MCCOOK PUBLIC POWER DISTRICT BOARD OF DIRECTORS

NAME	TITLE
Dennis Reiners	President
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HAZARD MITIGATION PLANNING TEAM

NAME	TITLE
Clint Bethell	General Manager
Kyle Wilcox	Administrative Services and Finance Manager
Scott Farber	Operations Manager
Josh Beideck	Engineering Manager
Josh Kautz	IT Manager
*Phil Luebbert	Project Manager
*Mary Baker	Resiliency Strategist
*Kayla Vondracek	Planning Intern

**Served as an advisory or consultant role*

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Table of Contents

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

ACS – American Community Survey
ACSR – Aluminum Conductor Steel Reinforced
BCA – Benefit Cost Analysis
BRIC – Building Resilient Infrastructure and Communities
CFR – Code of Federal Regulations
CIKR – Critical Infrastructure and Key Resources
CRS – Community Rating System
DHS – Department of Homeland Security
DMA 2000 – Disaster Mitigation Act of 2000
EAP – Emergency Action Plan
ELAP – Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish Program
EPA – Environmental Protection Agency
EPZ – Emergency Planning Zone
ESL – English as Second Language
FBI – Federal Bureau of Investigation
FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Map
FMA – Flood Mitigation Assistance Program
FRA – Federal Railroad Administration
FR – FEMA's Final Rule
GIS – Geographic Information Systems
HMA – Hazard Mitigation Assistance
HMGP – Hazard Mitigation Grant Program
HMP – Hazard Mitigation Plan
HPRCC – High Plains Regional Climate Center
IP – Office of Infrastructure Protection
JEO – JEO Consulting Group, Inc.
LEOP – Local Emergency Operations Plan
LFD – Livestock Forage Disaster Assistance Program
LIP – Livestock Indemnity Program
NCEI – National Centers for Environmental Information
NDA – Nebraska Department of Agriculture
NDEE – Nebraska Department of Environment and Energy
NDOT – Nebraska Department of Transportation
NDMC – National Drought Mitigation Center
NeDNR – Nebraska Department of Natural Resources
NEMA – Nebraska Emergency Management Agency
NFIP – National Flood Insurance Program
NFS – Nebraska Forest Service
NIPP – National Infrastructure Protection Plan
NOAA – National Oceanic and Atmospheric Administration
NRC – National Response Center
NTAS – National Terrorism Advisory System
NTSB – National Transportation Safety Board
NWS – National Weather Service
MPPD – McCook Public Power District
PDSI – Palmer Drought Severity Index
PHMSA – U.S. Pipeline and Hazardous Material Safety Administration
P.L. – Public Law
RMA – Risk Management Agency
SBA – Small Business Administration
SFHA – Special Flood Hazard Area
SPIA – Sperry-Piltz Ice Accumulation Index
SSA – Sector-Specific Agency
START – National Consortium for the Study of Terrorism and Responses to Terrorism
SURE – Supplemental Revenue Assistance Payments
TAP – Tree Assistance Program
TORRO – Tornado and Storm Research Organization
USACE – U.S. Army Corps of Engineers
USDA – United States Department of Agriculture
WUI – Wildland Urban Interface

EXECUTIVE SUMMARY

Introduction

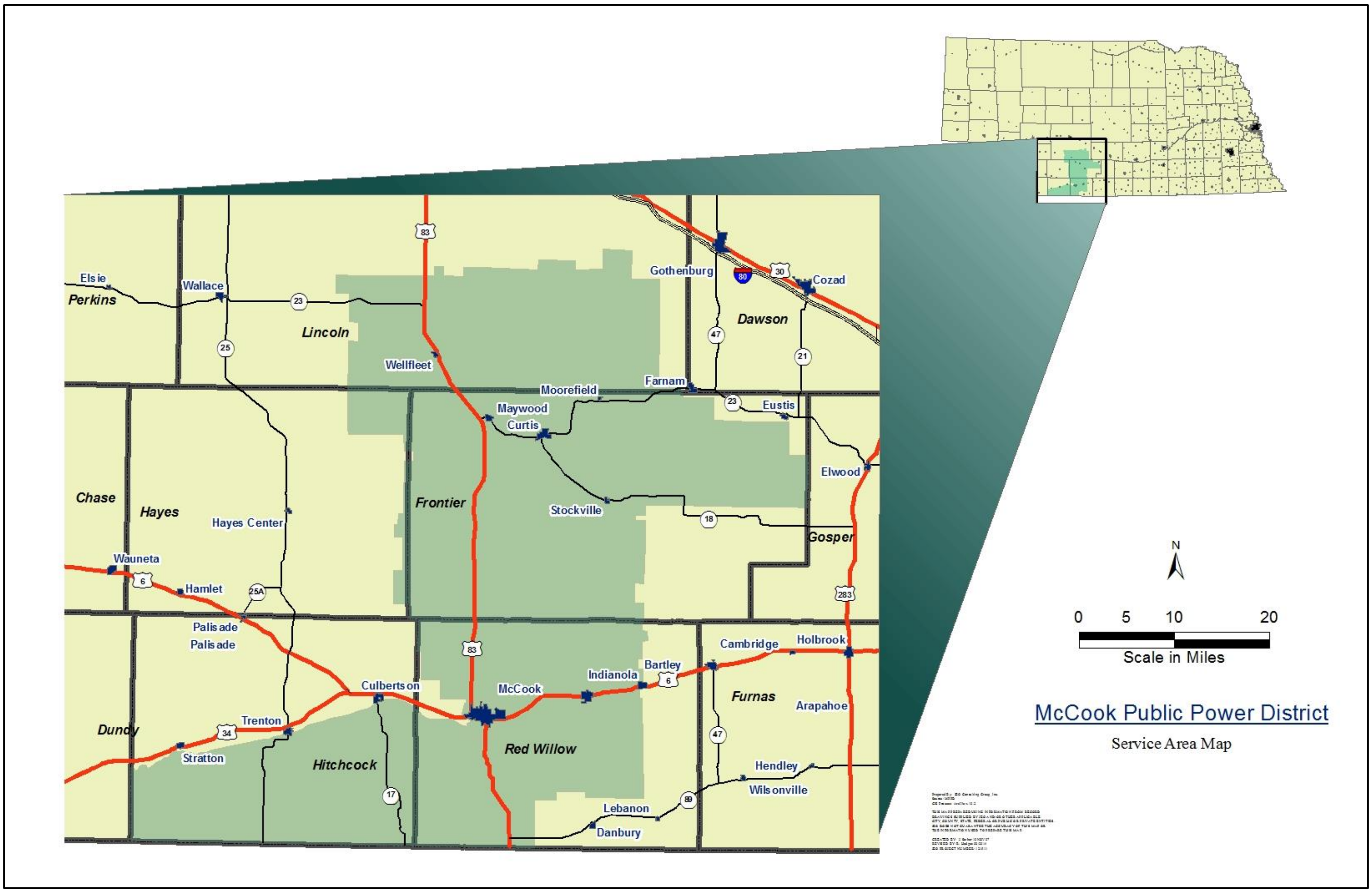
This plan is an update to the McCook Public Power District (MPPD) Hazard Mitigation Plan (HMP) approved in 2014. The plan update was developed in compliance with the requirements of the Disaster Mitigation Act of 2000 (DMA 2000).

Hazard mitigation planning is a process in which hazards are identified and profiled; people and facilities at-risk are identified and assessed for threats and potential vulnerabilities; and strategies and mitigation measures are identified. Hazard mitigation planning increases the ability of jurisdictions to effectively function in the face of natural and human-caused disasters. The goal of the process is to reduce risk and vulnerability, in order to lessen impacts to life, the economy, and infrastructure.

Table 1: Hazard Mitigation Planning Team

NAME	TITLE	JURISDICTION
Clint Bethell	General Manager	McCook Public Power District
Kyle Wilcox	Administrative Services and Finance Manager	McCook Public Power District
Scott Farber	Operations Manager	McCook Public Power District
Josh Beideck	Engineering Manager	McCook Public Power District
Josh Kautz	IT Manager	McCook Public Power District
*Phil Luebbert	Project Manager	JEO Consulting Group
*Mary Baker	Resilience Strategist	JEO Consulting Group
*Kayla Vondracek	Planning Intern	JEO Consulting Group

Figure 1: Map of Planning Area



Goals and Objectives

The potential for disaster losses and the probability of occurrence of natural and human-caused hazards present a significant concern for the jurisdiction in this plan update. The driving motivation behind the update of this hazard mitigation plan is to reduce vulnerability and the likelihood of impacts to the health, safety, and welfare of all citizens in the planning area. To this end, the Planning Team reviewed and approved goals which helped guide the process of identifying specific mitigation strategies and projects that will, when implemented, reduce their vulnerability and help build a stronger, more resilient district.

Goals from the 2014 HMP were reviewed, and the Planning Team agreed that they are still relevant and applicable for this plan update. Jurisdictions that participated in this plan update agreed that the goals identified in 2014 would be carried forward and utilized for the 2020 plan. The goals for this plan update are as follows:

Goal 1: Protect the Health and Safety of Customers (overall intent of the plan)
Objective 1.1: Provide a safe source of electricity to customers in the MPPD and keep the general public safe.

Goal 2: Protect the MPPD Transmission/ Distribution System
Objective 2.1: Improve all components of the electrical transmission and distribution system District-wide.

Objective 2.2: Provide a fully reliable and safe source of electricity to customers in the MPPD service area.

Goal 3: Reduce Future Losses from Hazard Events
Objective 3.1: Provide service to customers through existing structures, critical facilities, and other vital services in addition to future developments.

Objective 3.2: Minimize and control the impact of hazard events on the existing electrical system.

Objective 3.3: Perform regular upgrades of lines and equipment.

Objective 3.4: Ensure an adequate communication system is available during a hazard event.

Objective 3.5: Ongoing effort to upgrade the district's system with maintenance and replacement as well as the development of a four-year work plan for critical means to upgrade.

Objective 3.6: Use of FEMA guidelines and the National Electric Safety Code.

Objective 3.7: Coordinate MPPD efforts with local, regional, and state planning efforts.

Objective 3.8: Increase business continuity planning to reduce/eliminate service interruptions.

Goal 4: Increase Public Awareness and Educate Customers on the Vulnerability to Hazards
Objective 4.1: Develop and provide information on an ongoing basis to customers about the types of hazards, potential effects they can be exposed to after the occurrence of a hazard, and how they can be better prepared.

Summary of Changes

The hazard mitigation planning process undergoes several changes during each plan update to best accommodate the planning area and specific conditions. The most significant changes from the 2014 Hazard Mitigation Plan to this update were in relation to the planning process and risk assessment methodology.

Due to the COVID-19 outbreak, some changes to the planning process were necessitated to minimize delays while still meeting federal requirements. Most project meetings were held via an online and phone format rather than in-person public workshop meetings, to best protect residents and staff members in the planning area. Additional changes to the planning process are described in Section Two.

The 2014 McCook Public Power District Hazard Mitigation Plan utilized the HIRA information from the 2014 State of Nebraska Hazard Mitigation Plan to inform the plan's risk assessment. The District was unable to replicate this methodology for the current update as the State utilized a different method of assessment for the 2019 State of Nebraska Hazard Mitigation Plan update, and some of the hazards identified in this planning process were not profiled in the 2019 plan update. Therefore, this plan utilizes a methodology similar to many local hazard mitigation plans in the State of Nebraska, by capitalizing on the local data known for this planning district. See Section Four: Risk Assessment for more information about this plan's risk assessment methodology.

In Nebraska, public power districts are considered a 'quasi-state government' entity and historically submit individual mitigation plans as an annex to the Nebraska State Hazard Mitigation Plan. The State Plan is developed and maintained by the Nebraska Emergency Management Agency which is charged by state statute to reduce the vulnerabilities to the people and communities of the damage, injury, and loss of life and property resulting from natural, technological, or man-made disasters and emergencies. Since the public power districts were not included in the 2019 State of Nebraska HMP update, the McCook Public Power District sought to develop their plan update to maintain eligibility for FEMA grant programs. This plan will serve as a standalone plan with the ability to join the State of Nebraska HMP as an annex at a later date.

McCook Public Power District chose to adopt the plan by resolution to create 'individual ownership' of the plan by the District. Formal adoption provides evidence of the District's full commitment to implement the plan's goals, objectives, and action items, and authorizes the appropriate parties to perform their responsibilities.

The District is responsible to implement and update the plan within five years. In addition, the plan will need to be reviewed annually and updated as appropriate, including when a hazard event occurs that significantly affects the area.

Hazard Profiles

The hazard mitigation plan includes a description of the hazards considered, including a risk and vulnerability assessment. Data considered during the risk assessment process includes: historic occurrences and recurrence intervals; historic losses (physical and monetary); impacts to the built environment (including privately-owned structures as well as critical facilities); and the local risk assessment. The following tables provide an overview of the risk assessment for each hazard and the losses associated with each hazard within the counties of Hitchcock, Frontier, and Red Willow. See Section Four for an explanation of this methodology.

Table 2: Hazard Occurrences

Hazard	Previous Occurrence Events/Years	Approximate Annual Probability	Likely Extent
Agricultural Animal Disease	28/6	100%	~1 animal per event
Agricultural Plant Disease	45/20	100%	Crop Damage or Loss
Dam Failure	7/109	6%	Some inundation of structures (<1% of structures) and roads
Drought	434/1,489 months of drought	29%	D1-D2
Extreme Heat	Avg 9 days per year >100°F	100%	>100°F
Flooding	52/28	100%	Some inundation of structures (<1% of structures) and roads near streams. Some evacuations of people may be necessary (<1% of population)
Severe Thunderstorms	955/24	100%	≥1.5” rainfall Avg 57 mph winds; Hail range 0.75-4.5” (H2-H4); average 1.21”
Severe Winter Storms	144/24	100%	0.25” – 1.5” Ice 5°-40° below zero (wind chill) 2-29” snow 15-68 mph winds
Terrorism	1/47	<2%	Varies by event
Tornadoes & High Winds	154/24	100%	Avg: EF0 Range EF0-EF3 Avg 52 mph; Range 35-65 Estimated Gust
Transportation Incidents	Auto: 4,058/12	100%	Damages incurred to vehicles involved and traffic delays. Substantial damages to aircrafts involved with some aircrafts destroyed.
	Aviation: 17/57	30%	
	Highway Rail: 58/43	100%	
Wildfire	514/18	100%	Avg 85 acres Some homes and structures threatened or at risk

Table 3: Hazard Loss History

Hazard Type		Count	Property	Crop[2]
Agricultural Disease	Animal Disease[1]	14	28 animals	N/A
	Plant Disease[2]	45	N/A	$412,393
Dam Failure[5,6]		7	N/A	N/A
Drought[7]		434/1,498 months	N/A	$201,334,371
Extreme Heat[8]		Avg 9 days per year	N/A	$23,760,077
Flooding[9]	Flash Flood	46	$1,270,000	$112,746
	Flood	6	$200,000	
Severe Thunderstorms[9] *5 injuries* *1 fatality*	Hail	687	$4,420,200	$5,868,785
	Heavy Rain	1	$0	
	Lightning	8	$21,750	
	Thunderstorm Wind	259	$12,357,550	
Severe Winter Storms[9]	Blizzard	31	$72,000	$18,128,711
	Extreme Cold/Wind Chill	12	$0	
	Heavy Snow	31	$0	
	Ice Storm	0	$0	
	Winter Storm	61	$60,000	
	Winter Weather	9	$60,000	
Terrorism[10]		1	$0	N/A
Tornadoes and High Winds[9]	High Winds	110	$124,000	$4,722,780
	Tornadoes	44	$1,864,500	
Transportation Incidents *1,073 injuries* *67 fatalities*	Auto[11]	4,058	N/A	N/A
	Aviation[12]	17	N/A	
	Highway Rail[13]	58	$340,050	
Wildfire[14] *4 injuries* *1 fatality*		514	21,647 acres	$147,216
Total		**6,070**	**$20,847,990**	**$254,487,080**

N/A: Data not available
1 NDA (2014-2019)
2 USDA RMA (2000- October 2019)
3 NRC (1990-February 2020)
4 PHSMA (1971-June 2020)
5 Stanford NPDP (1911-2020)
6 DNR Dam Inventory, Accessed July 2020
7 NOAA (1895- October 2019)
8 NOAA (1897-June 2020)
9 NCEI (1996- December 2019)
10 University of Maryland (1970-2018)
11 NDOT (2006-2018)
12 NTSB (1962-2019)
13 FRA (1975-2018)
14 NFS (2000-2018)

Mitigation Strategies

There are a wide variety of strategies that can be used to reduce the impacts of hazards for the built environment and planning area. *Section Five: Mitigation Strategy* shows the mitigation actions chosen by MPPD to prevent future losses.

SECTION ONE
INTRODUCTION

Hazard Mitigation Planning

FEMA definition of Hazard Mitigation

"Any sustained action taken to reduce or eliminate the long-term risk to human life and property from [natural] hazards."

Severe weather and hazardous events are becoming a more common occurrence in our daily lives. Pursuing and completing mitigation strategies reduces risk and is a socially and economically responsible action to prevent long-term risks from natural and human-caused hazard events.

Natural hazards, such as severe winter storms, high winds and tornadoes, severe thunderstorms, flooding, extreme heat, drought, agriculture diseases, and wildfires are part of the world around us. Human-caused hazards are a product of the society and can occur with significant impacts to communities. Human-caused hazards can include dam failure, hazardous materials release, transportation incidents, and terrorism. These hazard events can occur as a part of normal operations or as a result of human error. All jurisdictions within the planning area are vulnerable to a wide range of natural and human-caused hazards that threaten the safety of residents, and have the potential to damage or destroy both public and private property, cause environmental degradation, or disrupt the local economy and overall quality of life.

The McCook Public Power District (MPPD) Hazard Mitigation Plan is an effective means to incorporate hazard mitigation principles and practices into the day-to-day activities of the District, the Manager, and the Board of Directors. This plan recommends specific actions designed to protect customers, employees, as well as MPPD assets from those hazards that pose the greatest risk. Identified mitigation actions go beyond recommending specific structural solutions to reduce existing vulnerabilities, to include non-structural solutions that address the district's risk as a whole. This plan demonstrates a regional commitment to reducing risks from hazards and serves as a tool to help decision makers establish mitigation activities and recovery resources. Further, this plan was developed to enable MPPD to be eligible for federal pre-disaster funding programs while accomplishing the following objectives:

- Minimize the disruption to the district following a disaster.
- Establish actions to reduce or eliminate future damages in order to efficiently recover from disasters.
- Investigate, review, and implement activities or actions to ensure disaster related hazards are addressed by the most efficient and appropriate solution.
- Educate customers about potential hazards.
- Facilitate development and implementation of hazard mitigation management activities to ensure a sustainable district.

Disaster Mitigation Act of 2000

The U.S. Congress passed the Disaster Mitigation Act 2000 to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act[1]. Section 322 of the DMA 2000 requires that state and local governments develop, adopt, and routinely update a hazard mitigation plan to remain eligible for pre- and post-disaster mitigation funding.[2] These funds include the Hazard Mitigation Grant Program (HMGP)[3], Building Resilient Infrastructure and Communities (BRIC)[4], and the Flood Mitigation Assistance Program (FMA)[5]. The Federal Emergency Management Agency (FEMA) administers these programs under the Department of Homeland Security (DHS).[6]

This plan was developed in accordance with current state and federal rules and regulations governing local hazard mitigation plans. The plan shall be monitored and updated on a routine basis to maintain compliance with the legislation – Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the DMA 2000 (P.L. 106-390)[7] and by FEMA's Final Rule (FR)[8] published in the Federal Register on November 30, 2007, at 44 Code of Federal Regulations (CFR) Part 201.

Hazard Mitigation Assistance

On June 1, 2009, FEMA initiated the Hazard Mitigation Assistance (HMA) program integration, which aligned certain policies and timelines of the various mitigation programs. These HMA programs present a critical opportunity to minimize the risk to individuals and property from hazards while simultaneously reducing the reliance on federal disaster funds.[9]

Each HMA program was authorized by separate legislative actions, and as such, each program differs slightly in scope and intent.

> **Mitigation** is the cornerstone of emergency management. Mitigation focuses on breaking the cycle of disaster damage, reconstruction, and repeated damage. Mitigation lessens the impact disasters have on people's lives and property through damage prevention, appropriate development standards, and affordable flood insurance. Through measures such as avoiding building in damage-prone areas, stringent building codes, and floodplain management regulations, the impact on lives and communities is lessened.
>
> - FEMA Mitigation Directorate

- HMGP: To qualify for post-disaster mitigation funds, local jurisdictions must have adopted a mitigation plan that is approved by FEMA. HMGP provides funds to states, territories, Indian tribal governments, local governments, and eligible private non-profits following a presidential disaster declaration. The DMA 2000 authorizes up to seven percent of HMGP funds available to a state after a disaster to be used for the development of state, tribal, and local mitigation plans.

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1 Federal Emergency Management Agency, Public Law 106-390. 2000. "Disaster Mitigation Act of 2000." Last modified September 26, 2013. https://www.fema.gov/media-library/assets/documents/4596.

2 Federal Emergency Management Agency. June 2007. "Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and Related Authorities." Federal Emergency Management Agency 592: 22. Sec. 322. Mitigation Planning (42 U.S.C. 5165). https://www.fema.gov/media-library/assets/documents/15271

3 Federal Emergency Management Agency. "Hazard Mitigation Grant Program." Last modified July 8, 2017. https://www.fema.gov/hazard-mitigation-grant-program.

4 Federal Emergency Management Agency. "Building Resilient Infrastructure and Communities." Last modified July 10, 2020. https://fema.gov/bric.

5 Federal Emergency Management Agency. "Flood Mitigation Assistance Grant Program." Last modified July 11, 2017. https://www.fema.gov/flood-mitigation-assistance-grant-program.

6 Federal Emergency Management Agency. "Hazard Mitigation Assistance." Last modified March 29, 2017. https://www.fema.gov/hazard-mitigation-assistance.

7 Federal Emergency Management Agency: Federal Register. 2002. "Section 104 of Disaster Mitigation Act 2000: 44 CFR Parts 201 and 206: Hazard Mitigation Planning and Hazard Mitigation Grant Programs; Interim Final Rule." https://www.fema.gov/pdf/help/fr02-4321.pdf.

8 Federal Emergency Management Agency: Federal Register. 2002 "44 CFR Parts 201 and 206: Hazard Mitigation Planning and Hazard Mitigation Grant Programs; Interim Final Rule." https://www.fema.gov/pdf/help/fr02-4321.pdf.

- FMA: To qualify to receive grant funds to implement projects such as acquisition or elevation of flood-prone homes, local jurisdictions must prepare a mitigation plan. Furthermore, local jurisdictions must be a participating community in good standing in the National Flood Insurance Program (NFIP). The goal of FMA is to reduce or eliminate flood risks and claims under the NFIP.
- BRIC: To qualify for funds, local jurisdictions must adopt a mitigation plan that is approved by FEMA. BRIC assists states, territories, Indian tribal governments, and local governments in implementing a sustained pre-disaster hazard mitigation program. Specifics of these programs are outlined in the FEMA hazard mitigation assistance guidance, as well as the Notice of Funding Opportunity, NOFO, that is released with each year's grant opportunity.

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SECTION TWO
PLANNING PROCESS

Introduction

The process utilized to develop a hazard mitigation plan is often as important as the final planning document. For this planning process, MPPD adapted the four-step hazard mitigation planning process outlined by FEMA to fit the needs of their District. The following pages will outline how the Planning Team was established; the function of the Planning Team; critical project meetings; outreach efforts to the general public; key stakeholders and neighboring jurisdictions; general information relative to the risk assessment process; general information relative to capabilities; plan review and adoption; and ongoing plan maintenance.

Hazard Mitigation Planning Process

The hazard mitigation planning process as outlined by FEMA has four general steps which are detailed in the figure below. The mitigation planning process rarely follows a linear progression. It's common that ideas developed during the initial assessment of risks may need revision later in the process, or that additional information may be identified while developing the mitigation plan or during the implementation of the plan that results in new goals or additional risk assessments.

Organization of Resources

- Focus on the resources needed for a successful mitigation planning process. Essential steps include: Organizing interested community members; and Identifying technical expertise needed.

Assessment of Risk

- Identify the characteristics and potential consequences of the hazard. Identify how much of the jurisdiction can be affected by specific hazards and the potential impacts on local assets.

Mitigation Plan Development

- Determine priorities and identify possible solutions to avoid or minimize the undesired effects. The result is the hazard mitigation plan and strategy for implementation.

Plan Implementation and Progress Monitoring

- Bring the plan to life by implementing specific mitigation projects and changing day-to-day operations. It is critical that the plan remains relevant to succeed. Thus, it is important to conduct periodic evaluations and revisions, as needed.

Organization of Resources

Plan Update Process

JEO Consulting Group, INC. (JEO) was contracted in March 2020 to guide and facilitate the planning process and assemble the hazard mitigation plan. MPPD and JEO staff then established the Hazard Mitigation Planning Team. This Planning Team guided the planning process and reviewed the existing plan. A list of Planning Team members can be found in Table 4, and these members attended all project meetings.

Table 4: Hazard Mitigation Planning Team

Name	Title	Jurisdiction
Clint Bethell	General Manager	McCook Public Power District
Kyle Wilcox	Administrative Services and Finance Manager	McCook Public Power District
Scott Farber	Operations Manager	McCook Public Power District
Josh Beideck	Engineering Manager	McCook Public Power District
Josh Kautz	IT Manager	McCook Public Power District
*Phil Luebbert	Project Manager	JEO Consulting Group
*Mary Baker	Resilience Strategist	JEO Consulting Group
*Kayla Vondracek	Planning Intern	JEO Consulting Group

**Served as a consultant or advisory role*

A kick-off meeting was held on April 2nd, 2020 to discuss an overview of the planning process between JEO staff and the Planning Team. Preliminary discussion was held regarding hazards to be included in this plan, changes to be incorporated since the last plan, goals and objectives, identification of key stakeholders to include in the planning process, and a general schedule for the plan update. This meeting also assisted in clarifying the role and responsibilities of the Planning Team and strategies for public engagement throughout the planning process.

Due to the COVID-19 outbreak, the kick-off meeting and following Round 1 meeting were held via an online and phone format rather than in-person public workshop meeting. This was done to best protect the health of residents and staff members in the planning area and to help reduce the spread of the virus. Table 5 shows the date, location, and agenda items of for the Kick-off Meeting.

Table 5: Kick-off Meeting Location and Time

Location and Time	Agenda Items
Zoom Meeting April 2nd, 2020 9:30am	-Consultant and Planning Team Responsibilities -Overview of plan update process and changes from 2014 HMP -Review and adoption of goals and objectives -Dates/Locations for meetings -Plan Goals/Objectives -Identification of regional hazards to discuss in the HMP

Engagement and Outreach

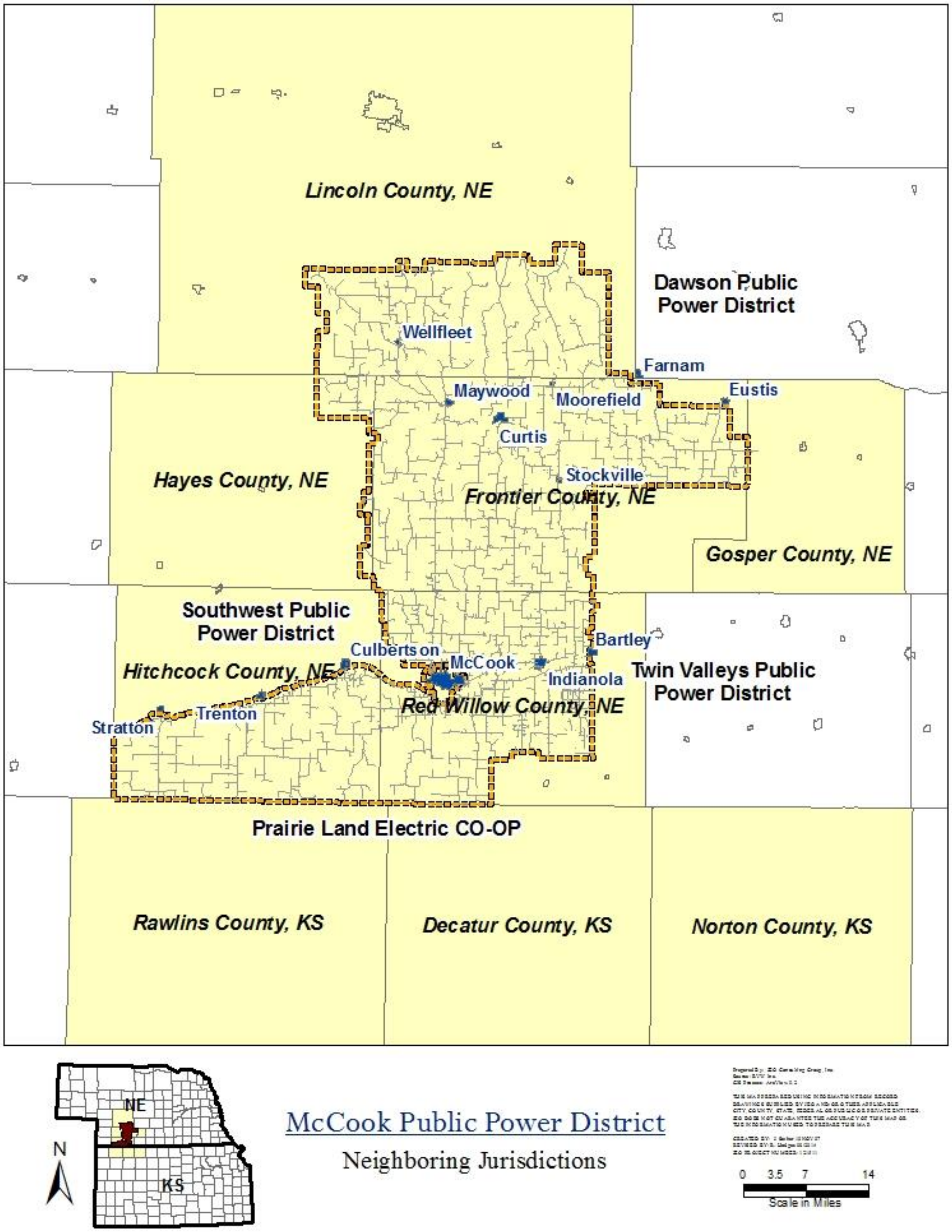
All counties, cities, and villages served by the District as well as neighboring jurisdictions including communities, counties, and public power districts were notified of the plan update effort via letters and phone calls. Invitation and informational letters were sent to county clerks, county emergency managers, and public power districts. The Planning Team also provided regular updates to the MPPD Board of Directors during their public meetings. There was no formal participation from any neighboring jurisdiction. Figure 2 displays the neighboring jurisdictions that were notified throughout the planning process.

Table 6 provides a summary of outreach activities utilized in this process.

Table 6: Outreach Activity Summary

Action	Intent
Project Announcement Press Release	Project announcement shared with local media outlets
District Newsletter	Article in quarterly newsletter sent to all District customers included a description of the project purpose, process, timeline, and an invitation to provide input.
Notification Phone Calls	Staff called neighboring jurisdictions and stakeholders to invite them to participate in the planning process.
Word-of-Mouth	Staff discussed the plan with stakeholders and neighboring jurisdictions throughout the planning process
Board Meetings	Staff provided updates to the Board of Directors during their public meetings.

Figure 2: Neighboring Jurisdictions



Assessment of Risk

Round 1 Meetings: Hazard Identification

At the Round 1 meeting, MPPD reviewed the hazards identified at the kick-off meeting and conducted risk and vulnerability assessments based on these hazards' previous occurrence and the planning areas' exposure. (For a complete list and overview of hazards reviewed, see *Section Four: Risk Assessment.)*.

Table 7: Round 1 Meeting Date and Location

Location and Time	Agenda Items
Zoom Meeting June 4th, 2020 10:00am	General overview of the HMP plan update process, discuss plan requirements, begin the process of risk assessment and impact reporting, update critical facilities, discuss the capability assessment, and status update on current mitigation projects

This meeting and follow up correspondence familiarized planning team members with the plan update process, expected actions for the coming months, the responsibilities of the Planning Team, and to collect preliminary information to update the HMP. Data collected at these meetings included: updates to mitigation actions from the 2014 MPPD HMP; review, confirm, or update hazards of top concern. Information and data reviewed includes but was not limited to: local hazard prioritization results; and identified critical facilities.

Mitigation Plan Development

Round 2 Meetings: Mitigation Strategies

The identification and prioritization of mitigation measures is an essential component in developing effective hazard mitigation plans. At the Round 2 meeting and follow up correspondence, the Planning Team identified new mitigation actions in addition to the mitigation actions continued from the 2014 HMP. The Planning Team was also asked to review the information collected from the Round 1 meeting related to their District through this planning process and discuss plan integration.

There was also a brief discussion about the planning process, when the plan would be available for public review and comment, and the sub-grant application process once the plan was approved. Although this meeting was held in-person, social distancing protocols were used, and no physical sign-in sheet was utilized to minimize the risk of COVID-19 spread.

Table 8: Round 2 Meeting Date and Location

<table>
<tr><th colspan="2">Agenda Items</th></tr>
<tr><td colspan="2">Identify new mitigation actions, review of local data and plan process, discuss review process, discuss plan integration and finalize capability assessment.</td></tr>
<tr><th>Location and Time</th><th>Date</th></tr>
<tr><td>McCook PPD Office</td><td>Wednesday, August 26, 2020</td></tr>
</table>

Data Sources and Information

Effective hazard mitigation planning requires the review and inclusion of a wide range of data, documents, plans, and studies. The following table identifies many of the sources utilized during this planning process.

Table 9: General Plans, Documents, and Information

Documents	
Disaster Mitigation Act of 2000 DMA https://www.fema.gov/media-library/assets/documents/4596?id=1935	Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (2013) https://www.fema.gov/media-library/assets/documents/30627
Final Rule (2015) https://www.fema.gov/emergency-managers/risk/hazard-mitigation/regulations-guidance/archive	National Flood Insurance Program Community Status Book (2020) https://www.fema.gov/national-flood-insurance-program-community-status-book
Hazard Mitigation Assistance Unified Guidance (2015) https://www.fema.gov/media-library/assets/documents/103279	National Response Framework (2019) https://www.fema.gov/media-library/assets/documents/117791
Hazard Mitigation Assistance Guidance and Addendum (2015) https://www.fema.gov/media-library/assets/documents/103279	Robert T. Stafford Disaster Relief and Emergency Assistance Act (2019) https://www.fema.gov/media-library/assets/documents/15271
Local Mitigation Plan Review Guide (2011) https://www.fema.gov/media-library/assets/documents/23194	The Census of Agriculture (2012) https://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Nebraska/
Local Mitigation Planning Handbook (2013) https://www.fema.gov/media-library/assets/documents/31598	What is a Benefit: Guidance on Benefit-Cost Analysis on Hazard Mitigation Projects http://www.fema.gov/benefit-cost-analysis
Plans and Studies	
McCook Public Power District Hazard Mitigation Plan (2014)	National Climate Assessment (2014) https://nca2014.globalchange.gov/
Flood Insurance Studies http://www.fema.gov/floodplain-management/flood-insurance-study	Nebraska Drought Mitigation and Response Plan (2000) http://carc.nebraska.gov/docs/NebraskaDrought.pdf
Fourth National Climate Assessment (2018) https://nca2018.globalchange.gov/	State of Nebraska Hazard Mitigation Plan (2019) https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmitplan2019.pdf
Data Sources/Technical Resources	
Arbor Day Foundation – Tree City Designation https://www.arborday.org/	Nebraska Department of Natural Resource – Geographic Information Systems (GIS) https://dnr.nebraska.gov/data
Environmental Protection Agency - Chemical Storage Sites https://myrtk.epa.gov/info/search.jsp	Nebraska Department of Natural Resources http://www.dnr.ne.gov
Federal Emergency Management Agency http://www.fema.gov	Nebraska Department of Natural Resources – Dam Inventory http://prodmaps2.ne.gov/html5DNR/?viewer=daminventory
FEMA Flood Map Service Center https://msc.fema.gov/portal/advanceSearch	Nebraska Department of Revenue – Property Assessment Division www.revenue.ne.gov/PAD
High Plains Regional Climate Center	Nebraska Department of Transportation

http://climod.unl.edu/	http://dot.nebraska.gov/
National Agricultural Statistics Service http://www.nass.usda.gov/	Nebraska Emergency Management Agency http://www.nema.ne.gov
National Centers for Environmental Information https://www.ncei.noaa.gov/	Nebraska Forest Service – Wildland Fire Protection Program http://nfs.unl.edu/fire
National Consortium for the Study of Terrorism and Responses to Terrorism (START) http://www.start.umd.edu/gtd/	Nebraska Forest Service (NFS) http://www.nfs.unl.edu/
National Drought Mitigation Center – Drought Impact Reporter http://droughtreporter.unl.edu/map/	Nebraska Public Power District https://www.nppd.com/
National Drought Mitigation Center – Drought Monitor http://droughtmonitor.unl.edu/	Nebraska State Historical Society http://www.nebraskahistory.org/histpres/index.shtml
National Environmental Satellite, Data, and Information Service http://www.nesdis.noaa.gov/	Stanford University - National Performance of Dams Program https://npdp.stanford.edu/
National Fire Protection Association https://www.nfpa.org/	Storm Prediction Center Statistics http://www.spc.noaa.gov
National Flood Insurance Program https://www.fema.gov/national-flood-insurance-program	United States Army Corps of Engineers – National Levee Database https://levees.sec.usace.army.mil/#/
National Flood Insurance Program https://dnr.nebraska.gov/floodplain/flood-insurance	United States Census Bureau http://www.census.gov
National Historic Registry https://www.nps.gov/subjects/nationalregister/index.htm	United States Census Bureau https://data.census.gov/cedsci/
National Oceanic Atmospheric Administration (NOAA) http://www.noaa.gov/	United States Department of Agriculture http://www.usda.gov
National Weather Service http://www.weather.gov/	United States Department of Agriculture – Risk Assessment Agency http://www.rma.usda.gov
Natural Resources Conservation Service www.ne.nrcs.usda.gov	United States Department of Agriculture – Web Soil Survey https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
Nebraska Association of Resources Districts http://www.nrdnet.org	United States Department of Commerce http://www.commerce.gov/
Nebraska Climate Assessment Response Committee http://carc.agr.ne.gov	United States Department of Transportation – Pipeline and Hazardous Materials Safety Administration https://www.phmsa.dot.gov/
Nebraska Department of Education http://nep.education.ne.gov/	United States Geological Survey http://www.usgs.gov/
Nebraska Department of Education http://educdirsrc.education.ne.gov/	United States National Response Center https://nrc.uscg.mil/
Nebraska Department of Environmental Quality http://www.deq.state.ne.us/	United States Small Business Administration http://www.sba.gov
Nebraska Department of Health and Human Services http://dhhs.ne.gov/Pages/default.aspx	UNL – College of Agricultural Sciences and Natural Resources – Schools of Natural Resources http://casnr.unl.edu

Public Review

Once the draft of the HMP was completed, a public review period was opened to allow for stakeholders, neighboring jurisdictions, and the public at large to review the final draft plan and provide comments and changes. The HMP was made available to download the document on the District's website. Received comments and suggested changes were incorporated into the plan.

