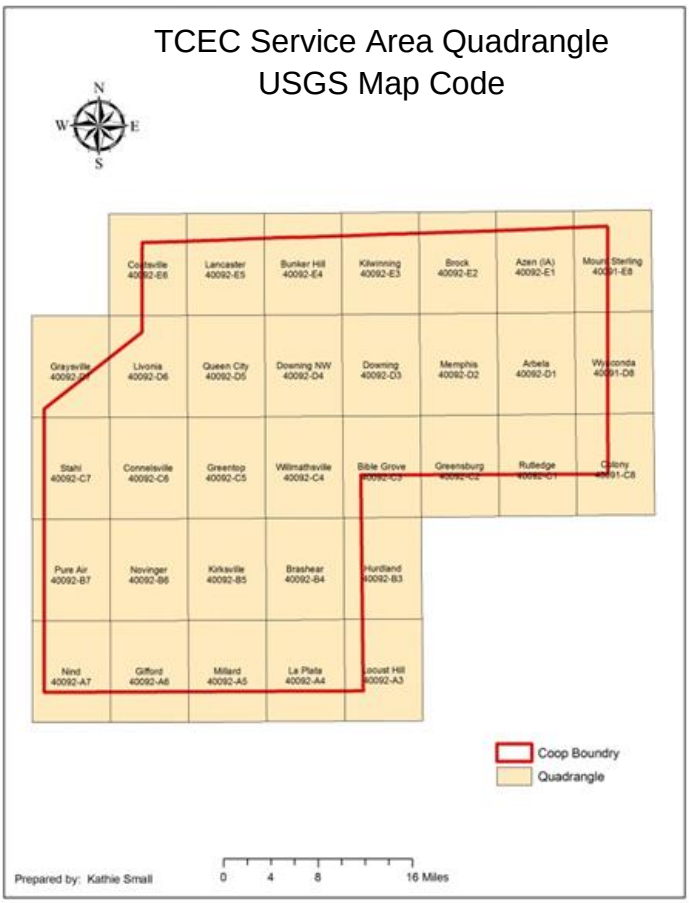
Contents: Tri-County Electric

Section 1: Introduction

Tri-County Electric Cooperative Association (TCEC) was established in 1939 to provide electric services to the rural areas of northeast Missouri. TCEC is a member-owned, non-profit distribution cooperative that supplied electric service to its members in northeast Missouri. Incorporated in 1938, Tri-County Electric now provides 6,292 meters with service to homes and businesses through 1,829 miles of distribution line. The cooperative employs more than 25 people and has headquarters in Lancaster, Missouri.

Tri-County Electric continues to dedicate time, energy, and resources to accomplishing its mission-to enhance the quality of life of member-owners by promoting a positive economic, political, social, and regulatory environment. Tri-County Electric Cooperative's service boundaries include Adair, Schuyler, Scotland, Sullivan, and Putnam Counties. Figure 1 depicts the geographic boundaries of the cooperative in relation to USGS local quadrangles within the state of Missouri. *(Map sources: www.usgs.gov, Association of Missouri Electric Cooperatives, Tri–County Electric Cooperative, MSDIS.)*

Figure 1 *TCEC Cooperative Boundaries*



Tri-County Electric Cooperative has approximately 4,826 members and a total of 6,292 total meters. Residential customers account for 90% of the membership (4,314 members). The remaining 10% are non-residential (480 members).

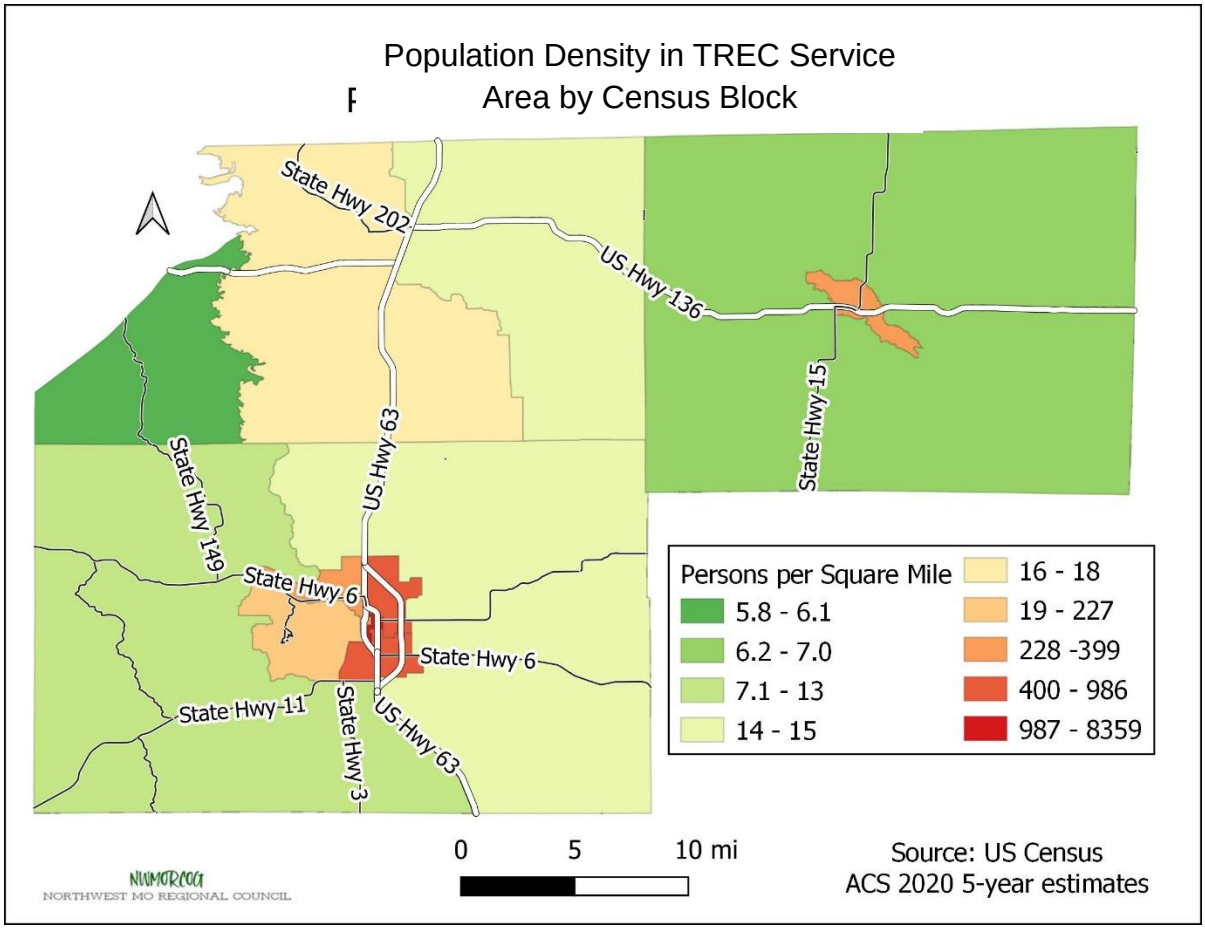
Table 1 provides the summary of metered customers by Missouri County.

Table 1 *Meters by Missouri County*

County	Number of Meters
Adair	2,930
Putnam	302
Schuyler	1,683
Scotland	1,541
Sullivan	20
Total	6,476

The average kilowatt hour usage daily is 11,615 for residential and 37,718 for commercial. The overall average is 7,522,673 per month. The annual average usage for all customers combined for 2021 was 90,272,080 kWh. Population density for the cooperative service area is depicted in Figure 2 (*Map source: U.S. Census 2020, MSDIS*).

