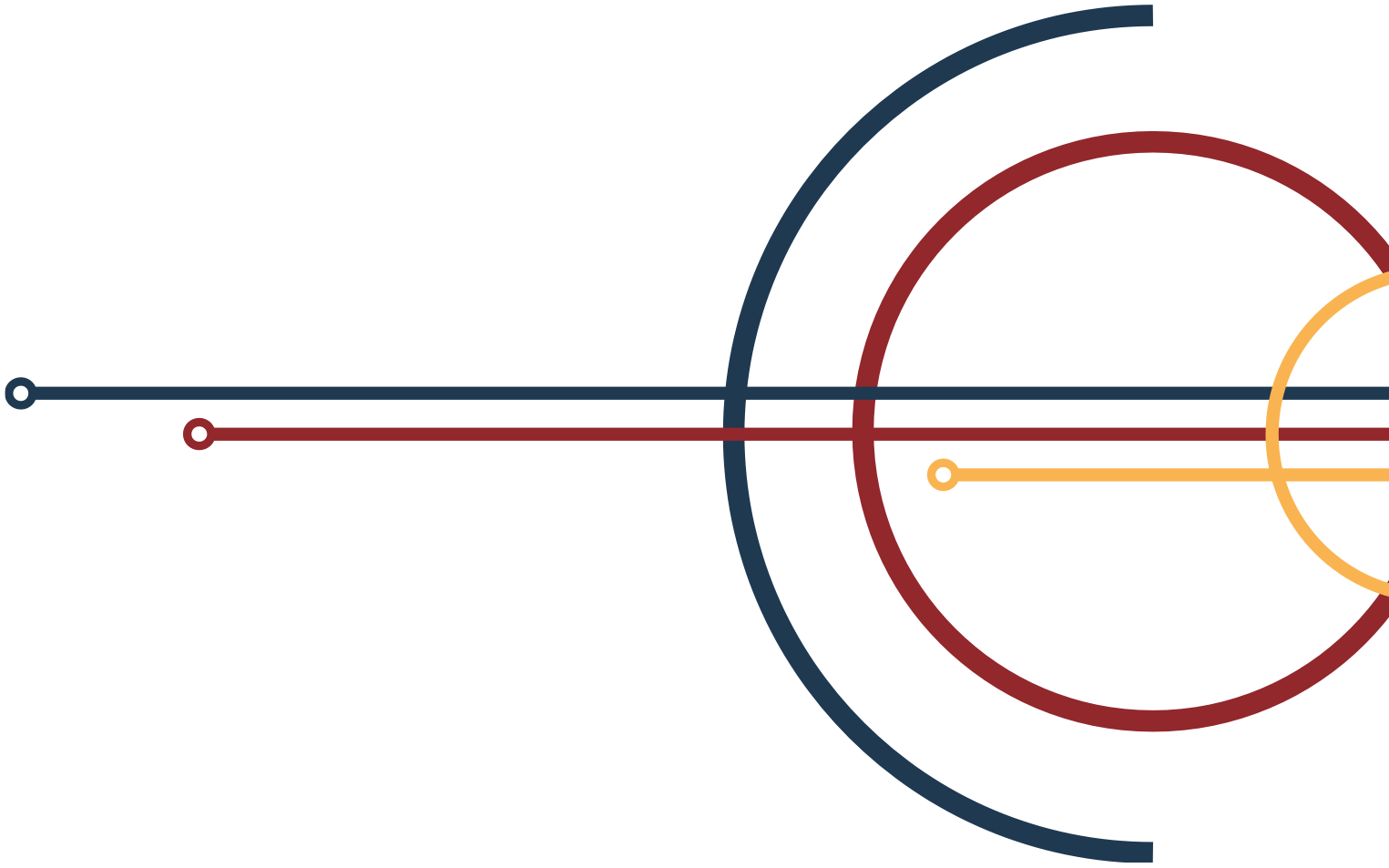

2021

Region 24 Emergency Management Multi-Jurisdictional Hazard Mitigation Plan

Plan developed for
Region 24 Emergency Management Agency
by JEO Consulting Group

Hazard Mitigation Planning Team

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List of Acronyms

BCA – Benefit Cost Analysis
BRIC – Building Resilient Infrastructure and Communities
CDC – Centers for Disease Control and Prevention
CF – Cubic Feet
COVID-19 – Coronavirus 2019
CRF – Code of Federal Regulations
CRS – Community Rating System
CWPP – Community Wildfire Protection Plan
DHHS – Nebraska Department of Health and Human Services
DHS – Department of Homeland Security
DMA 2000 – Disaster Mitigation Action of 2000
EAB – Emerald Ash Borer
EAP – Emergency Action Plan
EMA – Emergency Management Agency
EPA – Environmental Protection Agency
ESL – English as a Second Language
FBI – Federal Bureau of Investigation
FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Map
FMA – Flood Mitigation Assistance Program
FR – Final Rule
FRA – Federal Railroad Administration
HMA – Hazard Mitigation Assistance
HMGP – Hazard Mitigation Grant Program
HMP – Hazard Mitigation Plan
IPAWS – Integrated Public Alert and Warning System
JEO – JEO Consulting Group, INC.
LGA – Liquid Gallons
MPCC – Mid-Plains Community College
MPH – Miles Per Hour
NCEI – National Centers for Environmental Information
NDA – Nebraska Department of Agriculture
NDEE – Nebraska Department of Environmental and Energy
NDMC – National Drought Mitigation Center
NDOT – Nebraska Department of Transportation
NeDNR – Nebraska Department of Natural Resources
NEMA – Nebraska Emergency Management Agency
NFIP – National Flood Insurance Program
NFS – Nebraska Forest Service
NOAA – National Oceanic Atmospheric Administration
NPI – Nonpharmaceutical Intervention
NRC – National Response Center
NSFHA – No Special Flood Hazard Areas
NTSB – National Transportation Safety Board
NWS – National Weather Service
PDM – Pre-Disaster Mitigation
PDSI – Palmer Drought Severity Index
PHMSA – U.S. Pipeline and Hazardous Materials Safety Administration
RL – Repetitive Loss
RMA – Risk Management Agency
SBA – U.S. Small Business Administration
SEAT – Single Engine Air Tanker
SFHA – Special Flood Hazard Areas
SHMO – State Hazard Mitigation Officer
SPIA – Sperry-Piltz Ice Accumulation Index
SRL – Severe Repetitive Loss
START – Study of Terrorism and Response to Terrorism
USACE – United States Army Corps of Engineers
USDA – United States Department of Agriculture
USGS – United States Geological Survey
WHO – World Health Organization
WUI – Wildland-Urban Interface

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Executive Summary

Introduction

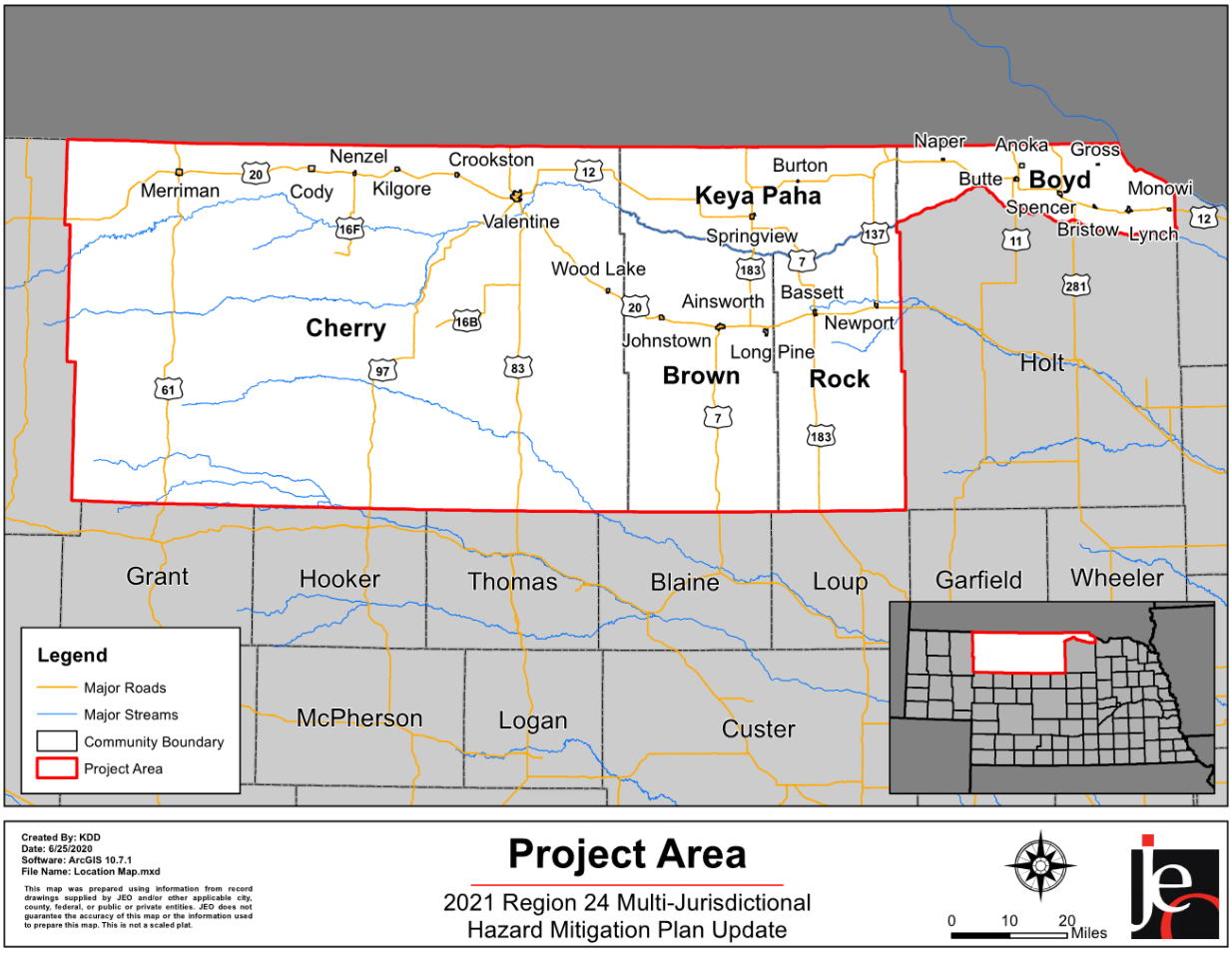
This plan is an update to the Region 24 Emergency Management Agency (EMA) Multi-Jurisdictional Hazard Mitigation Plan (HMP) approved in October 2015. The plan update was developed in compliance with the requirements of the Disaster Mitigation Action of 2000 (DMA 2000).

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 communities 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. Plan participants are listed in the following table and illustrated in the following planning area map.

Table 1: Participating Jurisdictions

Participating Jurisdictions	
Region 24 Emergency Management	Village of Nenzel
Lower Niobrara NRD	City of Valentine
Middle Niobrara NRD	**Keya Paha County**
Boyd County	Village of Springview
Village of Bristow	**Rock County**
Village of Butte	City of Bassett
Village of Lynch	Village of Newport
Village of Naper	**Other Special Districts**
Village of Spencer	Ainsworth Community Schools
Brown County	Boyd County Rural Water District #2
City of Ainsworth	Boyd County Schools
Village of Johnstown	Brown County Rural Fire Protection District
City of Long Pine	Keya Paha County Fire District
Cherry County	Naper Fire District
Village of Cody	Rock County Public Schools
Village of Crookston	Valentine Rural Fire District
Village of Kilgore	

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 communities participating in this plan. The driving motivation behind 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 both broad-based and community-specific mitigation strategies and projects that will, if implemented, reduce their vulnerability and help build stronger, more resilient communities.

Goals from the 2015 HMP were reviewed, and the Planning Team agreed that they are still relevant and applicable for this plan update. The goals for this plan update are as follows:

Goal 1: Protect Health and Safety of Residents

Objective 1.1: Reduce or prevent damage to property and prevent loss of life or serious injury (overall intent of the plan).

Goal 2: Reduce Future Losses from Hazard Events

Objective 2.1: Provide protection for existing structures, future development, critical facilities, services, utilities, and trees to the extent possible.

Objective 2.2: Develop hazard specific plans, conduct studies or assessments, and retrofit jurisdiction to mitigate for hazards and minimize their impact.

Objective 2.3: Minimize and control the impact of hazard events through enacting or updating ordinances, permits, laws, or regulations.

Goal 3: Increase Public Awareness and Educate on the Vulnerability to Hazards

Objective 3.1: Develop and provide information to residents and businesses about the types of hazards they are exposed to, what the effects may be, where they occur, and what they can do to be better prepared for them.

Goal 4: Improve Emergency Management Capabilities

Objective 4.1: Develop or improve Emergency Response Plans, procedures and abilities; increase the capability to respond.

Objective 4.2: Develop or improve Evacuation Plan and procedures.

Objective 4.3: Improve warning systems and ability to communicate to residents and businesses during and following a disaster or emergency.

Goal 5: Pursue Multi-Objective Opportunities (Whenever Possible)

Objective 5.1: When possible, use existing resources, agencies, and programs to implement the projects.

Objective 5.2: When possible implement projects that achieve several goals.

Goal 6: Enhance Overall Resilience and Promote Sustainability

Objective 6.1: Incorporate hazard mitigation and adaptation into updating other existing planning endeavors (e.g. comprehensive plans, zoning ordinance, subdivision regulation, etc.).

Summary of Changes

The hazard mitigation planning process undergoes several changes during each plan update to best accommodate the planning area and specific conditions. Changes from the 2015 Hazard Mitigation Plan and planning process in this update included: greater efforts to reach out to and include new participating jurisdictions, special districts, and stakeholder groups, such as fire districts and school districts; a more specific hazard risk assessment applicable to the planning area; and the inclusion of additional mitigation strategies. This update also works to unify the various planning mechanisms in place throughout the participating communities (i.e. comprehensive plans, local emergency operation plans, zoning ordinances, building codes, etc.) to ensure that the goals and objectives identified in those planning mechanisms are consistent with the strategies and projects included in this plan. Regional hazards identified in the plan were also updated. The planning team decided not to address urban fire and determined that it was necessary to add a discussion on the hazard of Public Health Emergency in the plan. Other changes as described in the 2015 Region 24 EMA Multi-Jurisdictional HMP review tool are described in the table below.

Table 2: Summary of Changes Based on 2015 Comments

Comments from 2015 Review Tool	Location of Revision	Summary of Change
Use of the term "ongoing" provides no meaningful indication of an action's status.	Individual Community Profiles	Statuses have been updated for all mitigation actions and no longer use the term ongoing.
Several jurisdictions indicate that participation "in the National Flood Insurance Program" is no longer needed". Since these jurisdictions never participated in the NFIP, some other phrasing is recommended.	Individual Community Profiles	Phrasing and statuses have been updated for any removed mitigation actions.
Use of the title "mitigation alternatives selected by each direct participant" is unnecessary and confusing.	Table 110, Table 111, Table 112	Title of the table has been updated to "Mitigation Actions Selected by Each Jurisdiction".
Action 2.2.4. It's not clear why a repetitive loss property in Boyd County would be a concern for Brown County.	N/A	Mitigation action was removed in the 2015 plan.

It should also be noted that due to the outbreak of the coronavirus disease 2019 (COVID-19), some adjustments were made to the planning process to appropriately accommodate plan meetings and requirements. To best provide options for residents and staff members in the planning area, meetings were held via an online/phone one-on-one format and in-person public workshop meetings. Additional changes are described in *Section Two: Planning Process*.

Plan Implementation

Various communities across the planning area have implemented hazard mitigation projects following the 2015 Hazard Mitigation Plan. A few examples of completed projects include alert and warning sirens, anchoring chemical storage tanks, backup and emergency generators, stream bank stabilization, water tank upgrades, weather radios, and others. To build upon these prior successes and to continue implementation of mitigation projects, despite limited resources, communities will need to continue relying upon multi-agency coordination as a means of leveraging resources. Communities across the region have been able to work with a range of entities to complete projects; potential partners for future project implementation include but are not limited to the Nebraska Forest Service (NFS), Nebraska Department of Transportation (NDOT), Nebraska Department of Natural Resources (NeDNR), Nebraska Emergency Management Agency (NEMA), United States Department of Agriculture (USDA), and United States Army Corps of Engineers (USACE).

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 hazard risk assessment and associated losses.

Table 3: Regional Risk Assessment

Hazard	Previous Occurrences Events/Years	Approximate Annual Probability	Likely Extent
Agricultural Disease	Animal: 48/6 Plant: 10/21	Animal: 100% Plant: 33%	~57 animals per event
Chemical & Radiological Hazards (Fixed Site)	1/30	3%	0 – 800 lbs
Chemical & Radiological Hazards (Transportation)	3/50	6%	0 – 218 gallons 0 – 135 cubic feet
Civil Disorder	0	Less than 1%	Varies by event
Dam Failure	12/131	9%	Varies by structure
Drought*	432/1,502 months	29%	D1-D4
Earthquakes	16/121	12%	<5.0 magnitude
Extreme Heat	533/116	80%	>100°F
Flooding	52/25	52%	Some inundation of structures (<1% of structures) and roads near major bodies of water. Some evacuations of people may be necessary (<1% of population)
Grass/Wildfires	718/21	100%	0 – 60,000 acres Some homes and structures threatened or at risk
Hail	1,427/25	100%	0.02 – 5.0 inches Avg: 1.21 inches
High Winds	118/25	92%	47 – 54 mph Avg: 48 mph
Landslides	57/54	13%	Width: 50 – 1,000 feet Length: 30 – 1,400 feet
Levee Failure	0	Less than 1%	Varies by extent
Public Health Emergency	2	Unknown	Varies by event
Severe Thunderstorms	433/25	100%	≥1” rainfall 58 – 119 mph Avg: 66 mph
Severe Winter Storms	434/25	100%	0.25 – 0.5” Ice 20°- 40° below zero (wind chill) 1-5” snow 25-35 mph winds
Terrorism	0/49	Less than 1%	Varies by event
Tornadoes	88/25	84%	EF0 – EF3 Avg: EF0
Transportation Incidents	Auto: 2,342/13 Aviation: 65/59 Railway: 20/46	Auto: 100% Aviation: 58% Railway: 0%**	Damages incurred to vehicles involved and traffic delays; substantial damages to aircrafts involved with some aircrafts destroyed

**Data given in months.*
***All rail lines in the planning area have been removed.*

The following table proves loss estimates for hazards with sufficient data. Descriptions of major events are included in *Section Seven: Community Profiles*.

Table 4: Loss Estimation for the Planning Area

Hazard Type		Count	Property Damage	Crop Damage[2]
Agricultural Disease	Animal Disease[1]	48	2,712 animals	N/A
	Plant Disease[2]	10	N/A	$82,790
Chemical & Radiological Hazards (Fixed Site)[3]		1	$0	N/A
Chemical & Radiological Hazards (Transportation)[4]		3	$330	N/A
Civil Disorder		0	$0	N/A
Dam Failure[5,6]		12	$0	N/A
Drought[7]		432 of 1,502 months	$72,000,000	$35,047,100
Earthquakes[17]		16	$0	N/A
Extreme Heat[8]		Avg. 5 days a year	$0	$6,271,141
Flooding[9]	Flash Flood 1 Fatality	33	$13,602,000	$327,796
	Flood	19	$11,070,000	
Grass/Wildfires[10] 5 injuries		718	130,379 acres burned	$116,359
Hail[9] Average: 1.21 inches Range: 0.02 – 5 inches		1,427	$4,681,600	$24,192,791
High Wind[9] Average: 54 mph Range: 40 – 77 mph		118	$91,000	$3,510,436
Landslides[15]		57	$0	N/A
Levee Failure[16]		0	$0	N/A
Public Health Emergency		2	N/A	N/A
Severe Thunderstorms[9]	Thunderstorm Wind Average:66 mph Range: 58 – 119 mph	412	$4,075,600	$15,453,591
	Heavy Rain	13	$0	
	Lightning 1 injury	8	$49,850	
Severe Winter Storms[9]	Blizzard 1 Fatality	77	$500,000	$3,236,582
	Extreme Cold/Wind chill	85	$0	
	Heavy Snow	26	$0	
	Ice Storm	5	$0	
	Winter Storm	241	$10,223,000	
	Winter Weather	0	$0	
Terrorism[14]		0	$0	N/A
Tornadoes[9] Average: EF0 Range: EF0 - EF3 1 injury		88	$2,215,750	$0
	Auto[11] 58 fatalities, 932 injuries	2,342	N/A	N/A

Hazard Type		Count	Property Damage	Crop Damage[2]
Transportation Incidents	Aviation[12] 14 fatalities, 18 injuries	65	N/A	N/A
	Railway[13] 10 injuries	20	$45,400	N/A
Total		**5,847**	**$118,554,530**	**$88,238,856**

N/A: Data not available
1 - NDA, 2014 – March 2020
2 - USDA RMA, 2000 – June 2020
3 - NRC, 1990 – February 2020
4 - PHSMA, 1971 – June 2020
5 - Stanford NPDP, 1890 – 2018
6 – DNR Correspondence
7 - NOAA, 1895 – May 2020
8 – NOAA Regional Climate Center, 1893 – May 2020
9 – NCEI, 1996 – March 2020
10 – NFS, 2000 – April 2020
11 – NDOT, 2006 – 2018
12 – NTSB, 1962 – June 2020
13 – DOT FRA, 1975 – 2020
14 – University of Maryland, 1970 – 2018
15 – University of Nebraska, 1960 – 2013
16 – USACE NLN, 1900 – June 2020
17 – USGS, 1900 – June 2020

Events like agricultural disease, hail, severe winter storms, and severe thunderstorms will occur annually. Other hazards like drought, dam failure, and terrorism will occur less often. The scope of events and how they will manifest themselves locally is not known regarding hazard occurrences. Historically, drought, flooding, hail, and severe winter storms have resulted in the most significant damages within the planning area. These hazards are summarized below.

Drought

Drought is a regular and reoccurring phenomenon in the planning area and the State of Nebraska. Historical data shows that droughts have occurred with regularity across the planning area and recent research indicates that trend will continue and intensify. Drought most commonly affects the agricultural and ranching sectors. Over $35 million in total crop losses and $72 million in livestock losses was reported for the planning area.

Prolonged drought events can profoundly affect the planning area and the individual communities within it. Expected impacts from prolonged drought events include but are not limited to: economic losses in the agricultural sector, loss of employment in the agricultural sector, livestock loss, limited water supplies (drinking, irrigation, and fire suppression), and decrease in recreational opportunities.

Flooding

Flooding is one of the most significant hazards for the planning area. Major flood events (since 1996) have occurred in 1997, 1999, 2001, 2007, 2008, 2010, and 2019, causing millions of dollars in property and crop damages. Both flash flooding and riverine flooding are expected to be continual hazards for the planning area due to the proximity to the North Loup River, Niobrara River, and Missouri River. One compounding factor is the stress on local dams during ice jam events, particularly along the Niobrara River. In March 2019, the Spencer Dam was destroyed due to high water and large ice chunks hitting the structure during catastrophic flooding. Flooding events can and have damaged municipal infrastructure, businesses, and residential homes, forced residents to evacuate, damaged agricultural fields; damaged livestock operations, and closed and/or damaged roadways.

Hail

Hailstorms are most likely to occur between the months of May and September. Additionally, hail is likely to occur alongside other hazards like high winds and severe thunderstorms. The National Centers for Environmental Information (NCEI) recorded 1,427 hail events in 24 years. These events caused over $4 million in property damage and $24 million in agricultural damage. Typical impacts resulting from hail include but are not limited to damage to buildings (siding, windows, roofs), loss of power, and destruction of crops. Vulnerable populations related to hail include those caught outside during an event and low-income and rental households. Most residents within the planning area are familiar with hailstorms and know how to appropriately prepare and respond to events.

Severe Winter Storms

Severe winter storms occur annually in the planning area, typically between November and March. Winter storms can bring extreme cold temperatures, freezing rain and ice, and heavy or drifting snow. Blizzards are particularly dangerous and can significantly impact the planning area. The NCEI reported 434 severe winter storm events that caused nearly $11 million in property damages in 24 years. Impacts resulting from severe winter storms include but are not limited to hypothermia and frost bite, closure of transportation routes, downed power lines and power outages, collapsed roofs from heavy snow loads, and closure of critical facilities. The most vulnerable citizens within the planning area are children, the elderly, individuals and families below the poverty line, and those new to the area.

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 residents. *Section Five: Mitigation Strategy* shows the mitigation actions chosen by the participating jurisdictions to assist in preventing future losses.

Section One
Introduction

Hazard Mitigation Planning

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

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."

