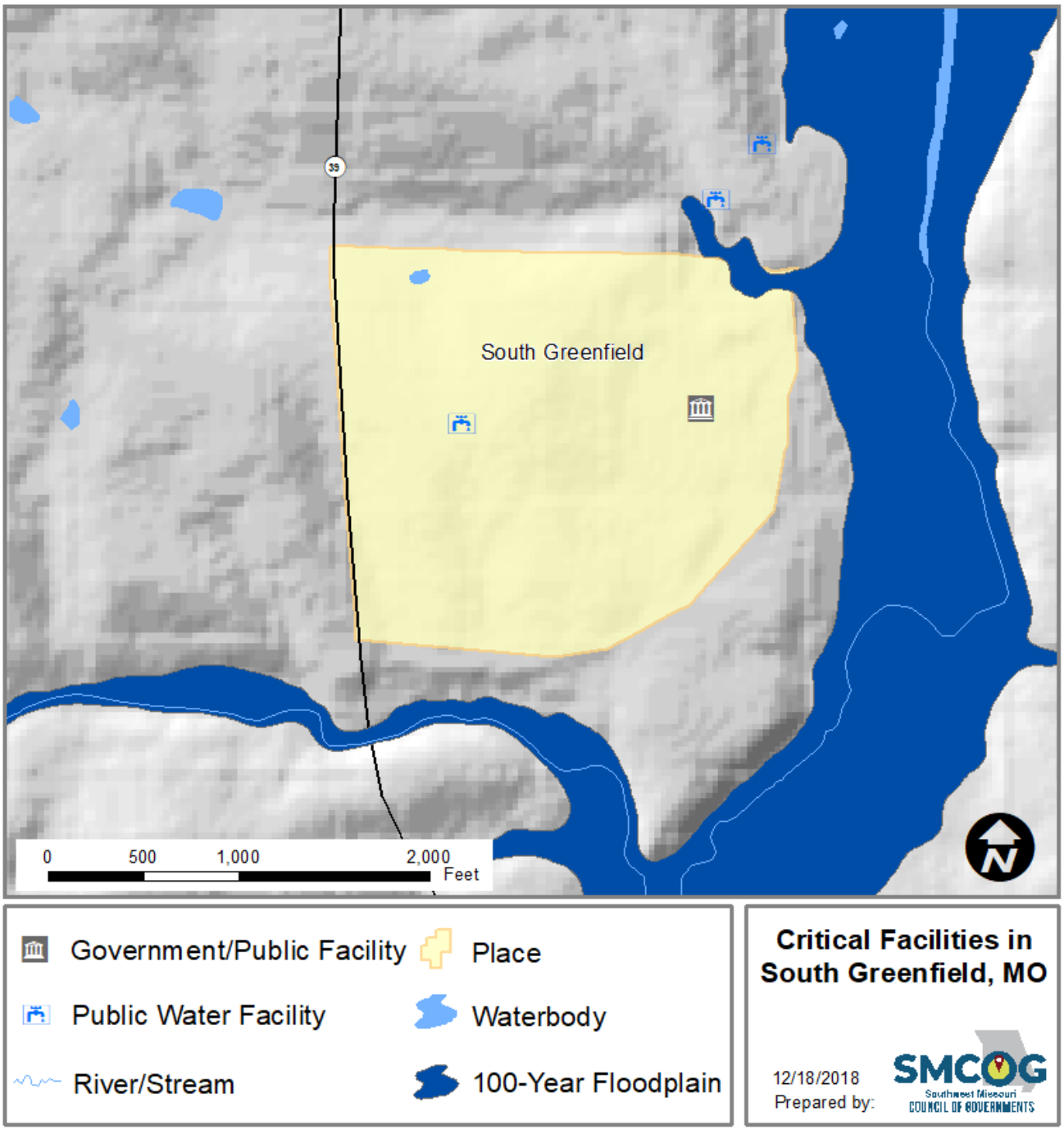


Figure 3.10. Village of South Greenfield SFHAs with Critical Facilities



Flash flooding events pose the most pervasive hazard of the two flood types in the county due to permeability of soils, slopes, increasing urban development and extensive network of streams and rivers. Sustained rainfall or downpours at the rate of one inch per hour have caused street flooding in incorporated areas and made a significant number of low water crossings impassible. Flash flooding occurs in the floodplain while low-lying areas in all jurisdictions are susceptible to flash floods outside the 100-year floodplain. They also occur in areas without adequate drainage to carry away the amount of water that falls during intense rainfall events. A review of the NCEI storm event database determined which jurisdictions are most prone to flooding and flash flooding from 1999 to 2018 are listed in **Table 3.16** and **Table 3.17**.

Table 3.16. Dade County NCEI Flood Events by Location, 1999-2018

Location	# of Events
Unincorporated Dade County	6
Countywide (5/8/2002), (5/12/2002), (3/19/2008)	
Highway EE northeast of Greenfield, Highway 97 east of Sylvania, Highway 215 west of Bona, and Highway K near Turnback Creek (1/5/2005)	
Highway K west of Everton (1/12/2005)	
Highway K near Pilgrim (2/24/2018)	
City of Everton	1
Area along Turnback Creek (6/2/2007)	

Source: National Centers for Environmental Information, 2019

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 with the narratives for flash flood events. Where specific roads and located 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 3.17. Dade County NCEI Flash Flood Events by Location, 1999-2018

Location	# of Events
Unincorporated Dade County	35
Countywide (4/25/1999), (5/4/1999), (5/7/2002), (5/12/2002), (3/18/2008), (4/10/2008), (8/8/2013), (4/30/2017)	
Southeastern Dade County (7/1/2000)	
Northern Dade County, Highway 39 near Neola (6/3/2001)	
Southern Dade County (8/29/2001), (10/10/2001), (8/20/2007)	
Highway EE northeast of Greenfield, Highway 97 east of Sylvania, Highway 215 west of Bona, and Highway K near Turnback Creek (1/5/2005)	
Highway K west of Everton (1/12/2005), (6/20/2008), (10/9/2009)	
Low water crossing near Greenfield (5/3/2006)	
Highway 160 east of Lockwood (6/11/2007)	
Low water crossings along Road 152 (7/1/2007), (7/26/2008)	
Intersection of Highway 97 and County Road E (7/9/2007)	
Highway 97 north of Lawrence County line (9/6/2007), (6/17/2013)	
Highway N south of Highway 160 (9/8/2007)	
Highway O near Pilgrim (9/8/2007)	
Sections along Highways D and E (5/13/2009)	
Intersection of Farm Road 182 and Highway 39 (7/16/2010)	
Route Z east of Highway 97 (7/30/2013)	
Highway 39 near Arcola (8/4/2013)	
Southwestern Dade County (6/5/2014)	
Highway 42 north of Dadeville (5/27/2015)	
Highway 97 near Ernest (5/31/2016)	
Highway RA near Bona (8/20/2017)	
Highway 215 near Bona (8/20/2017)	
City of Greenfield	2
Numerous city streets (6/12/2007)	
Highway 39 south of Broad Street (8/4/2013)	
City of Lockwood	2
Elm Street (3/23/2007)	
Sections along 12th Street and 17th Street (6/17/2013)	

Source: National Centers for Environmental Information, 2019

As shown in the tables above, there are some specific areas that are more prone to flooding. For example, Highway K west of Everton in unincorporated Dade County was specifically noted in three different events. Additionally, low water crossings across the county are at a high risk to flooding, but the scope of flood damage is not limited to streams, rivers, and creeks. Natural drains and floodplains can also flood during times of heavy precipitation, as shown by the flash floods near more populated areas without natural waterways.

Strength/Magnitude/Extent

Missouri has a long and active history of flooding over the past century, according to the 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.

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

National Flood Insurance Program (NFIP) Participation

Table 3.18 provides details on NFIP participation for communities in Dade County. **Table 3.19** shows the number of policies in force, amount of insurance in force, number of closed losses, and total payments, where applicable. The time period represented by the data for closed losses from January 1, 1978 through December 31, 2018. It should be noted that the cities of Greenfield and Lockwood and the Village of Arcola are noted as having no special flood hazards areas. Additionally, the Village of South Greenfield does not participate due to being sanctioned in 2003. South Greenfield has minimal flooding issues and does not have staff time or expertise to correct the sanctioned status.

Table 3.18. NFIP Participation in Dade County

Community ID #	Community Name	NFIP Participant (Y/N/Sanctioned)	Current Effective Map Date	Regular-Emergency Program Entry Date
290796#	Dade County	Y	05/24/11	12/22/03
290589#	City of Everton	Y	05/24/11(M)	08/01/86
290710#	City of Greenfield	Y	(NSFHA)	02/09/11
290682#	City of Lockwood	Y	(NSFHA)	10/22/03
290930#	Village of Arcola	Y	(NSFHA)	10/22/03
290929#	Village of South Greenfield	Sanctioned	05/24/11	S-07/17/03

Source: NFIP Community Status Book, 4/3/2018; BureauNet, http://www.fema.gov/national-flood-insurance-program/national- flood-insurance-program-community-status-book; M= No elevation determined – all Zone A, C, and X: NSFHA = No Special Flood Hazard Area; E=Emergency Program

Table 3.19. NFIP Policy and Claim Statistics as of September 30, 2018

Community Name	Policies in Force	Insurance in Force	Closed Losses	Total Payments
Dade County	1	$280K	0	0

Source: NFIP Community Status Book, 9/30/2018; BureauNet, https://nfipservices.floodsmart.gov/reports/W2RHUDRP20181129.pdf ;
*Closed Losses are those flood insurance claims that resulted in payment. Loss statistics are for the period from 1978 to 2018.

The only community listed in the NFIP report for a policy in force was Dade County and there were no losses or payments provided.

Repetitive Loss/Severe Repetitive Loss Properties

Repetitive Loss Properties are those properties with at least two flood insurance payments of $5,000 or more in a 10-year period. According to the Flood Insurance Administration, there have been no repetitive loss properties in Dade County.

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

Previous Occurrences

Table 3.20 and Table 3.21 reflect NCEI storm event data for flooding and flash flooding events in Dade County since 1999. There were 39 flash flood events and 7 riverine flood events resulting in $4.6 million in damages. Only one riverine flood event resulted in damage and five flash flood events were damaging. The most recent damaging event occurred in April of 2017 when several rounds of severe thunderstorms occurred across southwest Missouri, resulting in disaster declaration 4317. Dade County was also included in the presidential disaster declaration 4250 during major flooding across the state in December 2015. Numerous roads, bridges, and low water crossings were damaged.

Table 3.20. NCEI Dade County Flash Flood Events Summary, 1999 to 2018

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
1999	2	0	0	$0	$0
2000	1	0	0	$0	$0
2001	3	0	0	$0	$0
2002	2	0	0	$0	$0
2005	4	0	0	$0	$0
2006	1	0	0	$0	$0
2007	9	0	0	$2.3 M	$0
2008	4	0	0	$100 K	$0
2009	2	0	0	$0	$0
2010	1	0	0	$0	$0
2013	4	0	0	$200 K	$0
2014	1	0	0	$0	$0
2015	1	0	0	$10 K	$0
2016	1	0	0	$0	$0
2017	3	0	0	$500 K	$0
Total	**36**	**0**	**0**	**$3.11 M**	**$0**

Source: NCEI, data accessed, 1/28/2019

Table 3.21. NCEI Dade County Riverine Flood Events Summary, 1999 to 2018

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
2002	2	0	0	$1.5M	$0
2005	2	0	0	$0	$0
2007	1	0	0	$0	$0
2008	1	0	0	$0	$0
2018	1	0	0	$0	$0
Total	**7**	**0**	**0**	**$1.5M**	**$0**

Source: NCEI, 1/28/2019

Probability of Future Occurrence

There has been a total of 46 reported flood events in Dade County from 1999 to 2018 in the NCEI storm event database. Of those, 39 were flash floods. In this 20-year period, there were four years without any flash flood events, and five years with damaging events. This equates to an 80% probability that there will be a flash flood event in any given year and a 25% probability of a damaging event in any given year. Based on the number of events and years, the average number of flash flood events is 1.95 per year. From 1999 to 2018, flash floods accounted for $3.11 million in damages or $622,000 per damaging event.

During the same time period, there were only seven riverine flood events reported in Dade County. These events occurred in five years, giving a 20% probability for a riverine flood in any given year and an average of .35 events per year. All of the property damages incurred from a riverine event were tied to one flood in 2002. This event was responsible for approximately $1.5 million in damages.

Changing Future Conditions Considerations

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

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

Vulnerability

Vulnerability Overview

Flooding 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. Poor conditioned bridges identified in **Figure 3.1** show specific locations that might be more vulnerable to high or fast-moving floods. Floodwaters can also cause erosion undermining road beds. In some instances, steep slopes that are saturated with water may cause mud or rock slides onto roadways. These damages can cause costly repairs for state, county, and city road and bridge maintenance departments.

Flooding has been included in most of the presidential disaster declarations that have included Dade County. Periods of heavy rain falling at the rate of one inch per hour floods low water crossings throughout the county, making many roads impassable. This creates a severe threat to motorists that attempt to drive through flood waters over the roadway. Riverine flooding occurs less frequently than flash flooding. Although Dade County has no RL or SRL-properties, property damage is still likely to occur to non-SRL properties. Low lying areas outside of the floodplain may also be frequently flooded.

Potential Losses to Existing Development

Flood loss estimates were developed by selecting all parcels located in a floodplain. Building counts of the selected parcels were then sorted by participating jurisdiction and type. While some areas of the selected parcels may not be immediately adjacent to a floodplain, they have been included to take into account the potential damages from flash flooding. **Table 3.22** presents the building counts for each type of use within each participating municipality, as well as the unincorporated areas of Dade County.

Table 3.22. Potential Flood Losses for Building Types by Jurisdiction

Jurisdiction	Residential	Commercial	Agricultural	Other	Total
Village of Arcola	5	0	19	0	24
City of Everton	86	1	142	0	229
City of Greenfield	59	2	146	0	207
City of Lockwood	102	4	274	0	380
Village of South Greenfield	44	1	111	0	156
Unincorporated Dade County	159	2	447	0	608
Total	**455**	**10**	**1,139**	**0**	**1,604**

Source: Dade County Assessor's Office

The total exposure for structures and contents by building type and jurisdiction is provided in **Table 3.23**. Losses were estimated by adding a 5% damage factor to the total assessed value of structures in the jurisdiction.

Table 3.23. Total Flood Exposure and Estimated Losses by Jurisdiction

Jurisdiction	Residential	Commercial	Agricultural	Other	Total
Village of Arcola	$102,952.50	$0	$109,200	$0	$212,152.50
City of Everton	$1,179,360	$3,801	$366,849	$0	$1,550,010
City of Greenfield	$923,643	$188,223	$327,432	$0	$1,439,298
City of Lockwood	$1,759,348.50	$55,188	$1,319,661	$0	$3,134,197.50
Village of South Greenfield	$736,480.50	$1,879.50	$269,944.50	$0	$1,008,304.50
Unincorporated Dade County	$2,025,597	$129,486	$1,508,283	$0	$3,663,366
Total	**$6,727,381.50**	**$378,577.50**	**$3,901,369.50**	**$0**	**$11,007,328.50**

Source: Dade County Assessor's Office

There are two critical facilities located in the floodplain: the Hedeman Farms Lake dam and the Schilling Lake dam. These will be discussed in more detail in section 3.4.2. There is potential for damage and increased vulnerability to these facilities as flooding frequency and severity is likely to increase. There are no publicly-owned critical facilities in the floodplain.

Low Water Crossings

Damage to low water crossings due to flooding is a significant problem for communities. In early 2018, an inventory of all low water crossings in Dade County was conducted. Data gathered included condition, type of structure, measurements, and flooding risk. The inventory showed that there are 232 county-maintained water crossing of all types in Dade County. At the time of the inventory, there were 138 in good condition, 87 in fair condition, and 7 in poor condition. **Figure 3.11** shows the locations and conditions of all crossings in Dade County.

The data from the inventory was used to determine the top ten priority crossings for replacement and/or upgrading in Dade County based on several factors. **Figure 3.12** shows the location of the ten priority crossings and includes a picture of each crossing. Many of these crossings are repeatedly damaged

during heavy rain events and need substantial improvements or upgrades in order to increase resiliency towards flooding.

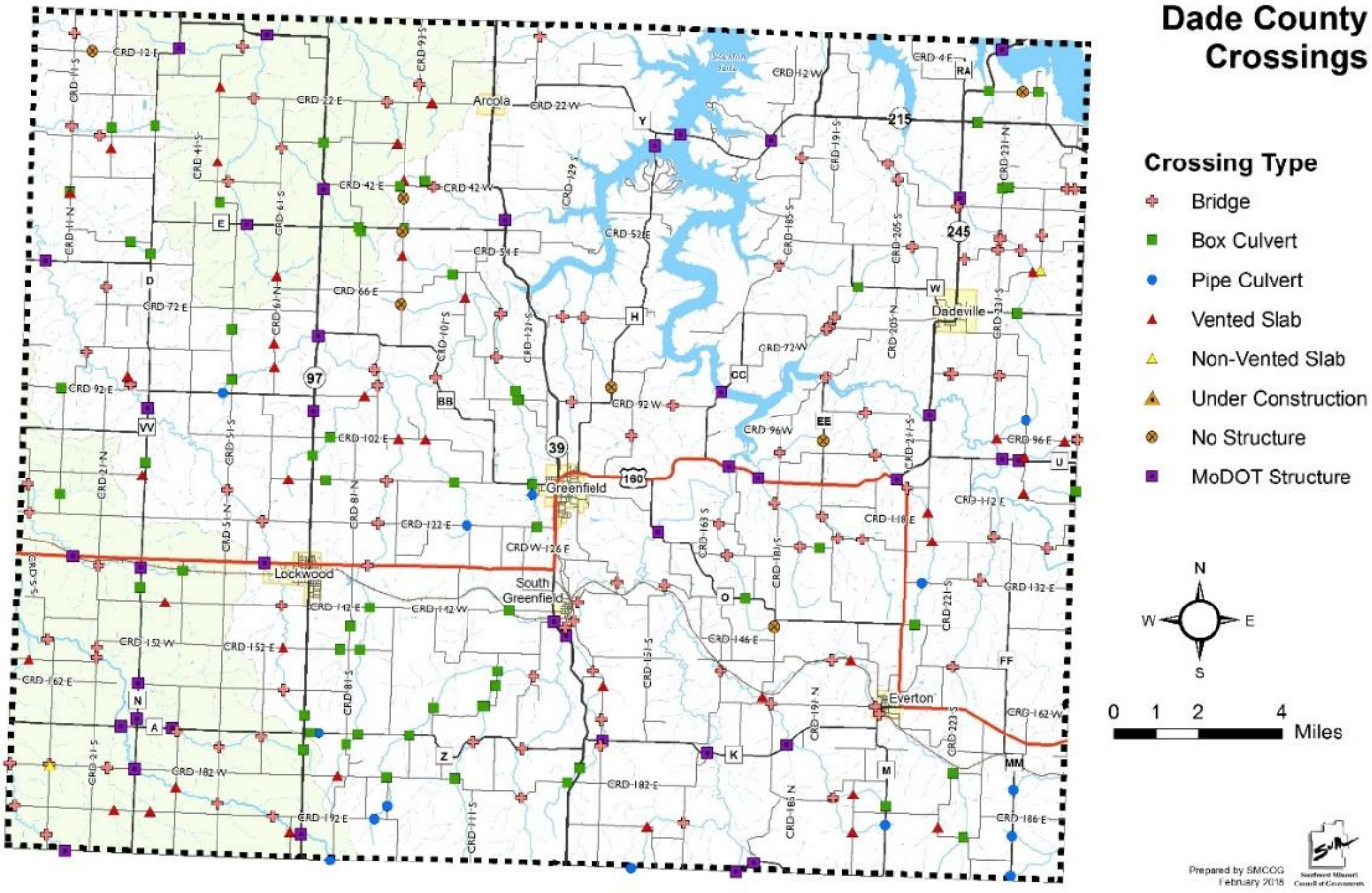
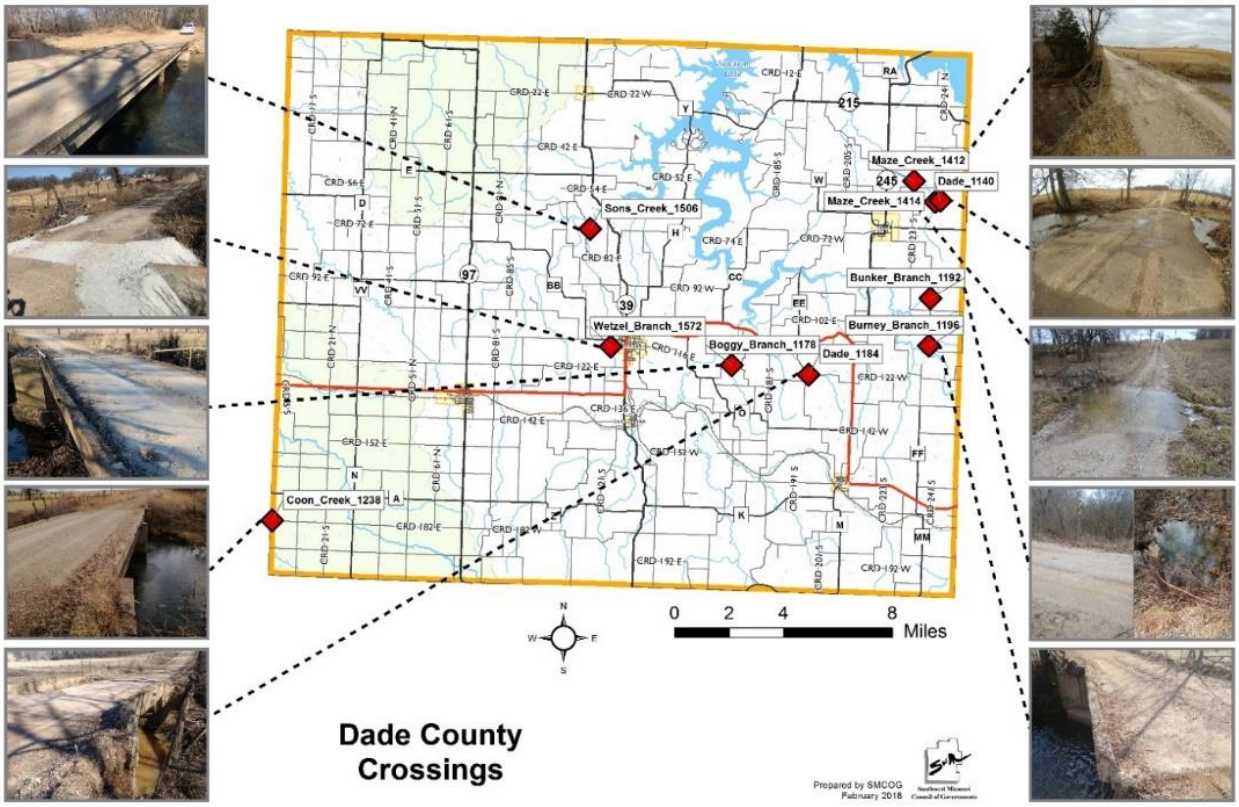


Figure 3.11. Dade County Low Water Crossings

Figure 3.12. Dade County Low Water Crossings Priorities



Impact of Previous and Future Development

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

Hazard Summary by Jurisdiction

All local jurisdictions in the county are at risk to flood hazards; however, as demonstrated in **Table 3.23** exposure of assets near SFHAs varies among jurisdictions. Communities such as Arcola, Greenfield, and Lockwood have limited floodplain within the jurisdiction and are likely at lower risk for damaging events. However, all of these communities can be impacted by flooding of major roads and low water crossings in the areas proximate to their corporate limits. Due to previous flood events and general frequent flooding some county bridges will need to be replaced.

The two critical facilities within floodplains are privately-owned dams in the southwestern quarter of the county. These dams are not located within the boundaries of a participating municipality, but rather the county. Neither of these dams are state regulated.

Community Comments on Hazard

Three of the 37 residents who completed the online survey stated that they had been impacted by flooding. Eleven of the respondents (30%) felt that flooding was highly likely to impact their community in the future. Only three respondents felt that flooding would have a catastrophic impact, though 23 felt flooding would have a critical impact. Respondents were somewhat supportive of flood-prone property acquisition and flood-prone structure elevation. MPC members highly prioritized primary infrastructure maintenance and improvements to mitigate the effects of this event. MPC members rated flooding as the natural hazard that puts Dade County the most at risk.

Problem Statement

Floods are frequent events and have been listed in ten of the seventeen presidential disaster declarations that have included Dade County. While there has not been substantial residential damage in the past, Dade County does experience frequent flood damage to infrastructure. Repeatedly damaged infrastructure, such as the Hulston Bridge, should be replaced in order to eliminate frequent flooding.

Street flooding in incorporated areas can be addressed through storm water management projects and enforcing storm water management regulations. To reduce the damage of floods to infrastructure and human life, several strategies can be implemented, such as hazard awareness programs, updating or adding low-water crossing markers, upgrading low-water crossings, and general waterway maintenance. Projects involving the improvements to river/stream embankments can also reduce flooding to surrounding areas. The enforcement of NFIP ordinances would also minimize the impact of flooding.

3.4.2 Dam Failure

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.3, Page 3.148
  https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- Missouri Department of Natural Resources, Dam and Reservoir Safety,
  https://dnr.mo.gov/geology/wrc/dam-safety/?/env/wrc/dam-safety/
- Stanford University's National Performance of Dams Program;
  http://npdp.stanford.edu/
- USACE National Inventory of Dams
  http://nid.usace.army.mil/cm_apex/f?p=838:12
- National Resources Conservation Service
  http://www.nrcs.usda.gov
- DamSafetyAction.org
  https://damsafety.org/missouri
- Missouri Hazard Mitigation Viewer
  http://bit.ly/MoHazardMitigationPlanViewer2018 - Website
  Hazard Profile

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 has 5,113 total dams recorded in the NID. Dam owners are charged with the primary responsibility for the safe design, operation, and maintenance of their dams. They also have responsibility for providing early warning of problems at the dam, for developing an effective emergency action plan, and for coordinating that plan with local officials.

Missouri's topography allows lakes to be built easily and inexpensively, contributing to the high number of dams. Despite the large number of total dams in the state, there are only 685 (about 13.4 percent) state regulated dams, with an additional 57 federally regulated dams. The remaining 4,371 dams are un-regulated.

Dams that fall under state regulation are non-federally regulated dams that are more than 35 feet in height. Most nonfederal dams are privately owned structures built either for agricultural, water supply or recreational use. The Department of Natural Resources (MDNR) Water Resources Center maintains the Dam and Reservoir Safety Program in Missouri. The program ensures that dams over 35 feet in height are safely constructed, operated, and maintained pursuant to Chapter 236 of 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 Dade 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 3.24**. The downstream environment zone classification is also used to prescribe the frequency of inspection.

Table 3.24. MoDNR Dam Hazard Classification Definitions

Hazard Class	Definition
Class I	The area downstream from the dam that would be affected by inundation contains ten (10) or more permanent dwellings or any public building. Inspection of these dams must occur every two years

Class II	The area downstream from the dam that would be affected by inundation contains one 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

Dams in the NID are classified according to hazard potential, an indicator of the consequences of dam failure. A dam's hazard potential classification, presented in **Table 3.25**, does not indicate its condition. Dams assigned the high 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 3.25. NID Dam Hazard Classification Definitions

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

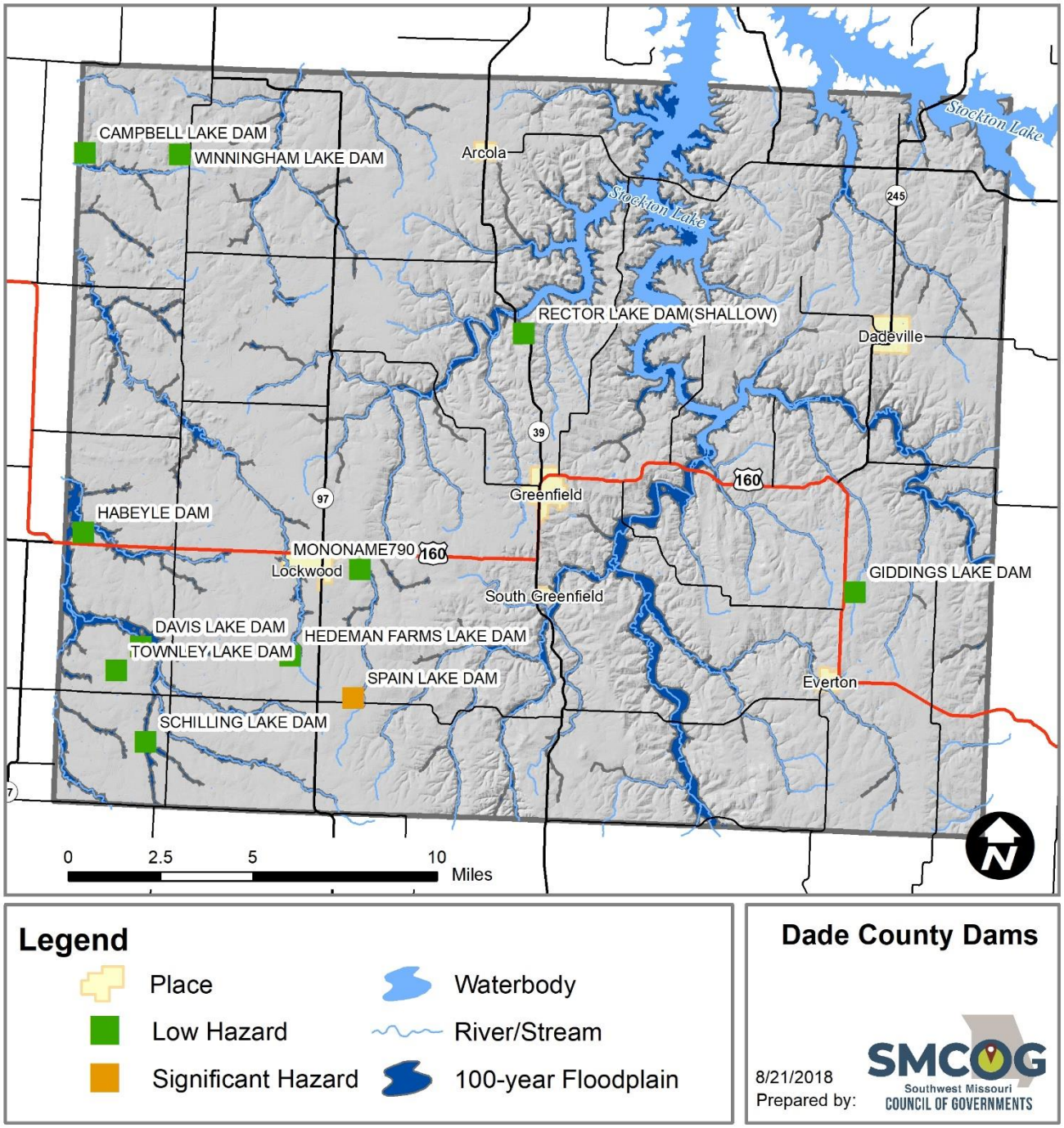
Geographic Location

Dams Located Within the Planning Area

There are 11 recorded dams in Dade County in both the MDNR and NID databases. There are zero high hazard dams, one significant hazard dam, and ten low hazard classified dams. None of the dams in Dade County are state regulated.

Figure 3.13 provides the locations of dams in Dade County. Inundation maps for dams were unable to be acquired, therefore making exact dam breach inundation areas unknown.

Figure 3.13. Dam Locations in Dade County



Source: U.S. Army Corps of Engineers, Missouri Department of Natural Resources

<u>Upstream Dams Outside the Planning Area</u>

There were no dams identified upstream that would impact Dade County jurisdictions. Stockton Lake Dam is north of Dade County, but Dade County communities would not be substantially impacted if that dam were to fail as water would flow into Cedar County, not Dade County.

Strength/Magnitude/Extent

The severity/magnitude of dam failure would be similar in some cases to the impacts associated with flood events (see the flood hazard vulnerability analysis and discussion). The strength/magnitude/extent of dam failure is related to the volume of water behind the dam as well as the potential speed of onset, depth, and velocity. Note that for this reason, dam failures could flood areas outside of mapped flood hazards. None of the dams in Dade County are state regulated and therefore no inspection reports are maintained.

Previous Occurrences

There have been no recorded instances of dam failure in Dade County.

