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Section 1: Introduction

Plan Summary

In October of 2000, the 106th Congress passed Public Law 106-390 known as the Disaster Mitigation Act (DMA 2000). The purpose of this act was two-fold: 1) "To reduce the loss of life and property, human suffering, economic disruption, and disaster assistance costs resulting from natural disasters," and 2) "to provide a source of pre-disaster hazard mitigation funding that will assist states and local governments in implementing effective hazard mitigation measures that are designed to ensure the continued functionality of critical services and facilities after a natural disaster." (*Disaster Mitigation Act of 2000*, Title I, Section 101(b)(1-2))

According to the Federal Emergency Management Agency (FEMA), DMA 2000 (Public Law 106-390) provides the legal basis for FEMA mitigation planning requirements for State, local and Indian Tribal governments as a condition of mitigation grant assistance. As an amendment to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), DMA 2000 repealed the previous mitigation planning provisions and replaced them with new requirements that emphasize the need for coordinated mitigation planning and implementation among State, local, and Indian Tribal entities. In this venue, the act also established requirements for local level plans. With the creation and adoption of a hazard mitigation plan which adheres to DMA 2000 and FEMA's Mitigation Planning regulations (44CFR §201), included jurisdictions have an improved disaster plan and planning mechanism, but are also eligible for mitigation project funding under Section 404 of the Stafford Act. Other public entities, including publicly owned electrical cooperatives, may participate in or create their own mitigation plans to improve disaster preparation and make themselves funding eligible as well.

The *Multi-jurisdictional Hazard Mitigation Plan for Missouri's Electric Cooperatives* is a document which may be used by local cooperatives in future planning for development and disaster response. The 2023 update is the second update of the original plan developed in 2012. This plan includes statewide information and hazard assessments, but also provides for disparities which exist between the cooperatives and their service areas. Cooperative-specific chapters allow for local consideration in hazard mitigation planning ensuring inclusion of all pertinent information including, but not limited to, critical facilities receiving service, unique natural hazard vulnerabilities, changes in development, and local capabilities.

The 2023 update of the plan is structured with the Statewide Summary as the first chapter including its own Contents page and Appendix I (Resolutions) and Appendix II (Public Notice and Comments). The individual chapters are structured in a slightly different format with an individual Contents page and three appendices: Appendix A (Model Resolution); Appendix B (Documentation of Participation); and Appendix C (Surveys) are included in each individual cooperative chapter. Individual cooperative chapters are not to be considered stand-alone mitigation plans. Only the plan in its entirety meets federal regulations.

Prerequisites

All requirements of a multi-jurisdictional hazard mitigation plan have been addressed during the creation of this plan. Each requirement as set forth in the Code of Federal Regulations is identified, defined, and cross-referenced in Table 1 below.

Table 1 *CFR Regulations for Multi-Jurisdictional Hazard Mitigation Plans*

Requirement Number	Requirement Text	Location in Plan
§201.6(a)(4)	Multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process. Statewide plans will not be accepted as multi-jurisdictional plans.	Statewide Summary: Section 1 All Individual Cooperative Chapters
§201.6(b) and §201.6(c)(1)	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: An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval. 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; and Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information. 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.	Statewide Summary: Section 2 Cooperative Chapters: Section 5
§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 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	Statewide Summary Section 4 Cooperative Chapters: Section 3

Requirement Number	Requirement Text	Location in Plan
	events and on the probability of future hazard events.	
§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. The risk assessment in all plans approved after October 1, 2008, must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged by floods.	Statewide Summary Section 4 Cooperative Chapters: Section 3 Cooperative Chapters: N/A Electric Cooperatives are not subject to NFIP
§201.6(c)(2)(ii)(A)	The plans 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.	Statewide Summary Section 3 Cooperative Chapters: Sections 2 and 3
§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.	Statewide Summary: Section 4 Cooperative Chapters: Section 3
§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.	Statewide Summary Section 5 Cooperative Chapters Section 1
§201.6(c)(2)(iii)	For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.	Statewide Summary: Section 4 Cooperative Chapters: Section 3
§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.	Statewide Summary: Section 5 Cooperative Chapters: Section 4
§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.	Statewide Summary: Section 5 Cooperative Chapters: Section 4

Requirement Number	Requirement Text	Location in Plan
	The mitigation strategy must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.	Statewide Summary: Section 5 Cooperative Chapters: N/A Electric Cooperatives are not subject to NFIP
§201.6(c)(3)(iii)	The mitigation strategy section shall include an action plan describing how the actions identified in section (c)(3)(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 benefit review of the proposed projects and their associated costs.	Statewide Summary: Section 5 Cooperative Chapters: Section 4
§201.6(c)(3)(iv)	For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.	Cooperative Chapters: Section 4
§201.6(c)(4)(i)	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.	Statewide Summary: Section 6 Cooperative Chapters: Section 5
§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 improvements, when appropriate.	Statewide Summary: Section 6 Cooperative Chapters: Section 5
§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.	Statewide Summary: Section 6 Cooperative Chapters: Section 5
§201.6(c)(5)	For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted. Multi-Jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process.	Statewide Summary: Section 6 Appendix: I
§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 within 5 years in order to	Statewide Summary: Section 6 Cooperative Chapters: Section4 and 5

Requirement Number	Requirement Text	Location in Plan
	continue to be eligible for mitigation project grant funding.	

Quick Reference Guide

The following list of abbreviations is utilized throughout the Missouri Electrical Cooperative plan. This glossary is provided as a quick reference list.

AMEC – Association of Missouri Electric Cooperatives

DMA – Disaster Mitigation Act

FEMA – Federal Emergency Management Agency

G&T – Generation and Transmission Cooperative

HMGP – Hazard Mitigation Grant Program

MACOG – Missouri Association of Councils of Government

NCEI - National Centers for Environmental Information

NOAA – National Oceanic and Atmospheric Administration

NWMORCOG – Northwest Missouri Regional Council of Governments

OCR – Oil Circuit Reclosures

OH – Overhead

REC – Rural Electric Cooperative

RPC – Regional Planning Commission

SEMA – State Emergency Management Agency

SP – Single Phase

2P – Two-Phase

TP – Three-Phase

UG – Underground

Project History

In 2003, Missouri's State Emergency Management Agency (SEMA) and the Missouri Association of Councils of Government (MACOG) fashioned a partnership to assist the state's 114 counties and more than 1,000 municipalities in the creation of county-level hazard mitigation plans. This relationship was renewed in 2009 and again in 2014 with the five-year required update process. MACOG's nineteen regional planning commission members worked directly with local governments to facilitate the research, public involvement, composition, and passage of each hazard mitigation plan. The successful completion of county-level hazard mitigation plans directly led to a new partnership with Missouri's electric cooperatives.

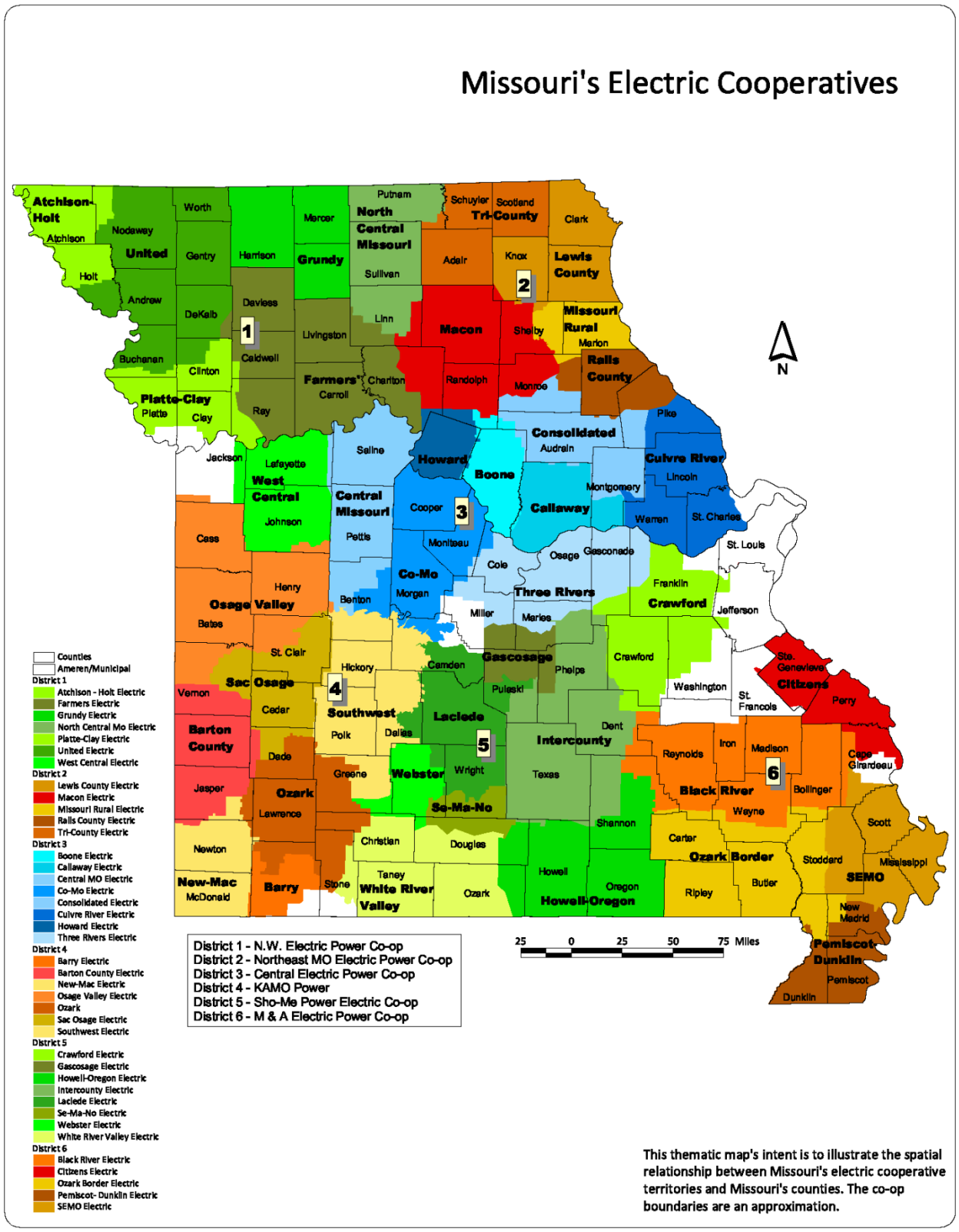
In 2010, the Association of Missouri Electric Cooperatives (AMEC) approached MACOG for assistance in the composition of hazard mitigation plans for their member Cooperatives. In order to provide local expertise and individual attention for each cooperative, the nineteen regional planning commissions were again asked to serve as the coordinating agencies. The Northwest Missouri Regional Council of Governments (NWMORCOG) served as the lead agency on the project by contracting directly with SEMA in January 2011, making NWMORCOG responsible for plan development, quality control, and overall administration of the project. Each regional planning commission was then subcontracted to complete up to four local cooperative chapters for inclusion in the statewide plan. Figure 1 shows Electric Cooperatives Regional boundaries (*Map source: AMEC website* www.amec.org)

For the 2023 plan update, MACOG contracted with NWMORCOG to be solely responsible for the statewide multi-jurisdictional plan update. This includes the Statewide Summary and the individual cooperative chapters. NWMORCOG staff worked through AMEC to distribute two surveys to the participating electric cooperatives. The first survey was a Data Survey to gather plan data that had changed over the last five years. This included the Asset Valuations and Asset Inventory as well as Risk Assessment information. The second survey was a Goals and Actions survey that provided a process for reviewing the mitigation actions updated for the 2018 plan. As part of the updating process, the objectives and tier levels used in the original plan were eliminated. Cooperative staff reviewed the goals and actions indicating the status of each for the 2023 plan update with the opportunity to add anything new as appropriate.

This project was funded through FEMA's Hazard Mitigation Grant Program, part of federal funds provided in the form of grant awards to "implement long-term hazard mitigation measures after a major disaster declaration."(www.fema.gov/government/grant/hmgp/index.shtm) Federal HMGP funds provided 75% of the costs associated with plan creation. The remaining 25% was provided by local cooperatives, coordinated through their statewide service organization, the Association of Missouri Electric Cooperatives, (AMEC) using in-kind match.

The large number of participating jurisdictions required the use of a multi-jurisdictional approach. While many elements can be considered on a regional or statewide basis, the vast differences in geography, vulnerabilities, demographics, and other characteristics required specialization for each rural electric cooperative. The finalized plan contains updates for both the statewide element and local/individual cooperative information in order to ensure that all characteristics, mitigation goals/actions, and potential projects are available to all participating cooperatives and other planning mechanisms throughout the state.

Figure 1 *Map of AMEC Electric Cooperatives*



Organizational Structure of Rural Electric Cooperatives in Missouri

The Association of Missouri Electric Cooperatives (AMEC) is a statewide service organization for Missouri's 47 electric cooperatives. Organized in 1937 and headquartered in Jefferson City, AMEC represents the interest of the state's electric co-ops and their members at the state capital and provides other needed services to Missouri's member-owned, not-for-profit electric providers. In addition to legislative activities, AMEC provides job training to electric co-op employees, organizes Missouri's annual participation in NRECA's youth tour of Washington DC, assists in marketing efforts and produces the award-winning monthly statewide publication *Rural Missouri* among other activities.

Missouri's electric cooperatives are non-profit power suppliers owned by their members. Each cooperative is governed by a board of directors elected from the membership. Each member-owner has one vote at an annual membership meeting at which bylaws are approved and board members are elected. The board members, each a member of the cooperative, sets policy for the co-op to direct day to day operations.

There are 40 distribution cooperatives which provide electricity to individual homes, farms, and businesses. Some of these co-ops are quite large while others may serve just one county. Missouri's smallest electric cooperative has just over 2,000 member-owners while our largest has more than 40,000 members. Regardless of size, each operates in a similar fashion.

Each electric cooperative operates its business according to the following cooperative principles:

- Voluntary and open membership
- Democratic member control
- Member economic participation
- Autonomy and independence
- Education, training, and information
- Cooperation among cooperatives
- Concern for the community

In addition to the 40 distribution cooperatives, six generation and transmission cooperatives and one wholesale distributor make up the balance of the cooperatives operating throughout the state. The generation and transmission cooperatives deliver wholesale electricity to local distribution cooperatives via high-voltage transmission lines. Associated Electric Cooperative, headquartered in Springfield, provides wholesale power to the generation and transmission cooperatives throughout the state except for Citizens Electric Corporation. Citizens Electric Corporation is part of the Wabash Valley Power Alliance with headquarters in Indianapolis, Indiana. Tables 2 and 3 provide listings of all member co-ops, contact, their location by city and county, and website. Forty-three (43) of the forty-seven (47) electric cooperatives participated in the 2023 plan update. Non-participants are noted on the listings. Central Missouri Electric Cooperative and White River Valley Electric Cooperative participated for the first time in the 2017 plan. Cuivre River Electric Cooperative participated for the first time in the 2023 plan. (*Source: Association of Mo. Electric Cooperatives)*

Table 2 *AMEC Distribution Cooperatives (2023 update)*

Cooperative	Contact	Email	City	Counties Served	Website
Atchison-Holt Electric Cooperative (AHEC)	Kevin Dechant	kdechant@ahec.coop	Rock Port	Atchison, Holt, Nodaway	www.ahec.coop
Barry Electric Cooperative (BEC)	Jennifer McBroom	jmcbroom@barryelectric.com	Cassville	Barry, McDonald, Newton	www.barryelectric.com
Barton County Electric Cooperative, Inc. (BCEC)	Jeff Hull	jhull@bartonelectric.com	Lamar	Barton, Dade, Jasper, Vernon	www.bartonelectric.com
Black River Electric Cooperative (BREC)	John Singleton	jsingleton@brec.coop	Fredericktown	Bollinger, Cape Girardeau, Dent, Iron, Madison, Reynolds, Shannon, Wayne	www.brec.coop
**Boone Electric Cooperative (Boone)	Todd Culley	tculley@booneelectric.com	Columbia	Audrain, Boone, Callaway, Howard, Monroe, Randolph	www.booneelectric.coop
Callaway Electric Cooperative (Callaway)	Tom Howard	thoward@callawayelectric.com	Fulton	Callaway, Montgomery, Audrain, Boone, Warren	www.callawayelectric.coop
Central Missouri Electric Cooperative, Inc. (CMEC)	Brian Jacobi	bjacobi@cmecinc.com	Sedalia	Benton, Pettis, Saline	www.cmecinc.com
Citizens Electric Corporation (Citizens)	Van Robinson	vrobinson@cecmo.com	Ste. Genevieve	Cape Girardeau, Perry, Ste. Genevieve, St. Francois, Bollinger, Jefferson	www.cecmo.com
**Co-Mo Electric Cooperative, Inc. (Co-Mo)	Aaron Bradshaw	abradshaw@co-mo.coop	Tipton	Benton, Camden, Cole, Cooper, Miller, Moniteau, Morgan, Pettis, Saline	www.co-mo.coop
Consolidated Electric Cooperative, Inc. (CEC)	Lynn Thompson	lthompson@consolidatedelectric.com	Mexico	Audrain, Callaway, Monroe, Montgomery, Pike, Boone Ralls	www.consolidatedelectric.com
Crawford Electric Cooperative, Inc. (Crawford)	Tony Mallory	t.mallory@crawfordelec.com	Bourbon	Crawford, Dent, Franklin, Gasconade, Jefferson, Washington, Phelps	www.crawfordelec.com
Cuivre River Electric Cooperative, Inc.	Doug Tracy	dtracy@cuivre.com	Troy	Lincoln, Montgomery, Pike, St. Charles, Warren	www.cuivre.com
Farmers' Electric Cooperative, Inc. (FEC)	Rod Cotton	rod@fec-co.com	Chillicothe	Caldwell, Carroll, Chariton, Clinton, Daviess, DeKalb, Linn, Livingston, Ray	www.fec-co.com

Cooperative	Contact	Email	City	Counties Served	Website
Gascosage Electric Cooperative (GEC)	Carmen Hartwell	Carmen.hartwell@gascosage.coop	Dixon	Maries, Miller, Phelps, Pulaski, Camden	www.gascosage.com
Grundy Electric Cooperative, Inc. (Grundy)	Scott Wilson	swilson@grundyec.com	Trenton	Daviess, Gentry, Grundy, Harrison, Linn, Livingston, Mercer, Putnam, Sullivan	www.grundyec.com
Howard Electric Cooperative (HEC)	Richard Fowler	rfowler@howardelectric.com	Fayette	Boone, Chariton, Howard, Randolph	www.howardelectric.com
Howell-Oregon Electric Cooperative, Inc. (HOEC)	Dan Singletary	dsingletary@hoecoop.org	West Plains	Douglas, Howell, Oregon, Ozark, Shannon, Texas	www.hoecoop.org
Intercounty Electric Cooperative Association (IECA)	Doug Lane	Doug.lane@ieca.coop	Licking	Crawford, Dent, Gasconade, Laclede, Maries, Phelps, Pulaski, Shannon, Texas, Wright	www.ieca.coop
Laclede Electric Cooperative (LEC)	Marc Roecker	mroecker@lacledeelectric.com	Lebanon	Camden, Dallas, Laclede, Pulaski, Webster, Wright	www.lacledeelectric.com
Lewis County Rural Electric Cooperative (LCREC)	Shawn Walling	swalling@lewiscountyrec.coop	Lewiston	Adair, Clark, Lewis, Knox, Marion, Scotland, Shelby	www.lewiscountyrec.org
Macon Electric Cooperative (MEC)	Tim Korman	tkorman@maconelectric.com	Macon	Adair, Chariton, Knox, Linn, Macon, Monroe, Randolph, Shelby, Sullivan	www.maconelectric.com
Missouri Rural Electric Cooperative (MOREC)	Matt Hudson	mhudson@morec.org	Palmyra	Lewis, Marion, Monroe, Ralls, Shelby	www.morec.org
New-Mac Electric Cooperative (New-Mac)	Stan Irsik	sirsik@newmac.com	Neosho	Barry, Jasper, Lawrence, McDonald, Newton	www.newmac.com
North Central Electric Cooperative, Inc. (NCMEC)	Loren Haines	lhaines@ncmec.coop	Milan	Linn, Putnam, Sullivan	www.ncmec.coop/
Osage Valley Electric Cooperative Association (OVEC)	Jarrod Campbell	jcampbell@osagevalley.com	Butler	Bates, Benton, Cass, Henry, Johnson, St. Clair, Vernon	www.osagevalley.com
Ozark Border Electric Cooperative, Inc. (OBEC)	David Schremp	dschremp@ozarkborder.org	Poplar Bluff	Bollinger, Butler, Carter, Dunklin, New Madrid, Oregon, Reynolds, Ripley, Shannon, Stoddard, Wayne	www.ozarkborder.org