Plan Adoption

This hazard mitigation plan will be formally adopted by MPPD through approval of a resolution. This approval will create individual ownership of the plan by the district. Formal adoption provides evidence of MPPD's full commitment to implementing the plan's goals, objectives, and action items. A copy of the resolution to be submitted by MPPD is located in *Appendix B*.

Once adopted, MPPD will be responsible for implementing the plan and updating it every five years. The General Manager and Board of Directors would be the logical champions for updating the plan. In addition, the plan will need to be reviewed and updated annually or when a hazard event occurs that significantly affects the area.

Plan Implementation and Progress Monitoring

Hazard mitigation plans are living documents, and as such, they must be monitored, evaluated, and updated on a five-year or less cycle. This includes incorporating the mitigation plan into other district plans as they stand or are developed. *Section Six* describes the system that MPPD has established to monitor the plan; provides a description of how, when, and by whom the HMP process and mitigation actions will be evaluated; presents the criteria used to evaluate the plan; and explains how the plan will be maintained and updated.

SECTION THREE
PLANNING AREA PROFILE

Introduction

To identify jurisdictional vulnerabilities, it is vitally important to understand the people and built environment of the planning area. The following section is meant to provide an overall profile description of the characteristics of the planning area.

Planning Area Summary

McCook Public Power District is a political subdivision of the State of Nebraska. Established in 1935, the District provides electrical service to customers in Frontier, Hitchcock, Lincoln, Red Willow, and portions of Hayes and Gosper Counties in southwestern Nebraska. Figure 1 displays the District's 2,800 square mile service area. The District headquarters are located in McCook, Nebraska. The District purchases wholesale energy from Nebraska Public Power District and delivers power through 13 substations to their customers. Some of the rural substations feed small communities through a designated circuit. Table 10: McCook Public Power District Customers 2004-2010summarizes the District customers, by type, from 2004 to 2020.

Rural distribution primary voltages are 7.2 KV (1 phase) and 7.2/12.5 KV (3 phase) line to line. Overall, the District services and maintains 2,379 miles of line consisting of 1,945 miles of overhead distribution, 435 miles of underground distribution, and 153 miles of sub-transmission line which is 69KV line to line. Installed conductor sizes range from 6 A to 795 ACSR. It is estimated that 40 percent of the distribution/ transmission system is 30 years of age or older. The District has approximately 20 percent of the distribution system underground as of 2020.

McCook Public Power District is a current member of the Nebraska Rural Electric Association.

Table 10: McCook Public Power District Customers 2004-2010

Customer Type	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Residential	1,854	1,884	1,905	1,925	1,925	1,938	1,961	1,972	1,674	1,989
Seasonal	1,606	1,616	1,624	1,629	1,651	1,658	1,664	1,660	1,684	1,695
Irrigation	808	801	785	787	796	789	790	803	819	857
Commercial	292	295	284	283	287	271	276	289	296	296
Large Commercial	2	2	2	2	2	2	2	2	2	2
Street Lighting	9	9	9	9	9	9	8	8	8	8
Other Sales Public	38	38	38	37	39	37	32	30	32	31
Resale	2	2	2	2	2	2	2	2	2	2
Total Customers	**4,611**	**4,647**	**4,649**	**4,674**	**4,711**	**4,706**	**4,735**	**4,766**	**4,815**	**4,880**

Customer Type	2014	2015	2016	2017	2018	2019	2020
Residential	2016	2024	2032	2022	2014	2007	2011

Seasonal	1699	1703	1711	1721	1720	1729	1733
Irrigation	895	908	925	929	940	942	941
Commercial	306	301	302	310	312	320	311
Large Commercial	2	2	2	2	2	2	2
Street Lighting	8	8	8	8	8	8	8
Other Sales Public	30	30	30	29	29	30	30
Resale	2	2	2	2	2	2	2
Total Customers	**4958**	**4978**	**5012**	**5023**	**5027**	**5040**	**5038**

Source: McCook Public Power District, 2020

Infrastructure Inventory

As a component of the plan update, the District's existing electrical infrastructure was reviewed and evaluated by the planning team. The inventory includes substations, number of services per substation, linear feet and miles of distribution line, and types of electrical service (single-phase, three phase, above and underground). The infrastructure inventory provided valuable information on the vulnerability and potential losses to the District. Figure 3 displays the sub-transmission and distribution system for the District.

Table 11: McCook Public Power District Substation Service

Substation Number	Substation Name	Number of Services	Line (Feet)	Line (Miles)
1	McCook	889	1,921,920	364
2	Maywood	235	1,172,160	222
3	Airbase	480	1,108,800	210
4	Stockville	222	696,960	132
6	Trenton	656	1,393,920	264
7	Cedar	412	411,840	78
8	Sleepy Hallow	250	543,840	103
9	Radar	124	253,440	48
10	Moorefield	459	1,393,920	264
11	Farnam	273	824,240	158
13	Indianola	358	1,193,280	226
15	Wellfleet	383	1,003,200	190
16	Quick	237	633,600	120
Total Network	**--**	**5,038**	**12,561,120**	**2,379**

NOTE: All substations are 69 to 7.2/12.5 KV
Source: McCook Public Power District, 2020

Table 12: McCook Public Power District Distribution Line Breakdown 7.2/12.5 KV

Distribution Line Type	Number of Services	Line (Miles)
Single Phase	3,697	1,407
Three Phase	1,224	952
Overhead	3,393	1,951
Underground	1,527	408
Single Phase Overhead	2,690	1,272
Single Phase Underground	1006	127
Three Phase Overhead	703	696
Three Phase Underground	521	284
Total Network	**4,920**	**2,379**

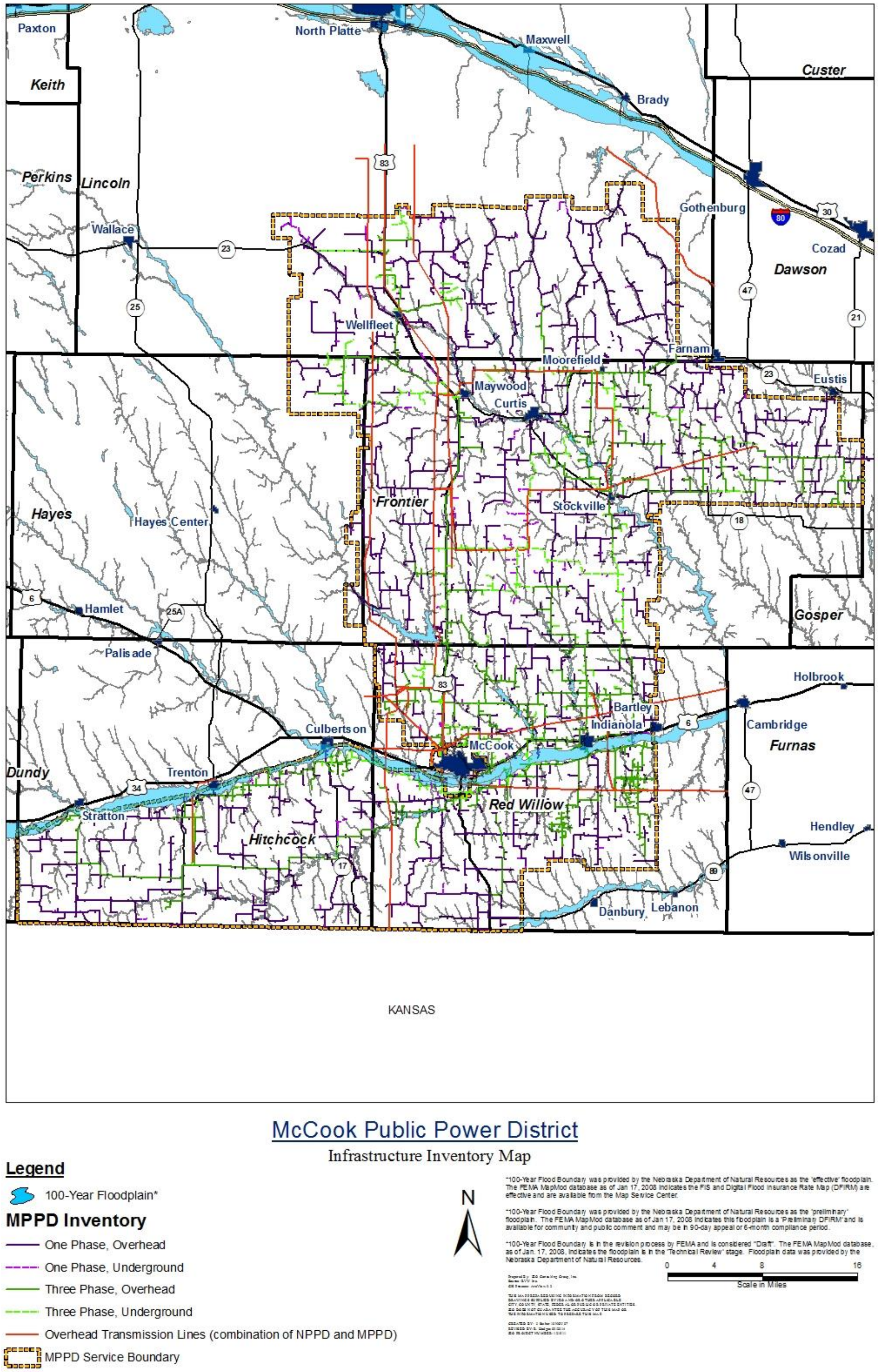
Source: McCook Public Power District, 2020

Table 13: McCook Public Power District Transmission Line Breakdown 69 KV

Transmission Line Type	Number of Services	Line (Feet)	Line (Miles)
Three Phase	4,735	807,840	153

Source: McCook Public Power District, 2020

Figure 3: McCook Public Power District Infrastructure



Critical Facilities

The planning team reviewed and evaluated critical facilities as a component of the plan update. Critical facilities were defined as essential for the distribution and transmission of electricity to customers. Critical infrastructure includes 13 substations, four communications towers, and the District headquarters building. Figure 4 displays the location of each critical facility.

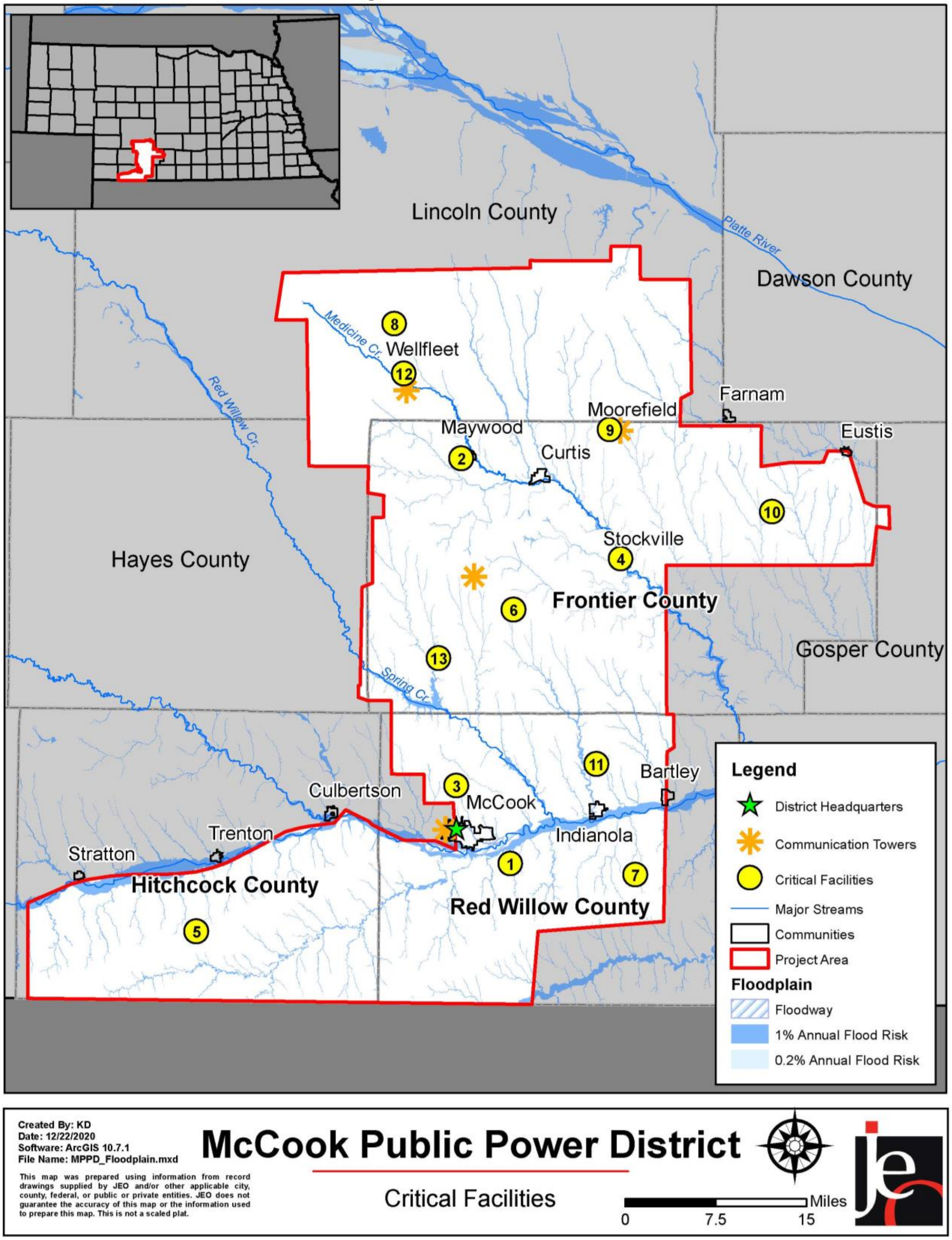
The City of Indianola, Nebraska is served via a wholesale agreement through the District. Indianola is served through approximately five miles of three phase 7.2/12.5 KV distribution line to a 7.2/12.5 KV metering point at the west edge of the City. This particular substation has a dedicated circuit to supply electricity to the City.

The District also has several customers that require utilization of life sustaining equipment and depend heavily on the continuity of service. The District maintains a list of these customers and their locations within the service area.

Demographics and At-Risk Populations

The planning area includes communities and unincorporated areas within Frontier, Gosper, Hayes, Hitchcock, Lincoln, and Red Willow Counties. Please refer to the Hitchcock, Hayes, and Frontier Hazard Mitigation Plan, Quad Counties Hazard Mitigation Plan, and Twin Platte NRD Hazard Mitigation Plan for summaries of demographics and vulnerable populations within these communities.

Figure 4: Critical Facilities



SECTION FOUR
RISK ASSESSMENT

Introduction

The ultimate purpose of this hazard mitigation plan is to minimize the loss of life and property across the planning area. The basis for the planning process is the regional and local risk assessment. This section contains a description of potential hazards, regional vulnerabilities and exposures, probability of future occurrences, and potential impacts and losses. By conducting a regional and local risk assessment, MPPD can develop specific strategies to address areas of concern identified through this process. The following table defines terms that will be used throughout this section of the plan.

Table 14: Term Definitions

Term	Definition
Hazard	A potential source of injury, death, or damages.
Asset	People, structures, facilities, and systems that have value to the community.
Risk	The potential for damages, loss, or other impacts created by the interaction of hazards and assets.
Vulnerability	Susceptibility to injury, death, or damages to a specific hazard.
Impact	The consequence or effect of a hazard on the community or assets.
Historical Occurrence	The number of hazard events reported during a defined period of time.
Extent	The strength or magnitude relative to a specific hazard.
Probability	Likelihood of a hazard occurring in the future.

Methodology

The risk assessment methodology utilized for this plan follows the risk assessment methodology outlined in the FEMA Local Mitigation Planning Handbook. This process consists of four primary steps: 1) Describe the hazard; 2) Identify vulnerable community assets; 3) Analyze risk; and 4) Summarize vulnerability.

When describing the hazard, this plan will examine the following items: previous occurrences of the hazard within the planning area; locations where the hazard has occurred in the past or is likely to occur in the future; extent of past events and likely extent for future occurrences; and probability of future occurrences. Analysis for regional risk will examine historic impacts and losses and what is possible should the hazard occur in the future. Risk analysis will include both qualitative (i.e. description of historic or potential impacts) and quantitative data (i.e. assigning values and measurements for potential loss of assets). Finally, each hazard identified the plan will provide a summary statement encapsulating the information provided during each of the previous steps of the risk assessment process.

For each of the hazards profiled the best and most appropriate data available will be considered. Further discussion relative to each hazard is discussed in the hazard profile portion of this section.

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

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

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

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

Requirement §201.6(c)(2)(ii): The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods.

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

Average Annual Damages and Frequency

FEMA *Requirement §201.6(c)(2)(ii) (B)* suggests that when the appropriate data is available, hazard mitigation plans should also provide an estimate of potential dollar losses for structures in vulnerable areas. This risk assessment methodology includes an overview of assets at risk and provides historic average annual dollar losses for all hazards for which historic event data is available. Additional loss estimates are provided separately for those hazards for which sufficient data is available. These estimates can be found within the relevant hazard profiles.

Average annual losses from historical occurrences can be calculated for those hazards for which there is a robust historic record and for which monetary damages are recorded. There are three main pieces of data used throughout this formula.

- Total Damages in Dollars: This is the total dollar amount of all property damages and crop damages as recorded in federal, state, and local data sources. The limitation to these data sources is that dollar figures usually are estimates and often do not include all damages from every event, but only officially recorded damages from reported events.
- Total Years of Record: This is the span of years there is data available for recorded events.
- Number of Hazard Events: This shows how often an event occurs. The frequency of a hazard event will affect how a community responds. A thunderstorm may not cause much damage each time, but multiple storms can have an incremental effect on housing and utilities. In contrast, a rare tornado can have a widespread effect on a community.

An example of the Event Damage Estimate is found below:

$$\textbf{Annual Frequency}\ (\#) = \frac{Total\ Events\ Recorded\ (\#)}{Total\ Years\ of\ Record\ (\#)}$$

$$\textbf{Annual Damages } (\$) = \frac{Total\ Damages\ in\ Dollars\ (\$)}{Total\ Years\ Recorded\ (\#)}$$

Data for all the hazards are not always available, so only those with an available dataset are included in the loss estimation.

Hazard Identification

The identification of relevant hazards for the planning area began with a review of the 2019 State of Nebraska Hazard Mitigation Plan. The Planning Team reviewed the list of hazards addressed in the state mitigation plan and determined which hazards were appropriate for discussion relative to the planning area. The hazards for which a risk assessment was completed are included in the following table.

Table 15: Hazards Addressed in the Plan

Hazards Addressed in the Plan		
Agricultural Disease	Flooding	Terrorism
Dam/Levee Failure	Power Failure	Tornadoes and High Winds
Drought	Severe Thunderstorms	Transportation Incidents
Extreme Heat	Severe Winter Storms	Wildfires

Hazard Elimination

Given the location and history of the planning area, several hazards from the 2014 MPPD HMP as well as the State HMP were eliminated from further review. These hazards are listed below with a brief explanation of why the hazards were considered but not profiled further.

- **Civil Disorder** – For the entire state, there have been a small number of civil disorder events reported, most date back to the 1960s and have occurred in the state's larger communities. The absence of civil unrest in recent years does not necessarily indicate there will not be events in the future, but there are other planning mechanisms in place to address this concern. This approach is consistent with the 2019 Nebraska State Hazard Mitigation Plan.

- **Earthquakes** – The planning team indicated earthquakes are not a hazard of top concern. The planning area has experienced three earthquakes since 1900. One occurred in Frontier County and two in Red Willow County. Due to the low probability of events and associated impacts this hazard is not fully profiled in this HMP.

- **Hazardous Materials Release (Chemical and Radiological)** – Although hazardous materials releases do have the potential to cause damages to MPPD property, the District believe the existing plans in place adequately address the hazard. This plan will reference the District SPCC plans when relevant.

- **Public Health Emergency** – Due to the Covid-19 pandemic in 2020, public health emergencies have now impacted the planning area, State of Nebraska, and United States as a whole. Although the pandemic had impacts in the planning area, MPPD was largely unaffected due to a smooth transition for employees to work remotely. The District will continue to evaluate this hazard for future inclusion in the HMP.

- **Landslides** – While there is data available related to landslides across the state, only one event has occurred within the planning area with no reported damages. The following table outlines the number of recorded landslide events that have occurred in the planning area. Landslides across the state have been highly localized and did not exceed local capabilities to respond. This approach is consistent with the 2019 Nebraska HMP.

Table 16: Known Landslides in the Planning Area by County

County	Number of Landslides	Total Estimated Damages
Frontier	0	$0
Hitchcock	1	$0
Red Willow	0	$0

Source: University of Nebraska-Lincoln, 2018[10]

- **Urban Fire -** Fire departments across the planning area have mutual aid agreements in place to address this threat, and typically this hazard is addressed through existing plans and resources. As such, urban fire will not be fully profiled for this plan. Discussion relative to fire will be focused on wildfire and the potential impacts they could have on the built environment. This approach is consistent with the 2019 Nebraska State Hazard Mitigation Plan.

Hazard Identification Changes

Additionally, some hazards from the 2014 MPPD HMP have been modified and combined to provide a more robust and interconnected discussion. Levee failure was not included in the previous HMP. The following hazards from the previous HMP have combined hazard profiles in the following section:

- Tornadoes and High Winds
- Severe Thunderstorms and Hail
- Dam Failure and Levee Failure

Hazard Assessment Summary Tables

The following table provides an overview of the data contained in the hazard profiles. Hazards listed in this table and throughout the section are in alphabetical order. This table is intended to be a quick reference for people using the plan and does not contain source information. Source information and full discussion of individual hazards are included later in this section.

Table 17: Hazard Identification

Hazard Type	Previous Occurrence	Probability of Future Occurrence	Vulnerability of Population	Vulnerability of Property	Impact on Local Economy
Ag. Animal Disease	Yes	High	Low	Low	Low-Medium
Ag. Plant Disease	Yes	High	Low	Low	Low-Medium
Dam/Levee Failure	Yes	Low	Low	Low	Low
Drought	Yes	High	Low	Low	Low

10 University of Nebraska-Lincoln. 2018. "Database of Nebraska Landslides." http://snr.unl.edu/data/geologysoils/landslides/landslidedatabase.aspx.

Extreme Heat	Yes	High	Low	Low	Low
Flooding	Yes	Medium	Low	Low	Low
Hazardous Materials Release	Yes	High	Low-Medium	Low	Low
Transportation Incidents	Yes	High	Low	Low	Low
Power Failure / Prolonged Power Outages	Yes	Low-Medium	Low	Low	Low
Severe Thunderstorms and Hail	Yes	High	High	Medium	Low
Severe Winter Storms	Yes	Medium	High	High	Medium
Terrorism	Yes	Low	Low	Low	Low
Tornadoes and High Winds	Yes	High	High	Medium	Low-Medium
Wildfire	Yes	High	Low	Low	Low

Table 18: Service Interruption by Ice, Lightning, and Severe Storms (Total Hours) displays the recorded number of hours service was interrupted due to ice, lightning, and other severe storm events between 1993 and 2020 as provided by the District. Severe storm events include flooding, high winds, and thunderstorms. The District has been installing a number of high voltage lightning arrestors since the mid-1960s and secondary meter arrestors since the mid-1980s to mitigate damages from lightning. MPPD defines service interruption as any loss of power that is reported. Total outage is calculated by determining the period of time service is out multiplied by the number of users impacted. For example, if power was out for 1 hour for 100 people the interruption would be quantified as an interruption of 100 hours.

Table 18: Service Interruption by Ice, Lightning, and Severe Storms (Total Hours)

Year	Ice	Lightning	Severe Storm	Year	Ice	Lightning	Severe Storm
1993	935	1,058	543	**2004**	0	136	0
1994	891,399	6,307	9,705	**2005**	25,322	640	0
1995	2,630	1,327	0	**2006**	11,530	290	154
1996	4,603	2,267	54	**2007**	359	1,649	5,680
1997	158	624	4,597	**2008**	0	1,375	436
1998	70	676	0	**2009**	2,827	1,059	597
1999	294	2,633	0	**2010**	253	217	1,731
2000	0	508	0	**2011**	0	4,181	4,410
2001	264	3,596	0	**2012**	281	325	1,492
2002	55	1,198	0	**2013**	3	838	3,412
2003	0	537	0	**Total 1993-2013**	**940,983**	**31,441**	**32,811**

During the plan update process, the Planning Team provided new information on service interruptions between 2014 and 2019. The information contained new causes to service interruption that were not included in the previous plan. Table 19 was created to include additional causes of power outages and displays the recorded number of hours service was interrupted due to ice, wind, lightning, severe storm, vehicles, aircraft, trees, and vandalism.

Table 19: Service Interruption by Cause (Total Hours)

Year	Ice	Wind	Lightning	Severe Storm	Vehicles	Aircraft	Trees	Vandalism
2014	0	1,739.25	1,418.50	8,723.50	36.50	16	208.50	0
2015	0	134	136.50	0	61.50	19	186.50	0
2016	76.5	278.75	304.50	0	195.75	0	0	0
2017	0	379.75	144.50	36,773.50	252.50	0	371.50	0
2018	93.25	683	552.50	0	241.75	0	389.50	0
2019	132.50	1,947	358	117.50	238.50	0	118.75	207.50
TOTAL	**302.25**	**5,161.75**	**2,914.50**	**45,614.50**	**1,026.50**	**35**	**1,274.75**	**207.50**

The following tables provide historical occurrences and loss estimates for each hazard profiled in this plan. Outside of the MPPD supplied service interruptions, data specific to MPPD service area was not available. Therefore, occurrence and loss data for Hitchcock, Frontier, and Red Willow Counties was utilized by the planning team as the best available and most accurate representation of data within the MPPD. This methodology is consistent with other HMPs in the state of Nebraska in which data is not available for every hazard or jurisdiction. Although the occurrence and loss data used in Section Four is not specific to the District, this data can and should be used to represent the frequency in which these hazards occur within the District, and represent which hazards cause the most damage within the planning area as a whole. This data allows the planning team to analyze the probability and potential extent of the identified hazards. Detailed descriptions of major events and any divergence from the three counties' data regarding frequency, extent, and vulnerability are included in the hazard profiles following this table.

Table 20: Risk Assessment Summary

Hazard	Previous Occurrence Events/Years	Approximate Annual Probability	Likely Extent
Agricultural Animal Disease	28/6	100%	~1 animal per event
Agricultural Plant Disease	45/20	100%	Crop Damage or Loss
Dam Failure	7/109	6%	Some inundation of structures (<1% of structures) and roads
Drought	434/1,489 months of drought	29%	D1-D2
Extreme Heat	Avg 9 days per year >100°F	100%	>100°F
Flooding	52/28	100%	Some inundation of structures (<1% of structures) and roads near streams. Some evacuations of people may be necessary (<1% of population)
Severe Thunderstorms	955/24	100%	≥1.5" rainfall Avg 57 mph winds; Hail range 0.75-4.5" (H2-H4); average 1.21"
Severe Winter Storms	144/24	100%	0.25" – 1.5" Ice 5°-40° below zero (wind chill) 2-29" snow 15-68 mph winds
Terrorism	1/47	<2%	Varies by event
Tornadoes & High Winds	154/24	100%	Avg: EF0 Range EF0-EF3 Avg 52 mph; Range 35-65 Estimated Gust
Transportation Incidents	Auto: 4,058/12	100%	Damages incurred to vehicles involved and traffic delays. Substantial damages to aircrafts involved with some aircrafts destroyed.
	Aviation: 17/57	30%	
	Highway Rail: 58/43	100%	
Wildfire	514/18	100%	Avg 85 acres Some homes and structures threatened or at risk

The following table provides loss estimates for the hazards outlined above.

Table 21: Loss Estimation for the Planning Area

HAZARD TYPE		Count	Property	Crop[2]
Agricultural Disease	Animal Disease[1]	14	28 animals	N/A
	Plant Disease[2]	45	N/A	$412,393
Dam Failure[5,6]		7	N/A	N/A
Drought[7]		434/1,498 months	N/A	$201,334,371
Extreme Heat[8]		Avg 9 days per year	N/A	$23,760,077
Flooding[9]	Flash Flood	46	$1,270,000	$112,746
	Flood	6	$200,000	
Severe Thunderstorms[9] *5 injuries* *1 fatality*	Hail	687	$4,420,200	$5,868,785
	Heavy Rain	1	$0	
	Lightning	8	$21,750	
	Thunderstorm Wind	259	$12,357,550	
Severe Winter Storms[9]	Blizzard	31	$72,000	$18,128,711
	Extreme Cold/Wind Chill	12	$0	
	Heavy Snow	31	$0	
	Ice Storm	0	$0	
	Winter Storm	61	$60,000	
	Winter Weather	9	$60,000	
Terrorism[10]		1	$0	N/A
Tornadoes and High Winds[9]	High Winds	110	$124,000	$4,722,780
	Tornadoes	44	$1,864,500	
Transportation Incidents *1,073 injuries* *67 fatalities*	Auto[11]	4,058	N/A	N/A
	Aviation[12]	17	N/A	
	Highway Rail[13]	58	$340,050	
Wildfire[14] *4 injuries* *1 fatality*		514	21,647 acres	$147,216
Total		**6,070**	**$20,847,990**	**$254,487,080**

N/A: Data not available
1 NDA (2014-2019)
2 USDA RMA (2000- October 2019)
3 NRC (1990-February 2020)
4 PHSMA (1971-June 2020)
5 Stanford NPDP (1911-2020)
6 DNR Dam Inventory, Accessed July 2020
7 NOAA (1895- October 2019)
8 NOAA (1897-June 2020)
9 NCEI (1996- December 2019)
10 University of Maryland (1970-2018)
11 NDOT (2006-2018)
12 NTSB (1962-2019)
13 FRA (1975-2018)
14 NFS (2000-2018)

The following section shows past disaster declarations that have been granted within the planning area.

Farm Service Agency Small Business Administration Disasters

The U.S. Small Business Administration (SBA) was created in 1953 as an independent agency of the federal government to aid, counsel, assist, and protect the interests of small business concerns, to preserve free competitive enterprise, and maintain and strengthen the overall economy of our nation. A program of the SBA includes disaster assistance for those affected by major natural disasters. The following table summarizes the SBA Disasters involving the planning area in the last decade.

Table 22: SBA Declarations

Disaster Declaration Number	Declaration Date	Description	Primary Counties	Contiguous Counties
NE-00073	3/21/2019	Severe Winter Storms, Straight-line Winds, and Flooding.	Frontier	-

Source: Small Business Administration, 2005-2020[11]

Presidential Disaster Declarations

Presidential disaster declarations are available via FEMA from 1953 to 2019. Declarations prior to 1962 are not designated by county on the FEMA website and are not included below. The following table describes presidential disaster declarations within the planning area for the period of record. Note that while data is available from 1953 onward, the planning area has received 19 presidential disaster declarations since 1967.

Table 23: Presidential Disaster Declarations

Disaster Declaration Number	Declaration Date	Title	Affected Counties	Public Assistance
228	7/18/1967	Severe Storms & Flooding	Frontier	N/A
873	6/10/1990	Severe Storms, Tornadoes & Flooding	Red Willow, Hitchcock	N/A
998	6/23/1993	Severe Storms & Flooding	Frontier	N/A
1027	4/10/1994	Severe Snow & Ice Storm	Frontier, Hitchcock, Red Willow	N/A
1190	10/24/1997	Severe Snowstorms, Rain, & Strong Winds	Frontier, Hitchcock, Red Willow	N/A
1517	5/20/2004	Severe Storms, Tornadoes & Flooding	Red Willow	$13,351,657.77
1590	5/11/2005	Severe Storms & Flooding	Frontier	N/A
3245	8/29/2005	Hurricane Katrina Evacuees	Frontier, Hitchcock, Red Willow	N/A

11 Small Business Administration. 2005-2020. "SBA Disaster Loan Data." Accessed October 2020. https://www.sba.gov/loans-grants/see-what-sba-offers/sba-loan-programs/disaster-loans/disaster-loan-data.

1627	11/27/2005	Severe Winter Storms	Frontier, Red Willow	N/A
1674	12/19/2006	Severe Winter Storms	Frontier, Hitchcock, Red Willow	N/A
1714	5/28/2007	Severe Storms & Flooding	Frontier, Hitchcock	N/A
1770	5/22/2008	Severe Storms, Tornadoes & Flooding	Frontier, Red Willow	$36,258,650.19
1878	12/22/2009	Severe Winter Storms & Snowstorm	Frontier	N/A
1924	6/1/2010	Severe Storms & Flooding	Frontier	N/A
4014	6/19/2011	Severe Storms, Tornadoes, Straight-line Winds, & Flooding.	Red Willow	N/A
4321	4/29/2017	Severe Winter Storms & Straight-line Winds	Red Willow	N/A
4420	3/9/2019	Severe Winter Storms, Straight-line Winds, & Flooding	Frontier	$151,791,288.53
3483	3/13/2020	Covid-19	All Counties	N/A
4521	4/4/2020	Covid-19 Pandemic	All Counties	N/A

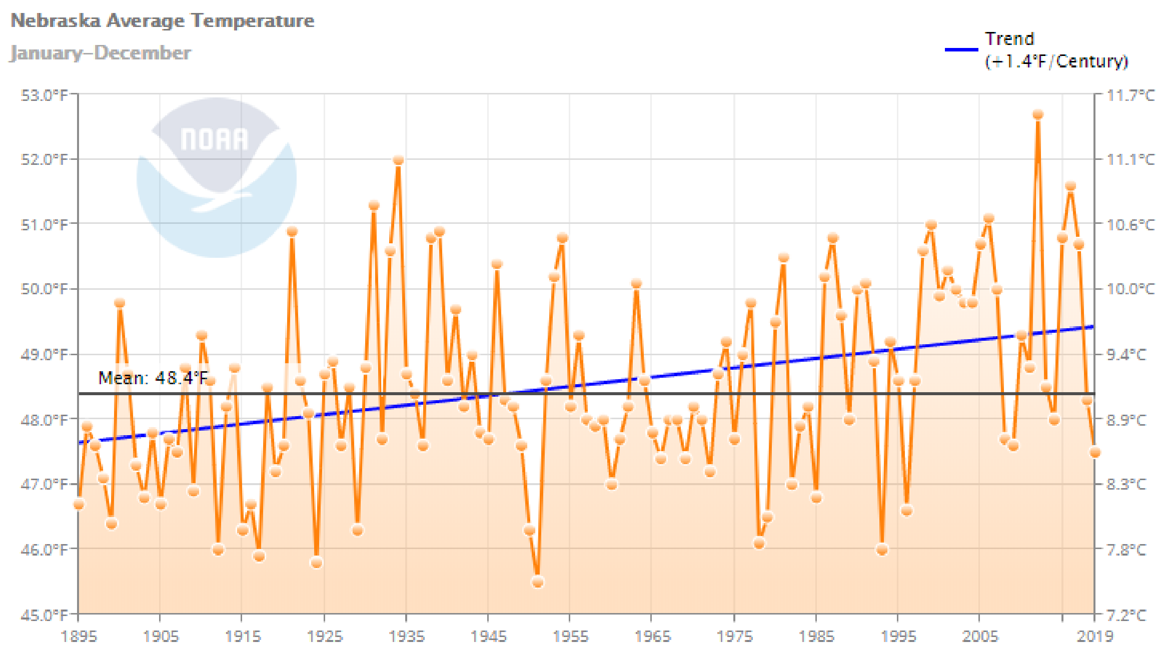
Source: Federal Emergency Management Agency, 1953-2020[12]

12 Federal Emergency Management Agency. 2019. “Disaster Declarations.” Accessed October 2020. https://www.fema.gov/disasters.

Climate Adaptation

Long term climate trends are on the rise and will continue to increase the vulnerability to hazards across the planning area. For example since 1895, Nebraska's overall average temperature has increased by about 2°F (Figure 5, blue line trend). These trends will likely contribute to an increase in the frequency and intensity of hazardous events, which will cause significant economic, social, and environmental impacts on Nebraskans.

Figure 5: Average Temperature (1895-2019)



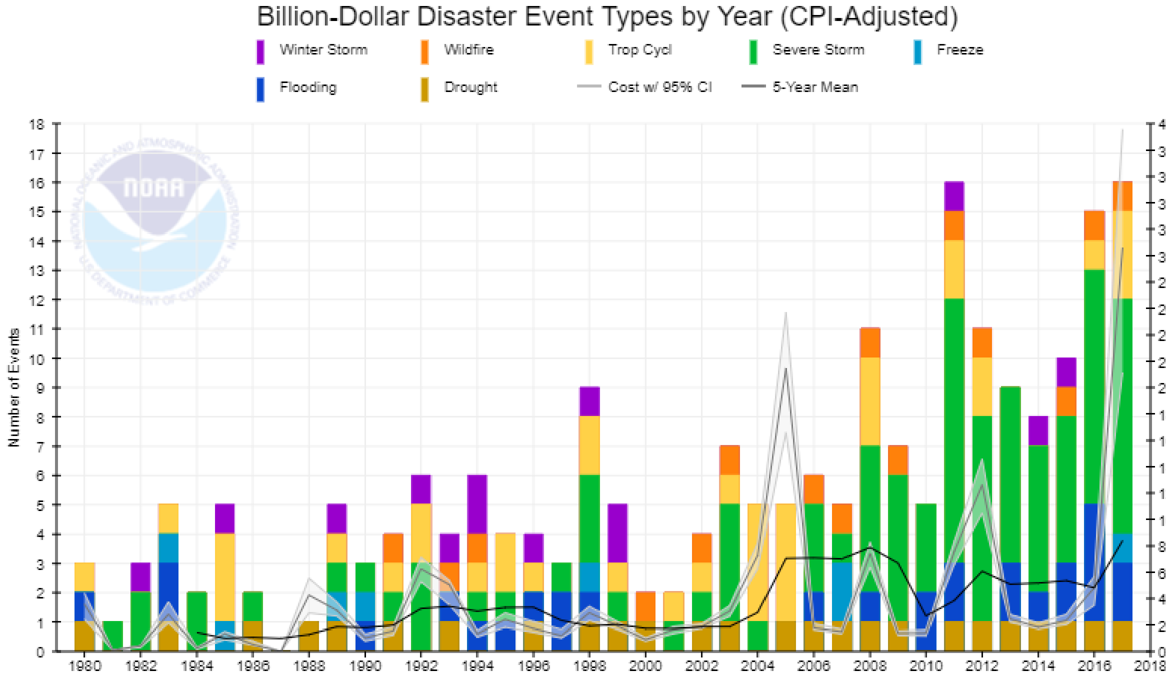
As seen in Figure 6 and Figure 7, the United States is experiencing an increase in the number of billion-dollar natural disasters. Regardless of whether these trends are due to a change in weather patterns or due to increased development, or a combination of both, the trends still exist.