Figure 2 *Population Density Map*



Critical Facilities

It is important in mitigation planning for the Electric Cooperatives to identify the critical facilities in each area and to be able to prioritize reconnection and back-up power needs. TCEC provides service to critical facilities as follows: two ambulance districts; three Public Water Supply Districts; four fire departments; five warning sirens; one television station; one 911 department; one nursing home; one health department; and two school districts.

Future Development

Tri-County Electric provided no information about plans for future development in their service area. Table 2 illustrates the population trend for the counties served by TCEC.

Table 2 *County Population Trend, 1990-2030*

County	1990	2000	2010	2020	2030 Projected
Adair	24,577	24,977	25,607	25,399	24,913
Putnam	5,079	5,223	4,979	4,688	4,391
Schuyler	4,236	4,170	4,431	4,534	3,999
Scotland	4,822	4,983	4,843	4,871	5,130
Sullivan	6,326	7,219	6,714	6,033	5,822
Source: U.S. Census Data					

Planning Process

Since the planning process is the same for each of the electric cooperative plans, the details of the planning process are presented in the Statewide Summary section of the plan.

Appendices

Three appendices are included at the end of each plan:

Appendix A contains the Adoption Resolution; a document signed by the Cooperative's governing official showing that the Board of Directors has adopted the mitigation plan.

Appendix B contains the Documentation of Participation; copies of press releases, website postings and other public outreach that was made to request public comment.

Appendix C contains the Surveys; the Data Survey that is the source of data for the 2023 plan update; the Goals and Actions Survey is the updated review of the mitigation strategies.

Section 2: Asset Inventory

Tri-County Electric Cooperative has a wide variety of assets by type. Real estate owned by the company includes office buildings, warehouses, garages, and other outbuildings throughout the service area. Twenty vehicles provide access to customers and infrastructure. TCEC does not own any electric generation or transmission infrastructure. Over 1,791 miles of distribution lines are owned and maintained by TCEC. Table 3 provides information concerning total asset valuation.

Table 3 *Tri-County Asset Inventory Valuation Summary*

Asset	Total Replacement Cost	Cost Breakdown
Total LCREC Assets	$182,570,000	Buildings and vehicles - $6,700,000 Overhead assets - $165,900,000 Underground assets - $9,900,000
Distribution Lines	OH $132,000,000 UG $8,100,000	*OH Single-phase lines - $96,000,000 **UG Single-phase lines - $7,200,000 OH Three-phase lines - $36,000,000 UG Three-phase lines - $900,000
Supporting Infrastructure	OH $33,900,000 UG $1,800,000	Meters - $2,880,000 Poles - $19,200,000 OH Transformers - $7,200,000 UG Transformers - $1,800,000 Guys/Anchors - $900,000 Cross-arms - $1,560,000 Regulators - $780,000 SP Oil-Circuit Reclosures - $780,000 3phase Oil-Circuit Reclosures - $510,000 Capacitors - $90,000
Office Buildings	$1,140,000	
Warehouses	$2,160,000	
Vehicles	$3,450,000	
*OH = overhead **UG = underground Source: Tri-County Electric Cooperative		

Ensuring quality distribution to its customers Tri-County Electric maintains not only distribution lines, but also the supporting infrastructure as well.

Table 4 includes a list of asset types, emergency replacement cost per unit or mile, the asset inventory by Service County, and total infrastructure numbers.

Table 4 *Tri-County Electric Asset Inventory by Service County*

Asset	Emergency Replacement Cost per unit or mile	Number of units or miles: ADAIR	Number of units or miles: SCOTLAND	Number of units or miles: SCHUYLER	Number of units or miles: SULLIVAN	Number of units or miles: PUTNAM	Total number of units or miles
Meters	500/unit	2930	1,541	1,683	20	302	6,476
Poles	1200/unit	17,560	12,739	10,214	323	1,854	42,690
SP*** Distribution Line	$55,000/mile OH* (10.42/foot OH) $68,640/mile UG** (13/foot UG)	615.03 OH 40.7 UG	425.53OH 32.22 UG	327.12 OH 19.75 UG	10.21OH 3.22 UG	75.20 OH .81 UG	1,453.09 OH 96.70 UG
TP**** Distribution Line	$105,000/mile OH (19.89/foot OH) $168,960/mile UG	119.02 OH .50 UG	83.43 OH UG	74.06 OH .8 UG	OH UG	1.4 OH UG	277.91 OH 1.3 UG
Transformers	$1,200 OH $2,725 UG	2,387 OH 169 UG	1,685 OH 130 UG	1,387 OH 83 UG	42 OH 14 UG	246 OH 2 UG	5,747 OH 398 UG
Guys/anchors	$100. /unit	1400	1,100	1,400	200	100	4,200
Cross-arms	$750	4120	2,982	2,364	387	103	9,956
Regulators	$17,000	24	17	13	2	1	57
Oil Circuit Reclosures	$1,250 SP $17,000 TP	252 SP 11 TP	128 SP 6 TP	114 SP 8 TP	23 SP 0 TP	7 SP 0 TP	524 SP 25 TP
Capacitors	$1,100/unit	20	20	19	0	0	59
Total Replacement Value by County		75,887,150 OH 3,338,653 UG	53,163,100 OH 2,565,830 UG	42,964,000 OH 1,716,983 UG	1,420,700 OH 259,170 UG	6,777,250 OH 61,048 UG	180,212,200 OH 7,941,686 UG

*OH = overhead **UG = underground ***SP = Single phase ****TP – Three phase

Source: Internal Tri-County Accounting and Maintenance records

Section 3: Risk Assessment

Risk Assessment Methodology

The risk assessment methodology used in the following section was utilized for both the statewide aggregation as well as for each individual cooperative chapter. Section 4 of the Statewide Summary details this methodology. 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.

For the purpose of this risk assessment, the identified hazards for the TCEC service area 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 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 numerically 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. 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 cost per incident. For TCEC, hazards with historical data include tornadoes, severe thunderstorms/high wind/hail, flood/levee failure and severe winter weather.
>
> **Non-historical Hazards** are hazards with no previous record of impact upon the local service area. 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. For TCEC, hazards without historical data include wildfire, earthquakes and dam failure.

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. Non-historical hazards assume damage to all general assets. For Historical Hazards, assets were divided into two groups based upon historical impact which were utilized in the hazard damage analysis:

- Overhead infrastructure assets and buildings
    - Used for:
        - Tornado damage assessments
            - Valued at $172,600,000
- Overhead infrastructure assets only
    - Used for:
        - Severe Thunderstorm / High Wind / Hail
        - Flood
        - Severe Winter Weather
            - Valued at $165,900,000