Cooperative	Contact	Email	City	Counties Served	Website
Ozark Electric Cooperative, Inc. (OZEC)	Pat Oehlschlager	patrick@ozarkelectric.com	Mt. Vernon	Barry, Christian, Dade, Greene, Jasper, Lawrence, Newton, Polk, Stone	www.ozarkelectric.com
Pemiscot-Dunklin Electric Cooperative (PDEC)	Jamie Vaughn	jamie@pemdunk.com	Hayti	Dunklin, New Madrid, Pemiscot	www.pemdunk.com
**Platte-Clay Electric Cooperative, Inc. (PCEC)	Dave Deihl	daved@pcec.coop	Kearney	Buchanan, Caldwell, Clay, Clinton, DeKalb, Platte, Ray	www.pcec.coop
Ralls County Electric Cooperative (RCEC)	Lynn Hodges	lhodges@rallstech.com	New London	Audrain, Marion, Monroe, Pike, Ralls	www.rallscountyelectric.com
Sac Osage Electric Cooperative (SOEC)	Jim Davis	jdavis@sacosage.com	El Dorado Springs	Barton, Benton, Cedar, Dade, Henry, Hickory, Polk, St. Clair, Vernon	www.sacosage.com
Se-Ma-No Electric Cooperative (Se-Ma-No)	Dan Sisco	dsisco@semano.com	Mansfield	Douglas, Texas, Webster, Wright	www.semano.com
SEMO Electric Cooperative (SEMO)	Sean Vanslyke	svanslyke@semoelectric.coop	Sikeston	Bollinger, Cape Girardeau, Mississippi, New Madrid, Scott, Stoddard	www.semoelectric.coop
Southwest Electric Cooperative, Inc. (SWEC)	James Ashworth	jashworth@swec.coop	Bolivar	Benton, Camden, Cedar, Dade, Dallas, Greene, Hickory, Laclede, Polk, St. Clair, Webster	www.swec.org
Three Rivers Electric Cooperative (Three Rivers)	Roger Kloeppel	rkloeppel@threeriverselectric.com	Linn	Cole, Franklin, Gasconade, Maries, Miller, Moniteau, Osage	www.threeriverselectric.com
Tri-County Electric Cooperative Association (TCEC)	Michael Scheib	mscheib@tricountyelectric.org	Lancaster	Adair, Macon, Putnam, Schuyler, Scotland, Sullivan	www.tricountyelectric.org.
United Electric Cooperative, Inc. (UEC)	James Bagley	jbagley@ueci.coop	Savannah	Andrew, Buchanan, Clinton, DeKalb, Gentry, Holt, Nodaway, Worth	www.ueci.coop
Webster Electric Cooperative (WEC)	Tom Houston	houston@websterec.com	Marshfield	Christian, Dallas, Douglas, Greene, Laclede, Webster, Wright	www.websterec.com

Cooperative	Contact	Email	City	Counties Served	Website
West Central Electric Cooperative (WCEC)	Mike Gray	mike@wcecoop.com	Higginsville	Cass, Lafayette, Jackson, Johnson, Pettis	www.westcentralelectric.com
White River Valley Electric Cooperative (WRVEC)	Chris Hamon	chamon@whiteriver.org	Branson	Christian, Douglas, Ozark, Stone, Taney	www.whiteriver.org

****Non-participating cooperative**

Table 3 *Transmission and Generation Cooperatives*

Cooperative	Contact email	Location by City	Distribution Cooperatives Served	Website
**Central Electric Power Cooperative	Chris Turner cturner@cepc.net	Jefferson City	Boone, Callaway, Central Missouri, Co-Mo, Consolidated, Cuivre River, Howard, Three Rivers	www.cepc.net
KAMO Electric Cooperative, Inc. (KAMO)	Ted Hilmes thilmes@kamopower.com	Vinita, OK	Barry, Barton, New-Mac, Osage Valley, Ozark, Sac-Osage, Southwest, White River Valley.	www.kamopower.com
M & A Electric Power Cooperative (M&A)	Daryl Sorrell dsorrell@maelectric.com	Poplar Bluff	Black River, Ozark Border, Pemiscot Dunklin, SEMO	www.maelectric.com
Northeast Missouri Electric Power Cooperative (Northeast Power)	Doug Aeilts daeilts@northeast-power.coop	Palmyra	Lewis County, Macon, Missouri Rural, Ralls County, Tri-County	www.northeast-power.coop
N.W. Electric Power Cooperative, Inc. (N.W.)	David McDowell d.mcdowell@nwepc.com	Cameron	Atchison-Holt, Farmers', Grundy, North Central Missouri, Platte-Clay, United, and West Central	www.nwepc.com
Sho-Me Power Electric Cooperative (SHO-ME)	John Richards jrichards@shomepower.com	Marshfield	Crawford, Gascosage, Howell Oregon, Intercounty, Laclede, Se-MaNo, Southwest, Webster, White River Valley	www.shomepower.com
Generation Cooperative				
Associated Electric Cooperative, Inc. (AECI)	David Tudor dtudor@aeci.org	Springfield	Central Electric Power Cooperative; KAMO Power; M & A Electric Power Cooperative; Northeast Missouri Electric Power Cooperative; N.W. Electric Power Cooperative; Sho-Me Power Electric Cooperative	www.aeci.org

****Non-participating cooperative**

Section 2: Planning Process

Organization

Through a partnership between the Association of Missouri Electric Cooperatives (AMEC) and the Missouri Association of Councils of Government (MACOG) the 2012 plans were written with a regional planning entity working in partnership with each electric cooperative to produce the individual Hazard Mitigation Chapters, coordinated by the Northwest Missouri Regional Council of Governments (NWMORCOG). On April 21, 2017, the following planning team met: Deputy State Hazard Mitigation Officer, State Emergency Management Agency (SEMA), Missouri State Hazard Mitigation Officer, SEMA, and by telephone a representative from Region VII, Federal Emergency Management Agency, (FEMA), Vice President, Risk Management & Training, AMEC, and the Executive Director and Community & Environmental Planner from NWMORCOG. For the 2023 update, NWMORCOG contracted individually with MACOG to facilitate the hazard mitigation plan update process for the entire State of Missouri. For the current update, a virtual meeting was held on July 28, 2021, with the following participants: Deputy State Hazard Mitigation Officer and State Hazard Mitigation Officer, State Emergency Management Agency (SEMA); AMEC; and the Executive Director, Program Assistant and Regional Planner from NWMORCOG.

Surveys

To gather the data for the 2023 update, NWMORCOG staff developed two surveys. The first was a Data Survey that addressed the general information about the co-ops, asset valuations, asset inventory and the risk assessment, focusing on any local information regarding natural hazards that may have cause damages to cooperative assets. The analysis was redesigned and a sample template for the individual co-op chapters was approved by SEMA and FEMA.

The second survey was the Goals and Actions survey. It was agreed at the planning meeting that the Staff of each individual cooperative would update the goals and action items without having public meetings. The survey was an interactive Excel file that facilitated the collection of the data for the mitigation strategies review. When the second survey was returned, the mitigation section of each chapter was updated, and the parts compiled into a single chapter for each electric cooperative. The chapters have three appendices: Appendix A, Resolution; Appendix B, Documentation of Participation; and Appendix C, Surveys.

Plan Development

For the previous update, NWMORCOG compiled the updated data into forty-five individual cooperative chapters including forty (40) distributions coops, five (5) generation and transmission cooperatives and one generation cooperative that provides power for most of the state. Two cooperatives chose not to participate. The *2017 Multi-jurisdictional Hazard Mitigation Plan for Missouri's Electric Cooperatives* reflects the new data and new analysis bringing the AMEC hazard mitigation plan (HMP) into a compatible format with the updated County HMPs. For this latest update, one generation and transmission cooperative that did not participate previously, chose not to be involved again. Three distribution cooperatives that had been participants, previously, made the decision to not be part of this updated plan. One distribution cooperative that had not been involved in the plan, chose to participate for this 2023 update. Staff from AMEC and

NWMORCOG were in dialogue with each other to monitor the progress of each individual cooperative in updating the data and reviewing the goals and actions.

Public Involvement

An invitation to comment and review the draft chapters was published in *Rural Missouri*, AMEC's monthly publication with a circulation of 580,000 statewide. Subscribing AMEC members distribute the publication; all customers are considered stakeholders for the purpose of hazard mitigation planning. Each individual draft chapter was either posted on its website for review and comment or made available in the local cooperative's office. All comments were reviewed for inclusion into the plan by NWMORCOG staff.

Each participating cooperative maintains an approved copy of their cooperative's chapter and documentation at their physical office. A local press release template was sent to AMEC for distribution to the cooperatives, to invite the local public to view the chapter posted on the NWMORCOG website. Because each chapter does not serve as a stand-alone plan, the completed Statewide Summary was also posted on the NWMORCOG website. Interested parties were able to review the plan in its entirety and then email NWMORCOG with comments. Documentation of public notice and comment is in Appendix II. Signed Resolutions for each participating cooperative have been received by FEMA to complete the planning process are found in Appendix I.

Section 3: Statewide Assets

Asset Valuations

In order to assess the vulnerability of each electric cooperative in the state of Missouri, NWMORCOG staff created a data survey to assist in updating the asset valuation section using cooperative records. The available data concerning assets and replacement costs varies widely among the state's rural electric cooperatives. Each electric distribution cooperative provided information as available to identify the replacement cost (minus labor) for each of the following assets:

- Distribution lines by overhead or underground and by phase type
- Fiber
- Substation assets
- Supporting infrastructure, including, but may vary by individual cooperative:
    - Meters, overhead or underground
    - Poles
    - Transformers, overhead or underground
    - Guys and anchors
    - Cross-arms
    - Regulators
    - Oil-Circuit Reclosures by phase type
    - Capacitors
    - Security lights and equipment
    - Other overhead assets
    - Other underground assets
- Office Buildings
- Warehouses
- Vehicles

Replacement costs were determined by cooperative staff that identified the approximate cost of materials for each asset using current prices or internal insurance records. Labor costs were excluded from replacement costs. Actual replacement cost may fluctuate based upon available materials, market prices, and labor costs. As such, the valuation assigned to each cooperative should be considered an estimate only. In addition, total asset valuations are based only upon the included asset types. Due to wide variances between cooperatives in the type of assets held, available information, and a host of other factors, the true asset valuation of many cooperatives may exceed the included total valuation by county significantly. With the exception of office buildings, warehouses, and vehicles, all assets were further organized by county of location within the cooperative's service area when possible.

The information provided by all electric cooperatives was used in the creation of a total statewide asset valuation as well. Table 4 provides a summary of all electric distribution cooperative assets statewide for participating cooperatives.

Table 4 *Distribution Cooperatives Asset Valuation Statewide Summary**

Asset Group	Replacement Cost	Asset Breakdown	Cost Breakdown
Total Assets for Distribution Cooperatives *	$9,856,021,871		
Substations	$73,165		
Transmission Lines (Citizens Electric only)	$68,730,100	69kV	$48,406,991
		138kV	$19,348,445
		34.5kV	$0
Distribution Lines	[1]OH $4,417,066,020 [2]UG $537,368,262 Fiber $42,355,050	Distribution line OH [3]SP	$3,056,576,421
		Distribution line UG SP	$479,391,406
		Distribution line OH [4]2P	$14,516,238
		Distribution line UG 2P	$1,015,440
		Distribution line OH [5]TP	$1,261,790,812
		Distribution line UG TP	$95,338,837
		OH/UG Fiber	$42,355,050
Supporting Infrastructure	OH $4,236,006,067 UG $203,082,271	Meters	$237,644,298
		Meters UG	$202,117,838
		Poles	$2,415,418,911
		OH Transformers	$635,884,857
		UG Transformers	$143,488,865
		Guys/Anchors	$367,495,022
		Cross-arms	$109,757,724
		Regulators	$56,446,359
		SP Oil Circuit Reclosures	$63,075,452
		TP Oil Circuit Reclosures	$37,356,184
		Capacitors	$15,214,705
		Security Lights/Equipment	$57,064,421
		Other OH Assets	$83,108,792
		Other UG Assets	$46,015,577
Other Assets	$627,575,668	Buildings/Warehouses	$371,146,045
		Vehicles	$157,108,783

Source: Statewide electric cooperative internal records, accounting, and insurance records.
*Statewide Summary does not include any data for the non-participating cooperatives Boone, Co-Mo, Platte-Clay Electric.
[1]OH=overhead [2]UG=underground [3]SP=Single phase [4]2P=Two phase [5]TP=Three phase

Each generation and transmission cooperative provided information as available to identify the replacement cost (minus labor) for each of the following assets:

- Generation facilities
- Coal stockpiles
- Substations by voltage capacity
- Transmission lines by voltage capacity

- Mobile substations
- Microwave towers
- Fiber
- Other overhead infrastructure
- Communication equipment
- Buildings
- Vehicles and equipment

The information provided by generation and transmission electric cooperatives was used in the creation of a statewide asset inventory as well. Table 5 provides a summary of all electric G&T cooperative assets statewide for participating cooperatives.

Table 5 *Generation and Transmission Cooperatives Asset Valuation Statewide Summary**

Asset Group	Total Replacement Cost	Asset Breakdown	Cost Breakdown
Total Assets for Transmission and Generation Cooperatives *	$14,952,896,971		
Generation Facilities	$5,440,275,000	Coal Stockpile	$30,880,767
Substations	$1,899,210,997	69kV	$516,582,209
		138kV	$57,577,318
		161kV	$195,295,858
		Mobile Substations	$12,990,100
Transmission Lines	$6,607,767,280	69kV	$3,063,138,880
		138kV	$5,974,250
		161kV	$1,064,355,100
		345 kV	$1,807,711,750
		500kV	$1,505,673,000
		Fiber	$219,600,000
Supporting Infrastructure	$610,555,400	Microwave Towers	$15,452,000
		Communication Equipment	$38,600,000
Other Assets	$293,606,461	Buildings/Warehouses	$208,568,536
		Vehicles	$85,037,925

Source: Statewide G&T internal records, accounting, and insurance records.
*Statewide Summary does not include any actual or estimated data for the non-participating cooperative, Central Electric Power Cooperative.

Asset Inventory

In order to further assess the vulnerability of each electric distribution cooperative in the state of Missouri, RCOG staff used the previously mentioned data survey to assist in updating the asset inventory

section using cooperative records. The information provided by all electric cooperatives was used in the creation of a statewide asset inventory as well. Table 6 provides a summary of the inventory of reported assets from the thirty-seven (37) participating distribution cooperatives.

Table 6 *Statewide* Distribution Cooperatives' Asset Inventory*

Asset	Total Number	Coops Reporting Asset
Meters [1]OH or not specified	7,039,240 units	37
Meter loops OH	31,455 units	2
Meters [2]UG	5,843 units	7
Meter loops UG	363 units	1
Poles	21,860,935 units	37
[3]SP Distribution Line OH/not specified	48,854,109 miles	37
SP Line UG Line	11,830,344 miles	35
[4]2P Distribution Line	214.87 miles	5
[5]TP Line OH Line	61,507,783 miles	35
TP Line UG Line	20,634,733 miles	28
Secondary Distribution Line OH	109 miles	1
Secondary Distribution Line UG	58 miles	1
Transformers OH or not specified	14,033,747 units	37
Transformers UG	3,461,732 units	29
Guys/Anchors	7,307,532 units	33
Cross-arms	4,948,858 units	31
Regulators	1,633,934 units	36
Oil Circulating Recloser (OCR) SP or not specified	957,948 units	37
OCR TP	1,285,543 units	15
Capacitors	418,192 units	35
Fiber	1,472 units	1
Security Lights	4,079 units	1
DD Lights	8,362 units	1
Lights	14,212 units	1
Special Equipment OH	2,713 units	1
Protective Devices UG	104 units	1
Insulators	19,692 units	1
Auto Transformers	4 units	1
SecServ	415 units	1
Breakers	66 units	1
Sectionalizers	40 units	1
Source: Statewide electric cooperative internal records, accounting, and insurance records. *Statewide does not include any data for the non-participating cooperatives OH = overhead UG = underground SP = Single phase 2P=Two phase TP=Three phase		

The available data concerning inventory of assets and replacement costs varies widely among the state's rural electric cooperatives. Each electric distribution cooperative provided information as available to identify the inventory of those items whose valuations were given previously in this section. This inventory was divided into each county of the cooperative's service area where the assets are located. The detailed table of this information is found in Section 2 of each distribution cooperative's chapter.

The G&T cooperatives provided asset inventory as part of the hazard mitigation update process. Using a data survey provided by NWMRCOG, staff from each participating cooperative provided available information on selected assets. The items reported varied depending on the cooperative's operating setup and the inventory system employed. The following Table 7 summarizes the information provided by the G&Ts.

Table 7 *Statewide* Generation and Transmission Cooperatives' Asset Inventory*

Asset	Total Number	Coops Reporting Asset
Substations	535 units	4
Meters	393 units	2
Poles	44,688 units	2
69 kV Transmission Line	1,185 miles	2
161kV Transmission Line	511 miles	2
345 kV Transmission Line	710 miles	2
500 kV Transmission Line	46 miles	1
Transmission Line (non-specified)	4,529 miles	4
Transformers	1,155 units	3
Guys/Anchors	4,692 units	2
Cross-arms	55,208 units	2
Fiber	539 miles	1
Regulators	207 units	1
Oil Circuit Reclosures	1 units	1
Capacitor Banks	6 units	1
Motor Operators	33 units	1
Circuit Breakers	76 units	1
Circuit Switchers	13 units	1
Source: Statewide electric cooperative internal records, accounting, and insurance records. *Statewide does not include any data for the non-participating cooperative		

In addition to cooperative assets, the impact of natural hazards extends to those who are served by each cooperative. Critical facilities such as hospitals, schools, government buildings, nursing homes, and sheltering stations which receive power from electric cooperatives can face dire consequences without access to electrical service. In the event of a disaster, each cooperative works to restore electrical service as quickly as possible. Service to critical facilities is considered to be the top priority when addressing power outages. Information concerning critical facilities is provided in each cooperative's chapter.

Section 4: Identified Hazards and Risk Assessment

Previous Impact of Natural Hazards

In the state of Missouri, natural hazard incidents have had a dramatic impact upon infrastructure, livelihoods, and citizens. Since 1990, Missouri has received close to 40 federal major disaster declarations. These disasters have included severe storms and flooding, ice storms, and tornadoes. Table 8 displays the Presidential disaster declarations within the state of Missouri from the last ten years. Federal Public Assistance funds provided to any of Missouri's rural electric cooperatives are listed in the last column.

Table 8 *List of Major Disaster Declarations (2007-2022)*

Year	Date	Disaster Type	Disaster Number	PA Funds Obligated
2007	12/12	Severe Winter Storms	3281	
2007	12/27	Severe Winter Storms	1736	
2008	02/05	Severe Storms, Tornadoes, and Flooding	1742	
2008	03/12	Severe Winter Storms and Flooding	1748	
2008	03/19	Severe Storms and Flooding	1749	
2008	05/23	Severe Storms and Tornadoes	1760	
2008	06/25	Severe Storms and Flooding	1773	
2008	11/13	Severe Storms, Flooding, and a Tornado	1809	
2009	01/30	Severe Winter Storm	3303	
2009	02/17	Severe Winter Storm	1822	
2009	06/19	Severe Storms, Tornadoes, and Flooding	1847	
2010	08/17	Severe Storms, Flooding, and Tornadoes	1934	
2011	02/03	Severe Winter Storm	3317	
2011	03/23	Severe Winter Storm and Snowstorm	1961	
2011	06/30	Flooding	3325	
2011	04/22	Severe Storms, Tornadoes, and Flooding	1980	
2011	08/22	Severe Storms, Tornadoes, and Flooding	4012	
2013	07/19	Severe Storms, Straight-line Winds, Tornadoes, and Flooding	4130	$97,627.31
2013	09/06	Severe Storms, Straight-line Winds, and Flooding	4144	$263,141.36
2014	10/31	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	4200	
2015	08/10	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	4238	$780,583.97
2015	12/27	Heavy Rains, Widespread Flash Flooding, and Flooding	4250	$388,879.27
2017	04/28	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	4317	$5,222,443.39
2019	05/20	Severe Storms, Straight-line Winds, and Flooding	4435	$26,445,766.32
2019	07/20	Severe Storms. Tornadoes, and Flooding	4451	$7,477,718.54

2020	03/20	COVID-19	4490	$438,227,845.45
2020	07/09	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	4552	$8,738,171.53
2021	09/01	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	4612	$5,380,599.33
2022	01/10	Severe Storms, Straight-line Winds, Tornadoes	4636	$1,617,000.03

Identified Hazards

Natural hazards in the state of Missouri vary dramatically with regard to intensity, frequency, and the scope of impact. Some hazards, like earthquakes, happen without warning and do not provide any opportunity to prepare for the threat. Other hazards, such as tornadoes, flooding, or severe winter storms, provide some period of warning which allows for public preparation prior to their occurrence. Regardless, hazard mitigation planning can lessen the negative impact of any natural disaster regardless of onset time. The naming conventions have been changed from the original 2012 AMEC plan and do not match up with the Missouri 2013 state hazards listings. We have been consistent in the naming the hazards in the individual cooperative chapters and this Statewide Summary. The discrepancies between the two lists are discussed later in this section. The following natural hazards have been identified as potential threats to the electric cooperative's infrastructure and uninterrupted service:

- Dam Failure
- Earthquakes
- Flooding and Levee Failure
- Severe Land Subsidence (Sinkholes)
- Severe Thunderstorms, Hail, and High Winds
- Severe Winter Weather
- Tornadoes
- Wildfire

Additional hazards may be eliminated for all electric cooperatives statewide:

- Landslides
- Drought
- Heat Wave

Landslides, slumps, and rock falls are potential geologic hazards throughout Missouri and can occur where there are bluffs or steep slopes. In Missouri, these are generally small, localized events that follow excessive rainfall events or when surficial materials are moved or modified by man. Consensus reached during the initial discussions was to eliminate this hazard as significant threat to assets.