According to a recent University of Nebraska report (*Understanding and Assessing Climate Change: Implications for Nebraska,* 2014),[13] Nebraskans can expect the following from the future climate:

- Increase in extreme heat events
- Increase in number of days above 100 degrees Fahrenheit
- Decrease in soil moisture by 5-10%
- Increase in drought frequency and severity
- Increase in heavy rainfall events
- Increase in flood magnitude
- Decrease in water flow in the Missouri River from reduced snowpack in the Rocky Mountains
- Additional 30-40 days in the frost-free season

13 Rowe, C.M., Bathke, D.J., Wilhite, D.A., & Oglesby, R.J. 2014. "Understanding and Assessing Climate Change: Implications for Nebraska."

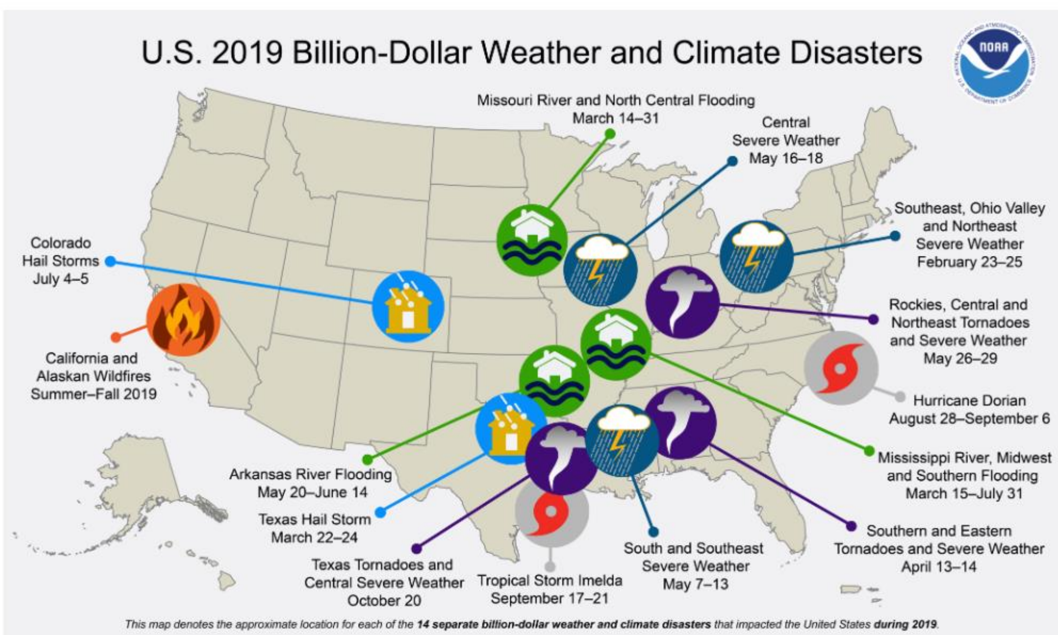
Figure 6: Billion Dollar Disasters



Source: NOAA, 2018

Figure 7: Billion Dollar Weather and Climate Disasters

In 2020 (as of April 8), there have been 2 weather and climate disaster events with losses exceeding $1 billion each across the United States. These events included 2 severe storm events. Overall, these events resulted in the deaths of 35 people and had significant economic effects on the areas impacted. The 1980–2019 annual average is 6.6 events (CPI-adjusted); the annual average for the most recent 5 years (2015–2019) is 13.8 events (CPI-adjusted).

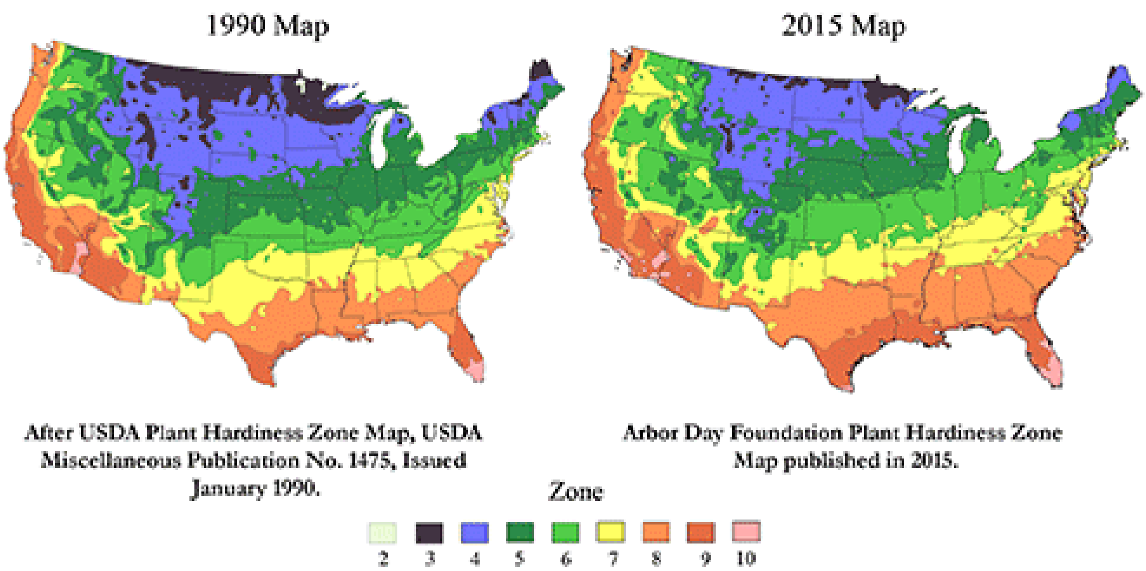


2019 is the fifth consecutive year (2015-2019) in which 10 or more billion-dollar weather and climate disaster events have impacted the United States. Over the last 40 years (1980-2019), the **years with 10 or more** separate billion-dollar disaster events include **1998, 2008, 2011-2012,** and **2015-2019**.

Source: NOAA, 2020

These trends will have a direct impact on water and energy demands. As the number of 100°F days increase, along with warming nights, the stress placed on the energy grid will likely increase and possibly lead to more power outages. Critical facilities and vulnerable populations that are not prepared to handle periods of power outages, particularly during heat waves, will be at risk. Furthermore, the agricultural sector will experience an increase in droughts, an increase in grass and wildfires, changes in the growth cycle as winters warm, and changes in the timing and magnitude of rainfall. These added stressors on agriculture could have devastating economic effects if new agricultural and livestock management practices are not adopted. Figure 8 shows the change in plant hardiness zones over a 25-year period.

Figure 8: Plant Hardiness Zone Change

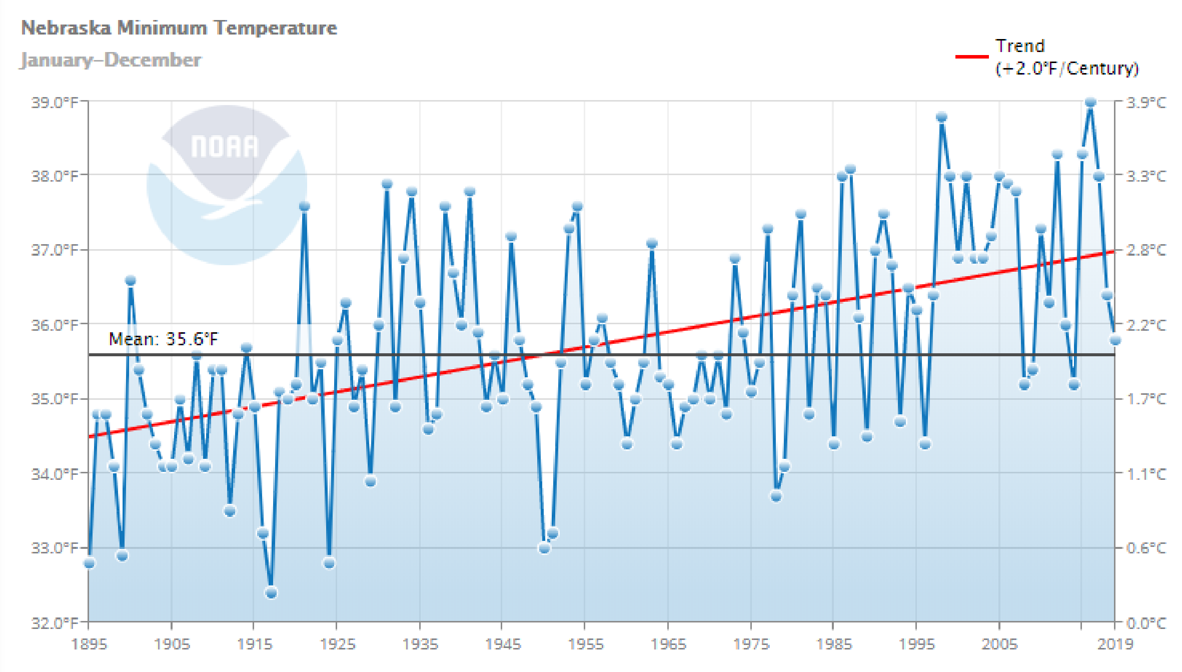


Source: Arbor Day Foundation, 2018[14]

Figure 9 shows a trend of increasing minimum temperatures in the state. High nighttime temperatures can reduce grain yields, increase stress on animals, and lead to an increase in heat-related deaths. These higher temperatures will therefore cause an increase in power usage across the entire MPPD service area.

14 Arbor Day Foundation. 2018. "Hardiness Zones." https://www.arborday.org/media/map_change.cfm.

Figure 9: Minimum Temperature 1895 – 2018



Source: NOAA, 2020

The planning area will have to adapt to these changes or experience an increase in economic losses, loss of life, property damages, and agricultural damages. HMPs have typically been informed by past events in order to be more resilient to future events, and this HMP includes strategies for the planning area to address these changes and increase resilience. However, future updates to this plan should consider integrating trend predictions and including adaptation as a core strategy to be better informed by future projections on the frequency, intensity, and distribution of hazards as well.

Hazard Profiles

Based on research and experiences of the District, the hazards profiled were determined to either have a historical record of occurrence or the potential for occurrence in the future. As the planning area is generally uniform in climate, topography, building characteristics, and development trends, overall hazards and vulnerability do not vary greatly across the planning area. The following profiles will broadly examine the identified hazards across the region. As a reminder, occurrence and loss data for Hitchcock, Frontier, and Red Willow Counties was utilized as the best available and most accurate representation of data within the planning area. Descriptions of major events and any divergence from the three counties' data regarding frequency, extent, and vulnerability are included in the hazard profiles below.

AGRICULTURAL ANIMAL AND PLANT DISEASE

Agriculture Disease is any biological disease or infection that can reduce the quality or quantity of either livestock or vegetative crops. This section looks at both animal disease and plant disease, as both make up a significant portion of Nebraska's and the planning area's economy.

The economy of the State of Nebraska is heavily vested in both livestock and crop sales. According to the Nebraska Department of Agriculture (NDA) in 2017, the market value of agricultural products sold was estimated at nearly $22 billion; this total is split between crops (estimated $9.31 billion) and livestock (estimated $12.67 billion). For the planning area, the market value of sold agricultural products exceeded $369 million.[15]

Table 24 shows the population of livestock within the planning area. This count does not include wild populations that are also at risk from animal diseases.

Table 24: Livestock Inventory

County	Market Value of 2017 Livestock Sales	Cattle and Calves	Hogs and Pigs	Poultry Egg Layers	Sheep and Lambs
Frontier	$60,678,000	56,197	1,504	552	98
Hitchcock	$14,010,000	21,459	10	210	216
Red Willow	$116,391,000	65,166	9,949	646	59
Total	**$191,079,000**	**142,822**	**11,463**	**1,408**	**373**

Source: U.S. Census of Agriculture, 2017

According to the NDA, the primary crops grown throughout the state include alfalfa, corn, sorghum, soybeans, and wheat. The following tables provide the value and acres of land in farms for the planning area.

Table 25: Land and Value of Farms in the Planning Area

County	Number of Farms	Land in Farms (acres)	Market Value of 2017 Crop Sales
Frontier	371	484,194	$60,762,000
Hitchcock	288	392,644	$45,613,000
Red Willow	333	439,377	$71,804,000
Total	**992**	**1,316,215**	**$178,179,000**

Source: U.S. Census of Agriculture, 2017

15 US Department of Agriculture, National Agricultural Statistics Server. 2020. "2017 Census of Agriculture – County Data." Accessed June 2020. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Nebraska/.

Table 26: Crop Values

County	Corn		Soybeans		Wheat	
	Acres Planted	Value (2017)	Acres Planted	Value (2017)	Acres Planted	Value (2017)
Frontier	101,899	$40,713,000	30,057	$13,185,000	19315	$3,768,000
Hitchcock	65,237	$25,912,000	3,651	$1,822,000	56613	$11,767,000
Red Willow	100,100	$45,343,000	18,057	$9,729,000	44811	$9,456,000
Total	**267,236**	**$111,968,000**	**51,765**	**$24,736,000**	**120,739**	**$24,991,000**

Source: U.S. Census of Agriculture, 2017

Location

Given the strong agricultural presence in the planning area, animal and plant disease have the potential to occur across the planning area. If a major outbreak were to occur, the economy in the entire planning area would be affected, including urban areas.

The primary land uses where animal and plant disease will be observed include: agricultural lands; range or pasture lands; and forests. It is possible that animal or plant disease will occur in domestic animals or crops in urban areas.

Historical Occurrences

Animal Disease

The NDA provides reports on diseases occurring in the planning area. There were 16 instances of animal diseases reported between January 2014 and January 2019 by the NDA (Table 27). These outbreaks affected 24 animals.

Table 27: Livestock Diseases Reported in the Planning Area

Year	County	Disease	Population Impacted
2014	Red Willow	Bovine Blue Tongue, Porcine Reproductive and Respiratory Syndrome	2
2015	Red Willow	Enzoonotic Bovine Leukosis, Equine Vesicular Stomatitis	2
2016	Red Willow	Bovine Blue Tongue, Bovine Anaplasmosis, Bovine Paratuberculosis	5
2017	Hitchcock	Bovine Anaplasmosis	1
2017	Red Willow	Bovine Paratuberculosis	1
2018	Red Willow	Bovine Blue Tongue, Enzoonotic Bovine Leukosis, Bovine Paratuberculosis	4
2019	Red Willow	Bovine Blue Tongue, Enzoonotic Bovine Leukosis	4
2020	Frontier	Infectious Bovine Rhinotracheitis/Infectious Pustul, Bovine Anaplasmosis, Bovine Paratuberculosis	4
2020	Red Willow	Enzoonotic Bovine Leukosis, Bovine Epizootic Hemorrhagic Disease, Leptospirosis	6

Source: Nebraska Department of Agriculture, January 2014- November 2019[16]

16 Nebraska Department of Agriculture. 2019. "Livestock Disease Reporting." http://www.nda.nebraska.gov/animal/reporting/index.html

Plant Disease

A variety of diseases can impact crops and often vary from year to year. The NDA provides information on some of the most common plant diseases, which are listed below.

Table 28: Common Crop Diseases in Nebraska by Crop Types

Crop Diseases		
Corn	Anthracnose	Southern Rust
	Bacterial Stalk Rot	Stewart's Wilt
	Common Rust	Common Smut
	Fusarium Stalk Rot	Gross's Wilt
	Fusarium Root Rot	Head Smut
	Gray Leaf Spot	Physoderma
	Maize Chlorotic Mottle Virus	
Soybeans	Anthracnose	Pod and Stem Blight
	Bacterial Blight	Purple Seed Stain
	Bean Pod Mottle	Rhizoctonia Root Rot
	Brown Spot	Sclerotinia Stem Rot
	Brown Stem Rot	Soybean Mosaic Virus
	Charcoal Rot	Soybean Rust
	Frogeye Leaf Spot	Stem Canker
	Phytophthora Root and Stem Rot	Sudden Death Syndrome
Wheat	Barley Yellow Dwarf	Leaf Rust
	Black Chaff	Tan Spot
	Crown and Root Rot	Wheat Soy-borne Mosaic
	Fusarium Head Blight	Wheat Streak Mosaic
Sorghum	Ergot	Zonate Leaf Spot
	Sooty Stripe	
Other Pests	Grasshoppers	Western Bean Cutworm
	European Corn Borer	Corn Rootworm
	Corn Nematodes	Bean Weevil
	Mexican Bean Beatle	Soybean Aphids
	Rootworm Beatles	Eastern Ash Borer

Average Annual Losses

According to the USDA RMA (2000-2019) there were 45 plant disease events in the planning area. While the RMA does not track losses for livestock, annual crop losses from plant disease can be estimated. Agricultural livestock disease losses are determined from the Nebraska Department of Agriculture.

Table 29: Agricultural Plant Disease Losses

Hazard Type	Number of Events	Events per Year	Total Crop Loss	Average Annual Crop Loss
Plant Disease	45	2	$412,393.25	$ 19275.24

Source: RMA, 2000-2020

Table 30: Agricultural Livestock Disease Losses

Hazard Type	Number of Events	Events per Year	Total Animal Losses	Average Animal Losses per Event
Animal Disease	16	2.9	24	1.5

Source: NDA, 2014-2020

Extent

There is no standard for measuring the magnitude of agricultural disease. Historical events have impacted livestock ranging from a single individual to eight individuals. The planning area is heavily dependent on the agricultural economy. Any severe plant or animal disease outbreak which may impact this sector would negatively impact the entire planning area's economy.

Probability

Given the historic record of occurrence for animal disease (16 outbreaks reported in six years) and plant disease (45 outbreaks in 20 years), for the purposes of this plan, the annual probability of agricultural disease occurrence is 100 percent.

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities.

Table 31: Regional Agricultural Disease Vulnerabilities

Sector	Vulnerability
People	-Those in direct contact with infected livestock -Potential food shortage during prolonged events -Residents in poverty if food prices increase
Economic	-Regional economy is reliant on the agricultural industry -Large scale or prolonged events may impact revenues and local capabilities -Land value may largely drive population changes within the planning area
Built Environment	None
Infrastructure	-Transportation routes can be closed during quarantine
Critical Facilities	None
Climate	-Exacerbate outbreaks, impacts, and/or recovery period -Changes in seasonal normals can promote spread of invasive species and agricultural disease

DAM/LEVEE FAILURE

According to the Nebraska Administrative Code, dams are "any artificial barrier, including appurtenant works, with the ability to impound water, wastewater, or liquid-borne materials and which is:

- twenty-five feet or more in height from the natural bed of the stream or watercourse measured at the downstream toe of the barrier, or from the lowest elevation of the outside limit of the barrier if it is not across a stream channel or watercourse, to the maximum storage elevation or
- has an impounding capacity at maximum storage elevation of fifty acre-feet or more, except that any barrier described in this subsection which is not in excess of six feet in height or which has an impounding capacity at maximum storage elevation of not greater than fifteen acre-feet shall be exempt, unless such barrier, due to its location or other physical characteristics, is classified as a high hazard potential dam.

Dams do not include:

- an obstruction in a canal used to raise or lower water;
- a fill or structure for highway or railroad use, but if such structure serves, either primarily or secondarily, additional purposes commonly associated with dams it shall be subject to review by the department;
- canals, including the diversion structure, and levees; or
- water storage or evaporation ponds regulated by the United States Nuclear Regulatory Commission."[17]

The NeDNR uses a classification system for dams throughout the state, including those areas participating in this plan. The classification system includes three classes, which are defined in the table below.

Table 32: Dam Size Classification

Size	Effective Height (feet) x Effective Storage (acre-feet)	Effective Height
Small	≤ 3,000 acre-feet	and ≤ 35 feet
Intermediate	> 3,000 acre-feet to < 30,000 acre-feet	or > 35 feet
Large	≥ 30,000 acre-feet	Regardless of Height

Source: NeDNR, 2013[18]

The effective height of a dam is defined as the difference in elevation in feet between the natural bed of the stream or watercourse measured at the downstream toe (or from the lowest elevation of the outside limit of the barrier if it is not across stream) to the auxiliary spillway crest. The effective storage is defined as the total storage volume in acre-feet in the reservoir below the elevation of the crest of the auxiliary spillway. If the dam does not have an auxiliary spillway, the effective height and effective storage should be measured at the top of dam elevation.

17 Nebraska Department of Natural Resources. "Department of Natural Resources Rules for Safety of Dam and Reservoirs." Nebraska Administrative Code, Title 458, Chapter 1, Part 001.09.

18 Nebraska Department of Natural Resources. 2013. "Classification of Dams: Dam Safety Section." https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/dam-safety/resources/Classification-Dams.pdf.

Dam failure, as a hazard, is described as a structural failure of a water impounding structure. Structural failure can occur during extreme conditions, which include, but are not limited to:

- Reservoir inflows in excess of design flows
- Flood pools higher than previously attained
- Unexpected drop in pool level
- Pool near maximum level and rising
- Excessive rainfall or snowmelt
- Large discharge through spillway
- Erosion, landslide, seepage, settlement, and cracks in the dam or area
- Earthquakes
- Vandalism
- Terrorism

The NeDNR, U.S. Army Corps of Engineers (USACE), and the Federal Energy Regulatory Commission all are involved in regulating dam safety in Nebraska. Dams are classified by the potential hazard each poses to human life and economic loss. The following are classifications and descriptions for each hazard class:

- **Low Hazard Potential** - failure of the dam expected to result in no probable loss of human life and in low economic loss. Failure may damage storage buildings, agricultural land, and county roads.
- **Significant Hazard Potential** - failure of the dam expected to result in no probable loss of human life but could result in major economic loss, environmental damage, or disruption of lifeline facilities. Failure may result in shallow flooding of homes and commercial buildings or damage to main highways, minor railroads, or important public utilities.
- **High Hazard Potential** - failure of the dam expected to result in loss of human life is probable. Failure may cause serious damage to homes, industrial or commercial buildings, four-lane highways, or major railroads. Failure may cause shallow flooding of hospitals, nursing homes, or schools.

According to FEMA:
"The United States has thousands of miles of levee systems. These manmade structures are most commonly earthen embankments designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water to provide some level of protection from flooding. Some levee systems date back as far as 150 years. Some levee systems were built for agricultural purposes. Those levee systems designed to protect urban areas have typically been built to higher standards. Levee systems are designed to provide a specific level of flood protection. No levee system provides full protection from all flooding events to the people and structures located behind it. Thus, some level of flood risk exists in these levee-impacted areas."

Levee failure can occur several ways. A breach of a levee is when part of the levee breaks away, leaving a large opening for floodwaters to flow through. A levee breach can be gradual by surface or subsurface erosion, or it can be sudden. A sudden breach of a levee often occurs when there are soil pores in the levee that allow water to flow through causing an upward pressure greater than the downward pressure from the weight of the soil of the levee. This under seepage can then resurface on the backside of the levee and can quickly erode a hole to cause a breach. Sometimes the levee actually sinks into a liquefied subsurface below. Another way a levee failure can occur is when the water overtops the crest of the levee. This happens when the flood waters simply exceed the lowest crest elevation of the levee. An overtopping can lead to significant erosion of the backside of the levee and can result to a breach and thus a levee failure.

The United States Army Corps of Engineers (USACE), who is responsible for federal levee oversight and inspection of levees, has three ratings for levee inspections.

Table 33: USACE Levee Rating Categories

Ratings	Low Hazard
Acceptable	All inspection items are rated as acceptable
Minimally Acceptable	One or more inspection items are rated as minimally acceptable or one or more items are Rated as unacceptable and an engineering determination concludes that the unacceptable Inspection items would not prevent the segment/system from performing as intended during the next flood event.
Unacceptable	One or more items are rated as unacceptable and would prevent the segment/system from performing as intended, or a serious deficiency noted in past inspections has not been corrected within the established timeframe, not to exceed two years.

Source: USACE, 2020[19]

Location

According to USACE's National Institute of Dams, there are a total of 82 dams located within the planning area, with classifications ranging from low to high hazard. Figure 10 shows the locations of the dams.

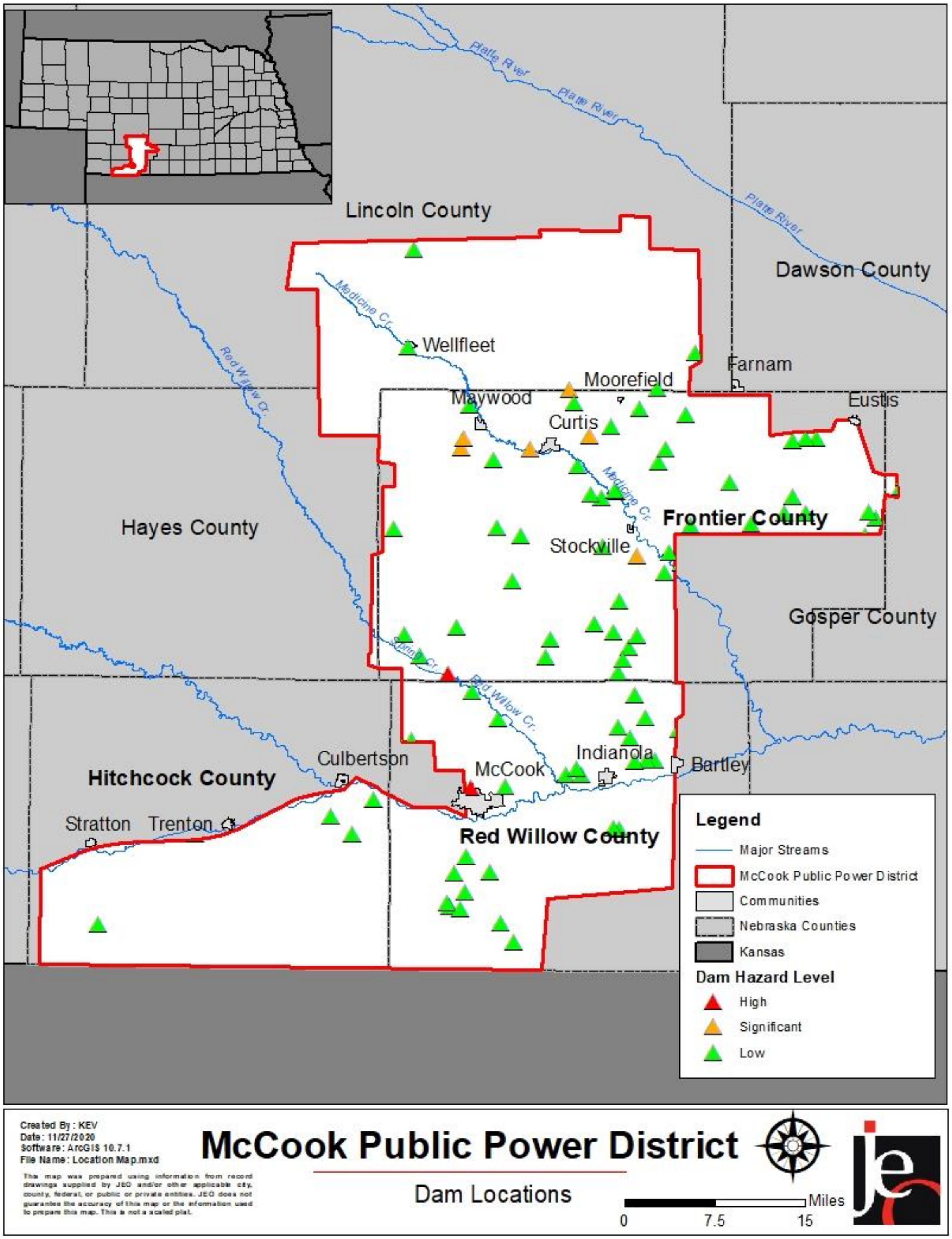
Table 34: Dams in the Planning Area

Low Hazard	Significant Hazard	High Hazard
74	6	2

Source: USACE, 2020[20]

19 United States Army Corps of Engineers. June 2020. "National Inventory of Dams." https://nid.sec.usace.army.mil/ords/f?p=105:1::::::.
20 United States Army Corps of Engineers. June 2020. "National Inventory of Dams." https://nid.sec.usace.army.mil/ords/f?p=105:1::::::.

Figure 10: Dam Locations



Dams classified with high hazard potential require the creation of an Emergency Action Plan (EAP). The EAP defines responsibilities and provides procedures designed to identify unusual and unlikely conditions which may endanger the structural integrity of the dam within sufficient time to take mitigating actions and to notify the appropriate emergency management officials of possible, impending, or actual failure of the dam. The EAP may also be used to provide notification when flood releases will create major flooding. An emergency situation can occur at any time; however, emergencies are more likely to happen when extreme conditions are present. There are four high hazard dams located within the planning area. Two are located in Frontier County, one in Hitchcock County, and one in Red Willow County.

Table 35: High Hazard Dams in the Planning Area

County	Dam Name	NID ID	Purpose	Dam Height	Max Storage (Acre Ft)	Last Inspection Date
Frontier	Medicine Creek	NE01073	Irrigation	115 ft	195,997	8/23/2017
Frontier	Red Willow Creek	NE01076	Irrigation	123 ft	163,415	8/23/2017
Hitchcock	Trenton Dam	NE01078	Irrigation	100 ft	353,901	7/17/2017
Red Willow	Kelley Creek West Dam	NE01672	Flood Control, Storm Water Management	34 ft	1,183	7/9/2019

Source: USACE, 2020[21]

There are two levees located within the MPPD planning area. These levees are located west and southwest of Indianola shown in the figure below.

21 United States Army Corps of Engineers. June 2020. "National Inventory of Dams." https://nid.sec.usace.army.mil/ords/f?p=105:1::::::.

Figure 11: Levee Locations Near Indianola

Upstream Dams Outside the Planning Area

Additionally, there is one High Hazard dam located outside of the MPPD area, upstream of the City of McCook which is in the planning area. If the dam were to fail, it would likely impact the City of McCook and the surrounding region.

Table 36: High Hazard Dams Outside the Planning Area

County, State	Dam Name	NID ID	Purpose	Dam Height	Max Storage (Acre Ft)	Last Inspection Date
Hayes, Nebraska	Blackwood Creek 11-A Dam	NE02369	Flood Control, Storm Water Management	59 ft	6,050	8/3/2020

Source: USACE, 2020

Historical Occurrences

According to the Stanford University National Performance of Dams Program and local resources, there has been one dam failure event within the planning area from 1911 to 2018.[22] According to the NeDNR Dam Inventory, there are currently six dams in failure within the planning area.[23] The table below shows information regarding the failed dams. There is no record of levee failure within the planning area.

Table 37: Dam Failures

Dam Name	Hazard Class	County	Failure Year	Downstream Community
Walter 4035 Dam	Low	Frontier County	-	-
Medicine Creek Dam	High	Frontier County	1964	-
Beverly Dam	Low	Hitchcock County	1980	Culbertson
Cobb Dam	Low	Hitchcock County	1980	-
Diehl Dam	Significant	Hitchcock County	1980	-
Malleck Dam	Low	Red Willow County	1982	Bartley
Gallatin Dam	Low	Red Willow County	1992	Danbury

Source: NeDNR, 2020

Due to lack of data and the sensitive nature of this hazard, potential losses are not calculated for this hazard.

Extent

Areas (i.e. agricultural land, out buildings, county roads, and communities) directly downstream of dams or within the leveed area are at greatest risk in the case of dam/levee failure. The extent of a dam/levee failure is indicated by its hazard classification and location. Note that a dam's hazard classification does not indicate the likelihood of a dam failure event to occur, but rather the extent of potential damages that may occur in the case of a failure. Thus, the high hazard dams in the planning area would have the greatest impact if they were to fail. Inundation maps are not publicly available due to concerns of vandalism and terrorism. Key facilities located in inundation areas are discussed in each county's LEOP. The United States Army Corp of Engineers maintains a database of leveed areas. Please refer to the Corp for data regarding the extent and potential losses during a levee failure in the planning area.

Probability

For the purpose of this plan, the probability of dam/levee failure will be stated as six percent annually as seven dams have failed in the planning area over the past 109 years.

22 Stanford University. 1911-2018. "National Performance of Dams Program Dam Incident Database." Accessed December 2019. http://npdp.stanford.edu/dam_incidents.

23 Nebraska Department of Natural Resources. 2020. "Inventory of Dams" https://gis.ne.gov/portal/apps/webappviewer/index.html?id=2aab04a13817421992dc5398ad462e22. Accessed February 2020.

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities.

Table 38: Regional Dam/Levee Failure Vulnerabilities

Sector	Vulnerability
People	-Those living downstream of high hazard dams/levees -Those at recreational sites situated near high hazard dams -Evacuation needs likely with high hazard dam failure events -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
Economic	-Loss of downstream agricultural land -Businesses or recreation sites located in inundation areas would be impacted and closed for an extended period of time -Employees of closed businesses may be out of work for an extended period of time
Built Environment	-Damage to facilities, recreation areas, and roads
Infrastructure	- Transportation routes could be closed for extended period of time -Electrical infrastructure could be damaged
Critical Facilities	-Any critical facilities in inundation areas are vulnerable to damages
Climate	-Increased annual precipitation contributes to sustained stress on systems -Changes in water availability and supply could strain systems

DROUGHT

Drought is generally defined as a natural hazard that results from a substantial period of below normal precipitation. Although many erroneously consider it a rare and random event, drought is a normal, recurrent feature of climate. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another. A drought often coexists with periods of extreme heat, which together can cause significant social stress, economic losses, and environmental degradation. The planning area is largely rural, which presents an added vulnerability to drought events; drought conditions can significantly and negatively impact the agricultural economic base.

> **Drought** is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another.
>
> ~National Drought Mitigation Center

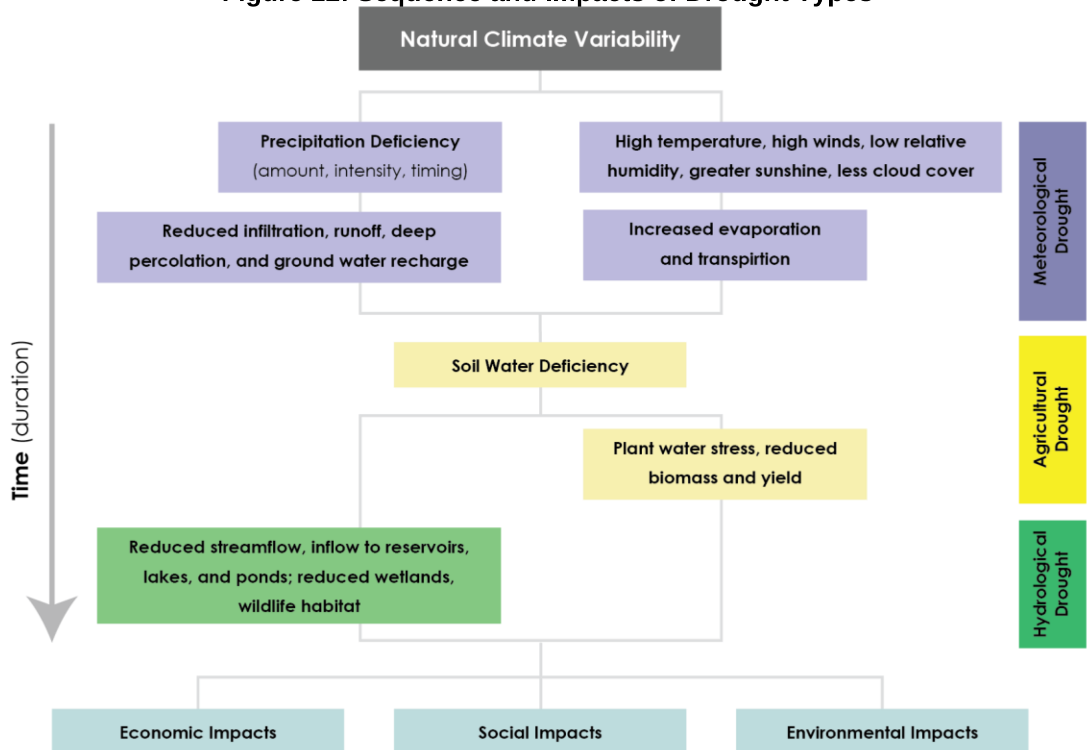
Drought is a slow-onset, creeping phenomenon that can affect a wide range of people, livestock, and industries. While many impacts of these hazards are non-structural, there is the potential that during prolonged drought events structural impacts can occur. Drought normally affects more people than other natural hazards, and its impacts are spread over a larger geographical area. As a result, the detection and early warning signs of drought conditions and assessment of impacts are more difficult to identify than that of quick-onset natural hazards (e.g., flood) that results in more visible impacts. According to the National Drought Mitigation Center (NDMC), droughts are classified into four major types:

- **Meteorological Drought** – is defined based on the degree of dryness and the duration of the dry period. Meteorological drought is often the first type of drought to be identified and should be defined regionally as precipitation rates and frequencies (norms) vary.
- **Agricultural Drought** – occurs when there is deficient moisture that hinders planting germination, leading to low plant population per hectare and a reduction of final yield. Agricultural drought is closely linked with meteorological and hydrological drought; as agricultural water supplies are contingent upon the two sectors.
- **Hydrologic Drought** – occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives average precipitation. This is due to the reserves diminishing from increased water usage, usually from agricultural use or high levels of evapotranspiration, resulting from prolonged high temperatures. Hydrological drought often is identified later than meteorological and agricultural drought. Impacts from hydrological drought may manifest themselves in decreased hydropower production and loss of water-based recreation.
- **Socioeconomic Drought** – occurs when the demand for an economic good exceeds supply due to a weather-related shortfall in water supply. The supply of many economic goods includes, but are not limited to, water, forage, food grains, fish, and hydroelectric power.[24]

The following figure indicates different types of droughts, their temporal sequence, and the various types of effects they can have on a community. The community impacts also affect the MPPD and their infrastructure that is responsible for supplying power to the over 5,000 users in their district. Increased drought puts a strain on both the communities and the MPPD infrastructure and personnel.