Dam failure events in Missouri include dams in Lawrenceton in 1968, Washington County in 1975, Fredericktown in 1977, and a near failure in Franklin County in 1978. The most recent example of a dam failure in Missouri happened in 2005, with the breech in the Taum Sauk reservoir dam owned by AmerenUE of St. Louis, when the stone retaining wall around a huge mountaintop reservoir around the collapsed before daybreak. A 600-foot breech in the northwest side of the retention facility released 1.5 billion galls of stored water into the Johnson Shut-Ins State Park in 10 minutes' time. The waters destroyed the park and the park Superintendent's house and swept the Superintendent's family out of their house. All five family members survived. The lower reservoir was overtopped by the flow of the east fork of the Black River. As a precautionary measure, the City of Lesterville (Reynolds County) evacuated 100- 150 people to higher ground. If the dam had failed during the summer months during the park's peak use, it is likely that many lives would have been lost. (2018 State Plan)

There was also a dam incident in Callaway County in August of 2016. Glover Spring Lake, a man-made lake created in 1956 east of Fulton overflowed after 8 inches of rain fell. Increased water levels split the dam and floodwaters rushed under a bridge on County Road 101 and into Crows Fork and Auxvasse Creeks. County Road 101 was closed to traffic after rainfall and the overflow washed away road sections on both sides of the bridge. The dam did not completely fail and there were no known injuries. No homes or farms downstream were flooded. If the dam had fully collapsed, there would have been additional damages.

Probability of Future Occurrence

Since there has been no recorded events in Dade County in the past 20 years, a calculation of a probability percent would give a 0 percent annual probability of a dam failure.

According to information from the 2018 State Plan, there were 19 dam failures and 68 incidents in a 42-year period in Missouri. This equates to an annual probability of 45% dam failure somewhere in the state and a 100% annual probability of a dam incident. However, with over 5,000 dams across the state the probability that a dam failure would occur at the significant hazard dam in Dade County is very low. If development occurs downstream of dams, then the percentage of significant or high hazard dams may increase. Additionally, the probability of dam failure may 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 greatly reduces the probability of dam failure.

Changing Future Conditions Considerations

According to the 2018 State Plan, dam failure is tied to flooding and the increased pressure that flooding has on dams. Future condition projections imply an increase in precipitation and more extreme events, which may increase flood risk and put additional stress on dams.

Vulnerability

Vulnerability Overview

The vulnerability to dam failure in Dade County is very small due to the lack of high hazard dams and limited significant hazard dams. Additionally, the dams located in Dade County have small associated water bodies and minimal downstream structures. There are no significant structures within the floodplain that may be affected in the event of a dam failure or within potential flow areas surrounding dams.

Potential Losses to Existing Development:

In the event of a dam failure in Dade County, losses would be minimal to none, because there are few structures downstream of the dams. With no inundation maps available, it can be assumed that the water in the event of a dam failure would follow the downstream topography and most affect the 100-year floodplain. As shown in **Figures 3.14 – 3.24** only one dam, the Davis Lake Dam, has a structure located on the edge of its flood plain. This is an agricultural and/or livestock structure, and the dam has been identified as a low hazard dam, meaning potential losses are minimal.