Although drought can potentially impact electric cooperatives, water availability does not directly impact the delivery of electric service to customers. A single exception to this rule is Associated Electric Cooperative Incorporated (AECI), the state's wholesale power producer, which uses river water to cool its system. Specific information concerning the impact of drought on AECI's facilities is available in its cooperative chapter.

Heat wave has also been eliminated. This hazard was part of the 2013 Missouri plan hazard listing of Extreme Temperatures. Though it may result in additional usage and potentially tax the system, heat waves have not caused either direct infrastructure damage to cooperative assets or extensive outages. The results of a heat wave in the state of Missouri may be considered cascading events rather than damage caused directly by the hazard itself. Though some cooperatives considered heat waves in their initial assessments, every cooperative eliminated the hazard upon further review. None of the cooperatives

considered extreme cold temperatures to be a hazard to their systems. To date, neither drought nor heat wave has resulted in infrastructure damage or reported outages.

Both major and flash floods are included in the flood hazard discussion in each individual plan. In early planning meetings with SEMA representatives regarding this update, it was agreed to allow the hazard of levee failure to continue to be included in the analysis of the hazard of flooding. Any other discrepancies between the list of hazards included in this update and the 2018 state plan are minor wording variations that have been retained from the original plan.

For the purpose of this risk assessment, the identified hazards for all Missouri electric cooperatives have been divided into two categories: **historical and non-historical hazards**. Based on the data collected for the update, the hazards have been reclassified to reflect the actual data available and those hazards with no data available from any cooperative statewide have been reclassified as non-historical. This does not mean that a non-historical hazard will never cause damage; it just means there have been no impacts prior to this report. The potential still exists, but the probability of the occurrence is statistically near zero. For the analysis in this plan non-historical hazard probability is stated as less than one.

> **Historical Hazards** are those hazards with a measurable previous impact upon the service area of Missouri Electric Cooperatives. Damage costs per event and a chronology of occurrences are available. The associated vulnerability assessments utilize the number of events and cost of each event to establish an average annual cost per incident.
>
> **Non-historical Hazards** are hazards with no previous record of impact upon the assets of Missouri Electric Cooperatives. As such, the associated vulnerability assessments for each of these hazards will have an occurrence probability of less than 1% in any given year, but the extent of damage will vary considerably.

This categorization was utilized for both the statewide aggregation as well as individual cooperative chapters. These designations fluctuate throughout the cooperative-specific chapters based upon local event records and damage assessments. For all electric cooperatives statewide, hazards with historical data include tornadoes, severe thunderstorms/high wind/hail, flood/levee failure and severe winter weather. Likewise, hazards without historical data of damages to electric cooperatives include wildfires, severe land subsidence / sinkholes, earthquakes, and dam failure.

Risk Assessment Methodology

The risk assessment methodology described in the following section was utilized for both the statewide aggregation as well as for each individual cooperative chapter. Some variation in the availability of data exists between the electric cooperatives as each utilizes a different system of recording the impact of natural disasters. Any differentiation from the process below is explained in the individual cooperative chapter as necessary.

Loss estimates were calculated using the asset summary created by internal accounting records for each cooperative. Each hazard has a unique impact upon the service area, requiring each hazard to utilize a different valuation amount depending upon the level of impact. For Historical Hazards, those assets which had been previously damaged or evidently vulnerable were considered in the assessment. Tornadoes, for

example, do not normally affect underground assets, but may decimate all overhead assets and buildings. Non-historical hazards assume no damage to all general assets.

Table 9 provides information on assets considered in the vulnerability assessment by hazard.

Table 9 *Vulnerability Assessment Considerations*

Hazard	Infrastructure Used in Analysis
Tornado	Overhead Infrastructure, Buildings
Severe Thunderstorms, High Wind, Hail	Overhead Infrastructure
Flood and Levee Failure	Overhead Infrastructure
Severe Winter Weather	Overhead Infrastructure
Severe Land Subsidence (sinkholes)	Overhead and Underground Infrastructure, Buildings
Earthquakes	Overhead and Underground Infrastructure, Buildings
Dam Failure	Overhead Infrastructure, Buildings
Wildfire	Overhead Infrastructure, Buildings

For Historical Hazards, assets were divided into three groups based upon historical impact which were utilized in the hazard damage analysis:

1) Missouri overhead infrastructure assets, supporting infrastructure assets, substations, power generation facilities and buildings
   - Used for
     - Tornado damage assessments
     - Dam Failure
     - Wildfire
       - Distribution Cooperatives-valued at $9,022,373,358
       - G&T Cooperatives–valued at $14,832,242,697
2) Missouri overhead infrastructure assets, supporting infrastructure assets, substations, and power generation facilities:
   - Used for:
     - Severe Thunderstorm/High Wind/Hail
     - Flood
     - Severe Winter Weather
       - Distribution Cooperatives-Valued at $8,139,594,143
       - G&T Cooperatives–Valued at $14,544,020,299
3) Missouri overhead infrastructure assets, supporting infrastructure assets, buildings, substations, underground infrastructure assets, and power generation facilities:
   - Used for
     - Land Subsidence
     - Earthquakes
     - Landslides
       - Distribution Cooperatives–Valued at $9,838,583,794
       - G&T Cooperatives–Valued at $14,544,020,299

Of these groups, only overhead assets and building were utilized to formulate the hazard damage analysis. No historic data related to underground asset damage was available. As such, underground assets were eliminated from each hazard damage analysis.

In order to arrive at the potential extent of damage to the infrastructure, the average annual damage cost was used. (Sum of all damage estimates/number of years = average annual cost per hazard). This average annual cost was then divided by the total assets potentially impacted by the identified hazard. (Average annual cost/total assets *100 = Percentage of assets impacted.)

While potential damages to cooperative assets are important, this type of impact study is insufficient. In many instances, natural hazard events occur without causing significant damage to the cooperative's infrastructure. The more significant impact of natural hazard episodes comes in the form of reported customer outages. The infrastructure may not be significantly harmed by an ice storm but may result in prolonged and widespread outages in the cooperative's service area. In considering the potential impact of a hazard, loss of function provides a more concise picture for comparison of events and geographic regions of the state. In addition to system damage, each hazard will be evaluated on the average annual number of reported or estimated outages per hazard type. (Formula: Average annual number of outages reported/Total number of meters multiplied by 100 = Average annual percentage of outages reported per hazard). Most cooperatives provided outage information or estimates for their direct customers. For distribution cooperatives, these direct customers are their member-owners. These members are served by a total of 739,149 meters statewide. For G&Ts across the state, distribution cooperatives, cities and an army base are their direct customers.

A. Historical Hazards

Tornadoes

Tornadoes are cyclical windstorms or violently rotating columns of air. Accompanying storm activities include downbursts, straight-line winds, lightning, hail, and heavy rain. The average forward speed of a tornado is about 30 miles per hour (mph), but may vary from nearly stationary to 70 mph. The path may vary in any direction, but the average tornado moves from southwest to northeast. Tornadoes are most likely to occur between 3 p.m. and 9 p.m. but may ensue at any hour of the day. Any person or structure at any location could be impacted by a tornado. The amount of damage depends on:

- The strength of the tornado,
- The tornado's proximity to the person/structure,
- The strength of the structure,
- How well a person is sheltered, etc.

Tornadoes are classified according to the Enhanced Fujita (EF) scale. Originally developed by Dr. Theodore Fujita in 1971, the Fujita scale ranks tornadoes according to wind speed and damage severity. In 2006, the National Weather Service released an updated version known as the Enhanced Fujita Scale after four years of collaborative research based at Texas Tech University. The new scale considers both wind speed and quality of construction in assessing each tornado after January 31, 2007. The most significant differences between the original and enhanced scales lie in the consolidation of the F5 and F6 categories into a single category (EF5) without maximum wind speeds, as well as the use of Damage

Indicators and Degrees of Damage ranking scales to help determine wind speed estimates. Table 10 provides the updated scale.

Table 10 *The Enhanced Fujita Tornado Damage Scale*

EF-Scale Number	Wind speed (mph)	Relative Frequency*	Potential damage
EF0	65-85	53.5%	Light damage. Peels surface off some roofs; some damage to gutters or siding; 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 damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	3.4%	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	0.7%	Devastating damage. Well-constructed houses and whole fame houses completely leveled; cars thrown, and small missiles generated.
EF5	>200	0.1%	Total destruction. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 feet; steel reinforced concrete structure badly damaged; high-rise buildings have significant structural deformation; incredible phenomena will occur.
*Relative Frequency compares the number of EF scale tornadoes in each category with the total number of confirmed tornadoes. For example, 53.5% of all tornado occurrences are rated as EF0. Source: NOAA, National Weather Service			

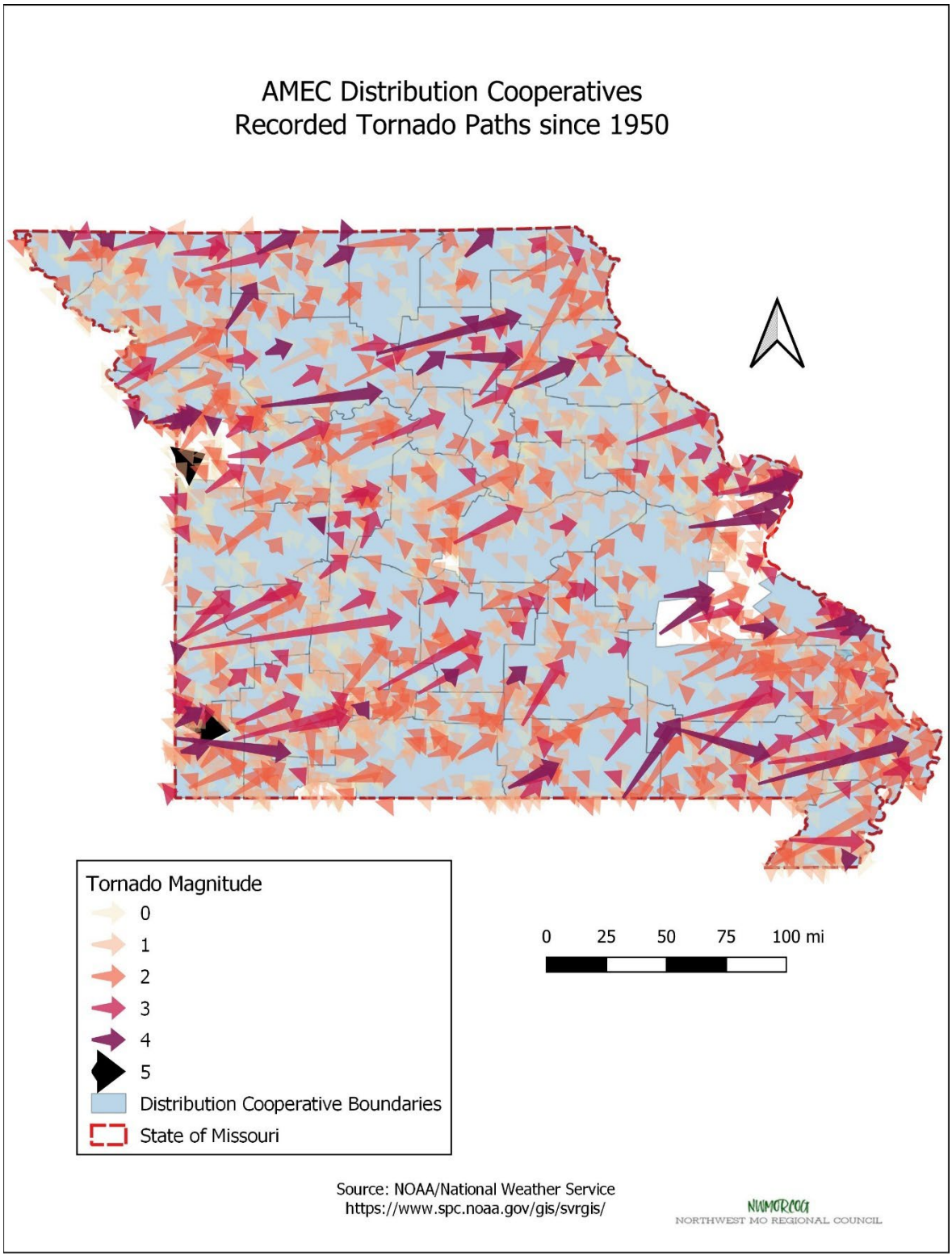
Previous Occurrences

According to the National Oceanic and Atmospheric Administration (NOAA), 2,111 tornadoes occurred from 1950-2020 within areas served by Missouri's electric cooperatives. An average of 30 tornadoes occurs each year in the areas served by AMEC cooperatives around the state. Historically, tornadoes in the state of Missouri according to the 2018 MO HMP for 1950-2016:

- Occur during every month of the year, most predominantly between April and October
- Can range from EF0 – EF5 in rating, with EF0, EF1 being the most likely to occur
- Resulted in 389-394 deaths (conflicting data in report)
- Caused 4,430 injuries
- Have resulted in property damage valued at $5.3 billion statewide

Figure 2 depicts the paths of tornadoes across the electric distribution cooperatives' boundaries since 1950. (*Map sources: NOAA*)

Figure 2 *Tornadoes in Missouri, 1950-2020*



Probability of Future Occurrence and Vulnerability

Historical tornado data for each cooperative is included in each participating cooperative's respective chapter. A summary of this information is provided in Table 11, showing the average annual number of tornadoes that have occurred within the service area from NOAA data. The average annual damages and outages based on data from the recording period provided by the cooperatives are also shown.

Table 11 *Summary of Distribution Cooperatives' Tornado Information*

Distribution Cooperative	Average Annual Occurrence	Average Annual Damages	Average Annual Outages
Atchison-Holt Electric	0.35	$361	0
Barry Electric	0.45	$8,540	272
Barton County Electric	0.94	$17,021	0
Black River Electric	1.2	$64,118	43
Callaway Electric	0.56	$2,232	63
Central Missouri Electric	1	$16,930	0
Citizens Electric	0.66	$115,295	981
Consolidated Electric	0.87	$5,669	22
Crawford Electric	0.66	$18,581	451
Cuivre River Electric	1.2	$9,736	0
Farmer's Electric	1.1	$333	10
Gascosage Electric	0.15	$2,553	58
Grundy Electric	0.66	0	0
Howard Electric	0.17	$2,348	64
Howell-Oregon Electric	1.1	0	0
Intercounty Electric	0.99	$3,407	28
Laclede Electric	0.66	$20,502	461
Lewis County Rural Electric	0.52	$6,823	105
Macon Electric	0.59	0	0
Missouri Rural Electric	0.28	$2,132	80
New-Mac Electric	1.1	$43,333	767
North Central Electric	0.34	$10,771	36
Osage Valley Electric	1.1	$8,877	829
Ozark Border Electric	1.5	$35,156	566
Ozark Electric	1.2	$22,500	504
Pemiscot-Dunklin Electric	0.86	$575,000	0
Ralls County Electric	0.28	$1,430	4
Sac Osage Electric	0.56	$20,031	0
Se-Ma-No Electric	0.34	$11,133	0
SEMO Electric	1.7	0	0
Southwest Electric	1.1	$40,584	1,657
Three Rivers Electric	0.75	$42,844	735
Tri-County Electric	0.42	$288	0
United Electric	1.7	$50	0
Webster Electric	0.63	$1,050	411
West Central Electric	0.76	$6,137	196
White River Valley Electric	1.4	$41,407	860
Median	0.75	$8,540	43
Total		$1,157,172	9,203
Source: www.spc.noaa..gov/gis/svrgis/ and data supplied by cooperatives			

The median likelihood of a tornado occurring within an electric distribution cooperative in Missouri is 75% annually. The range of probabilities is from 15% up to an average annual number of almost two tornadoes a year. The total average annual damage to distribution cooperatives' assets from tornadoes is $1,157,172. This is less than 0.02% of the total overhead and buildings assets state-wide total of

$9,022,373,358 for the distribution electric cooperatives. The average annual damages ranged from none to $575,000. The widely scattered assets of rural electric cooperatives help most avoid major damage as is shown in the median average annual damage amount of $8,540.

The availability of outage data from the participating cooperatives varied considerably. The record keeping differences between the cooperatives made it difficult to analyze the effect of different hazards on the interruption of service to the members. It should be noted that a zero in the data sometimes means that the information was not available in a form that could be used for the purposes of this analysis. For the hazard of tornadoes, the median number of average annual outages was 43, with a ranging up to over 1,600 average annual outages. The state-wide average annual number of outages was 9,203 due to tornadoes. This is 1.3% of the total number of 679,829 meters.

The electric generation and transmission cooperatives also provided information about the effect of tornadoes on their assets and outages. A summary of the information is shown in Table 12.

Table 12 *Summary of Generation/Transmission Cooperatives' Tornado Information*

Generation/Transmission Cooperative	Average Annual Number of Occurrences	Average Annual Damages	Average Annual Outages
KAMO Electric Power	7.1	$5,831	1,711
M & A Electric Power	5.0	0	0
Northeast Power	1.9	$5,226	0
N.W. Electric Power	5.4	0	0
Sho-Me Power Electric	6.5	$5,660	2
Median of 5 G&T cooperatives	5.4	$5,660	0
Associated Electric Cooperative	28.1	$352,773	0
	Total	$369,490	1,713
Source: www.spc.noaa..gov/gis/svrgis/ and data supplied by cooperatives			

The size of the areas served by the generation/transmission cooperatives increases the likelihood of tornadoes occurring within their boundaries compared to the distribution cooperatives. The median average annual occurrence is 5.4 tornadoes.

The average annual tornado caused damages for these cooperatives is $369,490 with a wide range of values. Two of the cooperatives reported not receiving any damage from tornadoes, while the median amount on an annual basis was $5,660. The combined overhead, buildings, and substation assets of the generation and transmission cooperatives are $14,544,020,299. According to this analysis, less than 0.01% of those assets are at risk from tornadic activity on an annual basis.

The outages reported for the generation/transmission cooperatives reflect the information available on the direct customers that they serve, not for the distribution cooperatives. Some of these cooperatives serve only distribution cooperatives, while others have municipal and governmental customers. While the majority of the generation/transmission cooperatives did not report any outages due to tornadic activity, there was average annual total of 1,713 outages.

Problem Statement

The random nature of tornadoes along with their potential destructive force makes it difficult for electric cooperatives to plan effective strategies to prepare for these violent storms. While placing assets underground is a method to avoid damage, this is not economically possible due to the large distances and the rocky terrain that electrical lines must span. There are over 56 million miles of overhead line and over 25 million miles of unground distribution line maintained by the state's electric cooperatives. The added expense of placing line underground prevents many cooperatives from using this option.

Severe Thunderstorms, High Wind, and Hail

As defined by the National Weather Service, a severe thunderstorm is a storm with hail equal to or greater than ¾ of an inch in diameter or convective wind gusts greater than or equal to 58 miles per hour. Thunderstorms develop when moisture, a rising unstable air mass, and updraft combine. Four types of thunderstorms may impact cooperatives around the state:

Single cell storm: The single cell storm lasts approximately 20-30 minutes and is not usually considered to be severe.