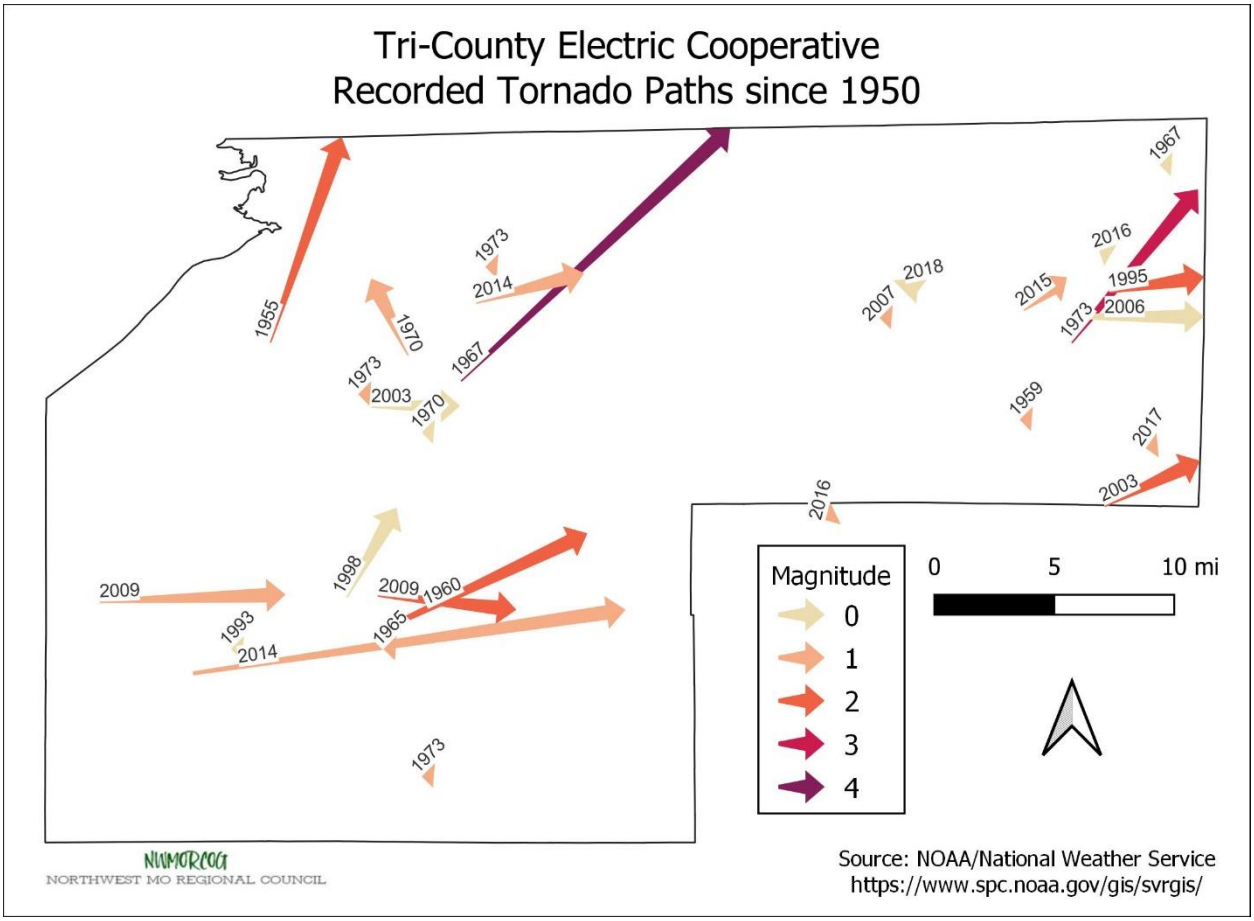
A. Historical Hazards

Tornadoes

Previous Occurrences

For the years 1950-2020, 30 tornadoes have been reported within the Tri-County cooperative boundaries. Figure 3 provides a pictorial representation of all recorded tornado recorded tracks. *(Data for map collected from National Oceanic and Atmospheric Administration, NOAA.)*

Figure 3 *TCEC Tornado Map*



For the purpose of this assessment, the years for which records exist for both NOAA and TCEC have been used. From 1997, Tri–County's service area within the state of Missouri has experienced a total of 14 tornadic events.

Probability of Future Occurrence and Vulnerability

The probability of a tornadic event in the Tri-County Electric's service area in any given year is 56% based on the 25-year period 1997-2016. Estimated cooperative material damages associated with each of these events were compiled by TCEC staff. Two occurrences caused damage to cooperative assets,

resulting in a 14.3% probability that any given tornadic occurrence will produce damage. For any given year, the probability of a damaging tornado is 8%. Table 5 provides a summary of event dates, EF-scale ratings, damage cost estimates and outages reported.

Table 5 *TCEC Tornadic Event Summary*

Date of Event	EF Scale Rating	Damage Estimates	Outages Reported
10/2/07	F1	$1,967	1
5/13/09	F2	$5,230	1
	Totals	$7,197	2
Data provided based on internal Tri-County records which reflect cost from the referenced event year.			

Based upon the last 25 years of historical event records, tornado events will cause an average annual damage of $288. This averaged amount accounts for less than 0.01% of Tri-County's total overhead assets and building valuation of $172,600,000.

An average annual of less than one outage was recorded during tornadoes since 1997. When compared with the total number of meters served by TCEC, it can be projected that less than 0.01% of all meters may experience outages during any given year due to a tornadic event.

Problem Statement

Tornadoes are potentially such violent events that it is cost prohibitive to build an infrastructure that can withstand such powerful winds. Strategies could be developed or improved, if already in place, to ensure that employees are warned of approaching storms when in the field. Procedures to restore power after outages should be reviewed regularly to ensure that power is restored to critical facilities as quickly as possible.

Severe Thunderstorms, High Wind, and Hail

Previous Occurrences

From 1997-2016, TCEC's service area within the state of Missouri has experienced 93 days of hail events and 81 days of thunderstorm/high wind events. NOAA's Storm Events Database was utilized to find records for Adair, Schuyler and Scotland Counties. Estimated property damages for these three counties totaled over $3.6 million from hailstorms and over $716,000 for thunderstorm high wind events. For this update, it was possible to look at the bounds of the Tri-County Electric Cooperative using GPS, finding 244 hail events and 256 high wind/thunderstorm events from 1955-2020.

Probability of Future Occurrence and Vulnerability

The average annual number of hail events is 3.7, while for high wind events the average annual number is 3.9. Estimated material damages associated with each of these events were compiled by TCEC staff. Table 6 provides a summary of those hail events which caused damage to cooperative infrastructure by date, cost estimate of damage, and reported outages.

Table 6 *TCEC Hail Event Damage Summary*

Event Date	Damage Estimates	Outages Reported
3/12/2006	$527	0
7/2/2006	$2,237	3
7/17/2006	$2,457	1
3/31/2007	$527	0
8/12/2007	$2,765	11
6/12/2008	$2,673	0
6/15/2008	$5,545	0
6/1/2009	$2,170	0
5/6/2010	$1,666	1
6/4/2010	$552	0
6/21/2010	$1,794	1
Totals	$22,912	17
Data provided based on internal TCEC records which reflect cost from the referenced event year.		

Eleven hail events produced storms that resulted in damage to TCEC assets in the years existing in cooperative records. In any given year, there is a 44% probability that damaging hailstorm will occur.

Based upon historical records, the average hail event to affect the cooperative will cause an average annual damage of $916. This averaged amount accounts for less than 0.001% of Tri-County's total overhead asset valuation of $165,900,000.

An average annual of less than 1 outage was recorded during hail events since 1997. When compared with the total number of meters served by TCEC, it can be projected that less than 0.01% of all meters may experience outages during any given year due to a hail event.

Estimated material damages and reported outages associated with each thunderstorm event with high winds events were compiled by TCEC staff. Twenty occurrences caused damage to cooperative assets during the years existing in cooperative records. This results in an 88% probability that a damaging windstorm will occur in any given year.

Based upon historical records, thunderstorm/high wind events will cause an average annual damage of $16,249. This averaged amount accounts for less than 0.1% of Tri-County's overhead asset valuation of $165,900,000.