Figure 3.14. Campbell Lake Dam

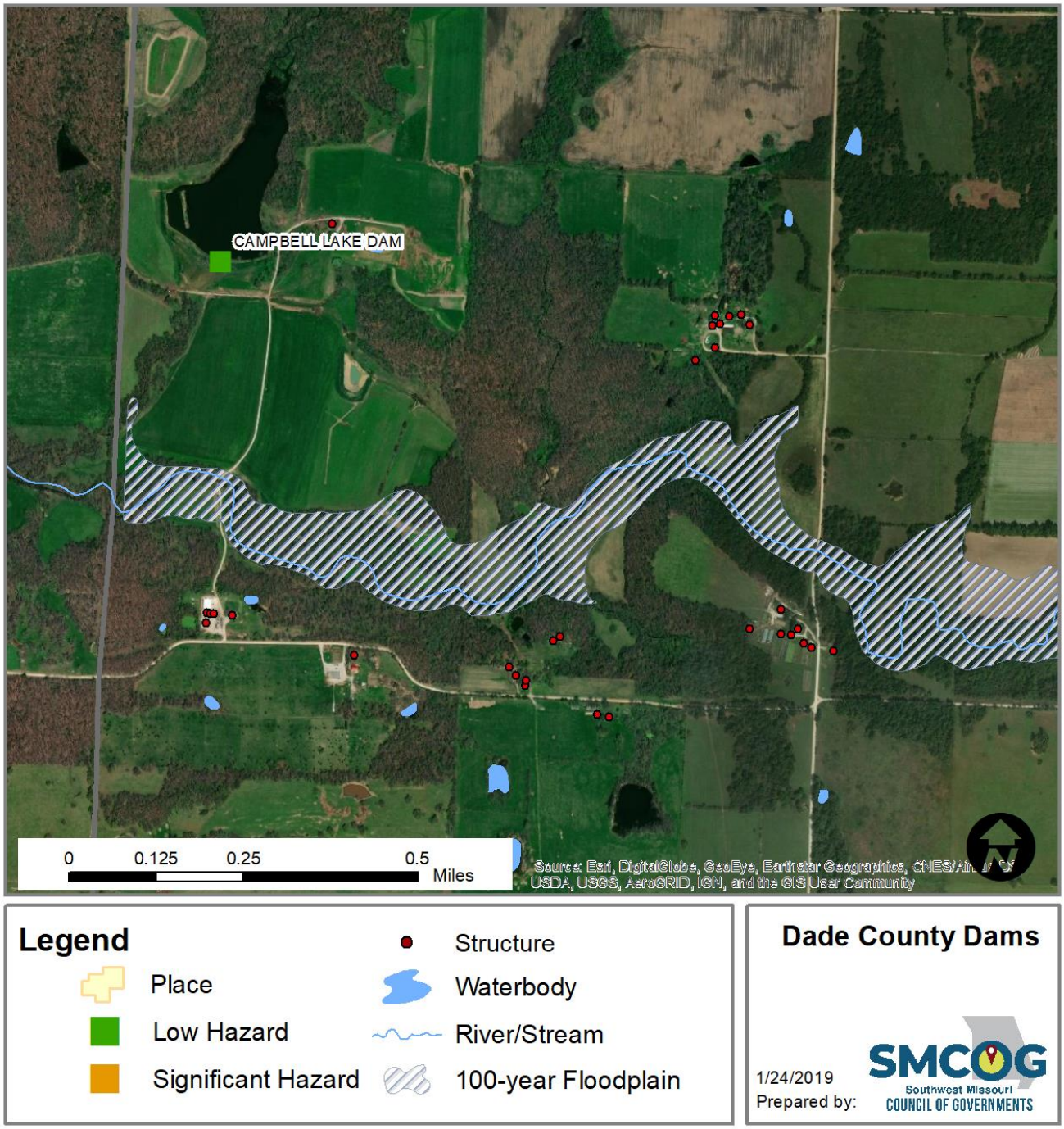


Figure 3.15. Davis Lake Dam

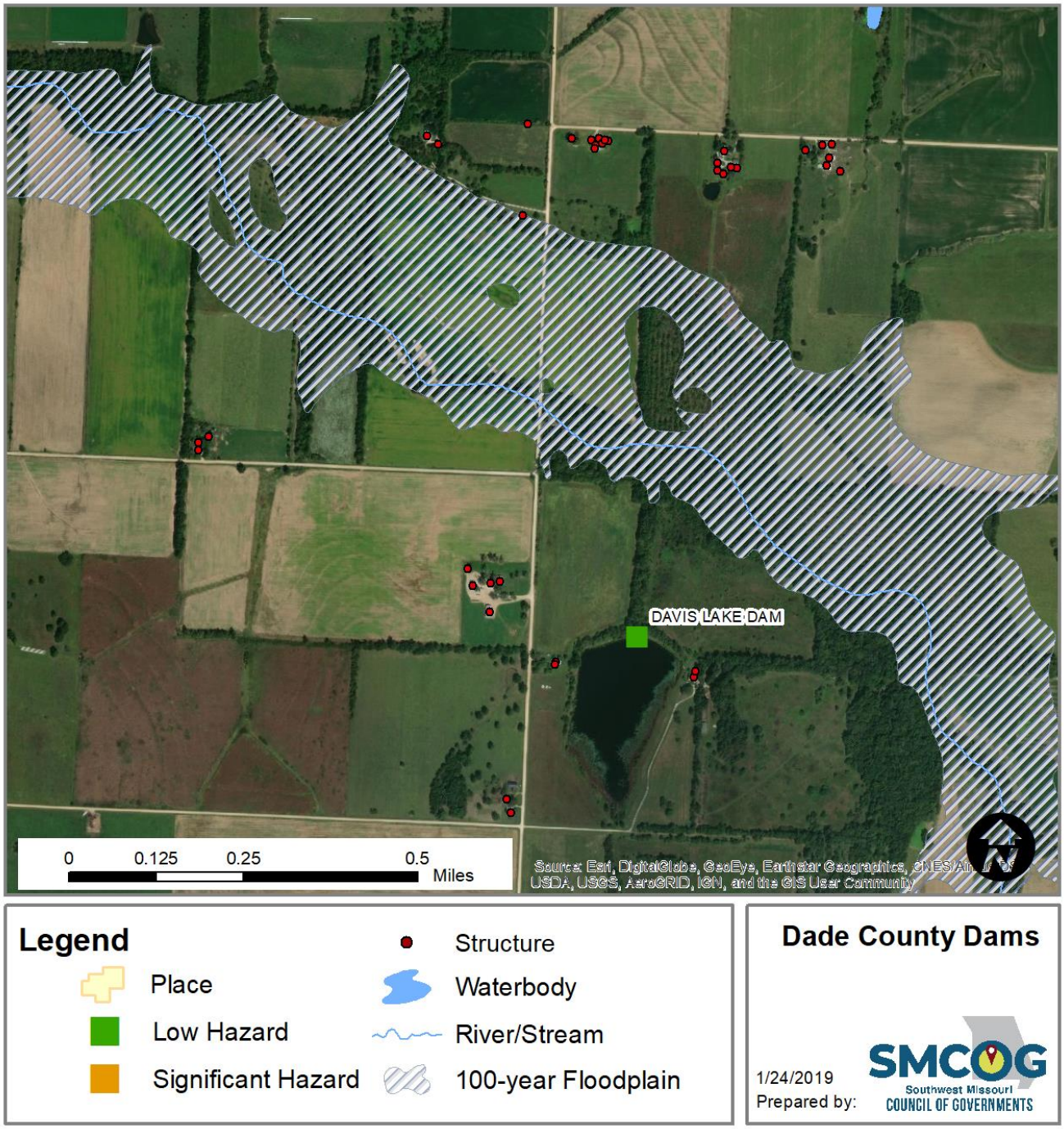


Figure 3.16. Giddings Lake Dam

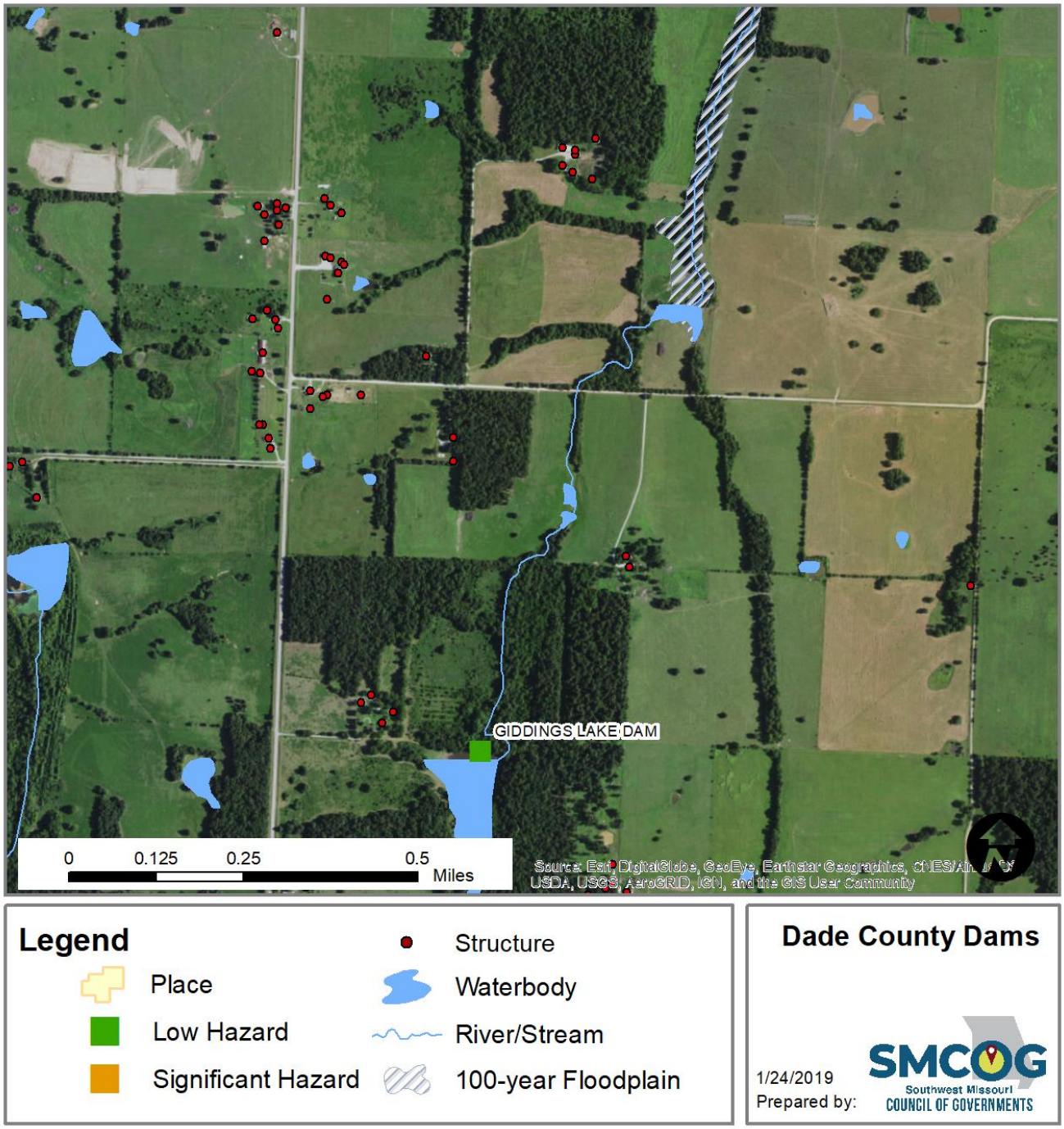


Figure 3.17. Habeyle Dam

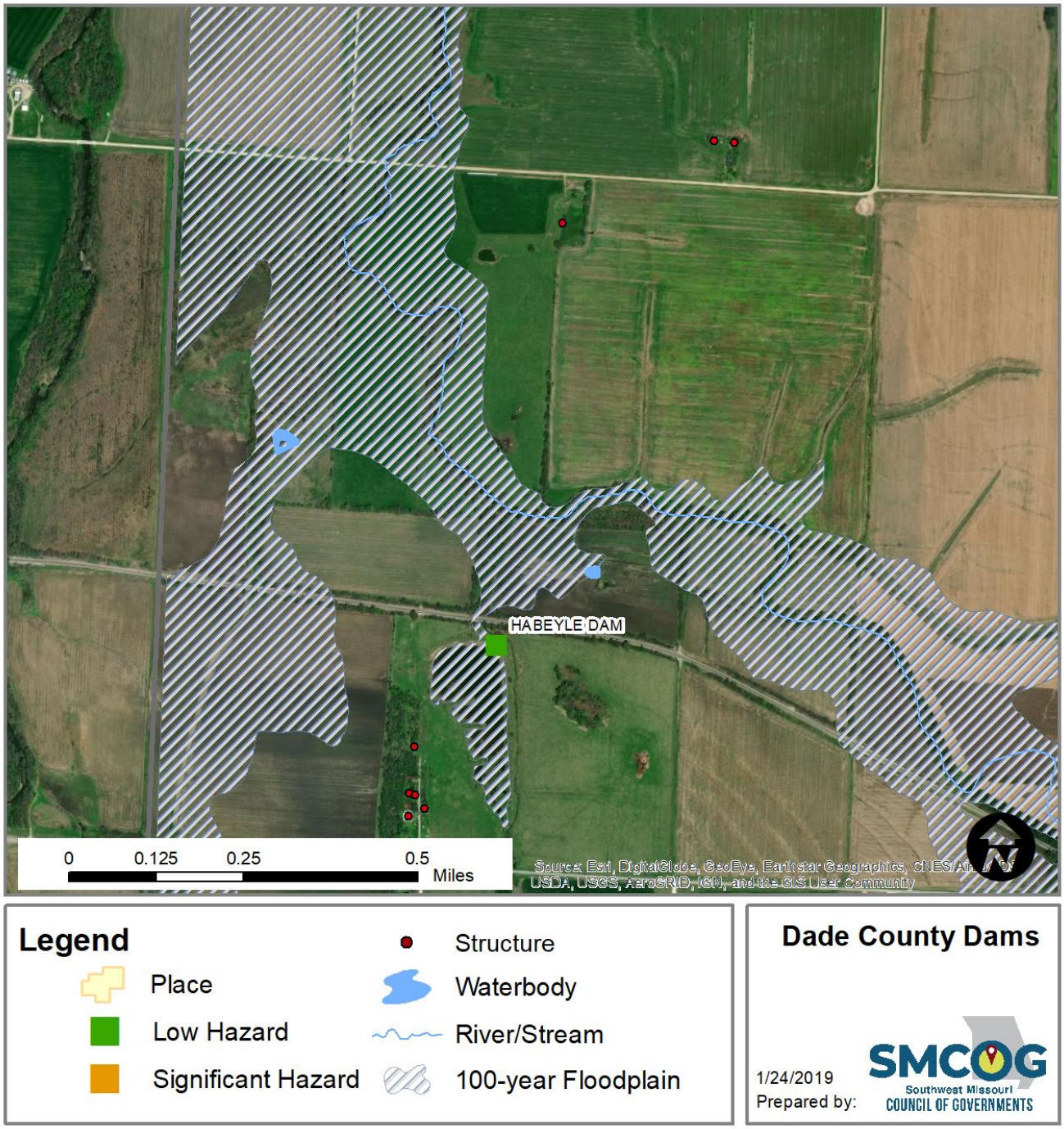


Figure 3.18. Hedeman Farms Lake Dam

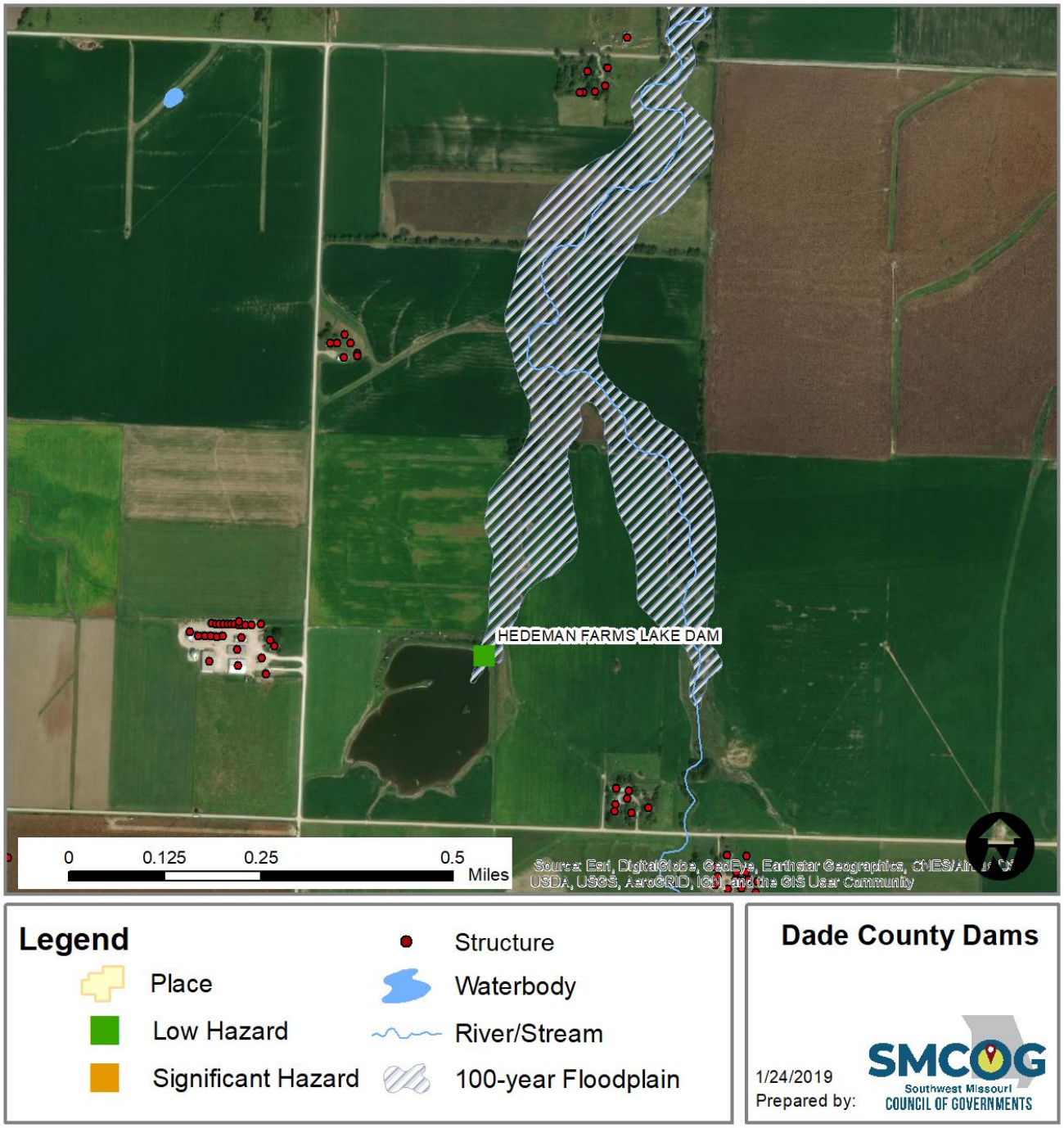


Figure 3.19. Rector Lake Dam

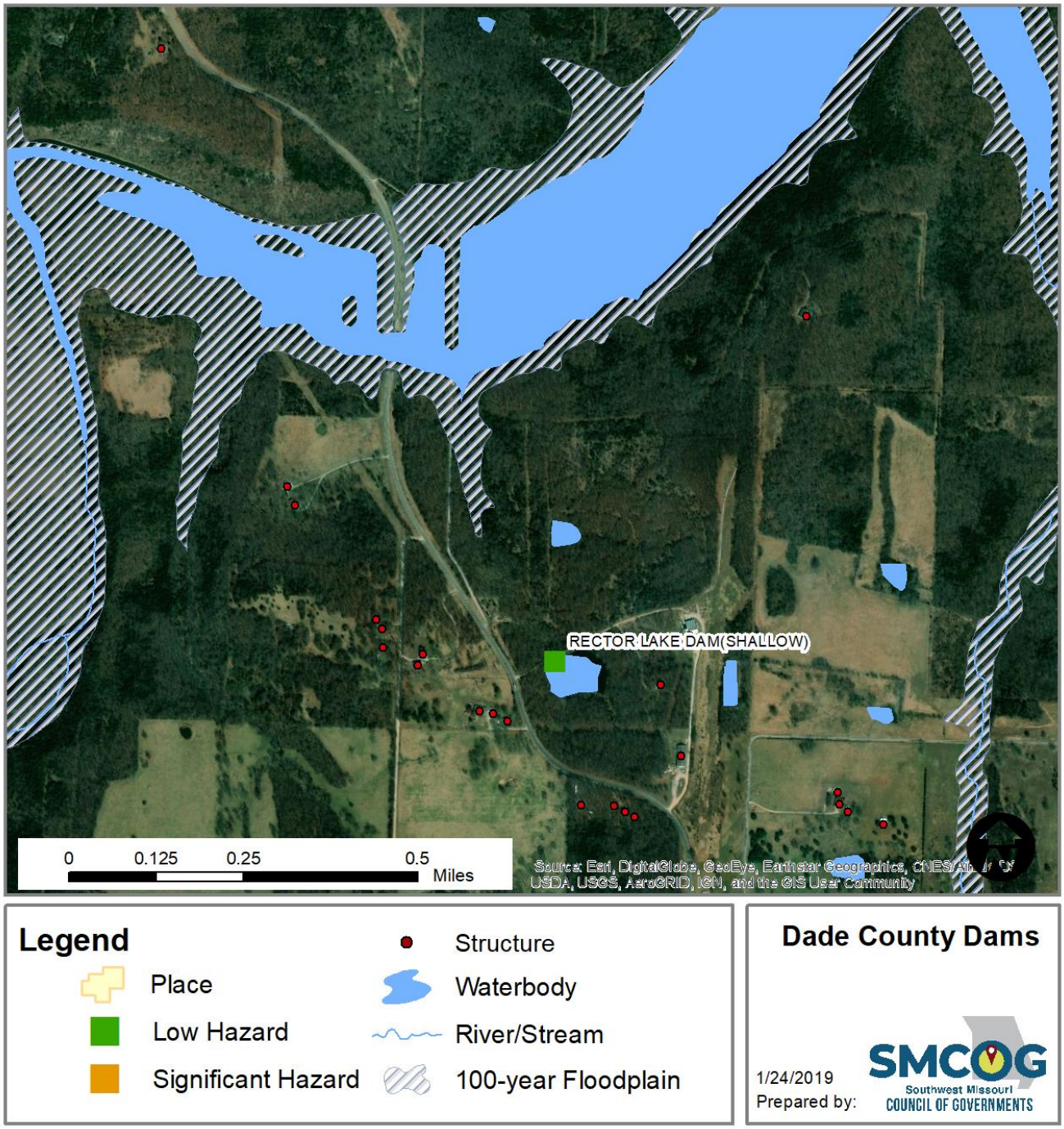


Figure 3.20. Schilling Lake Dam

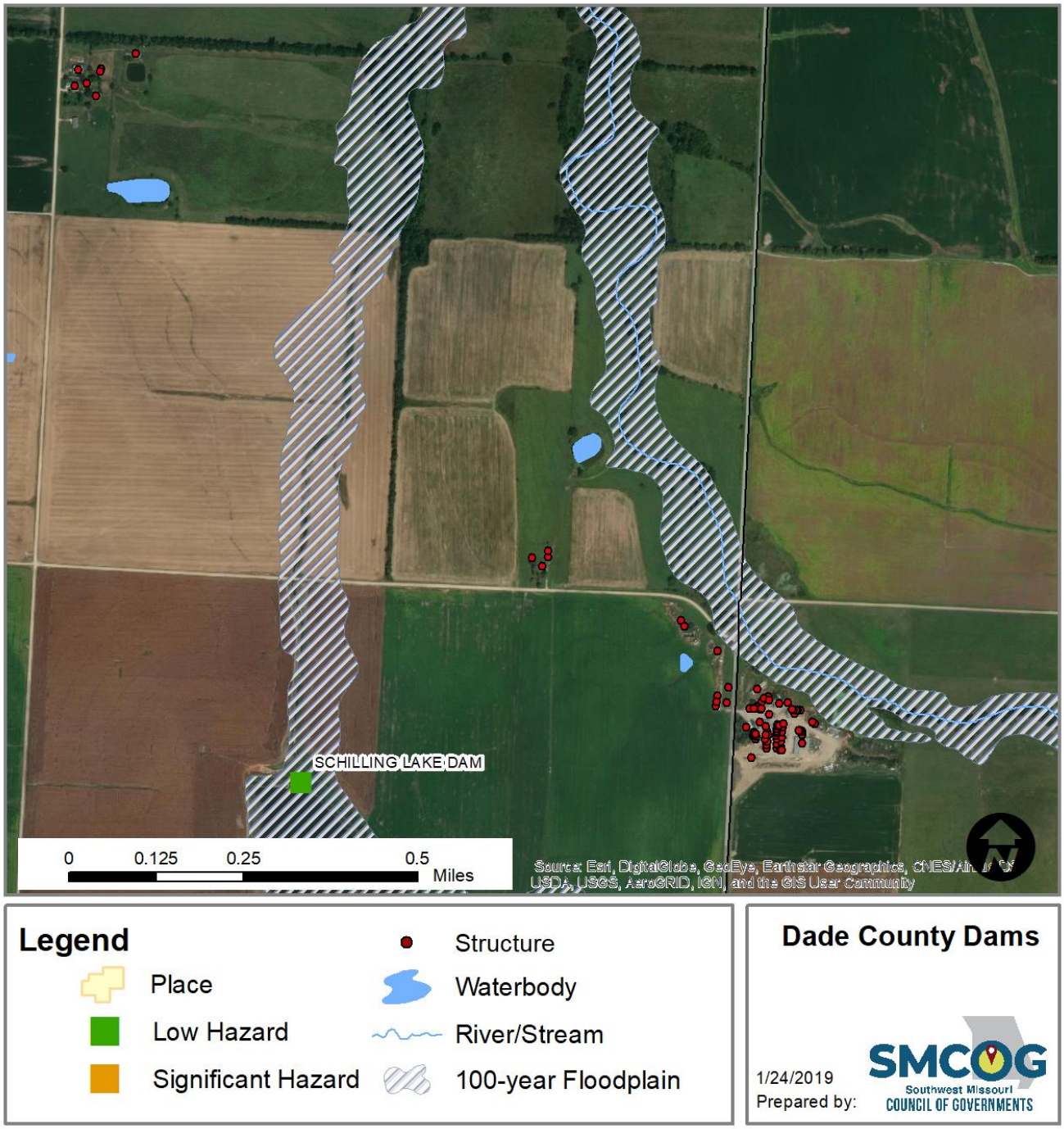


Figure 3.21. Spain Lake Dam

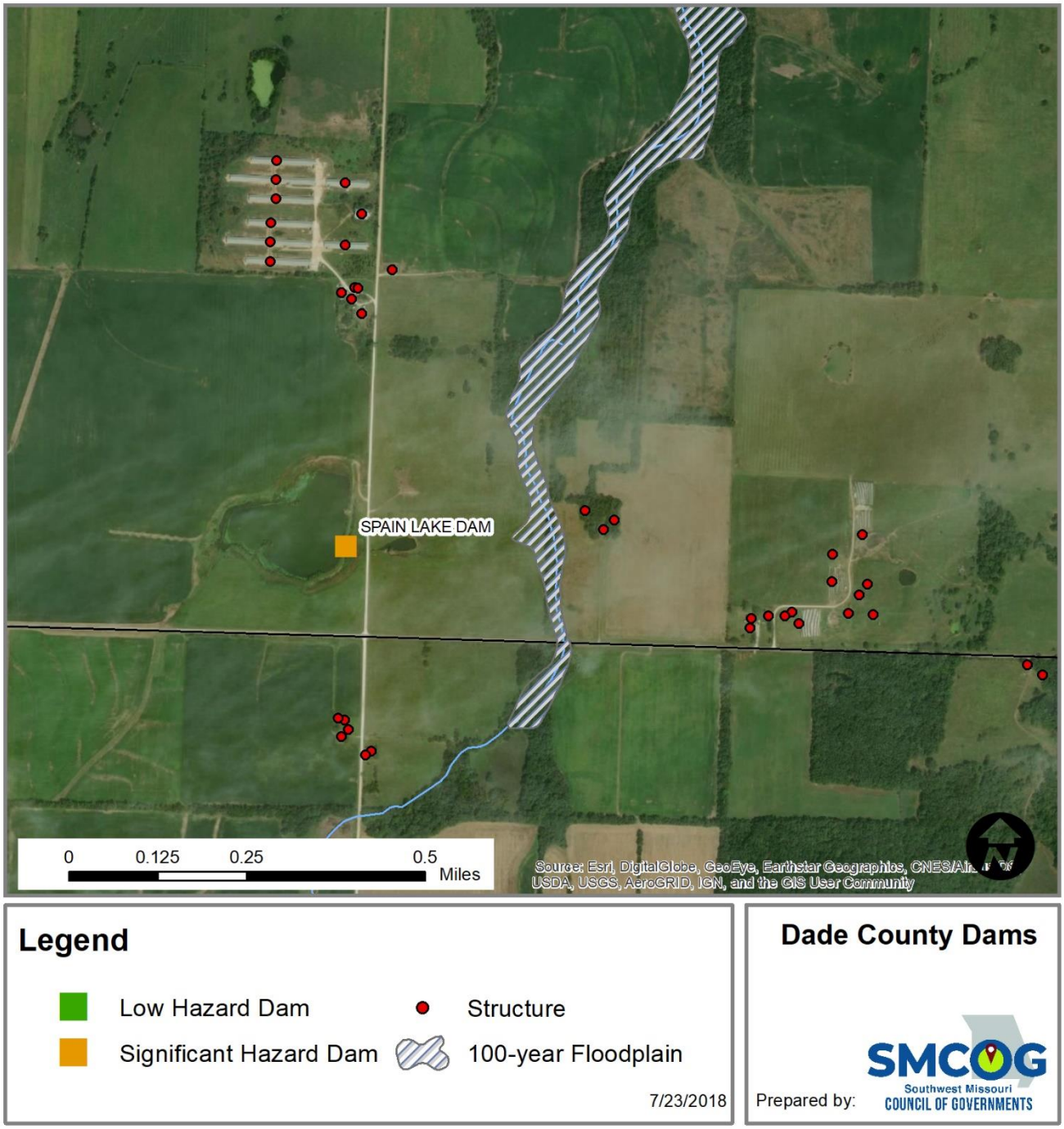


Figure 3.22. Townley Lake Dam

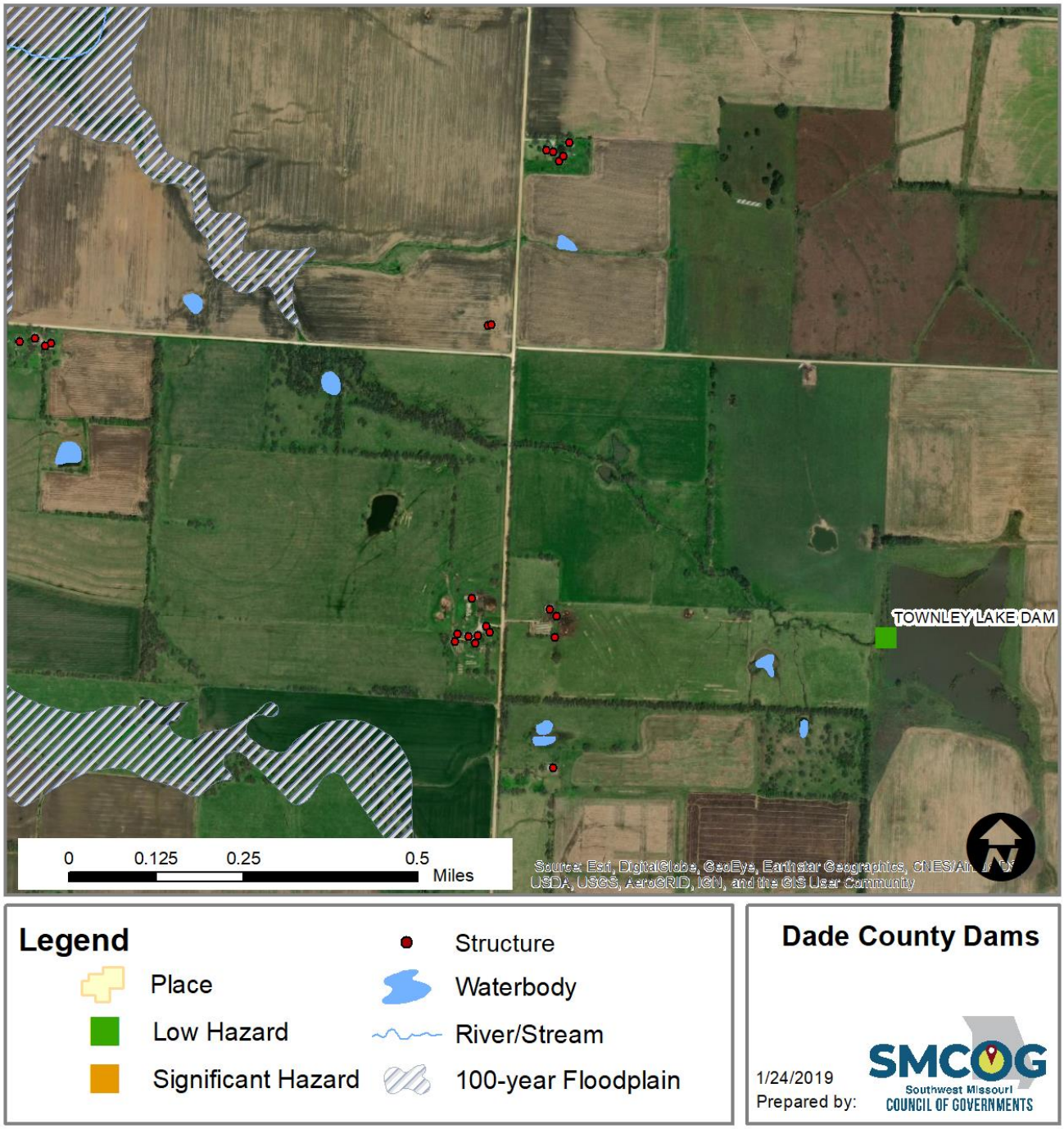


Figure 3.23. Winningham Lake Dam

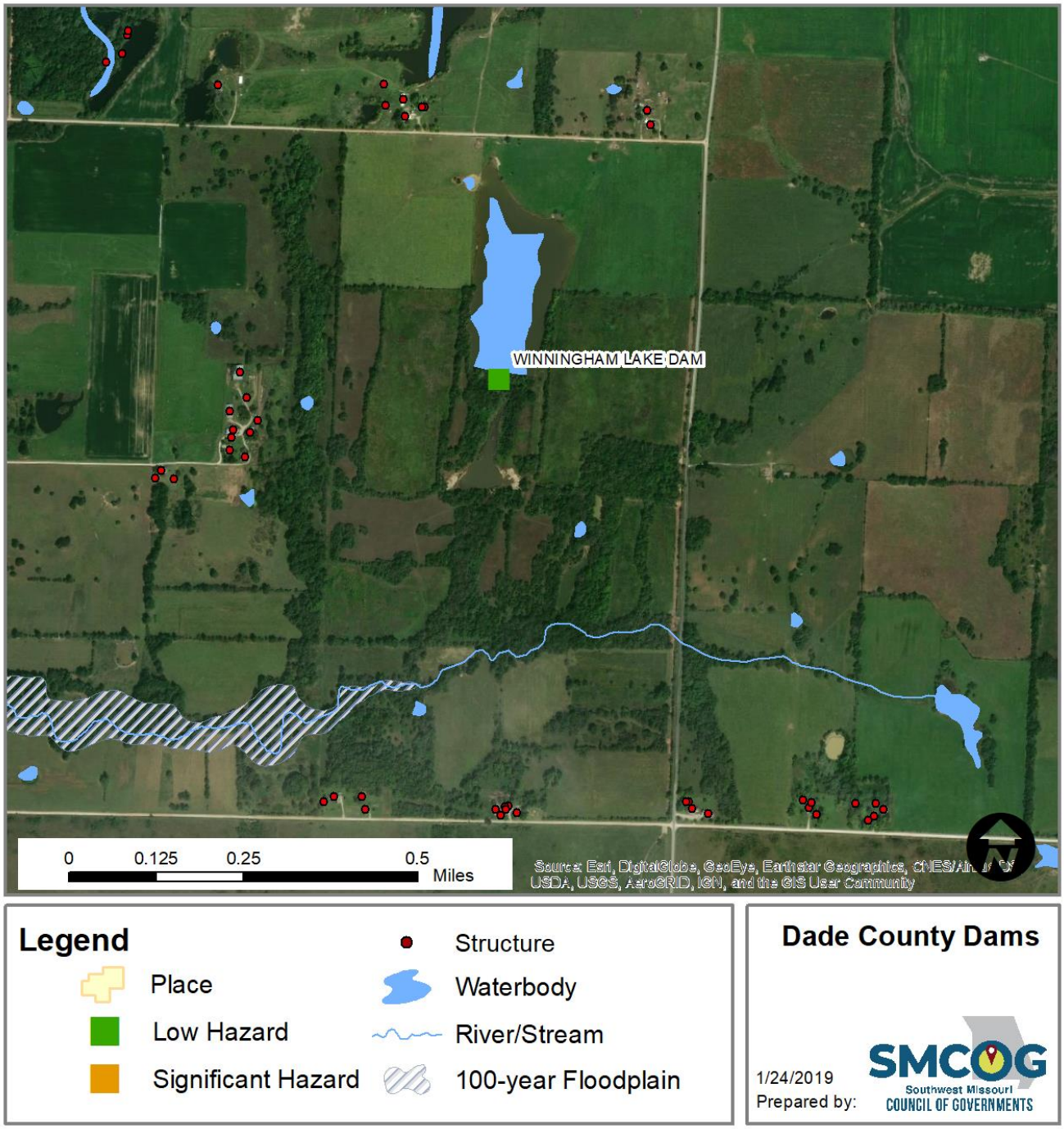
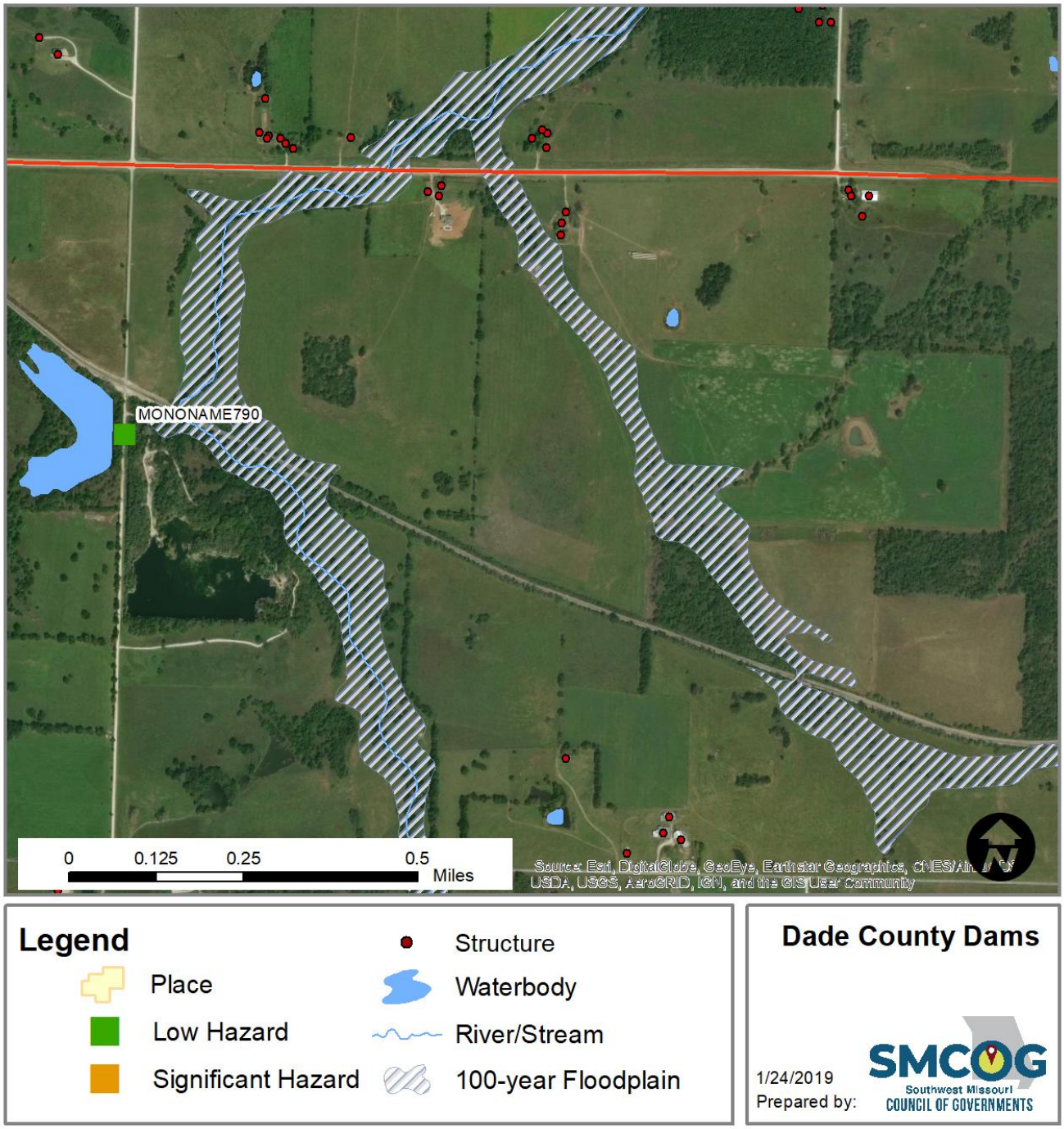


Figure 3.24. Unnamed Dam



Impact of Previous and Future Development

Any future development in Dade County that occurs in low-lying areas downstream of dams would be impacted in the event of a dam failure. However, due to the rural nature of Dade County, substantial future development in potentially affected areas is not anticipated.

Hazard Summary by Jurisdiction

No jurisdictions or school districts would suffer damages in the event of a dam failure. All potential damages would occur in unincorporated parts of the county.

Community Comments on Hazard

None of the 37 residents who completed the online survey stated that they had been impacted by dam failure. One of the respondents (3%) felt that dam failure was highly likely to impact their community in the future. Only one respondent felt that dam failure would have a catastrophic impact, though four felt dam failure would have a critical impact. Twenty-five of the 37 respondents (67.6%) said that they were not at all concerned with dam failure occurring in Dade County.

Problem Statement

There are no dams in Dade County with a high hazard potential, and only one dam with a significant hazard potential. The significant hazard rated Spain Lake Dam has no structures in the floodplain downstream. One agricultural structure is located in the floodplain downstream of a low hazard dam. No jurisdictions within the county were found to be at risk of damage due to dam failure, though several areas in unincorporated Dade County would see some slight losses in such an event.

No inspection records were reported, and it is unlikely that inspections will occur in the near future since every dam is privately owned. Educating the public on the location of dams and potential impacts could help reduce any potential negative effects. Additionally, identifying emergency access or evacuation routes that might be necessary in the event of a failure would minimize potential loss of life or injury if a dam were to fail.

3.4.3 Earthquakes

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.4, Page 3.192 https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- U.S. Seismic Hazard Map, United States Geological Survey, https://earthquake.usgs.gov/hazards/hazmaps/conterminous/2014/images/HazardMap2014_lg.jpg;
- Impact of Earthquakes on the Central USA http://www.cusec.org/documents/aar/NMSZ_CAT_PLANNING_SCENARIO.pdf
- Missouri Hazard Mitigation Viewer http://bit.ly/MoHazardMitigationPlanViewer2018 - Website

Hazard Profile

Hazard Description

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

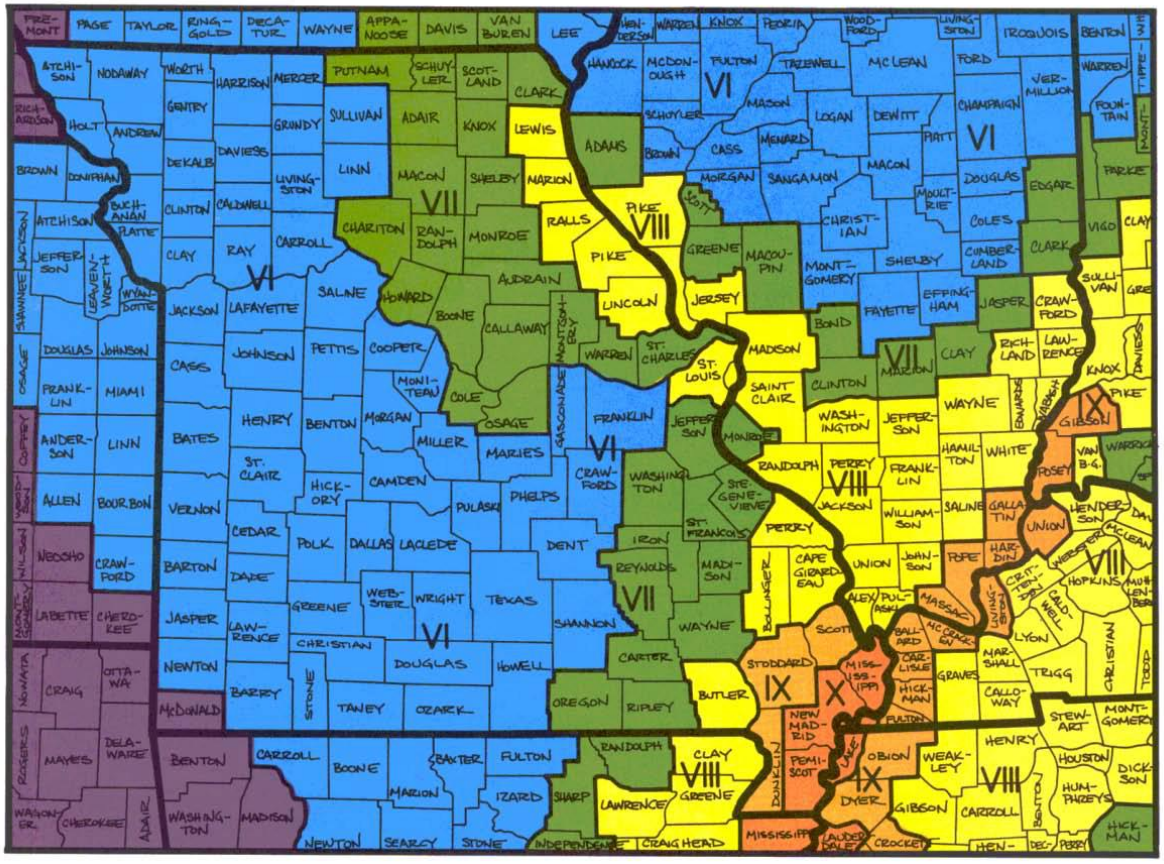
The subterranean faults were formed many millions of years ago on or near the surface of the earth. Subsequent to that time, these ancient faults subsided, while the areas adjacent were pushed up. As this fault zone (also known as a rift) lowered, sediments filled in the lower areas. Under pressure,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

Geographic Location

The greatest hazard from earthquakes in Dade County comes from the New Madrid Seismic Zone situated in the boot heel area of southeast Missouri. The potential of high magnitude earthquakes occurring along the New Madrid fault presents risk that does not vary across Dade County. The Nemaha uplift in central Kansas is also prone to seismic activity; however, the center of the Humbolt fault zone near the Nemaha Uplift is approximately 200 to 220 miles west of Dade County and produces lower magnitude seismic events.

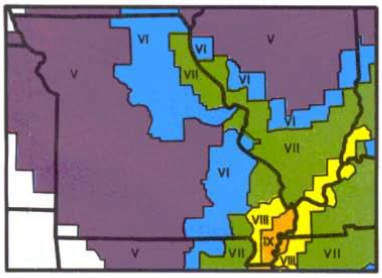
Figure 3.25 shows the highest projected Modified Mercalli intensities by county from a potential magnitude 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid Seismic Zone. The secondary maps in **Figure 3.25** show the same regional intensities for 6.7 and 9.6 earthquakes, respectively. Dade County is located in zone VI from a potential magnitude 7.6 earthquake along the New Madrid fault. Residents would feel movement, there could be minimal damage to structures, and dishes and glassware would likely be broken.

Figure 3.25. Impact Zones for Earthquake Along the New Madrid Fault



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

6.7

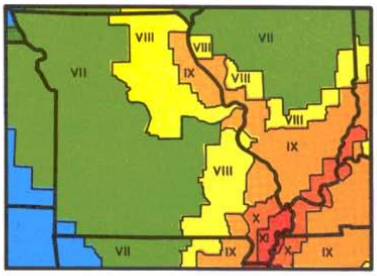


7.6

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

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

8.6

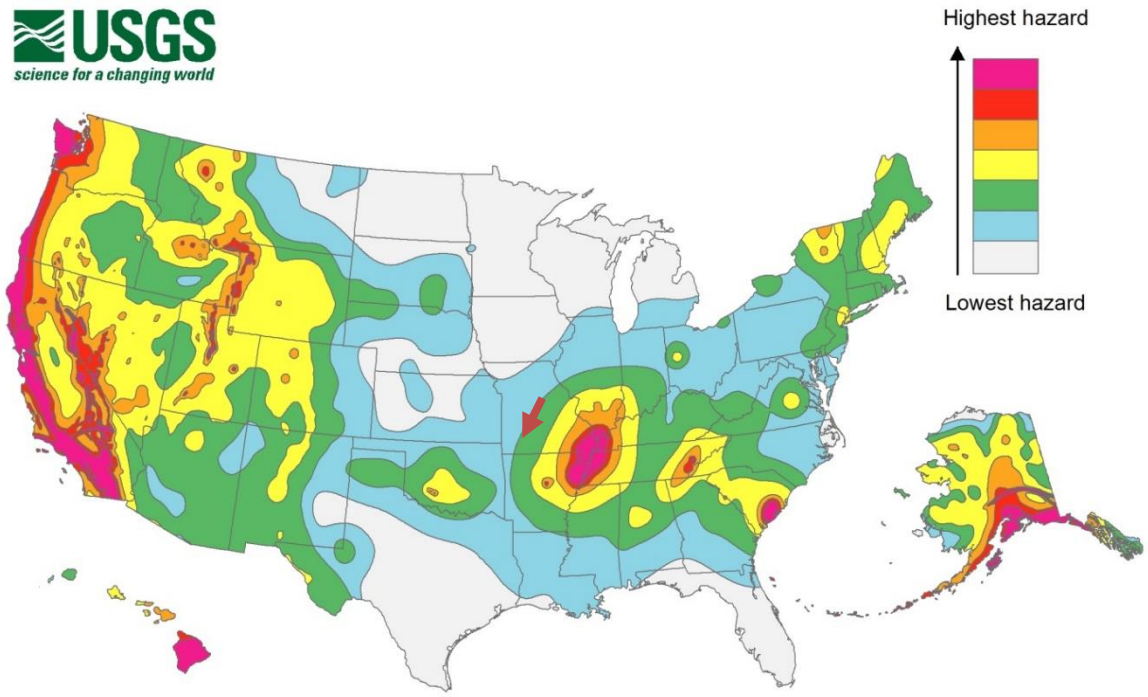


Source: https://sema.dps.mo.gov/docs/EQ_Map.pdf

The 2014 USGS National Seismic Hazard Maps display earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. The updated maps represent an assessment of the best available science in earthquake hazards and incorporate new findings on earthquake ground shaking, faults, seismicity, and geodesy. The USGS National Seismic Hazard Mapping Project developed these maps by incorporating information on potential earthquakes and associated ground shaking obtained from interaction in science and engineering workshops involving hundreds of participants, review by several science organizations and State surveys, and advice from expert panels and a Steering Committee.

Figure 3.26 illustrates seismicity in the United States. A red arrow showing the location of Dade County has been inserted on the map.

Figure 3.26. United States Seismic Hazard Map



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

Strength/Magnitude/Extent

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

Richter Magnitude Scale

The Richter Magnitude Scale was developed in 1935 as a device to compare the 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, shown below in **Table 3.26**. 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.

Table 3.26. Modified Mercalli Intensity Scale

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

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

Previous Occurrences

There is no historical record of an earthquake occurrence within Dade County. The southeastern portion of Missouri is most susceptible to earthquakes because it overlies the New Madrid Seismic Zone. Earthquake hazards in the western part of the State also exist because of the historical earthquakes in eastern Kansas and Nebraska. No area of Missouri is immune from the danger of earthquakes. Minor, but potentially damaging, earthquakes can occur anywhere in the state (SEMA, 2013).

Probability of Future Occurrence

Without a definite historical record for earthquakes in Dade County it is not possible to calculate a precise probability of earthquake occurrence. The Center for Earthquake Research and Information (CERI) at the University of Memphis has computed conditional probabilities of a magnitude 6.0 earthquake in the New Madrid seismic zone. According to a fact sheet prepared by SEMA in 2003, the probability for a magnitude 6.0 to 7.5 or greater earthquake along the New Madrid Fault is 25 to 40 percent over the next 50 years. At the 25% level, the likelihood of an earthquake happening in a given year is 1.0%. At the 40% level, the likelihood of an earthquake happening in a given year is 1.6%.

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 and most impactful earthquake risk to Dade 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 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 on the quality of construction. In addition, some underground utilities may be damaged. Some injuries may occur, but fatalities are unlikely.

Potential Losses to Existing Development

Potential losses to existing development include the total exposure for all communities. The total exposure of each jurisdiction was used to estimate losses due to a 7.6 earthquake along the New Madrid Fault. A damage factor of 0.5% was applied to each jurisdiction's total building and contents based on the expected impact for Zone VI on the modified Mercalli scale. **Table 3.27** depicts the estimated losses in each jurisdiction based on total exposure and a 0.5% damage factor.

Table 3.27. Estimated Potential Earthquake Losses

Jurisdiction	Potential Earthquake Losses
Unincorporated Dade County	$252,229
City of Everton	$7,393.75
City of Greenfield	$76,363
City of Lockwood	$92992
Village of Arcola	$2,748
South Greenfield	$15,259

Source: Dade County Assessor

Impact of Previous and Future Development

Previous development that may have been constructed without adherence to building codes may be at a greater risk of damage during an event. If future development follows building codes, it is not expected to increase the risk other than contributing to the overall exposure of what could become damaged as a result of an event. However, only the City of Greenfield and the City of Lockwood enforce building codes.

Hazard Summary by Jurisdiction

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

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

Jurisdiction	Built 1939 or earlier #	Built 1939 or earlier %
Dade County	1,020	25.8%
City of Everton	89	50.9%
City of Greenfield	239	32.8%
City of Lockwood	168	28.7%
Village of Arcola	6	10.2%
Village of South Greenfield	48	70.6%

Source: U.S. Census Bureau; 2011-2015 American Community Survey 5-Year Estimates

Unincorporated Dade County has the greatest number of structures built before 1939. The Village of South Greenfield is at the highest overall percentage risk for damage from an earthquake with the highest percentage of total structures built before 1939. South Greenfield and the County do not enforce building codes, so any new development would add to the exposure.

The City of Greenfield has 239 structures built prior to 1939. These are at higher risk for damage from an earthquake. As the community experiences a turnover in housing stock or substantial housing improvement with new building codes used for renovation, the older structures could become more resilient to a potential earthquake.

Community Comments on Hazard

None of the 37 residents who completed the online survey stated that they had been impacted by earthquakes. Twenty-one of the respondents (57%) felt that earthquakes were unlikely to impact their

community in the future. Only eight respondents felt that earthquakes would have a catastrophic impact, though nine felt that earthquakes would have a critical impact. Respondents were not concerned about earthquakes occurring in Dade County.

Problem Statement

Based on likely damage from a 7.6 magnitude earthquake along the New Madrid fault line, older, poorly built structures will suffer slight damage. The Village of South Greenfield faces the highest risk of losses due to its large rate of houses built before 1939. The City of Everton is also at great risk since half of its housing stock was also built prior to 1939. Adopting, updating, and enforcing building codes would assist in mitigating damages associated with earthquake events. Introducing public awareness programs that teach residents of the risks to older structures in earthquake events may motivate the public to support such legislation, as well as cooperate with its enforcement.

3.4.4 Land Subsidence/Sinkholes

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.5, Page 3.218
  https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- Sinkhole Fact Sheet, Missouri Department of Natural Resources
  http://www.dnr.mo.gov/geology/geosrv/envgeo/sinkholes.htm
- U.S. Sinkhole Map, U.S. Geological Survey
  http://strangesounds.org/2013/07/us-sinkhole-map-these-maps-show-that-around-40-of-the-u-s-lies-in-areas-prone-to-sinkholes.html
- Sinkhole Information Page, U.S. Geological Survey
  http://water.usgs.gov/edu/sinkholes.html
- Sinkhole Fact Sheet, U.S. Geological Survey
  http://pubs.usgs.gov/fs/2007/3060/
- Missouri Hazard Mitigation Viewer
  http://bit.ly/MoHazardMitigationPlanViewer2018 - Website

Hazard Profile

Hazard Description

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

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

In the case of sinkholes, the rock below the surface is rock that has been dissolving by circulating groundwater. As the rock dissolves, spaces and caverns form, and ultimately the land above the spaces collapse. In Missouri, sinkhole problems are usually a result of surface materials above openings into bedrock caves eroding and collapsing into the cave opening. These collapses are called “cover collapses” and geologic information can be applied to predict the general regions where collapse

will occur. Sinkholes range in size from several square yards to hundreds of acres and may be quite shallow or hundreds of feet deep.

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

Geographic Location

Dade County has concentrations of sinkholes in both its central and southeastern sections, though sinkholes are located throughout the entire county. There are no known sinkholes in northwest Dade County, though a small number of mines exist there, which heightens the risk of sinkholes in this area. **Figure 3.27** shows the locations of sinkholes and mines in Dade County. **Figure 3.28** shows a sinkhole-prone area that encroaches on the City of Everton's jurisdiction. MPC members also noted that sinkholes were known within the city limits of the City of Greenfield, although none are shown in collected map data.