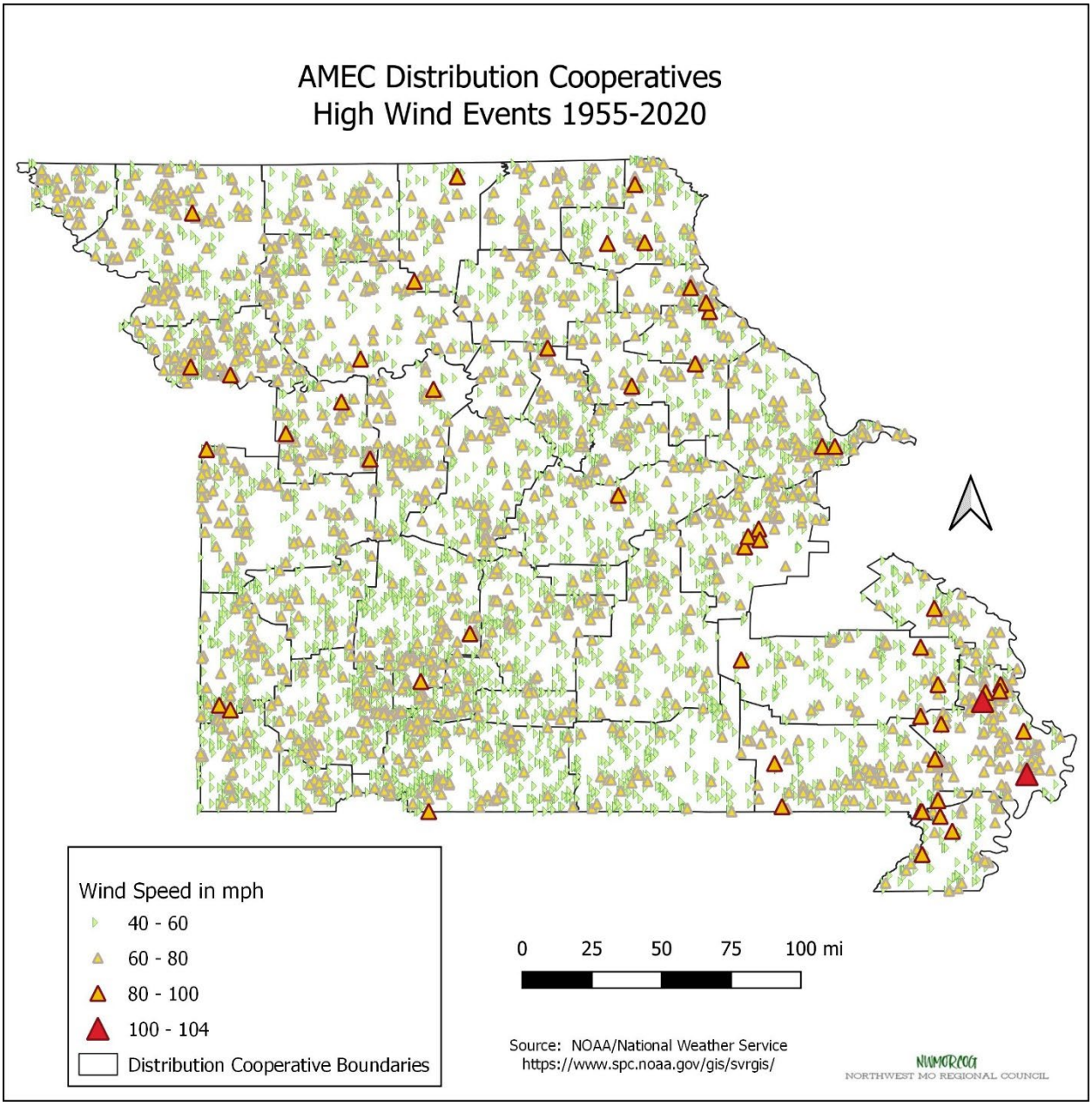
Multi-cell cluster: Multi-cell clusters are the most common type of thunderstorms. They consist of a group of storm cells which move as a single unit. Multi-cell storms may produce moderate size hail, flash flooding, and relatively weak tornadoes.

Multi-cell line: Also known as a squall line, the multi-cell line storm is comprised of a long line of storms with a well-developed updraft at its leading edge. These storms may produce golf-ball sized hail, heavy rainfall, and tornadoes, but most often cause significant damage from non-tornadic winds.

Supercell: Highly organized supercells pose a significant risk to life and property. With a strong rotating updraft reaching speeds of 150-175 miles per hour, the supercell is capable of producing hail more than two inches in diameter, strong downbursts of more than 80 miles per hour, torrential rain, and strong tornadoes.

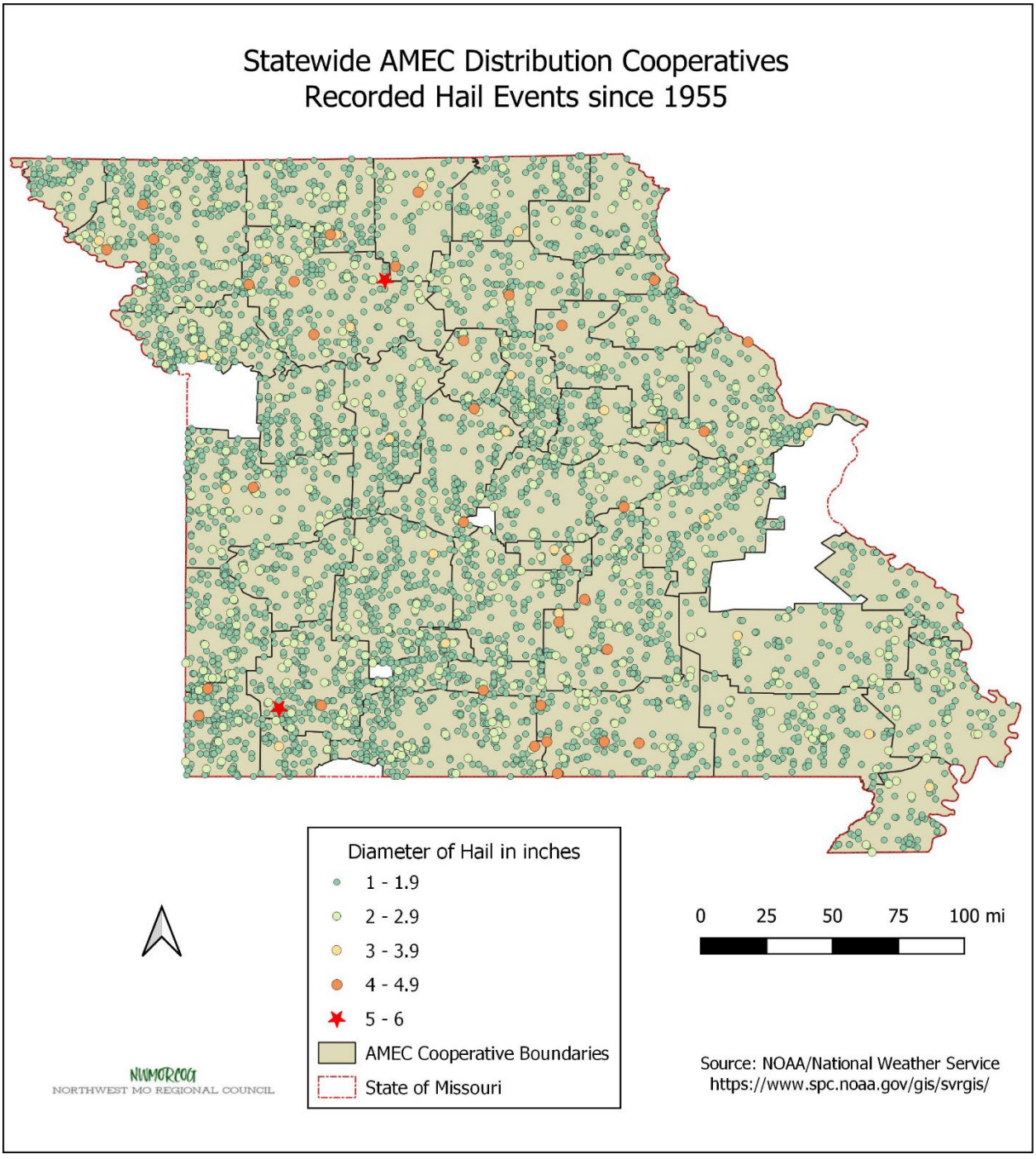
Lightning may be produced by any of the four types of storms but is most prevalent in the multi-cell and supercell storms. Lightning can cause significant injury and death as well as property damage from cascading effects such as fire. Currently, lightning cannot be separated from severe thunderstorms for Missouri's rural electric cooperatives because of data insufficiencies. As such, it has been included with severe thunderstorms in this plan. In many cooperatives, damages from hail and high winds are combined. Wind events 40-104 knots from 1955-2020 are mapped in Figure 3 (*Map source: NOAA*).

Figure 3 *Reported High Wind Events across Missouri AMEC Cooperatives*



The map in Figure 4 displays hail events in Missouri from 1955-2020 (*Map data source: NOAA*).

Figure 4 *Reported Hail Events across AMEC Cooperatives,1955-Present*



Previous Occurrences

Thunderstorms, high winds, and hail are regular occurrences throughout the state of Missouri. From 1955-2020, a total of 14,610 high-wind storms and 15,648 hailstorms were reported to occur in areas served by distribution cooperatives belonging to AMEC. Details of the events are included in each cooperative's part of the plan.

Probability of Future Occurrence and Vulnerability

The 2018 Missouri State HMP reports an average of 504 High Wind events and 604 Hail events annually for the state. Table 13 shows details of these hazards for each electric distribution cooperative from 1955-2020. The data for damages and outages is for the period that data was provided by each cooperative.

Table 13 *Summary of Distribution Cooperatives' Thunderstorm Information*

Distribution Cooperative	Average Annual Hail Occurrence	Average Annual Wind Occurrence	Average Annual Damages	Average Annual Outages
Atchison-Holt Electric	2.9	2.1	$7,057	488
Barry Electric	2.2	1.7	$13,392	1,150
Barton County Electric	7.2	6.8	$14,926	10
Black River Electric	4.4	4.9	$95,361	66
Callaway Electric	7.0	6.3	$0	910
Central Missouri Electric	2.4	3.2	$0	0
Citizens Electric	3.8	4.7	$197,933	3,833
Consolidated Electric	7.2	7.3	$9,127	151
Crawford Electric	8.4	10.9	$54,058	6,450
Cuivre River Electric	9.2	6.9	$0	0
Farmers Electric	1.4	1.0	$53,067	954
Gascosage Electric	5.6	4.2	$0	0
Grundy Electric	1.9	1.3	$4,680	142
Howard Electric	7.6	7.2	$4,995	205
Howell-Oregon Electric	8.6	7.3	$64,145	221
Intercounty Electric	7.5	6.5	$183,644	2,218
Laclede Electric	3.7	4.1	$12,899	788
Lewis County Rural EC	4.0	3.9	$15,630	6
Macon Electric	2.0	2.2	$30,000	0
Missouri Rural Electric	8.4	7.6	$14,125	468
New-Mac Electric	2.8	2.3	$8,500	150
North Central Electric	10.0	6.5	$0	1,243
Osage Valley Electric	6.1	7.4	$19,741	16,013
Ozark Border Electric	13.2	11.3	$121,406	3,821
Ozark Electric	3.2	4.3	$20,384	784
Pemiscot-Dunklin Electric	1.5	2.1	$13,752	0
Ralls County Electric	4.7	4.2	$36,090	19
Sac Osage Electric	2.5	2.5	$3,717	415
Se-Ma-No Electric	4.7	7.5	$33,000	0
SEMO Electric	10.9	9.9	$11,060	243
Southwest Electric	7.2	6.3	$41,207	6,662
Three Rivers Electric	3.7	3.9	$7,842	4,880
Tri-County Electric	13.7	10.2	$17,165	0
United Electric	4.0	4.3	$46,186	552
Webster Electric	5.9	4.9	$955	281
West Central Electric	11.9	13.1	$22,314	1,295
White River Valley EC	2.9	2.1	$29,063	1,404
Median	4.7	4.9	$13,752	415
		Total	$1,172,792	55,681

The average annual number of thunderstorms occurring within the boundaries of an electric distribution cooperative in Missouri calculates to a median of almost 5 for both wind and hailstorms. The range of probabilities is from one up to an average annual number of near fourteen storms a year.

The total average annual damage to distribution cooperatives' assets from thunderstorms is $1,172,792. This averaged amount is less than 0.01% of the combined overhead assets of the distribution cooperatives. The average annual damages ranged from none to over $197,000. The median average annual damage amount is $13,752.

Outage information, when available, shows the total outages for both high winds and hail. The average annual number of outages for all distribution cooperatives from the effects of severe thunderstorms was 48,878, while the median number for an individual cooperative was 429 outages. Out of the total of 679,829 meters, it can be projected that 7.2% of these will experience outages due to thunderstorm activity in any given year.

The large service areas of the G&T cooperatives means that numerous thunderstorms occur within each year with the median average annual occurrence of 37.8 high wind events and 50.5 hailstorms. The electric generation and transmission cooperatives also provided information about the effect of thunderstorms on their assets and outages. A summary of the information is shown in Table 14.

Table 14 *Summary of Generation/Transmission Cooperatives' Thunderstorm Information*

Generation/Transmission Cooperative	Average Annual Damages	Average Annual Outages
KAMO Electric Power	$4,386	966
M & A Electric Power	$48,683	0
Northeast Power	$5,364	0
N.W. Electric Power	$14,791	0
Sho-Me Power Electric	$17,592	7
Associated Electric Cooperative	$26,544	0
Median	$14,791	0
Total	$117,360	973

The median amount of damage on an annual basis was $14,791. The average annual thunderstorm caused damages for these cooperatives is $117,360. This amount is less than 1% of the valuation of assets at risk from thunderstorm activity.

The outages reported for the generation/transmission cooperatives to their non-distribution cooperative customers were minimal. While the majority of the generation/transmission cooperatives did not report any outages due to thunderstorm activity, there was average annual total of 973 outages. It is estimated that less than 1% of the meters directly served by these cooperatives would experience loss of service in any given year because of thunderstorm events.

Problem Statement

There are over 56 million miles of overhead distribution line maintained by the state's electric cooperatives. Rock underlying the soil and the extra cost of underground cable prevents many cooperatives from placing line underground protecting it from high winds and hail.

Flood and Levee Failure

A flood is a partial or complete inundation of normally dry land areas. Riverine flooding is defined as the overflow of rivers, streams, drainage channels, 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.

Flash flooding is characterized by rapid accumulation or runoff of surface waters from any source. This type of flooding can occur shortly after a heavy rain event, after a dam or levee failure, or following a sudden release of water held by an ice or debris jam. Because flash floods can develop in just a matter of hours, they can catch people unprepared, with most flood-related deaths resulting from this type of flooding event.

Several factors contribute to flooding. Two key elements are rainfall intensity and duration. Intensity is the rate of rainfall and duration is how long the precipitation lasts. Topography, soil conditions, and ground cover also play important roles. Most flash flooding is caused by slow-moving thunderstorms or heavy rains. Widespread floods, on the other hand, can be fast rising, but generally develop over a period of hours or days.

Urbanization further aggravates the flooding potential by increasing runoff two to six times over what would occur on natural terrain. As land is converted from fields or woodlands to buildings and pavement, it loses its ability to efficiently absorb rainfall. During periods of urban flooding, streets can become swift moving rivers, while basements and viaducts can fill with water, creating potentially dangerous situations.

The areas adjacent to rivers and stream banks that serve to carry excess floodwater during rapid runoff are called floodplains. A floodplain is defined as the lowlands and relatively flat areas adjoining rivers and streams. The term "base flood," or 100-year flood, is the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year, based upon historical records and scientific analysis.

Floodplains are a vital part of a larger entity called a basin, or watershed. A basin is defined as all the land drained by a river and its branches. In some cases, flooding may not necessarily be directly attributable to a river, stream or lake. Rather, it may be the combination of excessive rainfall/snowmelt, saturated ground, and inadequate drainage.

Levee failure also falls within the scope of potential flooding events. FEMA has defined a levee as "a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding." The primary function of levees is flood control, with most accredited levees built to the 100-year flood standard. The majority of Missouri levees are non-accredited levees, typically agricultural in nature and constructed only to withstand minor flooding events. Levees are constructed by

piling earth on a cleared, level surface and forming the earth into a structure with a broad base and tapered level top. Earthen levees are highly susceptible to erosion due to the increased height and speed of water flow. In order to mitigate this erosion, levees are often planted with vegetation to help bind the soil together, subsequently reinforcing the stability of the levee. Failsafe spillways may also be installed to serve as pressure-relief valves for the levees.

Levee failure occurs in two basic categories, breeches, and overtopping. A breech occurs when part of the levee breaks away, resulting in a large opening for water to flood protected land. Breeches can occur suddenly or gradually over time, caused by surface erosion or subsurface failure. Sand boils, a volcano-like structure, often accompany levee failure. Water seeps through soil pores under the levee, causing water pressure to build significantly. As the upward water pressure grows to exceed the pressure exerted by the weight of the soil, the water resurfaces on the levee's landside in a volcano-like cone structure. Sand boils demonstrate levee instability and may be followed by a complete breech. Overtopping occurs when flood waters exceed the lower crest of the levee. A subsequent breech of the levee is possible when overtopped due to the increased erosion speed. Levees are often reinforced with rock or concrete to prevent such erosion and possible breech. Flooding associated with levee failure is significantly different than standard riverine flooding. It tends to occur more rapidly, inundating the area in a shorter amount of time, while its impact area can be limited by additional levee systems in place.

With significant riverine systems present throughout the state of Missouri, flooding is a continuous concern. The Mississippi, Missouri, Grand, Chariton, Ozark, and White Rivers are but a few flood-prone waterways in the state. In addition to these larger rivers, Missouri's abundance of creeks, streams, and brooks further contributes to both localized and regional flooding of both varieties. The Modeled Floodplain Boundaries of Missouri are displayed in the following map, Figure 5. The map is incomplete because not all areas of Missouri have been mapped to modern standards. Much progress has been made in digitalizing flood maps and a more complete map is anticipated in the 2018 Missouri State Hazard Mitigation Plan.

Figure 5 *Map of Missouri Floodplains*

DFIRM & HAZUS-MH Countywide Base-Flood Scenarios: Modeled Floodplain Boundaries

Previous Occurrences

According to the National Oceanic and Atmospheric Administration's National Centers for Environmental Information (NCEI) 5,599 flood events occurred from 2007-2021. Of these events, there were both riverine and flash floods. The reported damages of all flooding events between 2007 and 2021 cost citizens and businesses of Missouri approximately $911,762,500. Cooperative boundaries do not match up to county lines throughout the state in most instances. As a result, each cooperative has utilized

the best available data to create Special Flood Hazard Area maps which identify potential areas of local vulnerability for their service area. These data sets vary, but may include traditional FIRMs, DFIRMs, HAZUS-MH, as well as other local information. As a planning document, this information is sufficient for the needs of the participating cooperatives at this time. Historical data for each cooperative is included in each respective chapter.

Probability of Future Occurrence and Vulnerability

During the ten years 2007-2021, the average annual number of flood events across the State of Missouri had been 373. According to NOAA, the total estimated property damage due to flooding across the state was almost $911 million from 2007 through 2021. For this 2023 update, the following Table 15 provides summary information for the participating electric distribution cooperatives regarding flooding and levee failure for the five-year period 2017-2021.

Table 15 *Summary of Flood and Levee Failure Information for Distribution Cooperatives*

Distribution Cooperative	Average Annual Occurrence	Average Annual Damages	Average Annual Outages
Atchison-Holt Electric	1.0	$55,371	2
Barry Electric	12.0	$1,761	31
Barton County Electric	13.0	$0	0
Black River Electric	7.8	$5,613	12
Callaway Electric	1.0	$0	100
Central Missouri Electric	5.0	$0	0
Citizens Electric	4.0	$4,303	0
Consolidated Electric	1.0	$0	0
Crawford Electric	4.6	$28,643	566
Cuivre River Electric	4.8	$0	0
Farmer's Electric	7.0	$8	1
Gascosage Electric	2.8	$20,600	33
Grundy Electric	5.4	$1,480	17
Howard Electric	1.4	$0	0
Howell-Oregon Electric	22.6	$92,000	23
Intercounty Electric	10.6	$16,238	383
Laclede Electric	15.8	$26,307	1,140
Lewis County Rural Electric	2.6	$6,031	24
Macon Electric	2.6	$0	0
Missouri Rural Electric	1.0	$4,475	63
New-Mac Electric	22.4	$14,667	53
North Central Electric	2.6	$0	9
Osage Valley Electric	9.2	$11,148	0
Ozark Border Electric	13.4	$103,281	184
Ozark Electric	19.8	$6,793	14
Pemiscot-Dunklin Electric	0.8	$600,000	0
Ralls County Electric	1.0	$600	0
Sac Osage Electric	2.4	$0	0
Se-Ma-No Electric	7.4	$0	0
SEMO Electric	14.2	$0	0
Southwest Electric	26.2	$226	410

Distribution Cooperative	Average Annual Occurrence	Average Annual Damages	Average Annual Outages
Three Rivers Electric	4.8	$71,477	242
Tri-County Electric	0.8	$839	0
United Electric	5.6	$0	0
Webster Electric	15.6	$0	0
West Central Electric	6.2	$0	0
White River Valley Electric	54.0	$0	275
Median	5.4	$839	2
	Total	$1,071,861	3,582

Several conclusions may be drawn from the flooding events records. However, no data concerning levee failure damage can be separated from general flood damage data provided by NCEI.