Table 7 provides the TCEC information for thunderstorm/high wind events.

Table 7 *TCEC Thunderstorm/High Wind Event Summary*

Event Date	Damage Estimates	Outages Reported
3/30/2006	$1,423	0
7/2/2006	$32,621	3
8/13/2006	$5,175	0
8/12/2007	$527	1

Event Date	Damage Estimates	Outages Reported
8/13/2007	$1,448	0
6/8/2008	$3,208	0
6/12/2008	$1,605	0
6/15/2008	$3,609	0
7/27/2008	$535	0
3/8/2009	$4,568	0
6/18/2010	$552	1
6/21/2010	$2,345	0
7/18/2010	$5,782	0
8/13/2010	$552	0
8/20/2010	$2,483	0
9/18/2010	$6,543	18
7/15/2011	$126,555	40
5/15/2015	$51,000	28
6/30/2014	$40,700	25
6/7/2015	$115,000	40
Totals	$406,231	156
Data provided based on internal TCEC records which reflect cost from the referenced event year.		

An average annual of 6 outages was recorded during high wind events since 1997. When compared with the total number of meters served by TCEC (6,476), it can be projected that less than 0.01% of all meters may experience outages during any given year due to a hail event.

Problem Statement

Thunderstorms producing hail and high winds are events that occur several times each year in the service area. Since the trend has been towards more intense storms over the last decade, replacing wooden poles with manufactured ones whenever possible is recommended.

Flood and Levee Failure

Flood and levee failure carry a potential threat to the existing infrastructure of the Tri–County Electric Cooperative. Unfortunately for the TCEC there is insufficient data to provide a figure which would represent the percentage if the cooperative service area located directly within the 100-year floodplain. Currently, inundation data for levee failure is lacking due to issues surrounding mapping, appropriate models, and its close association with flooding events. There is insufficient data to map the location of known state and federal levees within the cooperative's boundaries.

Previous Occurrences

From 1997-2016, TCEC's service area has experienced 47 days of flooding events. These occurrences included both flash and riverine flood events. Currently, no data concerning levee failure damage can be separated from flood damage data. NOAA estimated $1.21 million in property damage as a consequence of these events in the Counties of Adair, Schuyler, and Scotland. To update this data, NCEI reported 4

flood events occurring during the past five years in the area. TCEC did not report any additional damages or outages since the last update.

Probability of Future Occurrence and Vulnerability

The probability of a flood event occurring within the three main counties of the cooperative service area in any given year is 80%. Estimated material damages associated with each of these events were compiled by TCEC staff. Table 8 summarizes flood event dates by date, damage cost estimates, and reported outages. Eleven events out of the 20-year period damage occurred to cooperative assets, resulting in a 55% probability that a flood occurrence causing damage will occur in any given year.

Table 8 *TCEC Flood Event Summary*

Event Date	Damage Estimates	Outages Reported
8/24/2007	$685	1
6/3/2008	$2,138	1
6/25/2008	$2,138	1
7/24/2008	$1,203	2
7/25/2008	$2,272	1
7/28/2008	$1,929	1
5/12/2010	$2,759	1
5/13/2010	$713	1
6/22/2010	$1,104	2
7/7/2010	$1,265	2
7/20/2010	$4,757	1
Totals	$20,964	14
Data provided based on internal TCEC records which reflect cost from the referenced event year.		

Flood events vary widely based upon numerous factors including, but not limited to, annual precipitation. Based upon historical records, flood events will cause an average annual damage of $839. This averaged amount accounts for less than 0.01% of the overhead asset valuation of $165,900.000.

An average annual of less than 1 outage was recorded during flooding events since 1997. When compared with the total number of meters (6,476) served by TCEC, it can be projected that less than 0.01 percent of all meters may report outages during any given year due to a flooding event.

Problem Statement

With numerous flood-prone rivers crossing its area, TCEC needs to avoid placing assets in floodplains.

Severe Winter Weather

Previous Occurrences

From 1997-2016, Tri–County's service area has experienced a total of 74 days of severe winter weather events, including blizzards, heavy snowfalls, and ice storms. A winter storm with heavy snowfall and

strong winds on February 1, 2015 had very damaging effects on TCEC. To update this data, NCEI reported 18 winter weather events occurring during the past five years in the area. TCEC did not report any additional damages or outages since the last update.

Probability of Future Occurrence and Vulnerability

The probability of a severe winter weather event in the TCEC service area in any given year is 100% with an average annual of 3.6 events. Estimated material damages associated with each of these events were compiled by the cooperative's staff. Four occurrences caused damage to cooperative assets during the years existing in cooperative records. This resulted in a 24% probability that severe winter-weather will result in damage to TCEC in any given year. Table 9 provides a summary of event dates, types, associated damage estimates, and reported outages.

Table 9 *TCEC Severe Winter Weather Event Summary*

Event date	Event Type	Damage Estimates	Outages Reported
11/29/2008	Winter Storm	$535	1
12/8/2008	Ice Storm	$2,140	4
2/20/2009	Winter Storm	$543	2
2/1/2015	Winter Storm	$62,000	20
02/11/19	Winter Storm	$8,000	14
01/11/20	Winter Storm	$75,000	55
	Totals	$148,217	96
Data provided based on internal TCEC records which reflect cost from the referenced event year.			

Based upon these historical records, severe winter weather events will cause an average annual damage of $5,929. This averaged amount accounts for less than 0.01% of Tri-County's total overhead asset valuation of $165,900,000.

An average annual of 4 outage was recorded during severe winter weather events since 1997. When compared with the total number of meters served by TCEC, it can be projected that less than 0.1 percent of all meters may experience outages during any given year due to a severe winter weather event.

Problem Statement

Underground placement of assets remains the best protection against damage from ice storms.

B. Non-historical Hazards

Wildfire

Previous Occurrences

The incidence of wildfire in the TCEC service area presents a unique risk assessment. Wildfire events have occurred in each of the five counties. However, for this assessment the Counties of Putnam and Sullivan will not be included as only five percent of TCEC's meters are located within those two counties. Table 10 summarizes the incidences of wildfire within the three main counties.

Table 10 *Wildfire Summary by Service County*

County	# of Wildfires, 2004-16	Average Annual # of Wildfires	Acres Burned	Average Annual Acres Burned
Adair	156	12	1,643	126
Schuyler	70	5	1,265	97
Scotland	155	12	2,748	211
Totals:	381	29	5,656	343
Source: Missouri State Hazard Mitigation Plan, 2018				

The probability of a wildfire event in the Tri-County service area in any given year is 100% with an average annual of 30 wildfires throughout the three-county area. Although TCEC does not have records of any significant damage from wildfires, for the purposes of this assessment, wildfire and its associated impacts cannot be eliminated from the realm of possibility.

The potential extent of damage caused by wildfire is difficult to determine. Like earthquakes and dam failure, wildfires have had no measurable impact upon the TCEC service area. With an average annual of 343 acres burned in the area, and a total three-county area of 842,240 acres, it is unlikely that infrastructure damage would exceed one percent based upon asset location and the unlikeliness of an uncontrollable wildfire.

No customers have reported outages during recorded wildfires. When compared with the total number of customers served by Tri-County, it can be projected that less than 1 percent of all customers may report outages during any given wildfire event.

Problem Statement

Further study will be required to create a model for damage assessments related to wildfire.

Earthquakes

Previous Occurrences

The closest source of earthquake risk in northeast Missouri is the New Madrid Fault located in extreme southeast Missouri, which has, according to many experts, the potential to produce the largest earthquakes in North America. Undoubtedly, this fault has the potential to affect the TCEC service area in its entirety.