Figure 3.27. Sinkholes and Underground Mines in Dade County

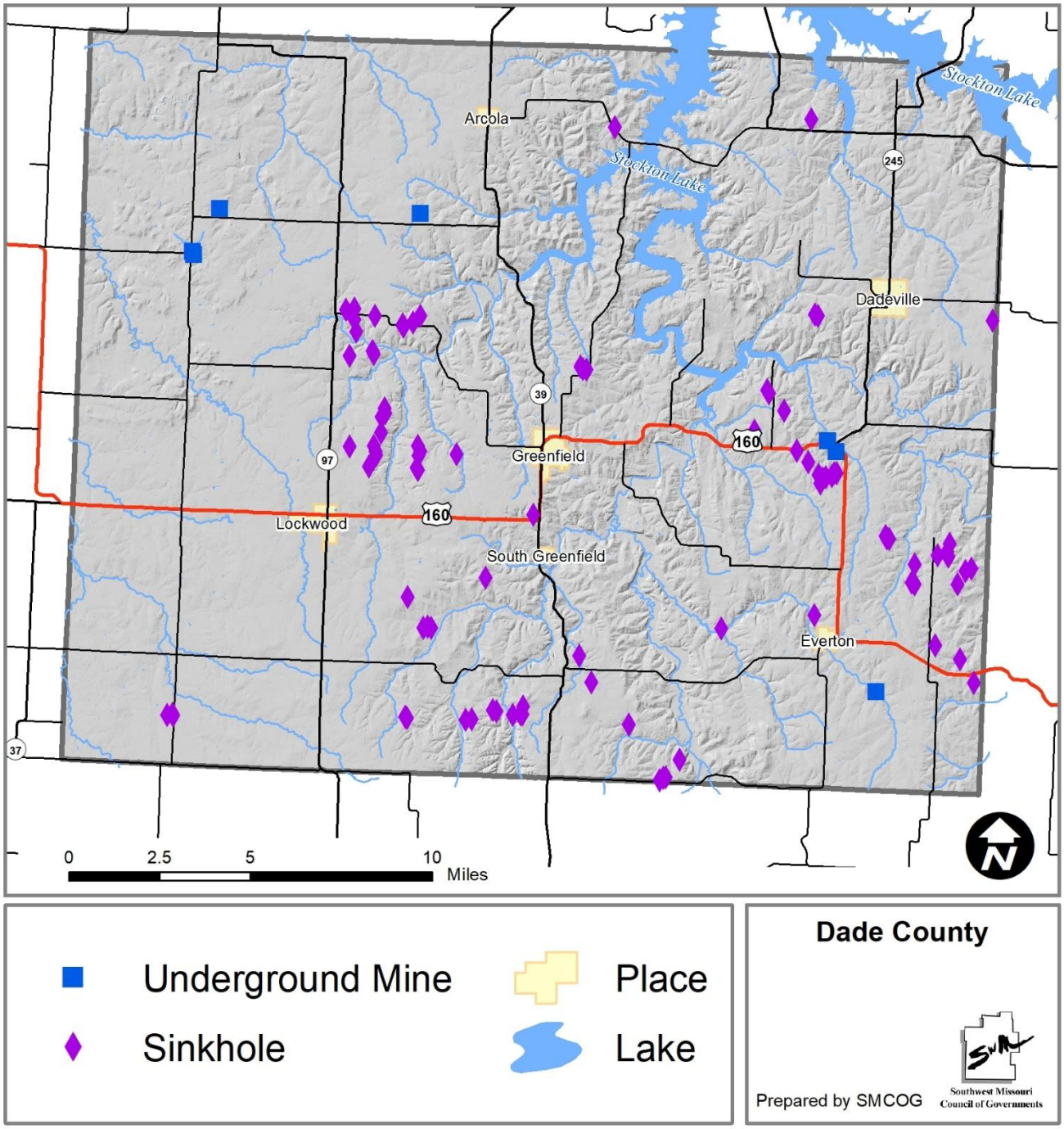
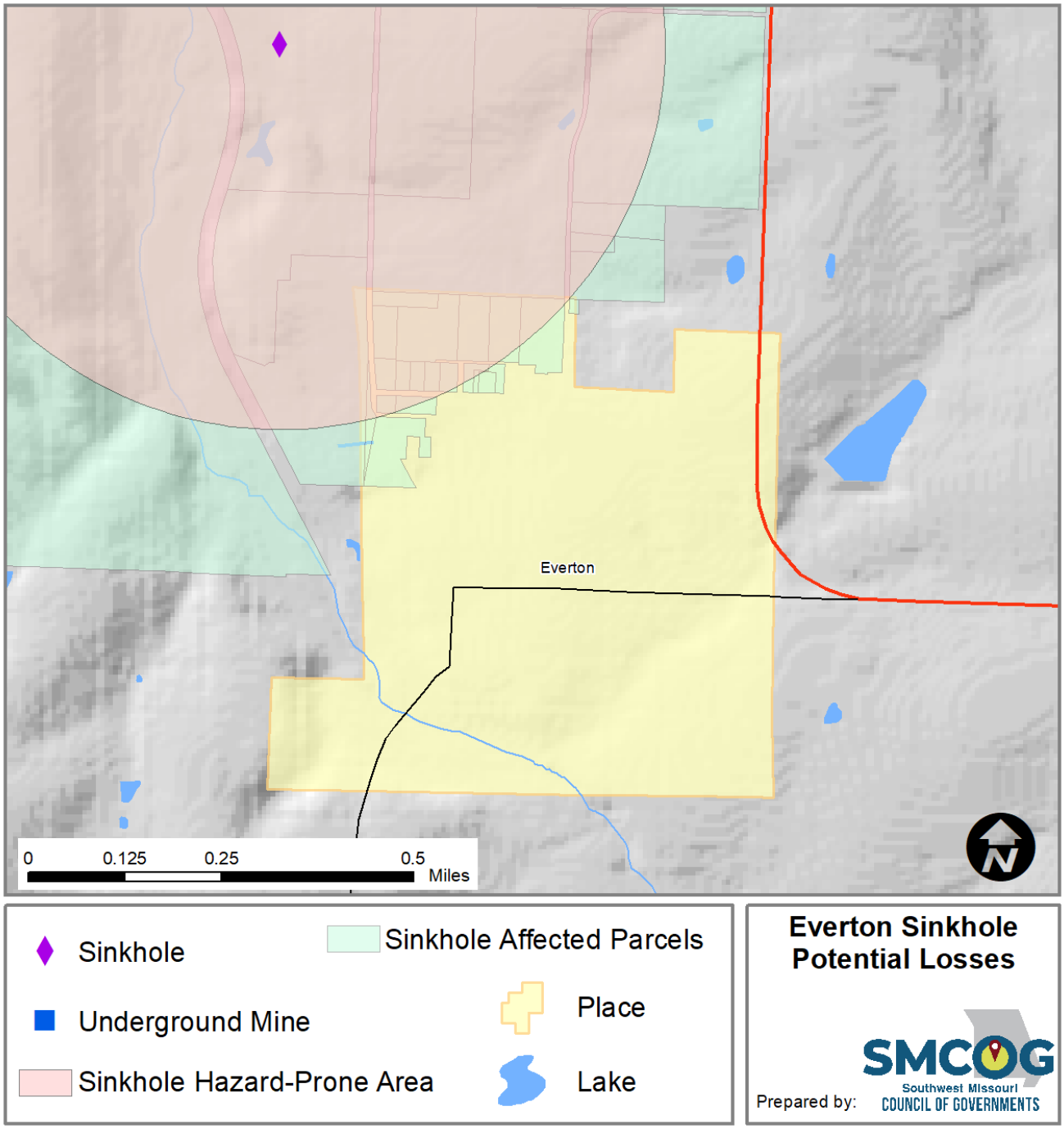


Figure 3.28. Sinkhole Hazard-Prone Area within City of Everton Boundary



Strength/Magnitude/Extent

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

studies difficult to model.

The 2018 State Plan documented several recent notable events, many in the Southwest Missouri area. However, historically sinkholes occur in areas away from development and do not cause serious damage.

Previous Occurrences

According to the 2014 Dade County NHMP, there were two occurrences of collapsed sinkholes reported to DGLS-MDNR by the public. The source for these records is unknown, however, and no data is available for sinkhole collapses since 2007. No structural damage was recorded on any of the reports. One collapse event occurred in the middle of an open field near Lockwood, and the other occurred at the base of a railroad support pier near Everton, where the base of the support had broken the underlying bedrock. Both of these events required filling of the sinkholes with foreign materials. The railroad sinkhole was filled with approximately eight yards of concrete, while the open field sinkhole was filled with large rock and debris, and then graded fully after stabilization of the sinkhole walls. As noted in the next section, there appears to have been several more sinkhole appearances since the last collection of data, though details regarding exact locations, descriptions of the events, and remedies have not been reported.

Probability of Future Occurrence

In the previous plan, it was noted that 85 sinkholes had been reported prior to 2007. The most recent data from 2014 reveals that the number of reported sinkholes increased to 96. Based on the reported number of sinkholes between 1898 and 2014, there is a 71 percent risk of sinkhole appearances in Dade County in any given year. When focusing on more recent history, however, the appearance of 11 sinkholes in only 7 years suggests that sinkhole occurrences are increasing in frequency. There is currently no data available that details sinkhole occurrences by year for a specific location, meaning only generalized predictions can be made concerning the probability of future occurrences.

Changing Future Conditions Considerations

Changes in climate conditions could increase the number of sinkhole occurrences throughout Dade County. Drought periods can reduce groundwater levels, making the sediments within a sinkhole prone hazard area dry and unstable. Severe storms triggered by drought could bring torrential rainfall that washes out the supporting sediments, undercutting the ground and creating conditions conducive to sinkhole formation.

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 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. A large portion of Dade County is underlain by both dolomite and limestone.

According to the 2018 Missouri State Hazard Mitigation Plan, Dade County rated low-medium on the sinkholes per county rating values. This category is comprised of counties that contain between 1 and 200 sinkholes.

Potential Losses to Existing Development

Sinkhole loss estimates were established using GIS processes and appraised valuations. A sinkhole point shapefile acquired from MDNR was used to generate a half-mile buffer around each sinkhole. The buffer layer was designated as the hazard-prone areas for sinkholes. The map layer of the sinkhole hazard-prone areas was used as an overlay on the parcel data to generate the loss estimates from this hazard by jurisdiction.

Existing structure data was also used to determine which parcels contained structures that fell within the sinkhole hazard-prone area. The data presented was extracted solely from these select parcels. The only jurisdiction that contains a sinkhole hazard-prone area within its boundaries is the City of Everton; all other sinkhole hazard-prone areas lie outside of city and village limits and fall under the jurisdiction of Dade County. **Table 3.29** provides the building count by type and by jurisdiction based on the results of the sinkhole analysis. **Table 3.30** provides a dollar amount for total exposure by jurisdiction and estimated losses. To calculate the losses a damage factor of 0.5% was applied to the total exposure.

Table 3.29. Sinkhole Exposure by Building Type by Affected Jurisdiction

Jurisdiction	Residential	Commercial	Agriculture	Building Count
Unincorporated Dade County	225	6	229	460
City of Everton	13	1	0	14
Total	238	7	229	474

Table 3.30. Total Sinkhole Exposure and Estimated Losses by Affected Jurisdiction

Jurisdiction	Residential	Commercial	Agriculture	Estimated Exposure	Estimated Loss
Unincorporated Dade County	$3,228,400	$84,690	$539,390	$3,852,480	$19,262.40
City of Everton	$107,080	$24,580	$0	$131,660	$658.30
Total	**$3,335,480**	**$109,270**	**$539,390**	**$3,984,140**	**$19,920.70**

Impact of Previous and Future Development

Development has taken place in the majority of the county's sinkhole prone areas. Almost every half-mile buffer surrounding a sinkhole contains numerous structures, though they mostly consist of agricultural buildings. Future development will pose an even greater threat. Currently, Dade County has no land use control ordinances, which allows unregulated development in potentially hazardous tracts of land. Unrestrained development could agitate the land and result in more sinkholes.

Hazard Summary by Jurisdiction

Though Dade County has a moderate number of existing sinkholes, most lie outside city limits and fall under the jurisdiction of the county. As stated previously, many of the hazard zones associated with these sinkholes envelop existing structures and have the potential to harm life and property. One sinkhole prone area overlaps with the city of Everton's limits. This zone contains several small parcels within northwestern section of the city. These properties are located on the outer edge of a half-mile buffer; while the threat is not eminent, the risk of a sinkhole occurrence in that area is relatively high.

Community Comments on Hazard

MPC members reported that a sinkhole has appeared along Garnet Street in Greenfield. The data used in this report's sinkhole analysis does not identify this area as a sinkhole prone hazard area, though it has not been updated since 2014. It is likely that many more sinkholes have occurred since the data was last collected.

Problem Statement

It is likely that more sinkholes will occur as development increases 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. Jurisdictions may adopt regulations prohibiting construction at least 30 feet from known sinkholes. Undeveloped land that is in a sinkhole risk area can be used for park space or other recreational purposes. Additionally, jurisdictions can utilize public awareness campaigns about sinkholes and risks associated with developing in prone areas. Maps of sinkholes and prone areas should be available to members of the public.

3.4.5 Drought

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.6, Page 3.235 https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- National Drought Mitigation Center (NDMC) located at the University of Nebraska in Lincoln, http://www.drought.unl.edu/
- Recorded low precipitation, NOAA Regional Climate Center, http://www.hprcc.unl.edu
- Water shortages, Missouri's Drought Response Plan, Missouri Department of Natural Resources, http://dnr.mo.gov/pubs/WR69.pdf
- MoDNR, Drought News, Conditions and Resources https://dnr.mo.gov/drought.htm
- Populations served by groundwater by county, USGS-NWIS, http://maps.waterdata.usgs.gov/mapper/index.html
- Census of Agriculture, http://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Missouri/
- USDA Risk Management Agency, Insurance Claims, https://www.rma.usda.gov/data/cause
- Natural Resources Defense Council, http://www.nrdc.org/globalWarming/watersustainability/

Hazard Profile

Hazard Description

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

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

conditions that result in deficiencies of precipitation are highly variable from region to region.

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

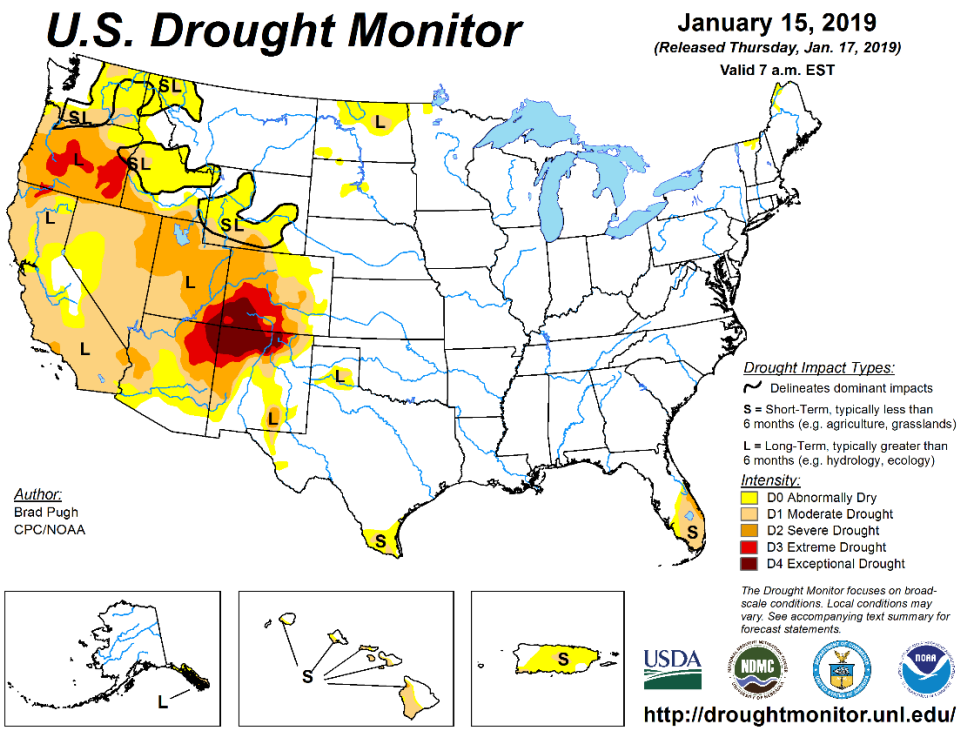
- Agricultural drought focus is on soil moisture deficiencies, differences between actual and potential evaporation, reduced ground water or reservoir levels, etc. Plant demand for water depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and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

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

Geographic Location

Droughts are regional climatic events that can impact large areas and multiple counties. The entire county is at risk to the impacts of drought. However, drought most directly impacts the agricultural sector, so areas within the county where there is extensive agricultural land use can experience significant impacts. The major agricultural activity in the county is livestock which accounts for 52% of sales. Due to the density of livestock in the region, an extreme drought can have a devastating effect. **Figure 3.29**. is a recent map from the U.S. Drought Monitor. At this snapshot in time, no parts of Missouri were in a drought. However, just a month earlier this map would have looked different.

Figure 3.29. U.S. Drought Monitor Map of Missouri on January 15, 2019



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

Strength/Magnitude/Extent

The most commonly used indicator of drought and drought severity is the Palmer Drought Severity Index (PDSI), jointly published by the NOAA and the United States Department of Agriculture. The Palmer Drought Indices measure dryness based on recent precipitation and temperature. The indices are based on a "supply-and-demand model" of soil moisture. Calculation of supply is relatively straightforward, using temperature and the amount of moisture in the soil. However, demand is more complicated as it depends on a variety of factors, such as evapotranspiration and recharge rates. These rates are harder to calculate. Palmer tried to overcome these difficulties by developing an algorithm that approximated these rates and based the algorithm on the most readily available data — precipitation and temperature.

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

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

Previous Occurrences

The NCEI storm events database includes 13 drought events occurring in Dade County from 1999 through 2018. Many of these were multiple reports from persistent drought events that lasted several months. The NCEI reports indicate that there were five distinct drought periods during the 26-year

timeframe. Much of Missouri experienced drought conditions during the summer of 2018, resulting in a declared state of emergency for many counties. While Dade County suffered from very near-drought conditions, it did not meet the requirements to be declared a drought-affected county. **Table 3.31** provides a summary of the recorded events from 1999-2018.

Table 3.31. Previous Drought Occurrences 1999-2018

Drought Year	Months	Property Damage	Crop Damage
1999	October	$0	$20,000
2000	August - September	$0	$0
2006	January - April	$0	$0
2011	October-November	$0	$0
2012	July - October	$600,000	$1,710,000

Source: NCEI Storm Events Database https://www.ncdc.noaa.gov/stormevents/

According to the USDA cause of loss historical data files, there were 27 insurance payments for crop loss over the past four years. **Table 3.32** provides details on past insurance payments.

Table 3.32. Insurance Payments by Year Because of Drought 2015-2018

Year	Insurance Payments	Total Cost
2018	18	$672,670.84
2017	6	$277,719.00
2016	5	$98,943
2015	0	$0

Source: USDA Cause of Loss Historical Data Files http://www.rma.usda.gov/data/cause.html

Probability of Future Occurrence

Over the 20-year record period, Dade County was in a drought for 13 months. There is a total of 240 months in the record period. Based on the number of months of drought and the total number of months in the record period, there is a 5.4% probability of drought occurrence in the county in any given month. Although drought is not predictable, long-range outlooks and predicted impacts of climate change could indicate an increased chance of drought persistence and severity.

Changing Future Conditions Considerations

Drought frequently affects Missouri, including Dade County. Increasing temperatures due to a changing climate will inevitably accelerate evaporation rates and increase the frequency of droughts. It can be expected that rivers and groundwater reserves will experience significant reductions in available water with the increasing severity and frequency of droughts. It may be necessary in the future to restrict water usage in Dade County, which would mainly affect the county's agriculture industry and would diminish residents' quality of life.

Vulnerability

Vulnerability Overview

Southwest Missouri has moderate drought susceptibility. Groundwater resources are adequate to meet domestic and municipal water needs, but due to required well depths, irrigation wells are very expensive. The topography is generally unsuitable for row-crop irrigation. During extended time periods without precipitation, municipal water sources may be at risk for contamination as the concentration of natural minerals, such as lead, will increase with low water levels.

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.

According to data from the USDA Risk Management Agency, there was $718,265.06 in insured crop loss payments in Dade County in the years of 2015-2018. Therefore, it is probably that future droughts will result in crop losses. There are no anticipated structural losses.

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 and increase waste water discharge, adding additional strain on water 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. Although communities with wells are susceptible to water shortages due to groundwater reduction, other communities with no source are more at risk to extreme water shortages in the event of a drought. School districts would be the least impacted by drought; however, those districts in communities with single source wells or none at all may experience water shortages prior to those in larger communities. Special districts, such as Dade County R4 Rural Fire Protection District, would feel impacts in the form of increased risk for wildfire and reduced fire-fighting water sources. Communities with waste water treatment facilities, such as Everton, would be impacted by low water levels that could limit the amount of effluent that could be discharged.

Community Comments on Hazard

Six of the 37 residents who completed the online survey stated that they had been impacted by drought. Twenty-six of the respondents (70%) felt that drought was highly likely to impact their community in the future. Fifteen respondents felt that drought would have a catastrophic impact, while 21 felt drought would have a critical impact. Respondents were very concerned about drought affecting their communities.

MPC members reported that wells in South Greenfield drawing from the Jefferson City Sands aquifer were drying up, likely due to increased crop irrigation during drought conditions. It was also noted that with decreasing water levels, there was increasing lead concentrations in drinking water which was becoming an issue.

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 actions to mitigate the impact of drought would be for communities to develop public information campaigns regarding water conservation techniques and measures and provide notification mechanisms for community members to know when drought conditions may occur. Some methods may include restrict the use of public water resources for non-essential usage, such as landscaping, washing cars, filling swimming pools, etc. during extreme drought periods. School and special districts can also implement water conservation measures at all district facilities as well. Additionally, Dade County should encourage the use of drought-resistant farming practices to help reduce the negative impacts on crops and municipal drinking water supplies.

3.4.6 Extreme Temperatures

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.7, Page 3.253 https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- National Centers for Environmental Information, Storm Events Database, http://www.NCEI.noaa.gov/stormevents/
- Heat Index Chart & typical health impacts from heat, National Weather Service; National Weather Service Heat Index Program, https://www.weather.gov/safety/heat-index
- Wind chill chart, National Weather Service, http://www.nws.noaa.gov/om/cold/wind_chill.shtml;
- Daily temperatures averages and extremes, High Plains Regional Climate Summary, http://climod.unl.edu/ ;
- Hyperthermia mortality, Missouri; Missouri Department of Health and Senior Service, http://health.mo.gov/living/healthcondiseases/hyperthermia/pdf/hyper1.pdf;
- Hyperthermia mortality by Geographic area, Missouri Department of Health and Senior Services, http://health.mo.gov/living/healthcondiseases/hyperthermia/pdf/hyper2.pdf

Hazard Profile

Hazard Description

Extreme temperature events, both hot and cold, can impact human health and mortality, natural ecosystems, agriculture, and other economic sectors. According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index chart shown in **Figure 3.30** 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 for ice jams on flat rivers or streams. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is hazardous to health and safety.

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

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

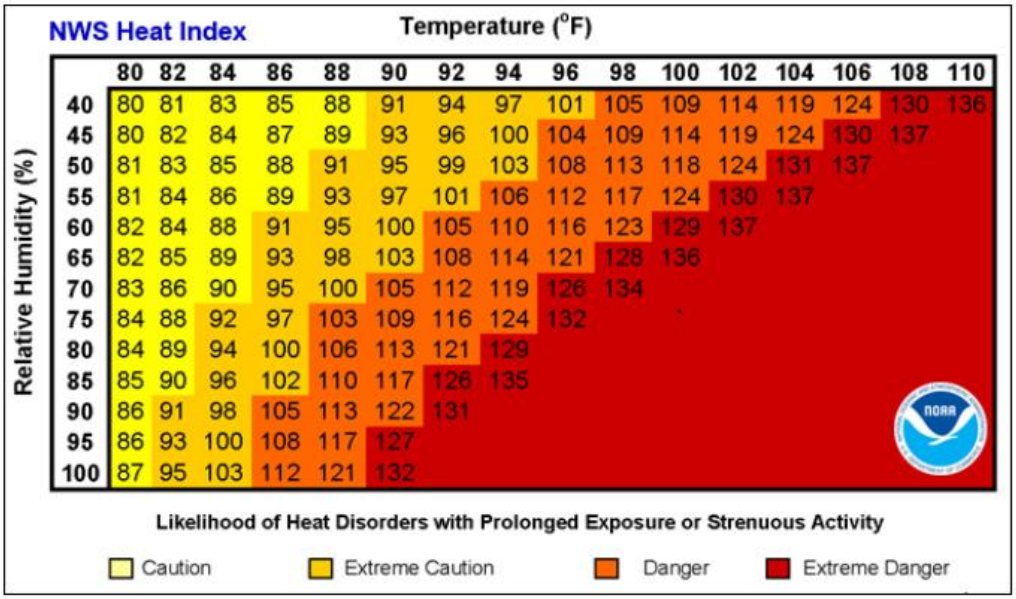
Geographic Location

Extreme temperatures are an area wide hazard event, and the risk of extreme temperatures does not vary across Dade County.

Strength/Magnitude/Extent

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

Figure 3.30. Heat Index (HI) Chart

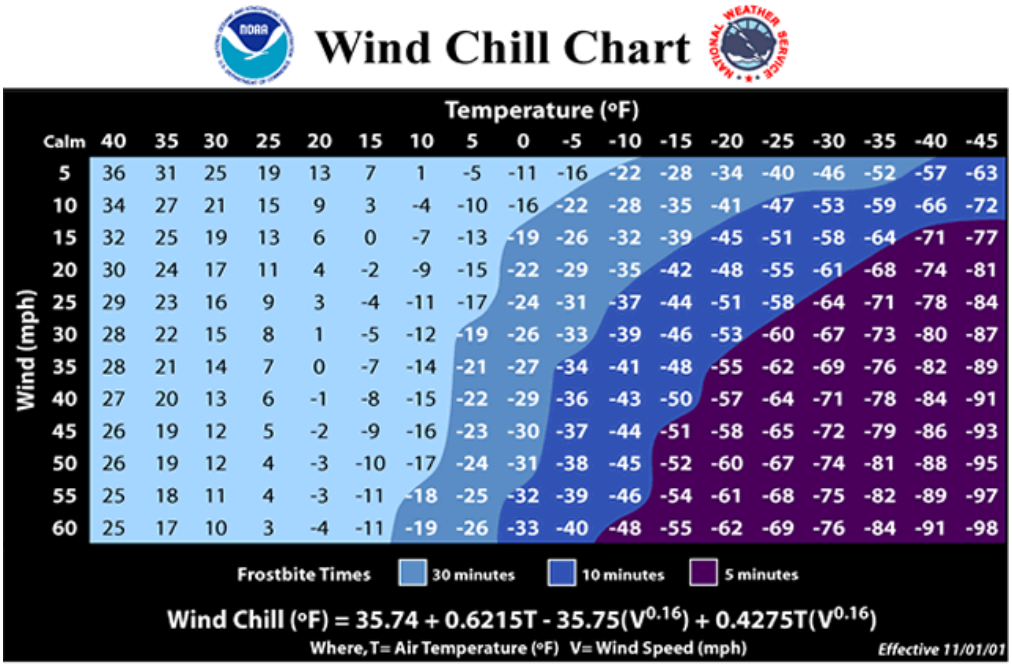


Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	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: National Weather Service (NWS); https://www.weather.gov/safety/heat-index
Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. The shaded zone above 105°F corresponds to a HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

The NWS Wind Chill Temperature (WCT) index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from winter winds and freezing temperatures. **Figure 3.31** 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 3.31. Wind Chill Chart



Wind Chill Chart

Wind (mph) \ Temperature (°F)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
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

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

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

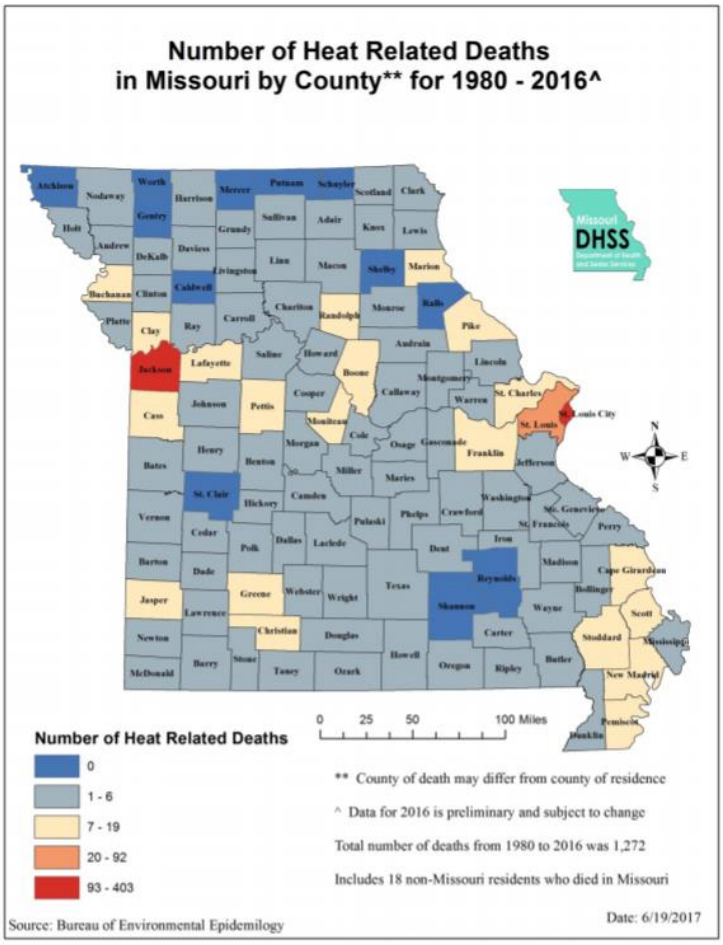
Previous Occurrences

There were nine (9) recorded extreme heat events in the National Centers for Environmental Information (NCEI) database from 1999 to 2018 for Dade County. There was one reported death and no injuries or property/crop damage associated with these events. The event narratives describe fatalities that occurred during regional multi-county heat events for other nearby counties as well. Extreme heat events in Dade County were recorded in consecutive months in four separate years from 1999 to 2018. The months for each year are summarized as follows:

- **1999** – July & August
- **2000** – August & September
- **2001** – July & August
- **2012** – June, July & August

Figure 3.32 is a map created by The Missouri Department of Health and Senior Services (DHSS) for heat related fatalities by county. The map indicates that there have been between one (1) and three (3) heat related fatalities in Dade County from 2000 to 2013.

Figure 3.32. Heat Related Deaths in Missouri 2000 - 2016



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

There were two (2) recorded extreme cold events in the National Centers for Environmental Information (NCEI) database from 1999 to 2018 for Dade County. The two events were concurrent with each other and lasted from December 2000 through January 2001. There were zero reported deaths and no injuries, or property and crop damage associated with these events.

Probability of Future Occurrence

Since there were four years with extreme heat events in a 20-year span, the probability that an extreme heat event will occur in Dade County in any given year is 20%, or once every four years.

There was only one period of extreme cold in Dade County over the past 20 years, which makes the probability of extreme cold occurring in any given year 5%.

The events recorded in the NCEI database describe extreme heat as prolonged periods where temperatures rose above at least 10° above normal for at least 12 consecutive days, and extreme cold as prolonged periods where the temperature was at least 10° below normal for at least 12 consecutive days. Heat and cold advisories and warnings are issued for shorter periods of extreme heat and cold nearly every year and may not meet the threshold for consecutive days in the NCEI database. This data limitation indicates that extreme temperature events may be underreported in the NCEI.

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 most likely exceed historical record levels by the middle of the 21st century. For example, in southern Missouri, the annual maximum number of consecutive days with temperatures exceeding 95 degrees F is projected to increase by up to 20 days. Temperature increases will cause future heat waves to be more intense, a concern for this region which already experiences hot and humid conditions. If the warming trend 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. 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 on public recreational facilities, utility systems, and healthcare centers. Improving energy efficiency in public buildings will also present an increasingly valuable savings potential.

Vulnerability

Vulnerability Overview

High humidity, which often accompanies heat in Missouri, can make the effects of heat even more harmful. While heat-related illness and death can occur from exposure to intense heat in just one afternoon, heat stress on the body has a cumulative effect. Consequently, the persistence of a heat wave increases the threat to public health. The people most at risk are children under five years of age and adults over the age of 65, as well as people who work outdoors. The agriculture sector can also suffer crop loss during periods of extreme heat. Extreme heat may also cause buckling of roads.

Table 3.33 lists typical symptoms and health impacts due to exposure to extreme heat.

Table 3.33. Typical Health Impacts of Extreme Heat

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

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

Potential Losses to Existing Development

Based on information in the 2018 Plan, Dade County has a low medium chance of experiencing both extreme heat and extreme cold every year. Dade County also is expected to have one to three heat related deaths over the next 13 years. Some crop or agricultural losses may also be expected, but amounts are difficult to estimate.

Impact of Previous and Future Development

Population growth can result in increases in the age-groups that are most vulnerable to extreme temperatures. Population growth also increases the strain on electricity infrastructure, as more electricity is needed to accommodate the growing population. Arcola has the largest percentage of population under 5 years of age and over 65. However, the county overall has high numbers of both at risk groups. Dade County, as a whole, has experienced a slight population decline in the last five years, and it is expected to continue into the future.

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 3.34** below summarizes vulnerable populations in the participating jurisdictions. Note that school and special districts are not included in the table because students and those working for the special districts are not customarily in these age groups.

Table 3.34. Dade County Population Under Age 5 and Over Age 65, 2010 Census Data

Jurisdiction	Population Under 5 yrs	Population 65 yrs and over	Percent of Total Population
Dade County	406	1,617	25.7%
Arcola	3	25	51%
Everton	25	61	23.8%
Greenfield	79	327	29.7%
Lockwood	42	230	29.1%
South Greenfield	2	16	20%

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

Schools in the county have proper air-conditioning and heating and follow proper procedures in the event of extreme temperatures. However, daycare and eldercare facilities may be at risk of heat related injuries if facilities are not properly cooled.

Community Comments on Hazard

The community survey only surveyed respondents about extreme heat. Extreme cold was included in the Severe Winter Weather portion of the survey. None of the 37 residents who completed the online survey stated that they had been impacted by extreme heat. Twenty of the respondents (30%) felt that extreme heat was highly likely to impact their community in the future. Only nine respondents felt that extreme heat would have a catastrophic impact, though 27 felt extreme heat would have a critical impact. Respondents were relatively concerned with how extreme heat would impact their community.

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 temperatures due to a lack of air conditioning or heating in their homes. Institutionalized populations, such as those living in nursing homes, become more vulnerable to extreme temperatures 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. Partnering with local

public, especially to those who have young children or are over the age of 65. Partnering with local community organizations to continue to donate fans and offer weatherization programs would mitigate the impact on vulnerable populations in the county. Additionally, backup generators should be installed in critical facilities, especially those housing vulnerable populations, to ensure property heating and cooling during extreme temperature events.

