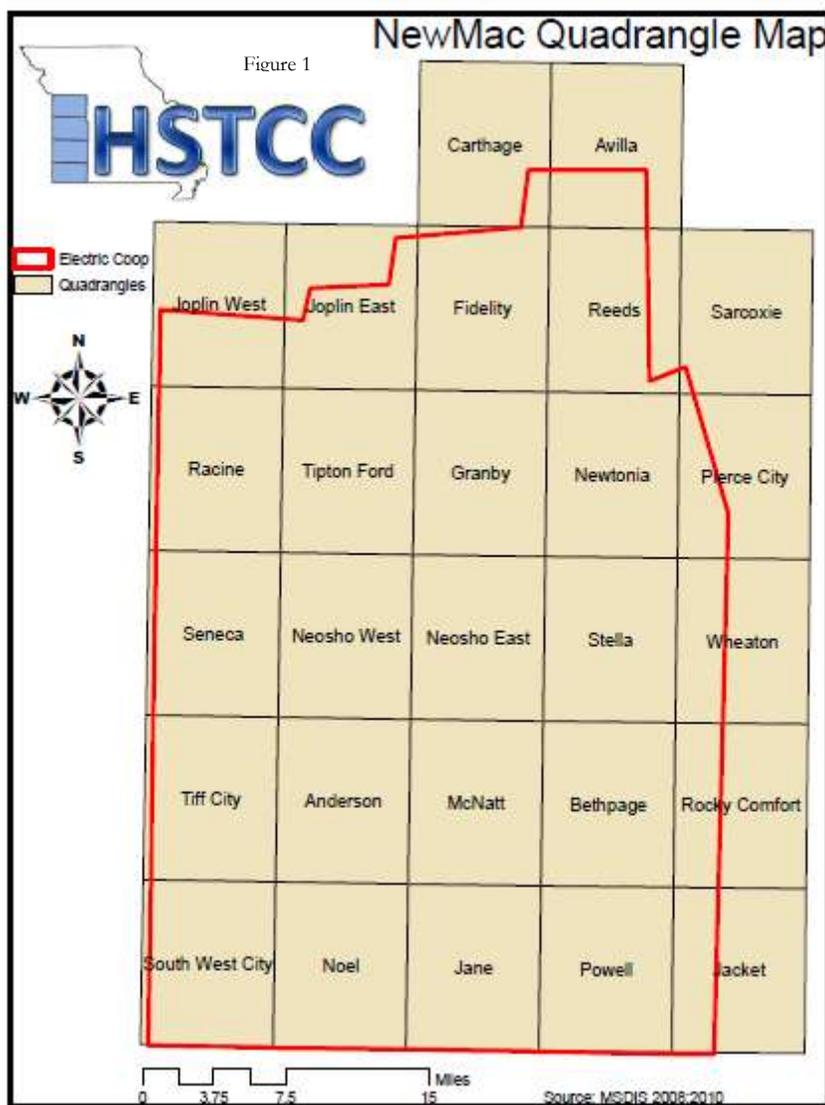


Section 1: Introduction

New-Mac Electric Cooperative was established in 1939 to provide electric service to the rural areas of southwest Missouri. A Touchstone Energy Cooperative, New-Mac is headquartered in Neosho, Missouri, and provides service to customers in Jasper, Newton, McDonald, Lawrence and Barry counties in Missouri. The cooperative is run by a board of nine directors which approve the company's mission and internally developed business policy:

“New-Mac Electric Cooperative is dedicated to providing our members with a reliable, competitively-priced, high quality supply of electric energy, while adhering to cooperative principles and striving to improve the quality of life for all members through a highly trained, efficient staff.”

New-Mac's service boundaries within the state of Missouri include Newton and McDonald counties in their entirety as well as the Southern and central portion of Jasper County. It also includes a small western portion of Lawrence and Barry County. The cooperative owns 2920 miles of distribution line within these 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,



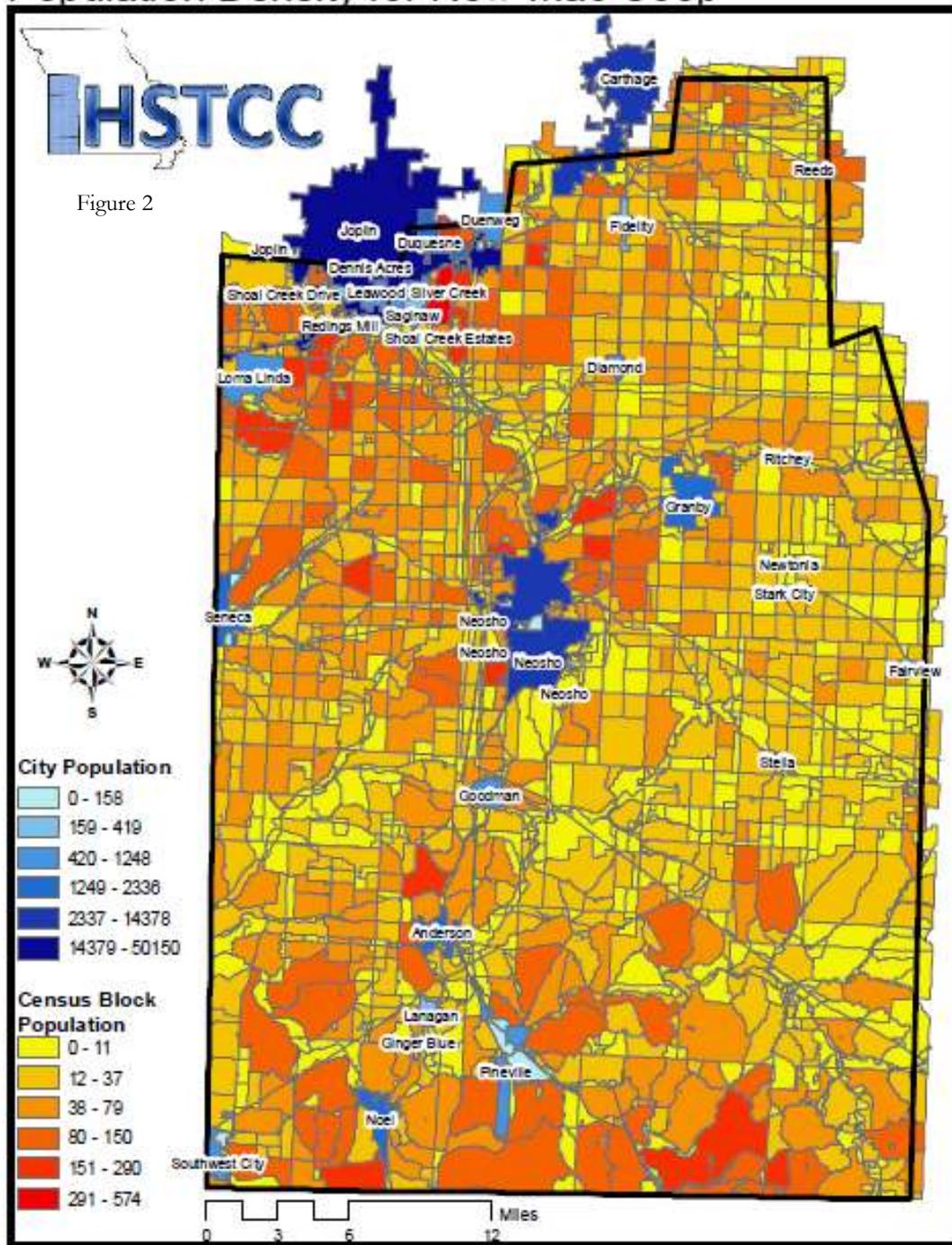
Association of Missouri Electric Cooperatives)