The average annual number of flooding events occurring within the boundaries of an electric distribution cooperative in Missouri is 5.4. The range of probabilities is from 80% up to an average annual number of 54 events a year. It should be noted again that same flood can be recorded at multiple locations within a REC's service area with each being counted as an event.

The average annual damages ranged from none to $1,071,861. The median average annual damage amount is $839. The total average annual damage to distribution cooperatives' assets from flooding is $1,071,861. This statewide amount is 0.03% of the distribution cooperatives' total valuation that is at risk from flooding ($8,139,594,143).

Outage information, when it was available, shows the total outages for both flash and riverine floods. The average annual number of outages for all distribution cooperatives from the effects of severe thunderstorms was 3,582, while the median number was 2 outages. The average annual number of outages is less than 1% of the total number of 739,149 meters.

The electric generation and transmission cooperatives also provided information about the effect of flooding on their assets and outages. A summary of the information is shown in Table 16.

Table 16 *Summary of Generation/Transmission Cooperatives' Flood Event Information*

Generation/Transmission Cooperative	Average Annual Occurrence	Average Annual Damages	Average Annual Outages
KAMO Electric Power	159	$0	0
M & A Electric Power	36.2	$12,356	121
Northeast Power	8.0	$2,240	0
N.W. Electric Power	32.8	$30,777	0
Sho-Me Power Electric	159.6	$22,028	0
Median for 5 G&T	36.2	$12,356	0
Associated Electric Cooperative	344.8	$279,905	0
Total		$347,306	121

The size of the areas served by the generation/transmission cooperatives increases the likelihood of flooding events occurring within their boundaries compared to the distribution cooperatives. The median average annual occurrence is 36.2 floods.

The median damage amount on an annual basis was $12,356. The sum of the average annual flood caused damages for these cooperatives is $347,306. This averaged amount is less than one percent of the valuation for the assets at risk from flooding events.

The outages reported for the generation and transmission cooperatives to their non-distribution cooperative customers were minimal. While most of the generation and transmission cooperatives did not report any outages due to flooding activity, there was average annual total of 121 outages. The number of outages is projected to be less than 1% of the direct meters served by generation and transmission cooperatives.

Problem Statement

Information provided by the individual cooperatives did not specify how their infrastructure was damaged from flooding effects. Assets, if any, that are still located in floodplains will be susceptible to major flooding effects.

Severe Winter Weather

Like thunderstorms, severe winter weather events tend to occur over wide geographic areas, encompassing an entire county or a large group of counties. According to SEMA, severe winter weather events such as snow, ice storms and extreme cold can cause injuries, deaths and property damage in a variety of ways. Winter storms are considered deceptive killers because most deaths are not directly related to the storm. Causes of death range from traffic accidents during adverse driving conditions to heart attacks caused by overexertion while shoveling snow. Hypothermia or frostbite may be considered the most direct cause of death and injuries attributed to winter storms and/or severe cold. Economic costs are difficult to measure. Heavy accumulations of ice can bring down trees, electric power lines and poles, telephone lines and communications towers. Crops, trees and livestock can be killed or injured due to deep snow, ice or severe cold. Buildings and automobiles may be damaged from falling tree limbs, power lines and poles. Local governments, homeowners, business owners, and power companies can be faced with spending millions of dollars for restoration of services, debris removal and landfill hauling.

Previous Occurrences

Severe winter weather events normally affect cooperatives on a regional basis. Ice and snowstorms tend to affect a large geographic area. From 2007-2016, the State of Missouri experienced five days of blizzards, 32 days with heavy snow events, 13 days of ice storms and 64 days with winter storms. There were some days when multiple types of events occurred. For this ten-year period, there were 85 days of severe winter weather with NCEI estimated property damage of over $555 million for these storms. For this 2023 update to the Plan, the NCEI database had records of 430 Severe Winter Weather events occurring within the service areas of AMEC distribution cooperatives over the past five years, 2017-2021.

Table 17 provides a summary of the 2017-2021 probability data and information provided by the distribution electric cooperatives regarding the effects of severe winter weather on their assets.

Table 17 *Summary of Winter Weather Information for Distribution Cooperatives*

Distribution Cooperative	Average Annual Occurrence	Average Annual Damages	Average Annual Outages
Atchison-Holt Electric	1.2	$14,411	244
Barry Electric	0.4	$110,293	1,086
Barton County Electric	1.8	$28,860	23
Black River Electric	1.4	$9,599	31
Callaway Electric	0.6	$57,513	555
Central Missouri Electric	3.2	$37,908	190
Citizens Electric	1.6	$67,774	2,478
Consolidated Electric	2.8	$9,327	106
Crawford Electric	3.2	$30,584	580
Cuivre River Electric	3.6	$0	0
Farmer's Electric	6.2	$35,772	485
Gascosage Electric	0.0	$163,516	460
Grundy Electric	3.8	$28,542	233
Howard Electric	2.0	$14,919	217
Howell-Oregon Electric	0.6	$118,784	0
Intercounty Electric	2.6	$26,621	729
Laclede Electric	2.4	$222,047	1,140
Lewis County Rural Electric	2.6	$6,075	88
Macon Electric	3.4	$0	0
Missouri Rural Electric	1.2	$8,763	65
New-Mac Electric	1.4	$700,000	1,893
North Central Electric	2.8	$26,359	36
Osage Valley Electric	3.2	$7,429	4,228
Ozark Border Electric	1.6	$657,094	317
Ozark Electric	2.4	$617,050	1,043
Pemiscot-Dunklin Electric	1.6	$2,400,000	0
Ralls County Electric	0.8	$2,600	0
Sac Osage Electric	1.8	$24,928	676
Se-Ma-No Electric	0.0	$11,667	0
SEMO Electric	4.0	$824,000	0
Southwest Electric	1.8	$216,586	1,503
Three Rivers Electric	1.8	$47,579	1,791
Tri-County Electric	3.6	$5,929	4
United Electric	10.6	$131,655	0
Webster Electric	0.6	$90,000	980
West Central Electric	2.6	$84,660	790
White River Valley Electric	0.8	$50,166	950
Median	1.8	$28,860	244
Total	430 events	$6,889,010	22,291

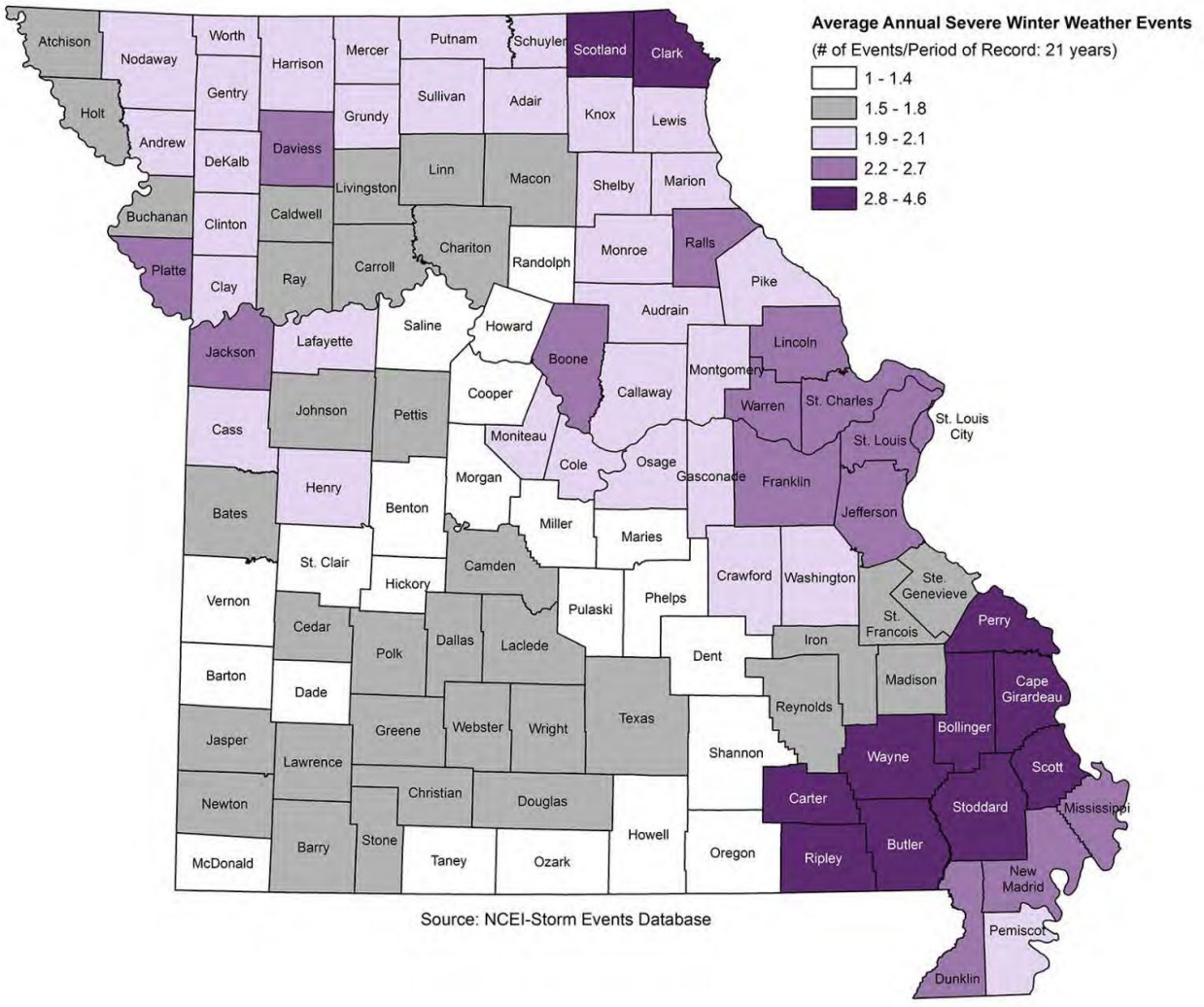
Probability of Future Occurrence and Vulnerability

Based on data from NOAA, the average annual number of severe winter events for the State of Missouri ranges from about one storm in the southwest corner up to almost five storms in the northeast corner and

an area in southeast Missouri north of the bootheel region. The median number of days of severe winter weather events occurring within an electric distribution cooperative in Missouri is 1.8. The range of probabilities is from 82% up to an average annual number of 10.6 events per year.

The widely scattered overhead assets of rural electric cooperatives were susceptible to winter weather with the median average annual damage amount equaling $28,860. The average annual damages ranged from none to $3 million. The total average annual damage to distribution cooperatives' assets from severe winter weather is $6,791,554. The total valuation of assets vulnerable to severe winter weather is $8,139,594,143. On an annual basis, damage from severe winter weather events equals about 0.1% of this amount. Figure 6 shows the historical average of winter weather events across the state (map from the 2018 Missouri State HMP).

Figure 6 *Likelihood of Severe Winter Weather in Missouri*



The availability of outage data from the participating cooperatives varied considerably. The record keeping methods of some of the cooperatives made it difficult to analyze the effect of different hazards on

the interruption of service to the members. For the hazard of severe winter weather, the median number of average annual outages was 244, ranging up to over 4,000 average annual outages for one cooperative. The average annual outages for all the distribution cooperatives totaled 22,291. Therefore, in any given year 3.3% of the total meters served may experience outages due to severe winter weather events.

The electric generation and transmission cooperatives also provided information about the effect of severe winter weather on their assets and service. A summary of the information is shown in Table 18.

Table 18 *Summary of Winter Weather Information, Generation/Transmission Coops*

Generation/Transmission Cooperative	Average Annual Occurrence (2017-2021)	Average Annual Damages	Average Annual Outages
KAMO Electric Power	13.6	$107,509	7,685
M & A Electric Power	8.6	$2,668,567	0
Northeast Power	11.6	$1,359	0
N.W. Electric Power	30.4	None reported	0
Sho-Me Power Electric	12.0	$39,585	2
Median for 5 G&T	12.0	$39,585	0
Associated Electric Cooperative	91.2	$1,191,108	0
Total		$4,008,128	7,687

The average annual occurrence statistical median is 12 severe winter weather events for the five generation-transmission cooperatives. NCEI reported 10 property damaging storms during this time. The median amount of severe winter weather damage on an annual basis is $39,585. The average annual damage for all these cooperatives is over $4 million with a wide range of values. This damage amount is less than 0.01% of the total asset valuation of $14,544,020,299.

The outages reported for the generation and transmission cooperatives reflect the information available on the direct customers that they serve, not for the distribution cooperatives. Some of these cooperatives serve only distribution cooperatives, while others have municipal and governmental customers. While the majority of the generation/transmission cooperatives did not report any outages due to winter weather activity, there was average annual total of 7,687 outages. An actual number of meters that are directly served by G&Ts were not available, but it is estimated that less than 5% of those meters would experience outages due to severe winter weather.

Problem Statement

The main threat from winter weather is ice accumulation accompanied by high winds. There were over 4,400 miles of overhead transmission line and over 56 million miles of overhead distribution line reported by Missouri's electric cooperatives. The line is most at risk when a severe ice storm occurs.

B. Non-historical Hazards

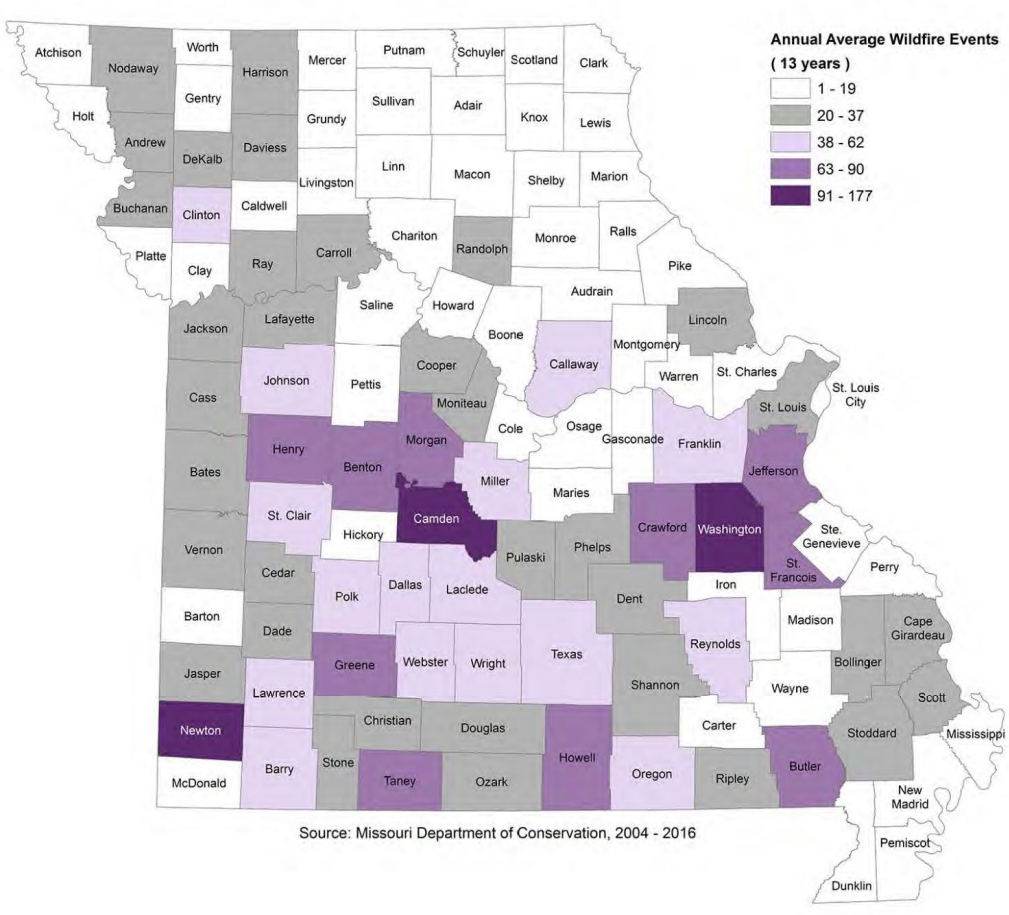
Wildfires

Grass, brush, and forest fires are natural events that have occurred periodically throughout the state of Missouri. There are three major classes of wild land fires: ground fires, surface fires, and crown fires. Ground fires spread across the grass and low-lying vegetation. Surface fires burn the trunks of trees as well as the grass and low-lying vegetation. During crown fires, the flames move across the ground, up the trees, and across the tops of the trees. Crown fires are the most dangerous and destructive class of wild land fires. Fire danger is based upon the burning index (BI). The burning index considers the fuel moisture, relative humidity, wind speed, temperature, and recent precipitation.

Previous Occurrences

In the United States, about 2.5 million acres of developed lands and wild lands burn every year. Each year, about 3,700 wildfires burn more than 55,000 acres of forest and grassland in our state. The following map (Figure 7) shows the Department of Conservation wildfire data from 1993 to 2016, it was determined that the average annual number of wildfires in Missouri was 3,209 burning an average annual 52,099 acres.

Figure 7 *Wildfire Likelihood Map*



Unlike Western states that have a summer fire season, Missouri's wildfires season is in the spring, normally between from February through May. Dead vegetation and minimal precipitation combined with the low humidity and high winds typical of this season make wildfire a greater risk at these times. A secondary critical period of wildfire season in Missouri occurs between mid-October and late November. Table 19 shows the wildfire information for each Missouri county and which distribution electric cooperatives have assets in each county *(Source: 2018 MO HMP)*.