24 National Drought Mitigation Center. 2017. “Drought Basics.” https://drought.unl.edu/.

Figure 12: Sequence and Impacts of Drought Types



Source: National Drought Mitigation Center, University of Nebraska-Lincoln, 2017[25]

Location

The entire planning area is susceptible to impacts resulting from drought.

Historical Occurrences

Table 39 indicates it is reasonable to expect extreme drought to occur in 5.1 percent of months for the planning area (77 extreme drought months in 1,498 months). Severe drought occurred in 71 months of the 1,498 months of record (4.7 percent of months). Moderate drought occurred in 102 months of the 1,498 months of record (6.8 percent of months), and mild drought occurred in 184 of the 1,498 months of record (12.3 percent of months). Non-drought conditions occurred in 1,064 months, or 71% percent of months. These statistics show that the drought conditions of the planning area are highly variable. The average annual planning area precipitation is approximately 22 inches according to the NCEI.[26]

Table 39: Historic Droughts

Drought Magnitude	Months in Drought	Percent Chance
-1 Magnitude (Mild)	184/1,498	12.3%
-2 Magnitude (Moderate)	102/1,498	6.8%
-3 Magnitude (Severe)	71/1,498	4.7%
-4 Magnitude or Greater (Extreme)	77/1,498	5.1%

Source: NCEI, Jan 1895-October 2019[27]

25 National Drought Mitigation Center. 2017. “Types of Drought.” https://drought.unl.edu/.
26 NOAA National Centers for Environmental Information. December 2019. "Data Tools: 1981-2010 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.
27 National Centers for Environmental Information. 1895-2018. Accessed December 6, 2018. https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp.

Extent

The Palmer Drought Severity Index (PDSI) is utilized by climatologists to standardize global long-term drought analysis. The data for the planning area was collected for Climate Division 7, which includes the planning area. This particular station's period of record started in 1895. Table 40 shows the details of the Palmer classifications. Figure 14 shows drought data from this time period. The negative Y axis represents the extent of a drought, for which '-2' indicates a moderate drought, '-3' a severe drought, and '-4' an extreme drought. The planning area has experienced several 'extreme' droughts and future moderate, severe, and extreme droughts are likely in the future.

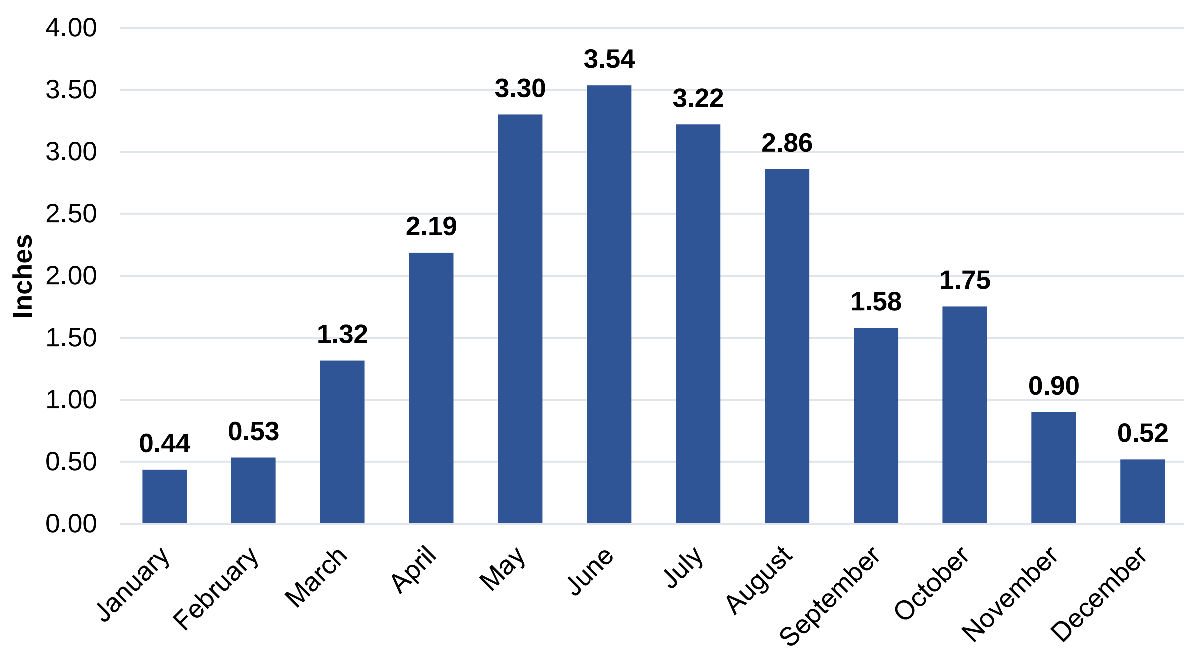
Table 40: Palmer Drought Severity Index Classification

Numerical Value	Description	Numerical Value	Description
4.0 or more	Extremely wet	-0.5 to -0.99	Incipient dry spell
3.0 to 3.99	Very wet	-1.0 to -1.99	Mild drought
2.0 to 2.99	Moderately wet	-2.0 to -2.99	Moderate drought
1.0 to 1.99	Slightly wet	-3.0 to -3.99	Severe drought
0.5 to 0.99	Incipient wet spell	-4.0 or less	Extreme drought
0.49 to -0.49	Near normal	--	--

Source: Climate Prediction Center[28]

Figure 13 shows the normal average monthly precipitation for the planning area, which is helpful in determining whether any given month is above, below, or near normal in precipitation.

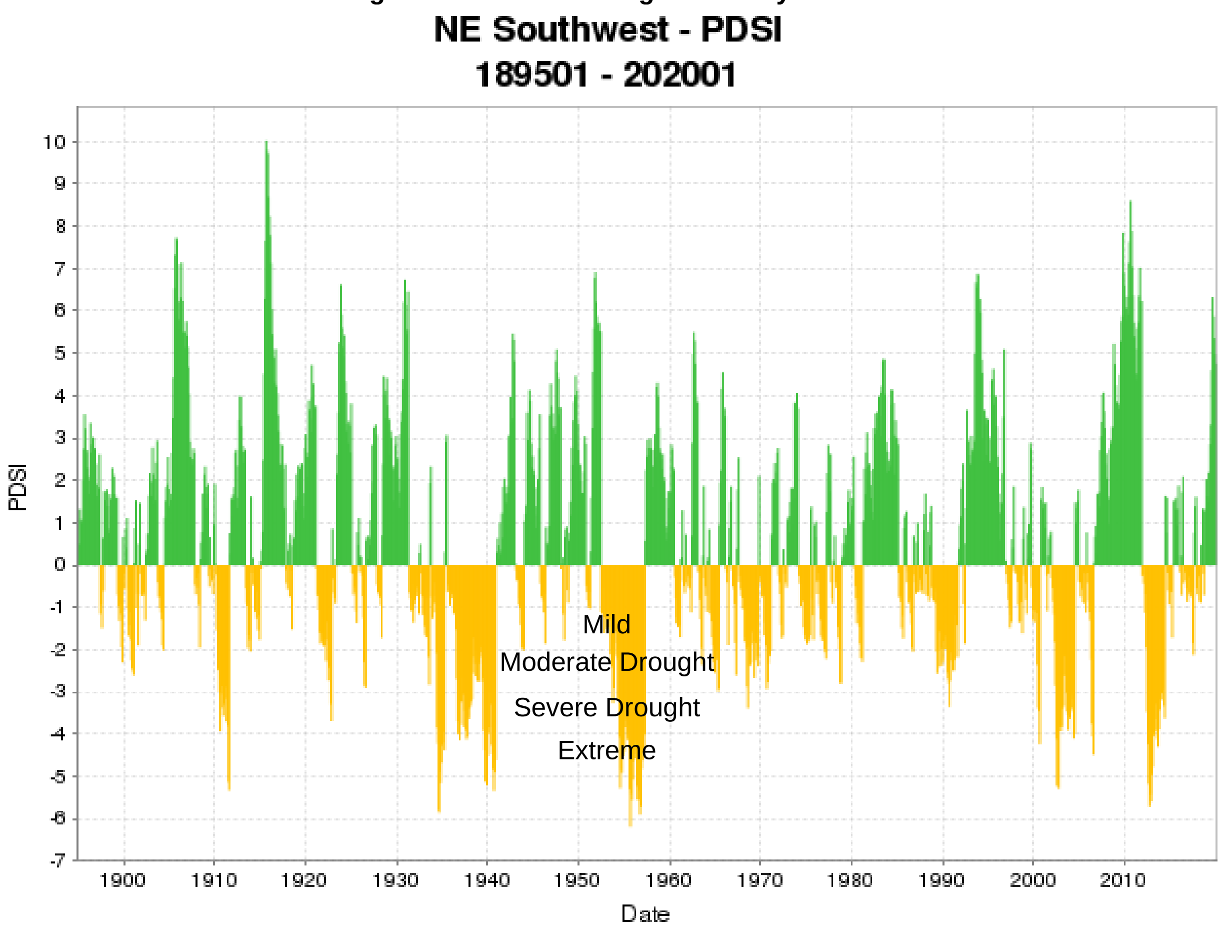
Figure 13: Average Monthly Precipitation for the Planning Area



Source: NCEI, 2019[29]

28 National Weather Service. 2017. "Climate Prediction Center." https://www.cpc.ncep.noaa.gov/.
29 NOAA National Centers for Environmental Information. May 2020. "Data Tools: 1981-2010 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Figure 14: Palmer Drought Severity Index



Source: NCEI, Jan. 1895-Jan. 2020

Average Annual Losses

The annual property estimate was determined based upon NCEI Storm Events Database since 1996. The annual crop loss was determined based upon the RMA Cause of Loss Historical Database since 2000. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. The direct and indirect effects of drought are difficult to quantify. Potential losses such as power outages could affect businesses, homes, and critical facilities. High demand and intense use of air conditioning or water pumps can overload the electrical systems and cause damages to infrastructure. The Planning Team identified that a short-term effect of drought conditions for the District would be increased revenue from sold electricity due to increased demand.

Table 41: Loss Estimate for Drought

Hazard Type	Total Property Loss[2]	Average Annual Property Loss[2]	Total Crop Loss[3]	Average Annual Crop Loss[3]
Drought	$1,000,000	$41,666	$201,334,371	$22,370,485

Source: 1 HPRCC (1899-2019); 2 Indicates data is from NCEI (Jan 1996 to Sept 2019); 3 Indicates data is from USDA RMA (2000 to 2019)

The USDA reported a total of $139,957,809 in drought relief to Nebraska from 2008 to 2011 for all five disaster programs: Supplemental Revenue Assistance Payments (SURE); Livestock Forage Disaster Assistance Program (LFD); Emergency Assistance for Livestock, Honeybees, and Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish Program (ELAP); Livestock Indemnity Program (LIP); and Tree Assistance Program (TAP).

The extreme drought in 2012 significantly affected the agricultural sector across the State of Nebraska. According to the PDSI, 2012's average severity index was ranked at a -4.47, with extremes in August and September of -7.35 and -7.57 respectively. The Farm Credit Services reported total indemnity payments to Nebraska totaled $1.49 billion from crop loss. Cattle ranching is a large driver of the local planning area's economy. The 2012 drought forced ranchers to cull herds by as much as 60% to cope with reduced forage production with an estimated loss of $200 per head by taking cattle to market earlier than normal. Neighborhood plots and small organic farms up to large-scale corn and soybean productions and ranches all faced agricultural declines. Hay production was down 28%, corn was down 16%, and soybean production dropped by 21%.[30]

Probability

Drought conditions are also likely to occur regularly in the planning year. The following table summarizes the magnitude of drought and monthly probability of occurrence.

Table 42: Period of Record in Drought

PDSI Value	Magnitude	Drought Occurrences by Month	Monthly Probability
4 or more to -0.99	No Drought	1,064/1,498	71.1%
-1.0 to -1.99	Mild Drought	184/1,498	12.3%
-2.0 to -2.99	Moderate Drought	102/1,498	6.8%
-3.0 to -3.99	Severe Drought	71/1,498	4.7%
-4.0 or less	Extreme Drought	77/1,489	5.1%

Source: NCEI, Jan 1895-Jan 2019

Regional Vulnerabilities

The Drought Impact Reporter is a database of drought impacts throughout the United States with data going back to 2000. The Drought Impact Reporter has recorded a total of 20 drought-related impacts throughout the region. This is not a comprehensive list of droughts which may have impacted the planning area. These impacts are summarized in the following table.

Table 43: Drought Impacts in Planning Area

Category	Date	Affected Counties	Title
Agriculture	3/10/2018	Red Willow	CoCoRaHS Report from Station #McCook 4.6 NE on 3/10/2018.
Agriculture	7/26/2017	Red Willow	Pasture grasses depleted in Red Willow County, Nebraska
Agriculture, Relief, Response & Restrictions	5/28/2014	Frontier, Red Willow	USDA Designates 18 Counties in Nebraska as Primary Natural Disaster Areas With Assistance to Producers in Surrounding States

30 National Integrated Drought Information System, National Drought Mitigation Center, and University of Nebraska-Lincoln. 2015. "From Too Much to Too Little: how the central U.S. drought of 2012 evolved out of one of the most devastating floods on record in 2011." https://www.drought.gov/drought/sites/drought.gov.drought/files/media/reports/regional_outlooks/CentralRegion2012DroughtAssessment_1-5-15.pdf.

Agriculture, Relief, Response & Restrictions	5/19/2016	Dundy	USDA Designates Dundy County in Nebraska as a Primary Natural Disaster Area with Assistance to Producers in Surrounding States
Agriculture, Relief, Response & Restrictions	2/07/2012	Frontier, Hitchcock, Red Willow	Heineman declares drought emergency - McCook Daily Gazette (NE)
Agriculture, Fire	7/11/2012	Red Willow	Dryland corn affected, grass fires reported in Red Willow County, Nebraska
Agriculture	7/11/2012	Hitchcock	Corn crops stressed in Hitchcock County, Nebraska
Fire	7/11/2012	Hitchcock	Grass fires reported in Hitchcock County, Nebraska
Agriculture	7/11/2012	Hitchcock, Red Willow	Grazing land adversely affected in Dundy, Hitchcock, and Red Willow counties in Nebraska
Agriculture	6/20/2012	Frontier	Producer not able to sustain cow/calf operation in Frontier County, Nebraska
Fire, Relief, Response & Restrictions	8/29/2013	Frontier, Hitchcock, Red Willow	Officials urge “common sense” when lighting campfires this weekend - Omaha World-Herald (NE)
Agriculture, Relief, Response & Restrictions	4/10/2013	Frontier, Hitchcock, Red Willow	USDA Designates 89 Counties in Nebraska as Primary Natural Disaster Areas With Assistance to Surrounding Counties
Agriculture, Relief, Response & Restrictions	1/9/2013	Hitchcock, Red Willow	USDA Designates 88 Counties in Kansas as Primary Natural Disaster Areas With Assistance to Surrounding States
Relief, Response & Restrictions, Water Supply & Quality	4/3/2013	Frontier, Hitchcock, Red Willow	State orders Republican reservoir releases - Lincoln Journal Star (NE)
Agriculture, Relief, Response & Restrictions	8/1/2012	Frontier	USDA Designates 47 Counties in Nebraska as Primary Natural Disaster Areas with Assistance to Producers in Surrounding States
Fire, Relief, Response & Restrictions	7/3/2012	Frontier, Hitchcock, Red Willow	Nebraska fights wildfire in rugged Sandhills - Grand Island Independent (NE)
Agriculture, Relief, Response & Restrictions	10/28/2008	Hitchcock	USDA Designates Two Nebraska Counties as Primary Natural Disaster Areas
Agriculture, Relief, Response & Restrictions	10/17/2006	Hitchcock, Red Willow	USDA Designates 57 Kansas Counties Natural Disaster Areas
Agriculture, Relief, Response & Restrictions	7/18/2006	Frontier, Hitchcock, Red Willow	USDA Designates Counties in Nebraska as Natural Disaster Area
Agriculture, Relief, Response & Restrictions	6/13/2006	Frontier, Hitchcock, Red Willow	Heineman to tour Panhandle to survey drought damage - Sioux City Journal (IA)

Source: NDMC, 2000-2019[31]

31 National Drought Mitigation Center. 2019. “U.S. Drought Impact Reporter.” Accessed January 2019. http://droughtreporter.unl.edu/map/.

The following table provides information related to regional vulnerabilities.

Table 44: Regional Drought and Extreme Heat Vulnerabilities

Sector	Vulnerability
People	-Insufficient water supply -Loss of jobs in agricultural sector -Residents in poverty if food prices increase
Economic	-Closure of water intensive businesses (carwashes, pools, etc.) -Short-term interruption of business -Loss of revenue (long term)
Built Environment	-Cracking of foundations -Damages to landscapes
Infrastructure	-Damages to underground lines -Damages to roadways (prolonged extreme events)
Critical Facilities	-Loss of power and impact on infrastructure
Climate	-Increased risk of wildfire events, damaging buildings and agricultural land

EXTREME HEAT

Extreme heat is often associated with periods of drought but can also be characterized by long periods of high temperatures in combination with high humidity. During these conditions, the human body has difficulty cooling through the normal method of the evaporation of perspiration. Health risks arise when a person is overexposed to heat. Extreme heat can also cause people to overuse air conditioners, which can lead to power failures. Power outages for prolonged periods increase the risk of heat stroke and subsequent fatalities due to loss of cooling and proper ventilation. The planning area is largely rural, which presents an added vulnerability to extreme heat events; those suffering from an extreme heat event may be farther away from medical resources as compared to those living in an urban setting. Since MPPD is the entity primarily responsible for supplying power to the district residences and customers, this risk can directly affect the MPPD infrastructure and operations.

Along with humans, animals also can be affected by high temperatures and humidity. For instance, cattle and other farm animals respond to heat by reducing feed intake, increasing their respiration rate, and increasing their body temperature. These responses assist the animal in cooling itself, but this is usually not sufficient. When animals overheat, they will begin to shut down body processes not vital to survival, such as milk production, reproduction, or muscle building.

Other secondary concerns connected to extreme heat hazards include water shortages brought on by drought-like conditions and high demand. Government authorities report that civil disturbances and riots are more likely to occur during heat waves. In cities, pollution becomes a problem because the heat traps pollutants in densely populated urban areas. Adding pollution to the stresses associated with the heat magnifies the health threat to the urban population.

The National Weather Service (NWS) is responsible for issuing excessive heat outlooks, excessive heat watches, and excessive heat warnings.

- **Excessive heat outlooks** are issued when the potential exists for an excessive heat event in the next three to seven days. Excessive heat outlooks can be utilized by public utility staffs, emergency managers, and public health officials to plan for extreme heat events.
- **Excessive heat watches** are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours.
- **Excessive heat warnings** are issued when an excessive heat event is expected in the next 36 hours. Excessive heat warnings are issued when an extreme heat event is occurring, is imminent, or has a very high probability of occurring.

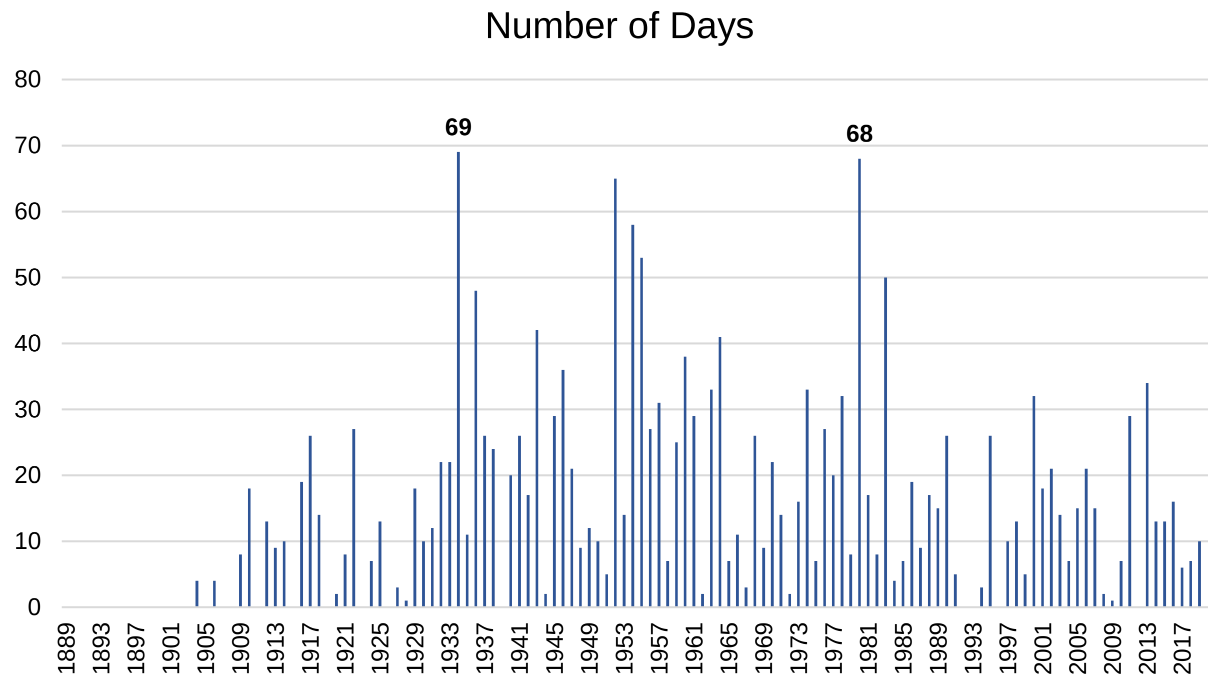
Location

The entire planning area is susceptible to impacts resulting from extreme heat.

Historical Occurrences

According to the High Plains Regional Climate Center (HPRCC), on average, the planning area experiences 15 days above 100°F per year. The planning area experienced the most days on record above 100°F in 1934 with 69 days and in 1980 with 68 days.

Figure 15: Number of Days Above 100°F



Source: HPRCC, 1899-2019

Extent

A key factor to consider regarding extreme heat situations is the humidity level relative to the temperature. As is indicated in the following figure from the National Oceanic and Atmospheric Administration (NOAA), as the relative humidity increases, the temperature needed to cause a dangerous situation decreases. For example, for 100 percent relative humidity, dangerous levels of heat begin at 86°F whereas a relative humidity of 50 percent, require 94°F. The combination of relative humidity and temperature result in a Heat Index as demonstrated below:

$$100\%\ Relative\ Humidity + 86°\mathrm{F} = 112°\mathrm{F}\ Heat\ Index$$

Figure 16: NOAA Heat Index

Temperature (°F)

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

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution **Extreme Caution** **Danger** **Extreme Danger**

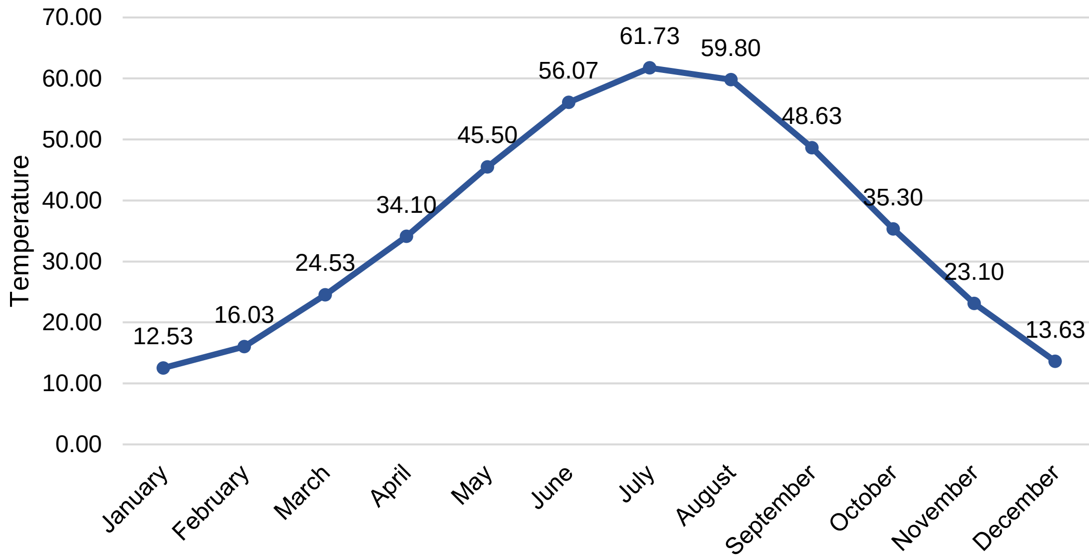
Source: NOAA, 2017[32]

The figure above is designed for shady and light wind conditions. Exposure to full sunshine or strong winds can increase hazardous conditions and raise heat index values by up to 15°F. For the purposes of this plan, extreme heat is being defined as temperatures of 100°F or greater.

For the planning area, the months with the highest temperatures are June, July, and August.

32 National Oceanic and Atmospheric Administration, National Weather Service. 2017. "Heat Index." http://www.nws.noaa.gov/om/heat/heat_index.shtml.

Figure 17: Monthly Climate Normals Max Temperature (1981-2010)



Source: NCEI, 2019

Average Annual Losses

The annual property estimate was determined based upon NCEI Storm Events Database since 1996. The annual crop loss was determined based upon the RMA Cause of Loss Historical Database since 2000. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. The direct and indirect effects of extreme heat are difficult to quantify. Potential losses such as power outages could affect businesses, homes, and critical facilities. High demand and intense use of air conditioning or water pumps can overload the electrical systems and cause damages to infrastructure. The Planning Team identified that during periods of extreme heat, power lines get hot, sag, and burn down; eventually having to be replaced. Also, following periods of extreme heat and high electrical loads, there have been instances of power failure.

Table 45: Loss Estimate for Extreme Heat

Hazard Type	Avg. Number of Days Above 100°F[1]	Total Property Loss[2]	Average Annual Property Loss[2]	Total Crop Loss[3]	Average Annual Crop Loss[3]
Extreme Heat	9 days	$0	$0	$23,760,077	$ 2,640,009

Source: 1 HPRCC (1899-2019); 2 Indicates data is from NCEI (Jan 1996 to Dec 2019); 3 Indicates data is from USDA RMA (2000 to 2019)

Estimated Loss of Electricity

According to the FEMA Benefit Cost Analysis (BCA) Reference Guide, if an extreme heat event occurred within the planning area, the following table assumes the event could potentially cause a loss of electricity for 10 percent of the population at a cost of $126 per person per day.[33] In rural areas, the percent of the population affected and duration may increase during extreme events. The assumed damages do not take into account physical damages to utility equipment and infrastructure, as those losses would be on top of the assumed damages represented in this table.

33 Federal Emergency Management Agency. June 2009. "BCA Reference Guide."

Table 46: Loss of Electricity - Assumed Damage by Jurisdiction

Jurisdiction	(est.) 2017 Population	Population Affected (Assumed)	Electric Loss of Use Assumed Damage Per Day
Frontier	2,609	261	$32,886
Hitchcock	2,843	284	$35,784
Red Willow	10,806	1,081	$136,206
Total	**16,258**	**1,626**	**$204,876**

Probability

Extreme heat is a regular part of the climate for the planning area; there is a 100 percent probability that temperatures greater than 100°F will occur annually.

The Union for Concerned Scientists released a report in July 2019 titled *Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days*[34] which included predictions for extreme heat events in the future dependent on future climate actions. The table below summarizes those findings for the planning area.

Table 47: Extreme Heat Predictions for Days over 100F

Jurisdiction	Midcentury Prediction 2036-2065 (days per year)	Late Century Prediction 2070-2099 (days per year)
Frontier	24	51
Hitchcock	25	51
Red Willow	28	54

Source: Union of Concerned Scientists[35]

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities.

Table 48: Regional Extreme Heat Vulnerabilities

Sector	Vulnerability
People	-Heat exhaustion -Heat Stroke
Economic	-Short-term interruption of business -Loss of power
Built Environment	-Damage to air conditioning/HVAC systems if overworked
Infrastructure	-Damages to roadways (prolonged extreme events) -Stressing of electrical systems (brownouts during peak usage) -Damages to power lines
Critical Facilities	-Loss of power
Climate	-Increased risk of wildfire events -Increases in extreme heat conditions are likely, adding stress on livestock, crops, people, and infrastructure

34 Union of Concerned Scientists. 2019. "Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days." https://www.ucsusa.org/sites/default/files/attach/2019/07/killer-heat-analysis-full-report.pdf.

35 Union of Concerned Scientists. 2019. "Extreme Heat and Climate Change: Interactive Tool". https://www.ucsusa.org/global-warming/global-warming- impacts/extreme-heat-interactive-tool?location=lancaster-county--ne

FLOODING

Flooding can occur on a local level, sometimes affecting only a few streets, but can also extend throughout an entire district, affecting whole drainage basins and impacting property in multiple states. Heavy accumulations of ice or snow can also cause flooding during the melting stage. These events are complicated by the freeze/thaw cycles characterized by moisture thawing during the day and freezing at night. There are four main types of flooding: riverine flooding, flash flooding, sheet flooding, and ice jam flooding.

Riverine Flooding

Riverine flooding, slower in nature, is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt or ice melt. The areas adjacent to rivers and stream banks that carry excess floodwater during rapid runoff are called floodplains. A floodplain or flood risk area is defined as the lowland and relatively flat area adjoining a river or stream. The terms “base flood” and “100-year flood” refer to the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year. Floodplains are part of a larger entity called a basin or watershed, which is defined as all the land drained by a river and its tributaries.

Flash Flooding

Flash floods, faster in nature than the other types of floods, result from convective precipitation usually due to intense thunderstorms or sudden releases from an upstream impoundment created behind a dam, landslide, or levee. Flash floods are distinguished from regular floods by a timescale of fewer than six hours. Flash floods cause the most flood-related deaths as a result of this shorter timescale. Flooding from excessive rainfall in Nebraska usually occurs between late spring and early fall.

Sheet Flooding

In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations – areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development exceeds the capacity of the drainage infrastructure, therefore limiting its ability to properly carry and disburse the water flow. Flooding also occurs due to combined storm and sanitary sewers being overwhelmed by the tremendous flow of water that often accompanies storm events. Typically, the result is water backing into basements, which damages mechanical systems and can create serious public health and safety concerns.

Ice Jam Flooding

Ice jams occur when ice breaks up in moving waterways, and then stacks on itself where channels narrow or human-made obstructions constrict the channel. This creates an ice dam, often causing flooding within minutes of the dam formation. Ice formation in streams occurs during periods of cold weather when finely divided colloidal particles called "frazil ice" form. These particles combine to form what is commonly known as “sheet ice.” This type of ice covers the entire river. The thickness of this ice sheet depends upon the degree and duration of cold weather in the area. This ice sheet can freeze to the bottom of the channel in places. During spring thaw, rivers frequently become clogged with this winter accumulation of ice. Because of relatively low stream banks and channels blocked with ice, rivers overtop existing banks and flow overland.

Location

Table 49 shows current statuses of Flood Insurance Rate Map (FIRM) panels within Frontier, Hitchcock, and Red Willow counties. Figure 18 shows the one percent annual flood risk hazard area within the planning area.

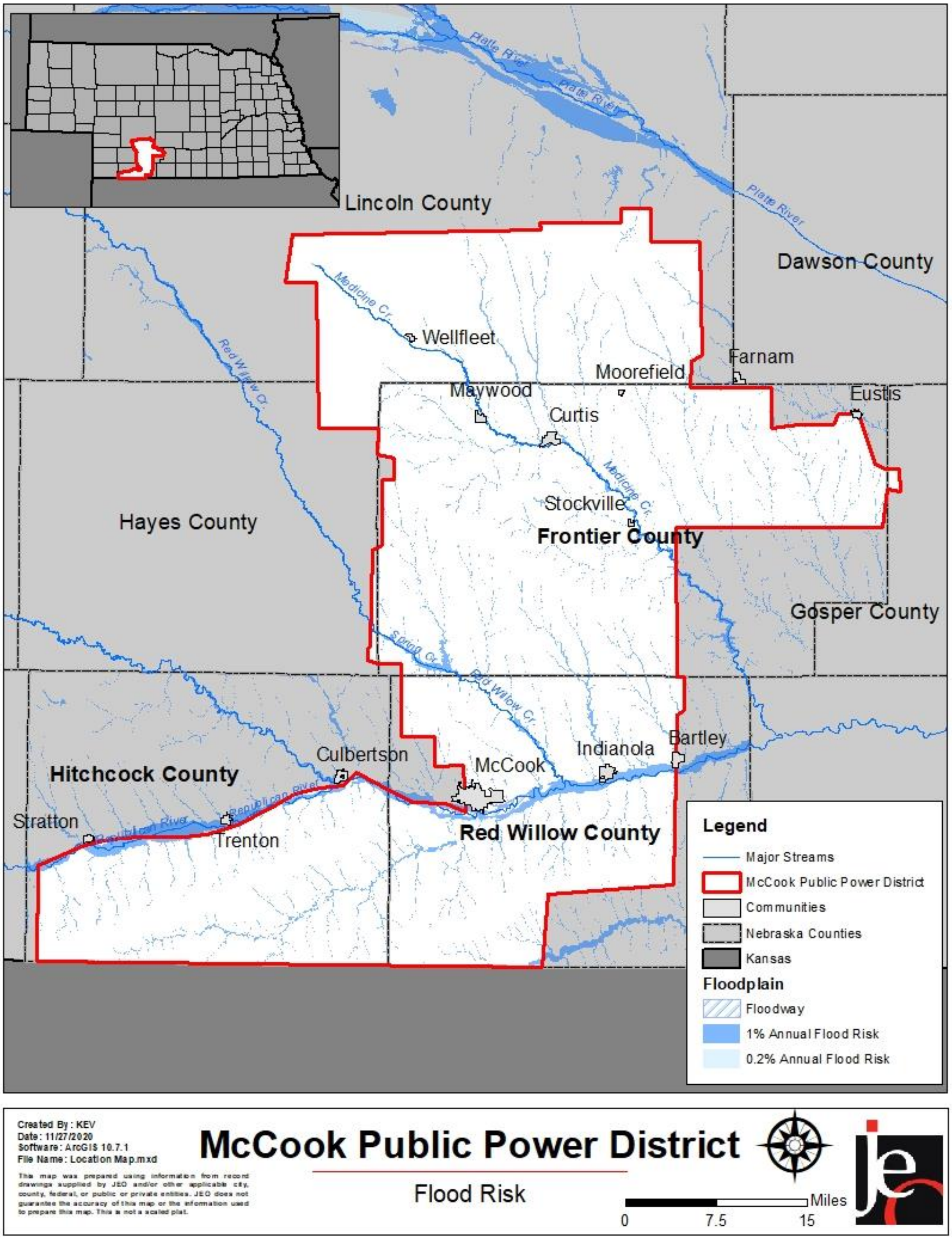
Table 49: FEMA FIRM Panel Status

Jurisdiction	Participating in NFIP? (Y/N)	Panel Number	Effective Date
Frontier County	Yes	31063CIND0A, 31063C0025C, 31063C0050C, 31063C0075C, 31063C0100C, 31063C0125C, 31063C0150C, 31063C0175C, 31063C0200C, 31063C0225C, 31063C0250C, 31063C0275C, 31063C0300C, 31063C0325C, 31063C0350C, 31063C0375C, 31063C0400C, 31063C0425C, 31063C0450C, 31063C0475C, 31063C0500C, 31063C0525C, 31063C0550C, 31063C0575C, 31063C0600C, 31063C0625C, 31063C0650C, 31063C0675C, 31063C0700C, 31063C0725C, 31063C0750C, 31063C0775C	04/02/08(M)
Hitchcock County	Yes	31087CIND0A, 31087C0025C, 31087C0050C, 31087C0055C, 31087C0075C, 31087C0100C, 31087C0125C, 31087C0150C, 31087C0165C, 31087C0175C, 31087C0195C, 31087C0200C, 31087C0225C, 31087C0230C, 31087C0250C, 31087C0275C, 31087C0300C, 31087C0325C, 31087C0350C, 31087C0375C	03/18/08
Red Willow	Yes	31145CIND0B, 31145C0025C, 31145C0050C, 31145C0075C, 31145C0100C, 31145C0125C, 31145C0150C, 31145C0175C, 31145C0185C, 31145C0195C, 31145C0200C, 31145C0205C, 31145C0215C, 31145C0225C, 31145C0230C, 31145C0235D, 31145C0250C, 31145C0275C, 31145C0300C, 31145C0325C, 31145C0350C, 31145C0375C, 31145C0400C, 31145C0425C, 31145C0450C	11/16/11(M)

Source: FEMA, 2020[36],[37]
**(M) indicates no elevation determined – All Zone A, C, and X*

36 Federal Emergency Management Agency. 2019. “FEMA Flood Map Service Center.” Accessed November 2020. http://msc.fema.gov/portal/advanceSearch.
37 Federal Emergency Management Agency. 2020. “Community Status Book Report.” Accessed November 2020. https://www.fema.gov/national-flood-insurance-program-community-status-book

Figure 18: 1% Annual Flood Risk Hazard Area



Extent

The NWS has three categories to define the severity of a flood once a river reaches flood stage as indicated in Table 50.