The customer base of New-Mac is currently 16,818 members. Residential customers account for 99.20% of memberships (16,683 members), while non-residential customers make up the remaining .80% (135 members). Table 1.1 provides the summary of metered customers by Missouri county.

Table 1.1 Meters by County	
County	Number of meters
Jasper	888
Newton	8,690
McDonald	7,181
Lawrence	48
Barry	11
Totals	16,818

The average daily customer usage for New-Mac is 62.16 kilowatt-hours (kWh). Annual total usage of New-Mac customers in 2010 was 380,399,758 kWh of service. Population density for the cooperative service area is depicted in Figure 2 (*Map source: U.S. Census 2010.*)

Population Density for New-Mac Coop



Section 2: Planning process:

Through a partnership between the Association of Missouri Electric Cooperatives and the Missouri Association of Councils of Government, the Harry S Truman Coordinating Council was contracted to facilitate a hazard mitigation planning process for New-Mac.

The initial meeting between the two entities was held on January 25, 2011 as part of a regional kick-off meeting for southwest Missouri. This informational meeting provided the basic responsibilities for each agency and allowed for initial discussion concerning the project timelines, data collection and other pertinent topics. Additional information was provided by New-Mac staff via email, such as business structure, customer information, critical facilities information, and asset inventory by type and location.

One formal planning meeting was held at the New-Mac offices in Neosho, Missouri on October 26, 2011. Table 1.2 summarizes the attendees and topics of this meeting. Meeting minutes are available in the chapter appendix.

Table 1.2 New-Mac Planning Meeting Synopsis		
Meeting Date	Attendees, Title, Organization	Topics of discussion
Ongoing communication via email	Stanley M. Irsik P.E., System Engineer Cathy Cooley, Plant Accountant	New-Mac business structure Customer information Critical facilities information Asset inventory by type and location
October 26, 2011	Stanley M. Irsik P.E., System Engineer Cathy Cooley, Plant Accountant David Childers, Controller Gloria Bottom, HSTCC Staff	Data collection review Current mitigation strategies Establishment of goals, actions, and objectives Method of prioritization Prioritization of goals, actions, and objectives

Public Involvement

As with all public hazard mitigation plans, public involvement was encouraged through a variety of methods. New-Mac’s plan was posted to New-Mac and HSTCC companies’ websites, inviting both cooperative members and the general public to provide comment. Print copies of the chapter were also made available upon request through the HSTCC and New-Mac offices. Comments from neighboring jurisdictions were also solicited using the standardized AMEC letter which was mailed to the appropriate contacts, including:

- Jasper County Commission,
- Newton County Commission,
- McDonald County Commission,
- local emergency management directors, and
- the local Red Cross chapter.

New-Mac Electric provides service to the 911 facility and two 911 communication towers for McDonald County. Also in McDonald County, New-Mac Electric provides service to 3 water districts operating a total of 6 well sites. New-Mac provides service to 8 fire stations, 2 helicopter pads, a highway patrol communication tower, and a satellite

office for the McDonald County Sheriff Department. New-Mac also serves 3 schools in McDonald County which are designated as Emergency Management locations. In Newton County, New-Mac provides service to 5 well sites operated by Missouri American Water. New-Mac's mitigation plan was included in the public comment period for the combined AMEC plan.

Section 3: Asset inventory

New-Mac Electric Cooperative has a wide variety of assets by type. Real estate owned by the company includes office buildings, garages, and other outbuildings throughout the service area. Seventy nine vehicles provide access to customers and infrastructure. New-Mac does not own any electric generation or transmission infrastructure. 2,920 miles of distribution lines are owned and maintained by New-Mac. Table 1.3 provides information concerning total asset valuation.

Asset	Total Replacement Cost	Cost breakdown
Total New-Mac Assets	\$278,331,958	Buildings and vehicles - \$16,122,809 Overhead assets - \$269,762,948 Underground assets - \$8,569,011
Substations	\$1,646,830	1 Major Substation - \$734,250 14 Minor Substations - \$912,580
Distribution Lines	\$214,192,115 OH \$ 6,704,128 UG	OH Single-phase lines - \$ 172,488,115 UG Single-phase lines - \$ 6,704,128 OH Three-phase lines - \$ 41,704,000 UG Three-phase lines - 0
Supporting Infrastructure	\$55,570,833 OH \$ 1,864,883 UG	OH Meters - \$ 1,984,623 OH Transformers - \$19,687,800 Poles - \$ 28,052,340 Guys/Anchors - \$3,568,250 Cross-Arms - \$601,500 UG Meters - \$ 75,593 UG Transformers - \$ 1,789,300 Regulators - \$ 912,870 Oil Circuit Reclosures - \$ 390,250 Capacitors - \$ 373,200
Office Buildings	\$10,554,246	Neosho - \$8,579,218 Anderson - \$1,975,028
Vehicles	\$5,568,563	
<i>Source: Internal New-Mac Accounting and Insurance records, 2011</i>		

Ensuring quality distribution to its customers, New-Mac maintains distribution lines and the supporting infrastructure. Table 1.4 includes a list of asset types, emergency replacement cost per unit or mile, the asset inventory by service county, and total infrastructure numbers.