Natural hazards, such as severe winter storms, tornadoes, high winds, severe thunderstorms, hail flooding, landslides, extreme heat, drought, agriculture diseases, earthquakes, and grass/wildfires are part of the world around us. Human-caused hazards are a product of the society and can cause significant impacts to communities. Human-caused hazards include levee failure, dam failure, chemical and radiological fixed site hazards, chemical and radiological transportation incidents, public health emergencies, terrorism, and/or civil disorder. These hazard events can occur as a part of normal operation or because of human error. All jurisdictions participating in this planning process are vulnerable to a wide range of natural and human-caused hazards that threaten the safety of residents, 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 Region 24 EMA prepared this multi-jurisdictional hazard mitigation plan to reduce impacts from natural and human-caused hazards and to better protect the people and property of the region from the effects of these hazards. This plan demonstrates a regional commitment to reducing risks from hazards and serves as a tool to help decision makers establish mitigation activities and resources. Further, this plan was developed to ensure the emergency management agency and participating jurisdictions are eligible for federal pre-disaster funding programs and to accomplish the following objectives:

- Minimize the disruption of each jurisdiction following a disaster.
- Establish actions to reduce or eliminate future damages 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 citizens about potential hazards.
- Facilitate development and implementation of hazard mitigation management activities to ensure a sustainable community.

Disaster Mitigation Act of 2000

The U.S. Congress passed the Disaster Mitigation Act of 2000 to amend the Robert T. Stafford Disaster Relief and Emergency 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 currently 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 fund.

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

- **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

> **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

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/pdf/about/stafford_act.pdf.
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 (BRIC)." Last modified June 9, 2020. https://www.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.

state after a disaster to be used for the development of state, tribal, and local mitigation plans.

- **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 participating communities in the National Flood Insurance Program (NFIP). The goal of FMA is to reduce or eliminate claims under the NFIP and reduce the flooding risk in the mapped floodplain.
- **BRIC:** To qualify for pre-disaster mitigation funds, local jurisdictions must adopt a mitigation plan that is approved by FEMA. BRIC assists states, territories, tribes, and local governments in undertaking hazard mitigation projects that reduce the risks they face from disasters and natural hazards. BRIC replaced the Pre-Disaster Mitigation (PDM) program in 2020, and targets community related infrastructure plans and projects.

Plan Financing and Preparation

Regarding plan financing and preparation, the Region 24 EMA is the eligible entity that submits a sub-application for FEMA assistance to the “Applicant”. The “Applicant” in this case is the State of Nebraska. If HMA funding is awarded, the sub-applicant becomes the “sub-grantee” and is responsible for managing the sub-grant and complying with program requirements and other applicable federal, state, territorial, tribal, and local laws and regulation.

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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, Region 24 EMA adapted the four-step hazard mitigation planning process outlined by FEMA to fit the needs of the participating jurisdictions. The following pages will outline how the Hazard Mitigation Planning Team was established; the function of the Hazard Mitigation Planning Team; critical project meetings and community representatives; outreach efforts to the general public; key stakeholders and neighboring jurisdictions; general information relative to the risk assessment process; general information relative to local/regional capabilities; plan review and adoption; and ongoing plan maintenance.

Requirement §201.6(b): Planning process. An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:
(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
Requirement §201.6(c)(1): The plan shall document the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Multi-Jurisdictional Approach

According to FEMA, "A multi-jurisdictional hazard mitigation plan is a plan jointly prepared by more than one jurisdiction." The term 'jurisdiction' means 'local government.' Title 44 Part 201, Mitigation Planning in the CFR, defines a 'local government' as "any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments, regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, any rural community, unincorporated town or village, or other public entity." For the purposes of this plan, a 'taxing authority' was utilized as the qualifier for jurisdictional participation. FEMA recommends the multi-jurisdictional approach under the DMA 2000 for the following reasons.

- It provides a comprehensive approach to the mitigation of hazards that affect multiple jurisdictions.
- It allows economies of scale by leveraging individual capabilities and sharing cost and resources.
- It avoids duplication of efforts.
- It imposes an external discipline on the process.

Both FEMA and NEMA recommend this multi-jurisdictional approach through the cooperation of counties, regional emergency management, and natural resources districts. The Region 24 EMA utilized the multi-jurisdictional planning process recommended by FEMA (Local Mitigation Plan Review Guide[9], Local Mitigation Planning Handbook[10], and Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards[11]) to develop this plan.

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 is rarely a linear process. It is 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

Bringing 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

The Region 24 EMA secured funding for their multi-jurisdictional hazard mitigation plan in May 2020 following a grant application process through the Hazard Mitigation Grant Program. JEO Consulting Group, INC. (JEO) was contracted in October 2020 to assist with the grant development; guide and facilitate the planning process; and assemble the multi-jurisdictional hazard mitigation plan. For the planning area, Doug Fox (Region 24 Director) led plan development and served as the primary point-of-contact throughout the project. A clear timeline of this plan update process is provided in Figure 2.

9 Federal Emergency Management Agency. 2011. “Local Mitigation Plan Review Guide.” https://www.fema.gov/media-library-data/20130726-1809-25045-7498/plan_review_guide_final_9_30_11.pdf.
10 Federal Emergency Management Agency. 2013. “Local Mitigation Planning Handbook.” https://www.fema.gov/media-library-data/20130726-1910-25045-9160/fema_local_mitigation_handbook.pdf.
11 Federal Emergency Management Agency. 2013. “Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards.” https://www.fema.gov/media-library-data/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf.

Figure 2: Project Timeline

Hazard Mitigation Planning Team

At the beginning of the planning process Region 24 EMA and JEO staff identified key contacts who would constitute the Hazard Mitigation Planning Team. This planning team, comprised of local participants and the consultant, was established to guide the planning process, review the existing plan, and service as a liaison to plan participants throughout the planning area. A list of Hazard Mitigation Planning Team members can be found in the following table. Staff from NEMA and NeDNR provided additional technical support.

Table 5: Hazard Mitigation Planning Team

Name	Title	Jurisdiction
Doug Fox	Director	Region 24 Emergency Management Agency
***Phil Luebbert**	Project Manager	JEO Consulting Group
***Karl Dietrich**	Planner	JEO Consulting Group
***Mary Baker**	Resiliency Strategist	JEO Consulting Group
***Lexy Hindt**	Deputy State Hazard Mitigation Officer	Nebraska Emergency Management Agency
***Adele Phillips**	Floodplain Mitigation Planner	Nebraska Department of Natural Resources

**Served as a consultant or advisory role.*

A kick-off meeting was held on June 15, 2020, to discuss an overview of the planning process between JEO and the Hazard Mitigation Planning Team. Preliminary discussion was held over 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 Hazard Mitigation Planning Team and strategies for public engagement throughout the planning process. Table 6 shows the kick-off meeting attendees. Table 7 shows the location, time, and agenda for the kick-off meeting.

Table 6: Kick-off Meeting Attendees

Name	Title	Jurisdiction
Doug Fox	Director	Region 24 Emergency Management Agency
Phil Luebbert	Project Manager	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group

Table 7: Kickoff Meeting

Location and Time	Agenda Items
Online Zoom Meeting June 15, 2020 10:00am	- Consultant and planning team responsibilities - Overview of plan update process and changes from 2015 HMP - Plan goals/objectives - Public involvement and outreach - Hazard Identification - Project schedule and dates/locations for public meetings

Public Involvement and Outreach

To notify and engage the public in the planning process, a wide range of stakeholder groups were contacted and encouraged to participate. Twenty-one stakeholder groups or entities were identified and sent letters to participate. These included five assisted living or long-term care facilities, four hospitals or health care providers, three Farm Service Agencies, a health district, and two economic development boards. The following entities attended meetings: UNL Extension, National Park Service, Nebraska Forest Service, and Cherry County Hospital. These entities provided input, which was incorporated into their respective county and community profiles (see *Section Seven*). NEMA also attended meetings and provided data and guidance during the planning process. The general public was encouraged to participate through the project website by providing comments to the Hazard Mitigation Planning Team members. No comments were received from the general public.

Table 8: Notified Stakeholder Groups

Organizations		
Boyd County Farm Service Agency	Country View Manor	North Central District Health Department
Brown County Hospital	Good Samaritan Society	North Central RC&D
Brown, Keya Paha, and Rock County Farm Service Agency	National Park Service	Rock County Hospital
Butte Senior Living	Nebraska Department of Natural Resources	Sandhills Care Center
Cherry County Farm Service Agency	Nebraska Emergency Management Agency	U.S. Fish and Wildlife Service
Cherry County Hospital	Nebraska Forest Service	UNL Extension – Cherry County
Cherry Hills Estates	Niobrara Valley Hospital	Valentine Cherry County Economic Development Board

Neighboring Jurisdictions

Neighboring jurisdictions were notified and invited to participate in the planning process and are listed in the following table. Invitation and informational letters were sent to county and regional emergency managers as well as natural resources districts. Jurisdictions outside of the planning area did not participate in the planning process.

Table 9: Notified Neighboring Jurisdictions

Notified Jurisdictions	
Bennett County, SD	Todd County, SD
Tripp County, SD	Gregory County, SD
Charles Mix County, SD	Oglala Lakota County, SD
Rosebud Sioux Tribe	Sheridan County, NE
Holt County, NE	Region 26 Emergency Management
Grant County, NE	Hooker County, NE
Upper Loup NRD	Lower Loup NRD
Upper Elkhorn NRD	

Participant Involvement

Participants play a key role in reviewing goals and objectives, identifying hazards, providing a record of historical disaster occurrences and localized impacts, identifying and prioritizing potential mitigation projects and strategies, and developing annual review procedures.

To be a participant in the development of this plan update, jurisdictions were required to have a minimum of one representative present at the Round 1 and Round 2 meetings or attend a follow-up meeting with a JEO staff member. Some jurisdictions sent multiple representatives to meetings. For jurisdictions who had only one representative, they were encouraged to bring meeting materials back to their governing bodies, to include diverse input on the meeting documents. Sign-in sheets from all public meetings can be found in *Appendix A*. Jurisdictions that were unable to attend the scheduled public meetings were able to request a meeting with JEO staff to satisfy the meeting attendance requirement. This effort enabled jurisdictions which could not attend a scheduled public meeting to participate in the planning process.

Outreach to eligible jurisdictions included notification prior to all public meetings, phone calls and email reminders of upcoming meetings or follow-up meetings, and invitations to complete surveys and worksheets required for the planning process. Table 10 provides a summary of outreach activities utilized in this process.

Table 10: Outreach Activity Summary

Action	Intent
Project Website	Informed the public and local/planning team members of past, current, and future activities (https://jeo.com/region-24-emergency-management-agency-hazard-mitigation-plan).
Round 1 Meeting Letters (30-day notification)	Sent to participants, stakeholders, and neighboring jurisdictions to discuss the agenda/dates/times/locations of the first round of public meetings.
Round 2 Meeting Letters (30-day notification)	Sent to participants to discuss the agenda/dates/times/locations of the second round of public meetings.
Notification Phone Calls	Called potential participants to remind them of upcoming meetings.
Follow-up Emails and Phone Calls	Correspondence was provided to remind and assist participating jurisdictions with the collection and submission of required local data.
Project Flyer	Flyers were posted about the Region 24 EMA HMP and how to get involved. Flyers were shared with all Hazard Mitigation Team members to distribute.
Word-of-Mouth	Staff discussed the plan with jurisdictions throughout the planning process.

Round 1 Meetings: Hazard Identification

At the Round 1 meetings, jurisdictional representatives (i.e. the local planning teams) reviewed the hazards identified at the kick-off meeting and conducted risk and vulnerability assessments based on these hazards' previous occurrence and the communities' exposure (For a complete list of hazards reviewed, see *Section Four: Risk Assessment*).

Table 11 shows the date and location of meetings held for the Round 1 meeting phase of the project. Due to the Covid-19 pandemic, the Hazard Mitigation Planning Team determined that both in-person and virtual meeting options were needed.

Table 11: Round 1 Meeting Dates and Locations

Agenda Items	
General overview of the HMP planning process, discuss participation requirements, begin the process of risk assessment and impact reporting, update critical facilities, capabilities assessment, and status update on current mitigation projects.	
Location and Time	**Date**
Spencer Village Office Spencer, NE, 7:00pm	September 23rd, 2020
Bassett City Hall Bassett, NE, 2:00pm	September 24th, 2020
Cherry County Courthouse Valentine, NE, 7:00pm	September 24th, 2020
Virtual Zoom Meeting Online or by Phone, 7:00pm	October 1, 2020

The intent of these meetings was to familiarize the jurisdictional representatives with an overview of the work to be completed over the next several months, discuss the responsibilities of being a participant, and to collect preliminary information to update the HMP. Data collected at these meetings included: updates to mitigation actions from the 2015 Region 24 EMA HMP; identify the top concerns from each jurisdiction; and to begin reviewing community profiles for demographics, capabilities, and critical facilities. These meetings also served as an opportunity to gather input on the identification of hazards, such as records of historical occurrences and the community's capability to mitigate and respond to those events.

Figure 3: Round 1 Meeting in Bassett, NE

The following tables show the attendees from each jurisdiction who attended a Round 1 meeting or had a one-on-one discussion with JEO staff. Follow-up one-on-one meetings were held for communities who did not have representatives present at public meetings either through watching a recording of the meeting or via conference call with JEO staff.

Table 12: Round 1 Meeting Attendees

Name	Title	Jurisdiction
Spencer – Wednesday, September 23, 2020		
Gail Spencer	Clerk/Treasurer/Floodplain Manager	Village of Bristow Boyd County Rural Water District #2
Doug Fox	Region 24 Coordinator	Region 24 EMA
Marlo Johnson	Board Chairperson	Village of Bristow
Shanna Brooks	Clerk	Village of Butte
Cathy Wade	Clerk/Floodplain Administrator	Village of Lynch
Pam Bergstrom	Forest Management & Rural Forester	Nebraska Forest Service
Jeff Hart	Board Member	Village of Lynch
Alan Nicolaus	Naper Fire County Board Supervisor	Boyd County Naper Fire District
Kenneth Crooks	Chairman	Village of Lynch
Gary Connot	Highway Superintendent	Boyd County

Name	Title	Jurisdiction
Mary Finnegan	Clerk	Village of Gross
Karl Dietrich	Planner	JEO Consulting Group
Mary Baker	Resiliency Strategist	JEO Consulting Group
Bassett – Thursday, September 24, 2020		
Doug Fox	Region 24 Coordinator	Region 24 EMA
Dennis Bauer	Commissioner	Brown County
Lisa Schroedl	Administrator/Clerk/Treasurer	City of Ainsworth
Kristy Beard	Clerk/Treasurer/Floodplain Administrator	City of Bassett
Bruce Ritterbush	Commissioner	Keya Paha County
Tim Wyrick	Deputy County Emergency Manager	Keya Paha County
Glen May	Commissioner/Deputy Emergency Manager	Rock County
Brenda Dobrovolny	Board Chairperson	Village of Newport
Dolly Kienke	Floodplain Manager	Boyd County
Brian Jordan	Fire Chief	Gracy Fire District
Jim Deboldt	Fire Chief	Brown County Rural Fire District
Scott Hallock	Fire Chief	Keya Paha Fire District
TJ Ellermeier	County Assessor/Zoning	Rock County
Brad Fiala	Fire Chief	Brown County Fire District
Chandler Schmidt	Watershed Coordinator	Middle Niobrara NRD
Mike Murphy	General Manager	Middle Niobrara NRD
Karl Dietrich	Planner	JEO Consulting Group
Mary Baker	Resiliency Strategist	JEO Consulting Group
Valentine – Thursday, September 24, 2020		
Doug Fox	Region 24 Coordinator	Region 24 EMA
Shane Siewert	City Manager/Floodplain Administrator	City of Valentine
Mike Halley	Superintendent	Valentine Community Schools
Phyllis Daniels	Board Member	Village of Crookston
Shirley Schuman	Clerk	Village of Crookston
Shirley Knudsen	Emergency Planner	Cherry County Hospital
Gary Weaver	Deputy Emergency Manager	Cherry County
Martin DeNaeyer	Commissioner	Cherry County
Terry Engles	Fire Chief	Valentine Fire District
Zac Peterson	Assistant Manager	Middle Niobrara NRD
Karl Dietrich	Planner	JEO Consulting Group
Mary Baker	Resiliency Strategist	JEO Consulting Group
Zoom – Thursday, October 1, 2020		
Dale Hafer	Superintendent	Aisnworth Community Schools
Michael Brown	Superintendent	Boyd County Schools
Michael Knapp	Board Member	Village of Cody
Gay Margary	Clerk/Treasurer	Village of Johnsontown
Deb Hand	Board Member	Village of Kilgore
Richard Schmit	Board Member	Village of Nenzel
Kim Schmit	Board Member	Village of Nenzel
Derek Bentz	Board Chairperson	Village of Spencer
Ernest Hallock	Board Chairperson	Village of Springview
John White	NSR Valentine Ranger Station	National Park Service

Name	Title	Jurisdiction
Sandy Benson	Community Wildfire Protection Plan Coordinator	Nebraska Forest Service
Michelle Garwood	-	UNL Extension – Cherry County
Lexy Hindt	Deputy State Hazard Mitigation Office	Nebraska Emergency Management Agency
Karl Dietrich	Planner	JEO Consulting Group
Phil Luebbert	Project Manager	JEO Consulting Group

Table 13: Round 1 One-on-One Meeting Attendees

Name	Title	Jurisdiction
Terry Julesgard	General Manager	Lower Niobrara NRD
Vernon Goodman	Board Chairperson	Village of Naper
Mark Otten	Superintendent	Rock County Public Schools

Round 2 Meetings: Mitigation Strategies

Round 2 meetings are designed to identify and prioritize mitigation measures and evaluate potential integration of the HMP alongside other local planning mechanisms. Mitigation actions and plan integration are essential components in effective hazard mitigation plans. Participating jurisdictions were asked to identify any new mitigation actions to pursue alongside continued actions from the 2015 HMP and provide copies or descriptions of current jurisdictional plans in which hazard mitigation goals and principals can be integrated. Participating jurisdictions were also asked to review the information collected from the Round 1 meeting related to their community through this planning process for accuracy. Information/data reviewed included but was not limited to local hazard prioritization results, identified critical facilities and their location within the community, future development areas, and expected growth trends (refer to *Appendix B*).

There was also a brief discussion about the planning process, when the plan would be available for public review and comment, annual review of the plan, and the approval and grant opportunities available once the plan was approved. As with Round 1 meetings, any jurisdictions unable to attend were given the opportunity to have a one-on-one phone conference with the consultant or view a recording of the meeting in order to meet plan participation requirements and complete required information.

Due to an increase in COVID-19 numbers across Nebraska, Round 2 meetings were held via an online and phone format rather than in-person public workshop meetings. This was done to protect the health of residents and staff members in the planning area and to help reduce the spread of the virus. The following table lists the dates and times of the meetings for the Mitigation Strategies phase of this project. Meeting attendees are identified in Table 15 and Table 16.

Table 14: Round 2 Meeting Dates and Locations

Agenda Items	
Identify new mitigation actions, review local data and community profile, discuss review process, discuss available grants and eligibility, and complete plan integration tool.	
Location and Time	**Date**
Virtual Zoom Meeting Online or by Phone, 7:00pm	December 16, 2020
Virtual Zoom Meeting Online or by Phone, 2:00pm	December 17, 2020

Table 15: Round 2 Meeting Attendees

Name	Title	Jurisdiction
Zoom – Wednesday December 16, 2020		
Dennis Bauer	Commissioner	Brown County
Brad Fiala	Fire Chief	Brown County Rural Fire District / City of Ainsworth
Martin DeNaeyer	Commissioner	Cherry County
Doug Fox	Region 24 Coordinator	Region 24 Emergency Management Agency
Tom Davis	Fireman	Valentine Fire District
Terry Engles	Fire Chief	Valentine Fire District
Lexy Hindt	Deputy State Hazard Mitigation Officer	Nebraska Emergency Management Agency
Jeff Hart	Board Member	Village of Lynch
CaCee McConaughey	Clerk/Treasurer	Village of Merriman
Leo Nelson	-	Village of Merriman
Gailund Valentine	Board Chairperson	Village of Merriman
Richard Schmit	Board Member	Village of Nenzel
Kim Schmit	-	Village of Nenzel
Tammy Cline	Board Chairperson	Village of Newport
Ernest Hallock	Board Chairperson	Village of Springview
Ron Pinney	Board Chairperson	Village of Wood Lake
Karl Dietrich	Planner	JEO Consulting Group
Phil Luebbert	Project Manager	JEO Consulting Group
Zoom – Thursday December 17, 2020		
Dale Hafer	Superintendent	Ainsworth Community Schools
Alan Nicolaus	Board of Supervisors	Boyd County / Naper Fire District
Dolly Kienke	Planning/Zoning/Floodplain Administrator	Boyd County
Chuck Wrede	Sheriff	Boyd County
Leslie Purviance	Board of Supervisors	Boyd County
Gail Spencer	Clerk / Treasurer / Floodplain Administrator	Boyd County Rural Water District #2 / Village of Bristow
Jody Kaczor	Manager	Boyd County Rural Water District #2
Kenneth Turpin Jr.	Highway Superintendent	Brown County
Jim Debolt	Fire Chief / Utility Superintendent	Brown County Rural Fire District / City of Long Pine
Gary Weaver	Deputy County Emergency Manager	Cherry County
Kristy Bear	Clerk/Treasurer/Floodplain Administrator	City of Bassett
Shane Siewert	City Manager / Floodplain Administrator	City of Valentine
Tim Wyrick	Deputy County Emergency Manager	Keya Paha County / Keya Paha County Fire District
Terry Julesgard	General Manager	Lower Niobrara NRD
Mike Murphy	General Manager	Middle Niobrara NRD
Chandler Schmidt	Watershed Coordinator	Middle Niobrara NRD
Doug Fox	Region 24 Coordinator	Region 24 Emergency Management Agency

Name	Title	Jurisdiction
Glen May	Commissioner / Deputy Emergency Manager	Rock County
Marlo Johnson	Board Chairperson	Village of Bristow
Shanna Brooks	Clerk	Village of Butte
Phyllis Daniels	Board Member	Village of Crookston
Linda Quick	Board Member	Village of Crookston
Shirley Schuman	Clerk	Village of Crookston
Gay Margary	Clerk/Treasurer	Village of Johnstown
Deb Hand	Board Member	Village of Kilgore
Beth Binder	Clerk/Treasurer/Floodplain Administrator	Village of Spencer
Karl Dietrich	Planner	JEO Consulting Group
Phil Luebbert	Project Manager	JEO Consulting Group
Mary Baker	Community Resiliency Strategist	JEO Consulting Group

Table 16: Round 2 One-on-One Meeting Attendees

Name	Title	Jurisdiction
Michael Brown	Superintendent	Boyd County Schools
Mark Otten	Superintendent	Rock County Public Schools
Michael Knapp	Board Member	Village of Cody
Vernon Goodman	Board Chairperson	Village of Naper

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. Specific references are included as footnotes when used as applicable. The following table is not exhaustive as many studies, plans, and data resources at the local level are not publicly available. Individual examples of plan integration are identified in *Section Seven: Community Profiles*.

Table 17: General Plans, Documents, and Information

Documents	
Disaster Mitigation Act of 2000 DMA https://www.fema.gov/media-library-data/20130726-1524-20490-1678/dma2000.txt	Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (2013) https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-ideas_02-13-2013.pdf
Final Rule (2007) https://www.fema.gov/emergency-managers/risk/hazard-mitigation/regulations-guidance/archive	National Flood Insurance Program Community Status Book (2020) https://www.fema.gov/flood-insurance/work-with-nfip/community-status-book
Hazard Mitigation Assistance Unified Guidance (2015) https://www.fema.gov/sites/default/files/2020-07/fy15_HMA_Guidance.pdf	National Response Framework (2019) https://www.fema.gov/emergency-managers/national-preparedness/frameworks/response
Hazard Mitigation Assistance Guidance and Addendum (2015) https://www.fema.gov/sites/default/files/2020-07/fy15_hma_addendum.pdf	Robert T. Stafford Disaster Relief and Emergency Assistance Act (2019) https://www.fema.gov/disasters/stafford-act
Local Mitigation Plan Review Guide (2011) https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-plan-review-guide_09_30_2011.pdf	The Census of Agriculture (2017) https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Census_by_State/Nebraska/

Local Mitigation Planning Handbook (2013) https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-planning-handbook_03-2013.pdf	What is a Benefit: Guidance on Benefit-Cost Analysis on Hazard Mitigation Projects https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis
Plans and Studies	
Nemaha NRD Hazard Mitigation Plan (2015) https://jeo.com/nnrd-hmp	Nebraska Drought Mitigation and Response Plan (2000) http://carc.nebraska.gov/docs/NebraskaDrought.pdf
Flood Insurance Studies https://msc.fema.gov/portal/home	State of Nebraska Hazard Mitigation Plan (2019) https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmitplan2019.pdf
Fourth National Climate Assessment (2018) https://nca2018.globalchange.gov/	State of Nebraska Hazard Mitigation Plan (2014) https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmitplan.pdf
National Climate Assessment (2014) https://nca2014.globalchange.gov/	State of Nebraska Flood Hazard Mitigation Plan https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/flood-hazmit-plan.pdf
Data Sources/Technical Resources	
Arbor Day Foundation – Tree City Designation https://www.arborday.org/programs/treecityusa/directory.cfm	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 https://dnr.nebraska.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 http://climod.unl.edu/	Nebraska Department of Transportation http://dot.nebraska.gov/
National Agricultural Statistics Service http://www.nass.usda.gov/	Nebraska Emergency Management Agency https://nema.nebraska.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 http://www.nfs.unl.edu/
National Drought Mitigation Center – Drought Impact Reporter http://droughtreporter.unl.edu/map/	Nebraska Public Power District Service https://www.nppd.com/
National Drought Mitigation Center – Drought Monitor http://droughtmonitor.unl.edu/	Nebraska State Historical Society https://history.nebraska.gov/
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/flood-insurance	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 Management 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 Environment and Energy 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 HMP draft was completed, a public review period opened to allow for participants and community members at large to review the plan and provide comments and suggest changes. The public review period was open from March 1, 2021 through March 31, 2021. Participating jurisdictions were emailed and mailed a letter notifying them of this public review period. The HMP was also made available on the project website (https://jeo.com/region-24-emergency-management-agency-hazard-mitigation-plan) to download the document. Jurisdictions and the public could make provide comments via mail, email, or by using the comment box on the project website. A review of the comments and who they were from can be found below.