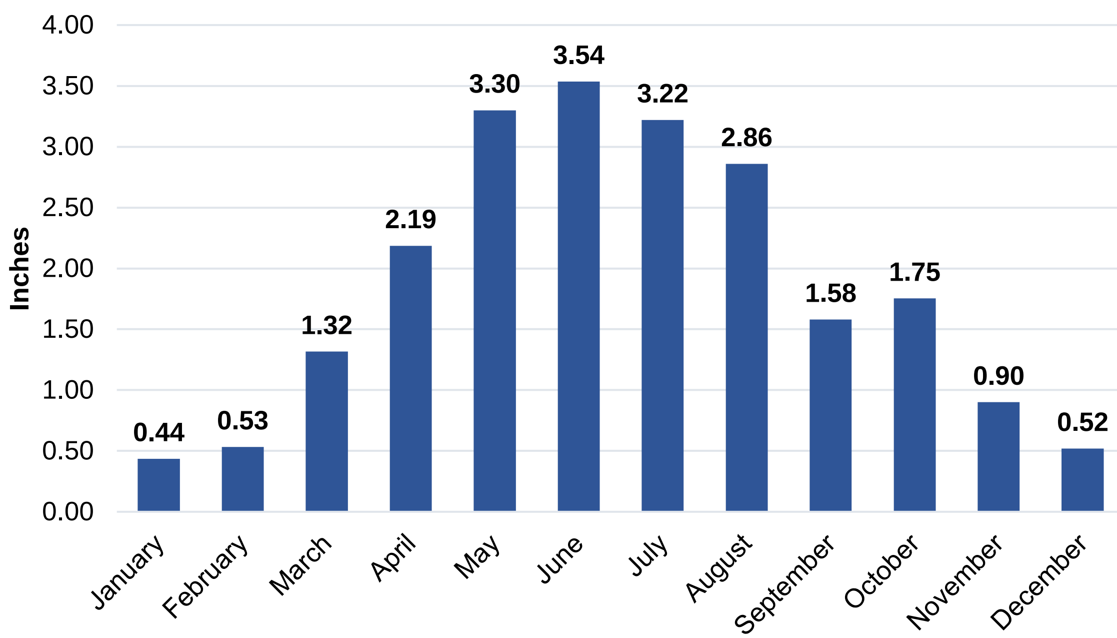
Table 50: Flooding Stages

Flood Stage	Description of flood impacts
Minor Flooding	Minimal or no property damage, but possibly some public threat or inconvenience
Moderate Flooding	Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary
Major Flooding	Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations

Source: NOAA, 2017[38]

Figure 19 shows the normal average monthly precipitation for the planning area, which is helpful in determining whether any given month is above, below, or near normal in precipitation. As indicated in Figure 20, the most common months for flooding within the planning area are May and July.

Figure 19: Average Monthly Precipitation for Planning Area

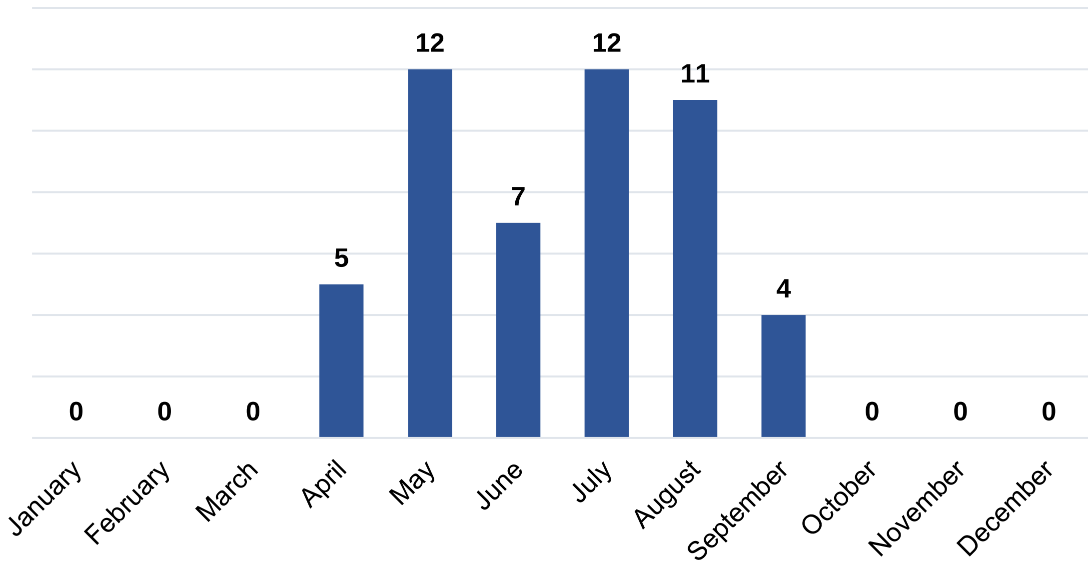


Source: NCEI, 2019[39]

38 National Weather Service. 2017. “Flood Safety.” https://www.weather.gov/safety/flood.

39 NOAA National Centers for Environmental Information. December 2019. "Data Tools: 1981-2010 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Figure 20: Monthly Events for Floods/Flash Floods



Source: NCEI, 1996-2019

National Flood Insurance Program (NFIP)

The NFIP was established in 1968 to reduce flood losses and disaster relief costs by guiding future development away from flood hazard areas where feasible; by requiring flood resistant design and construction practices; and by transferring the costs of flood losses to the residents of floodplains through flood insurance premiums.

In return for availability of federally backed flood insurance, jurisdictions participating in the NFIP must agree to adopt and enforce floodplain management standards to regulate development in special flood hazard areas (SFHA) as defined by FEMA's flood maps. One of the strengths of the program has been keeping people away from flooding rather than keeping the flooding away from people – through historically expensive flood control projects.

The following tables summarize NFIP participation and active policies within the planning area. As a quasi-state government, MPPD is generally exempt from local floodplain ordinances, and is not a member of the National Flood Insurance Program. Despite this exemption, MPPD is self-insured and incorporates mitigation into any structure or infrastructure located in the floodplain.

Table 51: NFIP Participants

Jurisdiction	Participate in NFIP	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded
Frontier County	Yes	4/02/08	4/02/08(M)	-	-	-
Hitchcock County	Yes	4/08/08	3/18/08	-	-	-
Red Willow County	Yes	5/01/88	11/16/11(M)	-	-	-

Source: Federal Emergency Management Agency, National Flood Insurance Program, 2017[40]
**(M) indicates no elevation determined – All Zone A, C, and X;*

40 Federal Emergency Management Agency: National Flood Insurance Program. September 2018. "Policy & Claim Statistics for Flood Insurance." Accessed December 2019. https://www.fema.gov/policy-claim-statistics-flood-insurance.

Table 52: NFIP Policies in Force and Total Payments

Jurisdiction	Policies In-force	Total Coverage	Total Premiums	Total Losses	Total Payments
McCook	12	$4,090	$10,148	3	$3,084
Hitchcock County	4	$739	$3,196	0	$0
Red Willow County	9	$917	$6,467	8	$32,450

Source: Federal Emergency Management Agency, National Flood Insurance Program, NFIP Community Status Book, 2019[41]

This plan highly recommends and strongly encourages eligible jurisdictions to enroll, participate, and remain in good standing with the NFIP. Compliance with the NFIP should remain a top priority for each jurisdiction. Jurisdictions are encouraged to initiate activities above the minimum participation requirements, which are described in the Community Rating System (CRS) Coordinator's Manual (FIA-15/2017).[42] Currently no jurisdictions within MPPD participate in the CRS program.

NFIP Repetitive Loss Structures

NeDNR was contacted to determine if any existing buildings, infrastructure, or critical facilities are classified as NFIP Repetitive Loss Structures. As of May 2020, there were no repetitive loss properties identified in the planning area.

Historical Occurrences

The NCEI reports events as they occur in each community. A single flooding event can affect multiple communities and counties at a time; the NCEI reports these large scale, multi-county events as separate events. The result is a single flood event covering a large portion of the planning area could be reported by the NCEI as several events. According to the NCEI, 46 flash flooding events resulted in $1,270,000 in property damage, while six riverine flooding events resulted in $200,000 in property damage. USDA RMA data does not distinguish the difference between riverine flooding damages and flash flooding damages. The total crop loss according to the RMA is $112,746. Descriptions of the most damaging flood events from the NCEI are below:

- **May 28, 2007 –** Thunderstorms produced very heavy rainfall of 2 to 9 inches across Frontier County. The heaviest rainfall occurred across the western portion of the county. North Brushy Road was completely washed out with a 30-foot by 50-foot gully in the road. Numerous secondary roads were severely damaged due to water over the roads and bridges. Medicine Creek rose rapidly and produced significant damage at Arrowhead Golf Course in Curtis. The flooding event resulted in $300,000 in property damages and $30,000 in crop damages.
- **May 29, 2007 –** Law enforcement reported that Frenchmen Creek was 25 feet wide at the river gauge. One home was flooded with some railroad damage between Palisade and Culbertson. Frenchman Creek near Palisade was running over the bridge. County roads around Palisade were washed out. Approximately 5.88 inches of rain produced flash flooding near Palisade where roads are also washed out. Frenchman Creek ultimately crested at 9.8 feet at Culbertson, which is 1.8 feet above flood stage (8.0 feet). The Frenchman was over flood stage for approximately 34 hours on May 30-31. This was the

41 Federal Emergency Management Agency: National Flood Insurance Program. December 2019. Policy & Claim Statistics for Flood Insurance." Accessed June 2020. https://www.fema.gov/policy-claim-statistics-flood-insurance.

42 Federal Emergency Management Agency. December 2019. "National Flood Insurance Program Community Rating System: Coordinator's Manual FIA-15/2017." Accessed December 2019. https://www.fema.gov/media-library/assets/documents/8768.

third highest crest reported in a nearly continuous period of record beginning in 1913. The flooding event resulted in $200,000.

- **May 23, 2008 –** Several days of heavy rainfall resulted in widespread flooding of roads across the county. Severe thunderstorms developed during the afternoon, producing extremely heavy rainfall and hail. The flooding event resulted in $200,000 in property damages.
- **August 9, 2008 –** The Hitchcock County Commissioner estimated 5.25 inches of rain fell from overnight storms, with several roads in the extreme northeast part of Hitchcock county damaged and impassible. At approximately 11:45 am CDT, an earthen dam partially failed on the Hayes-Hitchcock county border, resulting in further flooding during the next 24 hours. Extremely heavy rainfall occurred across northeastern Hitchcock county overnight producing flooding across rural northeast Hitchcock county roads. An earthen dam partially gave way on Blackwood Creek resulting in additional flooding. This flooding event resulted in $250,000 in property damages.

In March 2019, much of the State of Nebraska was impacted by a large winter storm and flood event. In the planning area, Frontier County was the only county to receive a disaster declaration in March 2019.

Average Annual Damages

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and the number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Flooding causes an average of $61,250 in property damages and $12,527 in crop losses per year for the planning area. The Planning Team also identified that past flooding events have caused damages to underground infrastructure, transformers, and poles.

Table 53: Flood Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Flooding	52	2.2	$1,470,000	$61,250	$112,746	$12,527

Source: 1 Indicates data is from NCEI (Jan 1996 to Sept 2019); 2 Indicates data is from USDA RMA (2000 to 2019)

Probability

The NCEI reports six flooding and 46 flash flooding events for a total of 52 events from January 1996 to January 2020. Based on the historic record and reported incidents by participating communities, there is a 100 percent probability that flooding will occur annually in the planning area.

Regional Vulnerabilities

A 2008 national study examining social vulnerability as it relates to flood events found that low-income and minority populations are disproportionately vulnerable to flood events. These groups may lack needed resources to mitigate potential flood events as well as resources that are necessary for evacuation and response. In addition, low-income residents are more likely to live in areas vulnerable to the threat of flooding but lack the resources necessary to purchase flood insurance. The study found that flash floods are more often responsible for injuries and fatalities than prolonged flood events.

Other groups that may be more vulnerable to floods, specifically flash floods, include the elderly, those outdoors during rain events, and those in low-lying areas. Elderly residents may suffer from a decrease or complete lack of mobility and as a result, be caught in flood-prone areas. Residents in campgrounds or public parks may be more vulnerable to flooding events. Many of these areas exist in natural floodplains and can experience rapid rise in water levels resulting in injury or death.

On a state level, the Nebraska's State National Flood Insurance Coordinator's office has studied who lives in special flood hazard areas. According to the NeDNR, floodplain areas have a few unique characteristics which differ from non-floodplain areas:

- Higher vacancy rates within floodplain
- Far higher percentage of renters within floodplain
- Higher percentage of non-family households in floodplain
- More diverse population in floodplain
- Much higher percentage of Hispanic/Latino populations in the floodplain

GIS parcel data was acquired from each county's assessor. This data was analyzed for the location, number, and value of property improvements at the parcel level. Property improvements include any built structures such as roads, buildings, and paved lots. The data did not contain the number of structures on each parcel. A summary of the results of this analysis is provided in Table 54.

Table 54: Parcel Improvements and Value in the Floodplain

County	Number of Improvements	Total Improvement Value	Number of Improvements in Floodplain	Value of Improvements in Floodplain	Percentage of Improvements in Floodplain
Frontier County[1]	2,652	$290,050,850	276	$17,011,884	10.4%
Hitchcock County[2]	2,137	$90,976,340	400	$24,950,414	18.7%
Red Willow County[3]	2,203	$240,386,527	141	$14,770,439	6.4%
Planning Area Total	**6,992**	**$621,413,717**	**817**	**$56,732,737**	**11.7%**

Source: 1 Frontier County Assessor, 2018; 2 Hitchcock County Assessor, 2018; 3 Red Willow County Assessor, 2018

The following table is a summary of regional vulnerabilities.

Table 55: Regional Flooding Vulnerabilities

Sector	Vulnerability
People	-Low income and minority populations may lack the resources needed for evacuation, response, or to mitigate the potential for flooding -Elderly or residents with decreased mobility may have trouble evacuating -Residents in low-lying areas, especially campgrounds, are vulnerable during flash flood events -Residents living in the floodplain may need to evacuate for extended periods
Economic	-Business closures or damages may have significant impacts -Agricultural losses from flooded fields or cattle loss -Closed roads and railways would impact commercial transportation of goods
Built Environment	-Buildings may be damaged
Infrastructure	-Damages to roadways and railways -Damages to electrical infrastructure
Critical Facilities	-Critical facilities, especially those in the floodplain, are at risk to damage
Climate	-Changes in seasonal and annual precipitation normals will likely increase frequency and magnitude of flood events

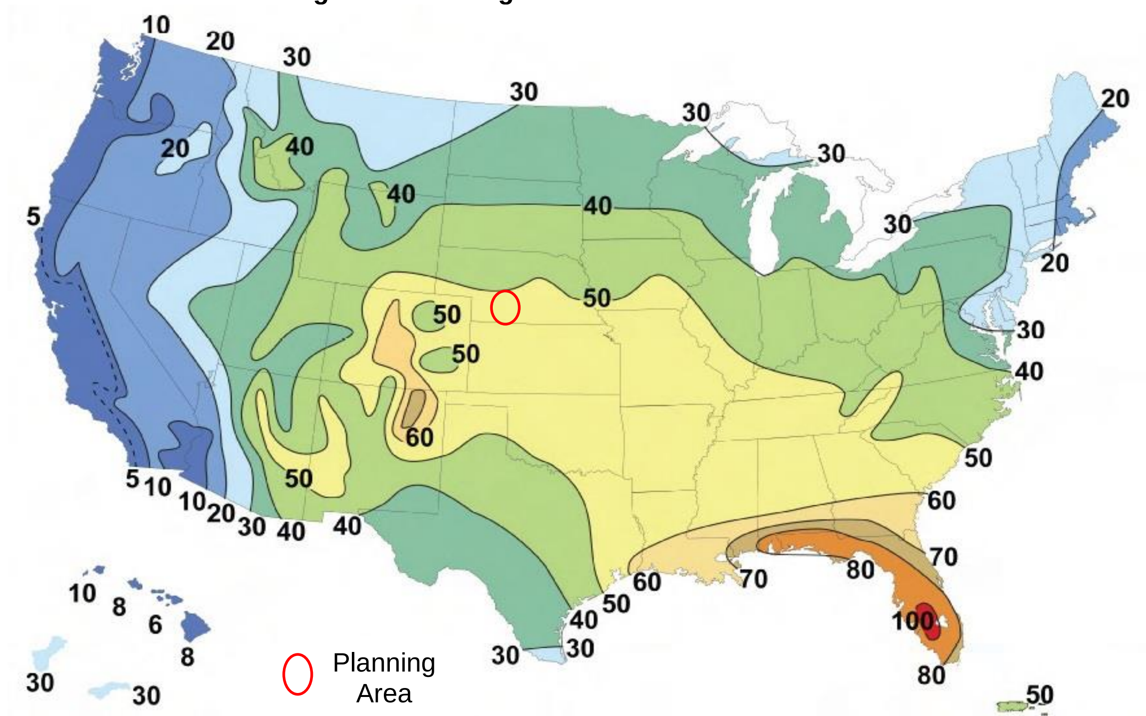
SEVERE THUNDERSTORMS

Severe thunderstorms are common and unpredictable seasonal events throughout Nebraska. A thunderstorm is defined as a storm that contains lightning and thunder, which is caused by unstable atmospheric conditions. When the cold upper air sinks and the warm, moist air rises, storm clouds or “thunderheads” develop, resulting in thunderstorms. This can occur singularly, in clusters, or in lines.

Thunderstorms can develop in fewer than 30 minutes and can grow to an elevation of eight miles into the atmosphere. Lightning, by definition, is present in all thunderstorms and can cause harm to humans and animals, fires to buildings and agricultural lands, and electrical outages in municipal electrical systems. Lightning can strike up to 10 miles from the portion of the storm depositing precipitation. There are three primary types of lightning: intra-cloud, inter-cloud, and cloud to ground. While intra and inter-cloud lightning are more common, communities are potentially impacted when lightning comes in contact with the ground. Lightning generally occurs when warm air mixes with colder air masses resulting in atmospheric disturbances necessary for polarizing the atmosphere. Additionally, hail is a common component of thunderstorms and often occurs in series, with one area having the potential to be hit multiple times in one day. Severe thunderstorms usually occur in the evening during the spring and summer months. Hail can destroy property and crops with sheer force, as some hail stones can fall at speeds up to 100 mph.

Economically, thunderstorms are generally beneficial in that they provide moisture necessary to support Nebraska’s largest industry, agriculture. The majority of thunderstorms do not cause damage, but when they escalate to severe storms and/or produce hail, the potential for damages increases. Damages can include: crop losses from wind and hail; property losses due to building and automobile damages from hail; high wind; flash flooding; death or injury to humans and animals from lightning, drowning, or getting struck by falling or flying debris; and personal injury from people not seeking shelter during these events or standing near windows. The potential for damages increases as the size of the hail increases. Figure 21 displays the average number of days with thunderstorms across the country each year. The planning area experiences an average of 50 thunderstorms over the course of one year.

Figure 21: Average Number of Thunderstorms



Source: NWS, 2018[43]

Location

The entire planning area is at risk to thunderstorms due to the regional nature of this type of event.

Extent

The geographic extent of a severe thunderstorm event may be large enough to impact the entire planning area (such as in the case of a squall line, derecho, or long-lived supercell) or just a few square miles, in the case of a single cell that marginally meets severe criteria. The NWS defines a thunderstorm as severe if it contains hail that is one inch in diameter or capable of winds gusts of 58 mph or higher. The Tornado and Storm Research Organization (TORRO) scale is used to classify hailstones and provides some detail related to the potential impacts from hail. Table 56 outlines the TORRO Hail Scale.

Table 56: TORRO Hail Scale

Class	Type of Material	Divisions
H0: Hard Hail	5 mm; (Pea size); 0.2 in	No damage
H1: Potentially Damaging	5 -15 mm (Marble); 0.2 – 0.6 in	Slight general damage to plants and crops
H2: Significant	10 -20 mm (Grape); 0.4 – 0.8 in.	Significant damage to fruit, crops, and vegetation
H3: Severe	20 -30 mm (Walnut); 0.8 – 1.2 in	Severe damage to fruit and crops, damage to glass and plastic structures
H4: Severe	30 -40 mm (Squash Ball); 1.2 – 1.6 in	Widespread damage to glass, vehicle bodywork damaged
H5: Destructive	40 – 50 mm (Golf ball); 1.6 – 2.0 in.	Wholesale destruction of glass, damage to tiled roofs; significant risk or injury

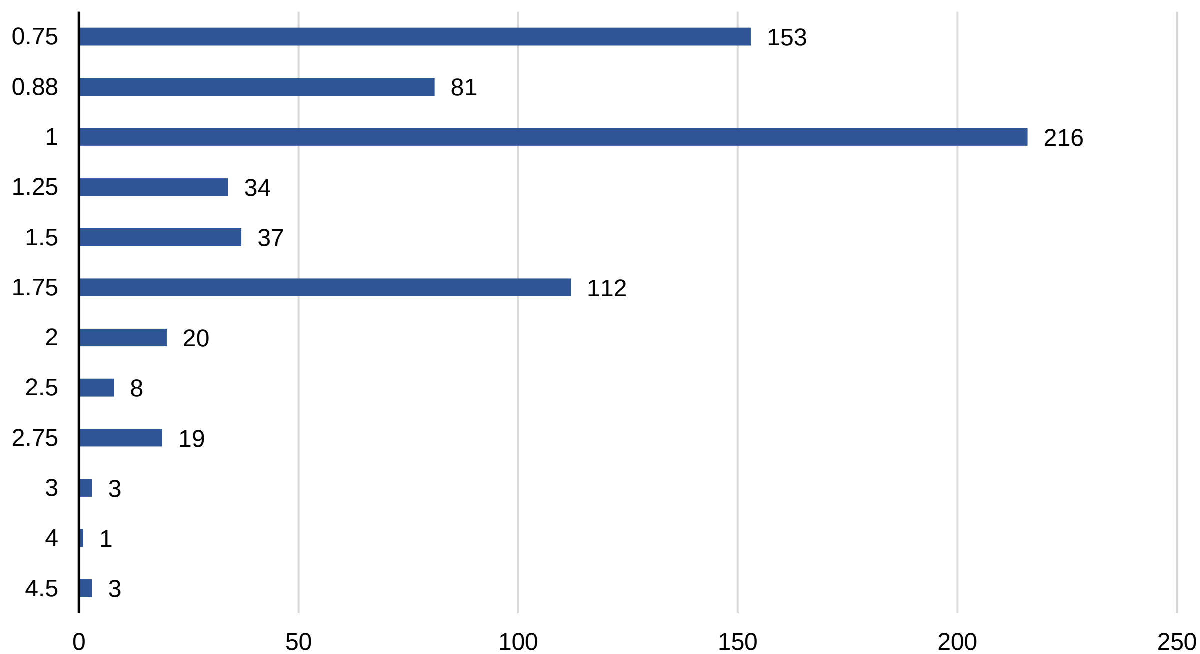
43 National Weather Service. 2018. "Introduction to Thunderstorms." https://www.weather.gov/jetstream/tstorms_intro.

H6: Destructive	50 – 60 mm (chicken egg); 2.0 – 2.4 in	Grounded aircrafts damaged, brick walls pitted; significant risk of injury
H7: Destructive	60 – 75 mm (Tennis ball); 2.4 – 3.0 in	Severe roof damage; risk of serious injuries
H8: Destructive	75 – 90 mm (Large orange); 3.0 – 3.5 in.	Severe damage to structures, vehicles, airplanes; risk of serious injuries
H9: Super Hail	90 – 100 mm (Grapefruit); 3.5 – 4.0 in	Extensive structural damage; risk of severe or even fatal injuries to persons outdoors
H10: Super Hail	>100 mm (Melon); > 4.0 in	Extensive structural damage; risk or severe or even fatal injuries to persons outdoors

Source: TORRO, 2017[44]

The NCEI reported 687 individual hail events across the planning area. As the NCEI reports events per county, this value overestimates the total amount of thunderstorm events. The average hailstone size was 1.21 inches. Events of this magnitude correlate to an H4 Severe classification. It is reasonable to expect H4 classified events to occur several times in a year throughout the planning area. In addition, it is reasonable, based on the number of occurrences, to expect larger hailstones to occur in the planning area annually. The planning area has endured four H10 hail events (>4.0 inches) during the period of record. Figure 22 shows hail events based on the size of the hail.

Figure 22: Hail Events by Magnitude



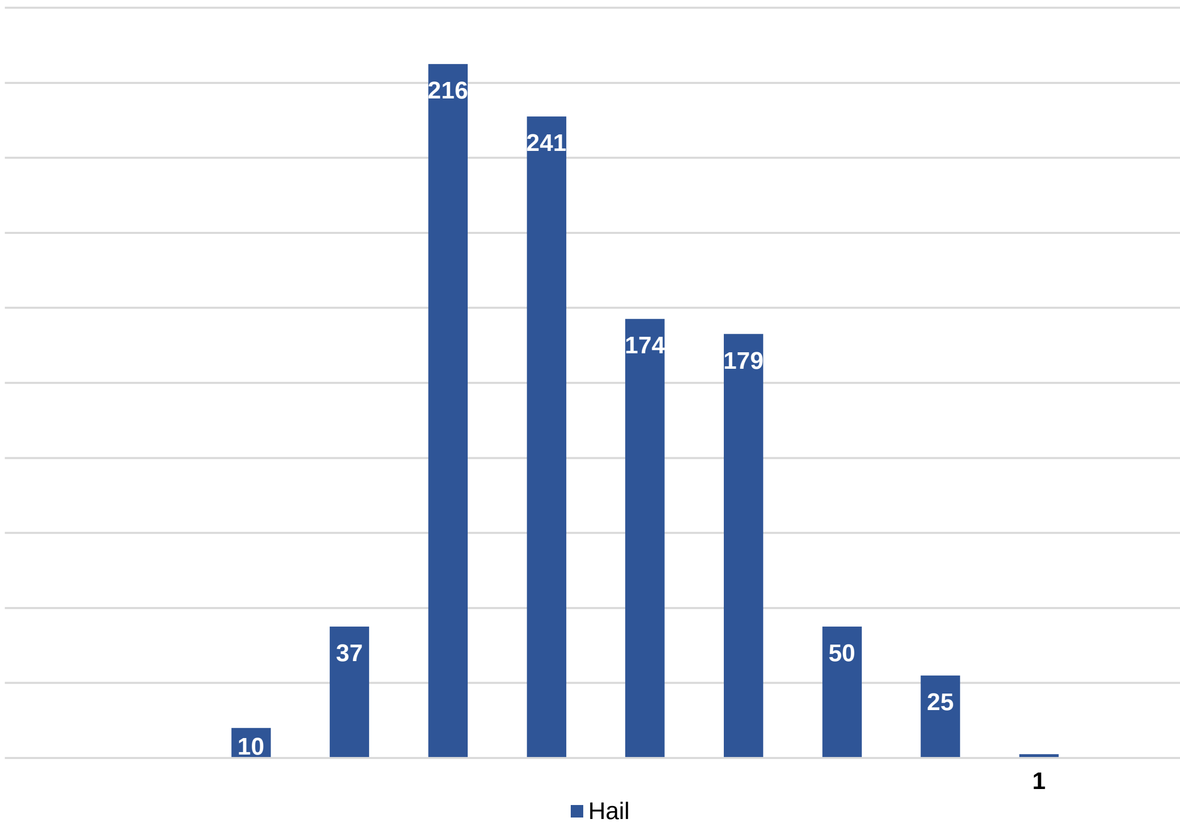
Source: NCEI, 1996-2019

Historical Occurrences

Historical occurrences of severe thunderstorm events were updated and provided by the planning team as well as researched on the National Centers for Environmental Information (NCEI) for January 1996 to December 2019. All damage estimates listed in the historical occurrences are in "year reported" dollars. Severe thunderstorms in the planning area usually occur in the afternoon and evening during the summer months (Figure 23).

44 Tornado and Storm Research Organization. 2017. "Hail Scale." http://www.torro.org.uk/hscale.php.

Figure 23: Severe Thunderstorm Events by Month



Source: NCEI, 1996-2019

The NCEI reports events as they occur in each community. A single severe thunderstorm event can affect multiple communities and counties at a time; the NCEI reports these large scale, multi-county events as separate events. The result is a single thunderstorm event covering the entire region could be reported by the NCEI as several events.

The NCEI reports a total of 259 thunderstorm wind, one heavy rain, eight lightning, and 687 hail events in the planning area from January 1996 to September 2019. In total these events were responsible for $16,799,500 in property damages. The USDA RMA data shows that severe thunderstorms caused $5,868,785 in crop damages. There were five injuries and one fatality reported in association with these storms.

Average Annual Damages

The average damage per event estimate was determined based upon recorded damages from NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe thunderstorms cause an average of $699,979 per year in property damages. The Planning Team estimated that lightning strikes cause tens of thousands of dollars in damages to electrical infrastructure every year.

Table 57: Severe Thunderstorms Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss	Total Crop Loss[2]	Average Annual Crop Loss
Hail	687	28.6	$4,420,200	$184,175	$5,868,785	$652,087
Heavy Rain	1	0.04	$0	$0		
Lightning	8	0.3	$21,750	$906		
Thunderstorm Wind	259	10.8	$12,357,550	$514,898		
Total	**955**	**39.74**	**$16,799,500**	**$699,979**	**184$5,868,785**	**$652,087**

Source: 1 Indicates data is from NCEI (January 1996 to Sept 2019); 2 Indicates data is from USDA RMA (2000 to 2019)

Probability

Based on historical records and reported events, severe thunderstorms events and storms with hail are likely to occur on an annual basis. The NCEI reported a total of 955 severe thunderstorm events between 1996 and 2019; resulting in 100 percent chance annually for thunderstorms.

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities.

Table 58: Regional Thunderstorm Vulnerabilities

Sector	Vulnerability
People	-Elderly citizens with decreased mobility may have trouble evacuating or seeking shelter -Mobile home residents are risk of injury and damage to their property if the mobile home is not anchored properly -Injuries can occur from: not seeking shelter, standing near windows, and shattered windshields in vehicles
Economic	-Damages to buildings and property can cause significant losses
Built Environment	-Buildings and infrastructure are at risk to hail damage -Downed trees and tree limbs -Roofs, siding, windows, gutters, HVAC systems, etc. can incur damage
Infrastructure	-High winds and lightning can cause power outages and down power lines -Roads may wash out from heavy rains and become blocked from downed tree limbs
Critical Facilities	-Power outages are possible -Critical facilities may sustain damage from hail, lightning, and wind
Climate	-Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of severe storm events

SEVERE WINTER STORMS

Severe winter storms are an annual occurrence in Nebraska. Winter storms can bring extreme cold, freezing rain, heavy or drifting snow, and blizzards. Blizzards are particularly dangerous due to drifting snow and the potential for rapidly occurring whiteout conditions which greatly inhibit vehicular traffic. Generally, winter storms occur between the months of November and March but may occur as early as October and as late as April. Heavy snow is usually the most defining element of a winter storm. Large snow events can cripple an entire jurisdiction by hindering transportation, knocking down tree limbs and utility lines, and structurally damaging buildings.

Extreme Cold

Along with snow and ice storm events, extreme cold is dangerous to the well-being of people and animals. What constitutes extreme cold varies from region to region but is generally accepted as temperatures that are significantly lower than the average low temperature. For the planning area, the coldest months of the year are December, January, and February. The average low temperature for these months are all below freezing (average low for the three months is 14.1°F). The average high temperatures for the months of January, February, and December are near 42°F.[45]

Freezing Rain

Along with snow events, winter storms also have the potential to deposit significant amounts of ice. Ice buildup on tree limbs and power lines can cause them to collapse. This is most likely to occur when rain falls that freezes upon contact, especially in the presence of wind. Freezing rain is the name given to rain that falls when surface temperatures are below freezing. Unlike a mixture of rain and snow, ice pellets or hail, freezing rain is made entirely of liquid droplets. Freezing rain can also lead to many problems on the roads, as it makes them slick, causing automobile accidents, and making vehicle travel difficult.

Blizzards

According to the National Weather Service, blizzards occur when the following conditions are expected to prevail for a period of three hours or longer: sustained wind or frequent gusts to 35 miles an hour or greater; and considerable falling and/or blowing snow, reducing visibility frequently to less and a quarter of a mile. Blizzards are particularly dangerous due to drifting snow and the potential for rapidly occurring whiteout conditions, which greatly inhibits vehicular traffic. Large snow events can cripple an entire region for several days by hindering transportation, knocking down tree limbs and utility lines, structurally damaging buildings, and injuring or killing crops and livestock.

Location

The entire planning area is at risk of severe winter storms.

Extent

The Sperry-Piltz Ice Accumulation Index (SPIA) was developed by the NWS to predict the accumulation of ice and resulting damages. The SPIA assesses total precipitation, wind, and temperatures to predict the intensity of ice storms. Figure 24 shows the SPIA index.

45 High Plains Regional Climate Center. 2020. "Monthly Climate Normals 1981-2010." http://climod.unl.edu/.

Figure 24: SPIA Index

ICE DAMAGE INDEX	*AVERAGE ICE AMOUNT (in inches) *Revised: Oct. 2011*	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	<0.25	<15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 – 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	>15	
2	0.10 – 0.25	25 – 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 – 25	
	0.50 – 0.75	>15	
3	0.10 – 0.25	> – 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 – 35	
	0.50 – 0.75	15 – 25	
	0.75 –1.00	>15	
4	0.25 – 0.50	> – 35	Prolonged and widespread utility interruptions with extensive damage to main distribution feeder lines and some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 – 35	
	0.75 –1.00	15 – 25	
	1.00 –1.50	>15	
5	0.50 – 0.75	> – 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeeks in some areas. Shelters needed.
	0.75 –1.00	> – 25	
	1.00 –1.50	> – 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Source: SPIA-Index, 2017[46]

The Wind Chill Index was developed by the NWS to determine the decrease in air temperature felt by the body on exposed skin due to wind. The wind chill is always lower than the air temperature and can quicken the effects of hypothermia or frost bite as it gets lower. Figure 25 shows the Wind Chill Index used by the NWS.

46 SPIA-Index. 2009. "Sperry-Piltz Ice Accumulation Index." Accessed June 2017. http://www.spia-index.com/index.php.

Figure 25: Wind Chill Index Chart

Temperature (°F)

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

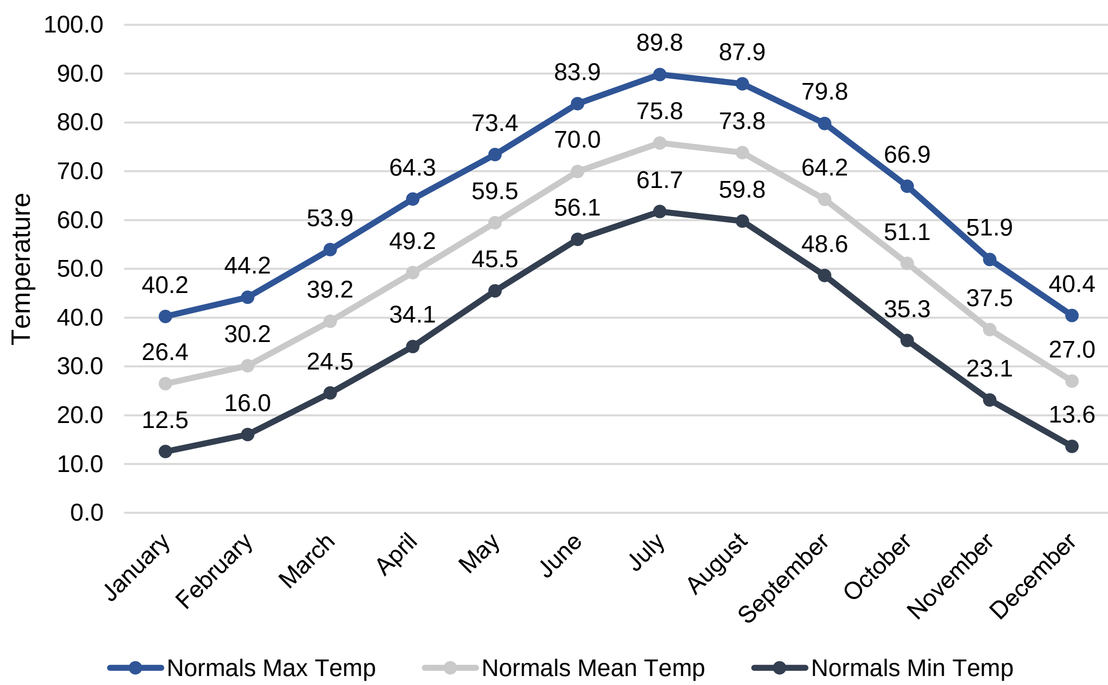
Frostbite Times 30 Minutes 10 Minutes 5 Minutes

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

T = Air Tempurature (°F) **V** = Wind Speed (mph)

Source: NWS, 2017[47]

Figure 26: Monthly Climate Normal Temperatures (1981-2010)



Source: HPRCC, 2020

47 National Weather Service. 2001. "Wind Chill Chart." http://www.nws.noaa.gov/om/cold/wind_chill.shtml.

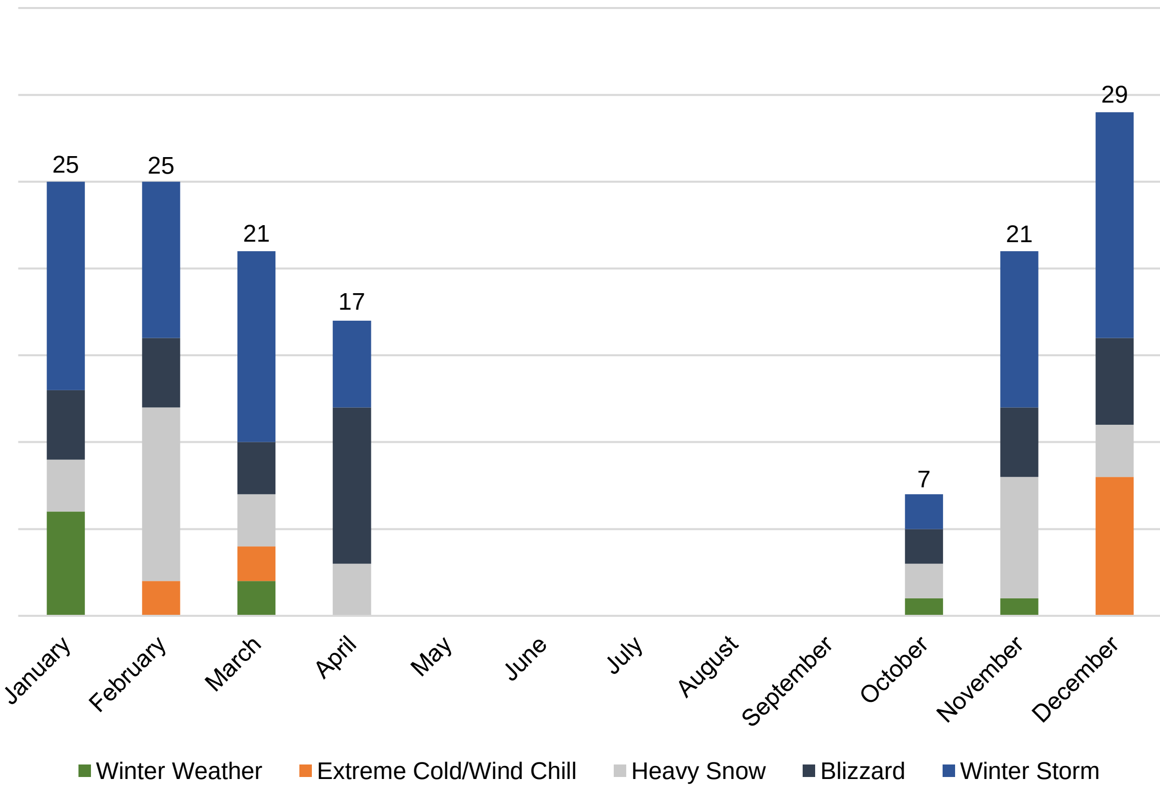
Historical Occurrences

Historical occurrences of severe winter storm events were updated and provided by the planning team as well as researched on the National Centers for Environmental Information (NCEI) for January 1996 to December 2019. All damage estimates listed in the historical occurrences are in "year reported" dollars. The following events recorded significant monetary damages for McCook Public Power District.