Table 1.4		New-Mac Asset Inventory by service county					
Asset	Emergency Replacement Cost per unit or mile	Number of units or miles: JASPER	Number of units or miles: NEWTON	Number of units or miles: McDONALD	Number of units or miles: LAWRENCE	Number of units or miles: BARRY	Total number of units or miles:
Meter	\$122.50/unit	856 OH 32 UG	8,380 OH 310 UG	6,906 OH 275 UG	48 OH	11 OH	16,201 OH 617 UG
Pole*	\$415.00/unit	3,481	33,800	30,106	179	30	67,596
SP*** distribution line	\$70,300/mile OH (\$13.32/foot OH) \$102,400/ mile UG (\$19.40/foot UG)	128.3854 OH** 3.2972 UG***	1,173.7403 OH** 31.7277 UG***	1,143.9679 OH** 30.4451 UG***	6.8864 OH** 0 UG***	.6205 OH** 0 UG***	2,453.6005 OH** 65.47 UG***
Guys/Anchors	\$250	717	6899	6620	34	3	14,273
Cross-Arms	\$75	300	4120	3600			8,020
TP**** distribution line	\$104,000/ mile (\$19.70/foot OH)	15 OH** UG***	206 OH** UG***	180 OH** UG***	0 OH** UG***	0 OH** UG***	401 OH** 0 UG***
Transformers	\$1,100 OH \$2,900 UG	856 OH 32 UG	9,000 OH 310 UG	7,988 OH 275 UG	46 OH	8 OH	17,898 OH 617 UG
Regulators	\$11,270	4	41	36	0	0	81
Oil Circuit Reclosures	\$1,750	11	112	99	1	0	223
Capacitors	\$1,200	16	155	139	1	0	311
Total Replacement Value by county							
OH		\$13,361,849	\$131,769,313	\$123,938,488	\$626,329	\$66,969	\$269,762,948
UG		\$434,353	\$4,185,891	\$3,948,766	\$0	\$0	\$8,569,011
		OH = overhead *UG = underground ***SP = Single phase ****TP = Three phase Source: Internal New-Mac Accounting and Maintenance records					

Section 4: Identified Hazards and Risk Assessment Methodology

Natural hazards in southwest 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 a period of warning which allows for public preparation prior to their occurrence. Regardless, hazard mitigation planning can lessen the negative of any natural disaster regardless of onset time. The following natural hazards have been identified as potential threats for the service region of the New-Mac Electric Cooperative:

- Tornadoes
- Severe Thunderstorms, Hail, and High Winds
- Flood
- Severe Winter Weather
- Earthquakes
- Dam Failure
- Wildfire

Likewise, a number of hazards may be eliminated from consideration in their local plan due to the state's geographic location including tsunamis, hurricanes, coastal storms, volcanic activity, avalanche, and tropical storms. Additionally, a number of hazards may be eliminated specifically for New-Mac because of asset types and geographic location in the state of Missouri. Those hazards eliminated for the New-Mac service region include:

- Drought
- Heat Wave
- Severe land subsidence
- Landslides
- Levee Failure

Although drought can potentially impact southwest Missouri, water availability does not directly impact the delivery of electric service to New-Mac customers. Similarly, heat wave has been eliminated. Though it may result in additional usage and potentially tax the system, heat waves do not usually cause infrastructure damage to cooperative assets. The results of a heat wave in the New-Mac service area may be considered cascading events rather than damage caused directly by the hazard itself. Land subsidence and landslides have also been eliminated based upon local soil structure categorization by the USGS. Limestone, carbonate rock, salt beds, and other naturally dissolving rock which are most susceptible to the formation of sinkholes are in karst areas. New-Mac is in the Springfield Plateau sub-province of the Ozarks Plateau. Few sinkholes have occurred in this area and none have impacted New-Mac. As none have affected or are expected to affect New-Mac, sinkholes will not be addressed in this planning process.

For the purpose of this risk assessment, the identified hazards for the New-Mac service area have been divided into two categories: **historical and non-historical hazards**.

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 New-Mac, hazards with historical data include tornadoes, severe thunderstorms/high wind/hail, flood, severe winter weather, and wildfire.

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 New-Mac, hazards without historical data include earthquakes and dam failure.

Probability of Occurrence

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard. For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year.
- 1-10% chance of an event occurrence in any given year
- 10-99% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

The number of occurrences was further refined to focus on damage-causing events. Those occasions which had reported damages were divided by the total number of recorded events to obtain a percentage of total storms which result in infrastructure damage. (Formula: Number of damage-causing events / total number of events = Percentage of occurrences which cause damage.)

Potential Extent of Damage

Vulnerability Assessment matrices for each hazard are included on the following pages. These worksheets detail loss estimates for each hazard affecting the cooperative's service area. Loss estimates were calculated using the asset summary created by internal New-Mac accounting records. 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 \$280,317,194
- Overhead infrastructure assets only
 - Used for:
 - Severe Thunderstorm / High Wind / Hail
 - Flood
 - Severe Winter Weather
 - Valued at \$269,762,948

In addition, historical hazards with recorded damages were used to identify an average cost per event. (Formula: Total cost of damages / total number of events = Average damage cost per event.) When discussing the extent of potential damages for all hazards, the following scale was utilized:

- Less than 10% potential damages to total cooperative infrastructure
- 10-25% potential damages to total cooperative infrastructure
- 25-50% potential damages to total cooperative infrastructure
- More than 50% potential damages to total cooperative infrastructure

Regardless of hazard categorization, the following matrix (Table 1.5) will be utilized to identify the potential damage extent and likelihood of occurrence for each natural hazard type.

Table 1.5 Sample New-Mac Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: _____		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	Near 100% probability in any given year
Potential Damage Extent of	Less than 10% of damage to system				
	10-25% damage of system				
	26-50% damage of system				
	More than 50% damage of system				

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 number of reported or estimated outages per event occurrence. (Formula: Average number of outages reported / Total number of customers = Average percentage of outages reported per event)

Table 1.6 Sample New-Mac Electric Cooperative Service Interruption Vulnerability Assessment Matrix Hazard: _____		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	> Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers report outages				
	10-25% of customers report outages				
	26-50% of customers report outages				
	More than 50% of customers report outages				

Section 5: Risk Assessment

A) Historical Hazards:

Tornadoes

In the last 60 years, 58 tornadoes have been reported within the New-Mac cooperative boundaries. Figure 3 provides a pictorial representation of all recorded tornado touchdown sites and recorded path. *(Data for map collected from NOAA and MSDIS.)*

As data insufficiency exists, however, between 1968 and 2006 in both historical hazard records and cooperative records concerning damage estimates. For the purpose of this assessment, the years for which records exist for both data sets have been used. From 2007-2010, New-Mac’s service area within the state of Missouri has experienced a total of 8 tornadic events. Using the previously described methodology, the probability of a tornadic event in the New-Mac service area in any given year is near 100% (8 events / 4 years = 200%). Estimated cooperative material damages associated with each of these events were compiled by New-Mac staff. 3 of the 8 occurrences caused damage to cooperative assets, resulting in a 37.5% probability that any given tornadic occurrence will produce damage. Table 1.7 provides a summary of event dates, EF-scale ratings, damage cost estimates and outages reported.