Table 19 *Missouri Wildfires, 2004-2016*

County	Wildfire Reports 2004-2016	Average Annual # of Wildfires	Acres Burned	Average Annual Acres Burned	Distribution Cooperatives with Assets Within the County
Adair	156	12	1,643	126	Tri-County, Lewis County Rural, Macon
Andrew	471	36	4,253	327	United
Atchison	208	16	1,808	139	Atchison-Holt, United
Audrain	113	9	524	40	Consolidated, Boone, Ralls County
Barry	696	54	5,993	461	Barry, New-Mac
Barton	130	10	4,549	350	Barton County, Sac Osage
Bates	281	22	4,038	311	Osage Valley
Benton	1,133	87	21,005	1,616	Southwest, CO-MO, Central Missouri, Osage Valley, Sac Osage
Bollinger	399	31	2,814	216	SEMO, Ozark Border, Black River
Boone	7	1	60	5	Boone, Howard
Buchanan	504	39	2,977	229	United, Platte-Clay
Butler	1,158	89	4,151	319	Ozark Border
Caldwell	152	12	5,010	385	Farmers', Platte-Clay
Callaway	589	45	3,997	307	Callaway, Boone, Consolidated
Camden	2,307	178	61,333	4,718	Southwest, CO-MO, Laclede
Cape Girardeau	366	28	2,527	194	SEMO, Citizens, Black River
Carroll	340	26	11,697	900	Farmers'
Carter	113	9	6,250	481	Ozark Border
Cass	380	29	2,244	173	Osage Valley, West Central
Cedar	403	31	6,145	473	Sac Osage, Barton County, Southwest
Chariton	239	18	3,423	263	Farmers', Macon, Howard, Macon
Christian	290	22	2,550	196	Webster, White River Valley
Clark	210	16	1,296	100	Lewis County Rural
Clay	191	15	727	56	Platte-Clay
Clinton	655	50	6,325	487	United, Farmers', Platte-Clay
Cole	179	14	728	56	Three Rivers, CO-MO
Cooper	459	35	3,083	237	Co-Mo
Crawford	1,133	87	11,080	852	Crawford, Intercounty
Dade	506	39	4,505	347	Sac Osage, Barton County, Southwest
Dallas	375	52	39,531	3,041	Southwest, Laclede, Webster
Daviess	332	26	5,610	432	Farmers', Grundy, United
Dekalb	412	32	10,356	797	United, Farmers', Platte-Clay
Dent	446	34	9,331	718	Intercounty, Crawford
Douglas	378	29	10,445	803	Howell-Oregon, White River Valley, Se-Ma-No, Webster
Dunklin	14	1	24	2	Pemiscot-Dunklin, Ozark Border
Franklin	795	61	2,734	210	Crawford, Three Rivers
Gasconade	99	8	1,136	87	Three Rivers, Crawford, Intercounty
Gentry	212	16	6,857	527	United, Grundy

County	Wildfire Reports 2004-2016	Average Annual # of Wildfires	Acres Burned	Average Annual Acres Burned	Distribution Cooperatives with Assets Within the County
Greene	936	72	4,875	375	Southwest, Webster
Grundy	133	10	1,946	150	Grundy
Harrison	280	22	9,830	756	Grundy, United
Henry	1,001	77	23,818	1,832	Osage Valley, Sac Osage
Hickory	206	16	3,977	306	Southwest, Sac Osage
Holt	137	11	829	64	Atchison-Holt, United
Howard	136	11	2,198	169	Howard
Howell	868	67	10,698	823	Howell-Oregon
Iron	141	11	7,064	543	Black River
Jackson	355	27	462	36	Osage Valley, West Central
Jasper	472	36	3,169	244	Barton County, New-Mac
Jefferson	1,057	81	2,987	230	Crawford
Johnson	754	58	3,778	291	Osage Valley, West Central
Knox	21	2	523	43	Lewis County Rural, Macon
Laclede	540	42	22,994	1,769	Laclede, Southwest, Webster
Lafayette	279	22	1,487	114	West Central
Lawrence	698	54	3,799	292	Ozark, New-Mac
Lewis	166	13	1,353	104	Lewis County Rural, Missouri Rural
Lincoln	423	33	2,198	169	Cuivre River
Linn	152	12	3,241	249	Farmers', North Central, Macon, Grundy
Livingston	133	10	4,340	334	Farmers', Grundy
Macon	196	15	4,162	320	Macon, Tri-County
Madison	233	18	1,316	101	Black River
Maries	231	18	4,290	330	Intercounty, Gascosage, Three Rivers
Marion	95	7	1,367	105	Missouri Rural, Ralls County, Lewis County Rural
McDonald	260	20	2,803	216	New-Mac
Mercer	71	6	1,580	122	Grundy
Miller	707	54	5,500	423	Three Rivers, Gascosage, Co-Mo
Mississippi	214	17	888	68	SEMO
Moniteau	375	29	2,665	205	Co-Mo, Three Rivers
Monroe	227	18	3,375	260	Ralls County, Consolidated, Macon, Boone, Missouri Rural
Montgomery	205	16	1,227	94	Consolidated, Callaway, Cuivre River
Morgan	890	69	11,082	852	Co-Mo
New Madrid	98	8	167	13	Ozark Border, Pemiscot-Dunklin, SEMO
Newton	1,759	135	7,222	556	New-Mac
Nodaway	479	37	6,963	536	United, Atchison-Holt
Oregon	622	48	6,919	532	Howell-Oregon, Ozark Border
Osage	211	16	1,422	109	Three Rivers
Ozark	419	32	12,100	931	White River Valley, Howell-Oregon
Pemiscot	74	6	302	23	Pemiscot-Dunklin
Perry	42	3	545	42	Citizens
Pettis	174	13	1,742	134	Central Missouri, CO-MO, West Central
Phelps	362	28	3,519	271	Intercounty, Gascosage
Pike	172	13	2,323	179	Consolidated, Cuivre River, Ralls County
Platte	80	6	387	30	Platte-Clay, United
Polk	599	46	4,909	378	Southwest, Sac Osage
Pulaski	463	36	3,513	270	Laclede, Intercounty, Gascosage
Putnam	126	10	1,649	127	North Central, Grundy, Tri-County
Ralls	90	7	2,096	161	Ralls County, Consolidated, Missouri Rural

County	Wildfire Reports 2004-2016	Average Annual # of Wildfires	Acres Burned	Average Annual Acres Burned	Distribution Cooperatives with Assets Within the County
Randolph	360	28	3,407	262	Macon, Howard, Boone
Ray	375	29	6,446	496	Farmers', Platte-Clay
Reynolds	559	43	21,737	1,672	Ozark Border, Black River
Ripley	418	32	4,900	377	Ozark Border
Saline	116	9	1,805	139	Central Missouri, CO-MO
Schuyler	70	5	1,265	97	Tri-County
Scotland	155	12	2,748	211	Tri-County, Lewis County Rural
Scott	359	28	2,110	162	SEMO
Shannon	510	39	13,437	1,034	Intercounty, Howell-Oregon, Black River, Ozark Border
Shelby	91	7	1,099	85	Macon, Missouri Rural, Lewis County Rural
St. Charles	161	12	933	72	Cuivre River
St. Clair	643	50	20,271	1,559	Sac Osage, Osage Valley, Southwest
Ste. Genevieve	331	26	1,706	131	Citizens
Stoddard	484	37	2,706	208	SEMO, Ozark Border
Stone	519	40	4,639	357	White River Valley
Sullivan	84	7	1,412	109	North Central, Grundy, Macon, Tri-County
Taney	884	68	7,978	614	White River Valley
Texas	803	62	9,065	695	Intercounty, Howell-Oregon, Se-Ma-No
Vernon	278	21	7,873	606	Sac Osage, Barton County, Osage Valley
Warren	124	10	405	31	Cuivre River
Washington	1,492	115	23,679	1,821	Crawford
Wayne	244	19	5,921	455	Ozark Border, Black River
Webster	684	53	5,700	438	Webster, Se-Ma-No, Laclede, Southwest
Worth	176	14	8,085	622	United
Wright	635	49	5,201	400	Se-Ma-No, Intercounty, Laclede, Webster
Totals	46,048	3,543	648,888	49,915	For all Missouri Electric Cooperatives
Source: 2018 Missouri State Hazard Mitigation Plan					

Probability of Future Occurrence and Vulnerability

The counties with electric cooperatives' assets had over 31,000 wildfires for the period 2004-2016. This is an average annual 3,543 wildfires. A total of 648,888 acres or 1,014 square miles was burned by these fires. The average annual acres burned were 46,048 acres or 72 square miles. The total area of the state of Missouri is 69,704 square miles, so less than 0.2% of the total area is affected by wildfires on an annual basis.

The potential extent of damage caused by wildfire is difficult to determine. To date, wildfires have had no measurable impact upon electric cooperatives' service areas. Because of this limited impact area and since an electric distribution cooperative's assets are located throughout the service area rather than being located at a single central site, it is unlikely that infrastructure damage would exceed 1%. The total assets at risk from wildfire for Missouri electric distribution cooperatives are $9,022,373,358.

The electric generation and transmission cooperatives have assets scattered across the state. None of these cooperatives reported damage from wildfire. The asset total at risk from wildfire for these cooperatives is $14,832,576,971. This assessment assumes an annual loss of less than 1%.

No cooperatives reported outages during recorded wildfires. When compared with the total number of customers served by rural electric cooperatives in the state, it can be projected that less than 1% of all customers may report outages during any given wildfire event.

Problem Statement

The scattered nature of electric distribution lines and the limited size of wildfires in Missouri diminish the risk of widespread damage.

Land Subsidence (Sinkholes)

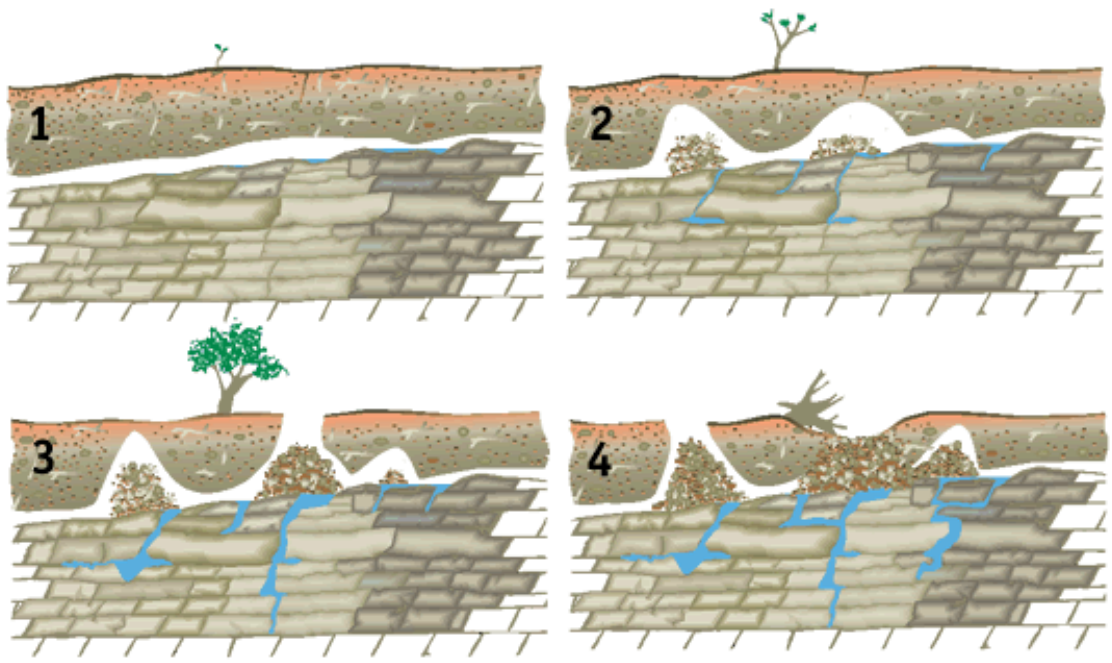
Land subsidence is characterized by a significant depression of a section of land due to movement of the earth's surface caused by subsurface water drainage or removal. The descent may gradually take place over time or occur suddenly without warning. In the state of Missouri, land subsidence may happen in a number of ways including naturally occurring sinkholes and caves as well as a result of mining activity.

Land subsidence occurs when large amounts of ground water have been withdrawn from certain types of rocks, such as fine-grained sediments. The rock compacts because the water is partly responsible for holding the ground up. When the water is withdrawn, the rock collapses in on itself. Land subsidence typically occurs over large areas, contrasted with localized damage caused by a sinkhole. One of the largest problems associated with land subsidence is the resulting permanent reduction in the total storage capacity of the affected aquifer system.

Sinkholes, also called dolines or cenotes, are the result of subsurface rock disintegration due to normal groundwater circulation. Those areas with soluble bedrock (limestone, carbonate rock, salt beds, etc.) are most at risk for the development of natural sinkholes. Extended periods of weathering further contribute to the development of sinkholes. In stage one of development, fractures or caverns in the subsurface rock are formed by water movement, allowing overlying soil to fill the existing voids. In stage two, the fill material of the void continues to be eroded slowly by ongoing water movement. Stages three, four, five, and six repeat this cycle in a process known as stoping where the existing void grows toward the earth's surface. Finally, in stage seven, the thinned soil roof is unable to support itself, resulting in a surface collapse. This collapse may or may not fill the void in the bedrock. If the bedrock fracture is completely filled, the sinkhole will eventually be filled in through the process of erosion in stage eight.

Though the process is the same, sinkholes vary in size from several square yards to hundreds of acres. Depth also varies from a few feet to hundreds of feet dependent upon existing geological circumstances. If water becomes choked in the existing sinkhole, a pond or lake may form over time. Simultaneously, the process may be repeated in nearby areas. Approximately 59% of the state of Missouri is vulnerable to the development of natural sinkholes. Land subsidence may also occur as a result of natural cave collapse, mining, and other human activities which result in the creation of voids. Figure 8 demonstrates the process by which sinkholes can form.

Figure 8 *Sinkhole Formation*



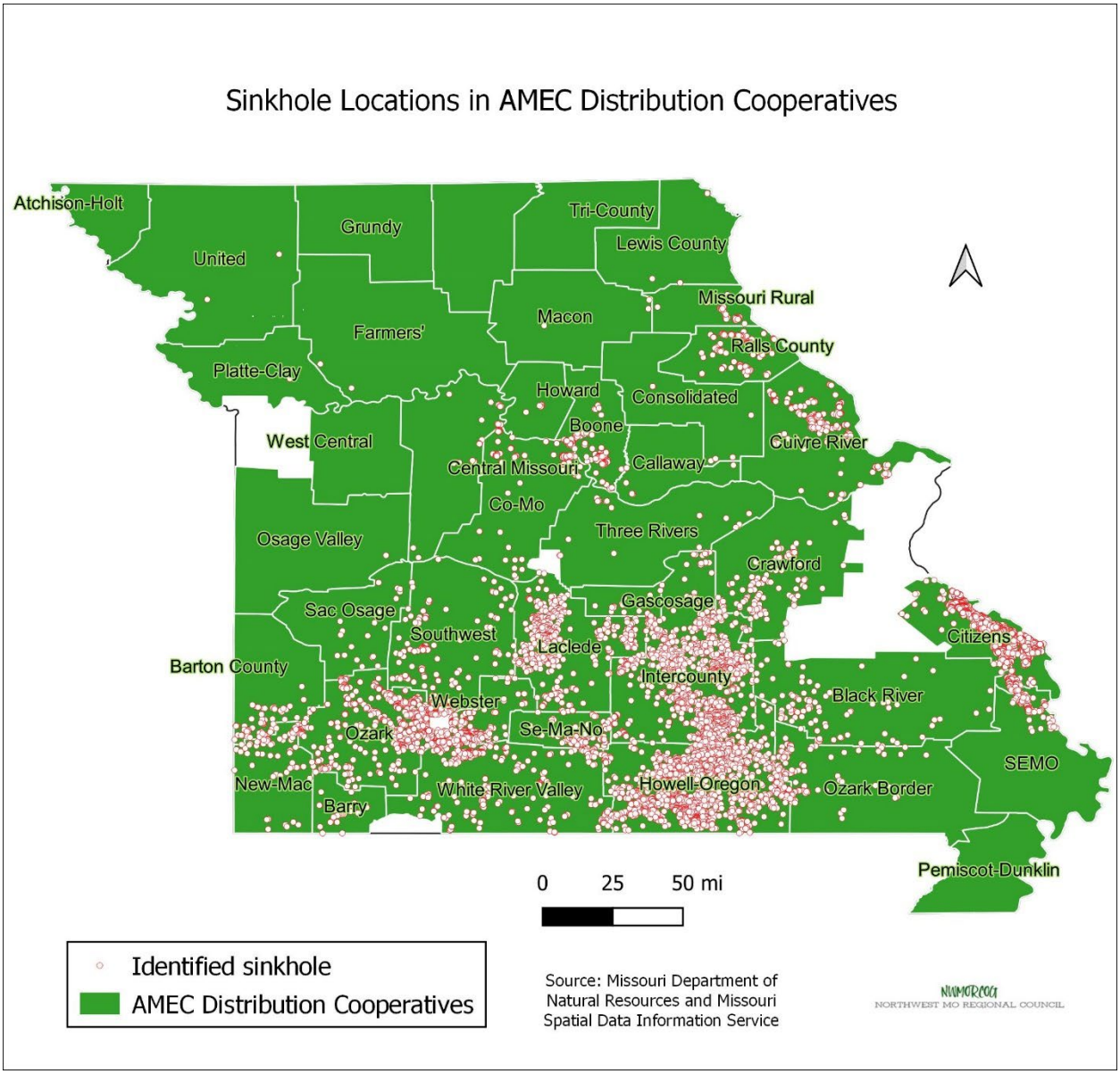
Sinkholes can form in a variety of ways, but all require collapse into voids that have developed in the subsurface. The movement of slightly acidic shallow groundwater dissolves the bedrock along fractures and other openings. The dissolved materials, along with some of the insoluble clays and rock fragments found above the bedrock, are removed through subsurface openings (fig. 1). Over time, the voids enlarge as groundwater movement carries away material (fig.2). A sinkhole commonly forms when the material above the void can no longer support its own weight and collapses (fig.3). Eventually, the sides of the sinkhole erode, leaving a bowl-shaped depression (fig.4).

Source: "Missouri Resources" magazine, Spring/Summer 2003 – Volume 20 – Number 1, "That Sinking Feeling – a Void, a Collapse" by Jim Van Dyke.

Previous Occurrences

While the occurrence of sinkholes is fairly common in the state of Missouri, the impact of such events tends to be isolated in scope. Most land subsidence events take place in the southern portions of the state which have large concentrations of limestone and dolomite bedrock but have also been reported in the northeast and central regions. The U.S. Geological Survey Program has identified 15,981 sinkholes in Missouri. Land subsidence events tend to be localized events in areas with karst topography or certain soil types. While these features do not categorically exclude the formation of sinkholes in any given area of the state, the likelihood of occurrence dramatically increases in regions with said features and a historical precedent of occurrence. Figure 9 shows the locations of known sinkholes in the state. (*Map source: Missouri Department of Natural Resources*)

Figure 9 *Sinkhole Locations in Missouri*



Of Missouri's 114 counties, 29 counties have never experienced a reported land subsidence event, 68 have experienced 1-200 events, and 17 have experienced in excess of 200 events.

Probability of Future Occurrence and Vulnerability

For the fourteen electric cooperatives in the state of Missouri that serve areas without historical instances of land subsidence, this hazard has been eliminated as a potential vulnerability based on local knowledge, research, and group planning discussions. Conversely, those cooperatives which serve areas that have a historical precedent, the potential for hazard occurrence varies widely. The instances of historical sinkhole events ranged from a single instance to over 2,000 in counties of service. As such, there is no

sufficient method which can address these regional differences and create a statewide standardized assessment.

Twenty-four of the 37 participating distribution cooperatives and all six of the participating G&Ts identified sinkholes as hazards. Without additional data related to dates of occurrence, it is difficult to quantify the risks associated with land subsidence/sinkholes for these electric cooperatives. As such, the probability of occurrence is assumed to be 10% for distribution cooperatives and G&Ts with historical events in their areas of service. To date, only one of the state's distribution cooperatives (Ozark Electric) and none of the G&Ts have reported any damages due to sinkhole incidents. For all the rest of the cooperatives that identified land subsidence (sinkhole) as a potential hazard, the probability of a damage-causing event is calculated to be less than 1%. Because sinkholes are normally isolated to a specific area of land, the potential impact on electrical systems statewide appears to be relatively minor with less than 1% damage to the existing system. At this time, sufficient data for damage-causing land subsidence events is unavailable. Further monitoring of research developments and information from SEMA and FEMA will be required to formulate a more specific impact study.

As with the potential extent of damage, the impact of future land subsidence events suggests a relatively minor impact upon system-wide service. While a specific location may experience power outages, the majority of customers' service would remain unaffected by land subsidence incidences. Currently, sufficient data for land subsidence events which interrupt power service is unavailable. However, for the purposes of this assessment, the potential extent of impact is assumed to be less than 5% of reported customer outages for both distribution cooperatives and G&Ts.

Problem Statement

Damage from sinkholes has been minimized by identifying their presence and avoiding them before any electric utility development commences. Extensive survey studies are completed before any construction of infrastructure begins to avoid future problems.

Dam Failure

A dam is defined by the National Dam Safety Act as an artificial barrier that impounds or diverts water and (1) is at least 6 feet high and stores at least 50 acre-feet of water, or (2) is at least 25 feet high and stores at least 15 acre-feet. Of the 80,000-plus dams in the United States, less than 5% are under the jurisdiction of the federal government.

Dams come under the regulation of the state Water Resources Division of the Department of Natural Resources (DNR). DNR regulates the design, construction and maintenance of these non-federal, non-agricultural dams that are at least 35 feet high. Additionally, DNR maintains a database of all dams, regardless of federal, state, local, or private ownership. Dam owners have primary responsibility for the safe design, operation, and maintenance of their dams. They are responsible for providing early warning of problems at the dam, for developing an effective emergency action plan, and for coordinating that plan with local officials. The state has ultimate responsibility for public safety and many states regulate construction, modification, maintenance, and operation of dams.

Dams can fail for a variety of reasons. The following are the most common causes of dam failure:

Piping Failure – piping failures are usually caused by embankment leakage, foundation leakage, and/or the deterioration of structures on the dam.

Erosion Failure – erosion of dams is generally caused by the inadequate capacity of a spillway, resulting in overtopping of the dam or flow erosion and/or inadequate slope protection.