In addition, there have been several small, virtually undetectable earth movements in the region in recent history, which may or may not be attributed to the aforementioned fault lines or other, very small faults located nearby. On February 8, 2004, a pair of earthquakes centered near Paris, Missouri was recorded. The magnitudes of these events were 2.3 and 2.9 and occurred about 80 miles south of TCEC.

Probability of Future Occurrence and Vulnerability

The New Madrid fault has the potential to cause damage throughout the state of Missouri, including the TCEC service area. Scientists from the U.S. Geological Survey (USGS) and the Center for Earthquake Research and Information (CERI) at the University of Memphis have estimated the probability of a magnitude 6.0 or greater earthquake from the New Madrid Fault is 25-40 percent through the year 2053.

The projected earthquake intensity ratings for the cooperative region changes based upon the Modified Mercalli Scale. Given a New Madrid earthquake with a 6.7 magnitude, the region would experience Level V intensity characteristics. In the event of an earthquake with a 7.6 rating, the region would experience Level VI intensity characteristics while an earthquake with an 8.6 rating would most likely cause Level VII intensity characteristics.

In the event of an earthquake with a 7.6 magnitude, the TCEC service area would most likely experience minor building damage as well as damage to the electrical distribution system. This damage, however, would most likely be relatively minimal and localized when compared with the southeast corner of the state. Distribution lines overhead and underground could become disconnected or severed, and transformers could be damaged.

Based upon information from CERI, FEMA, and SEMA, it may be estimated that 630 customers could report outages related to an earthquake event. When compared with the total number of customers served by TCEC, it can be projected that up to 10% of all customers may report outages during any given seismic event.

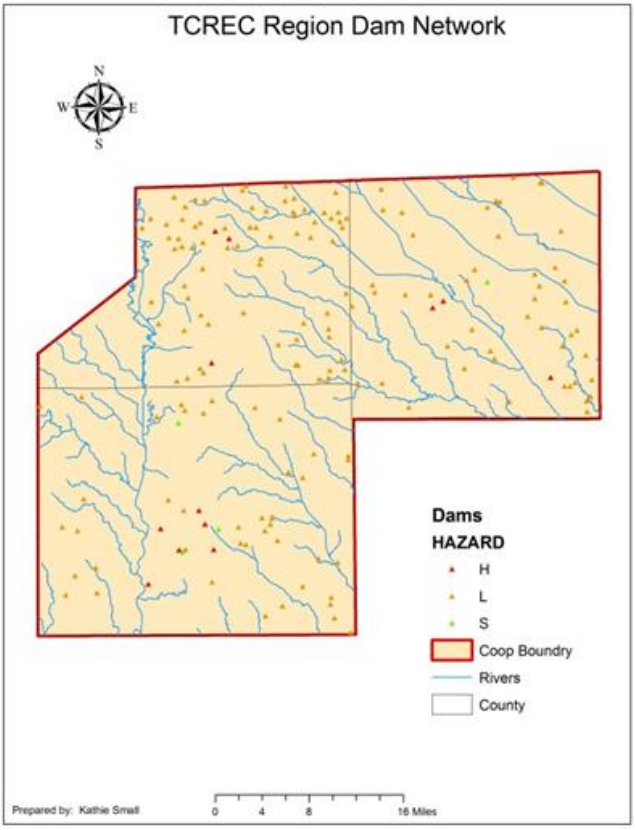
Problem Statement

Tri-County Electric Cooperative should strive to meet seismic design standards for electrical substation equipment and other overhead assets susceptible to damage from earthquake events.

Dam Failure

Like earthquakes, dam failures have had no measurable impact upon the TCEC service area to date. According to Missouri DNR's Dam Safety Division, 390 dams are within the counties served, however; only 178 dams currently exist within the cooperative boundaries: 55 in Adair, 72 in Schuyler, 51 in Scotland, 0 in Sullivan, and 0 in Putnam. Of these dams, three in Adair County, two in Schuyler County, and one in Scotland County are regulated by the state due to the fact that they are non-agricultural, non-federal dams which exceed 35 feet in height. Figure 4 on the next page, shows the locations of all known dams located within TCEC's service area. *(Map sources: www.msdis.missouri.edu; www.dnr.mo.gov/env/wrc.)*

Figure 4 *TCEC Dam Map*



Previous Occurrences

The 2018 Missouri State Hazard Mitigation plan states “For the 42-year period from 1975 to 2016 for which dam failure statistics are available, 19 dam failures and 68 incidents are recorded. According to this data, annual probability calculates to a 45 percent annual probability of a dam failure somewhere in the state and a 100 percent annual probability of dam incidents. In should be noted that historical dam failures and incidents include events from all hazard classes and all dams (whether regulated or un-regulated). Failures and incidents for regulated dams that have higher inspection frequencies should be less probable. The probability of future events is 45%." However, no such event has occurred within or near the cooperative’s boundaries.

Probability of Future Occurrence and Vulnerability

For the purposes of this assessment, dam failure and its associated impacts cannot be eliminated from the realm of possibility. In order to allow for a risk assessment, the probability of this event has been included as less than 1%.

Determining the potential extent of dam failure is currently impossible due to a lack of data concerning inundation zones. Based on discussions with Tri-County staff on location of infrastructure relative to dams, this assessment assumes a limited impact upon downstream electric distribution infrastructure of less than 10% for both infrastructure damage and service interruption.

Problem Statement

Further study concerning existing dams and the impact of their failure is required to make a more comprehensive assessment of potential damages and mitigation strategies to address this potential hazard.

C. Risk Assessment Summary

Most of the historical hazards have had an impact on the electric cooperatives. Table 11 shows the annual damages associated with each hazard for TCEC. The table is ranked by the highest Average Annual Damages which is an indication of the vulnerability to each hazard.

Table 11 *TCEC Hazard Risk Summary*

Hazard	Average Annual Damages
Severe Thunderstorms, and High Winds	$16,249
Severe Winter Weather	$5,929
Hail	$916
Flood and Levee Failure	$839
Tornadoes	$288
Earthquakes	$0
Dam Failure	$0
Wildfire	$0

Each of the non-historical hazards Wildfire, Earthquakes, and Dam Failure has the potential for causing catastrophic damages in any given year. To date there have been zero reported damages to the assets of the Tri-County Electric Cooperative Association from the non-historical events. Nonetheless, this set of hazards should be considered in mitigation strategies because of the damage potential.

Section 4: Mitigation Strategies

Previous Mitigation Efforts

For organizations like TCEC, 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, it is first "staked out" in coordination with local builders and property owners. This process, completed by the Line Superintendent and contracted engineers, identifies and addresses foreseeable hazards and safety issues before any new service lines area constructed. USDA-RUS specifications regarding operation and safety are utilized in every step of the process. Steps are taken to practically minimize the exposure of equipment to loss due to foreseeable hazards, particularly flooding. Customers who reside in the floodplain are not charged for repairs or losses associated with flooding unless they purposefully destroy or restrict the cooperative from protecting their distribution system assets.

Existing and Potential Resources

As stated above, mitigation is a key component of good business practices. Tri-County Electric Cooperative includes mitigation strategies as part of regular work activities to ensure service with minimal interruptions. Funding for these activities is provided through the cooperative's normal budgetary process for maintenance.