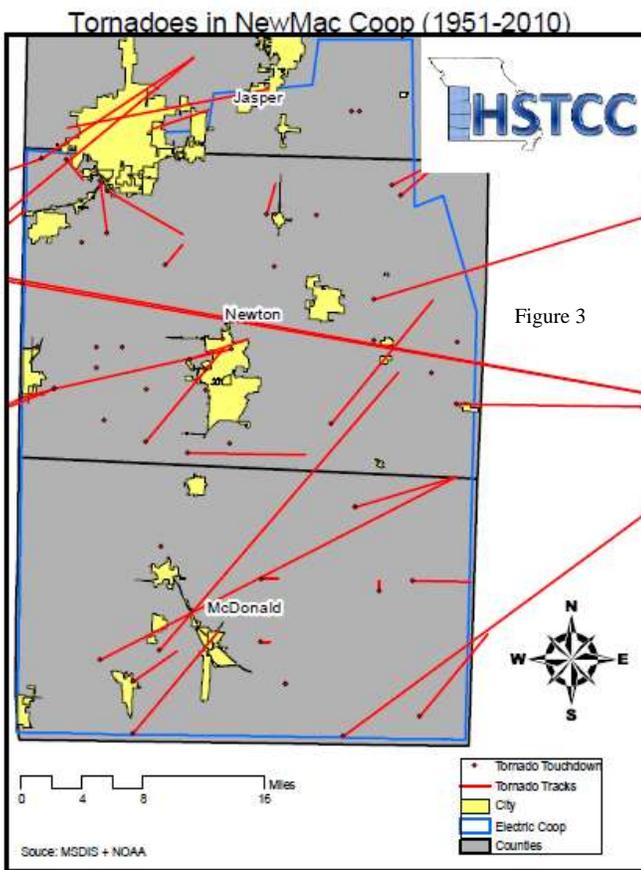


Figure 3

Date of event	EF Scale rating	Damage estimates	Outages Reported
1/7/2008	F1	\$ 50,000	1,500
5/10/2008	F4	\$300,000	4,500
5/10/2008	F1	\$300,000	4,500

Data provided based on internal New-Mac records which reflect cost from the referenced event year.

Based upon the last four years of historical event records, the average tornado to affect the cooperative will include an EF2 rating, causing an average damage cost of \$216,667 per event (\$650,000/3 events = \$216,667). This averaged amount accounts for .077% of New-Mac’s total overhead assets and building valuation (\$325,000/\$280,317,194 = 0.077%). Table 1.8 demonstrates the probability of occurrence in conjunction with the potential extent of damage.

Table 1.8 New-Mac Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: <u>Tornado</u>		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% damage of system				
	26-50% damage of system				
	More than 50% damage of system				

An average of 3,500 customers reported outages during recorded tornadoes since 2007. When compared with the total number of customers served by New-Mac, it can be projected that 21% of all customers may report outages during any given tornadic event. Table 1.9 demonstrates the probability of occurrence in conjunction with the potential extent of impact upon local customers.

Table 1.9 New-Mac Electric Cooperative Service Interruption Vulnerability Assessment Matrix Hazard: <u>Tornado</u>		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	> Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers report outages				
	10-25% of customers report outages				
	26-50% of customers report outages				
	More than 50% of customers report outages				

Severe Thunderstorms, High Wind, and Hail

From 2007-2010, New-Mac’s service area within the state of Missouri has experienced a total 89 hail events and 53 thunderstorm/high wind events. Therefore, the probability of

a hail event in the New-Mac service area in any given year is near 100% (89 events / 4 years = 2225%) while the probability of a thunderstorm/high wind event in any given year is near to 100% (53 events / 4 years = 725%). Estimated material damages associated with each of these events were compiled by New-Mac staff. None of the seven hail occurrences caused damage to cooperative assets, resulting in a less than 1% probability that any given hail occurrence will produce damage. Hail has never caused damages to the coop assets and is not considered a threat by New-Mac.

Table 1.10 provides the information for damaging thunderstorm/high wind events. 2 of the 53 occurrences caused damage to cooperative assets, resulting in a 3.8% probability that any given thunderstorm/high wind occurrence will produce damage. (2 / 53 = 3.8%)

Event date	Damage estimates	Outages reported
5/8/2009	\$57,500	750
5/8/2009	\$57,500	750
<i>Data provided based on internal New-Mac records which reflect cost from the referenced event year.</i>		

Based upon historical records, the average thunderstorm/high wind event to affect the cooperative will cause an average damage cost of \$57,500 (\$115,000 / 2 events = \$57,500). This averaged amount accounts for less than 1% of New-Mac’s overhead asset valuation (\$57,500 / \$269,762,948= .021%). Table 1.11 demonstrates the probability of occurrence in conjunction with the potential extent of damage for hail/thunderstorms/high wind events.

New-Mac Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: <u>Hail/Thunderstorm/High Wind</u>		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% damage of system				
	26-50% damage of system				
	More than 50% damage of system				

No customers reported outages during recorded hail storms and an average of 750 customers reported outages during any one thunderstorm and high wind event since 2007. When compared with the total number of customers served by New-Mac, it can be projected that 4.5% of all customers may report outages during any given thunderstorm,

or high wind event. Tables 1.12 and 1.13 demonstrate the probability of occurrence in conjunction with the potential extent of impact upon local customers for hail and wind.

Table 1.12 New-Mac Electric Cooperative Service Interruption Vulnerability Assessment Matrix Hazard: <u>Hail</u>		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	> Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers report outages				
	10-25% of customers report outages				
	26-50% of customers report outages				
	More than 50% of customers report outages				

Table 1.13 New-Mac Electric Cooperative Service Interruption Vulnerability Assessment Matrix Hazard: <u>Thunderstorm/High Wind</u>		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	> Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers report outages				
	10-25% of customers report outages				
	26-50% of customers report outages				
	More than 50% of customers report outages				

Flood

Flood events are small in relationship to eastern Missouri as this area has small rivers and streams. Damages from flooding, has not happened within this area during tracked years. Figure 4 depicts the 100 year floodplain in relation to the cooperative’s boundaries. (Map sources: FEMA HAZUS-MH; DFIRMS; Missouri Office of Administration, and Association of Missouri Electric Cooperatives.)

From 2007-2010, New-Mac’s service area has experienced 65 flooding events. The probability of a flood event affecting the cooperative assets in any given year is near 100% (65 events / 4 years = 1625%). None of these sixty-five occurrences caused

damage to cooperative assets, resulting in less than 1% probability that any given flood occurrence will produce damage.