- March 22, 1966: MPPD reported a winter snow and ice storm hit the southwest part of the District and required that 160 poles and 132 cross arms be replaced for $21,419.
- October 14, 1966: MPPD reported another storm hit the northeastern part of Frontier County and required that 716 poles and 443 cross arms be replaced. The total cost of the repairs was $60,916.
- March 11 and 18, 1977: MPPD has recorded that a winter storm hit both Red Willow and Frontier Counties, requiring that 290 poles and 310 cross arms be replaced. The cost of replacement was $47,292.
- October 31, 1979: Another winter snow occurred in the southwestern part and required the replacement of 41 poles and nine cross arms for a total of $13,396 in repairs.
- April 20-30, 1984: a winter snow hit most of the MPPD's system. They had to replace 33 poles and 10 cross arms and listed the total damage at $39,195.
- April 11, 1994: MPPD suffered the worst ice storm of their history. Thousands of customers were without water, heat, lights, and other necessities for days and some for several weeks. Conveniences normally taken for granted were forgotten as the public struggled to merely exist and live from day to day without electricity and in cold temperatures. A Presidential Disaster Declaration (FEMA 1027) was issued as a result of the storm. Overall, MPPD suffered widespread damage over the entire system and replaced 1,960 poles and 941 cross arms with damages totaling $6,547,229.
- November 27, 2005: A blizzard caused $7.6 million in damage that spanned over large parts of Nebraska. The damages that occurred were of trees falling on homes and power lines, broken power poles and lines, loss of livestock, and metal siding of businesses ripped away. As a result, power outages lasted from two to 10 days. Many travelers were stuck in the deep snow drifts, leaving them stranded for more than 12 hours.
- December 22 and 29, 2006: An ice storm caused system-wide damage. MPPD replaced 30 poles and 15 cross arms. Total damages were $270,123.
- October 21, 2009: A slow-moving winter storm produced one to six inches of snow across extreme southwest Nebraska. Eighteen utility poles were broken from the weight of heavy, wet snow, resulting in power outages. Damages were approximately $6,000.
- December 19, 2012: MPPF reported that ice and wind slapped overhead lines together causing OCR's (breakers) to operate. This resulted in five outages in the district. Consumer hours off totaled 391 during this storm.

Due to the regional scale of severe winter storms, the NCEI reports events as they occur in each county. According to the NCEI, there were a combined 144 severe winter storm events for the planning area from January 1996 to September 2019. December had the most recorded events for the planning area (Figure 27). These recorded events caused a total of $192,000 in reported property damages and $18,128,711 in crop damages.

Figure 27: Severe Winter Storm Events by Month



According to the NCEI, there were no injuries or deaths in association with winter storms in the planning area.

Average Annual Damages

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and includes aggregated calculations for each of the six types of winter weather as provided in the database. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe winter storms have caused an average of $8,348 per year in property damage and $2,014,301 per year in crop damages for the planning area.

Table 59: Severe Winter Storm Loss Estimate

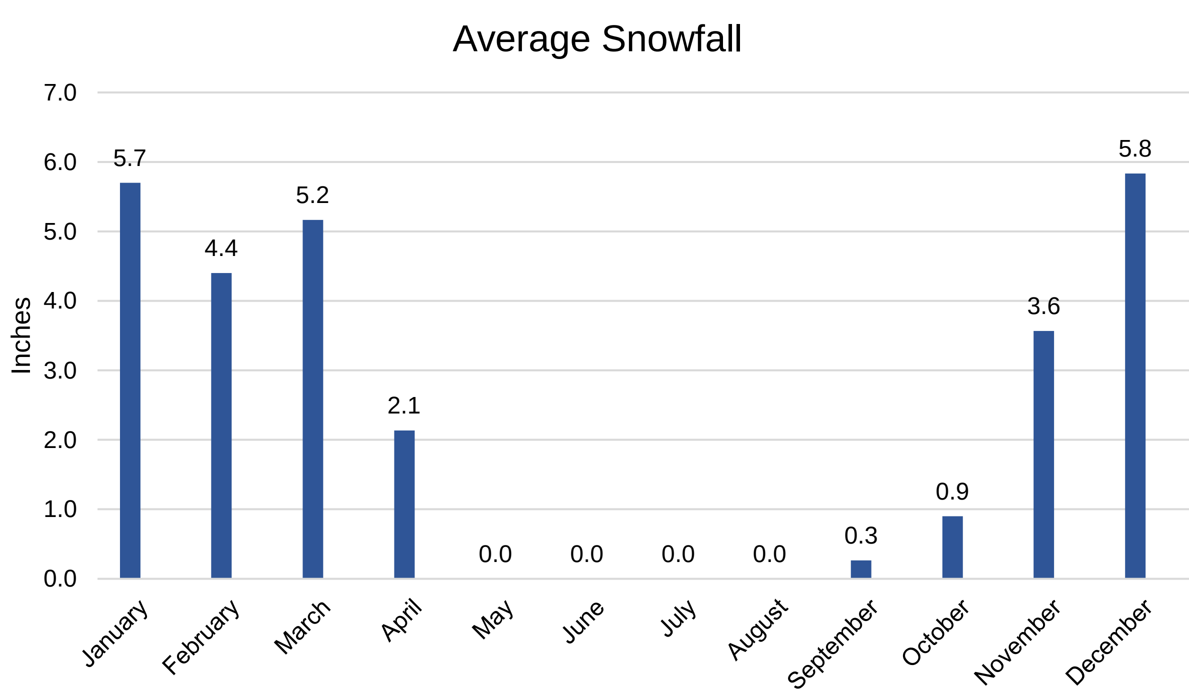
<table>
<tr><th>Hazard Type</th><th>Number of Events[1]</th><th>Average Events Per Year[1]</th><th>Total Property Loss[1]</th><th>Average Annual Property Loss [1]</th><th>Total Crop Loss[2]</th><th>Average Annual Crop Loss [2]</th></tr>
<tr><td>Blizzard</td><td>31</td><td>1.3</td><td>$72,000</td><td>$3,130</td><td rowspan="6">$18,128,711</td><td rowspan="6">$2,014,301</td></tr>
<tr><td>Heavy Snow</td><td>31</td><td>1.3</td><td>$0</td><td>$0</td></tr>
<tr><td>Ice Storm</td><td>0</td><td>0</td><td>$0</td><td>$0</td></tr>
<tr><td>Winter Storm</td><td>61</td><td>2.7</td><td>$60,000</td><td>$2,609</td></tr>
<tr><td>Winter Weather</td><td>9</td><td>0.4</td><td>$60,000</td><td>$2,609</td></tr>
<tr><td>Extreme Cold/Wind Chill</td><td>12</td><td>0.5</td><td>$0</td><td>$0</td></tr>
<tr><td>**Total**</td><td>**144**</td><td>**6.3**</td><td>**$202,000**</td><td>**$8,348**</td><td>**$18,128,711**</td><td>**$2,014,301**</td></tr>
</table>

Source: 1 Indicates data is from NCEI (Jan 1996 to Sept 2019); 2 Indicates data is from USDA RMA (2000 to 2019)

Probability

Average monthly snowfall for the planning area is shown in Figure 28, which shows the snowiest months are between November and April. A common snow event (likely to occur annually) will result in accumulation totals between one and five inches. Often these snow events are accompanied by high winds. It is reasonable to expect wind speeds of 25 to 35 mph with gusts reaching 50 mph or higher. Strong winds and low temperatures can combine to produce extreme wind chills of 20°F to 40°F below zero. With 144 severe winter storm events in 24 years, there is 100 percent probability that a severe winter storm will occur annually.

Figure 28: Monthly Normal (1981-2010) Snowfall in Inches



Source: High Plains Regional Climate Center, 2020

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities.

Table 60: Regional Severe Winter Storm Vulnerabilities

Sector	Vulnerability
People	-Elderly citizens are at higher risk to injury or death, especially during extreme cold and heavy snow accumulations -Citizens without adequate heat and shelter at higher risk of injury or death
Economic	-Closed roads and power outages can cripple a region for days, leading to significant revenue loss and loss of income for workers
Built Environment	-Heavy snow loads can cause roofs to collapse -Significant tree damage possible, downing power lines and blocking roads
Infrastructure	-Heavy snow and ice accumulation can lead to downed power lines and prolonged power outages -Transportation may be difficult or impossible during blizzards, heavy snow, and ice events
Critical Facilities	-Emergency response and recovery operations, communications, water treatment plants, and others are at risk to power outages, impassable roads, and other damages
Climate	-Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of severe winter storm events

TERRORISM

The Federal Bureau of Investigation (FBI) describes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. For the purpose of this report, the following definitions from the FBI will be used:

- Domestic terrorism is the unlawful use, or threatened use, of force or violence by a group or individual based and operating entirely within the United States or Puerto Rico without foreign direction committed against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives.

- International terrorism involves violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or any state, or that would be a criminal violation if committed within the jurisdiction of the United States or any state. These acts appear to be intended to intimidate or coerce a civilian population, influence the policy of a government by intimidation or coercion, or affect the conduct of a government by assassination or kidnapping. International terrorist acts occur outside the United States or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to coerce or intimidate, or the locale in which their perpetrators operate or seek asylum.

There are different types of terrorism depending on the target of attack, which are

- Political terrorism
- Bio-terrorism
- Cyber-terrorism
- Eco-terrorism
- Nuclear-terrorism
- Narco-terrorism
- Agro-terrorism

Terrorist activities are also classified based on motivation behind the event (such as ideology: i.e. religious fundamentalism, national separatist movements, and social revolutionary movements). Terrorism can also be random with no ties to ideological reasoning.

The FBI also provides clear definitions of a terrorist incident and prevention:

- A terrorist *incident* is a violent act or an act dangerous to human life, in violation of the criminal laws of the United States, or of any state, to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.

- Terrorism *prevention* is a documented instance in which a violent act by a known or suspected terrorist group or individual with the means and a proven propensity for violence is successfully interdicted through investigative activity.

Primarily, threat assessment, mitigation, and response to terrorism are federal and state directives and work in conjunction with local law enforcement. The Office of Infrastructure Protection (IP) within the Federal Department of Homeland Security is a component of the National Programs and Protection Directorate.

The IP leads the coordinated national program to reduce and mitigate risk within 18 national critical infrastructure and key resources (CIKR) sectors from acts of terrorism and natural disasters. The IP also works to strengthen sectors' ability to respond and quickly recover from attacks or other emergencies. This is done through the National Infrastructure Protection Plan (NIPP).

Under the NIPP, a Sector-Specific Agency (SSA) is a federal agency assigned to lead a collaborative process for infrastructure protection for each of the 18 sectors. The NIPP's comprehensive framework allows the IP to provide the cross-sector coordination and collaboration needed to set national priorities, goals, and requirements for effective allocation of resources. More importantly, the NIPP framework integrates a broad range of public and private CIKR protection activities.

SSAs provide guidance about the NIPP framework to state, tribal, territorial, and local homeland security agencies and personnel. They coordinate NIPP implementation within the sector, which involves developing and sustaining partnerships and information-sharing processes, as well as assisting with contingency planning and incident management.

The IP has SSA responsibility for six of the 18 CIKR sectors. Those six are:

- Chemical
- Commercial Facilities
- Critical Manufacturing
- Dams
- Emergency Services
- Nuclear Reactors, Materials and Waste

SSA responsibility for the other 12 CIKR sectors is held by other Department of Homeland Security components and other federal agencies. Those 12 are:

- Agriculture and Food – Department of Agriculture; Food and Drug Administration
- Banking and Finance – Department of the Treasury
- Communications – Department of Homeland Security
- Defense Industrial Base – Department of Defense
- Energy – Department of Energy
- Government Facilities – Department of Homeland Security
- Information Technology – Department of Homeland Security
- National Monuments and Icons – Department of the Interior
- Postal and Shipping – Transportation Security Administration
- Healthcare and Public Health – Department of Health and Human Services
- Transportation Systems – Transportation Security Administration; U.S. Coast Guard
- Water – Environmental Protection Agency

The NIPP requires that each SSA prepare a Sector-Specific Plan, review it annually, and update it as appropriate.

The Department of Homeland Security and its affiliated agencies are responsible for disseminating any information regarding terrorist activities in the country. The system in place is the National Terrorism Advisory System (NTAS). In 2011, NTAS replaced the Homeland Security

Advisory System which was the color-coded system put in place after the September 11th attacks by Presidential Directive 5 and 8 in March of 2002.

NTAS is based on a system of analyzing threat levels and providing either an imminent threat alert or an elevated threat alert.

An ***Imminent Threat Alert*** warns of a credible, specific, and impending terrorist threat against the United States.

An ***Elevated Threat Alert*** warns of a credible terrorist threat against the United States.

The Department of Homeland Security, in conjunction with other federal agencies, will decide which level of threat alert should be issued, should credible information be available.

Each alert provides a statement summarizing the potential threat and what, if anything, should be done to ensure public safety.

The NTAS Alerts will be based on the nature of the threat: in some cases, alerts will be sent directly to law enforcement or affected areas of the private sector, while in others, alerts will be issued more broadly to the American people through both official and media channels.

An individual threat alert is issued for a specific time period and automatically expires. It may be extended if new information becomes available or the threat evolves. The ***sunset provision*** contains a specific date when the alert expires, as there will not be a constant NTAS Alert or blanket warning of an overarching threat. If threat information changes for an alert, the Secretary of Homeland Security may announce an updated NTAS Alert. All changes, including the announcement that cancels an NTAS Alert, will be distributed the same way as the original alert.

Location

Terrorism can occur throughout the entire planning area. In rural areas, concerns are primarily related to infrastructure and vehicles. In urban areas, concerns are related to political unrest, activist groups, and others that may be targeting critical facilities and infrastructure. For the MPPD, terrorism is of greatest concern to the electrical infrastructure and sub-station system that they operate and maintain for their customers.

Extent

Terrorist attacks can vary greatly in scale and magnitude, depending on the location of the attack.

Historical Occurrences

Previous accounts of terrorism in the planning area were gathered from the Global Terrorism Database, maintained by the University of Maryland and the National Consortium for the Study of Terrorism and Responses to Terrorism (START). This database contains information for over 140,000 terrorist attacks. According to this database, there was one terrorist incident in the planning area from 1970 – October 2018.[48] The incident occurred in Red Willow County in April 2013. An explosive device was discovered at the airport in McCook, Nebraska, United States. The device was safely defused without incident and no group claimed responsibility for the unsuccessful attack.

48 National Consortium for the Study of Terrorism and Responses to Terrorism (START). October 2018. Global Terrorism Database [Data file]. Retrieved from https://www.start.umd.edu/gtd.

Average Annual Damages

According to the START Global Terrorism Database (1970-2018) there have been no civil disorder events that have occurred in the planning area. Although there was one terrorist incident within the planning area, there were no average annual damages.

Probability

Given there was one incident over a 49-year period, the annual probability for terrorism in the planning area has a less than two percent chance of occurring during any given year.

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities.

Table 61: Regional Terrorism Vulnerabilities

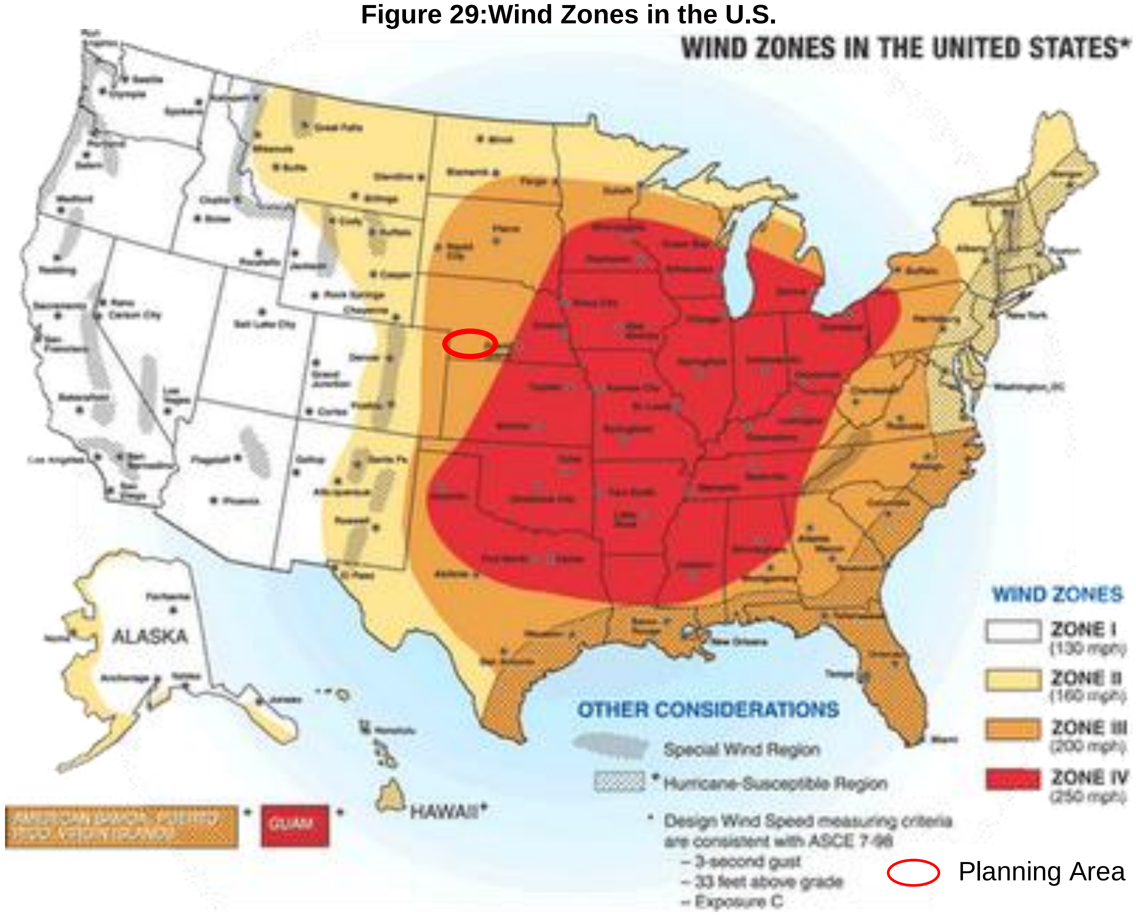
Sector	Vulnerability
People	-First responders at risk of injury or death
Economic	-Infrastructure attacks could cause significant economic losses for the region
Built Environment	-Targeted buildings may sustain heavy damage
Infrastructure	-Utilities may be damaged
Critical Facilities	-Office and above ground infrastructure are at a higher risk
Climate	-None

TORNADOES AND HIGH WINDS

High winds typically accompany severe thunderstorms, severe winter storms, tornadoes, and other large low-pressure systems, which can cause significant crop damage, downed power lines, loss of electricity, traffic flow obstructions, and significant property damage including to trees and center-pivot irrigation systems.

The National Weather Service (NWS) defines high winds as sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration.[49] The NWS issues High Wind Advisories when there are sustained winds of 25 to 39 miles per hour and/or gusts to 57 mph. Figure 29 shows the wind zones in the United States. The wind zones are based on the maximum wind speeds that can occur from a tornado or hurricane event. The planning area is located in Zone III which has maximum winds of 200 mph equivalent to an EF4/5 tornado.

Figure 29:Wind Zones in the U.S.



Source: FEMA, 2016

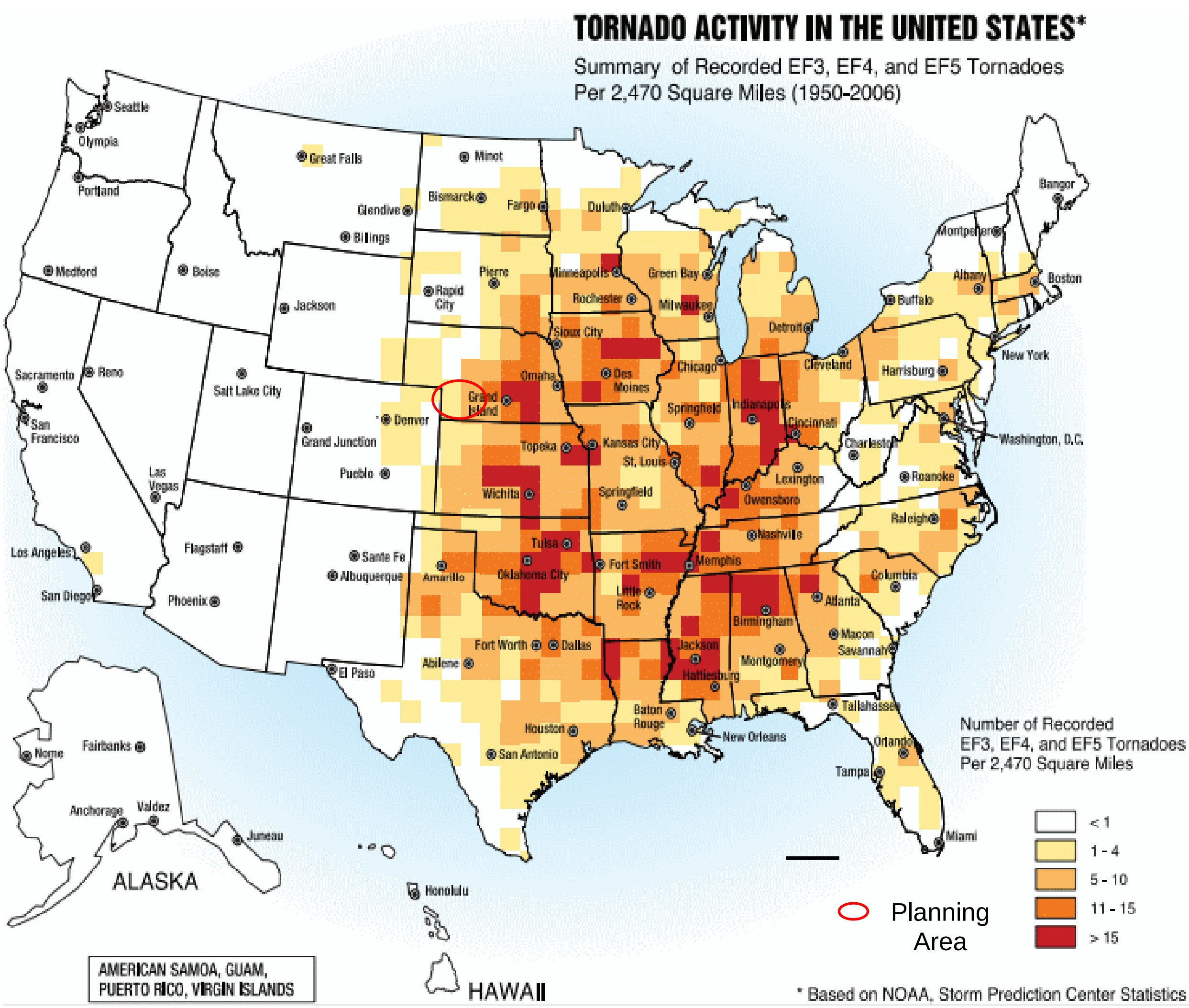
High winds are a critical component of tornado formation. A tornado is typically associated with a supercell thunderstorm. For a rotation to be classified as a tornado, three characteristics must be met:

49 National Weather Service. 2017. "Glossary." http://w1.weather.gov/glossary/index.php?letter=h.

- There must be a microscale rotating area of wind, ranging in size from a few feet to a few miles wide;
- The rotating wind, or vortex, must be attached to a convective cloud base and must be in contact with the ground; and,
- The spinning vortex of air must have caused enough damage to be classified by the Fujita Scale as a tornado.

Once tornadoes are formed, they can be extremely violent and destructive. They have been recorded all over the world but are most prevalent in the American Midwest and South, in an area known as "Tornado Alley." Approximately 1,250 tornadoes are reported annually in the contiguous United States. Tornadoes can travel distances over 100 miles and reach over 11 miles above ground. Tornadoes usually stay on the ground no more than 20 minutes. Nationally, the tornado season typically occurs between April and July. On average, 80 percent of tornadoes occur between noon and midnight. In Nebraska, 77 percent of all tornadoes occur in the months of May, June, and July.

Figure 30: Tornado Activity in the United States



Source: FEMA, 2008[50]

50 Federal Emergency Management Agency. August 2008. "Taking Shelter From the Storm: Building a Safe Room for Your Home or Small Business, 3rd edition."

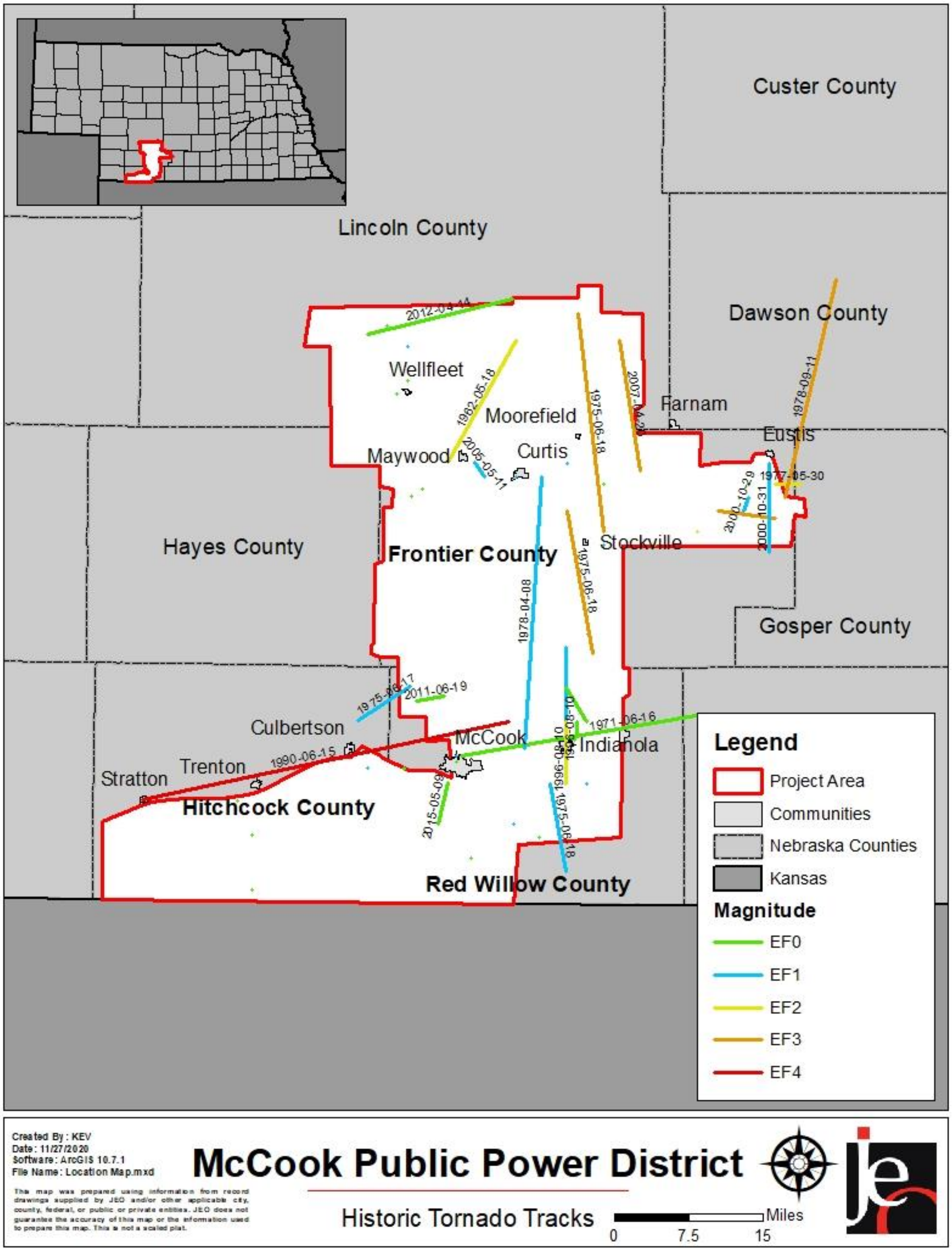
Nebraska is ranked fifth in the nation for tornado frequency with an annual average of 57 tornadoes between 1991 to 2010.[51] The following figure shows the tornado activity in the United States as a summary of recorded EF3, EF4, and EF5 tornadoes per 2,470 square miles from 1950-2006.

Location

High winds commonly occur throughout the planning area. Tornadoes can occur anywhere in the planning area. While the impacts would likely be greater in more densely populated areas, the MPPD infrastructure across these rural counties is at continued risk from high winds and tornadic activity. The following map shows the historical tornado track locations across the region from 1950 to 2017 according to the Midwestern Regional Climate Center.

51 National Centers for Environmental Information. 2013. "U.S. Tornado Climatology." https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology.

Figure 31: Historic Tornado Tracks



Extent

The Beaufort Wind Scale can be used to classify wind strength, while the magnitude of tornadoes is measured by the Enhanced Fujita Scale. Table 62 outlines the Beaufort scale, provides wind speed ranking, range of wind speeds per ranking, and a brief description of conditions for each ranking.

Table 62: Beaufort Wind Ranking

Beaufort Wind Force Ranking	Range of Wind	Conditions
0	<1 mph	Smoke rises vertically
1	1 – 3 mph	Direction shown by smoke but not wind vanes
2	4 – 7 mph	Wind felt on face; leaves rustle; wind vanes move
3	8 – 12 mph	Leaves and small twigs in constant motion
4	13 – 18 mph	Raises dust and loose paper; small branches move
5	19 – 24 mph	Small trees in leaf begin to move
6	25 – 31 mph	Large branches in motion; umbrellas used with difficulty
7	32 – 38 mph	Whole trees in motion; inconvenience felt when walking against the wind
8	39 – 46 mph	Breaks twigs off tree; generally, impedes progress
9	47 – 54 mph	Slight structural damage; chimneypots and slates removed
10	55 – 63 mph	Trees uprooted; considerable structural damages; improperly or mobiles homes with no anchors turned over
11	64 – 72 mph	Widespread damages; very rarely experienced
12 - 17	72 - > 200 mph	Hurricane; devastation

Source: Storm Prediction Center, 2017[52]

The Enhanced Fujita Scale replaced the Fujita Scale in 2007. The Enhanced Fujita Scale does not measure tornadoes by their size or width, but rather the amount of damage caused to human-built structures and trees after the event. The official rating category provides a common benchmark that allows comparisons to be made between different tornadoes. The enhanced scale classifies EF0-EF5 damage as determined by engineers and meteorologists across 28 different types of damage indicators, including different types of building and tree damage. To establish a rating, engineers and meteorologists examine the damage, analyze the ground-swirl patterns, review damage imagery, collect media reports, and sometimes utilize photogrammetry and videogrammetry. Based on the most severe damage to any well-built frame house, or any comparable damage as determined by an engineer, an EF-Scale number is assigned to the tornado. The following tables summarize the Enhanced Fujita Scale and damage indicators. According to a recent report from the National Institute of Science and Technology on the Joplin Tornado, tornadoes rated EF3 or lower account for around 96 percent of all tornado damages.[53]

52 Storm Prediction Center: National Oceanic and Atmospheric Administration. 1805. "Beaufort Wind Scale." http://www.spc.noaa.gov/faq/tornado/beaufort.html.
53 Kuligowski, E.D., Lombardo, F.T., Phan, L.T., Levitan, M.L., & Jorgensen, D.P. March 2014. "Final Report National Institute of Standards and Technology (NIST) Technical Investigation of the May 22, 2011, Tornado in Joplin, Missouri."

Table 63: Enhanced Fujita Scale

Storm Category	3 Second Gust (mph)	Damage Level	Damage Description
EF0	65-85 mph	Gale	Some damages to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
EF1	86-110 mph	Weak	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages might be destroyed.
EF2	111-135 mph	Strong	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	136-165 mph	Severe	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	166-200 mph	Devastating	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown, and large missiles generated.
EF5	200+ mph	Incredible	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.
EF No rating	--	Inconceivable	Should a tornado with the maximum wind speed in excess of F5 occur, the extent and types of damage may not be conceived. A number of missiles such as iceboxes, water heaters, storage tanks, automobiles, etc. will create serious secondary damage on structures.

Source: NOAA; FEMA

Table 64: Enhanced Fujita Scale Damage Indicator

Number	Damage Indicator	Number	Damage Indicator
1	Small barns, farm outbuildings	15	School - 1-story elementary (interior or exterior halls)
2	One- or two-family residences	16	School - Junior or Senior high school
3	Single-wide mobile home (MHSW)	17	Low-rise (1-4 story) bldg.
4	Double-wide mobile home	18	Mid-rise (5-20 story) bldg.
5	Apartment, condo, townhouse (3 stories or less)	19	High-rise (over 20 stories)
6	Motel	20	Institutional bldg. (hospital, govt. or university)
7	Masonry apartment or motel	21	Metal building system
8	Small retail bldg. (fast food)	22	Service station canopy
9	Small professional (doctor office, branch bank)	23	Warehouse (tilt-up walls or heavy timber)
10	Strip mall	24	Transmission line tower
11	Large shopping mall	25	Free-standing tower
12	Large, isolated ("big box") retail bldg.	26	Free standing pole (light, flag, luminary)
13	Automobile showroom	27	Tree - hardwood
14	Automotive service building	28	Tree - softwood

Source: NOAA; FEMA

Using the NCEI reported events, the most common high wind event is a nine on the Beaufort Wind Scale. Based on the historic record, it is most likely that tornadoes that occur within the planning area will be of EF0 strength. Of the 44 reported events, six were EF1, four were EF2, and one was EF3.

Historical Occurrences

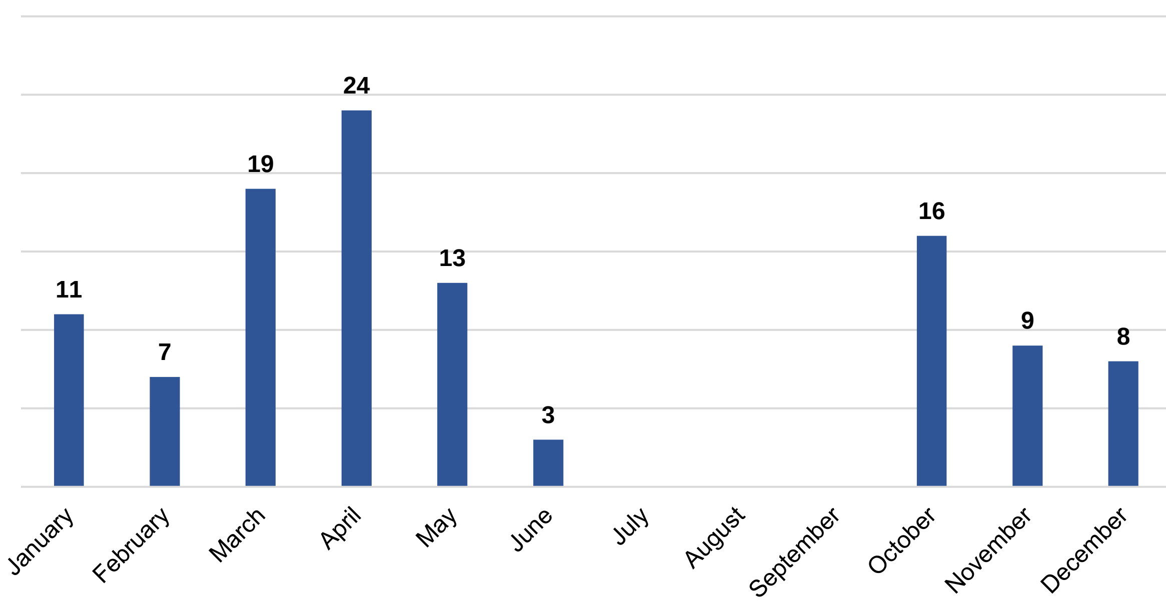
Historical occurrences of tornado and high wind events were updated and provided by the planning team as well as researched on the National Climatic Data Center for January 1950 to January 2014. All damage estimates listed in the historical occurrences are in “year reported” dollars. The following events recorded significant monetary damages for McCook Public Power District.

- May 18, 1990: MPPD reported this tornado as causing $38,173 in replacement costs for 22 poles and 46 cross arms. The F-scale rating of this event is not known.
- June 1, 1990: A total of $9,385 worth of damage in Hays, Lincoln, and Frontier Counties requiring nine new electrical poles and 12 cross arms. The F-scale rating of this event is not known.
- June 15, 1990: A F4 tornado caused widespread damage, specifically MPPD recorded that 22 poles and 35 cross arms be replaced for $61,688. This was the third recorded tornado for the summer of 1990.
- July 8, 1993: Tornado caused a total of $53,766 to replace 27 poles and 19 cross arms. The F-scale rating of this event is not known.
- June 25, 1997: These tornadoes recorded by MPPD damaged five poles and 13 cross arms requiring replacement. The F-scale rating of this event is not known.

- April 23, 2007: A total of $133,104 in damages in Frontier and Lincoln Counties requiring replacement of 17 electrical poles and MPPD replaced another 37 poles with underground for a total of 80 poles replaced due to the tornado.
- December 19, 2012: MPPD reported that ice and wind slapped overhead lines together causing OCR's (breakers) to operate. This resulted in five outages in the district. Consumer hours off totaled 391 during this storm.
- April 8, 2013: A major windstorm with very strong winds caused MPPD $95,843 in damage and 2,854 consumer hours off. MPPD had to replace 57 poles to repair the system. Below are pictures of the damages resulting from this event.
- April 8, 2013: Tornado high winds caused $96,000 in damage and damaged 57 poles.