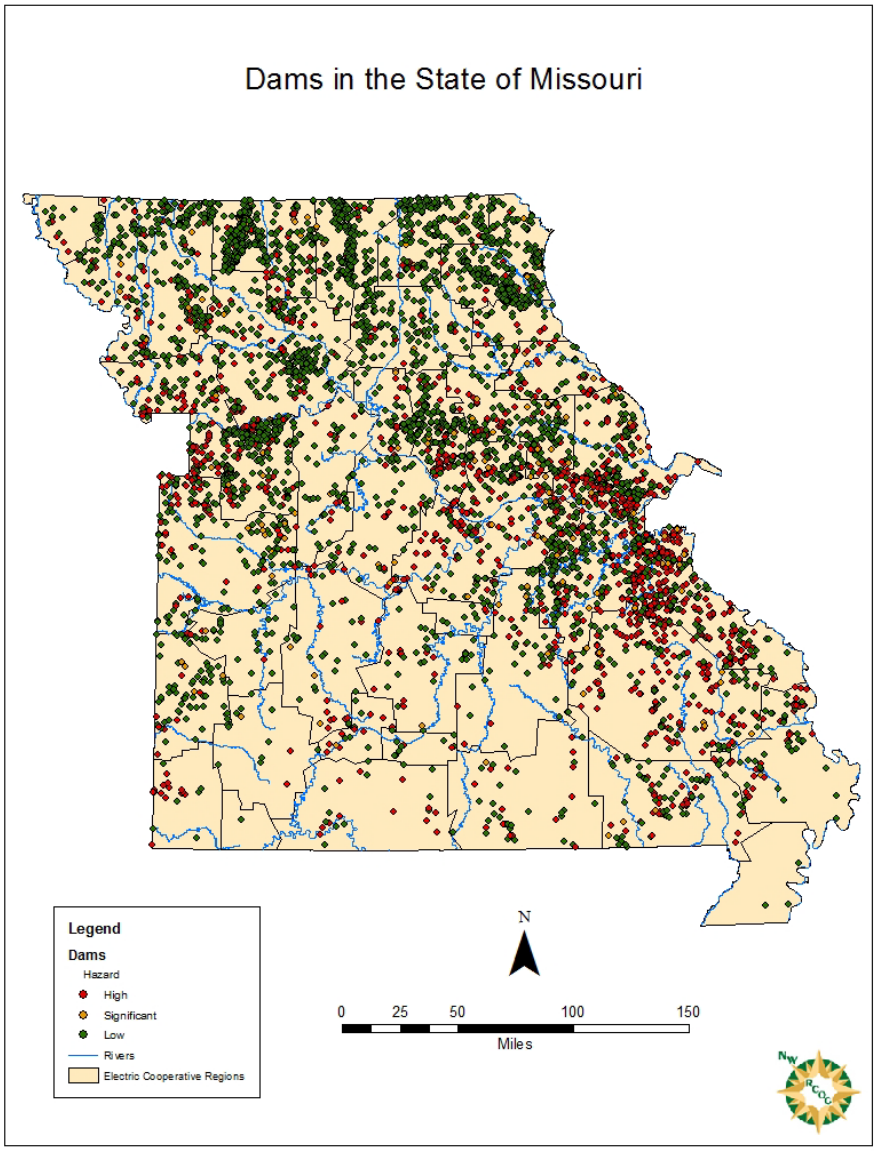
Structural Failure – structural failures of dams may be caused by an earthquake or slope instability or poor construction.

These failure types often are interrelated. For example, erosion, either on the surface or internal, may weaken the dam or lead to structural failure. Additionally, structural failure may shorten the seepage path and lead to a piping failure.

Previous Occurrences

Thousands of people have been injured, many killed, and billions of dollars in property damaged by dam failures in the United States. The problem of unsafe dams in Missouri was underscored by dam failures at Lawrenceton in 1968, Washington County in 1975, Fredericktown in 1977, a near failure in Franklin County in 1978, and Taum Sauk in 2005. There have been 26 recorded dam failures in Missouri over the last 100 years. One drowning is recorded among all of these disasters. Figure 10 identifies the dams across the state. *(Map source data: USACE National Inventory of Dams.)*

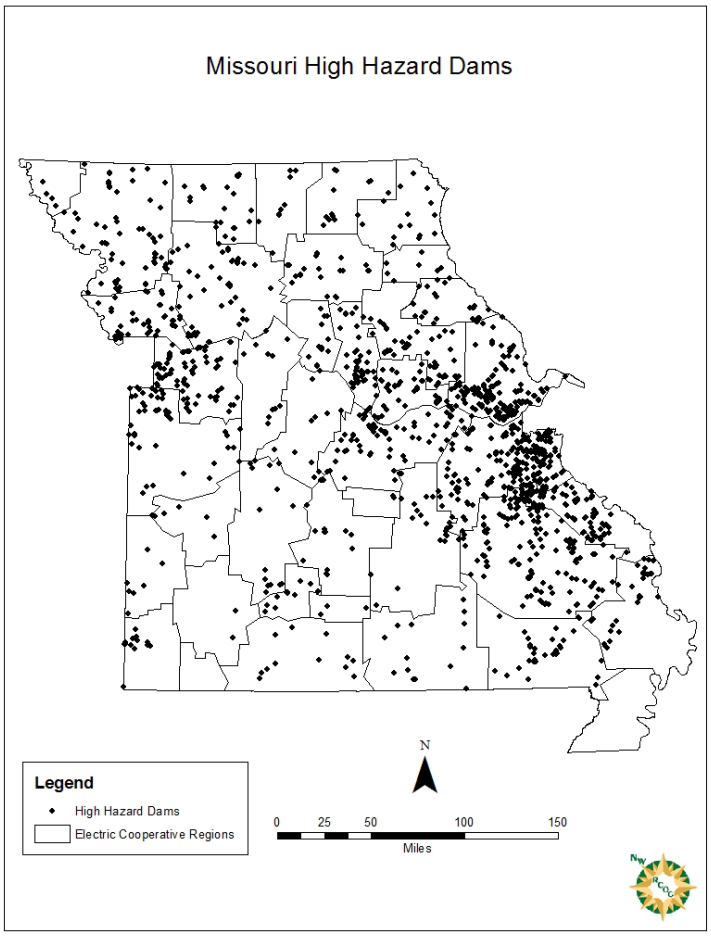
Figure 10 *Location of Dams in AMEC Distribution Cooperatives*



The latest listing by the Missouri Department of Natural Resources (DNR) contained information on 5,529 dams in the state of Missouri as of 2018. This includes 699 dams that are state regulated. Class 1 dams are considered high hazard dams. There is a total of 474 high hazard dams, 208 of these are regulated by the state. The United States Army Corps of Engineers (USACE) has created an inventory of dams across the United States. Dams in the inventory are rated using the following scale:

- Low: Dams assigned the low hazard potential classification are any that have not been assigned a significant or high hazard potential.
- Significant: Dams assigned the significant hazard potential classification are defined as, no loss of life expected if the dam were to fail, but significant economic losses or substantial damage to public services or infrastructure are probably or expected if the dam were to fail.
- High: Dams assigned the high hazard potential classification are defined as, loss of human life is probable or expected if the dam were to fail. Figure 11 shows the location of the identified high hazard dams across the state. *(Map sources data: USACE National Inventory of Dams.)*

Figure 11 *High Hazard Dam Location in AMEC Distribution Cooperatives*



Probability of Future Occurrence and Vulnerability

Using the previously described methodology, the probability of a dam failure event in the state of Missouri in any given year is 26% (26 events / 100 years * 100 = 26%). However, none of the failures, however, have had a measurable impact upon distribution or G&T cooperative assets.

Determining the potential effects of dam failure is currently impossible due to a lack of data detailing the value of cooperatives' assets that are inundation zones. Further study concerning existing dams and their impact is required to make a more comprehensive assessment of potential damages. This assessment assumes a limited impact upon downstream electric distribution infrastructure of less than 5% of the $14,832,576,971 total valuation for infrastructure damage and less than 1% service interruption.

Problem Statement

Information provided by the individual electrical cooperatives did not identify any assets in the inundation zones of dams. Cooperatives should be aware of the high hazard dams within their service areas and any construction within inundation zones.

Earthquakes

According to SEMA, earthquakes can be defined as shifts in the Earth's crust causing the surface to become unstable. This instability can manifest itself in intensity from slight tremors to large shocks. The duration of an earthquake can range from a few seconds up to five minutes, while the period of tremors and shocks can last up to several months. Ground failure, landslides, uplifts, liquefaction, and sand blows may result from larger shocks.

Tectonic plates are the basic component of the Earth's crust, forming the lithosphere which floats over the asthenosphere, the partially melted layer of crust. Boundaries are formed where one plate meets another. Two types of boundaries exist: convergent and divergent. Convergent plate boundaries are areas where tectonic plates move towards each other; divergent boundaries are areas where the plates move away from each other. Pressure continually builds along these boundaries until a sudden release of energy creates seismic waves. At the Earth's surface, the result is shaking and displacement of ground, dependent upon the amount of energy released and its intensity.

Large earthquakes alone can cause significant damage, but their cascading effects present additional hazards for susceptible areas. These cascading effects include soil liquefaction, sand blows, lateral spreading, landslides, and sinkhole collapse. Soil liquefaction occurs in sandy soil types where strong seismic waves cause the soil to act like a thick liquid and lose its load-bearing capacity. Sand blows are an eruption of sand onto the land surface in a geyser-like fashion. Lateral spreading and landslides result in a loss of soil on gentle and steep slopes respectively where the underlying geological materials are unstable. Each of these cascading effects can significantly impact local structures, transportation systems, utilities service, and other critical services.

Previous Occurrences

The state of Missouri has several seismic zones which carry the potential for significant damage-causing events. These seismic zones are the:

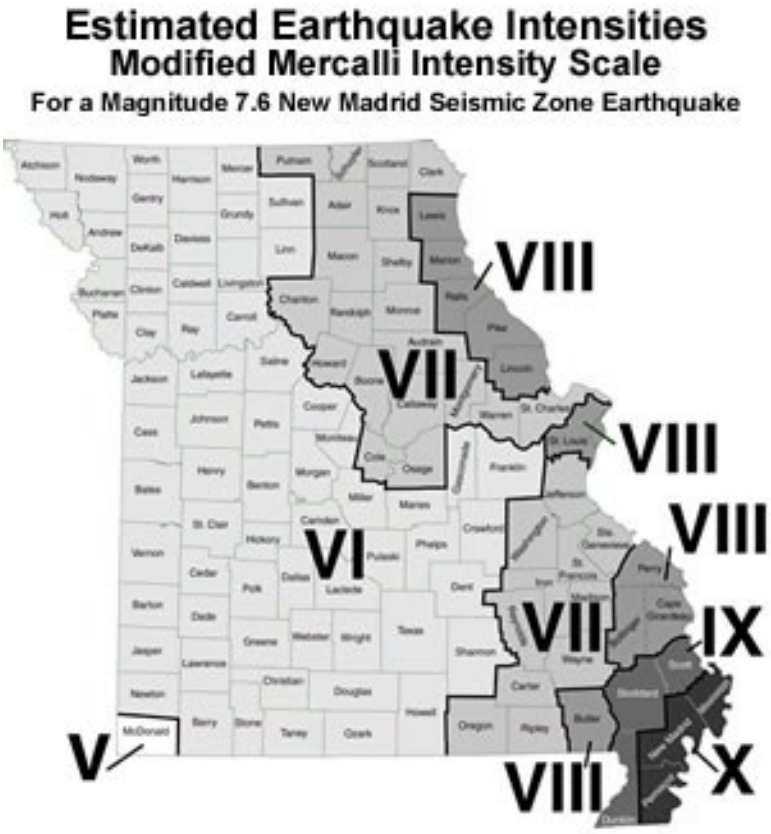
- New Madrid Seismic Zone
- Nemaha Uplift
- South Central Illinois Seismic Zone
- Wabash Valley Seismic Zone.

Of these four zones, New Madrid is the seismic zone with the most significant potential for widespread devastation. The southeastern portion of the state presents the highest risk for earthquake damage and its associated effects due to the presence of natural caves, soil types, and other important natural features. The Wabash Valley and South-Central Illinois Seismic Zones have not been as active to date, but are considered capable of producing a 6.0-6.8 magnitude earthquake impacting the central eastern portion of the state. Risk potential for the western side of the state comes from the Nemaha Uplift, though its events tend to be less severe than those associated with other seismic zones.

The most severe earthquakes in Missouri's history occurred in the New Madrid Seismic Zone from December 1811 – March 1812, well before the development of electrical power infrastructure. Approximately 200 small earthquakes occur each year in this zone, with 1-2 earthquakes in eighteen months that are strong enough to crack plaster in existing buildings. The National Earthquake Prediction

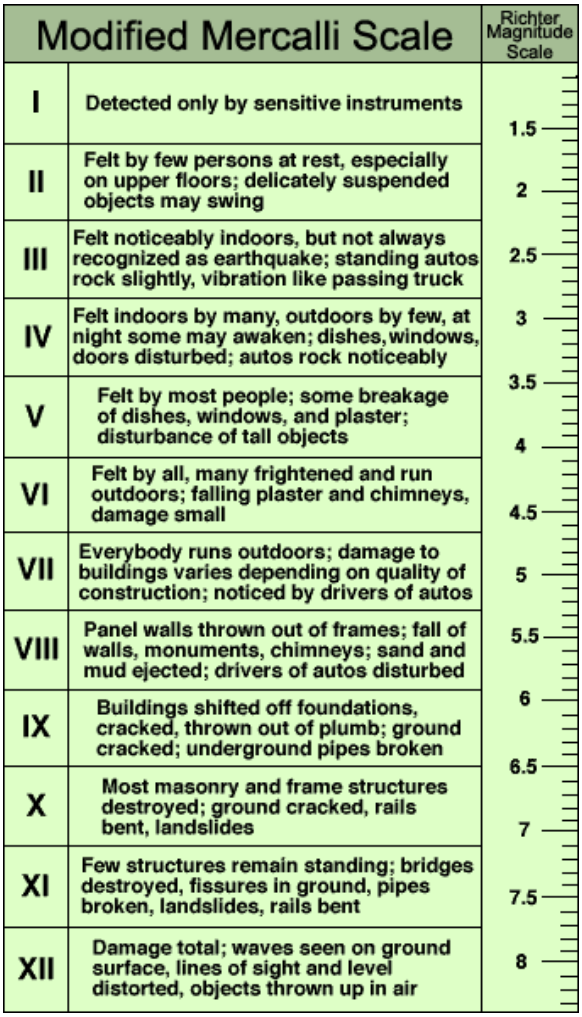
Evaluation Council (NEPEC) estimates that major earthquakes occur along the New Madrid Seismic Zone approximately every 500 years. Figure 12 provides the projected earthquake intensities for the state of Missouri in relation to a significant event in the New Madrid zone. *(Source: Missouri Department of Natural Resources).*

Figure 12 *Projected Earthquake Intensities Map*



The above map shows the predicted intensity of a 7.6 magnitude (on the Richter scale) earthquake across the state. The Richter scale is a measurement of the magnitude or total energy released by an earthquake. The Roman numerals show the Modified Mercalli scale predictions. The Modified Mercalli scale measures the intensity of the event. The following illustration, Figure 13, shows the relationship between the two measurements and the effects at each level. *(Source: Missouri Department of Natural Resources).*

Figure 13 *Relationship between Mercalli and Richter Scales*



Probability of Future Occurrence and Vulnerability

According to SEMA, the risk for all electric cooperatives in the state of Missouri ranges from a Level V-IX impact on the Modified Mercalli Intensity Scale from a 6.7 magnitude earthquake; Level VI-X impact from a 7.6 magnitude earthquake; or Level VII-XI impact in the event of an 8.6 earthquake centered within the New Madrid Fault.

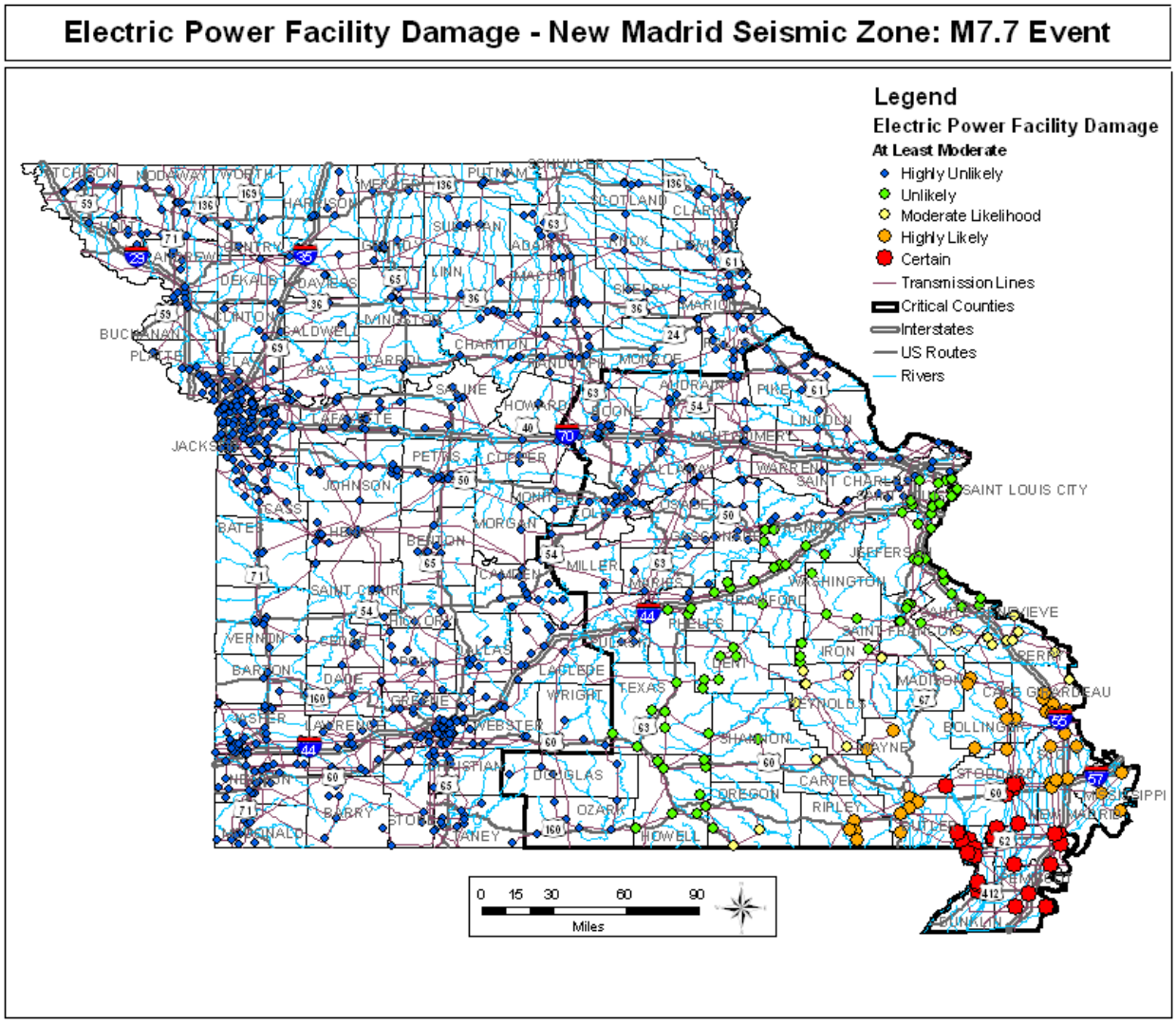
The unpredictability of earthquakes presents a significant challenge in establishing an accurate risk assessment. According to Missouri's Department of Natural Resources, approximately 200 shocks are detected annually from the New Madrid Seismic Zone, but most are detected only by precise instrumentation. The majority of these quakes are minor in scope and in magnitude. To date, no recorded damages to electrical infrastructure have been reported from earthquakes in the New Madrid Seismic Zone. Based on the definition of Historical and Non-Historical Hazards, earthquakes have been included as non-historical hazards. Earthquakes like those in 1811 and 1812, with a magnitude exceeding 7.0, are significant but rare. Based on the information from the NEPEC previously cited, the probability of occurrence for higher magnitude earthquakes is less than 1% in any given year (1 event / 500 years *100

= 0.2%). In the event of an earthquake with a 7.6 rating, the impact upon the cooperatives statewide would vary from minor to significant or incapacitating damage to buildings and electrical distribution infrastructure. Those with the most risk include Missouri Rural Electric, Ralls County Electric, Cuivre River Electric, Crawford Electric, Citizens Electric, Black River Electric, Ozark Border Electric, SEMO Electric, and Pemiscot-Dunklin Electric, all located along the eastern border of the state. Their proximity to three of the four seismic zones increases the likelihood of significant events and their associated impacts. For these cooperatives, both overhead and underground distribution lines could become disconnected or severed, transformers could be damaged, and the capability to maintain service to the affected region has the potential to be significant. As has been stated earlier, to date, earthquakes have not caused any reportable damage to cooperative assets. Though the probability of occurrence for higher magnitude earthquakes is very small in any given year, the potential extent of damage could significantly impact both cooperatives and customers.

Based on research from the Mid-America Earthquake Center in their publication, "Impact of Earthquakes on the Central USA," certain conclusions can be drawn *(Volume II, Appendix A, "Missouri Earthquake Impact Assessment Results,").* According to their research, in the event of an earthquake measuring 7.6 on the Richter Scale, over 100 electric power facilities would be damaged, mostly located in southeast Missouri, with utility damages statewide comprising nearly 70% of all direct losses. This would leave "tens of thousands of households without power immediately after the earthquake" *(ibid)*. On Day 1, the Center estimates over 310,000 households without power, 90% of which are located in eastern Missouri in 22 impacted counties The impacted distribution cooperatives in this scenario are Black River, Citizens, Crawford, Cuivre River, Howell-Oregon, Ozark Border, Pemiscot-Dunklin and SEMO.