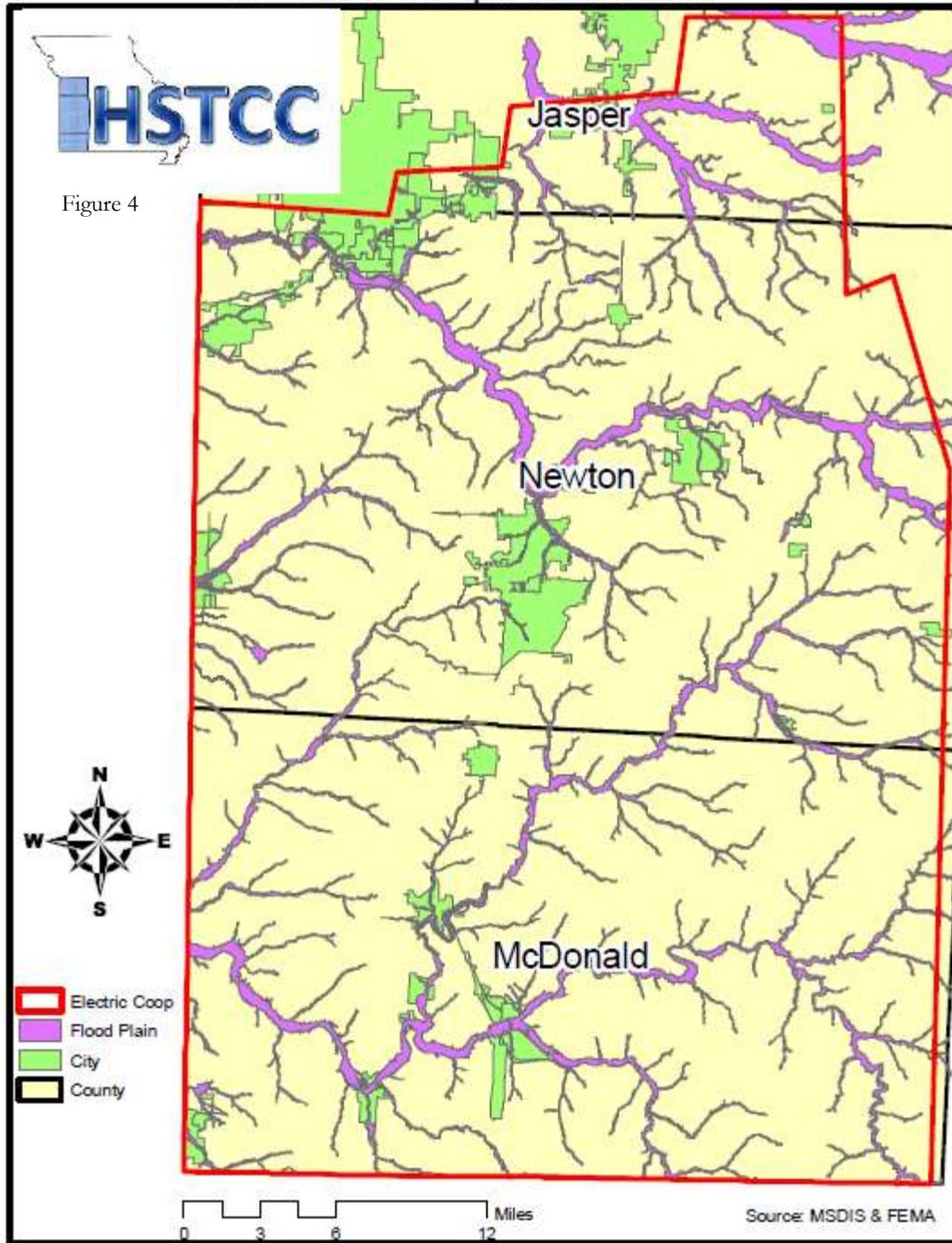
Flood events vary widely based upon numerous factors including annual precipitation. Based upon historical records, the average flood event to affect the cooperative will cause less than 1% of damages to the overhead assets. Table 1.14 demonstrates the probability of occurrence in conjunction with the potential extent of damage.

Table 1.14 New-Mac Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: <u>Flood</u>		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	≥100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% damage of system				
	26-50% damage of system				
	More than 50% damage of system				

No customers reported outages during recorded flooding events since 2007. It can be projected to be less than 1% of all customers may report outages during any given flooding event. Table 1.15 demonstrates the probability of occurrence in conjunction with the potential extent of impact upon local customers.

Table 1.15 New-Mac Electric Cooperative Service Interruption Vulnerability Assessment Matrix Hazard: <u>Flood</u>		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	> Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers report outages				
	10-25% of customers report outages				
	26-50% of customers report outages				
	More than 50% of customers report outages				

NewMac Coop Flood Plain



Severe Winter Weather

The greatest threat to utility services in southwest Missouri is ice. From 2007-2010, New-Mac’s service area has experienced a total of eleven winter weather events, including significant snowfall and ice storms. Therefore, the probability of a severe winter weather event in the New-Mac service area in any given year is near 100% (11 events / 4 years = 275%). Estimated material damages associated with each of these events were compiled by New-Mac staff, but damage estimates are available from 2007-2010 only. Table 1.16 provides a summary of event dates, types, associated damage estimates, and reported outages. Three occurrences caused damage to cooperative assets, resulting in a 27.3% probability that any given severe winter weather occurrence will produce damage. (3 / 11 = 27.3%)

Table 1.16		New-Mac Severe Winter Weather Event Summary	
Event date	Event type	Damage estimates	Outages reported
1/12/2007	Ice Storm	\$10,000,000	14,400
12/9/2007	Ice Storm	\$ 250,000	5,000
12/10/2007	Ice Storm	\$ 250,000	9,000
<i>Data provided based on internal New-Mac records which reflect cost from the referenced event year.</i>			

Based upon these historical records, the average severe winter weather event to affect the cooperative will cause an average damage cost of \$3,500,000 (\$10,500,000 / 3 events = \$3,500,000). This averaged amount accounts for 1.3% of New-Mac’s total overhead asset valuation (\$3,500,000 / \$269,762,948= 1.297%). Table 1.17 demonstrates the probability of occurrence in conjunction with the potential extent of damage.

Table 1.17 New-Mac Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: <u>Severe Winter Weather</u>		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% damage of system				
	26-50% damage of system				
	More than 50% damage of system				

An average of 9,467 customers reported outages during recorded severe winter weather events since 2007. When compared with the total number of customers served by New-Mac, it can be projected that 56% of all customers may report outages during any given severe winter weather event. Table 1.18 demonstrates the probability of occurrence in conjunction with the potential extent of impact upon local customers.

Table 1.18 New-Mac Electric Cooperative Service Interruption Vulnerability Assessment Matrix Hazard: Severe Winter Weather		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	> Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers report outages				
	10-25% of customers report outages				
	26-50% of customers report outages				
	More than 50% of customers report outages				

Wildfire

The incidence of wildfire in the New-Mac service area presents a unique risk assessment. Wildfire events have occurred in each of the 5 counties. According to the Missouri Department of Conservation, all New-Mac counties have experienced wildfires between 2004 and 2008. Table 1.19 summarizes the incidences of wildfire within the five counties. The probability of a wildfire event in the New-Mac service area in any given year is near 100% (1171 events / 5 years = 23,420%). Therefore, for the purposes of this assessment, wildfire and its associated impacts cannot be eliminated from the realm of possibility.