3.4.7 Severe Thunderstorms Including High Winds, Hail, and Lightning

Some Specific Sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.8, Page 3.280 https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- FEMA 320, Taking Shelter from the Storm, 3rd edition, http://www.weather.gov/media/bis/FEMA_SafeRoom.pdf
- Lightning Map, National Weather Service, http://www.vaisala.com/en/products/thunderstormandlightningdetectionsystems/Pages/NLDN.aspx
- Death and injury statistics from lightning strikes, National Weather Service.
- Wind Zones in the U.S. map, FEMA, https://www.fema.gov/pdf/library/ism2_s1.pdf ;
- Annual Windstorm Probability (65+knots) map U.S. 1980-1994, NSSL, http://www.nssl.noaa.gov/users/brooks/public_html/bigwind.gif
- Hailstorm intensity scale, The Tornado and Storm Research Organization (TORRO), http://www.torro.org.uk/site/hscale.php;
- NCEI data;
- USDA Risk Management Agency, Insurance Claims, https://www.rma.usda.gov/data/cause

National Severe Storms Laboratory – hail map, http://www.nssl.noaa.gov/users/brooks/public_html/bighail.gif

Hazard Profile

Hazard Description

Thunderstorms

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

High Winds

A severe thunderstorm can produce winds causing as much damage as a weak tornado. The damaging winds of thunderstorms include downbursts, microbursts, and straight-line winds. Downbursts are

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

Lightning

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

Hail

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

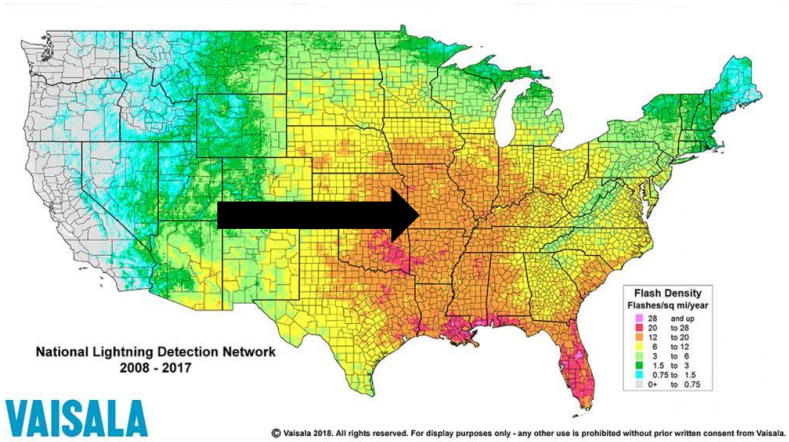
At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a ¼" diameter or pea sized hail requires updrafts of 24 miles per hour, while a 2 ¾" diameter or baseball sized hail requires an updraft of 81 miles per hour. According to the NOAA, the largest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

Geographic Location

Thunderstorms, high winds, hail, lightning events are an area-wide hazard that can happen anywhere in Dade County. Although these events occur similarly throughout the County, they are more frequently reported in the urbanized areas. In addition, damages are more likely to occur in more densely developed areas.

Figure 3.33 shows lightning frequency in the United States. Marked with a black arrow, Dade County is located in an area with an average flash density of 12-20.

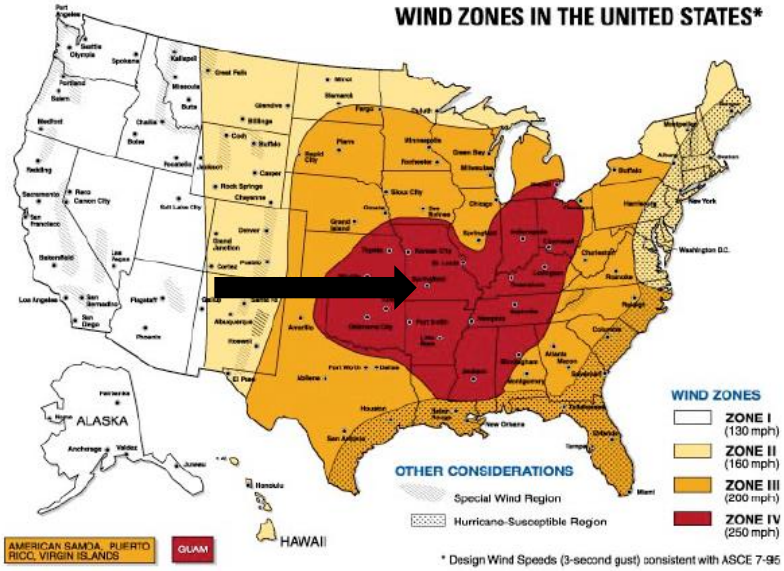
Figure 3.33. Location and Frequency of Lightning in Missouri



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

Figure 3.34 shows wind zones in the United States. Dade County is marked with a black arrow and lies in Zone IV, the zone with the highest possible wind speeds in the country.

Figure 3.34. Wind Zones in the United States



Source: FEMA 320, Taking Shelter from the Storm, 3rd edition, https://www.fema.gov/pdf/library/ism2_s1.pdf

Strength/Magnitude/Extent

Based on information provided by the Tornado and Storm Research Organization (TORRO), **Table 3.35** below describes typical damage impacts of the various sizes of hail.

Table 3.35. Tornado and Storm Research Organization Hailstorm Intensity Scale

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

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

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

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

Previous Occurrences

There were a total of 141 events in this hazard from 1999-2018.

Thunderstorm Winds

Location	# of Events
Unincorporated Dade County	20
Circola (2/28/2012)	
Crisp (8/8/2015)	
Dadeville (8/1/2003), (7/23/2005), (6/3/2008), (9/7/2012)	
Emmet (8/4/2012), (3/6/2017)	
Ernest (7/20/2013)	
Hulstan (2/27/2011), (8/4/2012), (7/19/2018)	
Kings Point (7/26/2008)	
Meinert (5/8/2009), (5/24/2011)	
Neola (8/19/2009)	
Pennsboro (7/26/2008)	
Roark Bluff Park (6/1/2001)	
Seybert (6/11/2012)	

Sylvania (6/3/2008)	
Village of Arcola	3
Citywide (6/3/2001), (8/3/2003), (5/23/2018)	
City of Everton	6
Citywide (7/1/1999), (4/6/2003), (8/4/2005), (9/28/2005), (5/3/2006), (3/6/2017)	
City of Greenfield	23
Citywide (7/6/1999), (5/27/2000), (9/11/2000), (5/20/2001), (6/1/2001), (10/9/2001), (5/8/2002), (5/13/2003), (6/25/2003), (11/27/2005), (4/23/2006), (6/3/2008), (5/13/2009), (6/10/2009), (8/15/2010), (9/15/2010), (6/18/2011), (5/28/2012), (5/19/2013), (7/8/2014), (10/2/2014), (3/1/2017), (7/19/2018)	
City of Lockwood	21
Citywide (8/12/1999), (4/20/2000), (5/8/2000), (4/11/2001), (4/22/2001), (5/6/2001), (5/6/2003), (9/6/2003), (5/27/2004), (9/28/2005), (4/2/2006), (7/10/2006), (6/3/2008), (8/15/2010), (6/18/2011), (9/7/2012), (4/13/2014), (7/8/2014), (5/19/2017), (10/21/2017), (8/16/2018)	
Village of South Greenfield	3
Citywide (8/15/2010), (6/18/2011), (9/7/2012)	

Hail

Unincorporated Dade County	29
Bona (8/19/2002), (3/27/2010), (2/27/2011), (4/3/2014)	
Cedarville (5/10/2007), (4/29/2012)	
Circola (2/27/2011), (5/12/2011)	
Dadeville (4/23/2000), (4/2/2001), (5/30/2004)	
Emmet (9/17/2014), (4/4/2017), (5/27/2017)	
Ernest (5/12/2011)	
Hulstan (3/10/2010), (4/3/2014), (5/26/2014), (5/27/2017)	
Meinert (5/31/2008)	
Neola (4/2/2001)	
Pennsboro (12/3/1999), (8/29/2001), (5/1/2003), (3/11/2006), (4/13/2012)	
Pilgrim (3/10/2010), (5/27/2017)	
Sylvania (8/8/2012)	
Village of Arcola	4
Citywide (5/4/2003), (4/22/2004), (5/27/2004), (9/18/2005)	
City of Everton	5
Citywide (3/26/2000), (6/3/2001), (3/15/2002), (5/1/2003), (8/4/2005)	
City of Greenfield	26
Citywide (2/11/1999), (6/7/1999), (7/6/1999), (5/6/2001), (9/7/2001), (5/8/2002), (5/12/2002), (8/19/2002), (4/6/2003), (5/1/2003), (7/12/2003), (8/1/2003), (8/3/2003), (3/29/2004), (6/9/2005), (11/5/2005), (3/11/2006), (5/3/2006), (6/30/2009), (3/10/2010), (6/2/2010), (5/12/2011), (2/28/2012), (3/25/2015), (5/27/2017), (5/19/2018)	
City of Lockwood	18
Citywide (12/3/1999), (4/15/2001), (5/12/2002), (3/12/2003), (4/6/2003), (7/11/2003), (7/12/2003), (4/23/2004), (5/23/2004), (5/30/2004), (3/11/2006), (6/4/2006), (4/23/2008), (6/11/2012), (4/13/2014), (3/25/2015), (4/21/2015), (5/27/2017)	
Village of South Greenfield	1
Citywide (4/22/2011)	

High Winds

Dade County	3
Countywide (5/13/2003), (9/14/2008), (4/3/2011)	

Lightning

Unincorporated Dade County	1
Pennsboro (9/17/2011)	

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

The tables below (**Table 3.36 through Table 3.38**) summarize past crop damages as indicated by crop insurance claims. The tables illustrate the magnitude of the impact on the planning area's agricultural economy.

Table 3.36. Crop Insurance Claims Paid in Dade County from Thunderstorms, 2014-2018.

Crop Year	Crop Name	Cause of Loss Description	Insurance Paid
2014	Wheat/Soybeans	Excess Moisture/Precipitation/Rain	$167,692.80
2015	Wheat/Corn/Soybeans	Excess Moisture/Precipitation/Rain	$842,599.42
2016	Wheat/Corn/Soybeans/Grain Sorghum	Excess Moisture/Precipitation/Rain	$225,242.70
2017	Wheat/Corn/Soybeans	Excess Moisture/Precipitation/Rain	$250,853.50
2018	Wheat/Corn/Soybeans	Excess Moisture/Precipitation/Rain	$18,278
Total			$1,504,666.42

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

Table 3.37. Crop Insurance Claims Paid in Dade County from High Winds, 2014-2018.

Crop Year	Crop Name	Cause of Loss Description	Insurance Paid
2017	Corn	Wind/Excess Wind	$1,270
Total			$1,270

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

Table 3.38. Crop Insurance Claims Paid in Dade County from Hail, 2014-2018.

Crop Year	Crop Name	Cause of Loss Description	Insurance Paid
2014	Soybeans	Hail	$985.05
2018	Corn	Hail	$12,606
Total			$13,591.05

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

Probability of Future Occurrence

Thunderstorm Winds

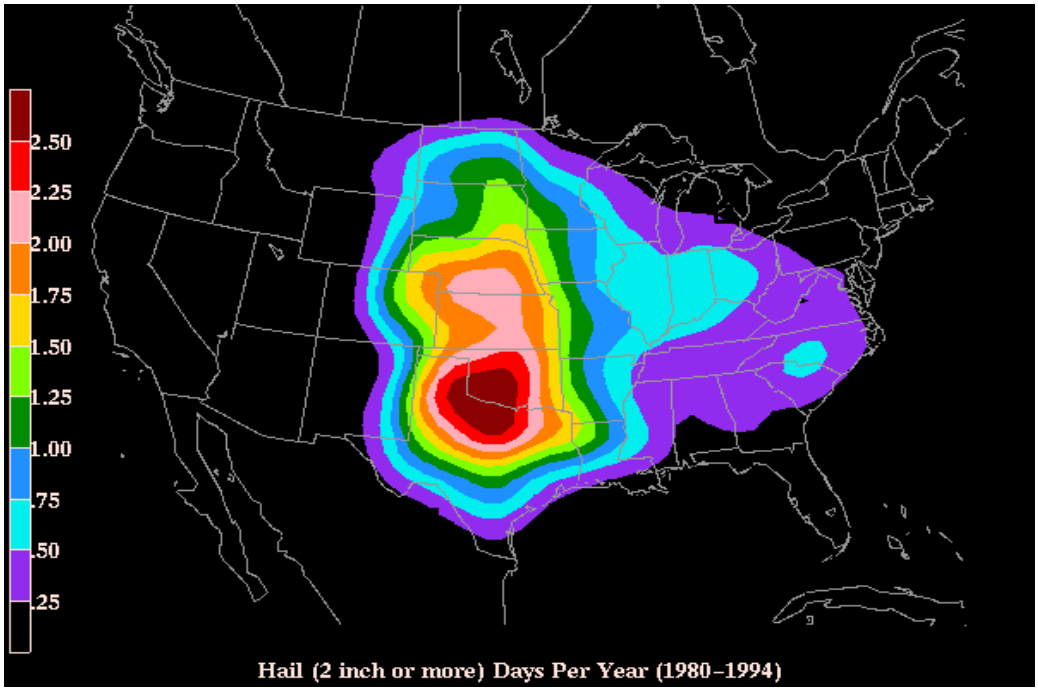
There were 60 thunderstorm wind events in Dade County over the 20-year period reported to the NCEI from 1999-2018. This is an average of 3 thunderstorm wind occurrences each year. There were 28 events that resulted in 0 injuries and $1,351,000 in property damage. This is an average of 1.4 damaging events per year with $67,550 of annualized losses.

Hail

There were 61 recorded hail events over the 20-year period from 1999-2018. This is an average of 3 hail events in any given year. There was one (1) event that resulted in $10,000 in property damage.

Figure 3.35 is a map based on hailstorm data from 1980-1994. It shows the probability of hailstorm occurrence (2" diameter or larger based on number of days per year. Dade County is in the green zone on the map meaning that the county should experience hail greater than 2" in diameter one day per year.

Figure 3.35. Annual Hailstorm Probability (2'' diameter or larger), U 1980- 1994



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

High Winds

There were three high wind events reported to the NCEI in the 20-year period from 1999-2018. This means there is a 15% probability of a high wind event in any given year. The events caused $2,000 in property damage, with an average of $667 in losses per event.

Lightning

There was one lightning event reported to the NCEI between 1999-2018. This means there is a 5% probability of a severe lightning event every year. The sole event was damaging, as it caused $55,000 in damages.

Changing Future Conditions Considerations

Increases in temperature and more frequent droughts will accelerate the evaporation of water into the atmosphere, which will produce higher water concentrations. Elevated levels of moisture raise the

likelihood of severe thunderstorms and tornadoes. Lives and property are endangered when the risk of these events increases, especially in jurisdictions that do not have a community safe room or the funds to construct one. This kind of event also possesses the threat of increasing the magnitude and frequency of other hazard events like riverine flooding, sinkhole occurrence, and flash flooding, putting residents in even greater danger.

Vulnerability

Vulnerability Overview

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

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

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

Potential Losses to Existing Development

The average annual loss determined from historical losses for thunderstorms, high wind, hail and lightning are indicators of the potential losses to existing development. Thunderstorm wind events in the county have damaged critical facilities, schools, local governments, and private property. Potential annual losses throughout Dade County are: Thunderstorm - $69,421; Hail - $526. Potential annual losses from high winds and lightning are not calculable but should be expected to occur and cause damages in the future. For example, the City of Greenfield has reported that a pump station is consistently struck by lighting and requires repair.

Impact of Previous and Future Development

Growth in Dade County is occurring at a slow rate, with Arcola currently seeing the most growth in terms of population percent, and South Greenfield in terms of 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, communities with a greater percentage of structures built prior to 1939 are considered to be more vulnerable to the impact of high

wind and hail damage. All of Dade County's jurisdictions have at least 10% of structures built prior to 1939. The unincorporated county is also above 10%. All of the jurisdictions, besides Arcola, are more than 25%. New construction and population growth would increase the exposure and risk to this hazard; however, the communities in Dade County with building codes will assist in mitigating the effects of strong storms.

Community Comments on Hazard

Four of the 37 residents who completed the online survey stated that they had been impacted by severe thunderstorms. Twenty-seven of the respondents (73%) felt that severe thunderstorms were highly likely to impact their community in the future. Only seven respondents felt that severe thunderstorms would have a catastrophic impact, though 24 felt severe thunderstorms would have a critical impact. Respondents were extremely concerned with severe thunderstorms impacting their communities. MPC members reported that the most costly event caused $1 million in damages to an agricultural implement dealer in Meinert in 2009. Another event noted by MPC members was a hail event that caused $10,000 in damages and necessitated a roof replacement in Ernest.

Problem Statement

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

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

3.4.8 Severe Winter Weather

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.9, Page 3.321 https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- Average Number of House per year with Freezing Rain, American Meteorological Society. "Freezing Rain Events in the United States." http://ams.confex.com/ams/pdfpapers/71872.pdf;
- USDA Risk Management Agency, Insurance Claims, https://www.rma.usda.gov/data/cause
- Any local Road Department data on the cost of winter storm response efforts.
- National Centers for Environmental Information, Storm Events Database, http://www.NCEI.noaa.gov/stormevents/
- Missouri Hazard Mitigation Viewer http://bit.ly/MoHazardMitigationPlanViewer2018 - Website

Hazard Profile

Hazard Description

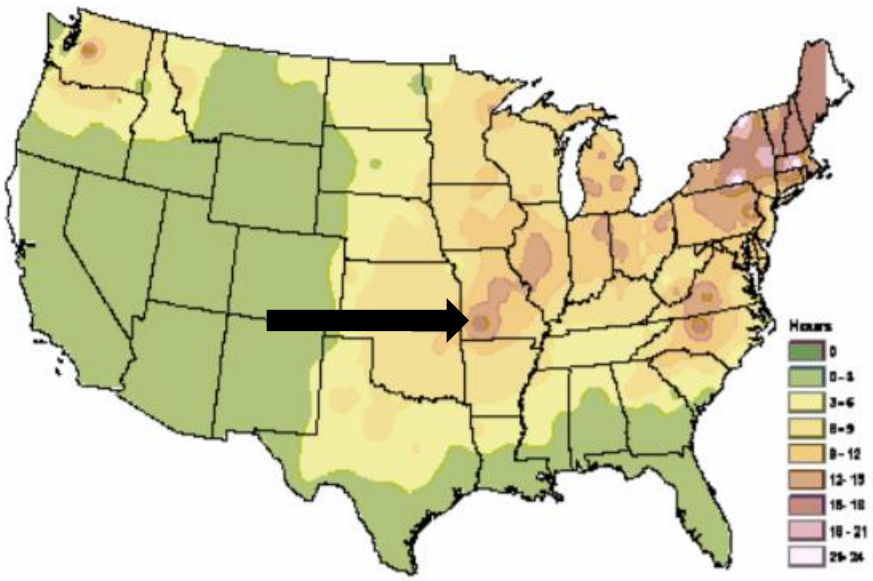
A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. The National Weather Service describes different types of winter storm events as follows.

- **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 3.36** depicts the average number of hours per year with freezing rain. Dade County is located in a zone that can expect 18 – 21 hours of freezing rain per year.

Figure 3.36. NWS Statewide Average Number of Hours per Year with Freezing Rain



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

Strength/Magnitude/Extent

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

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

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

Previous Occurrences

There were 29 recorded events in the NCEI database for Blizzard, Extreme Cold/Wind Chill, Frost/Freeze, Heavy Snow, Ice Storm, Sleet, and Winter Storm in Dade County from 1999 - 2018. **Table 3.39** includes the number of occurrences of these Winter Weather events. **Table 3.40** includes the three weather events that caused damage, with event narratives listed following the table.

Table 3.39. NCEI Dade County Weather Events Summary, 1998-2018

Type of Event	Number of Occurrences	# of Deaths	# of Injuries	Property Damages	Crop Damages
Blizzard	1	0	0	$0	$0
Extreme Cold/Wind Chill	2	0	0	$0	$0
Heavy Snow	2	0	0	$0	$0
Ice Storm	6	0	0	$600K	$0
Winter Storm	18	0	0	$25K	$0

Source: NCEI, data accessed 02/01/2019

Table 3.40. NCEI Dade County Winter Weather Events Summary, 1998-2018

Type of Event	Date	# of Deaths	# of Injuries	Property Damages	Crop Damages
Winter Storm	1/01/1999	0	0	$25K	$0
Ice Storm	1/12/2007	0	0	$500K	$0
Ice Storm	12/09/2007	0	0	$100K	$0

Source: NCEI, data accessed 02/01/2019

<u>Winter Storm – January 1999</u>

A band of snow and sleet (in addition to the ice) fell from southwest to central Missouri. Three to six-

inch amounts occurred in southwest Missouri in the Springfield, Galena, Ozark, and Buffalo areas. Heavier amounts of 5 to 10 inches occurred in central Missouri near the Lake of the Ozarks.

Ice Storm - January 2007

Ice accumulations caused eight barns to collapse while two restaurants and one nursing home experienced roof damage. 80 percent of the county experienced power outages and three communities lost water systems and were under a boil order. Loses from the damage were estimated at $500,000.

Ice Storm – December 2007

Ice accumulations ranging from one quarter of an inch to one inch occurred across all of Dade County. Rural sections northwest of Dade County were hit the hardest, with accumulations up to an inch. Damage to trees and power lines led to power outages west of Stockton Lake.

Winter Storms, cold, frost, and freeze take a toll on crop production in the planning area. **Table 3.41** shows the USDA's Risk Management Agency payments for insured crop losses in the planning area as a result of cold conditions and snow for the past 10 years.

Table 3.41. Crop Insurance Claims Paid in Dade County as a Result of Cold Conditions and Snow 2014-2018.

Crop Year	Crop Name	Cause of Loss Description	Insurance Paid
2014	Wheat	Cold wet weather	$86,138
2016	Wheat	Cold wet weather	$16,921
2017	Soybeans	Frost, freeze	$23,965
Total			$127,024

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

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 29 severe winter storm events in Dade County from 1999 to 2018. This equates to an average of 1.5 winter storm events occurring every year.

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, plant, and other animal populations. A lack of ice cover also leaves lakes exposed to wind and evaporation during a time of year when they are normally protected.

As both temperature and precipitation increase during the winter months, freezing rain will be more likely. Additional wintertime precipitation in any form will contribute to saturation and increase the risk and/or severity of spring flooding. A greater proportion of wintertime precipitation may fall as rain rather than snow.

Vulnerability

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 as a result of closure during power outages. In general, heavy winter storms increase wear and tear on roadways though the cost of such damages is difficult to determine. Businesses can experience loss of income as a result of closure during winter storms.

Overhead power lines and infrastructure are also vulnerable to damages from winter storms. In particular ice accumulation during winter storm events damage to power lines due to the ice weight on the lines and equipment. Damages also occur to lines and equipment from falling trees and tree limbs weighted down by ice. Potential losses could include cost of repair or replacement of damaged facilities and lost economic opportunities for businesses.

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

In the 2018 State Plan, the five factors were considered in determining overall severe winter storm vulnerability were as follows: housing density, building exposure, social vulnerability, likelihood of occurrence, and average annual property loss. The state ranked each of these criteria using a scale from one to five, one being lowest and five being the highest, to rank each county's vulnerability to severe winter weather. Dade County received a vulnerability rating for each criterion as follows: Housing Density Rating: low, Building Exposure: low, Social Vulnerability: medium, Likelihood of Occurrence: low, Average Annual Property Loss: low medium. This equates to an overall vulnerability rating of low.

Potential Losses to Existing Development

During the 20-year period from 1999 to 2018, a total of $625,000 in property damage equates to $31,250 in average annual losses countywide.

Impact to Previous and Future Development

Increased development and any resulting increase in population will increase exposure to damage from severe winter weather. Future commercial development can expect functional downtime and decreased revenues during periods of severe winter weather. Future construction of facilities that will serve vulnerable populations will need to be prepared for extreme weather conditions. 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. Any increase in agriculture crop production will also increase the risk of exposure.

Hazard Summary by Jurisdiction

Severe winter weather can cause power outages and put structures at risk to 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 and those living below the poverty level have an increased vulnerability

to severe winter weather. **Table 3.42** includes information on populations over 65 and the percent living below the poverty level by jurisdiction.

Table 3.42. Population over 65 and Percent Living Below the Poverty Level by Jurisdiction

Jurisdiction	% of Families Living Below Poverty Level	Population over 65	Population over 65 Percent
Dade County	14.3%	1,717	22.6%
City of Everton	14.1%	62	18.5%
City of Greenfield	13.6%	371	26.8%
City of Lockwood	10.1%	350	28.0%
Village of Arcola	7.9%	34	33.7%
Village of South Greenfield	58.3%	32	24.4%

Source: Census.gov; 2013-2017 ACS 5-year Estimates

Additionally, communities that may not have capacity for municipal snow removal would be at a greater risk during severe winter weather. Villages of Arcola and South Greenfield have very limited capacity.

Community Comments on Hazard

Three of the 37 residents who completed the online survey stated that they had been impacted by severe winter weather. Seventeen of the respondents (46%) felt that severe winter weather was highly likely to impact their community in the future. Only six respondents felt that severe winter weather would have a catastrophic impact, though 20 felt flooding would have a critical impact. Respondents were very concerned with severe winter weather impacting their communities in the future. MPC members reported damages of approximately $600,000 due to ice storms, which mostly involved damage to trees.

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.

Organizing outreach to at-risk populations, including establishing and promoting accessible heating and cooling centers can help reduce the potential exposure to harsh winter weather. Additionally, identifying debris disposal and burning locations can assist in facilitating recovery efforts after a significant winter storm or ice incident. An automated alert system could also be utilized to notify residents of incoming winter weather and warming locations in the community.

3.4.9 Tornado

Some specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.10, Page 3.355 **https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf**
- NWS Enhanced F Scale for Tornado Damage including damage indicators and degrees of damage www.spc.noaa.gov/faq/tornado/ef-scale.html;

- Tornado Activity in the U.S. map (1950-2006), FEMA 320, Taking Shelter from the Storm, 3rd edition; https://www.fema.gov/fema-p-320-taking-shelter-storm-building-safe-room-your-home-or-small-business
- Tornado Alley in the U.S. map, http://tornadochaser.com/education/tornado-alley/
- National Centers for Environmental Information, http://www.NCEI.noaa.gov/stormevents/
- Tornado History Project, map of tornado events, http://www.tornadohistoryproject.com/tornado/Missouri
- Missouri Hazard Mitigation Viewer http://bit.ly/MoHazardMitigationPlanViewer2018 - Website

Hazard Profile

Hazard Description

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 the 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 likely locations for future occurrences as the threat from this hazard is countywide.

Strength/Magnitude/Extent

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

Tornado magnitude is classified according to the EF- Scale (or the Enhance Fujita Scale, based on the original Fujita Scale developed by Dr. Theodore Fujita, a renowned severe storm researcher). The EF-Scale (see **Table 3.43**) 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 3.43. Enhanced F Scale for Tornado Damage

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

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

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center as listed in **Table 3.44**. 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 3.44. Enhanced Fujita Scale with Potential Damage

Enhanced Fujita Scale			
Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF0	65-85	53.5%	Light. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e. those that remain in open fields) are always rated EF0).
EF1	86-110	31.6%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	Considerable. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes complete destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
EF3	136-165	3.4%	Severe. Entire stores of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some

EF4	166-200	0.7%	Devastating. Well-constructed houses and whole frame houses completely levelled; cars thrown and small missiles generated.
EF5	>200	<0.1%	Explosive. Strong frame houses levelled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur.

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

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

Previous Occurrences

There are limitations to the use of NCEI tornado data that must be noted. For example, one tornado may contain multiple segments as it moves geographically. A tornado that crosses a county line or state line is considered a separate segment for the purposes of reporting to the NCEI. Also, a tornado that lifts off the ground for less than 5 minutes or 2.5 miles is considered a separate segment. If the tornado lifts off the ground for greater than 5 minutes or 2.5 miles, it is considered a separate tornado. Tornadoes reported in Storm Data and the Storm Events Database are in segments. **Table 3.45** below provides details on tornadoes in Dade County since 1993.

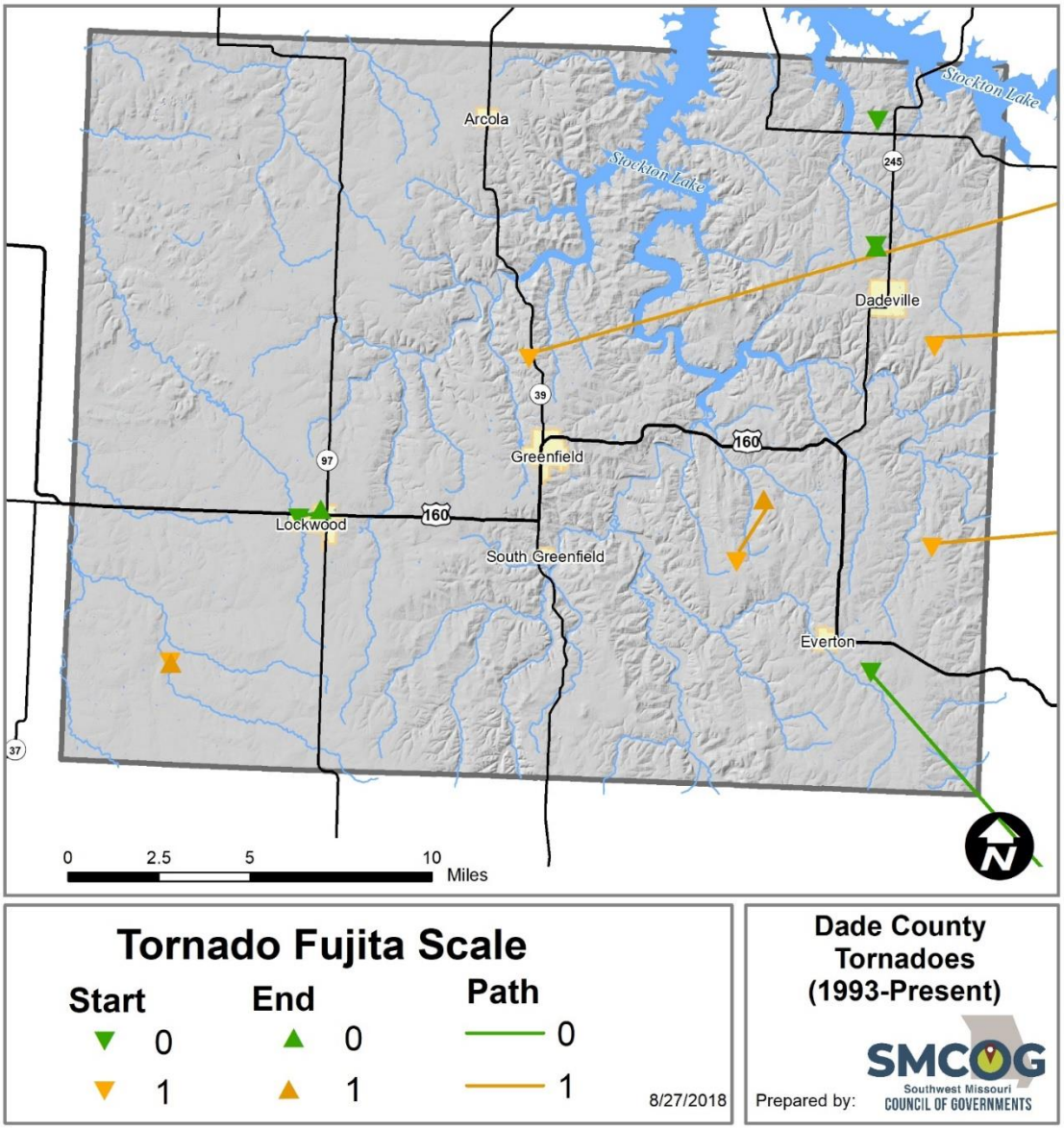
Table 3.45. Recorded Tornadoes in Dade County, 1993 – Present

Date	Beginning Location	Ending Location	Length (miles)	Width (yards)	F/EF Rating	Death	Injury	Property Damage	Crop Damages
5/27/1995	Bona	Bona	0.1	50	F0	0	0	$0	$0
5/4/2003	Meinert	Meinert	0.2	25	F1	0	0	$10,000	$0
5/6/2003	Dadeville	Dadeville	0.2	20	F0	0	0	$0	$0
3/12/2006	Lockwood	Arcola	14	35	F0	0	0	$0	$0
5/3/2006	Everton	Everton	3	25	F0	0	0	$0	$0
5/8/2006	Pilgrim	Pilgrim	1.9	100	EF1	0	0	$35,000	$0
6/18/2011	Everton	Emmet	1.72	100	EF1	0	0	$0	$0
6/18/2011	Dadeville	Dadeville	1.31	100	EF1	0	0	$5,000	$0
2/28/2012	Greenfield	Dadeville	13	100	EF1	0	0	$200,000	$0
5/19/2013	Lockwood	Lockwood	0.65	100	EF0	0	0	$250,000	$0
5/19/2017	Emmet	Emmet	0.86	100	EF0	0	0	$0	$0
5/19/2017	Emmet	Emmet	0.47	75	EF0	0	0	$0	$0
	Total					0	0	$500,000	$0

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

Figure 3.37 shows historic tornado paths in Dade County.