In order to expand mitigation efforts beyond normal maintenance, it is likely that TCEC 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, TCEC will be eligible for funding through FEMA in the following categories:

- Hazard Mitigation Grant Program
- Flood Mitigation Assistance Program
- Pre-Disaster Mitigation Program
- 406 Stafford Act
- USDA Economic Development Grants

Review of Goals and Actions

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 TCEC mitigation staff reviewed these goals and the actions from the previous update which addressed hazard mitigation issues. They evaluated each action to decide if it

was completed, will be continued, or should be deleted. There also was the opportunity to add new actions.

The staff considered which type of actions will maximize benefits and minimizes costs, how mitigation strategies will be implemented, and how the plan will be maintained and updated. Table 12 lists the goals as reviewed in the 2023 plan update.

Table 12 *TCEC Goals 2023*

Identified Goals	Reassessment of the Goal 2023
Goal 1: Protect the health and safety of the community.	Accept, as is
Goal 2: Reduce future losses due to natural hazard events.	Accept, as is
Goal 3: Improve emergency management capabilities and enhance local partnerships.	Accept, as is
Goal 4: Continue to promote public awareness and education.	Accept, as is

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.

The chosen method 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, Table 13, 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.

Table 13 *Cost Benefit Matrix*

COST	BENEFIT		
	High	Medium	Low
High	7	4	1
Medium	8	5	2
Low	9	6	3

The following tables represent the completed review of current and potential mitigation strategies. Each strategy has assigned a cost benefit score assigned by the cooperative staff based on prior experience and professional opinions. Table 14 shows review the actions and the results of the cost-benefit analysis. The table has been updated through the Goals and Actions Survey that was sent to facilitate the staff update review. The Survey can be found in Appendix C. Staff members reviewed each item on the original tables and determined the status of the item.

Table 14 *Prioritized Mitigation Actions for Tri-County Electric-2023*

Goal-Action #	Action Item	Status Update	Progress on Continued Actions	Hazards Addressed by This Action	Completion Date	Cost/ Benefit Score
1-1	Use vegetation management to prevent interference with delivery of power and limit public danger of downed lines.	Continue (In-progress)	ongoing	Thunderstorms Winter Weather	Annually	7
1-2	Partner with county emergency management agencies to ensure power for local shelters, fuel stations, and public safety.	Continue (In-progress)	ongoing	Thunderstorms Tornado Winter Weather	Annually	9
2-1	Addition of lightning arresters, electronic reclosures, conductors, guidewires, breakers, system coordination. Replacement or repair on poles, cross-arms, lines. Polymer equipment from porcelain.	Continue (In-progress)	ongoing	Thunderstorms Winter Weather	Annually	5
2-2	Upgrade class and height poles where possible.	Continue (In-progress)	ongoing	Thunderstorms Tornado	Annually	8
2-3	Add alternate source wiring to eliminate or reduce time of outages.	Continue (In-progress)	ongoing	Thunderstorms Tornado	2018	2
3-1	Maintain mutual aid agreements with other rural electric cooperatives.	Continue (In-progress)	ongoing	Thunderstorms Tornado Winter Weather	Annually	9
3-2	Cooperate with local law enforcement and government officials to reduce the impact of power outages.	Continue (In-progress)	ongoing	Flooding Thunderstorms Tornado Winter Weather	Annually	9
4-1	Provide safety and reporting information to the general public through varying methods: • Company website • Social media sites • Local newspapers • Presentations • Publications	Continue (In-progress)	ongoing	Flooding Thunderstorms Tornado Winter Weather	Annually	9

After review, there were one Action completed and one Action deleted and removed from the Action Items list for the 2023 plan update. The completed and deleted Actions are listed in the table below. All other actions are continued in the plan update. There are no new actions added to the plan.

Table 15 *Completed and Deleted Actions for Tri-County Electric*

Actions Item	Status Update	Explanation for Completed/Deleted Action
New Radio Frequency Automated Meter Intelligence Project (RF AMI)	Action Completed	metering system replacement complete
Complete annual inspections of lines and poles.	Delete this action	Routine maintenance

Section 5: Plan Implementation and Maintenance

Plan Incorporation

The goals and actions of the previous section identify both ongoing efforts at mitigation and potential methods for expanding efforts. The updated plan has been reviewed and adopted by the Board of Directors as part of the company's operations policy. This mitigation plan necessitates involvement from every TCEC employment level as the organization strives to ensure quality service to their customers.

Local Planning Capabilities

Some internal planning capabilities do exist at TCEC The Hazard Mitigation Plan can be considered and/or incorporated into regular budgetary planning, the four-year work plan for capital improvements, and the maintenance planning policy. Planning capabilities per se for the electric cooperatives are limited. What is important is that the Action Items developed through the mitigation planning process are incorporated into the daily activities of the cooperative.

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.

Other 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 TCEC's planning 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.

Beyond the Tri-County Electric Hazard Mitigation Plan, regional planning capabilities exist at the local level. The Missouri counties of Adair, Scotland, Schuyler, Putnam, and Sullivan each have a FEMA-approved Natural Hazard Mitigation Plan in place. County emergency management directors have Local Emergency Operations Plans which seek to mitigate the same hazards for residents. These same counties are also included in the Regional Transportation Plan (RTP) as well as a Comprehensive Economic Development Strategy (CEDS). TREC's plan can be easily incorporated into these local plans and allow for coordination across agencies in the event of an emergency.

Plan Maintenance

Tri-County Electric will follow the requirements coordinated by the Association of Missouri Electric Cooperatives (AMEC) for monitoring, evaluating, and updating the plan.

Continued Public Involvement Opportunities

Public notice was given in the form a notice in the *Rural Missouri*, a publication of the Association of Missouri Electric Cooperatives, distributed to all cooperative members. The updated 2023 plans were posted on the website of the Northwest Missouri Regional Council of Governments for public review and comment. Comments were considered and addressed. Once all co-op plans were completed, they were assembled into one plan and submitted to the State Emergency Management Agency and the Federal Emergency Management Agency for review and approval. The documentation for public involvement and comments can be found in Appendix B of each cooperative's section of the plan.

Tri-County Electric will follow the requirements coordinated by the Association of Missouri Electric Cooperatives (AMEC) for continued public involvement. Opportunities for public comment will continue to be offered through various media outlets and the physical office of TCEC.

Appendix: A - Adoption Resolution

RESOLUTION

HAZARD MITIGATION PLAN

(CORPORATE SEAL)

Appendix: B - Documentation of Participation

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

Appendix: C - Surveys

Data Survey

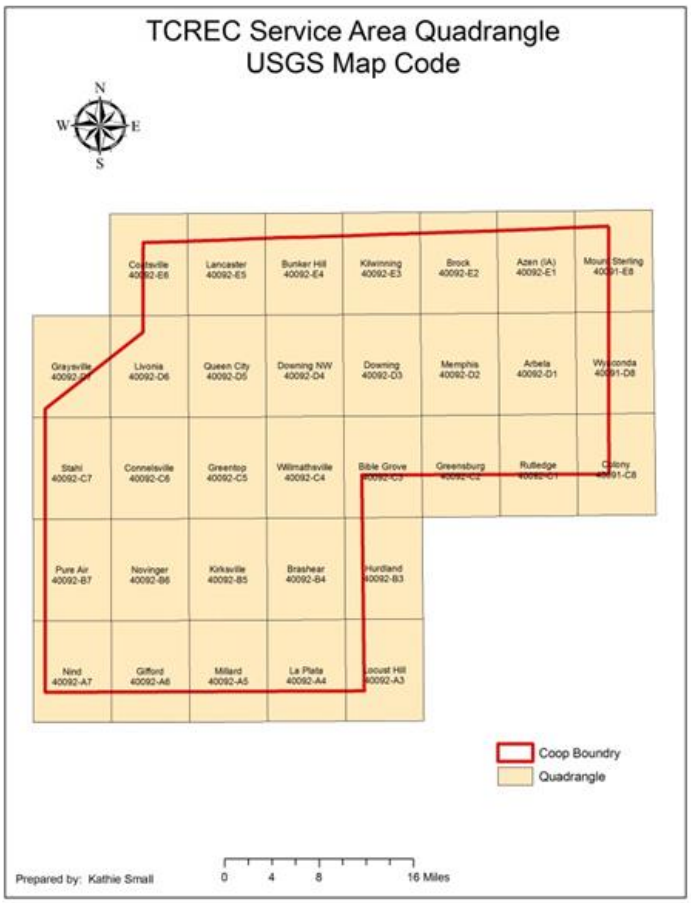
The following is the returned survey from TCEC which was used by NWMORCOG staff to update the Plan:

Please correct/update the following information from the previous plan.

Tri-County Electric Cooperative Association (TCEC) was established in 1939 to provide electric services to the rural areas of northeast Missouri. TCEC is a member-owned, non-profit distribution cooperative that supplied electric service to its members in northeast Missouri. Incorporated in 1938, Tri-County Electric now provides 6,476 meters with service to homes and businesses through 1,829 miles of distribution line. The cooperative employs more than 25 people and has headquarters in Lancaster, Missouri.

Tri-County Electric continues to dedicate time, energy, and resources to accomplishing its mission-to enhance the quality of life of member-owners by promoting a positive economic, political, social, and regulatory environment. Tri-County Electric Cooperative's service boundaries include Adair, Schuyler, Scotland, Sullivan, and Putnam Counties

if needed, please replace or attach a different map if available or provide info on changes so a new map can be made.



Tri-County Electric Cooperative has approximately 4,826 members and a total of 6,292 total meters. Residential customers account for 90% of the membership (4,314 members). The remaining 10% are non-residential (480 members).

Table ? provides the summary of metered customers by Missouri County.

Meters by Missouri County

County	Number of Meters
Adair	2,930
Putnam	302
Schuyler	1,683
Scotland	1,541
Sullivan	20
Total	6,476

The average kilowatt hour usage daily is 11,615 for residential and 37,718 for commercial. The overall average is 7,522,673 per month. The annual average usage for all customers combined for 2021 was 90,272,080 kWh.

Population Density Map will be updated by staff at NWMORCOG

Critical Facilities

TCEC provides service to critical facilities as follows: two ambulance districts; three Public Water Supply Districts; four fire departments; five warning sirens; one television station; one 911 department; one nursing home; one health department; and two school districts.

Future Development The info wanted here is if any of your members you serve have future development plans that would potentially affect your operation.

The FEMA reviewers that approved the previous update suggested including current operating budget information, any capital improvements, or strategic initiatives in this update. Please add or attach if possible.

Asset Inventory Please update the figures below to the most current information

Tri-County Electric Cooperative has a wide variety of assets by type. Real estate owned by the company includes office buildings, warehouses, garages, and other outbuildings throughout the service area. Twenty vehicles provide access to customers and infrastructure. TCEC does not own any electric generation or transmission infrastructure. Over 1,829 miles of distribution lines are owned and maintained by TCEC. Table ? provides information concerning total asset valuation.

Tri-County Asset Inventory Valuation Summary

Asset	Total Replacement Cost	Cost Breakdown
Total TCEC Assets	$182,570,000	Buildings and vehicles - $6,700,000 Overhead assets - $165,900,000 Underground assets - $9,900,000
Distribution Lines	OH $132,000,000 UG $8,100,000	*OH Single-phase lines - $96,000,000 **UG Single-phase lines - $7,200,000 OH Three-phase lines - $36,000,000 UG Three-phase lines - $900,000
Supporting Infrastructure	OH $33,900,000 UG $1,800,000	Meters - $2,880,000 Poles - $19,200,000 OH Transformers - $7,200,000 UG Transformers - $1,800,000 Guys/Anchors - $900,000 Cross-arms - $1,560,000 Regulators - $780,000 SP Oil-Circuit Reclosures - $780,000 3phase Oil-Circuit Reclosures - $510,000 Capacitors - $90,000
Office Buildings	$1,140,000	
Warehouses	$2,160,000	
Vehicles	$3,450,000	
*OH = overhead **UG = underground Source: Tri-County Electric Cooperative		

Ensuring quality distribution to its customers Tri-County Electric maintains not only distribution lines, but also the supporting infrastructure as well.

Table ? includes a list of asset types, emergency replacement cost per unit or mile, the asset inventory by Service County, and total infrastructure numbers.

Tri-County Electric Asset Inventory by Service County

Asset	Emergency Replacement Cost per unit or mile	Number of units or miles: ADAIR	Number of units or miles: SCOTLAND	Number of units or miles: SCHUYLER	Number of units or miles: SULLIVAN	Number of units or miles: PUTNAM	Total number of units or miles
Meters	500/unit	2930	1,541	1,683	20	302	6,476
Poles	1200/unit	17,560	12,739	10,214	323	1,854	42,690
SP*** Distribution Line	$55,000/mile OH* (10.42/foot OH) $68,640/mile UG** (13/foot UG)	615.03 OH 40.7 UG	425.53OH 32.22 UG	327.12 OH 19.75 UG	10.21OH 3.22 UG	75.20 OH .81 UG	1,453.09 OH 96.70 UG
TP**** Distribution Line	$105,000/mile OH (19.89/foot OH) $168,960/mile UG	119.02 OH .50 UG	83.43 OH UG	74.06 OH .8 UG	OH UG	1.4 OH UG	277.91 OH 1.3 UG
Transformers	$1,200 OH $2,725 UG	2,387 OH 169 UG	1,685 OH 130 UG	1,387 OH 83 UG	42 OH 14 UG	246 OH 2 UG	5,747 OH 398 UG
Guys/anchors	$100. /unit	1400	1,100	1,400	200	100	4,200
Cross-arms	$750	4120	2,982	2,364	387	103	9,956
Regulators	$17,000	24	17	13	2	1	57
Oil Circuit Reclosures	$1,250 SP $17,000 TP	252 SP 11 TP	128 SP 6 TP	114 SP 8 TP	23 SP 0 TP	7 SP 0 TP	524 SP 25 TP
Capacitors	$1,100/unit	20	20	19	0	0	59
Total Replacement Value by County		75,887,150 OH 3,338,653 UG	53,163,100 OH 2,565,830 UG	42,964,000 OH 1,716,983 UG	1,420,700 OH 259,170 UG	6,777,250 OH 61,048 UG	180,212,200 OH 7,941,686 UG

*OH = overhead **UG = underground ***SP = Single phase ****TP – Three phase
Source: Internal Tri-County Accounting and Maintenance records

Risk Assessment

Please add any known information related to each of the natural hazards that follow: Flooding (Major and Flash), Levee Failure, Dam Failure, Earthquake, Land Subsidence/Sinkholes, Drought, Extreme Temperature, Severe Thunderstorms, Severe Winter Weather, Tornadoes, Wildfire

NWMORCOG will add information to the narrative from the National Weather Service that has occurred since 2016

Tornadic Event Summary

Date of Event	EF Scale Rating	Damage Estimates	Outages Reported
10/2/07	F1	$1,967	1
5/13/09	F2	$5,230	1
Totals			
Data provided based on internal Tri-County records which reflect cost from the referenced event year.			