- National Park Service: Provided updates to the Valentine critical facility map and comments on transportation projects for the City of Valentine.
- Village of Butte: Provided updates to the village's critical facility map, updates to the future land use map, and updates to the local planning team.
- Nebraska Forest Service: Reviewed and provided comments on the upfront grass/wildfire section and participant sections that identified grass/wildfire as a top hazard of concern.
- Middle Niobrara NRD: Provided updates to the Middle Niobrara NRD profile.
- Village of Johnstown: Provided updates to planning team, future development, capability assessment, major employers, and hazard prioritization.

- Nebraska Department of Natural Resources: Reviewed the upfront flooding section and provided updates.

All changes and comments from participating jurisdictional representatives (i.e. local planning teams) and stakeholders were incorporated into the plan.

Plan Adoption and Implementation

Based on FEMA requirements, this multi-jurisdictional hazard mitigation plan must be formally adopted by each participant through approval of a resolution. This approval will create 'individual ownership' of the plan by each participant. Formal adoption provides evidence of a participant's full commitment to implement the plan's goals, objectives, and action items. A copy of the resolution draft submitted to participating jurisdictions is located in *Appendix A*. Copies of adoption resolutions may be requested from NEMA's State Hazard Mitigation Officer.

Requirement §201.6(c)(5): For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

Hazard mitigation plans are living documents. Once an HMP has been adopted locally, participants are responsible for implementing identified projects, maintaining the plan with relevant information, and fully updating the plan every five years. The plan must be monitored, evaluated, and updated on a five-year or less cycle. Those who participated directly in the planning process would be logical champions during the annual reviews and five-year cycle update of the plan. It is critical the plan be reviewed and updated annually or when a hazard event occurs that significantly affects the area or individual participants. These annual reviews are the responsibility of each jurisdiction's local planning team and should be documented and reflected in the plan via amendments. However, participants are encouraged to work alongside the plan sponsor, Region 24 EMA or the consultant, JEO, to document updates and revise the HMP.

Additional implementation of the mitigation plan should include integrating HMP goals, objectives, and mitigation actions into county and local comprehensive or capital improvement plans as they are developed or updated. *Section Six* describes the system that jurisdictions participating in the Region 24 EMA HMP have 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 description of the planning area's characteristics to create a summary profile for the region. Specific characteristics are covered in each jurisdiction's community profile, including demographics, transportation routes, and structural inventory. Redundant information will not be covered in this section. Instead, this section will highlight at-risk populations and characteristics of the built environment that add to regional vulnerabilities.

Planning Area Geographic Summary

The Region 24 EMA is located in north-central Nebraska and covers 9,565 square miles, including all of Boyd, Brown, Cherry, Keya Paha, and Rock Counties. Much of the EMA region lies within the sand hills, with some areas of plains, dissected plains, valleys, and bluffs and escarpments.[12] The sand hills experience flooding differently than other areas. Rainwater infiltrates better in the sand hills, which means it would take more water to cause flooding. Groundwater levels may play a larger role in determining flood locations than the amount of rain. The main rivers in the planning area include the Missouri River, Niobrara River, Keya Paha River, North Loup River, Middle Loup River, Snake River, Calamus River, and the Elkhorn River. The Samuel McKelvie National Forest, Fort Niobrara National Wildlife Refuge, and Valentine National Wildlife Refuge are also located in agency's boundary. The Niobrara National Scenic River, which is managed by the National Park Service and Niobrara Council, is located within the district. The river draws tens of thousands of visitors each year to Cherry, Brown, Rock, and Keya Paha Counties for river-related activities.

Demographics and At-Risk Populations

As noted above, the planning area includes five counties: Boyd, Brown, Cherry, Keya Paha, and Rock Counties. The U.S. Census Bureau collects specific demographic information for each county. The estimated population of the planning area in 2018 was 12,962.[13]

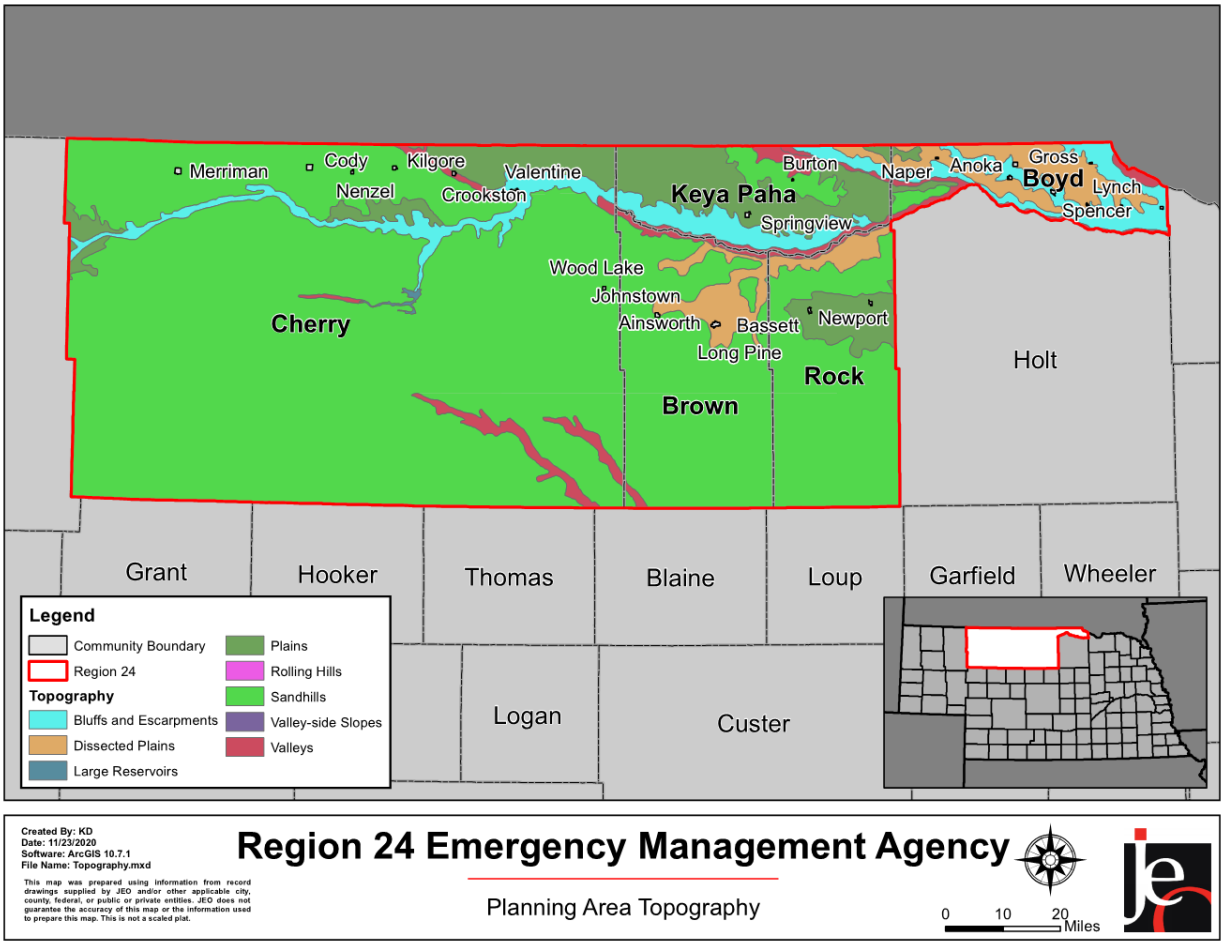
Table 18: Estimated Population for Planning Area

Age	Region 24 Emergency Management Agency	State of Nebraska
<5	5.9%	6.9%
5-19	16.6%	20.7%
20-64	53.3%	57.4%
>64	24.2%	15.0%
Median	47.7	36.4

Source: U.S. Census Bureau

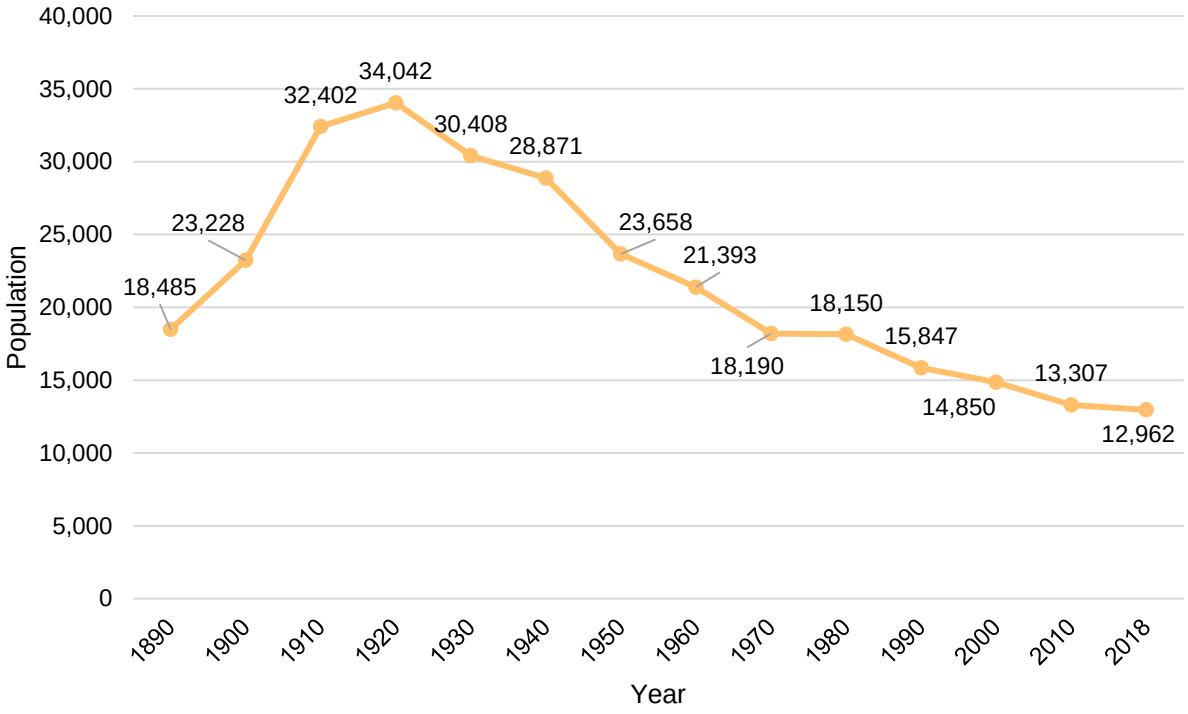
12 Conservation and Survey Division/Institute of Agriculture and Natural Resources. 2001. "Topographic regions map of Nebraska." https://digitalcommons.unl.edu/caripubs/62.
13 United States Census Bureau. 2018. "S0101: Age and Sex.". https://data.census.gov/cedsci/.

Figure 4: Planning Area Topography



Community and regional vulnerability are impacted by growing or declining populations. Communities growing quickly may lack resources to provide services for all community members in a reasonable timeframe including snow removal, emergency storm shelters, repairs to damaged infrastructure, or even tracking the location of vulnerable populations. Communities experiencing population decline may be more vulnerable to hazards because of vacant and/or dilapidated structures, an inability to properly maintain critical facilities and/or infrastructure, and higher levels of unemployment and population living in poverty. It is important for communities to monitor their population changes and ensure that potential issues be incorporated into hazard mitigation plans, as well as other planning mechanisms within the community.

Figure 5: Planning Area Population, 1890-2018



The planning area has displayed an overall decline in total population since the 1920s with population decline slowing since 1970. Subsequent updates to this HMP should include updated census data from the 2020 census to determine if the trend is continuing.

At-Risk Populations

In general, at-risk populations may have difficulty with medical issues, poverty, extremes in age, and communication issues due to language barriers. Several outliers may be considered when discussing potentially at-risk populations, including:

- Outward appearance does not necessarily mark a person as at-risk.
- A hazard event will, in many cases, impact at-risk populations in different ways.

The National Response Framework defines at-risk populations as "…populations whose members may have additional needs before, during, and after an incident in functional areas, including but not limited to maintaining independence, communication, transportation, supervision, and medical care."[14]

Dependent children under 20 years old are one of the populations most vulnerable to disasters.[15] The majority of people in this age group do not have access to independent financial resources or transportation. They also lack practical knowledge necessary to respond appropriately during a disaster. Despite this vulnerability, children are generally overlooked in disaster planning because the presence of a caretaker is assumed. With over 16% of the planning area's population younger than 20, children are a key vulnerable group to address in the planning process.

14 United States Department of Homeland Security. June 2016. National Response Framework Third Edition. https://www.fema.gov/media-library-data/1466014682982-9bcf8245ba4c60c120aa915abe74e15d/National_Response_Framework3rd.pdf.

15 Flanagan, Gregory, Hallisey, Heitgerd, & Lewis. 2011. "A Social Vulnerability Index for Disaster Management." Journal of Homeland Security and Emergency Management, 8(11): Article 3.

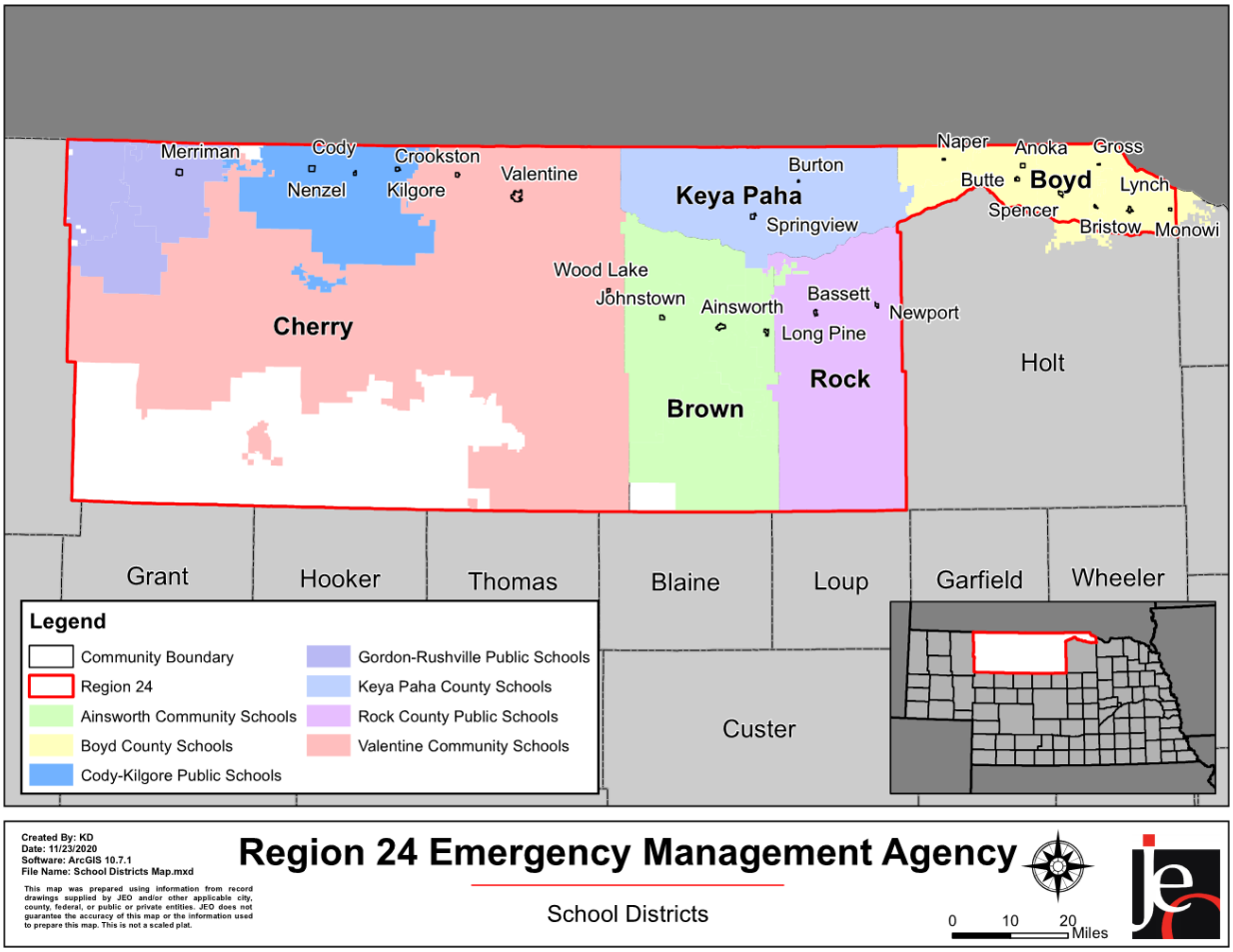
Schools house a high number of children and adults within the planning area during the daytime hours of weekdays, as well as during special events on evenings and weekends. The following table identifies the various school districts located within the planning area, and the following figure is a map of the school district boundaries. This list is comprehensive and does not represent only the school districts participating in this plan.

Table 19: School Inventory

School District	Total Enrollment (2019-2020)	Total Teachers
Ainsworth Community Schools	427	40
Boyd County Schools	357	30
Cody-Kilgore Public Schools	164	20
Gordon-Rushville Public Schools	607	55
Keya Paha County Schools	91	14
Rock County Public Schools	248	25
Valentine Community Schools	616	63

Source: Nebraska Department of Education[16]

Figure 6: Regional School Districts



16 Nebraska Department of Education. 2020. "Nebraska Education Profile". https://nep.education.ne.gov/.

Like minors, seniors (age 65 and older) are often more significantly impacted by temperature extremes and severe weather. During prolonged heat waves or periods of extreme cold, seniors may lack resources to effectively address hazard conditions and as a result may incur injury or potentially death. Prolonged power outages (either standalone events or as the result of other contributing factors) can have significant impacts on any citizen relying on medical devices for proper bodily functions. One study conducted by the Center for Injury Research and Policy found that increases in vulnerability related to severe winter storms (with significant snow accumulations) begin at age 55.[17] The study found that on average there are 11,500 injuries and 100 deaths annually related to snow removal. Males over the age of 55 are 4.25 times more likely to experience cardiac symptoms during snow removal.

While the elderly populations do live throughout the planning area, there is the potential that they will be located in higher concentrations at care facilities. The following table identifies the number and capacity of care facilities throughout the planning area.

Table 20: Inventory of Care Facilities

County	Hospitals	Hospital Beds	Health Clinics	Adult Care Homes	Adult Care Beds	Assisted Living Homes	Assisted Living Beds
Boyd	1	15	1	1	40	1	16
Brown	1	23	1	1	46	1	36
Cherry	1	21	2	1	52	2	86
Keya Paha	0	0	0	0	0	0	0
Rock	1	24	2	1	30	0	0
Planning Area	**4**	**83**	**6**	**4**	**168**	**4**	**138**

Source: Nebraska Department of Health and Human Services[18],[19],[20],[21]

In addition to residents being classified as at-risk by age, there are other specific groups within the planning area that experience vulnerabilities related to their ability to communicate or their economic status. Table 21 provides statistics per county regarding households with English as a second language (ESL) and families that reported as in poverty within the last 12 months.

Table 21: ESL and Poverty At-Risk Populations

County	Percent that Speaks English as Second Language	Families Below Poverty Level
Boyd	2.1%	6.6%
Brown	3.3%	11.2%
Cherry	2.8%	5.9%
Keya Paha	1.6%	3.1%
Rock	1.7%	4.5%
Planning Area	**2.5%**	**-**

Source: U.S. Census Bureau[22],[23]

17 Center for Injury Research and Policy. January 2011. "Snow Shoveling Safety." Accessed July 2017. http://www.nationwidechildrens.org/cirp-snow-shoveling.
18 Department of Health and Human Services. October 2020. "Assisted Living Facilities." http://dhhs.ne.gov/licensure/Documents/ALF%20Roster.pdf.
19 Department of Health and Human Services. October 2020. "Hospitals." http://dhhs.ne.gov/licensure/Documents/Hospital%20Roster.pdf.
20 Department of Health and Human Services. October 2020. "Long Term Care Facilities." http://dhhs.ne.gov/licensure/Documents/LTCRoster.pdf.
21 Department of Health and Human Services. October 2020. "Rural Health Clinic." http://dhhs.ne.gov/licensure/Documents/RHC_Roster.pdf.
22 United States Census Bureau. 2018. "S1601: Language Spoken at Home". https://data.census.gov/cedsci/.
23 United States Census Bureau. 2018. "DP03: Selected Economic Characteristics". https://data.census.gov/cedsci/.

Residents below the poverty line may lack resources to prepare for, respond to, or recover from hazard events. Residents with limited economic resources will struggle to prioritize the implementation of mitigation measures over more immediate needs. Further, residents with limited economic resources are more likely to live in older, more vulnerable structures. These structures could be mobile homes; located in the floodplain; located near know hazard sites (i.e. chemical storage areas); located in remote rural areas away from urban amenities; or older poorly maintained structures. Residents below the poverty line will be more vulnerable to all hazards within the planning area.

Residents who speak English as a second language may struggle with a range of issues before, during, and after hazard events. General vulnerabilities revolve around what could be an inability to effectively communicate with others or an inability to comprehend materials aimed at notification and/or education of hazard events. When presented with a hazardous situation it is important that all community members be able to receive, decipher, and act on relevant information. An inability to understand warnings and notifications may prevent non-native English speakers from taking action in a timely manner. Further, educational materials related to regional hazards are most often developed in the dominant language for the area, for the planning are that would be English. Residents who struggle with English in the written form may not have sufficient information related to local concerns to effectively mitigate potential impacts. Residents with limited English proficiency would be at an increased vulnerability to all hazards within the planning area.

Similar to residents below the poverty line, racial minorities tend to have access to fewer financial and systemic resources that would enable them to implement hazard mitigation projects and to respond and recover from hazard events, including residence in standard housing and possession of financial stability. While the planning area is primarily White, not Hispanic, diversity has increased since 2010 (Table 22).

Table 22: Racial Composition Trends

Race	2010		2018		% Change
	Number	% of Total	Number	% of Total	
White, Not Hispanic	12,863	95.5%	12,257	94.6%	-0.9%
Black	8	0.1%	21	0.2%	0.1%
American Indian and Alaska Native	319	2.4%	224	1.7%	-0.7%
Asian	34	0.3%	46	0.4%	0.1%
Native Hawaiian and Other Pacific Islander	24	0.2%	9	0.1%	-0.1%
Other Races	76	0.6%	14	0.1%	-0.5%
Two or More Races	149	1.1%	390	3.0%	1.9%
Total Population	**13,473**	**-**	**12,962**	**-**	**-**

Source: U.S. Census Bureau[24],[25]

24 United States Census Bureau. 2018. “DP05: ACS Demographic and Housing Estimates”. https://data.census.gov/cedsci/.
25 United States Census Bureau. 2010. “B02001: Race”. https://data.census.gov/cedsci/.

Built Environment and Structural Inventory

The US Census provides information related to housing units and potential areas of vulnerability as described in the following discussion.

Of the occupied housing units in the planning area, over 30 percent are renter-occupied. Renter-occupied housing units often do not receive many of the updates and retrofits that are needed to make them resilient to disaster impacts. Communities may consider enacting landlord outreach programs aimed at educating property owners about the threats in their area and what they can do to help reduce the vulnerability of the tenants living in their housing units.

Keya Paha County has the highest percentage of vacant housing units compared to the other four counties. Unoccupied homes may not be maintained as well as occupied housing, thus adding to their vulnerability. During disaster events like high winds or tornadoes, these structures may collapse and result in debris which can impact other structures as well as human beings, resulting in higher damage totals and injuries or fatalities. Some of the participating communities in this planning process have already identified the concern related to older building stock.