Figure 3.37. Dade County Map of Historic Tornado Events



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

There are no records in the USDA Risk Management Agency Database that refer to crop damages in Dade County as a result of tornadoes in the last 20 years.

Probability of Future Occurrence

From 1999-2018, a period of 20 years, there have been 11 tornado events recorded by the NCEI. That is a 55% chance that there will be a tornado event in any given year. Of the events, 5 caused damage, giving a 25% chance that there will be a damaging event 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

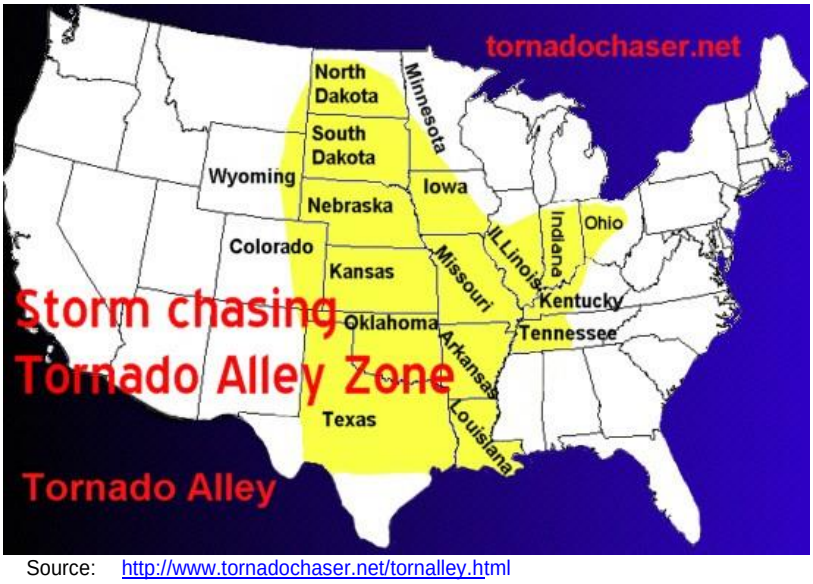
warming world, could be playing a role in making tornado outbreaks more common and severe in the U.S. The research concluded that the number of days with large outbreaks have been increasing since the 1950s and that densely concentrated tornado outbreaks are on the rise. It is notable that the research 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

In the 2018 State Plan, six factors were considered in determining overall tornado vulnerability as follows: building exposure, population density, social vulnerability, percentage of mobile homes, likelihood of occurrence, and annual property loss. The state ranked each of these criteria using a scale from one to five, one being lowest and five being the highest, to rank each county's vulnerability to tornadoes. Dade County received a vulnerability rating for each criterion as follows: Building Exposure: low, Population Density: low, Social Vulnerability: medium, Percentage of Mobile Homes: medium, Likelihood of Occurrence: low medium, Annual Property Loss: low. This equates to an overall vulnerability rating of low medium. **Figure 3.38** illustrates areas where dangerous tornadoes historically have occurred.

Figure 3.38. Tornado Alley in the U.S.



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

Potential Losses to Existing Development

During the 20-year period from 1999 to 2018, a total of $500,000 in property losses equates to $25,000 in average annual losses. The most common tornado events recorded in the county are F0 and F1 magnitude events. Seven of the ten tornado events on record have been F0 magnitude. There were also three F1 magnitude tornadoes recorded in the NCEI data. Potential losses for each jurisdiction were estimated based on the total exposure with applied damage factor of 1%, an estimate of the average damage a tornado could cause in a community. **Table 3.46** provides estimates for total losses by jurisdiction.

Table 3.46. Estimated Potential Tornado Losses by Jurisdiction

Jurisdiction	Total Exposure	Estimated Losses
City of Everton	$1,478,750	$14,788
City of Greenfield	$15,727,520	$157,275
City of Lockwood	$18,598,370	$185,984
Village of Arcola	$549,605	$5,496
Village of South Greenfield	$3,051,755	$30,518
Unincorporated	$50,455,795	$504,558
Totals	$89,861,795	$898,618

Impact of Previous and Future Development

Development across the county and within incorporated jurisdictions increases the potential for losses. During the 20-year period, the average annual losses countywide were $25,000. This indicates the potential future losses if the current development were to remain, with no additional development. Future development and population increases will increase exposure to damage. It is anticipated that some communities may experience new development, but those communities that enforce building codes may help reduce the risk of building damage.

Hazard Summary by Jurisdiction

Although tornado events are area-wide hazard, communities with a greater percentage of structures built prior to 1939 are considered to be more vulnerable to the impact of high wind and hail damage. Section 3.4.3 for discusses jurisdictions at a higher risk due to the number of homes built before 1939.

Community Comments on Hazard

Five of the 37 residents who completed the online survey stated that they had been impacted by tornadoes. Fifteen of the respondents (41%) felt that tornadoes were highly likely to impact their community in the future. Twenty respondents felt that tornadoes would have a catastrophic impact, while the other 17 felt that tornadoes would have a critical impact. Respondents were very supportive of tornado mitigation, with 48.6% respondents listing the construction or retrofitting of safe rooms as their top choice of project to fund with mitigation grants. According to MPC members, there are currently no tornado safe rooms in Lockwood, South Greenfield, or Everton.

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 Dade County have resulted in zero deaths, zero injuries, and $500,000 in property damage over the last 20 years. Information in the 2018 State Plan indicates that Dade County has a low moderate 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. 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. Promoting the installation of NOAA weather radios, and additional warnings and alerts systems, such as Swift 911 or Nixle, will also provide the public and schools more time to take cover during tornado.

3.4.10 Wildfire

The specific sources for this hazard are:

- 2018 Missouri State Hazard Mitigation Plan, Chapter 3, Section 3.3.11, Page 3.390 https://sema.dps.mo.gov/docs/programs/LRMF/mitigation/MO_Hazard_Mitigation_Plan2018.pdf
- Missouri Department of Conversation Wildfire Data Search at http://mdc7.mdc.mo.gov/applications/FireReporting/Report.aspx
- Statistics, Missouri Division of Fire Safety;
- National Statistics, US Fire Administration;
- Fire/Rescue Mutual Aid Regions in Missouri;
- Forestry Division of the Missouri Dept of Conservation;
- National Fire Incident Reporting System (NFIRS), http://dfs.dps.mo.gov/programs/resources/fire-incident-reporting-system.php
- Firewise, www.firewise.org
- University of Wisconsin Silvis Lab, http://silvis.forest.wisc.edu/maps/wui/2010/download
- Missouri Hazard Mitigation Viewer http://bit.ly/MoHazardMitigationPlanViewer2018 - Website

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.

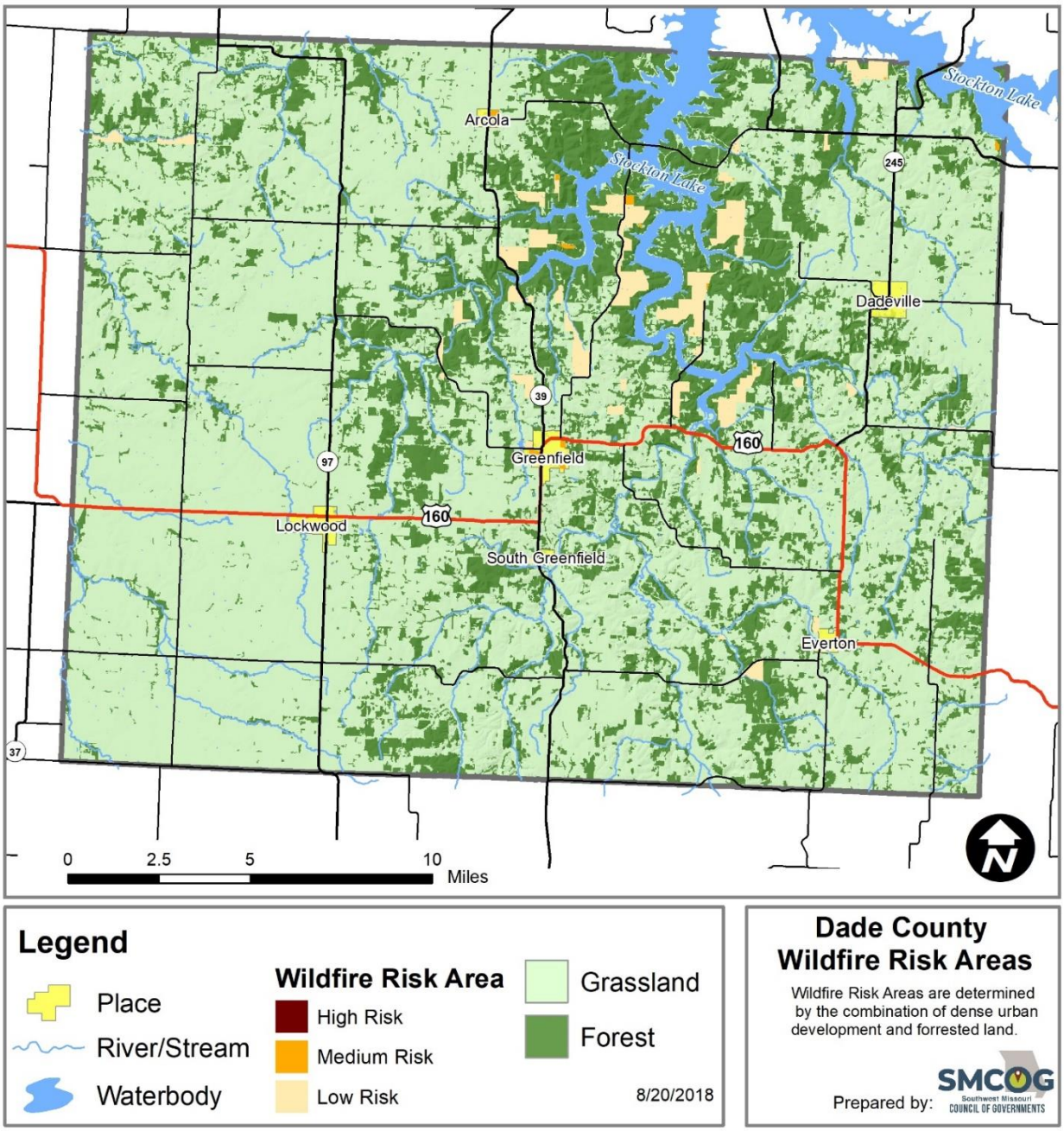
The Forestry Division of the Missouri Department of Conservation (MDC) is responsible for protecting privately owned and state-owned forests and grasslands from wildfires. To accomplish this task, eight forestry regions have been established in Missouri for fire suppression. The Forestry Division works 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 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

Damages due to wildfires are higher in communities with more wildland-urban interface (WUI) areas. The term refers to the zone of transition between unoccupied land and human development and needs to be defined in the plan. Within the WUI, there are two specific areas identified: 1) Interface and 2) Intermix. The interface areas are those areas that abut wildland vegetation and the Intermix areas are those areas that intermingle with wildland areas. Each of the communities in Dade County have some risk of wildfire; the Village of Arcola has the largest swaths of wildfire prone area, as well as the largest percentage of jurisdictional land prone to wildfire. **Figure 3.39** shows the Wildland/ Urban Intermix areas in Dade County.

Figure 3.39. Dade County Wildland Intermix and Wildfire Prone Areas



Strength/Magnitude/Extent

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

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

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

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

There have been no significant wildfires in Dade County over the past 20 years.

Previous Occurrences

According to MDC Wildfire Data, there have been 453 wildfires reported in Dade County from 2009 to 2018. A total of 3,649.6 acres were burned as a result of these reported wildfires. In addition, 138 buildings were destroyed which include residential, commercial, and outbuildings. Fifty-seven buildings were damaged and 40 were threatened by wildfires. **Table 3.47** contains MDC wildfire statistics by year.

Table 3.47. Dade County Wildfires, 2009-2018

Year	Number of Wildfires	Buildings Destroyed	Buildings Damaged	Buildings Threatened	Acres Burned
2009	61	9	3	3	615.5
2010	44	18	1	1	225
2011	64	19	9	8	382.75
2012	62	12	4	2	882.6
2013	24	3	2	1	128.2
2014	45	32	13	8	257
2015	26	17	9	7	42.6
2016	47	18	8	3	284.5
2017	45	4	5	2	650.05
2018	35	6	3	5	181.4
Total	**453**	**138**	**57**	**40**	**3,649.6**

No schools or special districts in Dade County reported any fire incidents that impacted their facilities.

Probability of Future Occurrence

There was a total of 453 reported wildfires from 2009 to 2018, with several events in each year. This equates to a 100% probability of wildfire events in Dade County in any given year, with an average of 45.3 events on average per year.

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 understory vegetation – providing fuel for destructive wildfires. Drought is also anticipated to increase in frequency and intensity during summer months under projected future scenarios. Drought can lead to dead or dying vegetation and landscaping material close to structures which creates fodder for wildfires 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.

Potential Losses to Existing Development

On average, 4 buildings are destroyed or damaged annually by wildfires in Dade County. Approximately, 13.8 structures are threatened per year and about 364 acres of land are burned on average, annually.

Impact of Previous and Future Development

It is anticipated that there will be minor 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 the cities of Greenfield and Lockwood may be mitigated by development regulations reducing the risk to wildfire hazard.

Hazard Summary by Jurisdiction

There are few areas of moderate risk that fall within jurisdictional boundaries; many areas at risk are under the jurisdiction of Dade County. Much of the county consists of grasslands, however, and lower-risk areas could quickly become dangerous in the event of a wildfire. School facilities in Greenfield are located near, but not within, an identified medium risk area, and are more likely to be affected in the event of a wildfire.

The Dadeville R-II School District has also identified wildfire as a risk to its facilities. Though it is not located near any identified areas of risk, the school district is surrounded by grasslands, and the potential for the spread of a wildfire is inherent.

This hazard is the primary focus of participating special fire districts in the county. Participating fire districts include Dade County Rural Fire Protection District and Dadeville Rural Fire Protection District. As local jurisdictions do not have municipal fire departments, the special fire districts are important to all communities for protection against wildfire and assisting in reducing exposure to wildfire risk.

Table 3.48 summarizes the structure exposure for Dade County and cities. Structure counts and exposure values were derived by overlaying parcel data from the Dade County Assessor with the WUI data. The exposure amount indicates the dollar amount of assets at risk and the variability of vulnerability from place to place.

Table 3.48. Wildfire Structure Exposure by Jurisdiction

Jurisdiction	Residential	Commercial	Agriculture	Exposure ($)
City of Everton	$38,450	$0	$850	**$39,300**
City of Greenfield	$679,290	$150,460	$5,110	**$834,860**
City of Lockwood	$0	$0	$0	**$0**
Village of Arcola	$227,860	$6,920	$12,250	**$247,030**
Village of South Greenfield	$0	$0	$0	**$0**
Non-participating Jurisdictions	$304,920	$52,470	$6,790	**$364,180**
Unincorporated Dade County	$9,884,270	$770,340	$1,295,760	**$11,950,370**
Dade County Total	**$11,134,790**	**$980,190**	**$1,320,760**	**$13,435,740**

Source: Dade County Parcel Data; University of Wisconsin SILVIS Lab WUI Data

Community Comments on Hazard

None of the 37 residents who completed the online survey stated that they had been impacted by wildfires. Only three of the respondents (8%) felt that wildfires were highly likely to impact their community in the future. Six respondents felt that wildfires would have a catastrophic impact, though 17 felt wildfires would have a critical impact. Respondents were not very supportive of wildfire mitigation and were not so concerned with wildfires impacting their communities.

Problem Statement

Wildfire occurrences are very frequent within Dade County. These events can destroy, damage, and threaten structures in hazard prone areas. Populations and structures in WUI areas of the county have an increased risk to wildfires due to the level of fuel mixed with structures. Approximately 24% of Dade County's parcels are located within the WUI area. **Table 3.48** indicates that of the participating incorporated jurisdictions of Dade County, Greenfield has the highest risk of wildfires. Cities that have adopted landscape ordinances can include fire safe landscape design requirements in these areas.

Cities that have building codes or design requirements may also encourage non-combustible materials for new construction.

The unincorporated part of the county has the highest risk and exposure to wildfires. County officials and fire departments can implement burn restrictions during weather conditions conducive to the spread of wildfire. Additionally, understanding highest risk locations and developing safe evacuation routes that members of the public are aware can reduce the risk of loss of life or injury.

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

This section presents the mitigation strategy updated by the Mitigation Planning Committee (MPC) based on the risk assessment. The mitigation strategy was developed through a collaborative group process. The process included review of [updated] general goal statements to guide the jurisdictions in lessening disaster impacts as well as specific mitigation actions to directly reduce vulnerability to hazards and losses. The following definitions are taken from FEMA's *Local Hazard Mitigation Review Guide (October 1, 2012)*.

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

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

4.1 Goals

44 CFR Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

This planning effort is an update to Dade County's existing hazard mitigation plan approved by FEMA on July 31, 2014. Therefore, the goals from the 2014 Dade 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, 2013 State Hazard Mitigation Plan goals were reviewed. It should be noted that this planning process was ongoing during the update of the 2018 State Hazard Mitigation, thus why the 2013 plan was used for a portion of the update process.

It was determined that the goals identified in the 2014 plan still applied and were unchanged for this plan update. In the 2014 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 and eliminate the objectives statements, moving forward with broad goals and specific mitigation actions. Objectives seemed unnecessary. During this update process, the intent was to provide a usable set of actions that each jurisdiction was able to work towards partial or full implementation.

The Plan update goals are as follows:

Goal 1: Protect lives and livelihood of the population
Goal 2: Preserve and maintain property, infrastructure, and the County's local economies.
Goal 3: Ensure continued operation of government and emergency functions during a disaster.

4.2 Identification and Analysis of Mitigation Actions

44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

Some specific sources for mitigation action ideas include the following:

- FEMA's Mitigation Action Ideas Publication, https://www.fema.gov/media-library/assets/documents/30627
- FEMA's Climate Resilient Activities for Hazard Mitigation Assistance, https://www.fema.gov/media-library/assets/documents/110202
- EPA's Hazard Mitigation for Natural Disasters Publication, https://www.epa.gov/waterutilityresponse/hazard-mitigation-natural-disasters

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

Jurisdiction representatives on the MPC were encouraged to review the details of the risk assessment vulnerability analysis specific to their jurisdiction, and the previously identified mitigation actions prior to Meeting #3. Representatives were 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.

The focus of meetings #3 and #4 was to update the mitigation strategy. For a comprehensive range of mitigation actions to consider, the MPC reviewed the following information during meeting #3:

- A list of actions proposed in the previous mitigation plan,
- Input during meetings
- Key issues from the risk assessments
- Responses to data collection questionnaires-where jurisdictions had reported progress made on previous actions

The MPC reviewed the actions from the previously approved plan for progress made since the plan had been adopted. The list of previous actions was included in the data collection questionnaire for each jurisdiction. The questionnaires were sent via email prior to meeting #1 and reviewed at

meetings #1 and #2 before discussion at meeting #3. 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;
- Ongoing, with a description of the progress made to date; or
- Not Yet Started, with a discussion of the reasons for lack of progress.

During meeting #3, discussion of action modification occurred in order to make actions SMART: specific, measurable, achievable, relevant, and time-bound. SMCOG staff provided some recommended altered language for some items and general discussion. MPC members were also encouraged to identify repetitive loss locations or infrastructure where the potential cost of a project may be high, but over time would cost less than frequent repairs and public assistance claims.

Additionally, the future inclusion of each mitigation action in the plan update was identified as either keep, delete, or modify. Based on the status updates, there were 9 completed actions, 80 continuing actions (either ongoing or modified), and 90 deleted actions.

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

Table 4.1. Action Status Summary

Jurisdiction	Completed Actions	Continuing Actions (ongoing or modify)	Deleted Actions
Unincorporated Dade County	2	21	2
Village of Arcola	0	2	14
City of Everton	0	8	13
City of Greenfield	1	10	10
City of Lockwood	0	12	9
Village of South Greenfield	1	0	20
Lockwood R-I School District	1	6	6
Dadeville R-II School District	1	7	4
Greenfield R-IV School District	3	9	1
Dade County Rural Fire Protection District	0	6	10

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

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

Completed Actions	Action Description	Completion Details (date, amount, funding source)
Unincorporated Dade County 2.1.1	Encourage the installation of emergency backup generators where needed for critical and vulnerable facilities and infrastructure	Installed at the jail; 2017
Unincorporated Dade County 2.1.3	Identify water drainage obstructions and clean out debris from drainage channels and under bridges to lessen flooding potential	Cleaned ditches
City of Greenfield 2.1.4	Where feasible, install and/or improve culverts to eliminate water flow restrictions	Various culverts repaired or replaced
Village of South Greenfield 2.1.4	Where feasible, install and/or improve culverts to eliminate water flow restrictions	Replaced problematic culvert
Lockwood R-I School District 3.1.5	Review emergency access routes and evacuation routes and work with the responsible entities to minimize or reduce identified problems	All doors numbered for improved communication during emergencies
Dadeville R-II School District 1.3.1	Where feasible, retrofit doors and windows in existing critical/vulnerable facilities serving concentrated populations	Doors and windows replaced in several buildings
Greenfield R-IV School District 1.1.2	Promote the location and utilization of NOAA all-hazard radios with S.A.M.E. technology in all critical/vulnerable facilities, residences, businesses, and places of population concentration	Radios have been made available throughout the district
Greenfield R-IV School District 1.1.4	Utilize available alert and automated messaging systems to provide storm warning	School website updated to include weather alert system
Greenfield R-IV School District 1.3.4	Encourage community organizations to continue programs to provide fans, winter weatherization, and other donations for vulnerable populations during weather extremes	Has been implemented
Deleted Actions	**Action Description**	**Reason for Deletion**
Unincorporated Dade County 1.3.3	Encourage hazard mitigation construction standards to be incorporated into the design and construction on new public facilities	No future construction planned
Unincorporated Dade County 2.2.5	Promote the use of fire-resistant construction and landscaping materials	No zoning or planning mechanisms
Village of Arcola 1.1.2	Promote the location and utilization of NOAA all-hazard radios with S.A.M.E. technology in all critical/vulnerable facilities, residences, businesses, and places of population concentration	No resources available
Village of Arcola 1.1.4	Utilize available alert and automated messaging systems to provide storm warning	No resources available
Village of Arcola 1.2.1	Work with the schools to provide educational materials on natural hazards and ways to reduce risks	Not applicable to jurisdiction
Village of Arcola 1.3.2	Encourage construction of tornado/severe wind safe rooms in areas of population concentration	No resources available
Village of Arcola 1.3.3	Encourage hazard mitigation construction standards to be incorporated into the design and construction of new public facilities	Not applicable to jurisdiction

Village of Arcola 1.3.4	Encourage community organizations to continue programs to provide fans, winter weatherization and other donations for vulnerable populations during weather extremes	No resources available
Village of Arcola 2.2.1	Integrate the goals, objectives and mitigation actions from the Dade County Natural Hazard Mitigation Plan into existing and new plans, programs and regulations where appropriate	Not applicable to jurisdiction
Village of Arcola 2.2.4	Implement burn restrictions during time of weather conditions conducive to the spread of wildfire	Not applicable to jurisdiction
Village of Arcola 2.2.5	Promote the use of fire-resistant construction and landscaping materials	Not applicable to jurisdiction
Village of Arcola 3.1.1	Continue information sharing and collaboration between the county and all jurisdictions and entities responsible for critical/vulnerable facilities and services	Not applicable to jurisdiction
Village of Arcola 3.1.2	Encourage all communities to have emergency response access to all portions of their jurisdictions	Not applicable to jurisdiction
Village of Arcola 3.1.3	Review and upgrade equipment as identified and budget for additional emergency equipment to enhance protection and responses during disaster events	No resources available
Village of Arcola 3.1.4	Annually review the Dade County Emergency Operations Plan and Hazard Mitigation Plan	Not applicable to jurisdiction
Village of Arcola 3.1.5	Review emergency access routes and evacuation routes and work with the responsible entities to minimize or reduce identified problems	Not applicable to jurisdiction
City of Everton 1.1.1	Maintain and replace low water crossing markers as needed	Low-scoring STAPLEE item
City of Everton 1.1.2	Promote the location and utilization of NOAA all-hazard radios with S.A.M.E. technology in all critical/vulnerable facilities, residences, businesses, and places of population concentration	No resources available
City of Everton 1.1.3	Encourage the installation of additional radio-controlled storm warning sirens in areas of population concentration	No resources available
City of Everton 1.3.1	Where feasible, retrofit doors and windows in existing critical/vulnerable facilities serving concentrated populations	No resources available
City of Everton 1.3.2	Encourage construction of tornado/severe wind safe rooms in areas of population concentration	No resources available
City of Everton 1.3.3	Encourage hazard mitigation construction standards to be incorporated into the design and construction of new public facilities	Low-scoring STAPLEE item
City of Everton 2.1.1	Encourage the installation of emergency backup generators where needed for critical and vulnerable facilities and infrastructure	No resources available
City of Everton 2.1.3	Identify water drainage obstructions and clean out debris from drainage channels and under bridges to lessen flooding potential	Low-scoring STAPLEE item
City of Everton 2.2.4	Implement burn restrictions during time of weather conditions conducive to the spread of wildfire	Low-scoring STAPLEE item
City of Everton 2.2.5	Promote the use of fire-resistant construction and landscaping materials	No resources available

City of Everton 3.1.2	Encourage all communities to have emergency response access to all portions of their jurisdictions	No resources available
City of Everton 3.1.3	Review and upgrade equipment as identified and budget for additional emergency equipment to enhance protection and responses during disaster	No resources available
City of Everton 3.1.5	Review emergency access routes and evacuation routes and work with the responsible entities to minimize or reduce identified problems	Low-scoring STAPLEE item
City of Greenfield 1.1.1	Maintain and replace low water crossing markers as needed	Low-scoring STAPLEE item
City of Greenfield 1.1.3	Encourage the installation of additional radio-controlled storm warning sirens in areas of population concentration	No resources available
City of Greenfield 2.2.1	Integrate the goals, objectives and mitigation actions from the Dade County Natural Hazard Mitigation Plan into existing and new plans, programs and regulations where appropriate	Low-scoring STAPLEE item
City of Greenfield 2.2.4	Implement burn restrictions during time of weather conditions conducive to the spread of wildfire	Low-scoring STAPLEE item
City of Greenfield 2.2.5	Promote the use of fire-resistant construction and landscaping materials	Low-scoring STAPLEE item
City of Greenfield 3.1.1	Continue information sharing and collaboration between the county and all jurisdictions and entities responsible for critical/vulnerable facilities and services	Low-scoring STAPLEE item
City of Greenfield 3.1.2	Encourage all communities to have emergency response access to all portions of their jurisdictions	Not applicable to jurisdiction
City of Greenfield 3.1.3	Review and upgrade equipment as identified and budget for additional emergency equipment to enhance protection and responses during disaster	No resources available
City of Greenfield 3.1.4	Annually review the Dade County Emergency Operations Plan and Hazard Mitigation Plan	Low-scoring STAPLEE item
City of Greenfield 3.1.5	Review emergency access routes and evacuation routes and work with the responsible entities to minimize or reduce identified problems	Low-scoring STAPLEE item
City of Lockwood 1.3.1	Where feasible, retrofit doors and windows in existing critical/vulnerable facilities serving concentrated populations	None listed
Village of South Greenfield 1.1.1	Maintain and replace low water crossing markers as needed	No resources available
Village of South Greenfield 1.1.2	Promote the location and utilization of NOAA all-hazard radios with S.A.M.E. technology in all critical/vulnerable facilities, residences, businesses and places of population concentration	No resources available
Village of South Greenfield 1.1.3	Encourage the installation of additional radio-controlled storm warning sirens in areas of population concentration	No schools within jurisdiction
Village of South Greenfield 1.1.4	Utilize available alert and automated messaging systems to provide storm warning	Not applicable to jurisdiction
Village of South Greenfield 1.2.1	Work with the schools to provide educational materials on natural hazards and ways to reduce risks	Small population, lack of funding, residents own adequate shelter

Village of South Greenfield 1.3.1	Where feasible, retrofit doors and windows in existing critical/vulnerable facilities serving concentrated populations	Not applicable to jurisdiction
Village of South Greenfield 1.3.2	Encourage construction of tornado/severe wind safe rooms in areas of population concentration	No resources available
Village of South Greenfield 1.3.3	Encourage hazard mitigation construction standards to be incorporated into the design and construction of new public facilities	No applicable to jurisdiction
Village of South Greenfield 1.3.4	Encourage community organizations to continue programs to provide fans, winter weatherization, and other donations for vulnerable populations during weather extremes	Not applicable to jurisdiction
Village of South Greenfield 2.1.1	Encourage the installation of emergency backup generators where needed for critical and vulnerable facilities and infrastructure	No resources available
Village of South Greenfield 2.1.3	Identify water drainage obstructions and clean out debris from drainage channels and under bridges to lessen flooding potential	No resources available
Village of South Greenfield 2.2.1	Integrate the goals, objectives and mitigation actions from the Dade County Natural Hazard Mitigation Plan into existing and new plans, programs and regulations where appropriate	No resources available
Village of South Greenfield 2.2.3	Communities that do not participate will be encouraged to apply for participation in the NFIP, including regulating all new and substantially improved construction in the Special Flood Hazard Areas (SFHAs)	Not applicable to jurisdiction
Village of South Greenfield 2.2.4	Implement burn restrictions during time of weather conditions conducive to the spread of wildfire	No resources available
Village of South Greenfield 2.2.5	Promote the use of fire-resistant construction and landscaping materials	Not applicable to jurisdiction
Village of South Greenfield 3.1.1	Continue information sharing and collaboration between the county and all jurisdictions and entities responsible for critical/vulnerable facilities and services	Not applicable to jurisdiction
Village of South Greenfield 3.1.2	Encourage all communities to have emergency response access to all portions of their jurisdictions	Not applicable to jurisdiction
Village of South Greenfield 3.1.3	Review and upgrade equipment as identified and budget for additional emergency equipment to enhance protection and responses during disaster events	No resources available
Village of South Greenfield 3.1.4	Annually review the Dade County Emergency Operations Plan and Hazard Mitigation Plan	No resources available
Village of South Greenfield 3.1.5	Review emergency access routes and evacuation routes and work with the responsible entities to minimize or reduce identified problems	Not applicable to jurisdiction
Lockwood R-I School District 1.1.3	Encourage the installation of additional radio-controlled storm warning sirens in areas of population concentration	No resources available
Lockwood R-I School District 1.3.2	Encourage construction of tornado/severe wind safe rooms in areas of population concentration	No resources available

Lockwood R-I School District 1.3.3	Encourage hazard mitigation construction standards to be incorporated into the design and construction of new public facilities	Not applicable to jurisdiction
Lockwood R-I School District 1.3.4	Encourage community organizations to continue programs to provide fans, winter weatherization, and other donations for vulnerable populations during weather extremes	No resources available
Lockwood R-I School District 2.2.1	Integrate the goals, objectives and mitigation actions from the Dade County Natural Hazard Mitigation Plan into existing and new plans, programs and regulations where appropriate	No resources available
Lockwood R-I School District 3.1.1	Continue information sharing and collaboration between the county and all jurisdictions and entities responsible for critical/vulnerable facilities and services	Low scoring STAPLEE item
Dadeville R-II School District 1.1.3	Encourage the installation of additional radio-controlled storm warning sirens in areas of population concentration	A city-wide siren has been installed
Dadeville R-II School District 1.1.4	Utilize available alert and automated messaging systems to provide storm warning	None listed
Dadeville R-II School District 1.3.4	Encourage community organizations to continue programs to provide fans, winter weatherization, and other donations for vulnerable populations during weather extremes	Community organizations will be allowed to distribute these materials at the school
Greenfield R-IV School District 1.1.3	Encourage the installation of additional radio-controlled storm warning sirens in areas of population concentration	Does not fall under school district's jurisdiction
Dade County Rural Fire Protection District 1.1.2	Promote the location and utilization of NOAA all-hazard radios with S.A.M.E. technology in all critical/vulnerable facilities, residences, businesses, and places of population concentration	Not applicable to district
Dade County Rural Fire Protection District 1.1.3	Encourage the installation of additional radio-controlled storm warning sirens in areas of population concentration	Completed by other jurisdictions
Dade County Rural Fire Protection District 1.3.4	Encourage community organizations to continue programs to provide fans, winter weatherization, and other donations for vulnerable populations during weather extremes	Not applicable, not fire-related

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

Many jurisdictions found that actions were still relevant and would be ongoing. Many of the continuing actions were re-worded for the update and are noted as "revised, continuing" on the action sheets.