Thunderstorm/ Hail Event Summary

Event Date	Damage Estimates	Outages Reported
3/12/2006	$527	0
7/2/2006	$2,237	3
7/17/2006	$2,457	1
3/31/2007	$527	0
8/12/2007	$2,765	11
6/12/2008	$2,673	0
6/15/2008	$5,545	0
6/1/2009	$2,170	0
5/6/2010	$1,666	1
6/4/2010	$552	0
6/21/2010	$1,794	1
Totals		
Data provided based on internal TCEC records which reflect cost from the referenced event year.		

Thunderstorm/High Windl Event Summary

Event Date	Damage Estimates	Outages Reported
3/30/2006	$1,423	0
7/2/2006	$32,621	3
8/13/2006	$5,175	0
8/12/2007	$527	1
8/13/2007	$1,448	0
6/8/2008	$3,208	0
6/12/2008	$1,605	0
6/15/2008	$3,609	0
7/27/2008	$535	0
3/8/2009	$4,568	0
6/18/2010	$552	1
6/21/2010	$2,345	0
7/18/2010	$5,782	0

Event Date	Damage Estimates	Outages Reported
8/13/2010	$552	0
8/20/2010	$2,483	0
9/18/2010	$6,543	18
7/15/2011	$126,555	40
5/15/2015	$51,000	28
6/30/2014	$40,700	25
6/7/2015	$115,000	40
Totals		
Data provided based on internal TCEC records which reflect cost from the referenced event year.		

The hazards of flood and levee failure have been separated in the Missouri State Hazard Mitigation Plan. If possible, separate any damage/outages data into the appropriate hazard's table.

Flood Event Summary

Event Date	Damage Estimates	Outages Reported
8/24/2007	$685	1
6/3/2008	$2,138	1
6/25/2008	$2,138	1
7/24/2008	$1,203	2
7/25/2008	$2,272	1
7/28/2008	$1,929	1
5/12/2010	$2,759	1
5/13/2010	$713	1
6/22/2010	$1,104	2
7/7/2010	$1,265	2
7/20/2010	$4,757	1
Totals		
Data provided based on internal TCEC records which reflect cost from the referenced event year.		

Levee failure,

Event date	Damage estimates	Outages reported

Severe Winter Weather Event Summary

Event date	Event Type	Damage Estimates	Outages Reported
11/29/2008	Winter Storm	$535	1
12/8/2008	Ice Storm	$2,140	4
2/20/2009	Winter Storm	$543	2
2/1/2015	Winter Storm	$62,000	20
02/11/19	Winter Storm	$8,000	14
01/11/20	Winter Storm	$75,000	55
Totals			
Data provided based on internal TCEC records which reflect cost from the referenced event year.			

Please add any dates, known damage, and outages since the last plan due to

dam failure,

Event date	Damage estimates	Outages reported

drought,

Event date	Damage estimates	Outages reported

earthquake,

Event date	Damage estimates	Outages reported

extreme temperatures (hot & cold)

Event Date	Event Type	Damage Estimates	Outages reported

land subsidence,

Event date	Damage estimates	Outages reported

or wildfire.

Event date	Damage estimates	Outages reported

Goals and Actions Survey

The original survey is an interactive Excel file that could not be inserted without stabilizing the formatting. All of the data submitted is included in the tables below.

A	B	C	D	E
Complete each row left to right. Click on each box to receive instructions for that box.	**Goals**	**Reassess the goal**	**Instructions**	**Justifications for modifying**
→	**Goal 1:** Protect the health and safety of the community	accept, as is ☑ yes	If you chose to remove or modify the goal, please give your reasons in the box to the right.	
→	**Goal 2:** Reduce future losses due to natural hazard events.	accept, as is ☑ yes	If you chose to remove or modify the goal, please give your reasons in the box to the right.	
→	**Goal 3:** Improve emergency management capabilities and enhance partnerships.	accept, as is ☑ yes	If you chose to remove or modify the goal, please give your reasons in the box to the right.	
→	**Goal 4:** Continue to promote public awareness and education.	accept, as is ☑ yes	If you chose to remove or modify the goal, please give your reasons in the box to the right.	
↘	**After completing this sheet, please click the "actions" tab at the bottom**			
risk summary table Information to consider when updating				

Table 1 *TCEC Hazard Risk Summary*

Hazard	Average Annual Damages
Severe Thunderstorms, and High Winds	$25,000
Severe Winter Weather	$7,000
Hail	$2,000
Flood and Levee Failure	$3,000
Tornadoes	$1,000
Earthquakes	$0
Dam Failure	$0
Wildfire	$0

goals actions

Goal-Action#	Action Items Specify locations when able	Status Update	Explanation for completed/deleted action	Report progress on continued actions	Select Hazard(s) addressed by this action	Completion Date	COST/BENEFIT SCORE
1-1	Use vegetation management to prevent interference with delivery of power and limit public danger of downed lines.	Continue (In-progress)		ongoing	Dam Failure Earthquakes Flooding Land Subsidence Levee failure **Thunderstorms** Tornado Wildfire **Winter Weather**	annually	7
1-2	Partner with county emergency management agencies to ensure power for local shelters, fuel stations, and public safety.	Continue (In-progress)		ongoing	Dam Failure Earthquakes **Flooding** Land Subsidence Levee failure **Thunderstorms** **Tornado** Wildfire **Winter Weather**	annually	9
2-1	Addition of lightning arresters, electronic reclosures, conductors, guy wires, breakers, system coordination, Polymer equipment from porcelain.	Continue (In-progress)		ongoing	Dam Failure Earthquakes Flooding Land Subsidence Levee failure **Thunderstorms** Tornado Wildfire **Winter Weather**	annually	5
2-2	Upgrade class and height poles where possible.	Continue (In-progress)		ongoing	Dam Failure Earthquakes Flooding Land Subsidence Levee failure **Thunderstorms** **Tornado** Wildfire Winter Weather		8
2-3	Add alternate source wiring to eliminate or reduce time of outages.	Continue (In-progress)		ongoing	Dam Failure Earthquakes Flooding Land Subsidence Levee failure **Thunderstorms** **Tornado** Wildfire Winter Weather	annually	2
2-4	New Radio Frequency Automated Meter Intelligence Project	Action Completed	metering system replacement complete		**Dam Failure** **Earthquakes** **Flooding** **Land Subsidence** **Levee failure** **Thunderstorms** **Tornado** **Wildfire** **Winter Weather**		7
3-1	Maintain mutual aid agreements with other rural electric cooperatives.	Continue (In-progress)		ongoing	Dam Failure Earthquakes **Flooding** Land Subsidence Levee failure **Thunderstorms** **Tornado** Wildfire **Winter Weather**	annually	9
3-2	Cooperate with local law enforcement and government officials to reduce the impact of power outages.	Continue (In-progress)		ongoing	Dam Failure Earthquakes **Flooding** Land Subsidence Levee failure **Thunderstorms** **Tornado** Wildfire **Winter Weather**	annually	9
4-1	Provide safety and reporting information to the general public through varying methods: • Company website • Social media sites • Local newspapers • Presentations • Publications	Continue (In-progress)		ongoing	**Dam Failure** **Earthquakes** **Flooding** **Land Subsidence** **Levee failure** **Thunderstorms** **Tornado** **Wildfire** **Winter Weather**	annually	9