Table 23: Housing Characteristics

Jurisdiction	Total Housing Units				Occupied Housing Units			
	Occupied		Vacant		Owner		Renter	
	#	%	#	%	#	%	#	%
Boyd County	903	64.1	505	35.9	734	81.3	169	18.7
Anoka	4	100	0	0.0	4	100	0	0.0
Bristow	36	60.0	24	40.0	27	75.0	9	25.0
Butte	148	77.9	42	22.1	122	82.4	26	17.6
Gross	0	0.0	0	0.0	0	0.0	0	0.0
Lynch	133	62.7	79	37.3	113	85.0	20	15.0
Monowi	0	0.0	5	100	0	0.0	0	0.0
Naper	61	88.4	8	11.6	55	90.2	6	9.8
Spencer	182	76.5	56	23.5	161	88.5	21	11.5
Brown County	1,434	76.3	446	23.7	1,064	74.2	370	25.8
Ainsworth	872	83.0	178	17.0	621	71.2	251	28.8
Johnstown	34	66.7	17	33.3	23	67.6	11	32.4
Long Pine	128	71.5	51	28.5	123	96.1	5	3.9
Cherry County	2,566	79.3	669	20.7	1,566	61.0	1,000	39.0
Cody	88	95.7	4	4.3	76	86.4	12	13.6
Crookston	23	59.0	16	41.0	18	78.3	5	21.7
Kilgore	28	68.3	13	31.7	22	78.6	6	21.4
Merriman	64	72.7	24	27.3	60	93.8	4	6.3
Nenzel	14	100	0	0.0	10	71.4	4	28.6
Valentine	1,312	88.9	163	11.1	775	59.1	537	40.9
Wood Lake	29	54.7	24	45.3	20	69.0	9	31.0
Keya Paha County	326	63.9	184	36.1	244	74.8	82	25.2
Burton	0	0.0	2	100	0	0.0	0	0.0
Springview	114	74.5	39	25.5	87	76.3	27	23.7
Rock County	626	71.1	255	28.9	457	73.0	169	27.0
Bassett	343	82.9	71	17.1	244	71.1	99	28.9
Newport	43	79.6	11	20.4	41	95.3	2	4.7
Planning Area	**5,855**	**74.0**	**2,059**	**26.0**	**4,065**	**69.4**	**1,790**	**30.6**

Source: U.S. Census Bureau[26]

The US Census provides information related to housing units and potential areas of vulnerability. The selected characteristics examined in Table 24 include lacking complete plumbing facilities; lacking complete kitchen facilities; no telephone service available; housing units with no vehicles; and housing units that are mobile homes.

26 United States Census Bureau. 2018. "DP04: Selected Housing Characteristics". https://data.census.gov/cedsci/.

Table 24: Selected Housing Characteristics

	Boyd	Brown	Cherry	Keya Paha	Rock	Total
Occupied Housing Units	903	1,434	2,566	326	626	**5,855**
Lacking Complete Plumbing Facilities	0.8%	0.8%	0.0%	0.6%	0.3%	**0.4%**
Lacking Complete Kitchen Facilities	0.7%	1.1%	2.0%	0.6%	0.0%	**1.3%**
No Telephone Service Available	1.6%	1.5%	2.3%	0.0%	0.0%	**1.6%**
No Vehicles Available	4.2%	3.8%	5.1%	0.6%	1.3%	**4.0%**
Mobile Homes	19.6%	9.3%	12.0%	18.7%	12.6%	**13.0%**

Source: U.S. Census Bureau[27]

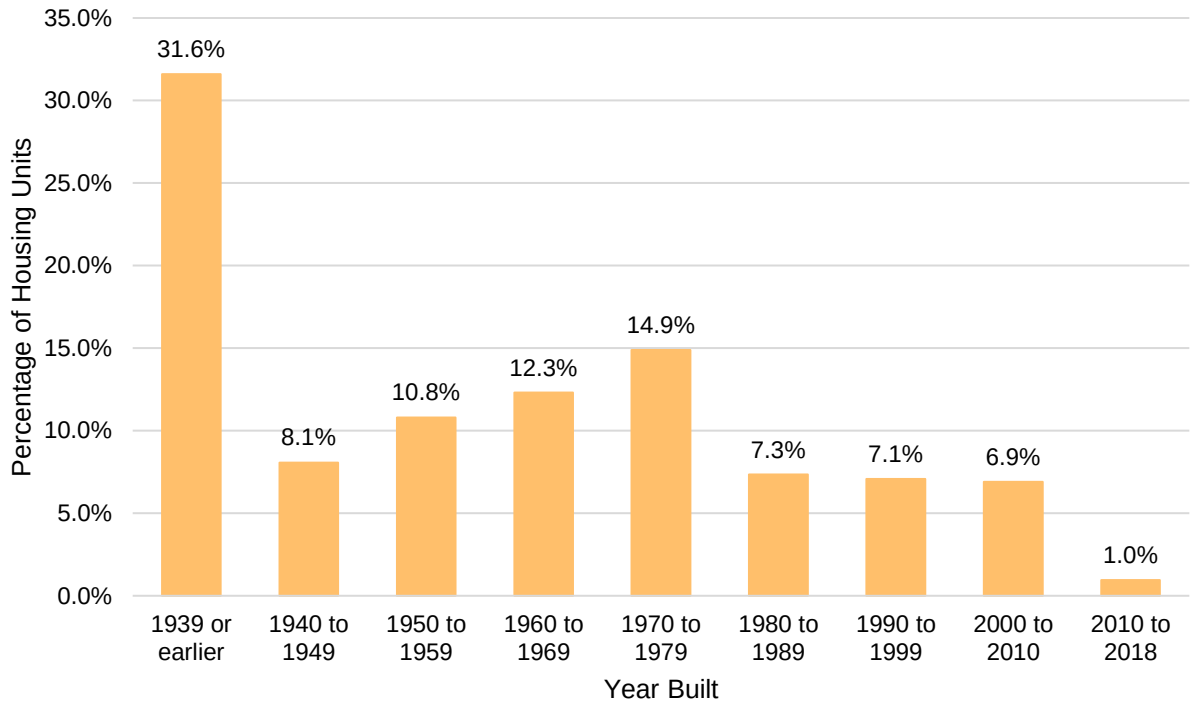
Approximately two percent of housing units lack access to landline telephone service. This does not necessarily indicate that there is not a phone in the housing unit, as cellular telephones are now the primary form of telephone service. However, this lack of access to landline telephone service does represent a population at increased risk to disaster impacts. Reverse 911 systems are designed to contact households via landline services and as a result, some homes in hazard prone areas may not receive notification of potential impacts in time to take protective actions. Emergency managers should continue to promote the registration of cell phone numbers with Reverse 911 systems. The CodeRED system is available for many communities and residents to use in the planning area. This opt-in program sends emergency alerts and hazard event updates to cellular devices located within specific geographical areas based on cell tower reception. Additionally, emergency managers, the National Weather Service, and other government agencies can utilize FEMA's Integrated Public Alert and Warning System (IPAWS) to send emergency alerts and weather warnings to cellphones within a designated area. Like CodeRED, notifications are sent to all cellphone users within specific geographical areas without needing to opt-in.

Over 12 percent of housing units in the planning area are mobile homes. Boyd and Keya Paha Counties have the highest rate of mobile homes in its housing stock at over 18 percent. Mobile homes have a higher risk of sustaining damages during high wind events, tornadoes, severe thunderstorms, and severe winter storms. Mobile homes that are either not anchored or are anchored incorrectly can be overturned by 60 mph winds. A thunderstorm is classified as severe when wind speeds exceed 58 mph, placing improperly anchored mobile homes at risk. Furthermore, nearly four percent of all housing units in the planning area do not have a vehicle available. Households without vehicles may have difficulty evacuating during a hazardous event and a reduced ability to access resources in times of need.

The majority of homes within the planning area were built prior to 1980 (77.7%), with 31.6% of homes built prior to 1939 (Figure 7). Housing age can serve as an indicator of risk, as structures built prior to the development of state building codes may be more vulnerable. Residents living in these homes maybe at higher risk to the impacts of high winds, tornadoes, severe winter storms, and thunderstorms.

27 United States Census Bureau. 2018. "DP04: Selected Housing Characteristics". https://data.census.gov/cedsci/.

Figure 7: Housing Age in the Planning Area



Source: U.S. Census Bureau[28]

State and Federally Owned Properties

The following table provides an inventory of state and federally owned properties within the planning area by county. In addition to the properties listed below, the Nebraska Department of Transportation has maintenance shops located throughout the planning area, as well as multiple US Post Offices in many of the communities. Electrical substations and state maintenance buildings are critical for continuity of operations (not included below), while recreational areas may house a vulnerable population with no permanent shelter facilities in case of high wind, severe thunderstorm, or tornado events.

Table 25: State and Federally Owned Facilities

Facility or Area	Nearest Community
Boyd County	
Parshall Bridge Wildlife Management Area	Butte, NE
Hull Lake Wildlife Management Area	Butte, NE
Brown County	
Keller Park State Recreation Area	Long Pine, NE
Long Pine State Recreation Area	Long Pine, NE
Will Lake B.C. Wildlife Management Area	Johnstown, NE
Long Lake State Recreation Area	Johnstown, NE
American Game March Wildlife Management Area	Johnstown, NE
Yellowthroat Wildlife Management Area	Ainsworth, NE
South Pine Wildlife Management Area	Long Pine, NE
Plum Creek Valley Wildlife Management Area	Johnstown, NE

28 United States Census Bureau. 2018. “DP04: Selected Housing Characteristics”. https://data.census.gov/cedsci/.

Facility or Area	Nearest Community
Long Pine Wildlife Management Area	Long Pine, NE
Pine Glen Wildlife Management Area	Long Pine, NE
Keller Park Wildlife Management Area	Long Pine, NE
Bobcat Wildlife Management Area	Ainsworth, NE
Cherry County	
Bowring Ranch State Historical Park	Merriman, NE
Cottonwood Lake State Recreation Area	Merriman, NE
Merritt Reservoir State Recreation Area	Valentine, NE
Smith Falls State Park	Valentine, NE
Fort Niobrara National Wildlife Refuge	Valentine, NE
Government Canyon Valentine Fish Hatchery	Valentine, NE
Borman Bridge Wildlife Management Area	Valentine, NE
Schlagel Creek Wildlife Management Area	Valentine, NE
Big Alkali Lake Wildlife Management Area	Wood Lake, NE
Ballards Marsh Wildlife Management Area	Wood Lake, NE
Valentine National Wildlife Refuge	Wood Lake, NE
Rat and Beaver Lake Wildlife Management Area	Elsmere, NE
Merritt Reservoir Wildlife Management Area	Kilgore, NE
Samuel R. McKelvie National Forest	Nenzel, NE
Anderson Bridge Wildlife Management Area	Kilgore, NE
Chat Canyon Wildlife Management Area	Nenzel, NE
Cottonwood/Steverson Wildlife Management Area	Merriman, NE
Shell Lake Wildlife Management Area	Merriman, NE
Keya Paha County	
Thomas Creek Wildlife Management Area	Springview, NE
Holt Creek Wildlife Management Area	Burton, NE
Rock County	
Fed Thomas Wildlife Management Area	Bassett, NE
Twin Lakes R.C. Wildlife Management Area	Bassett, NE
Peterson Lake Wildlife Management Area	Bassett, NE

Source: Nebraska Game and Parks[29],[30]

Mid-Plains Community College (MPCC) is a two-year college system that has a campus located on the southeastern corner of the City of Valentine. MPCC was created as a result of Nebraska legislation enacted in 1973 and 1975. There are 16,000 students enrolled annually over six campuses and an on-line campus. The campus in Valentine is made up of one building. Programs available on the campus include licensed practical nurse, business administration, information technology, associate of arts, and associate of science.

29 Nebraska Game and Parks. October 2020. https://maps.outdoornebraska.gov/Parks/
30 Nebraska Game and Parks. October 2020. https://maps.outdoornebraska.gov/PublicAccessAtlas/

Historical Sites

According to the National Register of Historic Places for Nebraska by the National Park Service, there are 24 historic sites located in the planning area (Table 26). Two of the historic sites are in the one percent annual chance floodplain.

Table 26: Historical Sites

Site Name	Date Listed	Nearest Community	County	In Floodplain?
Lynch Archeological Site	12/2/1974	Lynch	Boyd	No
Ponca Agency	7/12/2006	Niobrara	Boyd	No
Ponca Creek Bridge	6/29/1992	Lynch	Boyd	Yes
SS Peter & Paul Catholic School	1/7/1992	Butte	Boyd	No
The Tower	12/29/2004	Lynch	Boyd	No
White Horse Ranch	7/5/1990	Naper	Boyd	Yes
Miller Hotel	11/27/1989	Long Pine	Brown	N/A
Adamson Bridge	6/29/1992	Valentine	Cherry	N/A
Bell Bridge	6/29/1992	Valentine	Cherry	N/A
Berry State Aid Bridge	6/29/1992	Valentine	Cherry	N/A
Borman Bridge	6/29/1992	Valentine	Cherry	N/A
Brewer Bridge	6/29/1992	Valentine	Cherry	N/A
Bryan Bridge	6/23/1988	Valentine	Cherry	N/A
Cherry County Courthouse	1/10/1990	Valentine	Cherry	N/A
Dry Valley Church and Cemetery	7/3/2007	Mullen	Cherry	N/A
Twin Bridge	6/29/1992	Brownlee	Cherry	N/A
US Post Office – Valentine	12/13/1991	Valentine	Cherry	N/A
Valentine Public School	6/14/1984	Valentine	Cherry	N/A
Walcott F.M. House	10/7/1982	Valentine	Cherry	N/A
Keya Paha County High School	12/1/1986	Springview	Keya Paha	N/A
Lewis Bridge	6/29/1992	Springview	Keya Paha	N/A
Bassett Lodge and Range Café	7/26/2006	Bassett	Rock	N/A
Carns State Aid Bridge	6/29/1992	Bassett	Rock	N/A
Rock County Courthouse	7/5/1990	Bassett	Rock	N/A

Source: National Park Service[31]
N/A: Floodplain is not mapped for the county.

31 National Park Service. October 2020. “National Register of Historic Places NPGallery Database.” https://npgallery.nps.gov/nrhp.

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, participating jurisdictions 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 27: Term Definitions

Term	Definition
Hazard	A potential source of injury, death, damage.
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 same methodology as 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. While the identification of vulnerable assets will be conducted across the entire planning area, *Section Seven* will discuss community-specific assets at risk for relevant hazards. 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 have been 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.

Requirement §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Average Annual Damages and Probability

FEMA ***Requirement §201.6(c)(2)(ii) (B)*** suggests that when the appropriate data are 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 are available. Additional loss estimates are provided separately for those hazards for which sufficient data are 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 are data available for recorded events. During this planning process, vetted and cleaned NCEI data are available for January 1996 to March 2020. Although some data are available back to 1950, this plan update only utilizes the more current and more accurate data available. Wildfire data are available from the Nebraska Forest Service from 2000 to April 2020.

- **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 city.

An example of the annual damage estimate is found below:

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

Each hazard will be included, while those which have caused significant damages or occurred in significant numbers are discussed in detail. It should be noted NCEI data are not all inclusive and the database provides very limited information on crop losses. To provide a better picture of the crop losses associated with the hazards within the planning area, crop loss information provided by the Risk Management Agency (RMA) of the USDA was also utilized for this update of the plan for counties with available data. The collected data were from 2000 to June 2020. Data for all the hazards are not always available, so only those with an available dataset are included in the loss estimation.

Annual probability can be calculated based on the total years of record and the total number of years in which an event occurred. An example of the annual probability estimate is found below:

$$\textbf{Annual Probability } (\%) = \frac{Total\ Years\ with\ an\ event\ occuring\ (\#)}{Total\ Years\ of\ Record\ (\#)}\ x\ 100$$

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 Hazard Mitigation Planning Team and participating jurisdictions 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 28: Hazards Addressed in the Plan

Hazards Addressed in the Plan		
Agricultural Disease	Extreme Heat	Public Health Emergency
Chemical and Radiological Hazards (Fixed Site)	Flooding	Severe Thunderstorms
Chemical and Radiological Hazards (Transportation)	Grass/Wildfires	Severe Winter Storms
Civil Disorder	Hail	Terrorism
Dam Failure	High Winds	Transportation Incidents
Drought	Landslides	Tornadoes
Earthquakes	Levee Failure	

Hazard Elimination

Given the location and history of the planning area, one hazard from the 2015 Region 24 HMP were eliminated from further review. This hazard is listed below with a brief explanation of the elimination.

- **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 grass/wildfires and the potential impacts it could have on the built environment. This approach is consistent with the 2019 Nebraska HMP.

Hazard Addition

Due to the Covid-19 pandemic, the Hazard Mitigation Planning Team determined that Public Health Emergency should be addressed in this HMP. Although local health departments have plans in place and will lead many of the mitigation efforts, many communities were not prepared for the impacts and response for this hazard. Therefore, public health emergencies will be further analyzed in this planning effort.

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. Annual probability is based off the number of years that had at least one event.

Table 29: Regional Risk Assessment

Hazard	Previous Occurrences Events/Years	Approximate Annual Probability	Likely Extent
Agricultural Disease	Animal: 48/6 Plant: 10/21	Animal: 100% Plant: 33%	~57 animals per event
Chemical & Radiological Hazards (Fixed Site)	1/30	3%	0 – 800 lbs
Chemical & Radiological Hazards (Transportation)	3/50	6%	0 – 218 gallons 0 – 135 cubic feet
Civil Disorder	0	Less than 1%	Varies by event
Dam Failure	12/131	9%	Varies by structure
Drought*	432/1,502 months	29%	D1-D4
Earthquakes	16/121	12%	<5.0 magnitude
Extreme Heat	533/116	80%	>100°F
Flooding	52/25	52%	Some inundation of structures (<1% of structures) and roads near major bodies of water. Some evacuations of people may be necessary (<1% of population)
Grass/Wildfires	718/21	100%	0 – 60,000 acres Some homes and structures threatened or at risk
Hail	1,427/25	100%	0.02 – 5.0 inches Avg: 1.21 inches
High Winds	118/25	92%	47 – 54 mph Avg: 48 mph
Landslides	57/54	13%	Width: 50 – 1,000 feet Length: 30 – 1,400 feet
Levee Failure	0	Less than 1%	Varies by extent
Public Health Emergency	2	Unknown	Varies by event
Severe Thunderstorms	433/25	100%	≥1” rainfall 58 – 119 mph Avg: 66 mph

Hazard	Previous Occurrences Events/Years	Approximate Annual Probability	Likely Extent
Severe Winter Storms	434/25	100%	0.25 – 0.5" Ice 20°- 40° below zero (wind chill) 1-5" snow 25-35 mph winds
Terrorism	0/49	Less than 1%	Varies by event
Tornadoes	88/25	84%	EF0 – EF3 Avg: EF0
Transportation Incidents	Auto: 2,342/13 Aviation: 65/59 Railway: 20/46	Auto: 100% Aviation: 58% Railway: 0%**	Damages incurred to vehicles involved and traffic delays; substantial damages to aircrafts involved with some aircrafts destroyed

**Data given in months.*
***All rail lines in the planning area have been removed.*

Table 30: Loss Estimation for the Planning Area

Hazard Type		Count	Property Damage	Crop Damage[2]
Agricultural Disease	Animal Disease[1]	48	2,712 animals	N/A
	Plant Disease[2]	10	N/A	$82,790
Chemical & Radiological Hazards (Fixed Site)[3]		1	$0	N/A
Chemical & Radiological Hazards (Transportation)[4]		3	$330	N/A
Civil Disorder		0	$0	N/A
Dam Failure[5,6]		12	$0	N/A
Drought[7]		432 of 1,502 months	$72,000,000	$35,047,100
Earthquakes[17]		16	$0	N/A
Extreme Heat[8]		Avg. 5 days a year	$0	$6,271,141
Flooding[9]	Flash Flood 1 Fatality	33	$13,602,000	$327,796
	Flood	19	$11,070,000	
Grass/Wildfires[10] 5 injuries		718	130,379 acres burned	$116,359
Hail[9] Average: 1.21 inches Range: 0.02 – 5 inches		1,427	$4,681,600	$24,192,791
High Wind[9] Average: 54 mph Range: 40 – 77 mph		118	$91,000	$3,510,436
Landslides[15]		57	$0	N/A
Levee Failure[16]		0	$0	N/A
Public Health Emergency		2	N/A	N/A
Severe Thunderstorms[9]	Thunderstorm Wind Average:66 mph Range: 58 – 119 mph	412	$4,075,600	$15,453,591
	Heavy Rain	13	$0	
	Lightning 1 injury	8	$49,850	

Hazard Type		Count	Property Damage	Crop Damage[2]
Severe Winter Storms[9]	Blizzard 1 Fatality	77	$500,000	$3,236,582
	Extreme Cold/Wind chill	85	$0	
	Heavy Snow	26	$0	
	Ice Storm	5	$0	
	Winter Storm	241	$10,223,000	
	Winter Weather	0	$0	
Terrorism[14]		0	$0	N/A
Tornadoes[9] Average: EF0 Range: EF0 - EF3 1 injury		88	$2,215,750	$0
Transportation Incidents	Auto[11] 58 fatalities, 932 injuries	2,342	N/A	N/A
	Aviation[12] 14 fatalities, 18 injuries	65	N/A	N/A
	Railway[13] 10 injuries	20	$45,400	N/A
Total		**5,847**	**$118,554,530**	**$88,238,856**

N/A: Data not available
1 - NDA, 2014 – March 2020
2 - USDA RMA, 2000 – June 2020
3 - NRC, 1990 – February 2020
4 - PHSMA, 1971 – June 2020
5 - Stanford NPDP, 1890 – 2018
6 – DNR Correspondence
7 - NOAA, 1895 – May 2020
8 – NOAA Regional Climate Center, 1893 – May 2020
9 – NCEI, 1996 – March 2020
10 – NFS, 2000 – April 2020
11 – NDOT, 2006 – 2018
12 – NTSB, 1962 – June 2020
13 – DOT FRA, 1975 – 2020
14 – University of Maryland, 1970 – 2018
15 – University of Nebraska, 1960 – 2013
16 – USACE NLN, 1900 – June 2020
17 – USGS, 1900 – June 2020

Historical Disaster Declarations

The following tables show 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 since 2006.

Table 31: SBA Declarations

Disaster Declaration Number	Declaration Date	Description	Primary Counties	Continuous Counties
NE-00005	01/26/2006	Severe Winter Storms	Boyd, Rock	-
NE-00006	07/13/2006	High Winds, Excessive Heat, Freeze, Drought	Boyd, Brown, Keya Paha, Rock	Cherry
NE-00007	07/13/2006	High Temperatures, High Wind, Excess Heat, Drought	Cherry	Boyd, Brown, Keya Paha, Rock
NE-00008	09/27/2006	High Temperatures, High Winds, Excessive Heat, Tornadoes, Drought	-	Brown
NE-00011	01/07/2007	Severe Winter Storms	Brown, Keya Paha, Rock	-
NE-00013	06/06/2007	Severe Storms, Flooding, Tornadoes	Brown, Keya Paha	-
NE-00020	06/20/2008	Severe Storms, Tornadoes, Flooding	-	Boyd, Keya Paha, Rock
NE-00021	06/20/2008	Severe Storms, Tornadoes, Flooding	Boyd, Brown, Keya Paha, Rock	-
NE-00027	07/31/2009	Severe Storms, Tornadoes, Flooding	Cherry, Keya Paha, Rock	-
NE-00033	03/26/2010	Severe Winter Storms, Snowstorm	Boyd	-
NE-00035	04/21/2010	Severe Storms, Ice Jams, Flooding	Boyd	-
NE-00038	07/15/2010	Severe Storms, Flooding, Tornadoes	Boyd, Brown, Cherry, Keya Paha, Rock	-
NE-00041	08/12/2011	Flooding	Boyd	Keya Paha, Rock
NE-00042	07/18/2011	Flooding	Boyd	Keya Paha, Rock
NE-00049	08/01/2012	Drought	Brown, Cherry, Keya Paha, Rock	Boyd
NE-00050	04/08/2013	Drought	Boyd	Keya Paha, Rock
NE-00052	08/08/2012	Drought	Boyd	-
NE-00053	12/10/2013	Drought	Boyd, Brown, Cherry, Keya Paha, Rock	-
NE-00059	01/28/2015	Drought	-	Brown, Cherry, Rock
NE-00063	07/28/2014	Tornadoes, Straight-Line Winds, Flooding	Rock	-
NE-00073	03/21/2019	Severe Winter Storm, Straight-Line Winds, Flooding	Boyd	-

Source: Small Business Administration, 2006-2019[32]

Presidential Disaster Declarations

The presidential disaster declarations involving the planning area from 1962 to 2019 are summarized in the following table. Declarations prior to 1962 are not designated by county on the FEMA website and are not included below.