County	# of Wildfires, 2004-08	Average Annual # of Wildfires	Likelihood (1-5)	Acres Burned	Average Annual Acres Burned	Total Buildings Damaged	Vulnerability
Jasper	211	42.2	2	1207	241	1	Medium
Newton	528	105.6	4	1966.58	393	31	Medium-high
McDonald	78	15.6	1	832	166	0	Medium-low
Lawrence	206	41.2	2	1159.5	232	0	Medium
Barry	148	29.6	2	1850.25	370	1	Medium
Totals	1171	234.2	2-3	7015.33	1402	33	Medium

Source: Missouri State Hazard Mitigation Plan

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 New-Mac service area. For the 2004-2008 period, 1,171 fires have burned a total of 7,015.33

acres, for an average of 5.99 acres affected per event. New-Mac sustained no damage related to wildfires in its service area during this time period. Cooperative assets are located throughout the service area rather than being located at a single central site. With an average of 6 acres per fire in the service area, it is unlikely that infrastructure damage would exceed 5% based upon asset location and un-likelihood of an uncontrollable wildfire. This initial assessment assumes a limited impact upon electric distribution infrastructure of less than 10% (Table 1.20). Further study will be required to create a model for damage assessments related to wildfire.

Table 1.20 New-Mac Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: <u>Wildfire</u>		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% damage of system				
	26-50% damage of system				
	More than 50% damage of system				

No customers have reported outages during recorded wildfires between 2004 and 2008. When compared with the total number of customers served by New-Mac, it can be projected that less than 1% of all customers may report outages during any given wildfire event. Table 1.21 demonstrates the probability of occurrence in conjunction with the potential extent of impact upon local customers.

Table 1.21 New-Mac Electric Cooperative Service Interruption Vulnerability Assessment Matrix Hazard: <u>Wildfire</u>		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	> Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers report outages				
	10-25% of customers report outages				
	26-50% of customers report outages				
	More than 50% of customers report outages				

B. Non-historical Hazards

Earthquakes

There are 2 earthquake zones near the New-Mac area. One is NeMaha fault and the other is the well known New Madrid. Both are some distance away but due pose a risk to resources.

The NeMaha Fault, which runs roughly from Oklahoma City, Oklahoma north to Lincoln, Nebraska is west of New-Mac. In 1993, the NeMaha fault produced a discernable earthquake that was felt in the region, rating a 2.9 on the Richter Scale of Earthquake Intensity. Additional quakes took place February 11, 1995 (3.1 rating); July 16, 2004 (3.5 rating); March 23, 2003 (3.1 rating). More recently, an earthquake rating 3.6 was recorded on December 17, 2009. Although a relatively quiet fault system, the NeMaha fault has the potential to produce a damaging earthquake but because of the distance the damages should be minor.

The region is also subject to effects of 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 New-Mac service area in its entirety.

The NeMaha fault is geologically active, but C.E.R.I. records demonstrate the limited impact of said earthquakes, with no quakes to date exceeding a 5.5 on the Modified Mercalli Scale. Its cascading effects have been largely restricted to more localized regions, but even then the damage caused has been minimal. By contrast, the New Madrid fault has the potential to cause damage throughout the state of Missouri, including the New-Mac 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 probability of an earthquake increases with each passing day.

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 rating, the region would experience Level V intensity characteristics. In the event of an earthquake with a 7.6 rating, the region would experiences Level VI intensity characteristic 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 rating, the New-Mac service area would most likely experience minor building damage as well as damage to the electrical distribution system. The HAZUS-MH loss estimation per the State Hazard Plan 2010, gives a 2% chance of exceedance in the next 50 years. Counties within New-Mac have a loss ratio of 1.6 to 1.8 percent. This damage 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.

Though the probability of occurrence is very small, the potential extent of damage could impact both the cooperative and its customers as demonstrated in Table 1.22.

Table 1.22 New-Mac Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: <u>Earthquake</u>		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% damage of system				
	26-50% damage of system				
	More than 50% damage of system				

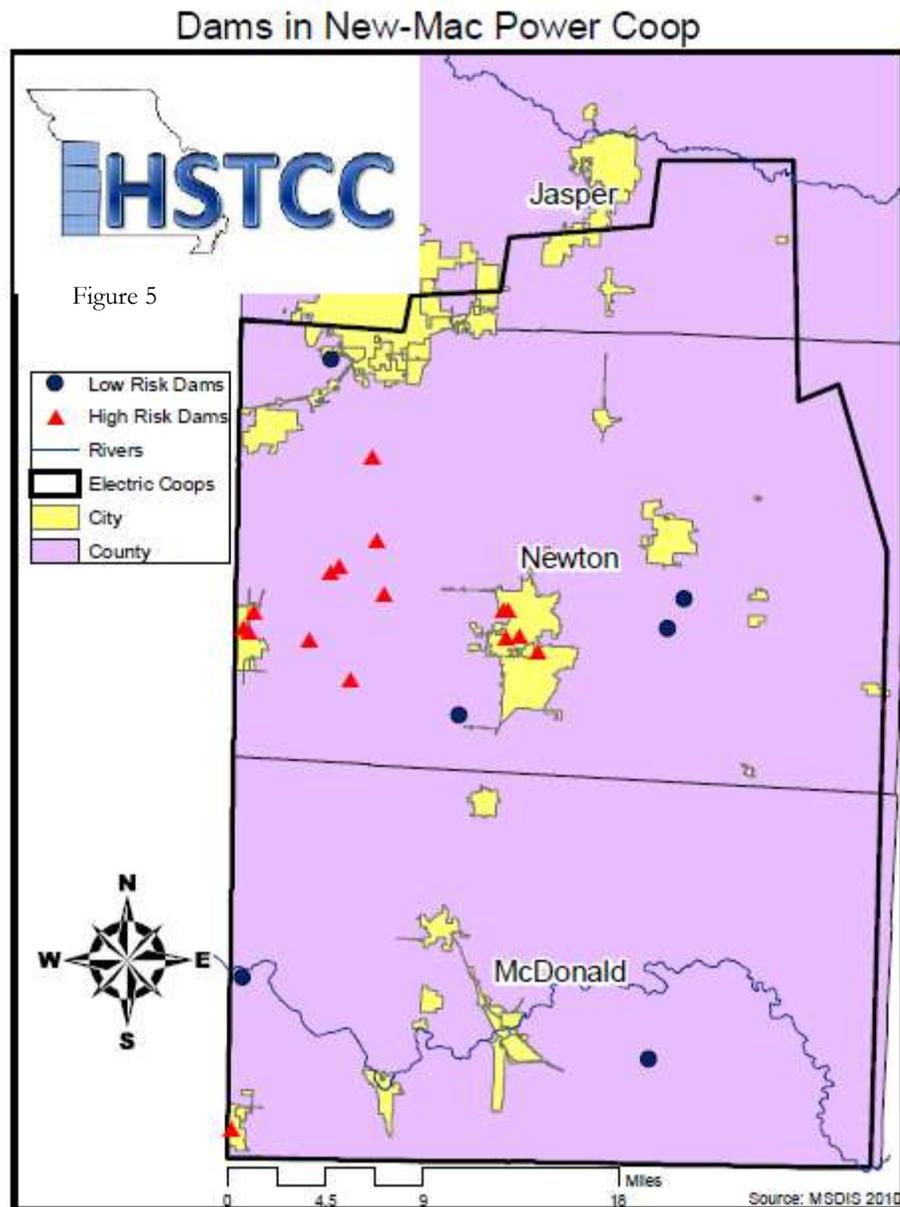
Based upon information outages related to damages from other events, it may be estimated that less than 10% customers could report outages related to an earthquake event. Table 1.23 demonstrates the probability of occurrence in conjunction with the potential extent of impact upon local customers.