The actions listed in **Table 4.1** and **Table 4.2** are numbered according to the 2014 Plan and are not consistent with the new numbering in this plan.

4.3 Implementation of Mitigation Actions

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

Jurisdictional MPC members were encouraged to meet with others in their community or within their organization to finalize the actions to be submitted for the updated mitigation strategy. 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 2013/2018 Missouri State Hazard Mitigation Plan. The benefit/cost review at the planning stage primarily consisted of a qualitative analysis and was not the detailed process required grant funding application. For each action, the plan sets forth a narrative describing the types of benefits that could be realized from action implementation. The cost was estimated as closely as possible, with further refinement to be supplied as project development occurs.

FEMA's STAPLEE methodology was used to assess the costs and benefits, overall feasibility of mitigation actions, and other issues impacting project. During the prioritization process, the jurisdictions used worksheets to assign scores. The worksheets posed questions based on the STAPLEE elements as well as the potential mitigation effectiveness of each action. Scores were based on the responses to the questions as follows:

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

The following questions were asked for each proposed action.

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?

The final scores are listed below in the analysis of each action. The worksheets are attached to this plan as Appendix B. 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**. Actions that scored in the low priority were omitted from the plan in order to allow the local jurisdictions to focus on higher priority items.

Figure 4.1. Blank STAPLEE Worksheet

XXXXXX COUNTY
MULTI-JURISDICTIONAL
LOCAL HAZARD MITIGATION PLAN

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

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

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

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

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

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

In addition to the STAPLEE cost benefit review prioritization, at the fourth MPC meeting, an implementation plan for each action was discussed. An action worksheet was used to development the implementation plan. The action worksheet format is shown in Table 4.3

Table 4.3. 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.

Goal 1: Protect lives and livelihood of the population

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Unawareness of flooded roadways
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	1.1
Name of Action or Project:	Low water crossing markers
Action or Project Description:	Maintain and replace low water markers, as needed.
Applicable Goal Statement:	Protect lives and livelihood of the population
Estimated Cost:	TBD; $1,000-$5,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Dade County Road and Bridge
Action/Project Priority:	High - 41
Timeline for Completion:	Ongoing
Potential Fund Sources:	Road and Bridge
Local Planning Mechanisms to be Used in Implementation, if any:	County Emergency Operations Plan
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing efforts

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness during natural hazard events
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.2
Name of Action or Project:	NOAA weather radios
Action or Project Description:	Use NOAA all-hazard radios with S.A.M.E technology in all critical/vulnerable facilities, residences, businesses, and places of population concentration.
Applicable Goal Statement:	Protect lives and livelihood of the population
Estimated Cost:	$30-$50 per radio
Benefits:	Reductions in injury and loss of life for citizens
Plan for Implementation	
Responsible Organization/Department:	Emergency Management
Action/Project Priority:	High - 32
Timeline for Completion:	Ongoing
Potential Fund Sources:	EMD Funds
Local Planning Mechanisms to be Used in Implementation, if any:	County Emergency Operations Plan
Progress Report	
Action Status	Continuing
Report of Progress	Radios recently provided to Greenfield and Lockwood Schools and City of Everton.

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Loss of life during severe storms and tornados
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.3
Name of Action or Project:	Outdoor storm sirens
Action or Project Description:	Install additional radio-controlled storm warning sirens in areas of population concentration
Applicable Goal Statement:	Protect lives and livelihood of the population
Estimated Cost:	$500,000 -$1,000,000
Benefits:	Reduction in loss of life and injury during hazard events
Plan for Implementation	
Responsible Organization/Department:	911; Emergency Management
Action/Project Priority:	High - 33
Timeline for Completion:	3-5 years
Potential Fund Sources:	HMGP; USDA Rural Development; Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	County Emergency Operations Plan
Progress Report	
Action Status	Continuing
Report of Progress	There is now one storm siren in each municipal area of Dade County, but additional sirens could be beneficial.

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness in the event of severe weather.
Hazard(s) Addressed:	Tornado, Severe Thunderstorms, Floods, Winter Weather
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Alert systems
Action or Project Description:	Use available alert and automated messaging systems to provide storm warning.
Applicable Goal Statement:	Protect lives and livelihood of the population
Estimated Cost:	$1,000-$5,000/ annually
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	911; Emergency Management
Action/Project Priority:	Medium - 29
Timeline for Completion:	3-5 years
Potential Fund Sources:	Local funds; Partner agencies funds
Local Planning Mechanisms to be Used in Implementation, if any:	County Emergency Operations Plan
Progress Report	
Action Status	Continuing
Report of Progress	Automated messages are now posted to Facebook. Other mass notification solutions have been investigated, but funding remains an issue.

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Lack of public awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.5
Name of Action or Project:	Public Awareness
Action or Project Description:	Provide educational materials on natural hazards and ways to reduce risk.
Applicable Goal Statement:	Protect lives and livelihood of the population
Estimated Cost:	$0-$200
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management
Action/Project Priority:	High - 34
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	County Emergency Operations Plan
Progress Report	
Action Status	Continuing
Report of Progress	EMD currently shares information with schools and fire districts and in progress of adding more.

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Lack of public knowledge regarding hazard mitigation and emergency management.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.6
Name of Action or Project:	Information website
Action or Project Description:	Establish an emergency management website for the county that includes hazard mitigation educational information.
Applicable Goal Statement:	Protect lives and livelihood of the population
Estimated Cost:	$0-$1,000
Benefits:	Reduction of injury and loss of life due to better informed public.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management
Action/Project Priority:	High - 30
Timeline for Completion:	1 year
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	County Emergency Operations Plan
Progress Report	
Action Status	Continuing
Report of Progress	In progress- called for price quote.

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Unsafe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.7
Name of Action or Project:	Retrofit existing facilities
Action or Project Description:	Where feasible, retrofit doors and windows in existing critical/vulnerable facilities serving concentrated populations.
Applicable Goal Statement:	Protect lives and livelihood of the population
Estimated Cost:	$20,000-$500,000
Benefits:	Lessens risk and injury during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	County Commissioners
Action/Project Priority:	Medium - 29
Timeline for Completion:	5 years
Potential Fund Sources:	HMGP; PDM; Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	
Progress Report	
Action Status	Continuing
Report of Progress	Under review

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Lack of safe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.8
Name of Action or Project:	Safe room construction
Action or Project Description:	Construct tornado/severe wind safe rooms in areas of population concentration.
Applicable Goal Statement:	Protect lives and livelihood of the population
Estimated Cost:	$1,000,000+
Benefits:	Lessens risks and injury to citizens during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	County Emergency Management
Action/Project Priority:	High - 31
Timeline for Completion:	5 years
Potential Fund Sources:	HMGP, PDM, Local Governments, Private Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Exploring funding options.

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Lack of shelters and extreme weather resources
Hazard(s) Addressed:	Winter Weather, Extreme Heat
Action or Project	
Action/Project Number:	1.10
Name of Action or Project:	Community programs
Action or Project Description:	Continue community programs to provide fans, winter weatherization, and other donations for vulnerable populations during weather extremes.
Applicable Goal Statement:	Protect lives and livelihood of the population
Estimated Cost:	$0
Benefits:	Reduce loss of life and injury during extreme heat and cold.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management
Action/Project Priority:	Medium - 25
Timeline for Completion:	Ongoing
Potential Fund Sources:	Emergency Management
Local Planning Mechanisms to be Used in Implementation, if any:	County Emergency Operations Plan
Progress Report	
Action Status	Continuing
Report of Progress	EMD will continue to encourage organizations.

Action Worksheet	
Name of Jurisdiction:	City of Everton
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness in the event of severe weather
Hazard(s) Addressed:	Tornado, Severe Thunderstorms, Floods, Winter Weather
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Alert systems
Action or Project Description:	Use available alert and automated messaging systems to provide storm warning.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$30 per month
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	City Clerk
Action/Project Priority:	High - 34
Timeline for Completion:	Immediate; 1-3 years
Potential Fund Sources:	Local taxes
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	In progress

Action Worksheet	
Name of Jurisdiction:	City of Everton
Risk / Vulnerability	
Problem being Mitigated:	Lack of public awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.5
Name of Action or Project:	Public Awareness
Action or Project Description:	Provide educational materials on natural hazards and ways to reduce risk.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$100
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	City Administration, Resident Konnie Brewer
Action/Project Priority:	High - 39
Timeline for Completion:	1 year
Potential Fund Sources:	City funds
Local Planning Mechanisms to be Used in Implementation, if any:	Monthly meeting
Progress Report	
Action Status	Continuing
Report of Progress	In progress

Action Worksheet	
Name of Jurisdiction:	City of Everton
Risk / Vulnerability	
Problem being Mitigated:	Lack of shelters and extreme weather resources
Hazard(s) Addressed:	Winter Weather, Extreme Heat
Action or Project	
Action/Project Number:	1.10
Name of Action or Project:	Community programs
Action or Project Description:	Continue community programs to provide fans, winter weatherization, and other donations for vulnerable populations during weather extremes.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$800
Benefits:	Reduce loss of life and injury during extreme heat and cold.
Plan for Implementation	
Responsible Organization/Department:	Mayor, City Council
Action/Project Priority:	High - 31
Timeline for Completion:	1 year
Potential Fund Sources:	PDM; local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Not started – need funding

Action Worksheet	
Name of Jurisdiction:	City of Everton
Risk / Vulnerability	
Problem being Mitigated:	Lack of safe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.11
Name of Action or Project:	New storm shelter
Action or Project Description:	Construct a community FEMA storm shelter
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$500,000+
Benefits:	Reduce loss of life and injury during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	High - 36
Timeline for Completion:	3 years
Potential Fund Sources:	PDM; HMGP: local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Town meetings, City Council, Annual budget
Progress Report	
Action Status	New
Report of Progress	In progress

Action Worksheet	
Name of Jurisdiction:	City of Everton
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness during natural hazard events.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.12
Name of Action or Project:	NOAA weather radios
Action or Project Description:	Obtain NOAA weather radios for public and vulnerable/critical facilities.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$2,000
Benefits:	Reduce loss of life and injury during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Mitigation planner Resident Konnie Brewer
Action/Project Priority:	High - 30
Timeline for Completion:	1 year
Potential Fund Sources:	PDM
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	New
Report of Progress	Not started – need not yet determined

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness during natural hazard events.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.2
Name of Action or Project:	NOAA weather radios
Action or Project Description:	Use NOAA all-hazard radios with S.A.M.E technology in all critical/vulnerable facilities, residences, businesses, and places of population concentration.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$60 per radio
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	City Council
Action/Project Priority:	High - 33
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	EOP, Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness in the event of severe weather.
Hazard(s) Addressed:	Tornado, Severe Thunderstorms, Floods, Winter Weather
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Alert systems
Action or Project Description:	Use available alert and automated messaging systems to provide storm warning.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$0
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	City Council
Action/Project Priority:	High - 34
Timeline for Completion:	1-5 years
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	EOP
Progress Report	
Action Status	New
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Lack of public awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.5
Name of Action or Project:	Public Awareness
Action or Project Description:	Provide educational materials on natural hazards and ways to reduce risk.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$1,500
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Chief of Police and City Maintenance
Action/Project Priority:	High - 34
Timeline for Completion:	1-5 years
Potential Fund Sources:	Local funds, available grants
Local Planning Mechanisms to be Used in Implementation, if any:	Annual budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Lack of public knowledge regarding hazard mitigation and emergency management.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.6
Name of Action or Project:	Information website
Action or Project Description:	Establish an emergency management website for the county that includes hazard mitigation educational information.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	Unknown
Benefits:	Reduction of injury and loss of life due to better informed public.
Plan for Implementation	
Responsible Organization/Department:	911 services, City Administration
Action/Project Priority:	High - 38
Timeline for Completion:	2 months – 1 year
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Unsafe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.7
Name of Action or Project:	Retrofit existing facilities
Action or Project Description:	Where feasible, retrofit doors and windows in existing critical/vulnerable facilities serving concentrated populations.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	Unknown
Benefits:	Lessens risk and injury during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	City Administration
Action/Project Priority:	High - 32
Timeline for Completion:	1-5 years
Potential Fund Sources:	Local funds, HMGP, PDM
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Lack of safe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.8
Name of Action or Project:	Safe room construction
Action or Project Description:	Construct tornado/severe wind safe rooms in areas of population concentration.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$5,000
Benefits:	Lessens risks and injury to citizens during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	City Council,
Action/Project Priority:	High - 30
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds, HMGP, PDM
Local Planning Mechanisms to be Used in Implementation, if any:	Annual budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Lack of construction standards
Hazard(s) Addressed:	Tornado, Severe Thunderstorm, Winter Weather, Extreme Heat
Action or Project	
Action/Project Number:	1.9
Name of Action or Project:	Construction standards
Action or Project Description:	Incorporate hazard mitigation construction standards into design and construction of new facilities.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$15,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	City Council
Action/Project Priority:	High - 34
Timeline for Completion:	1-5 years
Potential Fund Sources:	Local funds, available grants
Local Planning Mechanisms to be Used in Implementation, if any:	Annual budget, Building Code
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Lack of shelters and extreme weather resources
Hazard(s) Addressed:	Winter Weather, Extreme Heat
Action or Project	
Action/Project Number:	1.10
Name of Action or Project:	Community programs
Action or Project Description:	Continue programs to provide fans, winter weatherization, and other donations for vulnerable populations during weather extremes.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	Unknown
Benefits:	Reduce loss of life and injury during extreme heat and cold.
Plan for Implementation	
Responsible Organization/Department:	OACAC, Emergency Management
Action/Project Priority:	Medium - 29
Timeline for Completion:	12 months
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Unawareness of flooded roadways
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	1.1
Name of Action or Project:	Low water crossing markers
Action or Project Description:	Maintain and replace low water markers, as needed.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$1,500
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	City Administration, City Superintendent
Action/Project Priority:	High - 31
Timeline for Completion:	1 year
Potential Fund Sources:	Current City Street Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Progress is ongoing

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness during natural hazard events.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.2
Name of Action or Project:	NOAA weather radios
Action or Project Description:	Use NOAA all-hazard radios with S.A.M.E technology in all critical/vulnerable facilities and City of Lockwood owned buildings.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$0-100
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	City Administration, City Superintendent
Action/Project Priority:	High - 37
Timeline for Completion:	1 year
Potential Fund Sources:	Current City of Lockwood General Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Emergency Operations Plan
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness in the event of severe weather.
Hazard(s) Addressed:	Tornado, Severe Thunderstorms, Floods, Winter Weather
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Alert systems
Action or Project Description:	Participate with Dade County to implement automated messaging systems to provide storm warning.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$5,000
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	Local EMD (County EMA)
Action/Project Priority:	High - 41
Timeline for Completion:	1 year
Potential Fund Sources:	City General Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Not started
Report of Progress	Need to meet with the County EMA

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Lack of public awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.5
Name of Action or Project:	Public Awareness
Action or Project Description:	Provide educational materials on natural hazards and ways to reduce risk.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$500
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	City Administration, City Clerk
Action/Project Priority:	High - 31
Timeline for Completion:	3 months
Potential Fund Sources:	Current City General Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Not Started
Report of Progress	Not Started. Need to research available educational materials.

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Lack of shelters and extreme weather resources
Hazard(s) Addressed:	Winter Weather, Extreme Heat
Action or Project	
Action/Project Number:	1.6
Name of Action or Project:	Community programs
Action or Project Description:	Continue programs to provide fans, winter weatherization, and other donations for vulnerable populations during weather extremes.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$0 -100
Benefits:	Reduce loss of life and injury during extreme heat and cold.
Plan for Implementation	
Responsible Organization/Department:	City of Lockwood/City Clerk
Action/Project Priority:	High - 35
Timeline for Completion:	Ongoing
Potential Fund Sources:	OACAC/LIHEAP/State Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	City of Lockwood continues to participate with OACAC and LIHEAP program to provide funds for residents during times of need.

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Lack of safe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.7
Name of Action or Project:	Safe room construction
Action or Project Description:	Partner with local school district and fire district to develop a public storm shelter/safe room for the citizens of Lockwood.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$500,000-$1,500,000
Benefits:	Lessens risks and injury to citizens during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	City of Lockwood, Lockwood School District, Lockwood Fire District
Action/Project Priority:	High - 32
Timeline for Completion:	1-3 years
Potential Fund Sources:	CDBG, FHA Mortgage Insured Financing, HMGP, PDM
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Not started.
Report of Progress	Need to initiate first meeting with School and Fire District

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Lack of construction standards
Hazard(s) Addressed:	Tornado, Severe Thunderstorm, Winter Weather, Extreme Heat
Action or Project	
Action/Project Number:	1.8
Name of Action or Project:	Construction standards
Action or Project Description:	Incorporate hazard mitigation construction standards into design and construction of new facilities.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$0-$100
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	City Administration, City Superintendent
Action/Project Priority:	High - 44
Timeline for Completion:	Ongoing
Potential Fund Sources:	None
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Building Code
Progress Report	
Action Status	Ongoing
Report of Progress	Local ordinance A-289 passed in 1997 and enforcement is ongoing

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Lack of backup power in critical facilities
Hazard(s) Addressed:	Tornado, Severe Thunderstorm, Flood, Winter Weather, Extreme Heat, Earthquake
Action or Project	
Action/Project Number:	1.9
Name of Action or Project:	Backup generators
Action or Project Description:	Install emergency backup generators where needed for critical and vulnerable facilities and infrastructure.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$100,000
Benefits:	Improved public safety and preservation of critical infrastructure during hazard events.
Plan for Implementation	
Responsible Organization/Department:	City of Lockwood/City Superintendent
Action/Project Priority:	High - 34
Timeline for Completion:	2 Years
Potential Fund Sources:	SRF Grant/Loan Program, DNR Grants, Local Funding, HMGP
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Emergency Operations Plan
Progress Report	
Action Status	In Progress
Report of Progress	Application for SRF Grant and Loan has been submitted. Awaiting final result.

Action Worksheet	
Name of Jurisdiction:	Lockwood R-I School District
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness during natural hazard events.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.2
Name of Action or Project:	NOAA weather radios
Action or Project Description:	Use NOAA all-hazard radios with S.A.M.E technology in all school facilities.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$100
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	School District Administration including building principals
Action/Project Priority:	High - 39
Timeline for Completion:	1-5 years; Ongoing
Potential Fund Sources:	Local operating funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Emergency Plan
Progress Report	
Action Status	Continuing
Report of Progress	This was part of our last 5-year plan and we recently upgraded to a new radio in the high school building. We will now focus on the elementary building and hope to have a new radio in the next year.

Action Worksheet	
Name of Jurisdiction:	Lockwood R-I School District
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness in the event of severe weather.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Alert systems
Action or Project Description:	Use available alert and automated messaging systems to provide storm warning.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$3,000 annually
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	Superintendent, principals, and our media specialist will work to get information out to our students when applicable.
Action/Project Priority:	High - 31
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local operating funds will pay for this software annually
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	This is an ongoing process that we will continue to use to get information out of our students.

Action Worksheet	
Name of Jurisdiction:	Lockwood R-I School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of public awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.5
Name of Action or Project:	Public Awareness
Action or Project Description:	Partner with county to provide educational materials on natural hazards and ways to reduce risk.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$0-$200 annually
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Lockwood District staff as well as county officials with pertinent information
Action/Project Priority:	High - 32
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local District operating funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	We will continue to be a part of county meetings to maintain a partnership with county officials

Action Worksheet	
Name of Jurisdiction:	Lockwood R-I School District
Risk / Vulnerability	
Problem being Mitigated:	Unsafe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.7
Name of Action or Project:	Retrofit existing facilities
Action or Project Description:	Where feasible, retrofit doors and windows in existing facilities.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$140,000
Benefits:	Lessens risk and injury during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	Lockwood School District administration
Action/Project Priority:	Medium - 29
Timeline for Completion:	5 years
Potential Fund Sources:	HMGP, PDM, Possible future bond issue if grant funds are available to supplement
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Emergency Plan
Progress Report	
Action Status	Continuing
Report of Progress	Funding has not been available to complete this goal yet, but if we could solidify funds in the next 5 years this is something we would still like to accomplish.

Action Worksheet	
Name of Jurisdiction:	Lockwood R-I School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of safe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.11
Name of Action or Project:	New storm shelter
Action or Project Description:	Partner with the city of Lockwood to provide a tornado safe room for the students and citizens of Lockwood
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$4 million
Benefits:	Reduce loss of life and injury during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Lockwood School District administration, school board and city officials
Action/Project Priority:	High - 31
Timeline for Completion:	5 years
Potential Fund Sources:	HMGP, PDM, Possible future bond issue
Local Planning Mechanisms to be Used in Implementation, if any:	None at this time, if meetings with city officials begin a plan could be put together.
Progress Report	
Action Status	New
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	Dadeville R-II School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of safe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.8
Name of Action or Project:	Safe room construction
Action or Project Description:	Construct tornado/severe wind safe rooms in areas of population concentration.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$750,000 to $1,000,000
Benefits:	Lessens risks and injury to citizens during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	School Board; Administration
Action/Project Priority:	High - 37
Timeline for Completion:	1- 5 years
Potential Fund Sources:	HMGP; Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Master Plan
Progress Report	
Action Status	Continuing
Report of Progress	Primary barrier is lack of funding.

Action Worksheet	
Name of Jurisdiction:	Dadeville R-II School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of construction standards
Hazard(s) Addressed:	Tornado, Severe Thunderstorm, Winter Weather, Extreme Heat
Action or Project	
Action/Project Number:	1.9
Name of Action or Project:	Construction standards
Action or Project Description:	Incorporate hazard mitigation construction standards into design and construction of new facilities.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$10,000 - $100,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Dadeville School Board and Superintendent
Action/Project Priority:	High - 35
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, CSIP
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Greenfield R-IV School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of Weather Radios within the district
Hazard(s) Addressed:	Improving the districts warning system for potential bad weather
Action or Project	
Action/Project Number:	1.2
Name of Action or Project:	NOAA weather radios
Action or Project Description:	Use NOAA all-hazard radios with S.A.M.E technology in all critical/vulnerable facilities, residences, businesses, and places of population concentration.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	300.00
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	Maintenance Department
Action/Project Priority:	High - 45
Timeline for Completion:	6 months
Potential Fund Sources:	District Operating Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Ongoing
Report of Progress	The district is still in need of two or three weather radios

Action Worksheet	
Name of Jurisdiction:	Greenfield R-IV School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of public awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	1.5
Name of Action or Project:	Public Awareness
Action or Project Description:	Provide educational materials on natural hazards and ways to reduce risk.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$2,000.00
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Health Department or Central Office
Action/Project Priority:	High - 41
Timeline for Completion:	1 year - ongoing
Potential Fund Sources:	Grants or District Operating Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Ongoing
Report of Progress	The district continues to educate the community on hazards that exist at home and in the school.

Action Worksheet	
Name of Jurisdiction:	Greenfield R-IV School District
Risk / Vulnerability	
Problem being Mitigated:	Unsafe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.7
Name of Action or Project:	Retrofit existing facilities
Action or Project Description:	Where feasible, retrofit doors and windows in existing critical/vulnerable facilities serving concentrated populations.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$20,000
Benefits:	Lessens risk and injury during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	Maintenance and Central Office
Action/Project Priority:	High - 34
Timeline for Completion:	2 or 3 years
Potential Fund Sources:	Operating Funds; HMGP; PDM
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Master Plan, Capital Improvement Plan
Progress Report	
Action Status	Not Started
Report of Progress	The district does not currently have funds to address windows and doors

Action Worksheet	
Name of Jurisdiction:	Greenfield R-IV School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of safe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.8
Name of Action or Project:	Safe room construction
Action or Project Description:	Construct tornado/severe wind safe rooms in areas of population concentration.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$2,000,000 to $4,000,000
Benefits:	Lessens risks and injury to citizens during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	Maintenance Department and Central Office
Action/Project Priority:	High - 38
Timeline for Completion:	12-24 Months
Potential Fund Sources:	District Bond and Operating Funds, HMGP, PDM
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Master Plan, Capital Improvement Plan
Progress Report	
Action Status	Not Started
Report of Progress	The district does not have the funds for the construction of a new safe room. Basements have been repaired and currently serve as safe rooms in both buildings.

Action Worksheet	
Name of Jurisdiction:	Greenfield R-IV School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of construction standards
Hazard(s) Addressed:	Tornado, Severe Thunderstorm, Winter Weather, Extreme Heat
Action or Project	
Action/Project Number:	1.9
Name of Action or Project:	Construction standards
Action or Project Description:	Incorporate hazard mitigation construction standards into design and construction of new facilities.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$500
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Central Office or Building Admin Offices
Action/Project Priority:	High - 47
Timeline for Completion:	1 year
Potential Fund Sources:	District Operating Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Not Started
Report of Progress	We will need to develop a plan once the mitigation plan is created.

Action Worksheet	
Name of Jurisdiction:	Dade County R-IV Fire Protection District
Risk / Vulnerability	
Problem being Mitigated:	Lack of safe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.8
Name of Action or Project:	Safe room construction
Action or Project Description:	Construct tornado/severe wind safe rooms in areas of population concentration.
Applicable Goal Statement:	Protect citizens from injury and loss of life.
Estimated Cost:	$500,000
Benefits:	Lessens risks and injury to citizens during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	Department Administration
Action/Project Priority:	Medium - 26
Timeline for Completion:	5 Years
Potential Fund Sources:	HMGP, PDM, Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	
Progress Report	
Action Status	Continuing
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	Dadeville Rural Fire Protection District
Risk / Vulnerability	
Problem being Mitigated:	Severe Weather Warning to Citizens
Hazard(s) Addressed:	Citizens outdoors in the affected area will have knowledge of impending severe weather
Action or Project	
Action/Project Number:	1.3
Name of Action or Project:	Outdoor storm sirens
Action or Project Description:	Install a storm siren in the Bona area and enter into an agreement with Dade County 911 to activate in accordance to the county severe weather plan
Applicable Goal Statement:	Provide outdoor warning of severe weather to persons in the Bona area
Estimated Cost:	$13,000 - $23,000
Benefits:	Implementation could help prevent loss of life.
Plan for Implementation	
Responsible Organization/Department:	Dadeville Rural Fire Protection District
Action/Project Priority:	High - 37
Timeline for Completion:	24 months
Potential Fund Sources:	USDA, Grants, partnership with other agencies, private donations
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	New
Report of Progress	

Goal 2: Preserve and maintain property, infrastructure, and the County's local economies.

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Lack of backup power in critical facilities
Hazard(s) Addressed:	Tornado, Severe Thunderstorm, Flood, Winter Weather, Extreme Heat, Earthquake
Action or Project	
Action/Project Number:	2.1
Name of Action or Project:	Backup generators
Action or Project Description:	Install emergency backup generators where needed for critical and vulnerable facilities and infrastructure.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$5,000-$20,000
Benefits:	Improved public safety and preservation of critical infrastructure during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management; County Commission
Action/Project Priority:	High - 32
Timeline for Completion:	5+ years; ongoing
Potential Fund Sources:	HMGP; PDM; Local funds; Private funds; non-profit
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Emergency Operations Plan
Progress Report	
Action Status	Continuing
Report of Progress	Continue watching for grants and other funding opportunities

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Flooding of low water crossings
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.2
Name of Action or Project:	Low water crossing upgrades
Action or Project Description:	Improve low water crossings that frequently flood.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$2,500-$400,000
Benefits:	Improved public safety during hazard events and reduced infrastructure loss and repair costs.
Plan for Implementation	
Responsible Organization/Department:	Dade County Road & Bridge
Action/Project Priority:	High - 34
Timeline for Completion:	Ongoing; 5+ years
Potential Fund Sources:	Local County funds; HMGP; PDM
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Low water crossings have been identified and working on replacement as money becomes available.

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Buildup of debris in flooded areas
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.3
Name of Action or Project:	Drainage debris removal
Action or Project Description:	Identify water drainage obstructions and clean out debris from drainage channels and under bridges to lessen flooding potential.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$0-$10,000
Benefits:	Improved public safety during hazard events, mitigate future damage, and reduction in infrastructure repair costs.
Plan for Implementation	
Responsible Organization/Department:	Dade County Road & Bridge
Action/Project Priority:	High - 34
Timeline for Completion:	Ongoing; 5+ years
Potential Fund Sources:	Local County funds; HMGP; PDM
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Addressing as needed

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Flooding due to undersized infrastructure
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.4
Name of Action or Project:	Storm water improvements
Action or Project Description:	Where feasible, install and/or improve culverts to eliminate water flow restrictions.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$0-$10,000
Benefits:	Reduce future damage and infrastructure loss and repair costs.
Plan for Implementation	
Responsible Organization/Department:	Dade County Road and Bridge
Action/Project Priority:	High - 35
Timeline for Completion:	Ongoing; 5+ years
Potential Fund Sources:	Local County funds; HMGP; PDM
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Sites have been identified and work is being done as money is available.

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Economic loss resulting from drought.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.5
Name of Action or Project:	Drought-resistant practices
Action or Project Description:	Encourage best practices for drought-resistant farming.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$0-$1,000
Benefits:	Reduced agricultural loss from drought.
Plan for Implementation	
Responsible Organization/Department:	USDA Extension; Emergency Management
Action/Project Priority:	Medium - 28
Timeline for Completion:	Ongoing; 5 years
Potential Fund Sources:	USDA; Missouri Department of Conservation
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Not started

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Lack of integration into planning mechanisms
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	2.7
Name of Action or Project:	Goals integration
Action or Project Description:	Incorporate the goals, objectives, and mitigation actions from the Dade County Natural Hazard Mitigation Plan into existing and new plans, programs, and regulations where appropriate.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$0
Benefits:	Enable streamlined implementation of identified actions to preserve property, infrastructure, and reduce loss of life and injury.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management
Action/Project Priority:	Medium - 28
Timeline for Completion:	Ongoing; 5+ years
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	County Emergency Operations Plan; County Mitigation Plan
Progress Report	
Action Status	Continuing
Report of Progress	Will incorporate after adoption

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Repetitive flooding of property
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.8
Name of Action or Project:	NFIP Enforcement
Action or Project Description:	Enforce NFIP floodplain management requirements, including regulating all new and substantially improved construction in the Special Flood Hazard Areas (SFHAs).
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$0
Benefits:	Reduced loss of property and infrastructure
Plan for Implementation	
Responsible Organization/Department:	Dade County; Emergency Management
Action/Project Priority:	Medium - 28
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Floodplain Ordinance
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Unintentional fire setting due to burning during inappropriate conditions.
Hazard(s) Addressed:	Wildfire
Action or Project	
Action/Project Number:	2.10
Name of Action or Project:	Burn restrictions
Action or Project Description:	Implement burn restrictions during time of weather conditions conducive to the spread of wildfire.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$0
Benefits:	Reduced property and economic loss due to wildfire.
Plan for Implementation	
Responsible Organization/Department:	Dade County Commission; Fire Districts
Action/Project Priority:	Medium - 29
Timeline for Completion:	Ongoing
Potential Fund Sources:	Fire District funds; Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	None
Progress Report	
Action Status	Continuing
Report of Progress	Education ongoing

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Road damage due to flooding events
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.12
Name of Action or Project:	Ditches
Action or Project Description:	Cut ditches in areas of hills and curves on gravel roads to keep water from washing out roadways.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$20,000-$600,000
Benefits:	Reduced property damage from flooding events.
Plan for Implementation	
Responsible Organization/Department:	Dade County Roads & Bridges
Action/Project Priority:	High - 37
Timeline for Completion:	5+ years
Potential Fund Sources:	HMGP, PDM, County
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	New
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Repeated infrastructure damage from flooding
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.13
Name of Action or Project:	Hulston Bridge
Action or Project Description:	Replace Hulston Bridge and approaches at the end of EE Hwy in order to eliminate frequent flooding.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$300,000-$800,000
Benefits:	Reduced infrastructure damage cost from flood events
Plan for Implementation	
Responsible Organization/Department:	Dade County Roads & Bridges
Action/Project Priority:	High - 33
Timeline for Completion:	2 years
Potential Fund Sources:	HMGP, PDM, FMA, State, County
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	New
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	Village of Arcola
Risk / Vulnerability	
Problem being Mitigated:	Lack of backup power in critical facilities
Hazard(s) Addressed:	Tornado, Severe Thunderstorm, Flood, Winter Weather, Extreme Heat, Earthquake
Action or Project	
Action/Project Number:	2.1
Name of Action or Project:	Backup generators
Action or Project Description:	Install emergency backup generator for city well.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$20,000
Benefits:	Improved public safety and preservation of critical infrastructure during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Board
Action/Project Priority:	Medium - 28
Timeline for Completion:	1-5 years
Potential Fund Sources:	HMGP, USDA, surplus, local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual budget
Progress Report	
Action Status	Revised
Report of Progress	Trying to obtain from Army surplus/MDC but no success.