32 Small Business Administration. 2005-2019. Office of Disaster Assistance | Resources." https://www.sba.gov/offices/headquarters/oda/resources/1407821.

Table 32: Presidential Disaster Declarations

Disaster Declaration Number	Declaration Date	Disaster Type	Affected Counties	Total Public Assistance	Total Individual Assistance
228	7/18/1967	Flood, Severe Storms, Ice Jams	Cherry, Boyd, Brown, Keya Paha	-	-
983	4/2/1993	Flood, Ice Jams	Boyd	-	-
998	7/19/1993	Flood, Severe Storms	Boyd	-	-
1373	5/16/2001	Severe Storms, Severe Winter Storms, Flood, Tornadoes	Cherry, Brown, Keya Paha, Rock	$2,847,222	$0
1627	1/26/2006	Severe Storms, Severe Winter Storms	Boyd, Rock	$5,228,433	$0
1674	1/7/2007	Severe Storms, Severe Winter Storms	Keya Paha, Brown, Rock	$122,371,433	$0
1706	6/6/2007	Severe Storms, Flood, Tornadoes	Keya Paha, Brown	$5,857,427	$0
1770	6/20/2008	Severe Storms, Flood, Tornadoes	Brown, Cherry, Boyd, Rock, Keya Paha	$36,258,650	$2,747,277
1853	7/31/2009	Severe Storms, Flood, Tornadoes	Keya Paha, Rock, Cherry	$4,491,366	$0
1878	2/25/2010	Severe Storms, Severe Winter Storms, Snowstorm	Brown, Boyd, Cherry, Keya Paha, Rock	$6,577,021	$0
1902	4/21/2010	Flood, Severe Storms, Ice Jams	Boyd	$3,113,242	$0
1924	7/15/2010	Severe Storms, Flood	Boyd, Cherry, Brown, Keya Paha, Rock	$49,933,887	$0
2655	7/17/2006	Fire	Cherry	$0	$0
3022	1/18/1977	Drought	Boyd, Keya Paha	$0	$0
3245	9/13/2005	Hurricane (Katrina Evacuees)	Boyd, Cherry, Keya Paha, Brown, Rock	$376,579	$0
3323	6/18/2011	Flood	Boyd	$0	$0
4013	8/12/2011	Flood	Boyd	$62,781,690	$8,316,883
4185	7/28/2014	Severe Storms, Tornadoes, Straight-Line Winds, Flood	Rock	$837,595	$0
4321	6/26/2017	Severe Storms, Severe Winter Storms, Straight-Line Winds	Rock	$2,786,763	$0
4375	6/29/2018	Snow, Severe Winter Storm, Straight-Line, Winds	Boyd, Rock	$7,534,044	$0

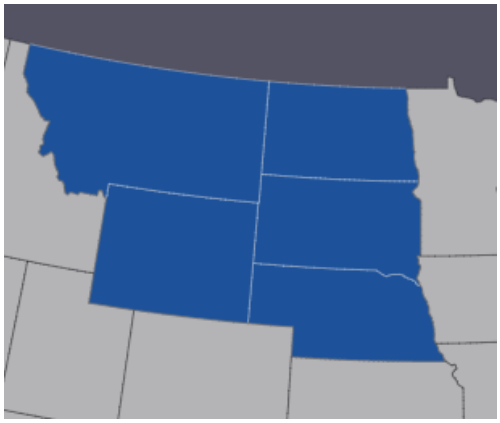
Disaster Declaration Number	Declaration Date	Disaster Type	Affected Counties	Total Public Assistance	Total Individual Assistance
4387	8/27/2018	Severe Storms, Tornadoes, Straight-Line Winds, Flood	Boyd	$2,686,082	$0
4420	3/21/2019	Flood, Severe Winter Storms, Straight-Line Winds	Brown, Boyd, Keya Paha, Cherry, Rock	$152,913,776	$48,815,923

Source: Federal Emergency Management Agency, 1953-2019[33]

Climate Adaptation

Long-term climate trends have shifted throughout the 21st century and have created significant changes in precipitation and temperature which have altered the severity and subsequent impacts from severe weather events. Discussions on temperature, precipitation, and climate impacts are included below.

Figure 8: Northern Great Plains Region



The planning area is located in the Northern Great Plains region of the United States, which stretches from Montana and North Dakota southward to Wyoming and Nebraska (Figure 8). A large elevation change across the region contributes to high geographical, ecological, and climatological variability, including a strong gradient of decreasing precipitation moving from east to west across the region. Significant weather extremes impact this area, including winter storms, extreme heat and cold, severe thunderstorms, drought, and flood producing rainfall.

The Fourth National Climate Assessment assess climate variability and its impacts across the U.S. including the Northern Great Plains. The report's overarching findings for the region are summarized below:[34]

- **Water**: Water is the lifeblood of the Northern Great Plains, and effective water management is critical to the region's people, crops and livestock, ecosystems, and energy industry. Even small changes in annual precipitation can have large effects downstream; when coupled with the variability from extreme events, these changes make managing these resources a challenge. Future changes in precipitation patterns, warmer temperatures, and the potential for more extreme rainfall events are very likely to exacerbate these challenges.

- **Agriculture:** Agriculture is an integral component of the economy, the history, and the culture of the Northern Great Plains. Recently, agriculture has benefited from longer growing seasons and other recent climatic changes. Some additional production and conservation benefits are expected in the next two to three decades as land managers employ innovative adaptation strategies but rising temperatures and changes in extreme weather events are very likely to have negative impacts on parts of the region. Adaptation

33 Federal Emergency Management Agency. 2019. "Disaster Declarations." Accessed November 2020. https://www.fema.gov/openfema-dataset-disaster-declarations-summaries-v1.
34 U.S. Global Change Research Program. 2018 "Fourth National Climate Assessment". https://nca2018.globalchange.gov/.

to extremes and to longer-term, persistent climate changes will likely require transformative changes in agricultural management, including regional shifts of agricultural practices and enterprises.

- **Recreation and Tourism:** Ecosystems across the Northern Great Plains provide recreational opportunities and other valuable goods and services that are at risk in a changing climate. Rising temperatures have already resulted in shorter snow seasons, lower summer stream flows, and higher stream temperatures and have negatively affected high-elevation ecosystems and riparian areas, with important consequences for local economies that depend on winter or river-based recreational activities. Climate-induced land-use changes in agriculture can have cascading effects on closely entwined natural ecosystems, such as wetlands, and the diverse species and recreational amenities they support. Federal, tribal, state, and private organizations are undertaking preparedness and adaptation activities, such as scenario planning, transboundary collaboration, and development of market-based tools.

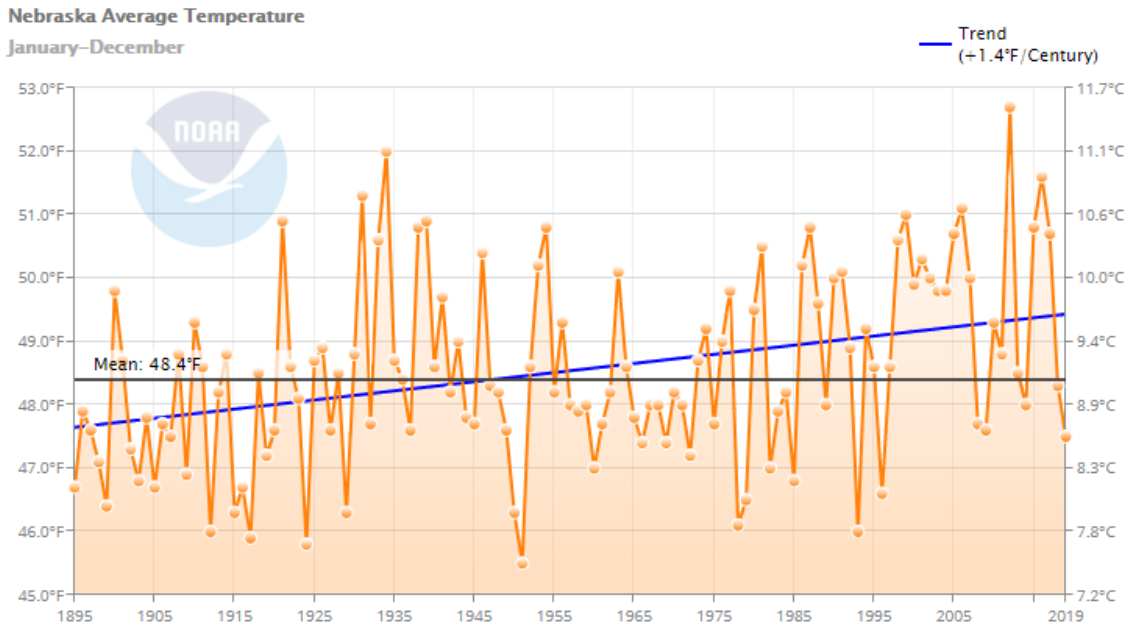
- **Energy:** Fossil fuel and renewable energy production and distribution infrastructure is expanding within the Northern Great Plains. Climate change and extreme weather events put this infrastructure at risk, as well as the supply of energy it contributes to support individuals, communities, and the U.S. economy. The energy sector is also a significant source of greenhouse gases and volatile organic compounds that contribute to climate change and ground-level ozone pollution.

Temperature

Since 1895, Nebraska's overall average temperature has increased by almost 2°F (Figure 9). This trend will likely contribute to increase in the frequency and intensity of hazardous events, which will cause significant economic, social, and environmental impacts on Nebraskans. Climate modeling suggests warmer temperature conditions will continue in the coming decades and will rise steadily into the mid-century.

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 greater risk. Furthermore, the agricultural sector will experience changes in the growth cycle as winters warm. High nighttime temperatures can reduce grain yields and increase stress on animals. These added stressors on agriculture could have devastating economic effects if more resilient agricultural and livestock management practices are not adopted.

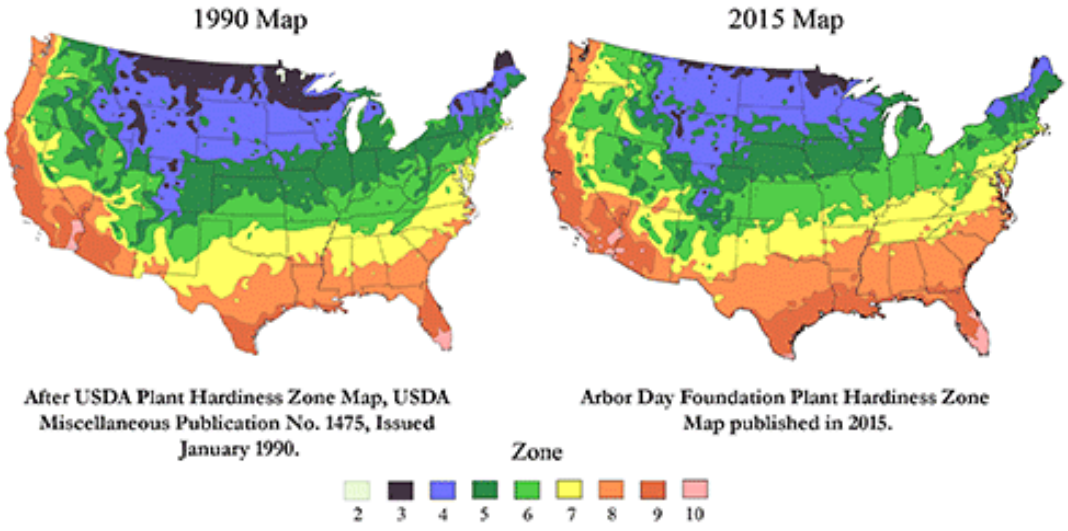
Figure 9: Average Temperature (1895-2019)



Source: NOAA/NCEI, 2020[35]

Additionally, the length of the frost-free season (i.e. growing season) has been increasing nationally since the 1980s. While a longer growing season may provide some benefit for heavily agricultural areas, concurrent changes in temperature, water availability, and pest pressures may cause additional impacts. For instance, longer growing seasons coinciding with periods of drought and extreme heat can indicate lower production from increased plant mortality and increased risk to wildfire ignition probability and fuel load potentials.[36]

Figure 10: Plant Hardiness Zone Change



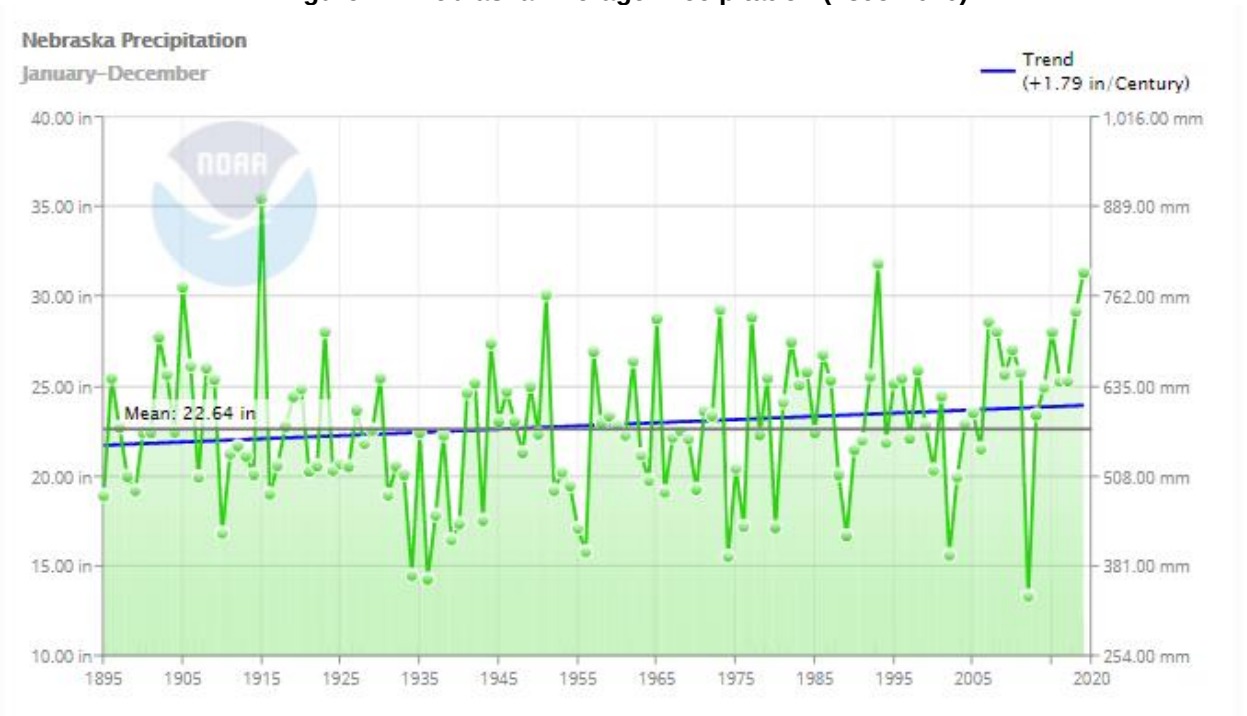
Source: Arbor Day Foundation, 2018[37]

35 NOAA National Centers for Environmental Information. July 2020. "Climate at a Glance". https://www.ncdc.noaa.gov/cag/statewide/time-series.
36 U.S. Global Change Research Program. 2018 "Fourth National Climate Assessment". https://nca2018.globalchange.gov/.
37 Arbor Day Foundation. 2018. "Hardiness Zones". https://www.arborday.org/media/map_change.cfm.

Precipitation

Changing extremes in precipitation is anticipated in the coming decades, particularly in the increasing likelihood of more significant rain and snowfall and more intense drought periods. Seasonal variations will be heightened, with more frequent and greater rainfall expected in the spring and winter and hotter, drier periods in the summer. Since 1895, yearly annual precipitation for Nebraska has increased slightly (Figure 11). This trend is expected to continue as the impacts of climate change continue to be felt. Climate modeling may show only moderate changes in precipitation and streamflow; however, most of the Great Plains region is already at risk to large annual and seasonable variability as seen by flooding and drought events occurring in concurrent years. There will likely be more days with a heavy precipitation event (rainfall of greater than one inch per day) across the region and subsequent impacts to riverine flooding events or overwhelmed local stormwater management systems. Groundwater and reservoir water sources are increasingly important to communities and residents in the great plains region to meet water needs during periods of shortage.

Figure 11: Nebraska Average Precipitation (1895-2020)



Source: NOAA, 2020[38]

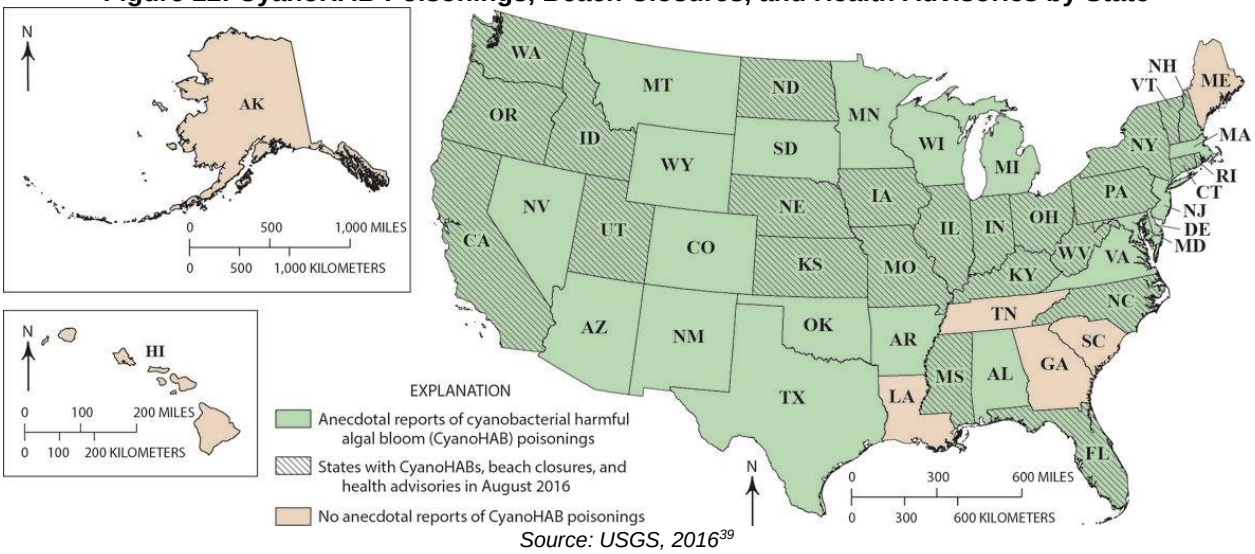
Water Quality

Increasing temperatures, shifting precipitation patterns, and extreme weather events impact water resources throughout the United States. As average temperatures increase, water temperatures also rise and put water bodies at risk for eutrophication and excess algal growth that reduce water quality. Extreme weather events and shifting precipitation can lead to fluctuating river flows, erosion, sediment accumulation, and morphological changes to water bodies and surrounding landscapes. In agricultural landscapes, major storm events can cause sediment and nutrients such as phosphorous and nitrogen to runoff into nearby water sources. Runoff can contribute to the buildup of nutrients in the water, increasing plant and algae growth that can deplete oxygen

38 NOAA National Centers for Environmental Information. 2020. "Climate at a Glance". https://www.ncdc.noaa.gov/cag/statewide/time-series.

and kill aquatic life. Nutrient enrichment can lead to toxic cyanobacterial harmful algae blooms (cyanoHABs), which can be harmful to animal and human health. In 2016, Nebraska was one of 19 states with anecdotal reports of poisonings, beach closures, and health advisories due to cyanoHABs (Figure 12). CyanoHABs can cause economic damage such as decreasing property values, reducing recreational revenue, and increasing the costs for treating drinking water.

Figure 12: CyanoHAB Poisonings, Beach Closures, and Health Advisories by State



Source: USGS, 2016[39]

Increasing extreme precipitation events can lead to flooding and stormwater runoff that can carry pollutants across landscapes and threaten human health by contaminating water wells, groundwater, and other bodies of water. Common pollutants include pesticides, bacteria, nutrients, sediment, animal waste, oil, and hazardous waste.

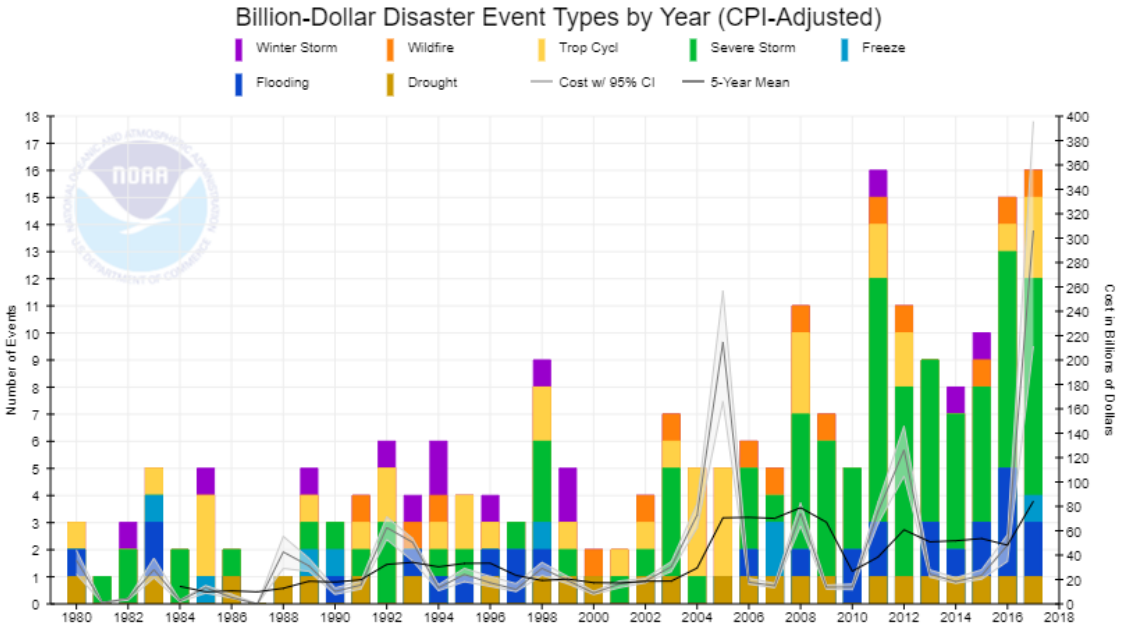
Economic Impacts

The United States is also experiencing an increase in the number of billion-dollar natural disasters, as depicted in Figure 13 and Figure 14. Regardless of whether this trend is due to a change in weather patterns or due to increased development, the trend exists.

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 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 including adaptation as a core strategy to be better informed by future projections on the frequency, intensity, and distribution of hazards as well.

39 USGS. "Nutrients and Eutrophication". 2016. https://www.usgs.gov/mission-areas/water-resources/science/nutrients-and-eutrophication?qt-science_center_objects=0#qt-science_center_objects.

Figure 13: Billion Dollar Disasters

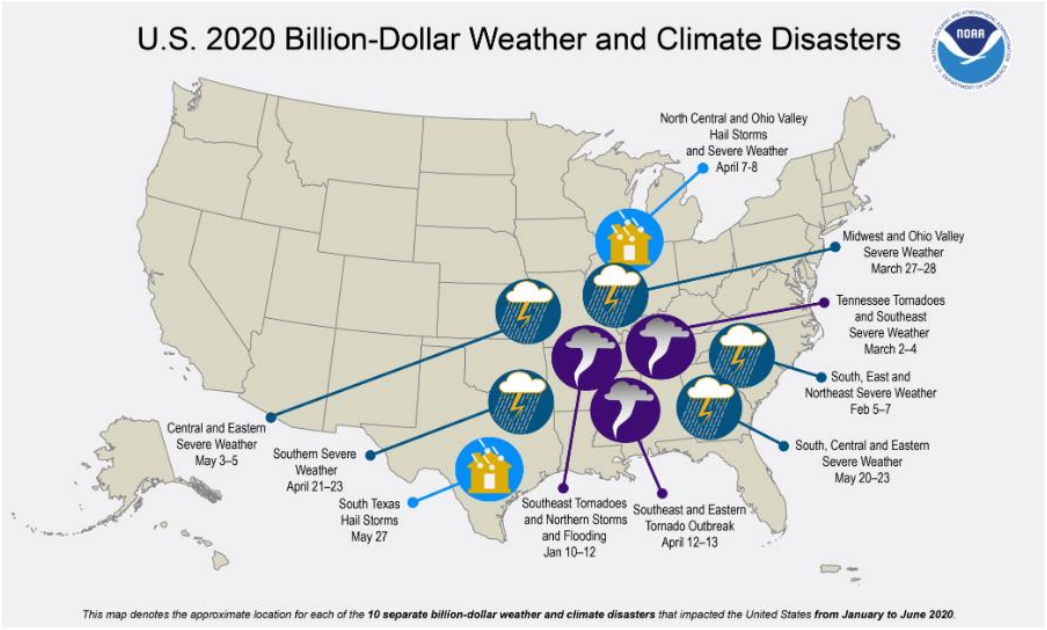


Source: NOAA, 2018

Figure 14: Billion Dollar Weather and Climate Disasters

2020 in Progress...