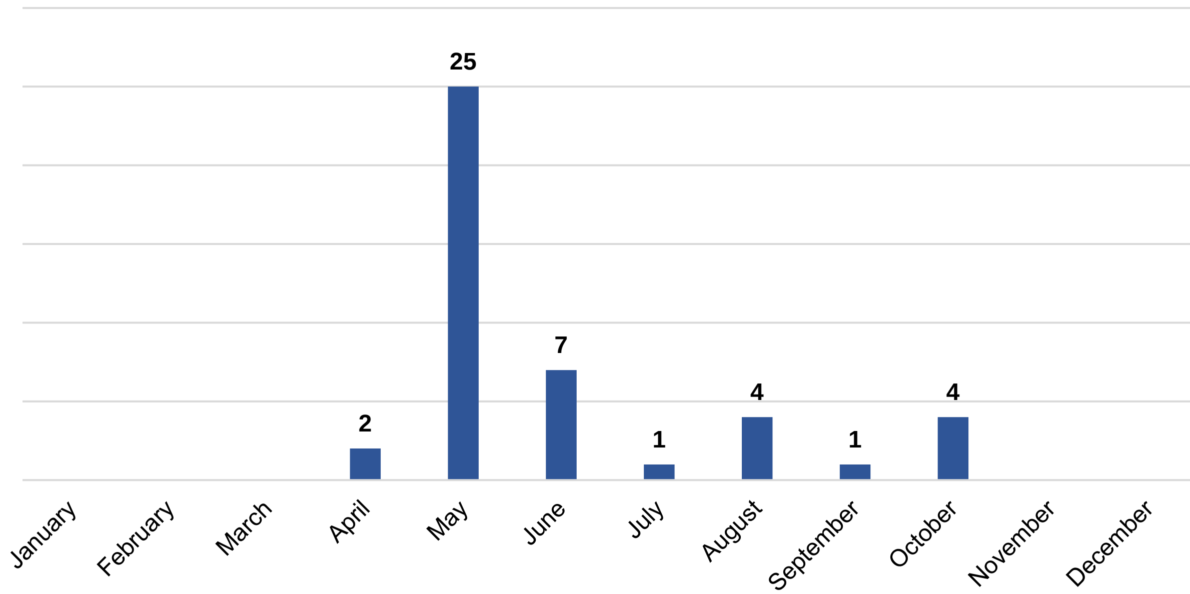
Due to the regional scale of high winds, the NCEI reports events as they occur in each county. While a single event can affect two or more counties at a time, the NCEI reports them as separate events. There were 110 high wind events that occurred between January 1996 and September 2019 and 44 tornadic events ranging from a magnitude of EF0 to EF3. These events were responsible for $ 1,988,500 in property damages. As seen in Figure 32, most high wind events occur in the spring and winter months. The most damaging tornadoes occurred in Red Willow County (1996: $750,000) and (2008: $350,000). The following figures show that April has the most high wind events and the month of May has the highest number of tornadoes in the planning area.

Figure 32: High Wind Events by Month



Source: NCEI, 1996-2019

Figure 33: Tornadoes by Month in the Planning Area



Source: NCEI, 1996-2019

Average Annual Damages

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. It is estimated that high wind events caused an average of $5,167 per year in property damage, and an average of $524,753 per year in crop damage for the planning area. Tornadoes cause an average of $77,688 per year in property damage. The RMA did not report crop damages due to tornadic events, but damage to crops from tornadoes is still a concern for the planning area.

Table 65: High Wind Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
High Winds	110	4.6	$124,000	$5,167	$4,722,780	$524,753
Tornadoes	44	1.8	$1,864,500	$77,688	$0	$0

Source: 1 Indicates data is from NCEI (Jan 1996 to Sept 2019); 2 Indicates data is from USDA RMA (2000 to 2019)

Probability

Based on historical records and reported events, it is likely that high winds and tornadic events will occur within the planning area annually. For the 24 years examined, there were 110 reported high wind events and 44 tornadoes. While the high wind events are expected to occur more often, the impact from a tornadic event is considerably higher in both damages to infrastructure and property loss.

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities.

Table 66: Regional High Wind and Tornado Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations include those living in mobile homes (especially if they are not anchored properly), nursing homes, and/or schools -People outdoors during events -Citizens without access to shelter below ground or in safe room -Elderly with decreased mobility or poor hearing may be higher risk
Economic	-Agricultural losses to both crops and livestock -Damages to buildings and prolonged power outages can cause significant impacts to the local economy, especially with EF3 tornadoes or greater
Built Environment	-All building stock is at risk of significant damages
Infrastructure	-Downed power lines and power outages -All above ground infrastructure at risk to damages -Impassable roads due to debris blocking roadways
Critical Facilities	-All critical facilities are at risk to damages and power outages
Climate	-Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of severe storm events

TRANSPORTATION INCIDENTS

A transportation accident involves a mishap between one or more conveyances on land, sea or air. Transportation accidents can cause property damage, bodily injury, and death. Accidents are influenced by several factors, including the type of driver, road condition, weather conditions, density of traffic, type of roadway, signage, and signaling.

In the planning area automobile accidents are likely to be the most common type of incident as there are very few rail lines and bodies of water. In addition, most of the airports in the three counties are small with a low number of flights in and out of the area.

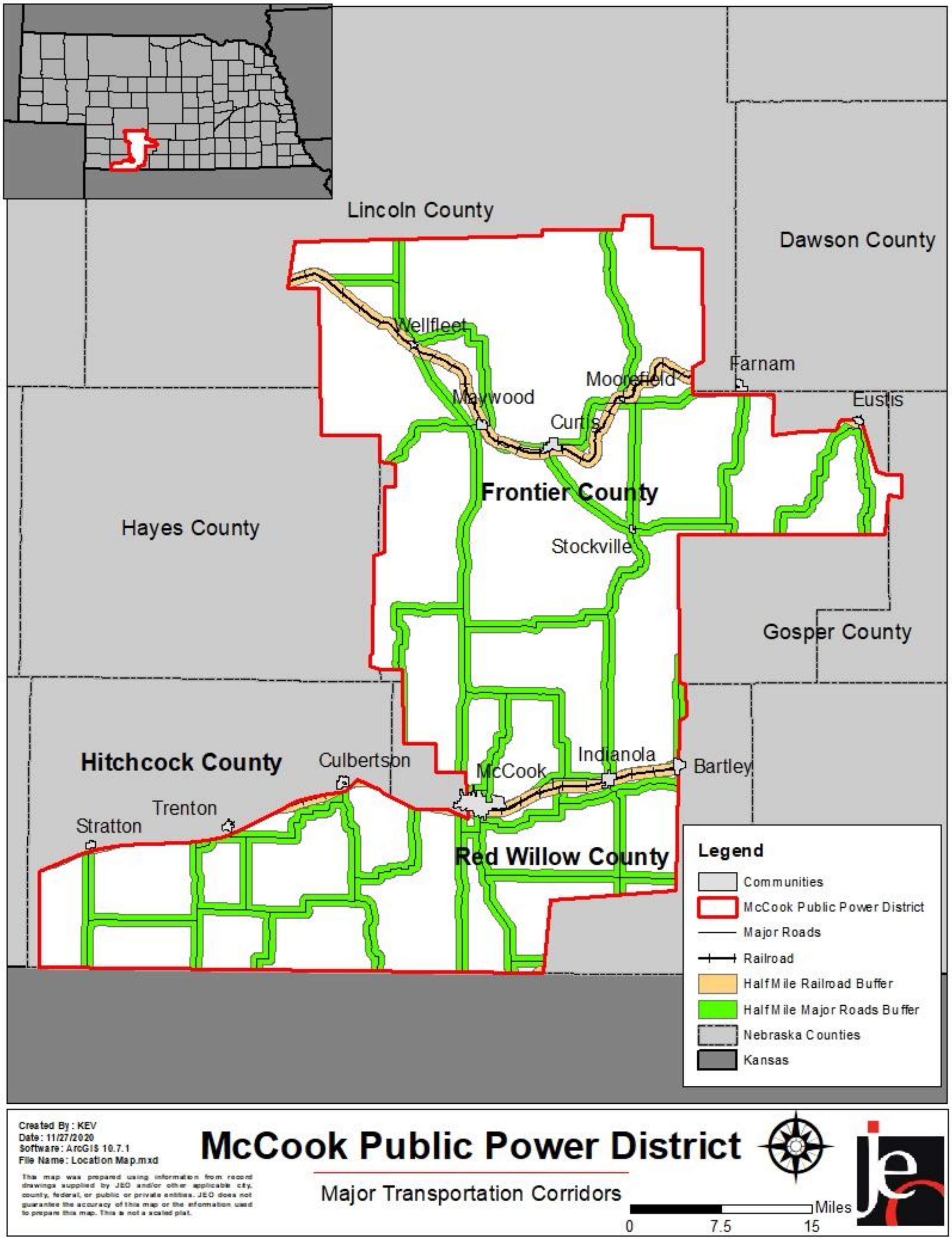
Location

Transportation incidents can occur anywhere along transportation routes in the planning area but are most likely to occur along rail lines and major highways due to increased speeds and the higher number of vehicles. Table 67 lists the location of the public and private airports in the planning area. Figure 34 shows the location of the major transportation routes in the planning area.

Table 67: Planning Area Airports

Airport	Nearest Community	County
Beebe Airport	Culbertson, NE	Hitchcock County
Curtis Municipal Airport	Curtis, NE	Frontier County
McCook Ben Nelson Regional Airport	McCook, NE	Red Willow County
Trenton Municipal Airport	Trenton, NE	Hitchcock County

Figure 34: Transportation Corridors



Extent

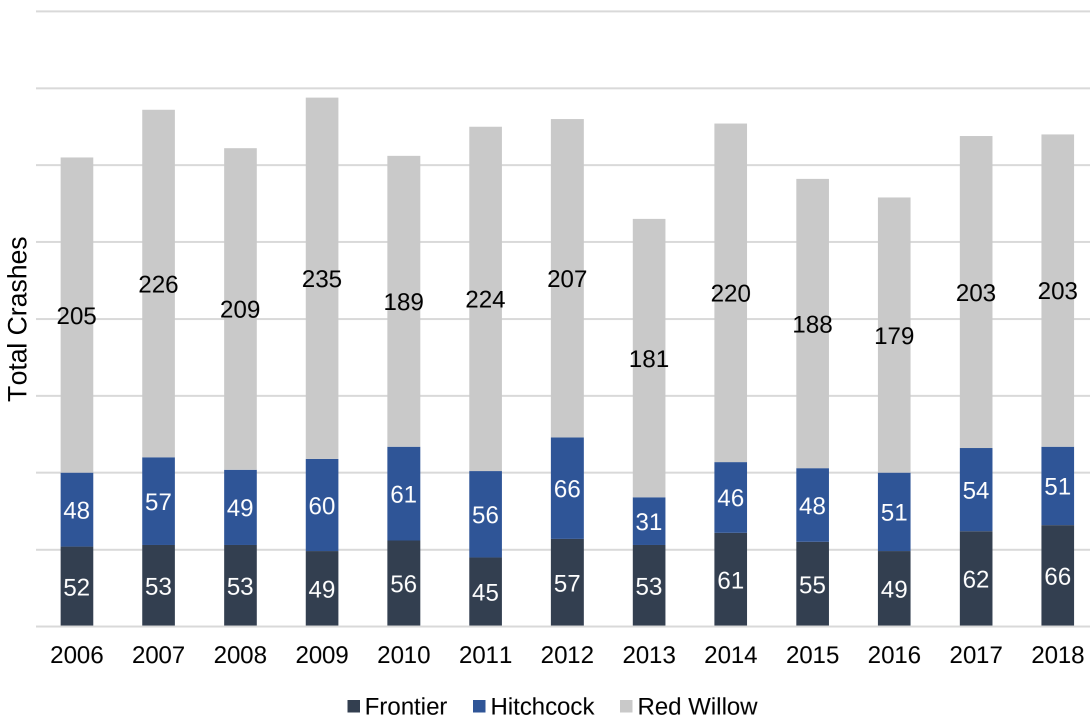
The extent of automobile, rail, and air incidents is usually localized, however catastrophic events may require assistance from outside jurisdictions. Transportation incidents can also cause hazard materials releases, which can further increase damages and risk of injury.

Historical Occurrences

Automobile

The Nebraska Department of Transportation (NDOT) maintains records at the county level for certain automobile related accidents. The following figure shows total crashes from 2006 to 2018 for each county. These events resulted in a total of 4,058 crashes, 1,048 injuries and 41 fatalities.

Figure 35: Automobile Crashes



Source: NDOT[54]

Highway Rail

The Federal Railroad Administration (FRA) keeps data on all highway rail accidents since 1975. Table 68 shows the number highway rail accidents by county since 1975. 24 injuries and 23 fatalities resulted from these events.

54 Nebraska Department of Transportation. February 2020. "Nebraska Traffic Crash Facts Annual Reports 2006-2018." [datafile]. https://dot.nebraska.gov/safety/crash/.

Table 68: Historical Highway Rail Incidents

County	Number of Incidents	Injuries	Fatalities
Frontier County	10	3	3
Hitchcock County	19	16	13
Red Willow County	29	5	7
Total	**58**	**24**	**23**

Source: Federal Railroad Administration, 1975-2000[55]

Aviation

Since 1962, there have been 17 aviation accidents in the planning areas, as reported by the National Transportation Safety Board (NTSB) database. The table below shows there were 17 incidents from 1983 to 2017. The events resulted in 21 injuries and three fatalities.

Table 69: Historical Aviation Incidents

Date	County	Phase of Flight	Injuries	Fatalities	Nearest Community
4/20/1983	Hitchcock	Climb	3	0	Trenton, NE
12/31/1983	Hitchcock	Cruise	0	0	Trenton, NE
6/8/1985	Frontier	Landing	0	0	Curtis, NE
7/20/1985	Red Willow	Takeoff	0	0	Indianola, NE
8/10/1985	Hitchcock	Maneuvering	1	0	Palisade, NE
7/2/1989	Frontier	Maneuvering	0	0	Stockville, NE
4/23/1991	Red Willow	Landing	0	0	McCook, NE
11/23/1992	Red Willow	Climb	1	0	McCook, NE
1/26/1994	Red Willow	Cruise	5	2	McCook, NE
8/5/1998	Hitchcock	Cruise	2	0	Trenton, NE
4/4/2004	Frontier	Takeoff	1	1	Curtis, NE
9/28/2006	Red Willow	Maneuvering	2	0	McCook, NE
7/22/2010	Red Willow	Taxi	1	0	McCook, NE
1/25/2014	Frontier	-	0	0	Eustis, NE
6/10/2015	Red Willow	-	5	0	McCook, NE
1/28/2017	Red Willow	Landing	0	0	McCook, NE
7/29/2017	Red Willow	Maneuvering	0	0	McCook, NE

Source: National Transportation Safety Board, 1962-2019[56]

Average Annual Damages

The average damage per event estimate was determined for each incident type based upon records from NDOT, FRA, NTSB, and number of historical occurrences. This does not include losses from functional downtime, economic loss, injury, or loss of life. Transportation incidents have caused an average of $7,728 per year in property damages to the planning area. RMA data is not available for transportation incidents, but crop damage would be expected to be minimal.

55 Federal Railroad Administration. 2020. “Highway Rail Accidents”. https://safetydata.fra.dot.gov/OfficeofSafety/publicsite/on_the_fly_download.aspx.
56 National Transportation Safety Board. 1962-2019. “Aviation Accident Database & Synopses”. https://www.ntsb.gov/_layouts/ntsb.aviation/index.aspx.

Table 70: Transportation Incidents Loss Estimate

Hazard Type	Number of Events	Average Events Per Year	Total Property Loss	Average Annual Property Loss
Auto[1]	4,058	312	N/A	N/A
Aviation[2]	17	0.29	N/A	N/A
Highway Rail[3]	58	1.4	$340,050	$7,728
Total	**4,133**	**313.69**	**$340,050**	**$7,728**

Source:1 NDOT, 2006-2018;2 NTSB 1962-2019;3 FRA 1975-2018

Probability

The probability of transportation incidents is based on the historic record provided by the NDOT, FRA, and NTSB. Based on the historic record, there is a 100 percent annual probability of auto incidents, a 30 percent annual probability for aviation incidents and a 100 percent probability for highway rail incidents occurring in the planning area each year.

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities.

Table 71: Regional Transportation Incidents Vulnerabilities

Sector	Vulnerability
People	-Injuries and fatalities to drivers and passengers -Injuries and fatalities to those nearby if hit
Economic	-Prolonged road closures and detours for clean-up
Built Environment	-Potential damage to buildings
Infrastructure	-Damage to roadways, utility poles, and other infrastructure if struck by a vehicle
Critical Facilities	-Roadway closures -Damage to facilities if located near transportation routes
Climate	-None

WILDFIRE

Wildfires, also known as brushfires, forest fires, or wildland fires, are any uncontrolled fire that occurs in the countryside or wildland. Wildland areas may include but are not limited to: grasslands; forests; woodlands; agricultural fields; pastures; and other vegetated areas. Wildfires differ from other fires by their extensive size, the speed at which they can spread from the original source, their ability to change direction unexpectedly, and to jump gaps (such as roads, rivers, and fire breaks). While some wildfires burn in remote forested regions, others can cause extensive destruction of homes and other property located in the wildland-urban interface (WUI), the zone of transition between developed areas and undeveloped wilderness (Figure 36).

Lightning starts approximately 10,000 forest fires each year, yet ninety percent of forest fires are started by humans.

~National Park Service

Wildfires are a growing hazard in most regions of the United States, posing a threat to life and property, particularly where native ecosystems meet urban developed areas or where local economies are heavily dependent on open agricultural land. Although fire is a natural and often beneficial process, fire suppression can lead to more severe fires due to the buildup of vegetation, which creates more fuel and increases the intensity and devastation of future fires.

Wildfires are characterized in terms of their physical properties including topography, weather, and fuels. Wildfire behavior is often complex and variably dependent on factors such as fuel type, moisture content in the fuel, humidity, wind speed, topography, geographic location, ambient temperature, the effect of weather on the fire, and the cause of ignition. Fuel is the only physical property humans can control and is the target of most mitigation efforts. The NWS monitors the risk factors including high temperature, high wind speed, fuel moisture (greenness of vegetation), low humidity, and cloud cover in the state on a daily basis (Figure 37). These fire danger predictions are updated regularly and should be reviewed frequently.

Figure 36: Wildland-Urban Interface

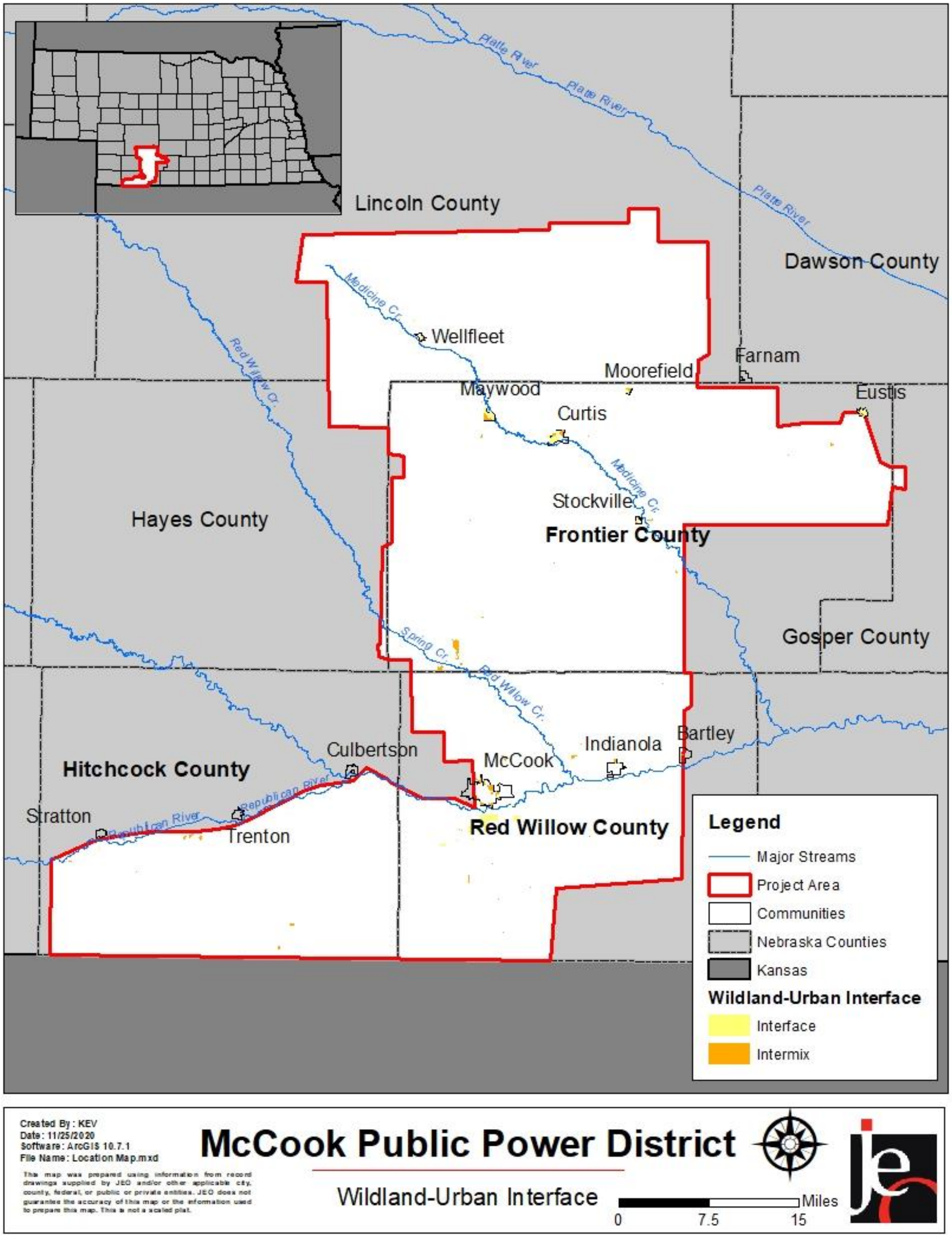
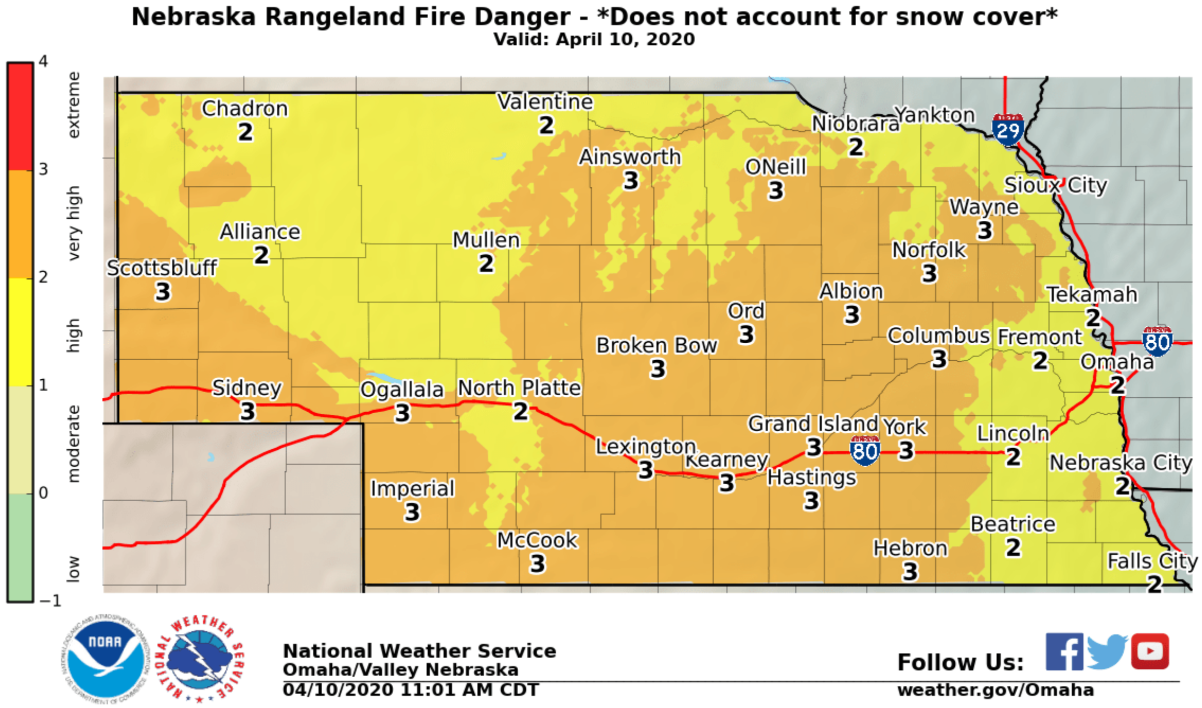


Figure 37: Rangeland Fire Danger



Source: NWS, 2019[57]

Location

For the planning area, twelve fire districts were identified to report events: Bartley Fire Department, Cambridge Fire Department, Culbertson Fire Department, Curtis Fire Department, Eustis Fire Department, Farnam Fire Department, Indianola Fire Department, Maywood Fire Department, and Palisade Fire Department, Red Willow Western Fire Department, Stratton Fire Department, and Trenton Fire Department (Figure 38). These fire districts respond to both wildfires and structural fires in cities and villages.

Figure 39 shows the USGS' Mean Fire Return Interval. This model considers a variety of factors, including landscape, fire dynamics, fire spread, fire effects, and spatial context. These values show how often fires are likely to occur in each area under natural conditions.

57 National Weather Service. January 2019. "Nebraska Fire Danger Map." https://www.weather.gov/oax/fire.

Figure 38: Fire Districts in the Planning Area

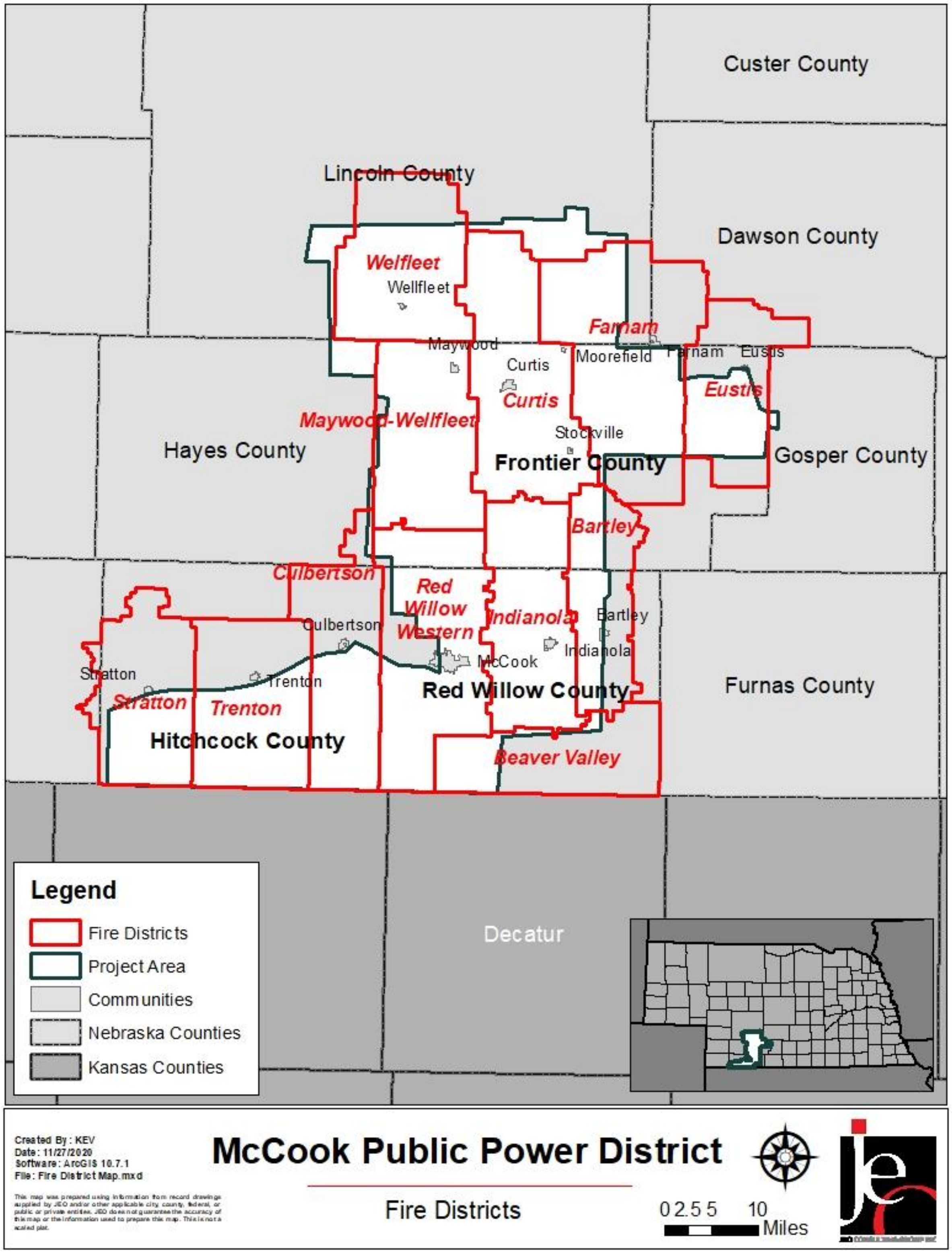
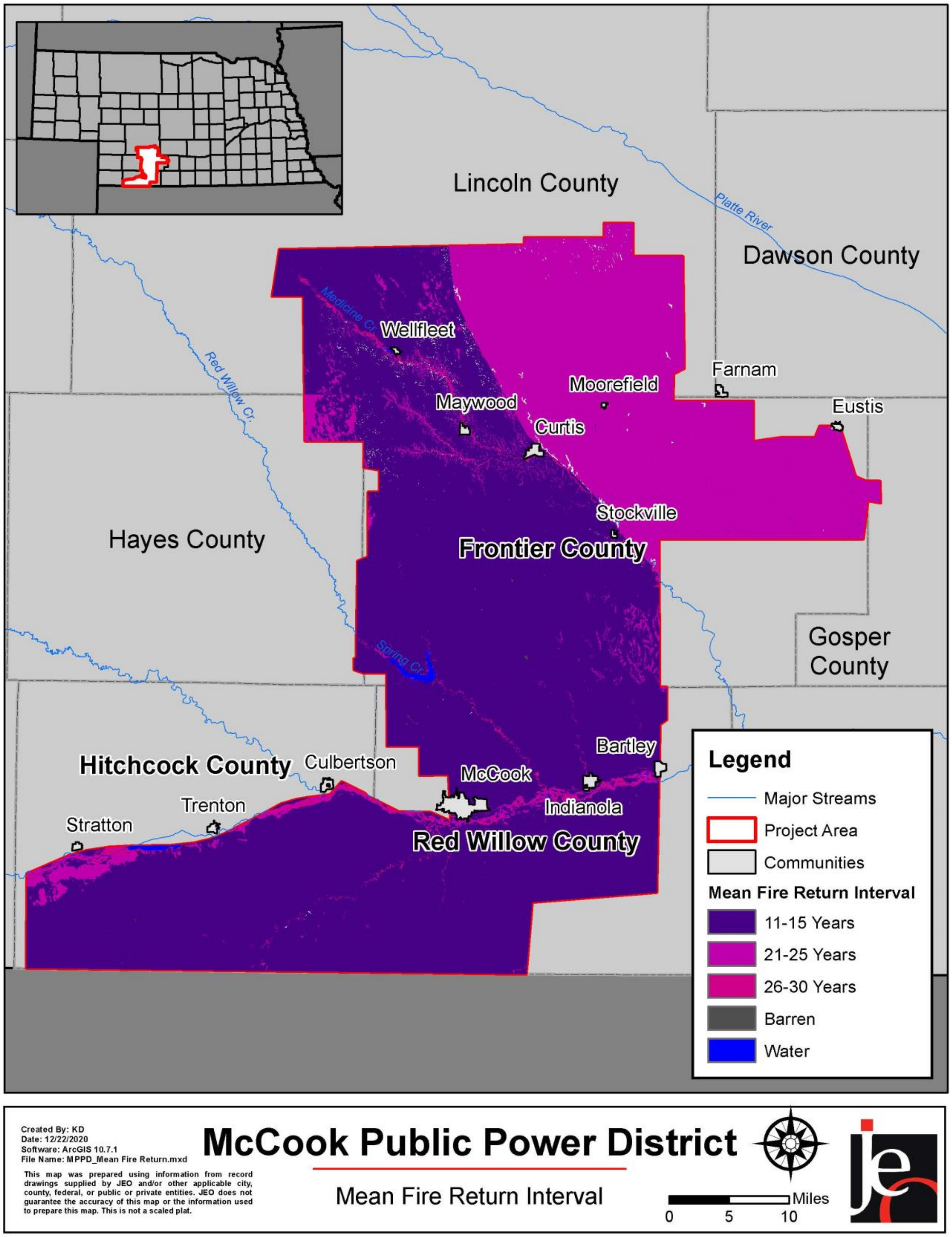


Figure 39: Mean Fire Return Interval



As the number of reported wildfires by county indicates, wildfire is a severe threat throughout the planning area. Red Willow County has reported the greatest number of fires, but Frontier County has had the greatest number of acres burned. For the MPPD, their electrical poles and infrastructure are at risk to damage from wildfires, as trees are fuel so are the many miles of wooden poles across the rural country-side.

Table 72: Reported Wildfires by County

County	Reported Wildfires	Acres Burned
Frontier	139	25,629
Hitchcock	114	7,376
Red Willow	261	1,334
Total	**514**	**34,339**

Source: Nebraska Forest Service, 2000-2018[58]

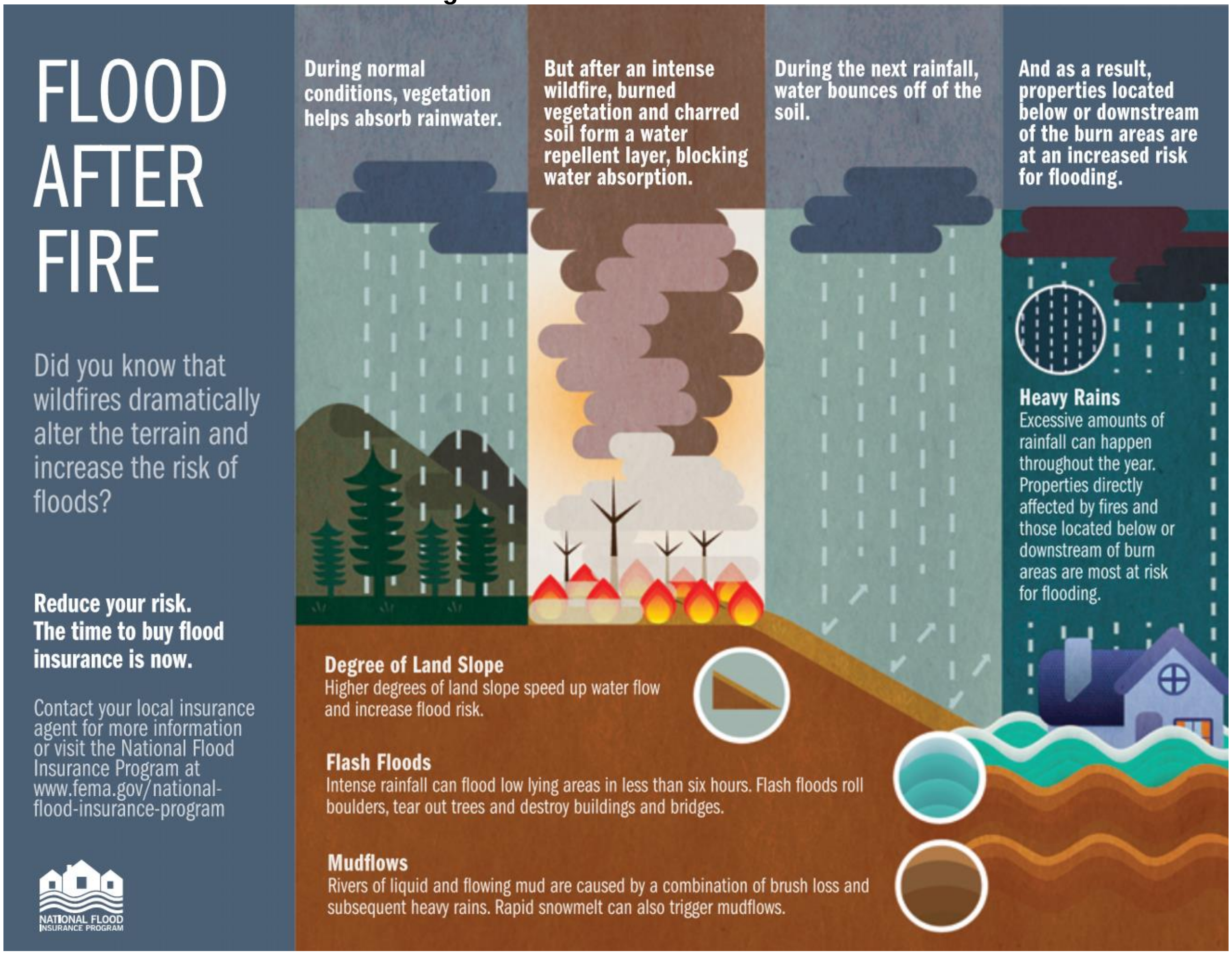
Extent

As seen in Table 72 above, wildfires have burned 34,339 acres of land. In total, there were 514 reported wildfires in the planning area. Of these, 15 fires burned 100 acres or more, with the largest wildfire burning over 22,000 acres in Frontier County in August 2002.

Wildfire also contributes to an increased risk from other hazard events, compounding damages and straining resources. FEMA has provided additional information in recent years detailing the relationship between wildfire and flooding. Wildfire events remove vegetation and harden soil, reducing infiltration capabilities during heavy rain events. Subsequent severe storms that bring heavy precipitation can then escalate into flash flooding, dealing additional damage to jurisdictions.