It is likely that many critical facilities would be without power. Figure 14, on the next page, demonstrates the likelihood of damage to existing electric power facilities in the state of Missouri (Source: *Mid-American Earthquake Center*).

Figure 14 *Earthquake Damage to Electric Power Facilities*



While it is highly unlikely that power interruption may result in the majority of the state, the potential for service interruption cannot be eliminated in these areas because of potential cascading impacts from a devastating quake in the New Madrid Seismic Zone. Failure in one section of the electrical grid could lead to additional outages around the state. Using this model and taking into consideration the effects associated with the Modified Mercalli Intensity Scale, the following potential outage percentages were calculated and assigned to each Intensity Scale Level:

- Level VI: Up to 10% of customers report outages
- Level VII: 10 - 20% of customers report outages
- Level VIII: 20 - 30% of customers report outages
- Level IX: 30 - 49% of customers, report outages
- Level X – 50% or more of customers report outages

The projections in the MAEC publication discussed above only projects the impacts upon 22 identified counties and the City of St. Louis. The total number of meters served by the three cooperatives shown as "certain" or "highly likely" to be impacted is 65,312. The meter count for the five cooperatives shown as at least partially in the area identified as "Moderate Likelihood" is 169,859. When compared with the total number of meters served by cooperatives in the state, it can be projected that approximately 10% to 35% of all distribution cooperatives' meters may report outages during an estimated 7.6 magnitude earthquake.

Problem Statement

The available data concerning earthquakes and their impacts upon electrical infrastructure does not currently support long term scenario planning. While the data related to potential outages on Day 1 paints a significant picture, the potential of such quakes to decimate the local infrastructure long term is significant, particularly in the southeast region of the state. The discussion of long-term impacts in this plan, however, is limited by available data concerning electric infrastructure. During the plan update process, further research into the long-term impacts will be considered and data provided as possible. It is noted that some of the cooperatives have indicated that they have taken steps to protect their most critical assets against seismic activity.

C. Risk Assessment Summary

Most of the historical hazards have had an impact on the electric cooperatives. Table 20 below shows the annual damages associated with each hazard for electric distribution cooperatives statewide. The table is ranked by the highest Average Annual Damages which is an indication of the vulnerability to each hazard.

Table 20 *Distribution Cooperatives' Hazard Risk Summary*

Hazard	Average Annual Damages
Severe Winter Weather	$6,899,010
Flood and Levee Failure	$1,071,861
Tornadoes	$1,157,172
Severe Thunderstorms, Hail and High Winds	$1,207,421
Severe Land Subsidence (Sinkholes)	$333
Dam Failure	$0
Earthquakes	$0
Wildfire	$0

The information on the generation and transmission cooperatives' combined hazard damages are shown in Table 21.

Table 21 *Generation and Transmission Cooperatives' Hazard Risk Summary*

Hazard	Average Annual Damages
Severe Winter Weather	$4,008,128
Tornadoes	$369,490
Flood and Levee Failure	$347,306
Severe Thunderstorms, High Wind and Hail	$117,061
Dam Failure	$0
Earthquakes	$0
Severe Land Subsidence (Sinkholes)	$0
Wildfire	$0

Severe winter weather is the costliest hazard to the rural electric cooperatives in Missouri. As previously discussed, ice storms, especially when accompanied with high winds, can play havoc with the poles, wires and other overhead assets across the state.

The non-historical hazards Wildfire, Earthquakes and Dam Failure have the potential for causing catastrophic damages in any given year. To date there have been zero reported damages to the assets of the electric cooperatives from the non-historical events. Nonetheless, this set of hazards should be considered in mitigation strategies because of their substantial damage potential.

Section 5: Mitigation Strategies

Introduction to Mitigation

Disasters occur every day. Floods, hurricanes, fires, ice storms, earthquakes, and tornadoes are just a few examples of natural calamities that have the potential for large-scale negative effects on communities, businesses, and residents. Disasters occur when human activity and development meets with sudden destruction due to natural or man-made occurrences. Certainly, these occurrences are not avoidable, but steps can be taken that will lessen the effects of the disaster or nullify them altogether. Mitigation focuses on breaking the cycle of disaster damage, reconstruction, and repeated damage. Hazard mitigation is defined by FEMA as "any action taken to eliminate or reduce the long-term risk to human life and property from hazards and their effects." (http://www.fema.gov)

For Missouri's rural electric cooperatives, mitigation focuses on activities which address the following:

- Preservation, maintenance, and improvement of existing infrastructure
- Reducing the number of service interruptions to customers
- Diminishing the associated impacts of service interruptions
- Identifying new technology or strategies which can improve other aspects of electrical service delivery and customer service

Previous Mitigation Efforts

For all rural electric cooperatives statewide, mitigation is considered to be part of prudent business operations. In order to ensure the delivery of a quality product and minimize service interruptions, a number of mitigation strategies are continually utilized. Routine maintenance and upgrades to existing equipment are completed as part of daily tasks. Vegetation management is utilized to limit the cascading effects of natural hazards. Safety and reporting information are disseminated to the public through various types of media. Mutual aid agreements and partnerships create relationships which provide for future support in the event of a natural disaster.

Additionally, mitigation is considered prior to any expansion of service into special hazard areas. Before any service is built or expansion is considered, it is first "staked out" in coordination with local builders, property owners, local governments, and other invested stakeholders. The scope of this process depends upon the scope of the project, but always seeks to identify and address foreseeable hazards and safety issues before any new construction. United States Department of Agriculture – Rural Utility System (USDA-RUS) specifications regarding operation and safety are utilized in every step of the process. The RUS standards are part of the Code of Federal Regulations, Title 7 which sets forth the regulations of the Department of Agriculture. These regulations minimize vulnerabilities when expansion does occur in hazard areas. Steps are taken to practically minimize the exposure of equipment to loss due to foreseeable hazards. Further information on RUS regulations and standards can be found at http://www.rurdev.usda.gov/RegulationsAndGuidance.html.

Existing and Potential Resources

As stated above, mitigation is a key component of good business practices. Electric Cooperatives in the state of Missouri include mitigation strategies as part of regular work activities to ensure service with minimal interruptions. Funding for these activities is provided through the normal budgetary process for maintenance.

In order to expand mitigation efforts beyond normal preventative maintenance and standard upgrades, it is likely that individual co-ops will need to seek outside funding sources. These may include private, state, or federal programs which provide grant and loan funding. Upon passage of this plan, participating cooperatives will be eligible for funding through FEMA funds in the following categories:

404 Stafford Act

The 404 Stafford Act provides funding for cost-effect hazard mitigation measures prior to disaster impacts. Applications are reviewed by SEMA based upon state priorities and cost effectiveness. Funds are based in three programs:

- Hazard Mitigation Grant Program
- Flood Mitigation Assistance Program
- Pre-Disaster Mitigation Program

For further information, please visit www.fema.gov/hazard-mitigation-grant-program

406 Stafford Act

The 406 Stafford Act provides funding for cost-effective hazard mitigation measures for electrical transmission and distribution facilities. Applications are reviewed by FEMA staff based upon standardized cost effectiveness. Awards may include up to 100% of eligible repair costs. For further information, please visit: www.fema.gov/

United States Department of Agriculture (USDA) Rural Development Grants

USDA Rural Development provides financial assistance opportunities that are available to assist rural businesses, including cooperatives and agricultural producers. For more information, please visit: https://www.rd.usda.gov/programs-services/cooperatives

Additional resources may also exist through the Homeland Security Grant Program www.fema.gov/homeland-security-grant-program - depending upon funding and priorities in the year of application.

NFIP Participation

Missouri's Rural Electric Cooperatives are not eligible for participation in the National Flood Insurance Program. As such, they do not participate.

Review of Goals and Actions

Establishing mitigation goals and actions for a utility requires a slightly different approach than public agencies. Certainly, a number of similarities exist; both entities must consider which hazards most commonly occur and have the greatest potential for causing disruption to members or residents. They must also consider which types of actions will maximize benefits and minimize costs, how mitigation strategies will be implemented, who will enforce implementation, and how the overall plan will be maintained and updated.

To focus on the mitigation actions for the 2023 update to this plan, it was decided to reach consensus on four goals that would address the needs of every cooperative member of AMEC and eliminate the objectives from previous updates. The mitigation review staff from each electric cooperative reviewed goals and actions which addressed hazard mitigation issues for the 2023 plan update. They evaluated each action to decide if it was completed, will be continued, or should be deleted. There also was the opportunity to add goals or new actions. The staff considered which type of actions will maximize benefits and minimizes costs, how mitigation strategies will be implemented, and how the overall plan will be maintained and updated.

The goals reviewed and accepted by the electric cooperatives for this update:

1. Protect the health and safety of the community.
2. Reduce future losses due to natural hazard events.
3. Improve emergency management capabilities and enhance local partnerships.
4. Continue to promote public awareness and education.

The reviewed and accepted actions that support these goals were similar across the state but reflected the characteristics of each cooperative. To focus their efforts to achieve the goal of protecting the health and safety of the community, a common purpose of actions was to prevent or lessen outages to critical facilities in the service area. The mitigation efforts to reduce future losses due to natural hazards were stated in actions to research and develop plans to improve the system's infrastructure resiliency. The third goal regarding emergency management and local partnerships was often supported with action to reduce response time and to explore mutually beneficial relationships with other agencies. For the fourth goal, actions were written expressing plans to work with community groups and local media outlets to promote public awareness concerns of the rural electric cooperatives.

Traditionally, the STAPLEE (Social, Technical, Administrative, Political, Legal, Environmental, and Economic) method is used to prioritize mitigation actions. These categories, however, do not necessarily align with the private sector in the same way they are applicable to governmental agencies. Several action items could be included with multiple goals, for example. As a result, the cooperatives chose to use a different method to prioritize their mitigation strategy.

Another component of reviewing the proposed and existing mitigation strategies was to perform a cost-benefit analysis of all mitigation actions. The analysis was based on past experiences of performing certain actions and the potential number of beneficiaries. The following matrix, Figure 15, was used to rate each mitigation action. Cooperative staff was asked in the Goals and Actions Survey to review the cost-benefit rating and change if necessary.

Figure 15 *Cost Benefit Matrix*

Scoring matrix	Low Cost	Medium Cost	High Cost
Low Benefit	3	2	1
Medium Benefit	6	5	4
High Benefit	9	8	7

The rating given each action is displayed in the Actions Tables for each cooperative's chapter. For example, an action that was deemed to be of high benefit to the cooperative, yet low in cost was given a score of 9; a mitigation action that would be of high cost and medium benefit would earn a score of 4 and so forth.

Cooperative mitigation staff reviewed and assigned a cost-benefit score to each action. Although Action Items may be similar between cooperatives, the cost-benefit score can vary widely across the state dependent upon internal cooperative capabilities, local geographic features, potential extent of hazard, projected hazard impact, and other factors. Further information on each electric cooperative's Action Item list is available within the cooperative chapters.

Samples of the most common continuing annual actions are listed in Table 22 below. It did not matter the size of the cooperative; these actions were commonly held across the state. The cost/benefit scores vary between cooperatives depending on local operations and budget available for the actions. Actions are consistent especially between the distribution cooperatives. The generation and transmission cooperatives are not in direct contact with the public as are the distribution cooperatives and that changes the focus of their actions in the mitigation of the effects of natural disasters.

Table 22 *Sample Common Actions*

Goal	Example Action Items	Cost/Benefit Score Range
1	Use vegetation management to limit public safety danger of downed lines and to prevent interference with delivery of power.	6-9
2	Addition of lightning arresters, electronic reclosures, conductors, guide wires. Replacement or repair on poles, cross-arms, lines. Raising transmission lines in flood prone areas. Rebuild aging critical infrastructure.	4-9
3	Partner with county emergency management agencies to ensure power for local shelters, fuel stations, and public safety.	5-9
4	Provide safety and reporting information to the general public through varying methods:	6-9

Actions of each priority may be funded through regular budgetary methods or identified outside sources. The 2023 update of the 2017 plan contains lists of the competed, deleted, and new actions in each individual electric cooperative chapter. These Action Items vary widely from chapter to chapter, coming from addressing all goals and will not be addressed in the Statewide Summary.

Section 6: Plan Adoption, Implementation, and Maintenance

Plan Adoption and Incorporation

The updated plan has been reviewed and adopted by the Board of Directors as part of each cooperative's operations policy. Implementation of this mitigation plan necessitates involvement from every employment level as the organization strives to ensure quality service to their customers. The General Manager of each cooperative is responsible for the implementation, and many of the Action are part of the cooperative's daily business. This multi-jurisdictional plan identifies ongoing efforts and methods for expanding mitigation efforts to reduce the impact of natural hazards on cooperative infrastructure and electric service.

An adoption Resolution was approved by each participating cooperative's Board of Directors. As each chapter cannot stand alone as a completed plan, the plan in its entirety was adopted by the electric cooperatives. Distribution cooperatives, wholesale power producer, and the generation and transmission cooperatives across the state have adopted the plan. This does not, however, result in individual cooperatives assuming responsibility for implementing mitigation activities which are included as part of other cooperative chapters. Documentation of adoption comes in the form of Resolutions. Appendix I contains a template for the Resolutions and the signed Resolutions from all participating cooperatives.

Local Planning Mechanisms and Capabilities

Internal planning mechanisms and capabilities for Missouri's rural electric cooperatives are as diverse as the cooperatives themselves. Regardless of size, however, each cooperative has budgetary planning mechanisms in place as well as a four-year work plan. Both may be utilized to implement potential mitigation actions. Each chapter addresses the existence of internal capabilities for each electric cooperative individually due to the wide variety across the state.

The four-year work plans embrace the mitigation efforts that are in the mitigation plan. The electric cooperatives across Missouri are always working to strengthen their systems. This would include installing stronger/larger poles when smaller ones need to be changed out, installing stronger/larger conductors that can carry more weight and decreasing span lengths between poles, installing larger anchors, relocating structures out of flood plains, and installing structures to stop cascading during ice storms. As these work plans are developed, hazard mitigation strategies are incorporated.

Other mechanisms and capabilities are unique to the electric cooperative's business of providing reliable electricity to their members. Many of the Action Items listed in the plan include tree trimming plans, use of GPS to locate outages, service upgrades to lines and poles, warning systems and use of weather radios, collection of GIS data and utility specific software for locating and rerouting outages to restore power, all contribute to local capabilities. Integration of hazard mitigation planning capabilities with local law enforcement, mutual aid agreements, and partnerships with local emergency management resources ensures power to critical facilities during a hazard event. This coordination and cooperation broaden the capabilities of the local cooperative.

Likewise, the existence of external planning mechanisms varies widely throughout the state of Missouri. Comprehensive plans, capital improvement plans, regional transportation and economic development plans, multi-jurisdictional hazard mitigation plans, county and city planning efforts are only a few of the

plan types which exist around the state. Each individual chapter in this plan update includes a section on local planning capabilities which exist in their service area.

Plan Maintenance and Update Process

The plan maintenance process establishes a schedule for monitoring and evaluating the plan annually and producing a plan revision every five years. Cooperative staff, under direction of the General Manager will be responsible for the annual review of the hazard mitigation strategies and integration into internal and external planning mechanisms. Implementation and coordination with these local planning capabilities will be pursued on a case-by-case basis.

AMEC may serve as the organizing entity for the five-year update process, with committees formed by each cooperative exclusively for the purpose of updating the natural hazard plan in the fifth year of the FEMA-approved plan. For the 2023 update, AMEC membership agreed to follow the requirements coordinated by the organization for monitoring, evaluating, and updating the plan.

AMEC worked with Northwest Missouri Regional Council of Governments (NWMOCOG) to oversee the update of each electric cooperative chapter and the Statewide Summary. Two surveys from NWMORCOG guided the review and data collection for the plan update. NWMORCOG was responsible for writing the 2023 plan and worked closely with SEMA and FEMA to develop the format and analysis to be in line with the current format for the county and city hazard mitigation plans.

In the five-year update, each goal and action were reviewed by the cooperative's mitigation committee to determine continued relevance, compliance to state and federal policy and cost effectiveness. The natural hazards related to each action were also identified in the tables in the 2023 update. In addition, mitigation strategies and disaster responses shall be reviewed as deemed necessary following a natural hazard event.

Continued Public Involvement Opportunities

AMEC member cooperatives encouraged public and stakeholder involvement and considered public comments in hazard mitigation planning. Each cooperative agreed to follow the requirements coordinated by AMEC for continued public involvement. Opportunities for public and stakeholder comment will continue to be offered through various media outlets and the cooperatives' physical offices. Copies of the complete plan and its required documentation are available at the AMEC offices in Jefferson City. Each electric cooperative's office will have a copy of the Statewide Summary and its local chapter.

For the 2023 *Multi-jurisdictional Hazard Mitigation Plan for Missouri's Electric Cooperatives*, public notice was given in the *Rural Missouri*, a publication of AMEC, distributed to 580,000 cooperative members. Access to the state summary and links to the websites of each participating cooperative were posted on the website of Northwest Missouri Regional Council of Governments (NWMORCOG) for public access for review and comment. Comments were considered and addressed. Once all cooperative chapters and the Statewide Summary were completed, they were assembled into one plan and submitted to the State Emergency Management Agency (SEMA) and the Federal Emergency Management Agency (FEMA) for review and approval. The documentation for public review and comments can be found in Appendix of B of each cooperative's chapter and in Appendix II of the Statewide Summary.

Appendix: I – Adoption Resolutions

Template for Adoption

RESOLUTION

HAZARD MITIGATION PLAN

WHEREAS (Cooperative name) wishes to be more prepared for the occurrence of natural hazards and to offset their impacts where possible; and

WHEREAS the (Cooperative name) has participated in the preparation of a multi-hazard mitigation plan, hereby known as the Multi-jurisdictional Hazard Mitigation Plan for Missouri's Electric Cooperatives, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, this living document was updated in 2022 and is intended to serve as a planning mechanism for participating Missouri Rural Electric Cooperatives; and

WHEREAS, (Cooperative name) worked to identify hazards, vulnerabilities and potential actions that may lessen the impact of natural hazards upon (Cooperative name) assets in the future; and

THEREFORE, BE IT RESOLVED: That (Cooperative name) adopts the Multi-Jurisdictional Hazard Mitigation Plan 2017 Update for Missouri Electric Cooperatives as it pertains and applies to (Cooperative name).

CERTIFICATE OF SECRETARY

I, _____, do hereby certify that I am Secretary of (Cooperative name); that the above and foregoing is a true copy of the Resolution adopted by the Board of Directors of said Cooperative relating to the Hazard Mitigation Plan.

IN WITNESS WHEREOF, I have hereunto set my hand as Secretary of Cooperative name)

And affixed the seal thereof this ___ Day of ___, 2022

_____

_____, Secretary

(CORPORATE SEAL)

Appendix: II - Public Notice and Comments

Public Notice

This ad was published in the *Rural Missouri,* a monthly publication of the Missouri Association of Missouri Electric Cooperatives (AMEC), giving public notice to all subscribing members of AMEC.

New-Mac Electric Cooperative does not subscribe to *Rural Missouri* for all of its members, so the notice was published in the co-op newsletter and copies of *Rural Missouri* are available in their office. New-Mac also posted the plan on the cooperative's website. The newsletter posting is on the following pages.

This will updated with the information regarding the advertisement when received

RURAL MISSOURI

Linda Laderoute
Northwest Missouri Regional Council of Governments 114 West Third Street
Maryville, MO 64468

Dear Linda,

This is to certify that the Hazard Mitigation ad was published in the December 2017 edition of Rural Missouri and was mailed beginning on November 20, 2017 to 555,968 members of Missouri Electric Cooperatives. Attached is a tearsheet of the printed ad.

Sincerely,

12-1-2017

Jim McCarty
Editor

KELLY L. BAX
Notary Public - Notary Seal
STATE OF MISSOURI
County of Osage
My Commission Expires 7/2012021
Commission# 13541948

Tear Sheet from *Rural Missouri*

A 30-day public comment period for the 2023 update of the Multi-Jurisdictional Hazard Mitigation Plan for Missouri's Electric Cooperatives will be open starting

August 29, 2022

Individual Cooperative plans may be accessed on their respective website.
A list of Cooperative websites, and the State Summary for this plan update, may be accessed at www.nwmorcog.org.

Written comments for the Cooperative's plans and/or the State Summary may be submitted via email to amy@nwmorcog.org

Public Comment

There have been no comments received at this time.