In 2020 (as of July 8), there have been 10 weather/climate disaster events with losses exceeding $1 billion each to affect the United States. These events included 10 severe storm events. Overall, these events resulted in the deaths of 80 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 sixth consecutive year (2015-2020) in which 10 or more billion-dollar weather and climate disaster events have impacted the United States. Over the last 41 years (1980-2020), the **years with 10 or more** separate billion-dollar disaster events include **1998, 2008, 2011-2012,** and **2015-2020**.

Source: NOAA, 2020[40]

40 NOAA. 2020. "Billion-Dollar Weather and Climate Disasters: Overview. Accessed September 2020. https://www.ncdc.noaa.gov/billions/overview.

Hazard Profiles

Information from participating jurisdictions was collected and reviewed alongside hazard occurrence, magnitude, and event narratives as provided by local, state, and federal databases. Based on this information, profiled hazards were determined to either have a historical record of occurrence or the potential for occurrence in the future. The following profiles will broadly examine the identified hazards across the region. Hazards of local concern or events which have deviated from the norm are discussed in greater detail in each respective community profile (see *Section Seven* of this plan). The following table identifies the prioritization of hazards by participating jurisdictions (i.e. hazards of top concern). Local jurisdictional planning teams selected these hazards from the regional hazard list as the prioritized hazards for the community based on historical hazard occurrences, potential impacts, and the jurisdictions' capabilities. However, it is important to note that while a jurisdiction may not have selected a specific hazard to be profiled, hazard events can impact any community at any time and their selection is not a full indication of risk.

Table 33: Prioritized Hazards by Jurisdiction

Jurisdiction	Agricultural Disease	Chemical & Radiological Hazards (Fixed Site)	Chemical & Radiological Hazards (Transportation)	Civil Disorder	Dam Failure	Drought	Earthquakes	Extreme Heat	Flooding	Grass/Wildfires	Hail	High Winds	Landslides	Levee Failure	Public Health Emergency	Severe Thunderstorms	Severe Winter Storms	Terrorism	Tornadoes	Transportation Incidents
Lower Niobrara NRD		X	X			X			X	X						X	X		X	
Middle Niobrara NRD						X			X	X							X			
Region 24 EMA	X					X	X			X						X			X	
Boyd County					X	X		X	X				X			X	X		X	
Bristow								X	X	X	X	X				X	X			
Butte										X	X					X	X			
Lynch									X	X							X		X	
Naper									X		X	X								
Spencer		X					X		X	X		X								X
Brown County						X			X	X							X		X	
Ainsworth									X								X		X	X
Johnstown									X	X									X	
Long Pine									X	X							X		X	

Jurisdiction	Agricultural Disease	Chemical & Radiological Hazards (Fixed Site)	Chemical & Radiological Hazards (Transportation)	Civil Disorder	Dam Failure	Drought	Earthquakes	Extreme Heat	Flooding	Grass/Wildfires	Hail	High Winds	Landslides	Levee Failure	Public Health Emergency	Severe Thunderstorms	Severe Winter Storms	Terrorism	Tornadoes	Transportation Incidents
Cherry County										X						X			X	
Cody																	X		X	
Crookston			X			X														
Kilgore									X	X									X	
Nenzel									X											
Valentine						X			X	X		X				X				
Keya Paha County									X	X						X				
Springview										X							X		X	
Rock County								X		X		X					X			
Bassett									X			X					X			
Newport									X			X				X				
Ainsworth Community Schools						X			X						X	X	X		X	
Boyd County Rural Water District #2						X			X			X	X			X			X	
Body County Schools									X	X							X			
Brown County Fire District						X		X		X		X				X				X
Keya Paha County Fire District									X	X						X	X		X	
Naper Fire District						X				X	X	X							X	
Rock County Public Schools																	X		X	

Jurisdiction	Agricultural Disease	Chemical & Radiological Hazards (Fixed Site)	Chemical & Radiological Hazards (Transportation)	Civil Disorder	Dam Failure	Drought	Earthquakes	Extreme Heat	Flooding	Grass/Wildfires	Hail	High Winds	Landslides	Levee Failure	Public Health Emergency	Severe Thunderstorms	Severe Winter Storms	Terrorism	Tornadoes	Transportation Incidents
Valentine Rural Fire District						X				X		X								

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Agricultural Disease

Agricultural 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 State of Nebraska's economy 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 more than $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 was nearly $663 million.[41]

Table 34 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 34: Livestock Inventory

County	Market Value of 2017 Livestock Sales	Cattle and Calves	Hogs and Pigs	Sheep and Lambs	Poultry Egg Layers
Boyd	$63,962,000	$62,778,000	$1,070,000	D	$330,000
Brown	$268,135,000	$136,854,000	D	D	$515,000
Cherry	$197,173,000	$284,602,000	$100,000	$304,000	$605,000
Keya Paha	$34,133,000	$54,091,000	$0	$534,000	$207,000
Rock	$85,838,000	$79,783,000	D	$0	$99,000
Total	**$649,241,000**	**$618,108,000**	**$1,170,000**	**$838,000**	**$1,756,000**

Source: U.S. Census of Agriculture, 2017
D: Withheld to avoid disclosing data for individual farms.

The following tables provide the value and acres of land in farms for the planning area. Cherry County has the highest number of farms and land in farms in the planning area, but Boyd County has the highest crop sales, which accounts for nearly 30 percent of sales in the five-county area. Corn is the most prevalent crop type in the region followed by soybeans.

Table 35: Land and Value of Farms in the Planning Area

County	Number of Farms	Land in Farms (Acres)	Market Value of 2017 Crop Sales
Boyd	229	116,564	$40,307,000
Brown	165	81,892	$22,611,000
Cherry	359	331,558	$33,754,000
Keya Paha	168	84,323	$18,199,000
Rock	142	107,703	$22,262,000
Total	**1,063**	**722,040**	**$137,133,000**

Source: U.S. Census of Agriculture, 2017

41 US Department of Agriculture, National Agricultural Statistics Server. 2020. "2017 Census of Agriculture – County Data."

Table 36: Crop Values

County	Corn		Soybeans		Wheat	
	Acres Planted	Value (2017)	Acres Planted	Value (2017)	Acres Planted	Value (2017)
Boyd	45,059	$21,433,000	28,728	$14,009,000	1,412	$291,000
Brown	28,261	$16,142,000	8,229	D	0	$0
Cherry	27,276	$14,484,000	2,627	$2,154,000	3,108	$710,000
Keya Paha	20,130	$10,632,000	4,957	$2,308,000	0	$0
Rock	20,333	$12,358,000	15,554	D	0	$0
Total	**141,059**	**$75,049,000**	**62,095**	**$18,471,000**	**4,520**	**$1,001,000**

Source: U.S. Census of Agriculture, 2017
D: Withheld to avoid disclosing data for individual farms.

Location

Given the strong agricultural presence in the planning area, animal and plant diseases have the potential to occur across the planning area. If a major outbreak were to occur, the entire planning area's economy 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 are 48 instances of animal diseases reported between January 2014 and March 2020 by the NDA (Table 37). These outbreaks affected 2,712 animals.

Table 37: Livestock Diseases Reported in the Planning Area

Year	County	Disease	Population Impacted
2014	Cherry	Bluetongue	2001
	Cherry	Enzootic Bovine Leukosis	1
	Cherry	Equine Rhinopneumonitis	2
	Boyd, Cherry, Keya Paha, Rock	Paratuberculosis	56
2015	Brown, Cherry, Rock	Bluetongue	154
	Boyd	Bovine Viral Diarrhea	1
	Boyd	Paratuberculosis	1
2016	Rock	Bluetongue	2
	Rock	Bovine Viral Diarrhea	1
	Boyd, Brown, Cherry, Rock	Paratuberculosis	14
2017	Brown, Cherry	Anaplasmosis	2
	Cherry	Bluetongue	302
	Rock	Bovine Viral Diarrhea	1
	Boyd, Cherry, Keya Paha, Rock	Paratuberculosis	17
2018	Boyd	Anaplasmosis	1
	Cherry	Bluetongue	1
	Brown	Bovine Viral Diarrhea	2

Year	County	Disease	Population Impacted
	Boyd, Cherry, Keya Paha, Rock	Paratuberculosis	121
	Cherry	West Nile Virus	1
2019	Brown	Anaplasmosis	1
	Boyd	Enzootic Bovine Leukosis	1
	Boyd, Brown, Cherry, Keya Paha, Rock	Paratuberculosis	20
2020	Cherry	Bovine Viral Diarrhea	2
	Keya Paha	Enzootic Bovine Leukosis	1
	Boyd	Infectious Bovine Rhinotracheitis/Infectious Pustule	1
	Boyd, Cherry, Keya Paha	Paratuberculosis	4

Source: Nebraska Department of Agriculture, Jan 2014 – March 2020[42]

The most prevalent agricultural diseases seen across the planning area include: Bluetongue and Paratuberculosis. The economic impacts of outbreaks can negatively impact businesses, farmers, ranchers, and communities reliant on the agricultural sector.

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 plan diseases, which are listed below.

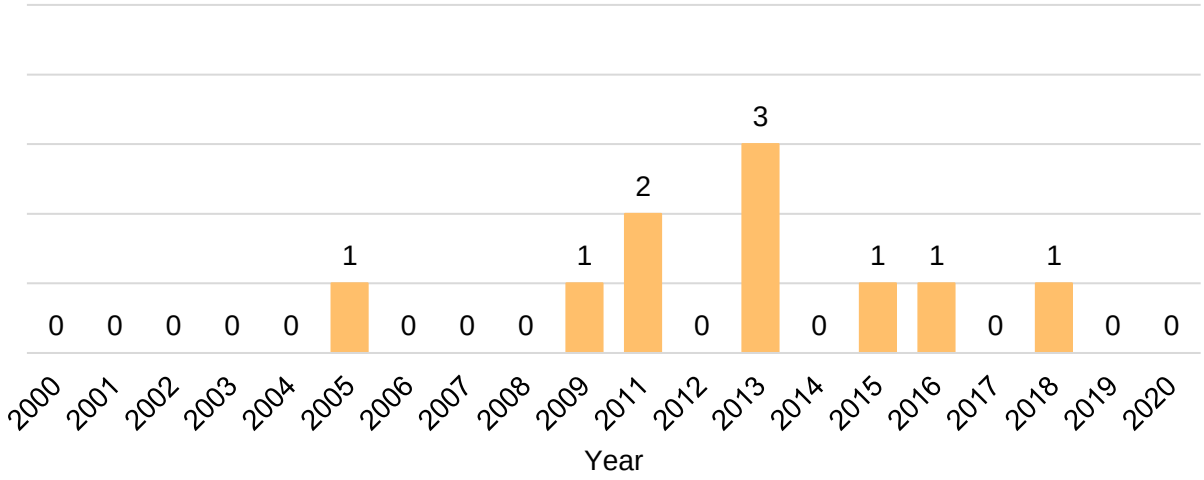
Table 38: Common Plant Diseases in Nebraska by Type

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	Physodrma
	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	Emerald Ash Borer	Dutch Elm Disease
	Burr Oak Blight	Leaf Spot and Blight
	Powdery Mildew	Crown Gall
	Canker (various types)	Root Rot
	Pine Wilt Disease	

42 Nebraska Department of Agriculture. 2020. "Livestock Disease Reporting." http://www.nda.nebraska.gov/animal/reporting/index.html.

The RMA provides data on plant disease events and plant losses in the planning area. There are 10 instances of plan diseases reported between January 2000 and June 2020 by the RMA (Figure 15). These outbreaks caused $82,790 in plant losses.

Figure 15: Plant Disease Events by Year



Source: NDA, 2000-June 2020

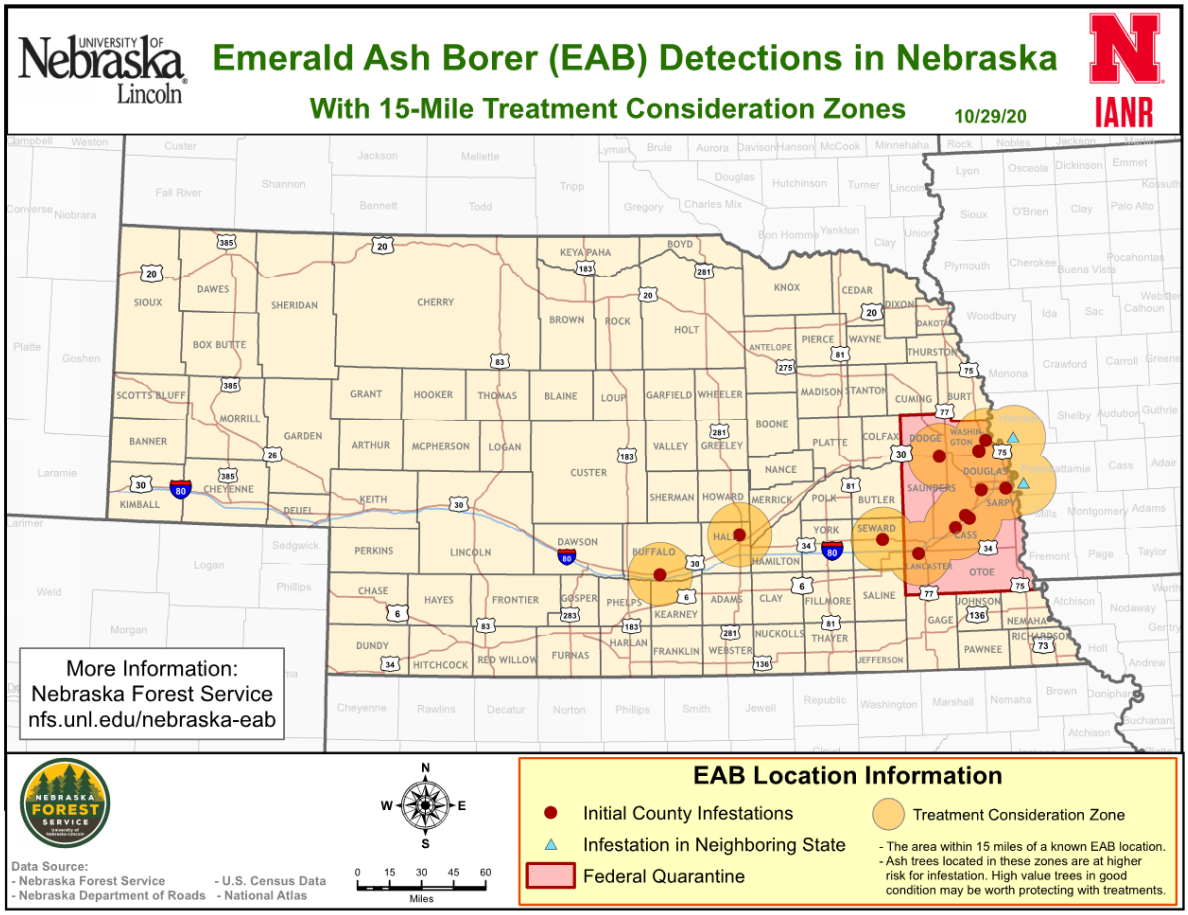
Emerald Ash Borer

The spread and presence of the Emerald Ash Borer (EAB) have become a rising concern for many Nebraskan communities in recent years. The beetle spreads through transport of infected ash trees, lumber, and firewood. All species of North American ash trees are vulnerable to infestation. Confirmed cases of EAB have been found in three Canadian provinces and 35 US states, primarily in the eastern, southern, and midwestern regions. The two most recent infestation confirmations came from South Dakota and Vermont in early 2018; however, EAB can be found in Iowa, Missouri, Kansas, South Dakota, and Colorado. Nebraska's confirmed cases occurred on private land in Omaha and Greenwood in 2016.[43] Figure 16 shows the locations of Nebraska's confirmed EAB cases as of August 2020. Additional confirmed cases have likely occurred and many communities across the state are prioritizing the removal of ash trees to help curb potential infestations and tree mortality.

While adult beetles cause little damage, larvae damage trees by feeding on the inner bark of mature and growing trees, causing tunnels. Effects of EAB infestation include extensive damage to trees by birds, canopy dieback, bark splitting, and water sprout growth at the tree base, and eventual tree mortality. EAB has impacted millions of trees across North America, killing young trees one to two years after infestation and mature trees three to four years after infestation.[44] Estimated economic impacts to Nebraska's 44 million ash trees exceed $981 million.[45] Dead or dying trees affected by EAB are also more likely to cause damage during high winds, severe thunderstorms, or severe winter storms from weakened or hazardous limbs and can contribute a significant fuel load to grass/wildfire events.

43 Emerald Ash Borer Information Network. April 2018. "Emerald Ash Borer." http://www.emeraldashborer.info/.
44 Arbor Day Foundation. 2015. "Emerald Ash Borer." https://www.arborday.org/trees/health/pests/emerald-ash-borer.cfm.
45 "Nebraska Emerald Ash Borer Response Plan." May 2015. https://nfs.unl.edu/NebraskaEABResponsePlan.pdf.

Figure 16: EAB Detections in Nebraska



Average Annual Losses

According to the USDA RMA (2000 – June 2020) 10 plant disease events occurred 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 39: Agricultural Plan Disease Losses

Hazard Type	Number of Events	Events Per Year	Total Plant Losses	Average Annual Crop Loss
Plant Disease	10	0.5	$82,790	$3,942

Source: RMA, 2000-June 2020

Table 40: Agricultural Livestock Disease Losses

Hazard Type	Number of Events	Events Per Year	Total Animal Losses	Average Animal Losses Per Event
Animal Disease	48	6.9	2,712	56.5

Source: NDA, 2014-March 2020

Extent

There is no standard for measuring the magnitude of agricultural disease. Historical events have impacted a relatively small number of livestock and/or crops. However, the planning area is heavily dependent on the agricultural economy. Changes in climate (as discussed previously) may significantly alter the frequency and magnitude of disease outbreaks. Any severe plant or animal disease outbreak which may impact this sector would negatively impact the entire planning area.

Probability

Given the historic record of occurrence for agricultural animal disease events (at least one animal disease outbreak reported in all six years), for the purposes of this plan, the annual probability of agricultural animal disease occurrence is 100 percent. Given the historic record of occurrence for agricultural plant disease events (seven out of 21 years with a reported event), for the purposes of this plan, the annual probability of agricultural plan disease occurrence is 33%.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 41: Regional 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 tax revenues and local capabilities
Built Environment	None
Infrastructure	-Transportation routes can be closed during quarantine
Critical Facilities	None
Climate	-Changes in seasonal climate normals can promote spread of invasive species and agricultural disease

Chemical and Radiological Hazards (Fixed Site)

The following description of hazardous materials is provided by FEMA:

> Chemicals are found everywhere. They purify drinking water, increase crop production, and simplify household chores. But chemicals also can be hazardous to humans or the environment if used or released improperly. Hazards can occur during production, storage, transportation, use or disposal. You and your community are at risk if a chemical is used unsafely or released in harmful amounts into the environment where you live, work, or play.[46]

Hazardous materials in various forms can cause fatalities, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. Many products containing hazardous chemicals are used and stored in homes routinely. Chemicals posing a health hazard include carcinogens, toxic agents, reproductive toxins, irritants, and many other substances that can harm human organs or vital biological processes.

Chemical manufacturers are one source of hazardous materials, but there are many others, including service stations, hospitals, cooperatives, agricultural sites, and hazardous materials waste sites.

Varying quantities of hazardous materials are manufactured, used, or stored in an estimated 4.5 million facilities in the United States—from major industrial plants to local dry-cleaning establishments or gardening supply stores.

Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. Hazardous materials incidents are technological (meaning non-natural hazards created or influenced by humans) events that involve large-scale releases of chemical, biological, or radiological materials. Hazardous materials incidents generally involve releases at fixed-site facilities that manufacture, store, process or otherwise handle hazardous materials or along transportation routes such as major highways, railways, navigable waterways, and pipelines.

The Environmental Protection Agency (EPA) requires the submission of the types and locations of hazardous chemicals being stored at any facility within the state over the previous calendar year. This is completed by submitting a Tier II form to the EPA as a requirement of the Emergency Planning and Community Right-to-Know Act of 1986.[47]

Fixed sites are those that involve chemical manufacturing sites and stationary storage facilities. Table 42 demonstrates the nine classes of hazardous material according to the 2016 Emergency Response Guidebook.

46 Federal Emergency Management Agency. 2017. “Hazardous Materials Incidents.” https://www.ready.gov/hazardous-materials-incidents.

47 Emergency Planning and Community Right-to-Know Act of 1986, Pub. L. No. 116 § 10904. 1986.

Table 42: Hazardous Materials Classes

Class	Type of Material	Divisions
1	Explosives	Division 1.1 – Explosives with a mass explosion hazard Division 1.2 – Explosives with a projection hazard but not a mass explosion hazard Division 1.3 – Explosives which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard Division 1.4 – Explosives which present no significant blast hazard Division 1.5 – Very insensitive explosives with a mass explosion hazard Division 1.6 – Extremely insensitive articles which do not have a mass explosion hazard
2	Gases	Division 2.1 – Flammable gases Division 2.2 – Non-flammable, non-toxic gases Division 2.3 – Toxic gases
3	Flammable liquids (and Combustible liquids)	
4	Flammable solids; Spontaneously combustible materials	Division 4.1 – Flammable solids, self-reactive substances and solid desensitized explosives Division 4.2 – Substances liable to spontaneous combustion Division 4.3 – Substances which in contact with water emit flammable gases
5	Oxidizing substances and Organic peroxides	Division 5.1 – Oxidizing substances Division 5.2 – Organic peroxides
6	Toxic Substances and infectious substances	Division 6.1 – Toxic substances Division 6.2 – Infectious substances
7	Radioactive materials	
8	Corrosive materials	
9	Miscellaneous hazardous materials/products, substances, or organisms	

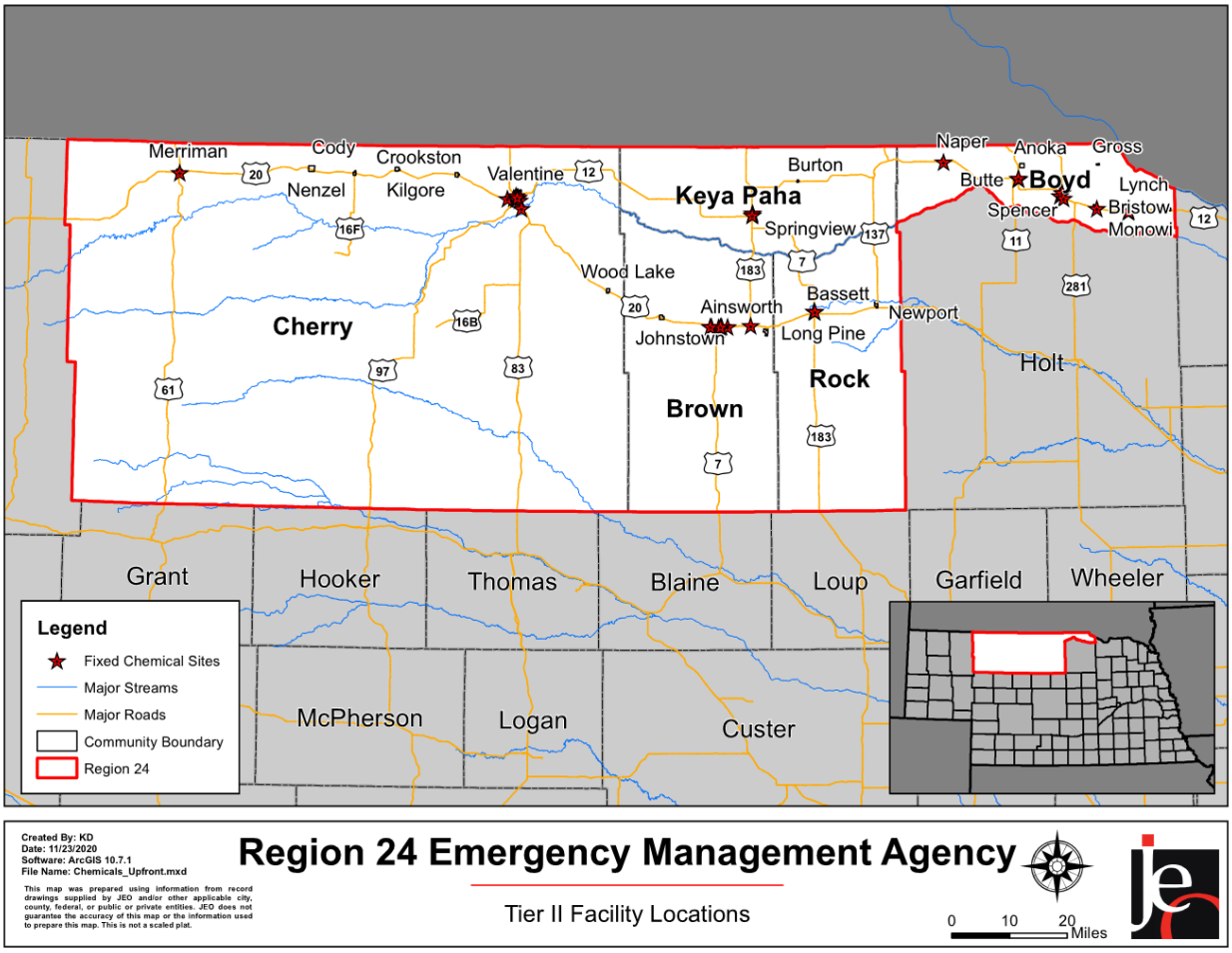
Source: Emergency Response Guidebook, 2016[48]

Location

There are 33 locations across the planning area that house hazardous materials, according to the Tier II reports submitted to the Nebraska Department of Environment and Energy (NDEE) in 2019. A list of chemical storage sites can be found in *Section Seven: Community Profiles* for each county. Figure 17 shows the location of the chemical sites. There are no facilities that house radiological materials.