Action Worksheet	
Name of Jurisdiction:	Village of Arcola
Risk / Vulnerability	
Problem being Mitigated:	Repetitive flooding of property
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.8
Name of Action or Project:	NFIP Enforcement
Action or Project Description:	Enforce NFIP floodplain management requirements, including regulating all new and substantially improved construction in the Special Flood Hazard Areas (SFHAs).
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	No additional cost
Benefits:	Reduced loss of property and infrastructure
Plan for Implementation	
Responsible Organization/Department:	Board
Action/Project Priority:	Medium - 27
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Floodplain ordinance
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Everton
Risk / Vulnerability	
Problem being Mitigated:	Flooding due to undersized infrastructure
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.4
Name of Action or Project:	Storm water improvements
Action or Project Description:	Where feasible, install and/or improve culverts to eliminate water flow restrictions.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$5,000-$10,000
Benefits:	Reduce future damage and infrastructure loss and repair costs.
Plan for Implementation	
Responsible Organization/Department:	Mayor
Action/Project Priority:	High - 45
Timeline for Completion:	2 years
Potential Fund Sources:	FMA, PDM, local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Not started – need further planning and funds

Action Worksheet	
Name of Jurisdiction:	City of Everton
Risk / Vulnerability	
Problem being Mitigated:	Lack of integration into planning mechanisms
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	2.7
Name of Action or Project:	Goals integration
Action or Project Description:	Incorporate the goals, objectives, and mitigation actions from the Dade County Natural Hazard Mitigation Plan into existing and new plans, programs, and regulations where appropriate.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$0
Benefits:	Enable streamlined implementation of identified actions to preserve property, infrastructure, and reduce loss of life and injury.
Plan for Implementation	
Responsible Organization/Department:	City Council
Action/Project Priority:	High - 36
Timeline for Completion:	1 year
Potential Fund Sources:	None needed
Local Planning Mechanisms to be Used in Implementation, if any:	Mitigation Plan
Progress Report	
Action Status	Continuing
Report of Progress	Started – city bylaws being incorporated again

Action Worksheet	
Name of Jurisdiction:	City of Everton
Risk / Vulnerability	
Problem being Mitigated:	Repetitive flooding of property
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.8
Name of Action or Project:	NFIP Enforcement
Action or Project Description:	Enforce NFIP floodplain management requirements, including regulating all new and substantially improved construction in the Special Flood Hazard Areas (SFHAs).
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$0
Benefits:	Reduced loss of property and infrastructure
Plan for Implementation	
Responsible Organization/Department:	City Council
Action/Project Priority:	Medium - 28
Timeline for Completion:	1 year
Potential Fund Sources:	Local Funds, PDM
Local Planning Mechanisms to be Used in Implementation, if any:	Floodplain Ordinance
Progress Report	
Action Status	Continuing
Report of Progress	Work in progress – city bylaws being reinforced

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Lack of backup power in critical facilities
Hazard(s) Addressed:	Tornado, Severe Thunderstorm, Flood, Winter Weather, Extreme Heat, Earthquake
Action or Project	
Action/Project Number:	2.1
Name of Action or Project:	Backup generators
Action or Project Description:	Install emergency backup generators where needed for critical and vulnerable facilities and infrastructure.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$15,000
Benefits:	Improved public safety and preservation of critical infrastructure during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Chief of Police, City Council
Action/Project Priority:	Medium - 25
Timeline for Completion:	12 months
Potential Fund Sources:	Local funds, available grants, USDA
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Flooding of low water crossings
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.2
Name of Action or Project:	Low water crossing upgrades
Action or Project Description:	Improve low water crossings that frequently flood.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	Unknown
Benefits:	Improved public safety during hazard events and reduced infrastructure loss and repair costs.
Plan for Implementation	
Responsible Organization/Department:	Public Works
Action/Project Priority:	Medium - 25
Timeline for Completion:	12 months
Potential Fund Sources:	Local funds, street budget, HMGP
Local Planning Mechanisms to be Used in Implementation, if any:	Annual budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Buildup of debris in flooded areas
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.3
Name of Action or Project:	Drainage debris removal
Action or Project Description:	Identify water drainage obstructions and clean out debris from drainage channels and under bridges to lessen flooding potential.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	Unknown
Benefits:	Improved public safety during hazard events, mitigate future damage, and reduction in infrastructure repair costs.
Plan for Implementation	
Responsible Organization/Department:	Public Works
Action/Project Priority:	Medium - 28
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Flooding due to undersized infrastructure
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.4
Name of Action or Project:	Storm water improvements
Action or Project Description:	Where feasible, install and/or improve culverts to eliminate water flow restrictions.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$50,000
Benefits:	Reduce future damage and infrastructure loss and repair costs.
Plan for Implementation	
Responsible Organization/Department:	Public Works
Action/Project Priority:	Medium - 28
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds, street budget
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Repetitive flooding of property
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.8
Name of Action or Project:	NFIP Enforcement
Action or Project Description:	Enforce NFIP floodplain management requirements, including regulating all new and substantially improved construction in the Special Flood Hazard Areas (SFHAs).
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	None
Benefits:	Reduced loss of property and infrastructure
Plan for Implementation	
Responsible Organization/Department:	City Council
Action/Project Priority:	High - 35
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Floodplain Ordinance, Annual Budget, Council meetings
Progress Report	
Action Status	Continuing
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Flooding due to undersized infrastructure
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.1
Name of Action or Project:	Storm water improvements
Action or Project Description:	Where feasible, install and/or improve culverts to eliminate water flow restrictions.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$50,000
Benefits:	Reduce future damage and infrastructure loss and repair costs.
Plan for Implementation	
Responsible Organization/Department:	City of Lockwood/City Superintendent
Action/Project Priority:	High - 33
Timeline for Completion:	2 years
Potential Fund Sources:	City Street, Water, and Sewer Fund, Parks and Stormwater Tax, SRF Grant and Loan
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Drainage Ordinance
Progress Report	
Action Status	Continuing
Report of Progress	Improvements are ongoing. A local parks and stormwater tax have been added to the ballot for April. The City has also applied for an SRF grant and loan.

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Lack of integration into planning mechanisms
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	2.2
Name of Action or Project:	Goals integration
Action or Project Description:	Incorporate the goals, objectives, and mitigation actions from the Dade County Natural Hazard Mitigation Plan into existing and new plans, programs, and regulations where appropriate.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$0
Benefits:	Enable streamlined implementation of identified actions to preserve property, infrastructure, and reduce loss of life and injury.
Plan for Implementation	
Responsible Organization/Department:	Mayor/Board of Aldermen
Action/Project Priority:	High - 47
Timeline for Completion:	Already in place
Potential Fund Sources:	Current City Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	The City will continue to partner with the County to implement County wide actions.

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Buildup of debris in flooded areas
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.3
Name of Action or Project:	Drainage debris removal
Action or Project Description:	Identify water drainage obstructions and clean out debris from drainage channels and under bridges to lessen flooding potential.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$10,000-$20,000
Benefits:	Improved public safety during hazard events, mitigate future damage, and reduction in infrastructure repair costs.
Plan for Implementation	
Responsible Organization/Department:	City of Administration, City Superintendent
Action/Project Priority:	High - 36
Timeline for Completion:	1 year
Potential Fund Sources:	City Street, Sewer, and Water fund
Local Planning Mechanisms to be Used in Implementation, if any:	Drainage Ordinance, Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Progress is ongoing. Ditches continually being maintained/improved by City Utilities.

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Lack of information for critical facilities during hazard events
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	2.4
Name of Action or Project:	Information sharing
Action or Project Description:	Share information with all jurisdictions and entities responsible for critical/vulnerable facilities and services.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$1,000
Benefits:	Cohesive response by all jurisdictions during hazard events
Plan for Implementation	
Responsible Organization/Department:	Mayor/Board of Aldermen, Local EMD, County EMA, Fire Department
Action/Project Priority:	High - 47
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	In progress and ongoing. No issues.

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Inadequate equipment for emergency response
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	2.5
Name of Action or Project:	Equipment upgrades
Action or Project Description:	Review and upgrade equipment as identified and budget for additional emergency equipment to enhance protection and response during disaster events.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$100,000-$300,000
Benefits:	Reduced loss of life and injury and improved emergency functions during hazard events.
Plan for Implementation	
Responsible Organization/Department:	City Administration, City Superintendent
Action/Project Priority:	Medium - 29
Timeline for Completion:	3 years
Potential Fund Sources:	Available City Funds, State Grants
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing. The City upgrades as the budget permits.

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Complacency with implementation of identified actions & operations
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	2.6
Name of Action or Project:	Annual review
Action or Project Description:	Review the Dade County Emergency Operations Plan and Hazard Mitigation Plan annually.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$0
Benefits:	Awareness of identified actions and ability to update as things change.
Plan for Implementation	
Responsible Organization/Department:	Mayor/Board of Aldermen/Local EMD/County EMA
Action/Project Priority:	High - 39
Timeline for Completion:	Ongoing
Potential Fund Sources:	Available City Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing. Plan is reviewed annually.

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Inaccessible evacuation or emergency routes
Hazard(s) Addressed:	Flood, Winter Weather, Earthquake, Dam Failure, Wildfire
Action or Project	
Action/Project Number:	2.7
Name of Action or Project:	Evacuation and emergency access
Action or Project Description:	Review emergency access routes and evacuation routes and work with the responsible entities to minimize or reduce identified problems.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$100
Benefits:	Allows for updated routes for emergency access and evacuation during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Mayor/Board of Alderman/Local EMD/County EMA
Action/Project Priority:	High - 39
Timeline for Completion:	Ongoing
Potential Fund Sources:	Available City Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing. No issues.

Action Worksheet	
Name of Jurisdiction:	City of Lockwood
Risk / Vulnerability	
Problem being Mitigated:	Repetitive flooding of property
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.8
Name of Action or Project:	NFIP Enforcement
Action or Project Description:	Enforce NFIP floodplain management requirements, including regulating all new and substantially improved construction in the Special Flood Hazard Areas (SFHAs).
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$100
Benefits:	Reduced loss of property and infrastructure
Plan for Implementation	
Responsible Organization/Department:	Mayor/Board of Aldermen
Action/Project Priority:	High - 47
Timeline for Completion:	Ongoing
Potential Fund Sources:	City Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Floodplain Ordinance
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing. The City will continue to implement and enforce NFIP floodplain management requirements.

Action Worksheet	
Name of Jurisdiction:	Village of South Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Repeated infrastructure damage from flooding
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.13
Name of Action or Project:	Highway 39 Bridge
Action or Project Description:	Replace South Highway 39 Bridge in order to reduce damage from frequent flooding.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	Unknown
Benefits:	Reduced infrastructure damage cost from flood events
Plan for Implementation	
Responsible Organization/Department:	City Council
Action/Project Priority:	Medium - 25
Timeline for Completion:	Unknown
Potential Fund Sources:	HMGP, Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	New
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	Village of South Greenfield
Risk / Vulnerability	
Problem being Mitigated:	Repeated infrastructure damage from flooding
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.14
Name of Action or Project:	City Road Improvement
Action or Project Description:	Elevate city roads to mitigate the effects of flash flooding.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	Unknown
Benefits:	Reduced infrastructure damage cost from flood events
Plan for Implementation	
Responsible Organization/Department:	City Council
Action/Project Priority:	Medium - 25
Timeline for Completion:	Unknown
Potential Fund Sources:	HMGP, Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	New
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	Lockwood R-I School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of backup power in critical facilities
Hazard(s) Addressed:	Tornado, Severe Thunderstorm, Flood, Winter Weather, Extreme Heat, Earthquake
Action or Project	
Action/Project Number:	2.1
Name of Action or Project:	Backup generators
Action or Project Description:	Install emergency backup generators in school facilities.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$10,000 per building
Benefits:	Improved public safety and preservation of critical infrastructure during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Lockwood School District administration
Action/Project Priority:	High - 31
Timeline for Completion:	5 years
Potential Fund Sources:	Local operating funds and possible grant funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	New
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	Dadeville R-II School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of backup power in critical facilities
Hazard(s) Addressed:	Tornado, Severe Thunderstorm, Flood, Winter Weather, Extreme Heat, Earthquake
Action or Project	
Action/Project Number:	2.1
Name of Action or Project:	Backup generators
Action or Project Description:	Install emergency backup generators where needed for critical and vulnerable facilities and infrastructure.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$5,000-$10,000
Benefits:	Improved public safety and preservation of critical infrastructure during hazard events.
Plan for Implementation	
Responsible Organization/Department:	School Board and Superintendent
Action/Project Priority:	High - 36
Timeline for Completion:	1 year
Potential Fund Sources:	HMGP Grant, Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, School Emergency Plan, CSIP
Progress Report	
Action Status	Continuing
Report of Progress	Barriers may include lack of funding

Action Worksheet	
Name of Jurisdiction:	Dadeville R-II School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of integration into planning mechanisms
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	2.7
Name of Action or Project:	Goals integration
Action or Project Description:	Incorporate the goals, objectives, and mitigation actions from the Dade County Natural Hazard Mitigation Plan into existing and new plans, programs, and regulations where appropriate.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$0
Benefits:	Enable streamlined implementation of identified actions to preserve property, infrastructure, and reduce loss of life and injury.
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	High - 34
Timeline for Completion:	Ongoing
Potential Fund Sources:	None
Local Planning Mechanisms to be Used in Implementation, if any:	School Emergency Plan
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Greenfield R-IV School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of backup power in critical facilities
Hazard(s) Addressed:	Tornado, Severe Thunderstorm, Flood, Winter Weather, Extreme Heat, Earthquake
Action or Project	
Action/Project Number:	2.1
Name of Action or Project:	Backup generators
Action or Project Description:	Install emergency backup generators where needed for critical and vulnerable facilities and infrastructure.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$10,000 - $15,000
Benefits:	Improved public safety and preservation of critical infrastructure during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Maintenance and Central Office
Action/Project Priority:	High - 31
Timeline for Completion:	12 months
Potential Fund Sources:	HMGP, USDA, District Operating Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, School Emergency Plan
Progress Report	
Action Status	Not Started
Report of Progress	District does not have the funds to cover this expense at the moment.

Action Worksheet	
Name of Jurisdiction:	Greenfield R-IV School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of integration into planning mechanisms
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	2.7
Name of Action or Project:	Goals integration
Action or Project Description:	Incorporate the goals, objectives, and mitigation actions from the Dade County Natural Hazard Mitigation Plan into existing and new plans, programs, and regulations where appropriate.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$1000.00
Benefits:	Enable streamlined implementation of identified actions to preserve property, infrastructure, and reduce loss of life and injury.
Plan for Implementation	
Responsible Organization/Department:	Local Governments and Central Office
Action/Project Priority:	High - 44
Timeline for Completion:	12 Months
Potential Fund Sources:	District Operating Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Working on promoting hazard mitigation goals.

Action Worksheet	
Name of Jurisdiction:	Dade County R-IV Fire District
Risk / Vulnerability	
Problem being Mitigated:	Lack of integration into planning mechanisms
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	2.7
Name of Action or Project:	Goals integration
Action or Project Description:	Incorporate the goals, objectives, and mitigation actions from the Dade County Natural Hazard Mitigation Plan into existing and new plans, programs, and regulations where appropriate.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	$0
Benefits:	Enable streamlined implementation of identified actions to preserve property, infrastructure, and reduce loss of life and injury.
Plan for Implementation	
Responsible Organization/Department:	EMD, All county
Action/Project Priority:	High - 39
Timeline for Completion:	Ongoing
Potential Fund Sources:	EMD
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dadeville Rural Fire Protection District
Risk / Vulnerability	
Problem being Mitigated:	Integrate Dade County Hazard Mitigation Plan into existing plans and training
Hazard(s) Addressed:	All
Action or Project	
Action/Project Number:	2.7
Name of Action or Project:	Goals integration
Action or Project Description:	Incorporate the goals, objectives, and mitigation actions from the Dade County Natural Hazard Mitigation Plan into existing and new plans, programs, and regulations where appropriate.
Applicable Goal Statement:	Preserve and maintain property, infrastructure and the county's local economies.
Estimated Cost:	No cost expected
Benefits:	Integration of the DCHMP will better familiarize our agency with others in the county and ways in which we can help our community in the event of a disaster.
Plan for Implementation	
Responsible Organization/Department:	Dadeville Rural Fire Protection District
Action/Project Priority:	High - 40
Timeline for Completion:	6 months from DCHMP approval
Potential Fund Sources:	None needed
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	New
Report of Progress	

Goal 3: Ensure continued operation of government and emergency functions during a disaster.

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Lack of information for critical facilities during hazard events
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.1
Name of Action or Project:	Information sharing
Action or Project Description:	Share information with all jurisdictions and entities responsible for critical/vulnerable facilities and services.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$0
Benefits:	Cohesive response by all jurisdictions during hazard events
Plan for Implementation	
Responsible Organization/Department:	EMD
Action/Project Priority:	High - 38
Timeline for Completion:	Ongoing
Potential Fund Sources:	EMD
Local Planning Mechanisms to be Used in Implementation, if any:	None
Progress Report	
Action Status	Continuing

Report of Progress	Ongoing with e-mails and county meetings

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Lack of access to citizens
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.2
Name of Action or Project:	Emergency response access
Action or Project Description:	Require all communities to have emergency response access to all portions of their jurisdictions.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$0
Benefits:	Reduced loss of life, injury, and continuation of operations during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Dade County Sheriff, Missouri Highway Patrol, EMD
Action/Project Priority:	High - 38
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Inadequate equipment for emergency response
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.3
Name of Action or Project:	Equipment upgrades
Action or Project Description:	Review and upgrade equipment as identified and budget for additional emergency equipment to enhance protection and response during disaster events.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$1-$1,000
Benefits:	Reduced loss of life and injury and improved emergency functions during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management, Fire Departments, First Responders
Action/Project Priority:	Medium - 25
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local Funds, Grants - State, County, Federal
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing

Report of Progress	Mobile Emergency Operations Command Vehicle; repaired and upgraded generator

Action Worksheet	
Name of Jurisdiction:	Dade County
Risk / Vulnerability	
Problem being Mitigated:	Inaccessible evacuation or emergency routes
Hazard(s) Addressed:	Flood, Winter Weather, Earthquake, Dam Failure, Wildfire
Action or Project	
Action/Project Number:	3.5
Name of Action or Project:	Evacuation and emergency access
Action or Project Description:	Review emergency access routes and evacuation routes and work with the responsible entities to minimize or reduce identified problems.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$0
Benefits:	Allows for updated routes for emergency access and evacuation during hazard events.
Plan for Implementation	
Responsible Organization/Department:	MoDOT, Dade County Road & Bridge, Dade County Sheriff
Action/Project Priority:	High - 33
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local Funds, Partner Agency Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Everton
Risk / Vulnerability	
Problem being Mitigated:	Lack of information for critical facilities during hazard events
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.1
Name of Action or Project:	Information sharing
Action or Project Description:	Share information with all jurisdictions and entities responsible for critical/vulnerable facilities and services.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	Unknown
Benefits:	Cohesive response by all jurisdictions during hazard events
Plan for Implementation	
Responsible Organization/Department:	City Council
Action/Project Priority:	High - 40
Timeline for Completion:	1 year
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Meetings
Progress Report	
Action Status	Continuing

Report of Progress	Not started – to begin with new council

Action Worksheet	
Name of Jurisdiction:	City of Everton
Risk / Vulnerability	
Problem being Mitigated:	Complacency with implementation of identified actions & operations
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.4
Name of Action or Project:	Annual review
Action or Project Description:	Annually review the Dade County Emergency Operations Plan and Hazard Mitigation Plan.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$400
Benefits:	Awareness of identified actions and ability to update as things change.
Plan for Implementation	
Responsible Organization/Department:	City Council
Action/Project Priority:	High - 37
Timeline for Completion:	1 year
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Not started – to begin with new council

Action Worksheet	
Name of Jurisdiction:	Lockwood R-I School District
Risk / Vulnerability	
Problem being Mitigated:	Complacency with implementation of identified actions & operations
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.4
Name of Action or Project:	Annual review
Action or Project Description:	Annually review the Dade County Emergency Operations Plan and Hazard Mitigation Plan.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$0
Benefits:	Awareness of identified actions and ability to update as things change.
Plan for Implementation	
Responsible Organization/Department:	District Administration
Action/Project Priority:	High - 34
Timeline for Completion:	Ongoing
Potential Fund Sources:	None needed
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing

Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dadeville R-II School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of information for critical facilities during hazard events
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.1
Name of Action or Project:	Information sharing
Action or Project Description:	Share information with all jurisdictions and entities responsible for critical/vulnerable facilities and services.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$0
Benefits:	Cohesive response by all jurisdictions during hazard events
Plan for Implementation	
Responsible Organization/Department:	Superintendent
Action/Project Priority:	High - 37
Timeline for Completion:	Ongoing
Potential Fund Sources:	None needed
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Will continue to share information

Action Worksheet	
Name of Jurisdiction:	Dadeville R-II School District
Risk / Vulnerability	
Problem being Mitigated:	Complacency with implementation of identified actions & operations
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.4
Name of Action or Project:	Annual review
Action or Project Description:	Annually review the Dade County Emergency Operations Plan and Hazard Mitigation Plan.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$0
Benefits:	Awareness of identified actions and ability to update as things change.
Plan for Implementation	
Responsible Organization/Department:	School Board and Superintendent
Action/Project Priority:	High - 36
Timeline for Completion:	1 month
Potential Fund Sources:	None Needed
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	

Action Status	Continuing
Report of Progress	Will add to the board agenda annually

Action Worksheet	
Name of Jurisdiction:	Greenfield R-IV School District
Risk / Vulnerability	
Problem being Mitigated:	Lack of information for critical facilities during hazard events
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.1
Name of Action or Project:	Information sharing
Action or Project Description:	Share information with all jurisdictions and entities responsible for critical/vulnerable facilities and services.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$1,000
Benefits:	Cohesive response by all jurisdictions during hazard events
Plan for Implementation	
Responsible Organization/Department:	Maintenance and Central Office
Action/Project Priority:	High - 44
Timeline for Completion:	12 Months
Potential Fund Sources:	District Operating Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Emergency Plan
Progress Report	
Action Status	Not Started
Report of Progress	Will start the process once the mitigation plan is approved.

Action Worksheet	
Name of Jurisdiction:	Greenfield R-IV School District
Risk / Vulnerability	
Problem being Mitigated:	Complacency with implementation of identified actions & operations
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.4
Name of Action or Project:	Annual review
Action or Project Description:	Annually review the Dade County Emergency Operations Plan and Hazard Mitigation Plan.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$1,000
Benefits:	Awareness of identified actions and ability to update as things change.
Plan for Implementation	
Responsible Organization/Department:	Central Office
Action/Project Priority:	High - 47
Timeline for Completion:	12 Months
Potential Fund Sources:	District Operating Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	New
Report of Progress	Will Begin the process once the mitigation plan is approved

Action Worksheet	
Name of Jurisdiction:	Greenfield R-IV School District
Risk / Vulnerability	
Problem being Mitigated:	Inaccessible evacuation or emergency routes
Hazard(s) Addressed:	Flood, Winter Weather, Earthquake, Dam Failure, Wildfire
Action or Project	
Action/Project Number:	3.5
Name of Action or Project:	Evacuation and emergency access
Action or Project Description:	Review emergency access routes and evacuation routes and work with the responsible entities to minimize or reduce identified problems.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	1000
Benefits:	Allows for updated routes for emergency access and evacuation during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Central Office and Maintenance Dept
Action/Project Priority:	High - 47
Timeline for Completion:	12 months
Potential Fund Sources:	District Operating Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget, Emergency Plan
Progress Report	
Action Status	Continuing
Report of Progress	The District reviews this information yearly with staff and students.

Action Worksheet	
Name of Jurisdiction:	Dade County R-IV Fire District
Risk / Vulnerability	
Problem being Mitigated:	Lack of information for critical facilities during hazard events
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.1
Name of Action or Project:	Information sharing
Action or Project Description:	Share information with all jurisdictions and entities responsible for critical/vulnerable facilities and services.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$0
Benefits:	Cohesive response by all jurisdictions during hazard events
Plan for Implementation	
Responsible Organization/Department:	Fire, Critical/Vulnerable Facilities
Action/Project Priority:	High - 39
Timeline for Completion:	Ongoing
Potential Fund Sources:	Fire, Critical/Vulnerable Facilities
Local Planning Mechanisms to be Used in Implementation, if any:	None
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dade County R-IV Fire District
Risk / Vulnerability	
Problem being Mitigated:	Inadequate equipment for emergency response
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.3
Name of Action or Project:	Equipment upgrades
Action or Project Description:	Review and upgrade equipment as identified and budget for additional emergency equipment to enhance protection and response during disaster events.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	Varies/unknown
Benefits:	Reduced loss of life and injury and improved emergency functions during hazard events.
Plan for Implementation	
Responsible Organization/Department:	LEPC, Fire, EMD
Action/Project Priority:	High - 45
Timeline for Completion:	Ongoing
Potential Fund Sources:	Fire, LEPC
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dade County R-IV Fire District
Risk / Vulnerability	
Problem being Mitigated:	Complacency with implementation of identified actions & operations
Hazard(s) Addressed:	All hazards
Action or Project	
Action/Project Number:	3.4
Name of Action or Project:	Annual review
Action or Project Description:	Annually review the Dade County Emergency Operations Plan and Hazard Mitigation Plan.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$0
Benefits:	Awareness of identified actions and ability to update as things change.
Plan for Implementation	
Responsible Organization/Department:	EMD, Fire
Action/Project Priority:	High - 39
Timeline for Completion:	Ongoing
Potential Fund Sources:	Fire, EMD
Local Planning Mechanisms to be Used in Implementation, if any:	Annual Budget
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dade County R-IV Fire District
Risk / Vulnerability	
Problem being Mitigated:	Inaccessible evacuation or emergency routes
Hazard(s) Addressed:	Flood, Winter Weather, Earthquake, Dam Failure, Wildfire
Action or Project	
Action/Project Number:	3.5
Name of Action or Project:	Evacuation and emergency access
Action or Project Description:	Review emergency access routes and evacuation routes and work with the responsible entities to minimize or reduce identified problems.
Applicable Goal Statement:	Ensure continued operations of government and emergency functions during a natural hazard event.
Estimated Cost:	$0
Benefits:	Allows for updated routes for emergency access and evacuation during hazard events.
Plan for Implementation	
Responsible Organization/Department:	EMD, Road & Bridge
Action/Project Priority:	High - 41
Timeline for Completion:	Ongoing
Potential Fund Sources:	EMD, Road & Bridge
Local Planning Mechanisms to be Used in Implementation, if any:	None
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

5 PLAN MAINTENANCE PROCESS

This chapter provides an overview of the overall strategy for plan maintenance and outlines the method and schedule for monitoring, updating and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

5.1 Monitoring, Evaluating, and Updating the Plan

44 CFR Requirement 201.6(c)(4): The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

5.1.1 Responsibility for Plan Maintenance

The Mitigation Planning Committee (MPC) has served as an advisory body during the plan update process, but is not a standing committee. Many MPC representatives and stakeholders are also represented on the Local Emergency Planning Committee (LEPC), as well as several other committees and groups in Dade County. The County Emergency Management Director oversees the LEPC and will be charged with reconvening the MPC, either as part of the already established LEPC, or as a separate group if necessary. However, it will be up to the County Commission, Office of Emergency Management, and the local jurisdictions to carry out the goals and actions outlined. Maintenance will involve agreement of the participating jurisdictions, including schools and special districts, to:

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

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

5.1.2 Plan Maintenance Schedule

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

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

5.1.3 Plan Maintenance Process

Progress on the proposed actions can be monitored by evaluating changes in vulnerabilities identified in the plan. During the annual meeting, members of the MPC will review changes in vulnerability identified as follows:

- Decreased vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions,
- Increased vulnerability due to hazard events, and/or
- Increased vulnerability as a result of new development (and/or annexation).

Future 5-year updates to this plan will include the following activities:

- Consideration of changes in vulnerability due to action implementation,
- Documentation of success stories where mitigation efforts have proven effective,
- Documentation of unsuccessful mitigation actions and why the actions were not effective,
- Documentation of previously overlooked hazard events that may have occurred since the previous plan approval,
- Incorporation of new data or studies with information on hazard risks,
- Incorporation of new capabilities or changes in capabilities,
- Incorporation of growth data and changes to inventories, and
- Incorporation of ideas for new actions and changes in action prioritization.

In order to best evaluate any changes in vulnerability as a result of plan implementation, the participating jurisdictions will adopt the following process:

- Each proposed action in the plan identified an individual, office, or agency responsible for action implementation. This entity will track and report on an annual basis to the jurisdictional MPC 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 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 appropriate and necessary. Changes will be approved by the Dade County Commission and the governing boards of the other participating jurisdictions.

5.2 Incorporation into Existing Planning Mechanisms

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

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

- Comprehensive plans of participating jurisdictions;
- Ordinances of participating jurisdictions;
- Dade County Emergency Operations Plan;
- Capital improvement plans and budgets;
- School and Special District Plans and budgets

Jurisdictional representatives involved in updating these existing planning mechanisms will be responsible for integrating the findings and actions of the mitigation plan, as appropriate The EMD and MPC is also responsible for monitoring this integration and incorporation of the appropriate information into the next five-year update of the multi-jurisdictional hazard mitigation plan.

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

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

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

Jurisdiction	Planning Mechanisms	Integration Process for Previous Plan	Integration Process for Current Plan
Unincorporated Dade County	Annual Budget County Emergency Operations Plan County Mitigation Plan Floodplain Ordinance	Installed generator at jail Cleared ditches	Annual Budget County Emergency Operations Plan County Mitigation Plan Floodplain Ordinance
Village of Arcola	Annual Budget Floodplain Ordinance	None – limited staff and funding	Annual Budget Floodplain Ordinance
City of Everton	Annual Budget Tree Trimming Ordinance Nuisance Ordinance Floodplain Ordinance	Reinforced city bylaws NFIP regulation enforcement	Annual Budget Floodplain Ordinance Monthly Meetings
City of Greenfield	Annual Budget Zoning Ordinance Building Code Tree Trimming Ordinance Nuisance Ordinance Emergency Operations Plan Storm Water Ordinance Floodplain Ordinance	New building codes adopted Culverts replaced	Annual Budget Building Code Emergency Operations Plan Floodplain Ordinance
City of Lockwood	Annual Budget Building Code Emergency Operations Plan Tree Trimming Ordinance Nuisance Ordinance Drainage Ordinance Floodplain Ordinance	Building regulations adopted Generators installed Cleared ditches	Annual Budget Building Code Emergency Operations Plan Drainage Ordinance Floodplain Ordinance
Village of South Greenfield	Annual Budget	Culverts replaced	Annual Budget
Lockwood R-I School District	Annual Budget School Emergency Plan Weapons Policy	Evacuation routes improved Expanded radio network	Annual Budget School Emergency Plan
Dadeville R-II School District	Annual Budget Master Plan School Emergency Plan Weapons Policy CSIP	Siren installation Door and window replacement Installed safe rooms	Annual Budget Master Plan School Emergency Plan CSIP
Greenfield R-IV School District	Annual Budget Master Plan Capital Improvement Plan School Emergency Plan Weapons Policy	Alert system updates Ongoing plan review	Annual Budget Master Plan Capital Improvement Plan School Emergency Plan
Dade County Rural Fire Protection District	Annual Budget	Alert system updates New equipment	Annual Budget
Dadeville Rural Fire Protection District	Annual Budget County Mitigation Plan	Did not participate	Annual Budget

5.3 Continued Public Involvement

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

The hazard mitigation plan update process provides an opportunity to publicize success stories resulting from the plan's implementation and seek additional public comment. Information about the annual reviews will be posted in the local newspaper, as well as, on the Dade County Emergency Management social media following each annual review of the mitigation plan and will solicit comments from the public based on the annual review.

When the MPC reconvenes for the five-year update, the EMD 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.