58 Nebraska Forest Service. 2000-2014. "Fire Incident Type Summary." Data Files 2000-2018.

Figure 40: FEMA Flood and Fire



Source: FEMA, 2018[59]

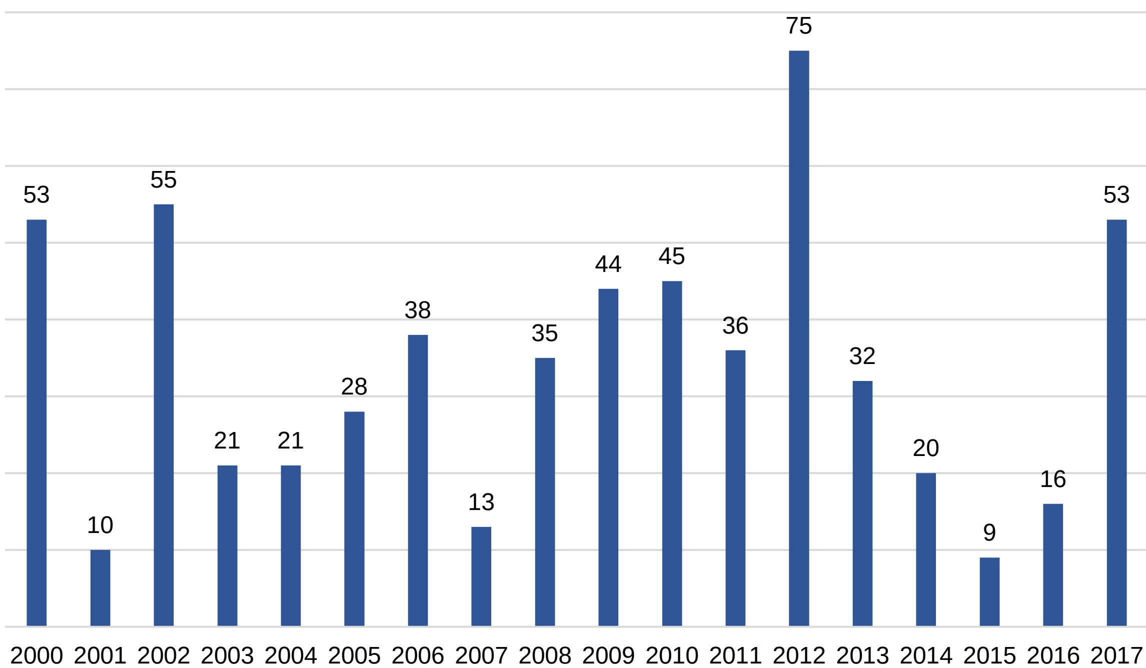
59 Federal Emergency Management Agency. 2018. "Flood After Fire." https://www.fema.gov/flood-after-fire.

Historical Occurrences

Local fire districts reported a total of 514 wildfires, according to the National Forest Service (NFS), from 2000 to 2018. Most fires occurred in 2012 (Figure 41). The reported events burned 34,339 acres. The NFS also reported $147,216 in crop damages. Wildfire events caused four injuries, one fatality, threatened 20 homes and 23 other structures, and destroyed 6 other structures.

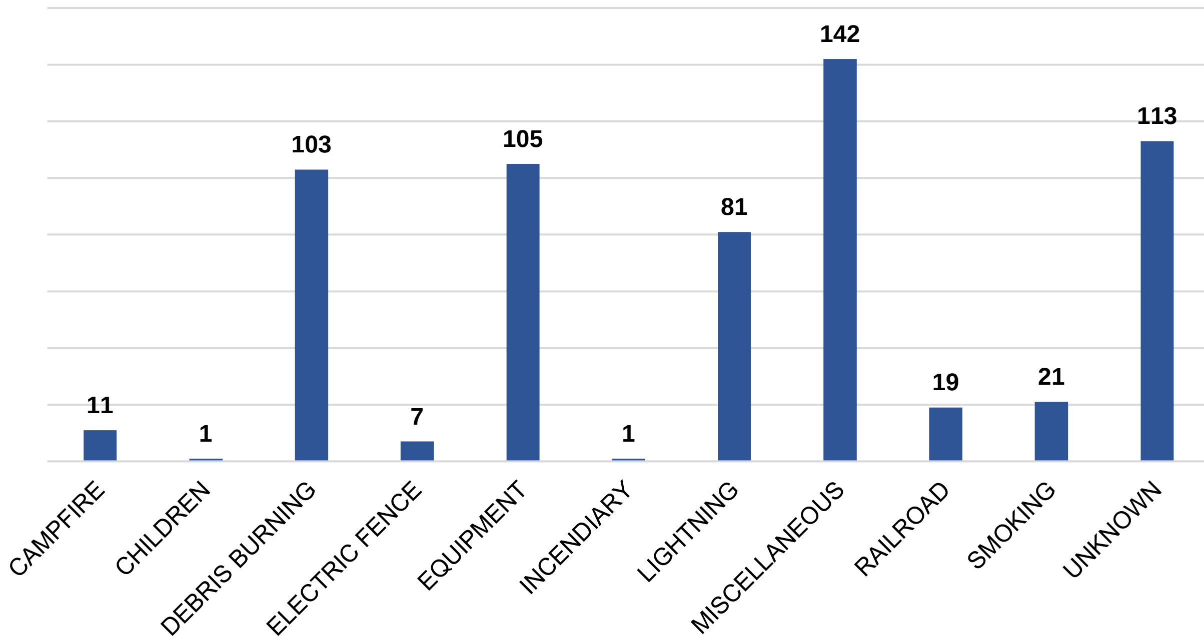
The majority of wildfires in the planning area are caused by miscellaneous sources (24%), with unknown as the second leading cause (19%) (Figure 42). Wildfires in the planning area have ranged from zero to 22,000 acres, with an average event burning 85 acres.

Figure 41: Number of Wildfires by Year in the Planning Area



Source: Nebraska Forest Service, 2000-2018

Figure 42: Wildfires by Cause in the Planning Area



Source: Nebraska Forest Service, 2000-2018

Average Annual Damages

The average damage per event estimate was determined based upon records from the Nebraska Forest Service Wildfires Database from 2000 to 2018 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. During the 19-year period, 514 wildfires burned 34,339 acres and caused $147,216 in crop damages to the planning area.

Table 73: Wildfire Loss Estimation

Hazard Type	Number of Events	Events Per Year	Total Crop Loss	Average Annual Crop Loss
Wildfires	514	27	$147,216	$7,748

Source: Nebraska Forest Service, 2000-2018

Table 74: Wildfire Threats

Hazard Type	Injuries	Homes Threatened or Destroyed	Other Structures Threatened or Destroyed	Total Acres Burned	Average Acres Per Fire
Wildfires	4	20	29	34,339 acres	85

Source: Nebraska Forest Service, 2000-2018

Probability

The probability of wildfire occurrence is based on the historic record provided by the Nebraska Forest Service and reported potential by participating jurisdictions. Based on the historic record, there is a 100 percent annual probability of wildfires occurring in the planning area each year.

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities.

Table 75: Regional Wildfire Vulnerabilities

Sector	Vulnerability
People	-Risk of injury or death for residents and firefighting personnel -Displacement of people and loss of homes -Lack of transportation poses risk to low income individuals, families, and elderly -Transportation routes may be blocked by fire, preventing evacuation efforts
Economic	-Damages to buildings and property can cause significant losses
Built Environment	-Property damages
Infrastructure	-Damage to power lines and utility structures -Potential loss of equipment and resources
Critical Facilities	-Risk of damages
Climate	-Increase chance of landslides and erosion -May lead to poor water quality -Post fire, flash flooding events may be exacerbated

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SECTION FIVE
MITIGATION STRATEGY

Introduction

The primary focus of the mitigation strategy is to identify action items to reduce the effects of hazards on existing infrastructure and property based on the established goals and objectives. These actions should consider the most cost effective and technically feasible manner to address risk.

The establishment of goals and objectives took place during the kick-off meeting with the planning team. Meeting participants reviewed the goals from the 2014 HMP and discussed recommended additions and modifications. The intent of each goal and set of objectives is to develop strategies to account for risks associated with hazards and identify ways to reduce or eliminate those risks.

The Planning Team voted to maintain the same list of goals from the 2014 HMP.

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

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

Requirement: §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.

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

Requirement §201.6(c)(3)(iv): For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

Summary of Changes

The development of the mitigation strategy for this plan update includes the addition of new mitigation actions and the updated status or removal of past mitigation actions.

Goals

Below is the final list of goals as determined for this plan update. These goals provide direction to guide participants in reducing future hazard related losses.

Goal 1: Protect the Health and Safety of Customers (overall intent of the plan)

Objective 1.1: Provide a safe source of electricity to customers in the MPPD and keep the general public safe.

Goal 2: Protect the MPPD Transmission/ Distribution System

Objective 2.1: Improve all components of the electrical transmission/ distribution system District-wide.

Objective 2.2: Provide a fully reliable and safe source of electricity to customers in the MPPD service area.

Goal 3: Reduce Future Losses from Hazard Events
Objective 3.1: Provide service to customers through existing structures, critical facilities, and other vital services in addition to future developments.

Objective 3.2: Minimize and control the impact of hazard events on the existing electrical system.

Objective 3.3: Perform regular upgrades of lines and equipment.

Objective 3.4: Ensure an adequate communication system is available during a hazard event.

Objective 3.5: Ongoing effort to upgrade the system with maintenance and replacement as well as the development of a four-year work plan for critical means to upgrade.

Objective 3.6: Use of FEMA guidelines and the National Electric Safety Code.

Objective 3.7: Coordinate MPPD efforts with local, regional, and state planning efforts.

Objective 3.8: Increase business continuity planning to reduce/eliminate service interruptions.

Goal 4: Increase Public Awareness and Educate Customers on the Vulnerability to Hazards
Objective 4.1: Develop and provide information on an ongoing basis to customers about the types of hazards, potential effects they can be exposed to after the occurrence of a hazard, and how they can be better prepared.

Mitigation Actions

After establishing the goals, mitigation actions were evaluated and prioritized by the Planning Team. These actions included the mitigation actions identified in the previous plan and additional mitigation actions discussed during the planning process.

The planning team was asked to prioritize their list of alternatives FEMA's recommended STAPLEE process. The planning team chose to do so through a verbal discussion, with the results being presented in this section. This process addressed all the major factors when weighing the relative costs and benefits of implementing one action over another. These factors included the prohibitive costs, the District's resource capabilities, the District's desires and concerns, and the overall feasibility of the alternative. The STAPLEE process, taken from FEMA's Multi-Hazard Mitigation Planning Guidance, considered the social, technical, administrative, political, legal, economic, and environmental benefits of each action. The criteria are summarized below.

S – Social: Mitigation actions are acceptable to the jurisdiction if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the jurisdiction's social and cultural values.
T – Technical: Mitigation actions are technically most effective if they provide long-term reduction of losses and have minimal secondary adverse impacts.
A – Administrative: Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.

P – Political: Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support of the action.
L – Legal: It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E – Economical: Budget constraints can significantly deter the implementation of mitigations actions. Hence, it is important to evaluate whether an action is cost-effective, as determined by a cost-benefit review, and possible to fund.
E – Environmental: Sustainable mitigation actions that do not have an adverse effect on the environment, that comply with federal, state, and local environmental regulations, and that are consistent with the jurisdiction's environmental goals, have mitigation benefits while being environmentally sound.

Mitigation actions identified by the MPPD are found below. Each action includes the following information:

- Mitigation Action – general title of the action item
- Description – brief summary of what the action item(s) will accomplish
- Hazard(s) Addressed – which hazard the mitigation action aims to address
- Estimated Cost – a general cost estimate for implementing the mitigation action
- Potential funding – a list of any potential funding mechanisms to fund the action
- Timeline – a general timeline as established by planning participants
- Priority –a general description of the importance and workability in which an action may be implemented (high/medium/low); priority may vary, mostly dependent on funding and technical capabilities
- Status – a description of what has been done, if anything, to implement the action item

These projects are the core of a hazard mitigation plan. The Planning Team was instructed that each alternative must be directly related to the goals of the plan and the hazards of top concern for the district. Alternatives must be specific activities that are concise and can be implemented individually. Mitigation actions were evaluated based on referencing the District's risk assessment and capability assessment.

It is important to note that not all of the mitigation actions identified by the District may ultimately be implemented due to limited capabilities, prohibitive costs, low benefit/cost ratio, or other concerns. Some of these factors may not be identified during the planning process. The cost estimates and priority rankings give MPPD an idea of what actions may be the most feasible over the next five years.

The General Manager will oversee the implementation and serve as the lead agency of all projects identified in the HMP. MPPD will pursue grant funding through BRIC, HMGP, FMA and other applicable grants as appropriate. However, McCook Public Power District General Funds will fund the implementation of all other projects as well as provide the local match for awarded grants.

The completion of a cost-benefit analysis assessment for these projects is beyond the scope of this plan process but could potentially be completed prior to submittal of a project grant application or as part of an annual review or five-year update. Completed, removed, and ongoing or new mitigation actions for MPPD can be found below.

Completed Mitigation Actions:

GIS mapping of entire MPPD transmission and distribution lines and facilities.

Description: Improve system by replacing paper mapping with GIS map system to improve data retrieval in critical situations and improve accuracy of information.
Hazard(s) Addressed: All
Estimated Cost: $100,000
Funding: McCook Public Power District General Funds
Status: This action has been completed since the previous plan.

Removed Mitigation Actions:

Build a 69KV sub-transmission tie between Farnam substation and Dawson PPD.

Description: Dawson would need to build 3 miles and MPPD 4 miles to create a loop 69KV feed between both systems. It would be a tremendous asset in severe storms. It would create a backup for 6 substations in MPPD service area and 4 substations for Dawson PPD.
Reason for Removal: Project was determined to be not feasible. The District will pursue additional projects to create system redundancy.

Ongoing Mitigation Actions:

Updated Emergency Response Plan (ERP).

Description: Review MPPD's Emergency Disaster Plan and incorporate into an Emergency Response Plan.
Hazard(s) Addressed: All
Estimated Cost: $10,000 or Staff Time
Timeline: 2-5 Years
Priority: High
Status: Not Yet Started

Install additional primary and secondary arresters.

Description: Better prepare the distribution systems resistance to lightning, especially secondary arrestors at the customer's meter.
Hazard(s) Addressed: Severe Thunderstorms
Estimated Cost: $100 for primary line arrestors; $75 for secondary service arrestors
Timeline: Ongoing, 5+ Years
Priority: Medium
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken.

Use T-2 conductors on main feeder circuits.

Description: Reduce galloping of lines with cross winds by using more T-2 conductor on main feeder circuits.
Hazard(s) Addressed: Severe Thunderstorms, Tornadoes, High Winds, Severe Winter Storms
Estimated Cost: $90,000/ mile
Timeline: Ongoing, 5+ Years
Priority: Medium
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken.

Use HDPE conduit in critical areas of flooding when installing underground lines.

Description: Provide better support of conductors in washout areas.
Hazard(s) Addressed: Flood/Flash Flood
Estimated Cost: $5,000/ 1,000 feet
Timeline: Ongoing, 5+Years
Priority: Medium
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken.

Provide looped distribution service or other redundancies in the electrical service to critical facilities.

Description: Construct loop feed tie lines.
Hazard(s) Addressed: All
Estimated Cost: $70,000/ mile
Timeline: Ongoing, 5+ Years
Priority: High
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken. This action is part of ongoing project which is budgeted for yearly. Currently 10% complete.

Install two-way feeds on main circuits to allow sectionalizing of circuits to restore power to customers in a more timely fashion.

Description: Put distribution class air brake switches in existing main line feeders and construct additional main circuit line to intersect with another main.
Hazard(s) Addressed: All
Estimated Cost: Switching $10,000/ location; T2 3-phase tie line $70,000/ mile
Timeline: Ongoing; one day/ location; tie line ten days/ mile
Priority: High
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken. This action is part of ongoing project which is budgeted for yearly. Currently 75% complete.

Replace east/ west overhead main feeder circuits out of substations with 4/0 underground lines.

Description: Improve distribution of 7.2/12.5kv by construction underground circuits.
Hazard(s) Addressed: All
Estimated Cost: $70,000-$100,000/ mile
Timeline: Ongoing, 5+ Years
Priority: High
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken. This action is part of ongoing project. At this time it is 20% complete.

Install heavier guy wires and anchors and side guy critical structures in both transmission and distribution overhead lines.

Description: Establish a program to stabilize structures to prevent movement during heavy loading conditions and wind.
Hazard(s) Addressed: Severe Thunderstorms, Tornadoes, High Winds, Severe Winter Storms
Estimated Cost: $2,000/ mile
Timeline: Ongoing, 5+ Years
Priority: High

Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken.

Installation of additional guy wires or other additional support to power lines.

Description: Increased support to power lines to eliminate for the most part cascading of poles in ice/wind conditions.
Hazard(s) Addressed: Severe Thunderstorms, Hail, Tornadoes, High Winds, Severe Winter Storms
Estimated Cost: $2,000/ mile
Timeline: Ongoing, 5+ Years
Priority: High
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken.

Replace overhead lines with underground conductor on east/ west lines (other than main feeder circuits).

Description: Replace highly vulnerable overhead power lines with underground conductor line.
Hazard(s) Addressed: Severe Thunderstorms, Severe Winter Storms, Terrorism, Tornadoes, High Winds, Transportation Incidents.
Estimated Cost: $70,000-$100,000/ mile
Timeline: Ongoing
Priority: High
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken.

Installing pad-mounted transformers (in non-flood areas) where pole-mounted transformers are presently vulnerable to wind.

Description: Reduce the vulnerability of overhead transformers and transmission poles to high winds installing pad-mounted transformers.
Hazard(s) Addressed: Severe Thunderstorms, Severe Winter Storms, Tornadoes, High Winds
Estimated Cost: $8,000/ location
Timeline: Ongoing
Priority: Low
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken.

Replace sub-transmission line (69KV) overhead conductor with T-2 conductor with HHS 3/8 high strength static conductors and shorter spans on overhead lines.

Description: Replacements to prioritize sub-transmission lines of 69KV.
Hazard(s) Addressed: All
Estimated Cost: $150,000-$200,000/ mile
Timeline: 2-5 years
Priority: High
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken.

Shorten length of pole spans.

Description: Re-span sections of distribution line both 1Ø and 3Ø by adding more poles/mile.

Hazard(s) Addressed: All
Estimated Cost: $70,000/ mile
Timeline: Ongoing
Priority: High
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken.

Replace damaged poles with higher-class pole. Use a class 3 or 4 pole as standard construction practices.

Description: Replacement of existing poles built based upon lower standards which do not meet current standards, possibly utilizing some laminated poles.
Hazard(s) Addressed: Dam/Levee Failure, Earthquake, Flood/Flash Flood, Hail, Landslides, Severe Thunderstorms, Severe Winter Storms, Terrorism, Tornadoes, High Winds, and Transportation Incidents.
Estimated Cost: $1,800/ pole
Timeline: 2-5 Years
Priority: High
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken.

Upgrade McCook substation circuit #2 for the last seven miles where by it ties into Trenton substation circuit #2 which is 4/0 ACSR.

Description: Upgrade 7 miles of existing 3Ø #2 ACSR at the end of circuit #2 to tie into Trenton sub circuit #2 4/0 ACSR and 4/0 URD. Use 4/0 T-2 or 4/0 URD, shorter spans, and longer poles and cross arms if overhead.
Hazard(s) Addressed: All
Estimated Cost: $70,000-$100,000/ mile
Timeline: 2-5 Years
Priority: High
Status: This action is in progress and anticipated to be completed in 2021.

Upgrade tie between Airbase circuit #1 and Indianola circuit #2.

Description: Replace 6 miles existing overhead 3Ø distribution line with underground or overhead with T-2 1/0 wire.
Hazard(s) Addressed: All
Estimated Cost: $70,000-$100,000/ mile
Timeline: One to two years
Priority: High
Status: Not yet started.

Replace tin communications buildings in substations with a weather-proof structure.

Description: Install new storm proof (and vandalism) buildings to protect important electronic monitoring gear at substations. Use of automated breaker operation.
Hazard(s) Addressed: Severe Winter Storms, Terrorism, Tornadoes, Severe Thunderstorms
Estimated Cost: $20,000/ unit
Timeline: 2-5 Years
Priority: Medium
Status: In Progress. This action is part of ongoing project which is budgeted for yearly. At this time there is one more to complete.

Replace wood pole communication structures with steel towers in substations.

Description: Improve the communication system by replacing more vulnerable wooden poles with steel towers to hold communications equipment.
Hazard(s) Addressed: Dam/Levee Failure, Earthquake, Flood/Flash Flood, Hail, Landslides, Severe Thunderstorms, Severe Winter Storms, Terrorism, Tornadoes, High Winds, and Transportation Incidents.
Estimated Cost: $80,000
Timeline: 2-5 Years **Priority**: Medium
Status: In Progress. This action is part of an ongoing project which is budgeted for yearly. At this time, it is approximately 20% complete.

Improve communications infrastructure.

Description: Improve substation, data, and monitoring two-way radio communications with new technologies, existing technologies, and new communications tower in the counties served by MPPD.
Hazard(s) Addressed: All
Estimated Cost: $500,000+
Timeline: Ongoing
Priority: Medium
Status: In Progress. This is a standard operating procedure and as identified and needed this action is taken.

Increase public awareness of hazards

Description: Establish an educational campaign, such as a booth at fair, public service messages, etc. to provide information to customers about how to respond when coming across downed power lines, and the proper mitigation/response to other hazards.
Hazard(s) Addressed: All
Estimated Cost: $30,000/ year
Timeline: Ongoing
Priority: High
Status: In Progress. MPPD utilizes several opportunities to educate the public regarding hazards and safety including their newsletter, website, and in-person visits.

<u>New Mitigation Actions:</u>

Install Backup Generation at Maywood Site

Description: Install a generator, servers, and battery backup at the Maywood site.
Hazard(s) Addressed: All
Estimated Cost: $144,152
Timeline: 2-5 Years
Priority: High
Status: Not yet started

Install Fiber Network Between All MPPD Substations

Description: Create a private and secure high speed communications network between all of MPPD substations by replacing all transmission line static wires with fiber core static wire.
Hazard(s) Addressed: All
Estimated Cost: $4.2 Million
Timeline: 2-5 Years
Priority: High
Status: Not yet started

Upgrade Airbase Sub Circuit #2

Description: One and a half miles of #2 ACSR three phase line converted to 1/0 T2 conductor three phase. This is a north- south mainline that feeds into the north edge of McCook, NE. It would provide for future development on the north edge of McCook. Currently this circuit consists of 2.25 miles of 4/0 ACSRthree phase overhead going south of the sub-station this feeds two miles of #2 ACSR three phase overhead then continuing by feeding one mile of 4/0, three phase underground to the north edge of McCook. This would eliminate the weak link between two 4/0 lines and shore up future development on the north end of McCook that the McCook EDC claims is where developers are interested building.
Hazard(s) Addressed: All
Estimated Cost: $120,425
Timeline: 2-5 years
Priority: Medium
Status: Not yet started

Upgrade Wellfleet Sub Circuit #1

Description: Six miles of 1/0 ACSR overhead three phase mainline, converted to three phase 1/0 T2 conductor overhead line. This line is in a location that the terrain is too rough to facilitate underground line. There is a high irrigation load on the end this line. Upgrading would open the possibility of adding more irrigation load to the end of this existing line.
Hazard(s) Addressed: All
Estimated Cost: $481,701
Timeline: 2-5 years
Priority: Medium
Status: Not yet started

Build New Overhead Line

Description: Seven miles of new 1/0 T2 overhead line to possibly pick up more irrigation load and provide for a two-way feed option to circuit four of Radar sub that supplies power to an 80,000 head feed lot.
Hazard(s) Addressed: All
Estimated Cost: $704,603
Timeline: 2-5 years
Priority: Medium
Status: Not yet started

Upgrade Radar Sub Circuit #4

Description: 1.5 miles of 1/0 ACSR 3 phase overhead line converted to 1/0 T2 3 phase overhead line in addition to, 3.5 miles of new 1/0 T2 overhead 3 phase construction. This would reroute two miles of east-west 3 phase mainline that is in private right of way and has been damaged several times before in storms. This would provide a better power source to North Platte Livestock Feeders, an 80,000 head feedlot.
Hazard(s) Addressed: All
Estimated Cost: $401,415
Timeline: 2-5 years
Priority: Medium
Status: Not yet started

Provide Two-way Feed to North Platte Feeders

Description: Seven miles of new 1/0 T2 overhead 3 phase construction to provide a two-way feed to North Platte Feeders and to provide a power source for new irrigation loads in the area.
Hazard(s) Addressed: All
Estimated Cost: $704,603
Timeline: 2-5 years
Priority: Medium
Status: Not yet started

Upgrade Indianola Sub Circuit #2

Description: Four miles of 1/0 ACSR 3 phase overhead line going west from the sub-station converted to 4/0 underground 3 phase line. This is an existing east-west mainline that has been damaged before in storms.
Hazard(s) Addressed: All
Estimated Cost: $321,132
Timeline: 2-5 years
Priority: Medium
Status: Not yet started

Rebuild Overhead Line

Description: Three miles of #2 ACSR overhead 3 phase line rebuilt to 1/0 T2 conductor overhead line. This would make the whole mainline circuit 4/0 equivalent. To provide a better two-way feed possibility and provide better continuity of service for 66 consumers on circuit two of Indianola and 129 consumers on circuit one of Airbase sub.
Hazard(s) Addressed: All
Estimated Cost: $240,850
Potential Funding: McCook Public Power District General Funds
Timeline: 2-5 years
Priority: Medium
Status: Not yet started

Upgrade Indianola Sub Circuit #4

Description: Four miles of 1/0 acsr overhead three phase line rebuilt to 4/0 underground three phase line going east from the sub-station. This is an existing east-west mainline that has been damaged several times in storms.
Hazard(s) Addressed: All
Estimated Cost: $402,628
Timeline: 2-5 years
Priority: High
Status: Not yet started

Upgrade Overhead Mainline

Description: Three miles of #2 acsr overhead three phase mainline construction rebuilt to three phase 1/0 T2 conductor. This would make the entire circuit 4/0 equivalent. To provide improved two-way feed capabilities to 145 consumers on circuit four of Indianola and 145 consumers on circuit three of Sleepy Hollow substation.
Hazard(s) Addressed: All
Estimated Cost: $240,849
Timeline: 2-5 years
Priority: Medium

Status: Not yet started

Upgrade Stockville Sub Circuit #2

Description: Eleven and a half miles of #2 ACSR three phase overhead construction converted to three phase 1/0 T2 overhead construction. This is an east –west mainline feeder that has been damaged several times in past storms. By upgrading this to 1/0 T2 this would provide for better continuity of service on this circuit that includes 77 consumers, and better provide for two-way feed capabilities for Farnum sub circuit three which has 132 consumers on it. It will also aid in the two-way feed to Farnum sub circuit #4 that has 145 consumers.
Hazard(s) Addressed: All
Estimated Cost: $923,254
Timeline: 1-3 years
Priority: High
Status: Not yet started

Previous Mitigation Efforts

Below is a summary of all previous and ongoing mitigation efforts of MPPD. The projects are separated by efforts prior to the development of the district's first HMP and efforts following the adoption of the first HMP in 2008.

Mitigation Efforts (Pre-2008)

- Ongoing: MPPD began an ongoing effort during the 1960s to install a number of high voltage lightning arrestors which have proven successful in limiting the average number of service hours interrupted.
- Ongoing: MPPD began in the 1980s installation of secondary meter arrestors to mitigate damages from lightning strikes. This effort has been successful in greatly reduced the number of interruption hours and loss of meters.
- Ongoing: MPPD routinely installs higher class poles as part of replacing or repairing structures.
- 1994: MPPD submitted a Hazard Mitigation Program 404 Grant application for construction of an alternate electrical transmission line feeds and the improvement to a higher standard of other transmission lines. The project goal was to mitigate damage to the public's property and livelihood during disasters which would interrupt power service. MPPD pursued this project after the April 11, 1994 ice storm which caused thousands of customers to be without power for several weeks. A Presidential Disaster Declaration (FEMA 1027) was issued as a result of the ice storm.
- 1994: MPPD installed 11 miles of T2 wire on a transmission line between the Maywood and Moorefield substations. Since this time, only one break was recorded during the 1994 ice storm. After the 1994 ice storm, 23 miles of T2 was installed on a sub-transmission line. MPPD has experienced no problems with this 23 mile stretch since the installation occurred.
- 2006: MPPD completed a four-year work plan to identify weak areas regarding voltage drop in the distribution system. In most cases, a feeder line needed to be upgraded in conductor size. Underground conductor was specified in most cases. The engineering firm of RVW Inc. in Columbus, Nebraska prepared the plan.

Mitigation Efforts (2008 - 2020)

Airbase East Overhead to Underground (Project #1)

The first of the five projects (DR-1674-0042) included replacement of 3.7 miles of 3-phase overhead distribution line with 3.7 miles of 3-phase 4/0 underground distribution line just east of

Substation #3 (Airbase substation) north of McCook off of Highway 16. The total project cost was $249,607 and was started on March 3, 2010 and completed on October 20, 2010. This project eliminated threats from severe thunderstorms, severe winter storms, tornadoes, and high winds.

Moorefield Substation East (Project #2)
The second of the five projects (DR-1674-0043) replaced two miles of 2 6/1 ACSR 3-phase overhead line with T-2 1/0 3-phase overhead line which strengthens the resistance of the line to potential damages resulting from severe thunderstorms, severe winter storms, tornadoes, and high winds. The project was started on April 2, 2010 and completed October 27, 2010 with a total cost of $118,993. The project location is just east of Moorefield, Nebraska.

Maywood to Moorefield Overhead to Underground (Project #3)
The third of the five projects (DR-1706-0001), which began in August 2010 and is currently being constructed, is intended to replace 9.3 miles of existing #2 6/1 ACSR 3-phase underbuild distribution line with #4/0 underground 3-phase distribution line and convert 4.3 miles of #2 6/1 ACSR 3-phase underbuild distribution line to T-2 1/0 3-phase underbuild distribution line. This project will both eliminate the threat of potential damages resulting from severe thunderstorms, severe winter storms, tornadoes, and high winds as well as create a greater resistance to a portion of line from potential damages resulting from severe thunderstorms, severe winter storms, tornadoes, and high winds.

McCook Substation Circuit 5 Convert Overhead to Underground (Project #4)
Construction has not started on the fourth of the five projects (DR-1674-0041) which will convert 8 miles of 3-phase overhead distribution line to #4/0 underground distribution line and convert two miles of 3-phase overhead distribution line to 1-phase overhead distribution line. MPPD is currently working with the US Fish and Wildlife Service to ensure migratory birds are not affected through installation of bird flight diverters on certain locations of the project. The projected date of completion is August 10, 2013 (three years from the approval date for the funding).

MPPD has also conducted the following mitigation projects on their own accord since the approval of the previous mitigation plan.

Line Replacement
- Trenton Circuit Three – Rebuilt 3 miles of mainline with T-2 1/0
- Trenton Circuit One – Rebuilt 4 miles of mainline with T-2 1/0
- Stockville Circuit Four – Rebuilt 2.5 miles of mainline with T2 1/0
- McCook Circuit Two – Replaced 2 miles OH with URD
- McCook Circuit Five – Replaced remaining mile of OH with URD

Improve Communications Infrastructure
As part of McCook Public Power District’s on going plan to improve communication infrastructure, between September of 2013 and April of 2014 McCook Public installed two 150’ self-supporting towers, one approximately 1 mile south of the town of Wellfleet, NE and one approximately 1 mile west of the town of Moorefield, NE. New two way VHF radio equipment was installed at these locations along with the district’s office to further enhance our ability to communicate with our fleet of trucks. All sites are were also equipped with standby generation for continuous operation in the event of power failure.

Wellfleet Irrigation Project

MPPD built approximately thirty-four miles of 3 phase main line URD to serve several irrigation wells in the northwest part of the district. With this project seven miles of OH conductor was converted to T-2 conductor. Two miles of OH mainline was also removed and converted to URD.

Infrastructure Hardening Following 2017 Storm

On April 30, 2017 an ice storm hit McCook PPD. The result was 144 poles being broke off. They were all replaced with a heavier class pole and much of the wire was also replaced. In addition to all the broken poles there were also 68 poles leaning poles that were straightened and foamed to prevent them leaning again. This included 32 miles of lines being damaged.

Line Replacements

- Sleepy Hollow sub underground outs and add one circuit to lighten the load on circuit #3&4
- Airbase circuit 1 replace 4 miles of overhead with 4/0 underground
- Maywood circuit 3 replace 9 mile of overhead with 4/0 underground
- Moorefield circuit 4 replaced 2.5 miles of overhead with 4/0 underground
- McCook circuit 2 rebuild 7 more miles of overhead with T-2 1/0
- McCook circuit 2 replaced 2 miles of overhead with 4/0 underground

Improved Back-up Generation

To improve the back-up generation in the event of power failure at the MPPD headquarters a new 300 kw 3 phase generator was installed to replace an aging single-phase generator. This will help with both communication and operations in the main warehouse.

Maintenance Programs

McCook PPD has implemented the oil circuit recloser maintenance program. This consists of testing 1/3 of the OCR breakers in our district per year. This will provide better continuity of service throughout the entire district. We are also conducting a pole inspection program this will consist of testing of 2500 to 4000 poles per year. By doing this we can change out the aging poles and replace them with larger class poles before the aging poles fail.

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SECTION SIX
PLAN IMPLEMENTATION AND MAINTENANCE

Monitoring, Evaluating, and Updating the Plan

MPPD staff will be responsible for monitoring (annually at a minimum), evaluating, and updating the plan during its five-year lifespan. Hazard mitigation projects will be prioritized by the Board of Directors and Manager with support and suggestions from the public and stakeholders. The Board of Directors and Manager will be responsible for implementation of the recommended projects. The lead agency (or appropriate department/staff) identified on each mitigation action will report on the status of projects and include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies could be revised.

To assist with monitoring of the plan, as each project is completed, a detailed timeline of how that project was completed will be written and attached to the plan in a format selected by the Board of Directors. Information that will be included will address project timelines, agencies involved, area(s) benefited, total funding (if complete), etc. At the discretion of the Board and Manager, a task force will be used to review the original draft of the mitigation plan and to recommend changes.

Reviewing and updating of this plan will occur at least every five years. At the discretion of the Board of Directors and Manager updates may be incorporated more frequently, especially in the event of a major hazard. The Board of Directors and Manager will meet to discuss mitigation updates at least six months prior to the deadline for completing the plan review. The persons overseeing the evaluation process will review the goals and objectives of the previous plan and evaluate them to determine whether they are still pertinent and current. Among other questions, they may want to consider the following:

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

Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

- Do the goals and objectives address current and expected conditions?
- If any of the recommended projects have been completed, did they have the desired impact on the goal for which they were identified? If not, what was the reason it was not successful (lack of funds/resources, lack of political/popular support, underestimation of the amount of time needed, etc.)?
- Have either the nature, magnitude, and/or type of risks changed?
- Are there implementation problems or barriers?
- Are current resources appropriate to implement the plan?
- Were the outcomes as expected?
- Did the plan partners participate as originally planned?

- Are there other agencies which should be included in the revision process?

Worksheets in *Appendix C* may also be used to assist with plan updates.

Continued Public Involvement

To ensure continued plan support and input from the public and stakeholders, public involvement will remain a top priority for each participant. Notices for public meetings involving discussion of an action on mitigation updates should be published and posted in the following locations:

- MPPD office
- MPPD website
- Local radio stations
- MPPD newsletter

Unforeseen Opportunities

If new, innovative mitigation strategies arise that could impact the planning area or elements of this plan, which are determined to be of importance, a plan amendment may be proposed and considered separate from the annual review and other proposed plan amendments. MPPD should compile a list of proposed amendments received annually and prepare a report for NEMA, by providing applicable information for each proposal, and recommend action on the proposed amendments.

Integration into Existing Planning Mechanisms

The McCook Public Power District Board of Directors and Manager will be responsible for ensuring that the goals and objectives of this plan are incorporated into applicable revisions or any new planning projects undertaken by the District. In addition, this plan should be incorporated into existing planning mechanisms, as necessary, including procedures for implementing projects, updating the plan, continuing communication, and amending the plan as needed over the next five years utilizing FEMA's *Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan*[60] guidance, as well as FEMA's *2015 Plan Integration*[61] guide.

MPPD has an Emergency Disaster Plan that addresses many of the hazards included in the HMP. The District would like to update this plan to incorporate the appropriate response to all hazards that may affect the District to ensure business continuity. The District maintains several SPCC plans for all chemical storage sites. MPPD also has a Four-Year Work Plan that outlines the projects the district will pursue (similar to a community's capital improvements plan). The projects identified in this HMP will be incorporated into the MPPD work plan to ensure the plan is implemented and as many projects are completed as possible.

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60 Federal Emergency Management Agency. November 2013. "FEMA Region X Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan." https://www.fema.gov/media-library-data/1388432170894-6f744a8afa8929171dc62d96da067b9a/FEMA-X-IntegratingLocalMitigation.pdf.

61 Federal Emergency Management Agency. July 2015. "Plan Integration: Linking Local Planning Efforts." https://www.fema.gov/media-library-data/1440522008134-ddb097cc285bf741986b48fdcef31c6e/R3_Plan_Integration_0812_508.pdf.

Capability Assessment

The following capability assessment was created through a facilitated discussion with the planning team and a review of existing policies, regulations, and plans.

Planning and Regulatory Capabilities

- MPPD regularly develops and maintains planning mechanisms such as the Emergency Response Plan, Four-Year Work Plan, and HMP.
- As a quasi-state government, MPPD is generally exempt from local floodplain ordinances, and is not a member of the National Flood Insurance Program. Despite this exemption, MPPD is self-insured and incorporates mitigation into any structure or infrastructure located in the floodplain.

Administrative and Technical Capabilities

- MPPD has the administrative staff and experience to apply for grant funding.
- MPPD has several staff with the technical capability to assess vulnerabilities, design solutions, and implement mitigation projects. The District also has the capability to hire contractors to assist in the implementation of projects.

Fiscal Capability

- MPPD receives funding through the collection of fees from electrical customers. The District carefully plans and manages financial commitments. Although funding is never in excess, MPPD has the mechanisms in place to pursue funding for mitigation projects that will reduce risk within their District.
- MPPD will pursue grants to assist in funding mitigation projects when applicable and feasible. The District has experience in pursuing and acquiring grants to assist with the implementation of projects.

Communication, Education & Outreach Capabilities

- MPPD utilizes several methods to educate customers and stakeholders. Outreach efforts include the District website, quarterly newsletter, and regular in-person outreach throughout the District.