48 U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration. 2016. "2016 Emergency Response Guidebook." https://www.phmsa.dot.gov/hazmat/outreach-training/erg.

Figure 17: Tier II Facility Locations



Historical Occurrences

According to the U.S Coast Guard's National Response Center (NRC) database, there has been one fixed site chemical spill from 1990 to February 2020 in the planning area. There were no reported property damages or evacuations form the chemical spill. The following table lists the chemical information.

Table 43: Chemical Fixed Site Incidents

Year of Event	Location of Release	Quantity Spilled	Material Involved	Number of Injuries
1992	Ainsworth	800 Pounds	Anhydrous Ammonia	0

Source: National Response Center, 1990-Feb. 2020[49]

Extent

The extent of chemical spills at fixed sites varies and depends on the type of chemical that is released, with most events localized to the facility. One release has occurred in the planning area, and the total amount spilled was 800 pounds of anhydrous ammonia.

49 U.S. Coast Guard National Response Center. 2020. "Chemical Pollution and Railroad Incidents, 1990-February 2020." [datafile]. https://nrc.uscg.mil/.

Probability

Given the historic record of occurrence (one chemical fixed site spill reported in 30 years), the probability of occurrence for chemical fixed site spills is three percent annually.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 44: Regional Chemical and Radiological Fixed Site Vulnerabilities

Sector	Vulnerability
People	-Those in proximity could have minor to severe health impacts -Possible evacuation -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
Economic	-A chemical plant shutdown in smaller communities would have significant impacts on the local economy
Built Environment	-Risk of fire or explosion
Infrastructure	-Transportation routes can be closed during evacuations
Critical Facilities	-Critical facilities are at risk of evacuation or damage from fire or explosion
Climate	-None

Chemical and Radiological Hazards (Transportation)

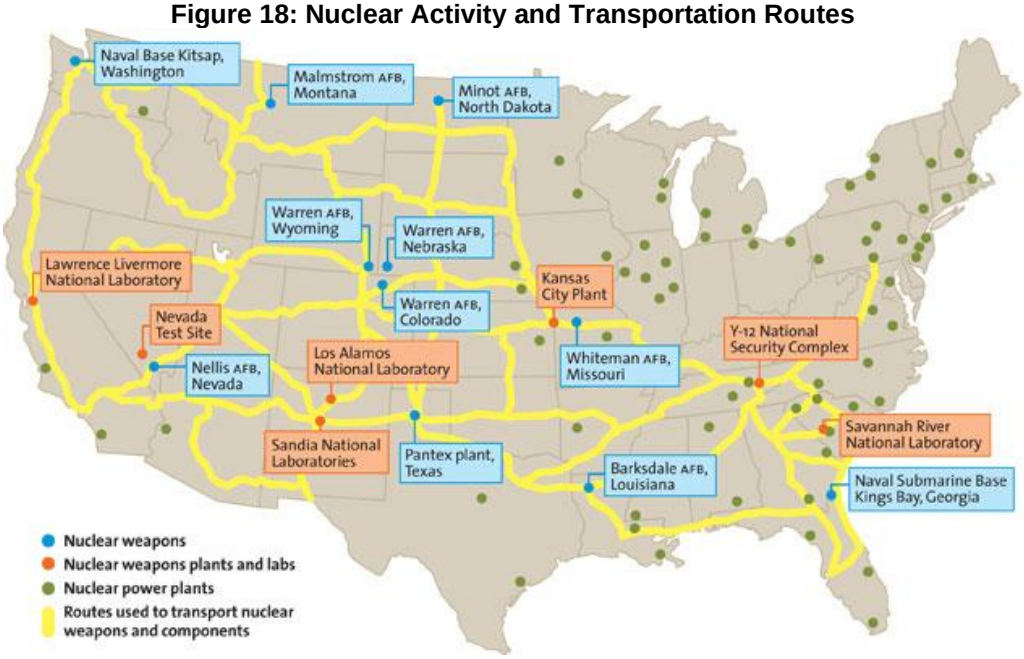
The transportation of hazardous materials is defined by the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) as "…a substance that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce…"[50] According to PHMSA, hazardous materials traffic in the U.S. now exceeds 1,000,000 shipments per day.[51]

Nationally, the U.S has had 116 fatalities associated with the transport of hazardous materials between 2007 through 2017.[52] While such fatalities are a low probability risk, even one event can harm many people. For example, a train derailment in Crete, Nebraska, in 1969 allowed anhydrous ammonia to leak from a ruptured tanker. The resulting poisonous fog killed nine people and injured 53.

Location

Chemical releases can occur during transportation, primarily on major transportation routes as identified in Figure 18 and Figure 19. A large number of spills also typically occur during the loading and unloading of chemicals. According to PHMSA there is one gas transmission pipeline traveling through Brown and Rock Counties.[53]

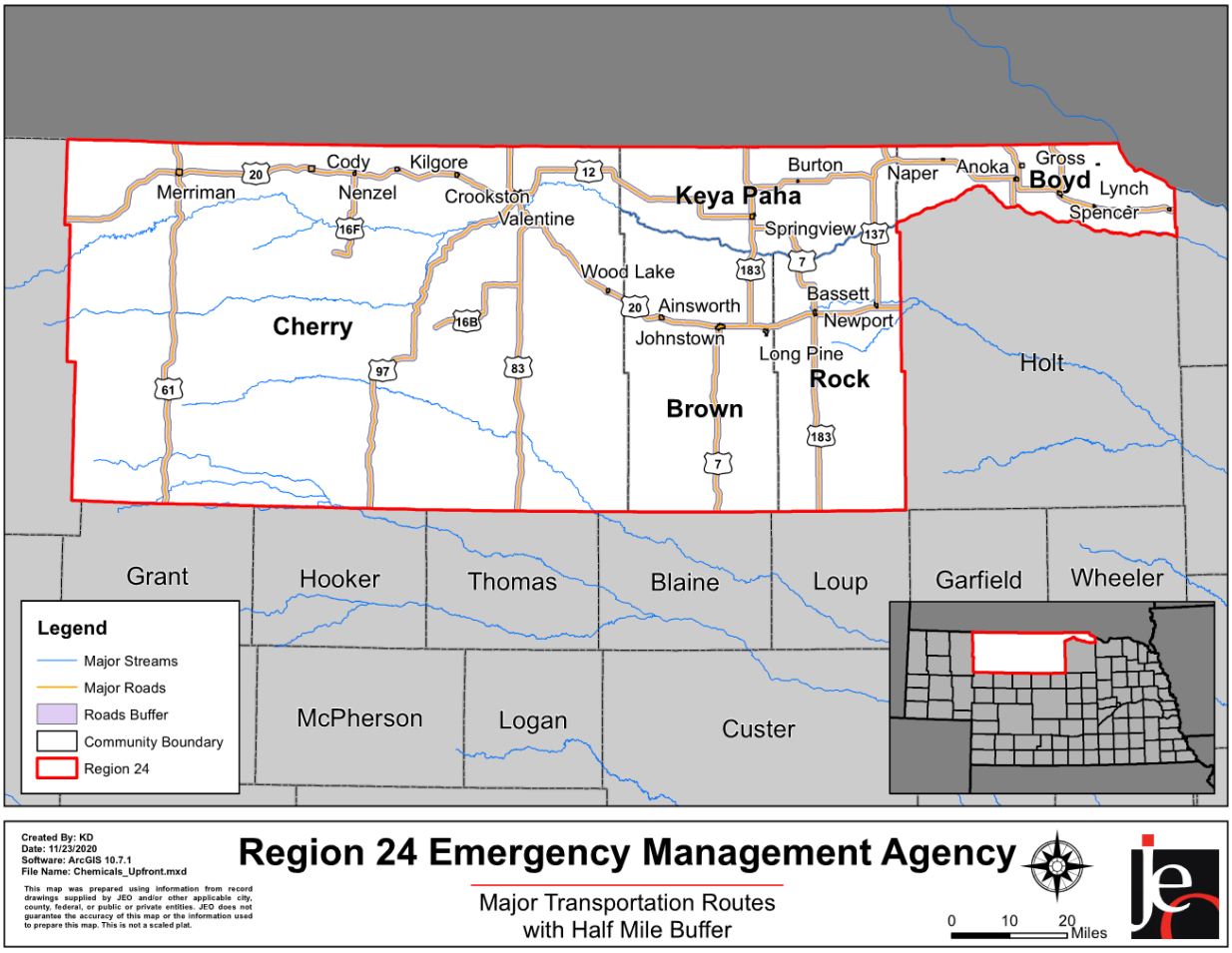
Figure 18: Nuclear Activity and Transportation Routes



Source: Jeff Berlin

50 Pipeline and Hazardous Materials Safety Administration. 2018. "Hazmat Safety Community FAQ." https://phmsa.dot.gov/regulations.
51 U.S. Department of Transportation. 2015. "2012 Economic Census: Transportation." https://www.census.gov/library/publications/2015/econ/ec12tcf-us.html.
52 Pipeline and Hazardous Materials Safety Administration. 2017. "10 Year Incident Summary Reports." https://www.phmsa.dot.gov/hazmat/library/data-stats/incidents.
53 Pipeline and Hazardous Materials Safety Administration. 2019. "National Pipeline Mapping System." https://www.npms.phmsa.dot.gov/.

Figure 19: Major Transportation Routes with Half Mile Buffer



Historical Occurrences

PHMSA reports that three chemical spills have occurred during transportation in the planning area between 1971 and June 2020. During these events, there was $330 in damages and no fatalities or injuries. There were no reports of radiological incidents during transportation in the planning area. The following table provides a list of the chemical transportation events in the planning area.

Table 45: Historical Chemical Spills 1971-June 2020

Date of Event	Location of Release	Failure Description	Material Involved	Transportation Method	Injuries or Fatalities	Total Damage
3/30/1975	Valentine	Freezing	Gasoline	Highway	0	$0
8/9/1978	Kilgore	Loose Component	218 LGA Gasoline	Highway	0	$0
6/12/2000	Bassett	Vehicle Accident	134 CF Anhydrous Ammonia	Highway	0	$330

Source: PHMSA, 1971-June 2020[54]

54 Pipeline and Hazardous Materials Safety Administration. 2020. "Office of Hazardous Materials Safety: Incident Reports Database Search." Accessed July 2020. https://www.phmsa.dot.gov/hazmat/library/data-stats/incidents.

Extent

The probable extent of chemical spills during transportation is difficult to anticipate and depends on the type and quantity of chemical released. Releases that have occurred during transportation in the planning area ranged from zero to 218 liquid gallons (LGA) and 135 cubic feet (CF). None of the events led to an evacuation. Based on historic records, it is likely that any spill involving hazardous materials that occurs will not affect an area larger than a tenth of a mile from the spill location.

Average Annual Losses

The average damage per event estimate was determined based upon PHMSA's Incidents Reports since 1971 and the number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. This hazard causes, on average, less than $7 per year in property damages.

Table 46: Chemical Transportation Losses

Hazard Type	Number of Events	Events Per Year	Total Property Loss	Average Annual Property Loss
Chemical Transportation Spills	3	0.06	$330	$7
Radiological Transportation Spills	0	N/A	N/A	N/A

Source: PHMSA 1971-June 2020

Probability

The historical record indicates that chemical releases during transportation have a six percent chance of occurring annually in planning area.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 47: Regional Chemical and Radiological Transportation Vulnerabilities

Sector	Vulnerability
People	-Those in close proximity to transportation corridors -Possible evacuation -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
Economic	-Evacuations and closed transportation routes could impact businesses near spill
Built Environment	-Risk of fire or explosion
Infrastructure	-Transportation routes can be closed
Critical Facilities	-Critical facilities near major transportation corridors are at risk
Climate	-None

Civil Disorder

Civil disorder, also known as civil unrest or civil strife, is a broad term that is typically used by law enforcement to describe one or more forms of unrest caused by a group of people. Civil disturbance is typically a symptom of, and a form of protest against major socio-political problems; the severity of the action coincides with public expression(s) of displeasure. Examples of civil disorder include but are not necessarily limited to illegal parades; sit-ins and other forms of obstructions; riots; sabotage; and other forms of crime. It is intended to be a demonstration to the public and the government but can escalate into general chaos.

Though peaceful public demonstrations are allowed under US Federal law, any domestic situations such as a strike or riot involving three or more people could be considered a civil disorder event if the demonstration has devolved into having a potential for causing injuries, casualties, or property damage.[55]

Location

Urban areas or areas with controversial projects such as pipelines are most likely to experience this hazard. Historical occurrences suggest that the most likely location of occurrence is at governmental offices and other gathering sites for large crowds.

Historical Occurrences

Through discussions with the hazard mitigation planning team and participating jurisdictions, there is no record of civil disorder in the planning area. Although there are no records of civil disorder in the region, the Planning Team wanted to include this hazard because of the Keystone Pipeline which runs through this region and because of recent national events that occurred in 2020 and 2021.

Extent

The impacts of civil disorder can vary greatly in scale and magnitude. As this event has not occurred in the planning area the extent for this hazard is unknown.

Average Annual Losses

The average damage per event estimate was determined based on local events identified by the hazard mitigation planning team and participating jurisdictions. As there have been no events this hazard causes $0 per year in property damages.

Table 48: Civil Disorder Losses

Hazard Type	Number of Events	Events Per Year	Total Property Loss	Average Annual Property Loss
Civil Disorder	0	N/A	N/A	N/A

Source: Hazard Mitigation Planning Team and Participating Jurisdictions

Probability

Given the historic record of occurrence (no reported events), the probability of occurrence for civil disorder is less than one percent annually.

55 Civil Disorders, 18 U.S. Code Section 231-233 (1992)

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 49: Civil Disorder Vulnerability

Sector	Vulnerability
People	-Police officers at risk of injury -Civilians at risk of injury -Possible curfews implemented by local governments
Economic	-Damage to businesses can cause loss of revenue and loss of income for workers -Risk of violence in an area can reduce income flowing into and out of that area
Built Environment	-Public property may be at risk of damage from thrown items or fire
Infrastructure	-Lights, hydrants, and other utilities are at risk of damage
Critical Facilities	-Police stations and governmental offices are at higher risk
Climate	-Activism pertaining to climate can place first responders and residents at risk

Dam 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."[56]

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 50: 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[57]

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.

56 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.

57 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 and USACE regulate dam safety in Nebraska and across the country. 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.

Location

According to USACE's National Inventory of Dams, there are a total of 85 dams located within the five-county planning area, with classifications ranging from low to high hazard. Figure 20 maps the location of these dams.

Table 51: Dam Classification in the Planning Area

County	Low Hazard	Significant Hazard	High Hazard
Boyd	23	0	0
Brown	8	0	0
Cherry	23	1	1
Keya Paha	25	1	0
Rock	3	0	0
Total	**82**	**2**	**1**

Source: USACE, 2020

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

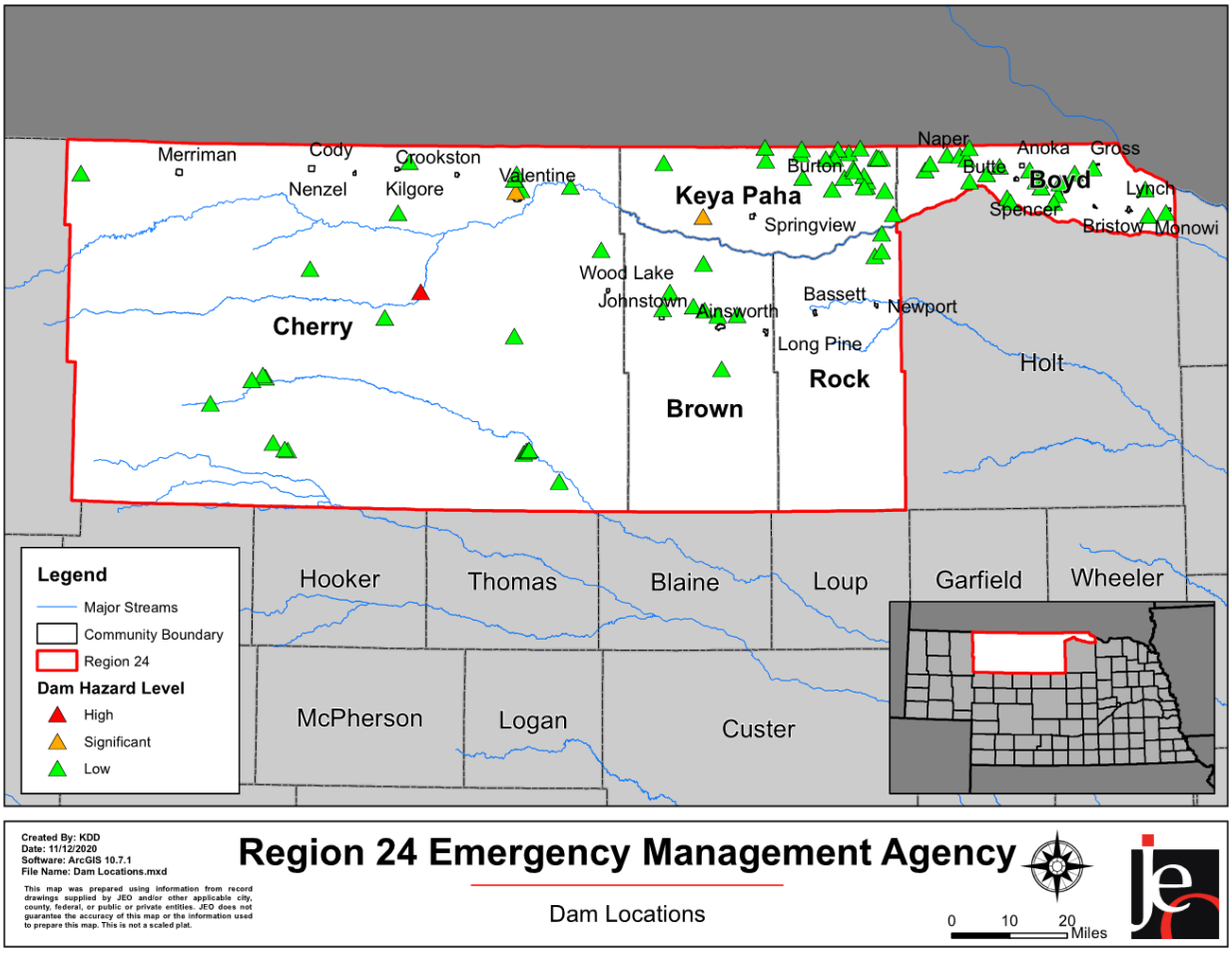
when flood releases will create major flooding. An emergency situation can occur at any time; however, emergencies are more likely to happen when extreme conditions are present. There is one high hazard dam located within the planning area.

Table 52: High Hazard Dams in the Planning Area

County	Dam Name	NID ID	Purpose	Dam Hight (Feet)	Max Storage (Acre-Feet)	Last Inspection Date
Cherry	Merritt Dam	NE01074	Irrigation	121	78,375	9/24/2019

Source: USACE, 2020

Figure 20: Dam Locations



Upstream Dams Outside the Planning Area

There is only one upstream dam that could affect the planning area. Data on this dam is provided in the following table.

Table 53: Upstream Dams

Dam Name	Location	Owner	Hazard Potential
Fort Randall Dam	Lake Andes, South Dakota	U.S Army Corps of Engineers	High

Source: Boyd County LEOP, Brown County LEOP, Cherry County LEOP, Keya Paha County LEOP, Rock County LEOP

Historical Occurrences

According to the Stanford University National Performance of Dams Program and the NeDNR dam inventory map, there have been 12 dam failure events within the planning area. The following table lists information about these failure events. There were no reported damages from the dam failure events.

Table 54: Dam Failure Events

Dam Name	County	Failure Year	Downstream Community	Hazard Potential	Downstream Damage	Rebuilt
Valentine Fish Hatchery Dam	Cherry	1911	Meadville	Low	Unknown	Yes
Ainsworth Dam	Brown	1913	Ainsworth	Low	Unknown	Yes
Ainsworth Dam	Brown	1962	Ainsworth	Low	Unknown	Yes
Lost Creek Dam	Cherry	1970	N/A	N/A	None Reported	No
Wallenstein Dam	Brown	1972*	Niobrara	Low	None Reported	No
Crawford Dam	Brown	1976*	N/A	Low	Unknown	No
Cox Dam 1-A	Cherry	1986*	Brewster	Low	None Reported	Yes
Gordon Valley Dam	Cherry	1993*	Valentine	Low	None Reported	No
Dickau Dam	Rock	1994*	N/A	Low	None Reported	Yes
Horseshoe Dam	Keya Paha	1995*	Niobrara	Low	None Reported	No
Sloan Dam	Keya Paha	1999*	Mills	Low	None Reported	No
Potter Dam 2	Cherry	2017	Niobrara	Low	None Reported	No

Source: Stanford University, 1890-2018[58] and NeDNR, 2020[59]
**Year of failure is estimated based on periodic inspection reports.*

Spencer Dam Failure

Although not technically located in the planning area, the Spencer Dam failure in March 2019 should be discussed due to its impact on the planning area. The Spencer Dam is located on the Niobrara River between Holt and Boyd Counties directly west of the Highway 281 bridge. In March 2019 warm weather and heavy precipitation caused ice jams along the Niobrara River to be released. Large ice blocks weighing between two and 20 tons were carried downstream and helped lead to the complete failure of the Spencer Dam. All structures immediately below the dam were washed away. This included Highway 281, campsites, a house, and resulted in one fatality. Further downstream the failure further exacerbated flooding in both Boyd and Holt Counties.

For a detailed report on the Spencer Dam Failure, see the *Spencer Dam Failure Investigation Report* by the Association of State Dam Safety Officials (https://damsafety-prod.s3.amazonaws.com/s3fs-public/files/Spencer%20Dam%20Report%20Final.pdf).[60]

58 Stanford University National Performance of Dams Program. 2018. "NPDP Dam Incident Database." https://npdp.stanford.edu/dam_incidents.
59 Nebraska Department of Natural Resources. 2020. Direct Correspondence
60 Association of State Dam Safety Officials. April 2020. “Spencer Dam Failure Investigation Report”. https://damsafety-prod.s3.amazonaws.com/s3fs-public/files/Spencer%20Dam%20Report%20Final.pdf.

Extent

Areas (i.e. agricultural land, out buildings, county roads, and communities) directly downstream of dams are at greatest risk in the case of dam failure. The extent of dam failure is indicated by its hazard classification and location. Note that 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 case of a failure. Thus, the high hazard dam in the planning area would have the greatest impact if it 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.

Average Annual Losses

There were no reported damages from any of the dam failures. In general, dam failure events would be confined to damage in the inundation area. Community members in the planning area that wish to quantify and evaluate the threat of dam failure should contact their County Emergency Management, local NRD, or the NeDNR to view EAPs and breach inundation area maps.

Probability

There have been 12 years with a reported dam failure out of 129 years, so the probability of dam failure will be stated as nine percent annually.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 55: Dam Failure Vulnerabilities

Sector	Vulnerability
People	-Those living downstream of high hazard dams -Evacuation likely with high hazard dams -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
Economic	-Businesses located in the inundation areas would be impacted and closed for an extended period of time -Employees working in the inundation area may be out of work for an extended period of time
Built Environment	-Damage to homes and buildings
Infrastructure	-Transportation routes could be closed for extended periods of time
Critical Facilities	-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 can constrain energy production and reservoir storages

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.