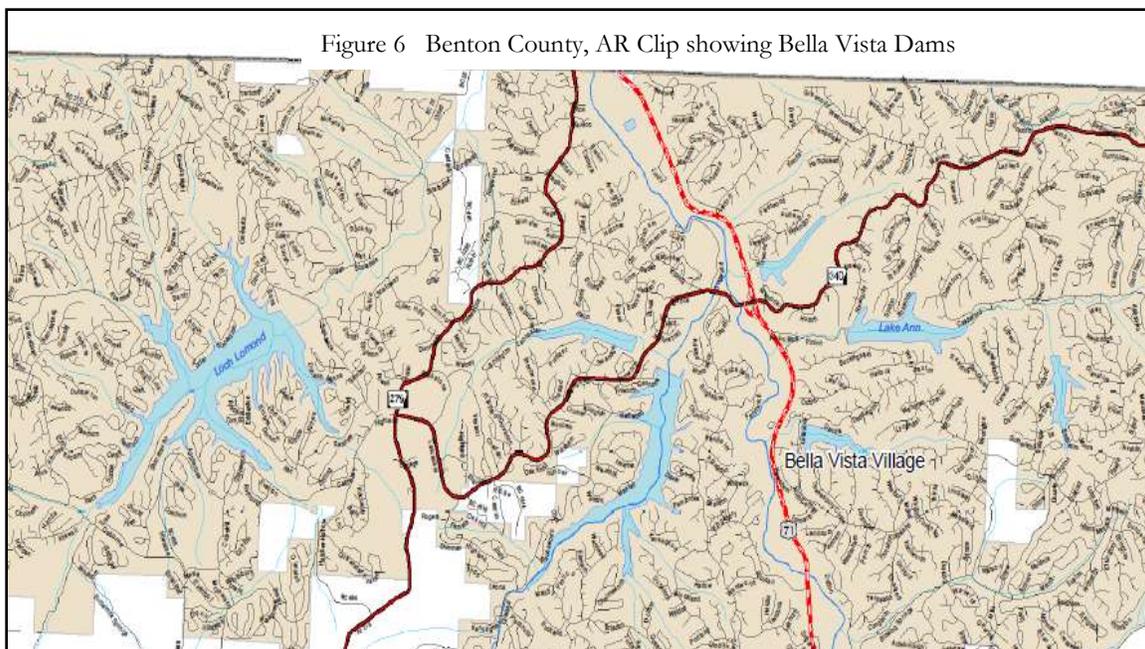
Table 1.23 New-Mac Electric Cooperative Service Interruption Vulnerability Assessment Matrix Hazard: <u>Earthquake</u>		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	> Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers report outages				
	10-25% of customers report outages				
	26-50% of customers report outages				
	More than 50% of customers report outages				

Dam Failure

Like earthquakes, dam failures have had no measurable impact upon the New-Mac service area to date. According to Missouri DNR’s Dam Safety Division, 23 dams currently exist within the cooperative boundaries: 20 in Newton County, and 3 in McDonald County. Of these dams, seven in Newton County and one in McDonald County are regulated by the state due to the fact that they are non-agricultural, non-federal dams which exceed 35 feet in height. In addition, there are 7 dams in the Bella Vista area of Arkansas that could impact McDonald County. Figure 5 shows the locations of all known dams located within New-Mac’s service area. Figure 6 shows the Arkansas dams that could impact the service area. Little Sugar Creek flows north out of Arkansas through

southern McDonald County. (Map sources: www.msdis.missouri.edu; www.dnr.mo.gov/env/wrc; and Benton County, Arkansas Map (cropped) as created by NWARPC.)





26 dam failures have occurred within the state of Missouri over the past 100 years. No such event has occurred within or near the cooperative's boundaries. However, 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. Further study concerning existing dams and their impact is required to make a more comprehensive assessment of potential damages. This initial assessment assumes a limited impact upon downstream electric distribution infrastructure of less than 10% for both infrastructure damage and service interruption. (Tables 1.24 and 1.25).

Table 1.24 New-Mac Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: <u>Dam Failure</u>		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% damage of system				
	26-50% damage of system				
	More than 50% damage of system				

Table 1.25 New-Mac Electric Cooperative Service Interruption Vulnerability Assessment Matrix Hazard: <u>Dam Failure</u>		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10- 99% chance in any given year	> Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers report outages				
	10-25% of customers report outages				
	26-50% of customers report outages				
	More than 50% of customers report outages				

Section 6: Mitigation strategies

Previous efforts at mitigation

For organizations like New-Mac, 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 build, 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. New-Mac 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 New-Mac 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, New-Mac 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

Development of goals, objectives, and actions

Establishing mitigation goals, objectives, and actions for a business entity 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.

The New-Mac mitigation planning committee, with assistance from HSTCC staff, worked to identify goals, actions, and objectives which addressed hazard mitigation issues. The committee first identified ongoing mitigation strategies as well as potential strategies which seek to improve service and limit disruptions resulting from natural hazards. Action items were then analyzed for common characteristics and summarized to create nine objectives. Likewise, these nine objectives were grouped into similar categories and used as the basis for the four overarching goals. Table 1.29 provides a simple synopsis of the goals and objectives before prioritization.

Table 1.29	New-Mac goals and objectives
Identified Goals	Identified Objectives
Goal 1: Protect the health and safety of the community.	Objective 1: Prevent injury, loss of life, and damage to property.
	Objective 2: Reduce outage time to critical facilities.
Goal 2: Reduce future losses due to natural hazard events.	Objective 1: Protect and maintain existing infrastructure.
	Objective 2: Research and develop plans for future infrastructure improvements, seeking implementation where feasible.
	Objective 3: Research and develop plans for future communication and data collection improvements where feasible.
Goal 3: Improve emergency management capabilities and enhance local partnerships.	Objective 1: Improve assessment of outages and reduce response time.
	Objective 2: Create or maintain partnerships with outside agencies.
Goal 4: Continue to promote public awareness and education.	Objective 1: Utilize media resources to promote public education.
	Objective 2: Continue interaction with local schools and civic groups.

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

After identifying ongoing and potential action items, the committee used three priority tiers:

- **First tier** actions focus on physical infrastructure protection and improvements which ensure continued, quality service and seek to reduce power outages. These types of actions are the highest priority of New-Mac.
- **Second tier** actions create and maintain working relationships to reduce and prevent the impact of power outages. These include improvements to safety and reporting information, mutual aid agreements, and other efforts which seek to expand and improve both customer service and disaster planning.
- **Third tier** actions identify potential projects for other system improvements. These include mapping efforts, technological improvements, and research related to the expansion of mitigation efforts.

Actions within each tier may be funded through regular budgetary methods or identified outside sources. Tables 1.30, and 1.31, and 1.32 provide lists of action items by tier as well as the goals and objectives identified with each.

Table 1.30 Prioritized Mitigation Actions for New-Mac Electric Cooperative – Tier 1

Tier 1			
<i>Action item:</i>	<i>Goal/ Objective</i>	<i>Timeframe for completion</i>	<i>Cost-benefit score</i>
Perform routine maintenance and utilize upgraded equipment where possible to ensure quality of system. Tasks may include part replacement and/or upgrades. Identified work includes, but is not limited to: <ul style="list-style-type: none"> • Addition of lightning arresters, electronic reclosures, conductors, guidewires. • Replacement or repair on poles, cross-arms, lines. 	Goal 1 / Objective 1 Goal 2 / Objective 1	Ongoing effort	Low cost High benefit Score: 9
Upgrade critical Road Crossings	Goal 1 / Objective 2 Goal 2 / Objective 1	Dependent upon additional funding.	Medium cost High benefit Score: 8
Use vegetation management to prevent interference with delivery of power.	Goal 1 / Objective 1 Goal 2 / Objective 1	Ongoing effort	Low cost High benefit Score: 9
Complete annual inspections of lines and poles.	Goal 1 / Objective 1 Goal 2 / Objective 1	Completed annually.	Low cost Medium benefit Score: 6
Add alternate source wiring to eliminate or reduce time of outages.	Goal 1 / Objective 1 Goal 1 / Objective 2 Goal 2 / Objective 2	Dependent upon additional funding.	High cost High benefit Score: 7
Convert overhead lines to underground lines or vice versa in troubled areas based on vulnerability.	Goal 1 / Objective 1 Goal 1 / Objective 2 Goal 2 / Objective 1 Goal 2 / Objective 2	Dependent upon additional funding.	High cost High benefit Score: 7
Convert underground lines to overhead lines in troubled areas based on vulnerability.	Goal 1 / Objective 1 Goal 1 / Objective 2 Goal 2 / Objective 1 Goal 2 / Objective 2	Ongoing effort; Dependent upon funding.	Low cost High benefit Score: 9
Add poles etc. to create shorter spans	Goal 1 / Objective 1 Goal 1 / Objective 2 Goal 2 / Objective 1 Goal 2 / Objective 2	Dependent upon additional funding.	High cost High benefit Score: 7

Table 1.31 Prioritized Mitigation Actions for New-Mac Electric Cooperative – Tier 2

Tier 2			
<i>Action item:</i>	<i>Goal/ Objective</i>	<i>Timeframe for completion</i>	<i>Cost-benefit Score</i>
Provide safety and reporting information to the general public through varying methods: <ul style="list-style-type: none"> • Company website • Social media sites • Local newspapers • Presentations • Publications 	Goal 1 / Objective 1 Goal 4 / Objective 1	Ongoing effort	Low cost Medium benefit Score: 6
Maintain mutual aid agreements with other rural electric cooperatives.	Goal 3 / Objective 2	Ongoing effort.	Low cost Low benefit Score: 3
Partner with county emergency management agencies to ensure power for local shelters, fuel stations, and public safety.	Goal 1 / Objective 1 Goal 1 / Objective 2 Goal 3 / Objective 2	Ongoing effort.	Low cost High benefit Score: 1
Cooperate with local law enforcement and government officials to reduce the impact of power outages.	Goal 1 / Objective 1 Goal 3 / Objective 2	Ongoing effort.	Low cost High benefit Score: 1

Table 1.32 Prioritized Mitigation Actions for New-Mac Electric Cooperative – Tier 3

Tier 3			
<i>Action item:</i>	<i>Goal/ Objective</i>	<i>Timeframe for completion</i>	<i>Cost-benefit Score</i>
Collect GPS data for all existing infrastructure.	Goal 2 / Objective 1 Goal 2 / Objective 3 Goal 3 / Objective 1	Dependent upon additional funding.	High cost High benefit Score: 7
Utilize GIS technology to reduce site identification and response time.	Goal 2 / Objective 2 Goal 2 / Objective 3 Goal 3 / Objective 1	Dependent upon additional funding.	Medium cost Medium benefit Score: 5
Monitor developments in data availability concerning the impact of dam failure and wildfire upon the New-Mac service area through local, state, and federal agencies.	Goal 1 / Objective 1 Goal 2 / Objective 1	Ongoing effort.	Low cost Low benefit Score: 3
Apply for funding to build a saferoom at the Anderson office for the protection of employees.	Goal 1 / Objective 1	Dependent upon additional funding.	High cost High benefit Score7

Section 7 – Plan Implementation and Maintenance

Plan incorporation

The goals, objectives, and actions of the previous section identify both ongoing efforts at mitigation and potential methods for expanding efforts. The 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 New-Mac employment level as the organization strives to ensure quality service to their customers.

Other Local Planning Mechanisms

Beyond the New-Mac plan, few planning mechanisms exist at the local level. The Missouri counties of Jasper, McDonald and Newton each have a FEMA-approved Natural Hazard Mitigation Plan in place. Lawrence and Barry plans are in the process of revision. 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 two different Regional Transportation Plan (RTP) as well as Comprehensive Economic Development Strategies (CEDS) through their respective Regional Planning Commissions. New-Mac's plan can be easily incorporated into these local plans and allow for coordination across agencies in the event of an emergency.

New-Mac is located within the rural portions of third-class counties which are prohibited from enforcing building codes and zoning by the state of Missouri, and Jasper County which is a 1st class county but has not adopted a Comprehensive Plan for zoning enforcement. They do not provide service to any municipality within these counties.

Plan Maintenance

New-Mac will conform to the requirements established by the Association of Missouri Electric Cooperatives (AMEC) for monitoring, evaluating, and updating the plan.

Continued Public Involvement Opportunities

New-Mac will conform to the requirements established 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, the cooperative's website, and the physical office of New-Mac.