Drought is a slow-onset, creeping phenomenon that can affect a wide range of people and industries. While many drought impacts are non-structural, there is the potential that during extreme or 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:

> **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

- **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.

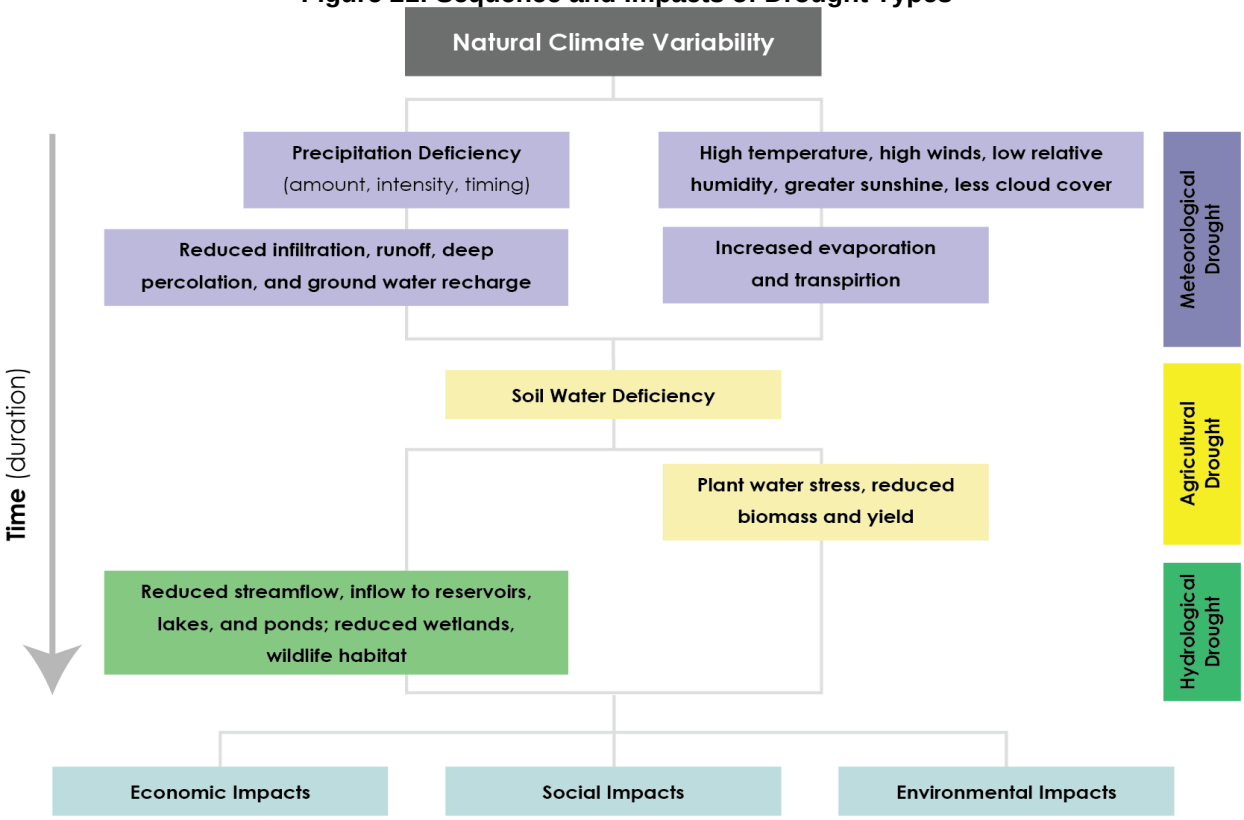
- **Hydrological Drought** occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives average precipitation. This is due to the reserves diminishing from increased water usage, usually from agricultural 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.[61]

The following figure indicates different types of droughts, their temporal sequence, and the various types of effects they can have on a community.

61 National Weather Service. 2020. “Heat Watch vs. Warning.” https://www.weather.gov/safety/heat-ww.

Figure 21: Sequence and Impacts of Drought Types



Source: National Drought Mitigation Center, University of Nebraska-Lincoln, 2017[62]

Location

The entire planning area is susceptible to drought impacts.

Historical Occurrences

Table 56 indicates it is reasonable to expect extreme drought to occur 8.4% of the time for the planning area (126 extreme drought months in 1,504 months). Severe drought occurred in 75 months of the 1,504 months of record (5.0% of months). Moderate drought occurred in 96 months of the 1,504 months of record (6.4% of months), and mild drought occurred in 135 of the 1,504 months of record (9.0% of months). Non-drought conditions occurred in 1,072 months, or 71.3% 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 23 inches according to the NCEI.[63]

62 National Drought Mitigation Center. 2017. “Types of Drought.” http://drought.unl.edu/DroughtBasics/TypesofDrought.aspx.
63 NOAA National Centers for Environmental Information. November 2020. "Data Tools: 1981-2010 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Table 56: Historic Droughts

Drought Magnitude	Months in Drought	Percent Chance
-1 Magnitude (Mild)	135/1,504	9.0%
-2 Magnitude (Moderate)	96/1,504	6.4%
-3 Magnitude (Severe)	75/1,504	5.0%
-4 Magnitude or Greater (Extreme)	126/1,504	8.4%

Source: NCEI, 1895-May 2020[64]

Extent

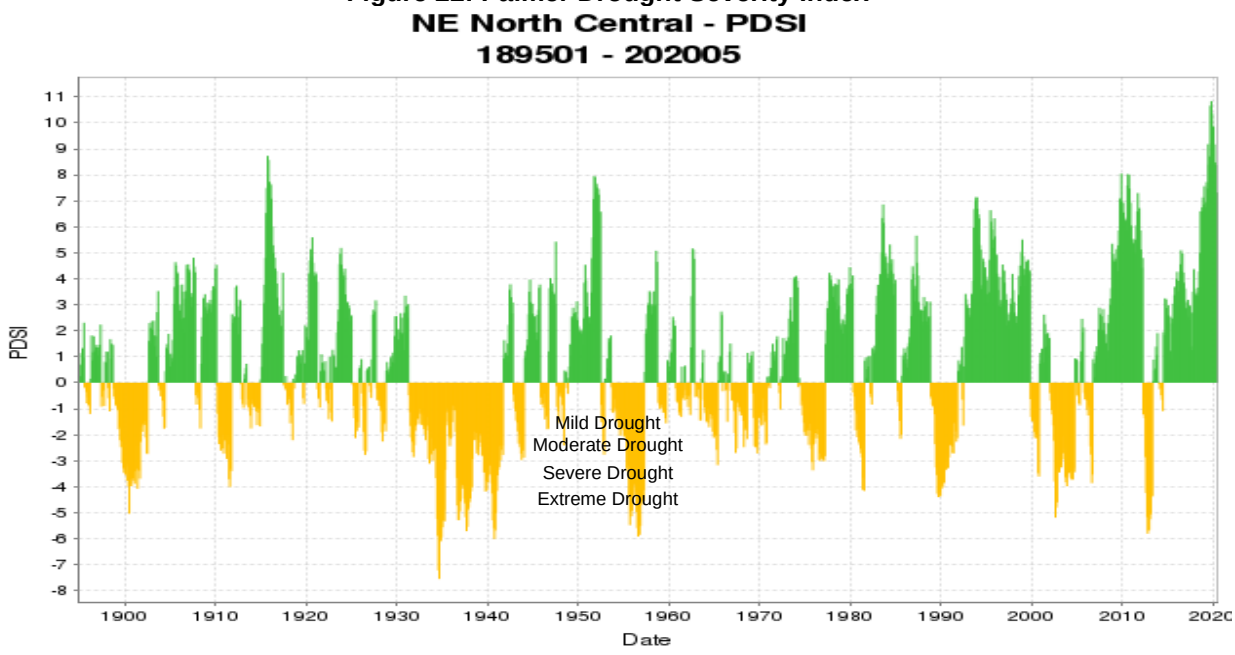
The Palmer Drought Severity Index (PDSI) is utilized by climatologists to standardize global long-term drought analysis. The data for the planning area was collected for Climate Division 2, which includes the planning area. This station's period of record started in 1895. Table 57 shows the details of the Palmer classification. Figure 22 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 57: 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[65]

Figure 22: Palmer Drought Severity Index

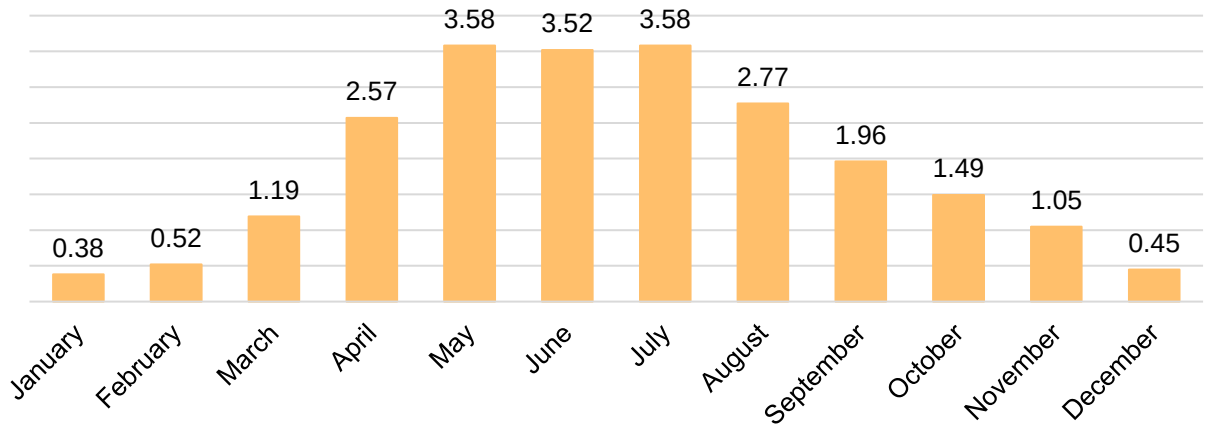


Source: NCEI, 1895-May 2020

64 National Centers for Environmental Information. 1895-2020. Accessed June 17, 2020. https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp.
65 National Weather Service. 2017. "Climate Prediction Center." https://www.cpc.ncep.noaa.gov/.

Figure 23 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 precipitation. Prolonged deviation from the norm showcase drought conditions and influence growing conditions for farmers.

Figure 23: Region 24 Average Monthly Precipitation (Inches)



Source: NCEI, 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 damage infrastructure.

Table 58: Loss Estimate for Drought

Hazard Type	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Drought	$72,000,000	$2,880,000	$35,047,100	$1,668,910

Source: 1 Indicates data is from NCEI (Jan 1996-March 2020); 2 Indicates data is from USDA RMA (2000-June 2020)

Probability

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

Table 59: Period of Record in Drought

PDSI Value	Magnitude	Drought Occurrences by Month	Monthly Probability
4 or more to -0.99	No Drought	1,072/1,504	71.3%
-1.0 to -1.99	Mild Drought	135/1,504	9.0%
-2.0 to -2.99	Moderate Drought	96/1,504	6.4%
-3.0 to -3.99	Severe Drought	75/1,504	5.0%
-4.0 or less	Extreme Drought	126,1,504	8.4%

Source: NCEI, 1895-May 2020[66]

66 National Centers for Environmental Information. 1895-2020. Accessed June 17, 2020. https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp.

Regional Vulnerabilities

The Drought Impact Reporter is a database of drought impacts throughout the United States with data going back to 1900. The Drought Impact Reporter has recorded a total of 35 drought-related impacts throughout the five-county area, which are summarized in the following table. This is not a comprehensive list of droughts which may have impacted the planning area.

Table 60: Drought Impacts in Planning Area

Category	Date	Affected Counties	Title
Agriculture, Relief, Response & Restrictions	1/9/2014	Brown, Cherry, Keya Paha, Rock	Drought-Related USDA Disaster Declarations
Fire, Relief, Response & Restrictions, Tourism & Recreation	8/30/2013	Brown, Cherry	Campers in western Nebraska were urged to be particularly careful with campfires over the Labor Day weekend
Agriculture, Relief, Response & Restrictions	1/9/2013	Cherry, Rock	Drought-related USDA disaster declarations
Agriculture, Water Supply & Quality	8/7/2012	Boyd, Brown, Keya Paha, Rock	Nebraska ranchers hauling water to livestock
Agriculture, Fire	7/27/2012	Brown, Keya Paha, Rock	Fire in north central Nebraska consumed precious hay, pasture
Agriculture, Relief, Response & Restrictions, Water Supply & Quality	7/19/2012	Boyd, Rock	Low flow in several Nebraska rivers brought surface irrigation closures
Fire, Relief, Response & Restrictions	6/28/2012	Boyd, Brown, Cherry, Keya Paha, Rock	Nebraskans urged to leave the fireworks to the professionals
Plants & Wildlife	6/1/2012	Brown, Cherry, Keya Paha	Many trees in western Nebraska died from drought, high temperatures and strong winds
Plants & Wildlife	5/1/2012	Boyd, Brown, Cherry	Grass planted on new levees along the Missouri River in eastern Nebraska was slow to grow
Agriculture, Plants & Wildlife	5/1/2012	Boyd, Keya Paha, Rock	Drought led ranchers in western Nebraska to cull cow herds by 25 to 60 percent
Relief, Response & Restrictions	8/1/2007	Cherry	Relief, Response & Restrictions impact
Water Supply & Quality	10/1/2006	Boyd	Water Supply & Quality impact
Relief, Response & Restrictions	9/13/2006	Boyd, Brown, Cherry, Keya Paha, Rock	Relief, Response & Restrictions impact
Relief, Response & Restrictions	7/17/2006	Boyd, Brown, Cherry, Keya Paha, Rock	Relief, Response & Restrictions impact
Fire	7/14/2006	Cherry	Fire impact
Water Supply & Quality	10/5/2005	Boyd	Water Supply & Quality impact
Agriculture, Fire, Water Supply & Quality	9/28/2005	Cherry	Agriculture, Fire, Water Supply & Quality impact
Fire	7/29/2005	Cherry	Fire impact

Category	Date	Affected Counties	Title
Water Supply & Quality	7/26/2005	Boyd	Water Supply & Quality impact
Water Supply & Quality	5/2/2005	Boyd	Water Supply & Quality impact
Water Supply & Quality	5/1/2005	Boyd	Water Supply & Quality impact
Water Supply & Quality	4/12/2005	Boyd	Water Supply & Quality impact
Relief, Response & Restrictions	1/13/2004	Boyd, Brown, Cherry, Keya Paha, Rock	Relief, Response & Restrictions impact
Relief, Response & Restrictions	1/1/2004	Boyd, Brown, Rock	Relief, Response & Restrictions impact
Plants & Wildlife	9/12/2003	Boyd, Brown, Keya Paha, Rock	Plants & Wildlife impact from Media
Relief, Response & Restrictions	1/1/2003	Boyd, Brown, Cherry, Keya Paha, Rock	Relief, Response & Restrictions impact
Agriculture	1/1/2003	Boyd, Brown, Cherry, Keya Paha, Rock	Agriculture impact
Agriculture	9/1/2002	Boyd, Cherry	Agriculture impact
Agriculture	9/1/2002	Boyd, Brown, Cherry, Keya Paha, Rock	Agriculture impact
Water Supply & Quality	6/18/2001	Boyd	Water Supply & Quality
Water Supply & Quality	12/18/2000	Boyd	Water Supply & Quality
Fire	3/16/1999	Cherry	Fire impact
Relief, Response & Restrictions	8/17/1988	Boyd, Cherry	Relief, Response & Restrictions impact
Agriculture, Relief, Response & Restrictions	8/1/1953	Boyd, Brown, Cherry, Keya Paha, Rock	Nebraska's corn yield estimate revised downward
Plants & Wildlife	1/1/1934	Cherry	Plants & Wildlife impact

Source: NDMC, 1900-June 2020[67]

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

67 National Drought Mitigation Center. 2020. "U.S. Drought Impact Reporter." Accessed June 2020. http://droughtreporter.unl.edu/map/.

Table 61: Regional Drought 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 tourism dollars -Decrease in cattle prices -Decrease of land prices may jeopardize educational funds
Built Environment	-Cracking foundations (residential and commercial structures) -Damages to landscapes
Infrastructure	-Damages to waterlines below grounds -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 -Changes in annual precipitation can be detrimental to agriculture and energy production sectors

Earthquakes

An earthquake is the result of a sudden release of energy in the Earth's tectonic plates that creates seismic waves. The seismic activity of an area refers to the frequency, type, and size of earthquakes experienced over a period of time. Although rather uncommon, earthquakes do occur in Nebraska and are usually small, generally not felt, and cause little to no damage. Earthquakes are measured by magnitude and intensity. Magnitude is measured by the Richter Scale, a base-10 logarithmic scale, which uses seismographs around the world to measure the amount of energy released by an earthquake. Intensity is measured by the Modified Mercalli Intensity Scale, which determines the intensity of an earthquake by comparing actual damage against damage patterns of earthquakes with known intensities. The following tables summarize the Richter Scale and Modified Mercalli Scale.

Table 62: Richter Scale

Richter Magnitudes	Earthquakes Effects
Less than 3.5	Generally not felt but recorded.
3.5 – 5.4	Often felt, but rarely causes damage.
Under 6.0	At most, slight damage to well-designed buildings. Cas cause major damage to poorly constructed buildings over small regions.
6.1 – 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 – 7.9	Major earthquake. Can cause serious damage over larger areas.
8.0 or Greater	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: FEMA, 2016[68]

Table 63: Modified Mercalli Intensity Scale

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	
II	Feeble	Some people feel it	< 4.2
III	Slight	Felt by people resting, like a truck rumbling by	
IV	Moderate	Felt by people walking	
V	Slightly Strong	Sleepers awake; church bells ring	< 4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves	< 5.4
VII	Very Strong	Mild Alarm; walls crack; plaster falls	< 6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	< 6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	< 7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	< 8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>8.1

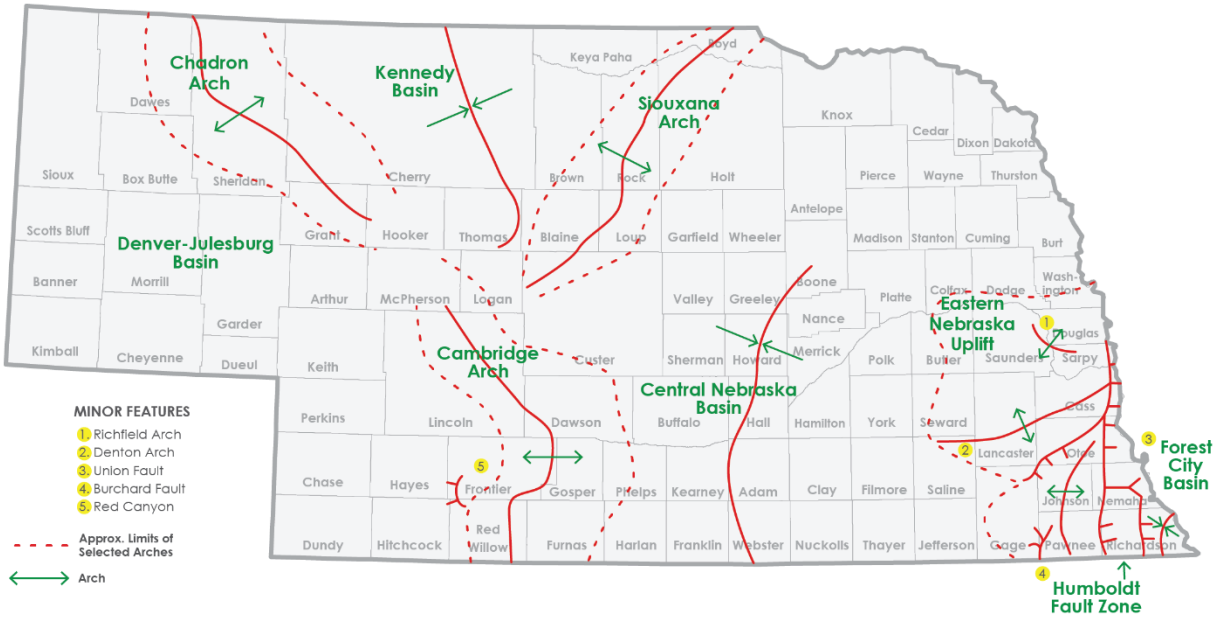
Source: FEMA, 2016

68 Federal Emergency Management Agency. 2016. "Earthquake." https://www.fema.gov/earthquake.

Location

The planning area has a few fault lines crossing it. The Siouxana Arch, Kennedy Basin, and Chadron Arch are features that occur in the planning area. The following figure shows the fault lines in Nebraska.

Figure 24: Fault Lines in Nebraska



Source: Nebraska Department of Natural Resources

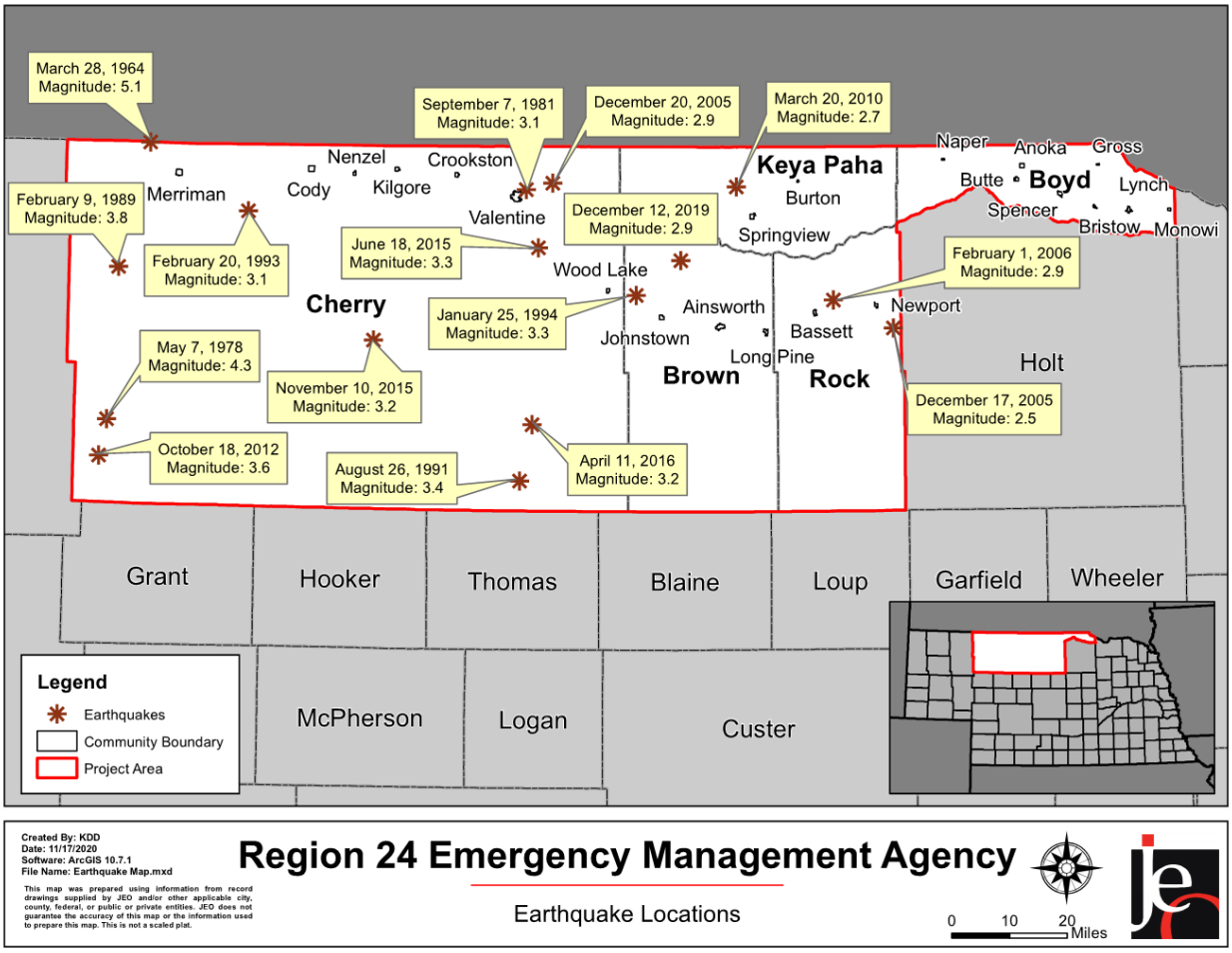
Historical Occurrences

Figure 25 displays historical occurrences of earthquakes in the planning area since 1900. Sixteen earthquakes have occurred. The strongest earthquake was a 5.1 in March 1964 that occurred in northwestern Cherry County. The second strongest earthquake was a 4.3 in May 1978 in southwestern Cherry County. None of the earthquakes caused any known damage.

Extent

If an earthquake were to occur in the region, it would likely measure 5.0 or less on the Richter Scale. Very little to no damage is anticipated from events of these magnitudes.

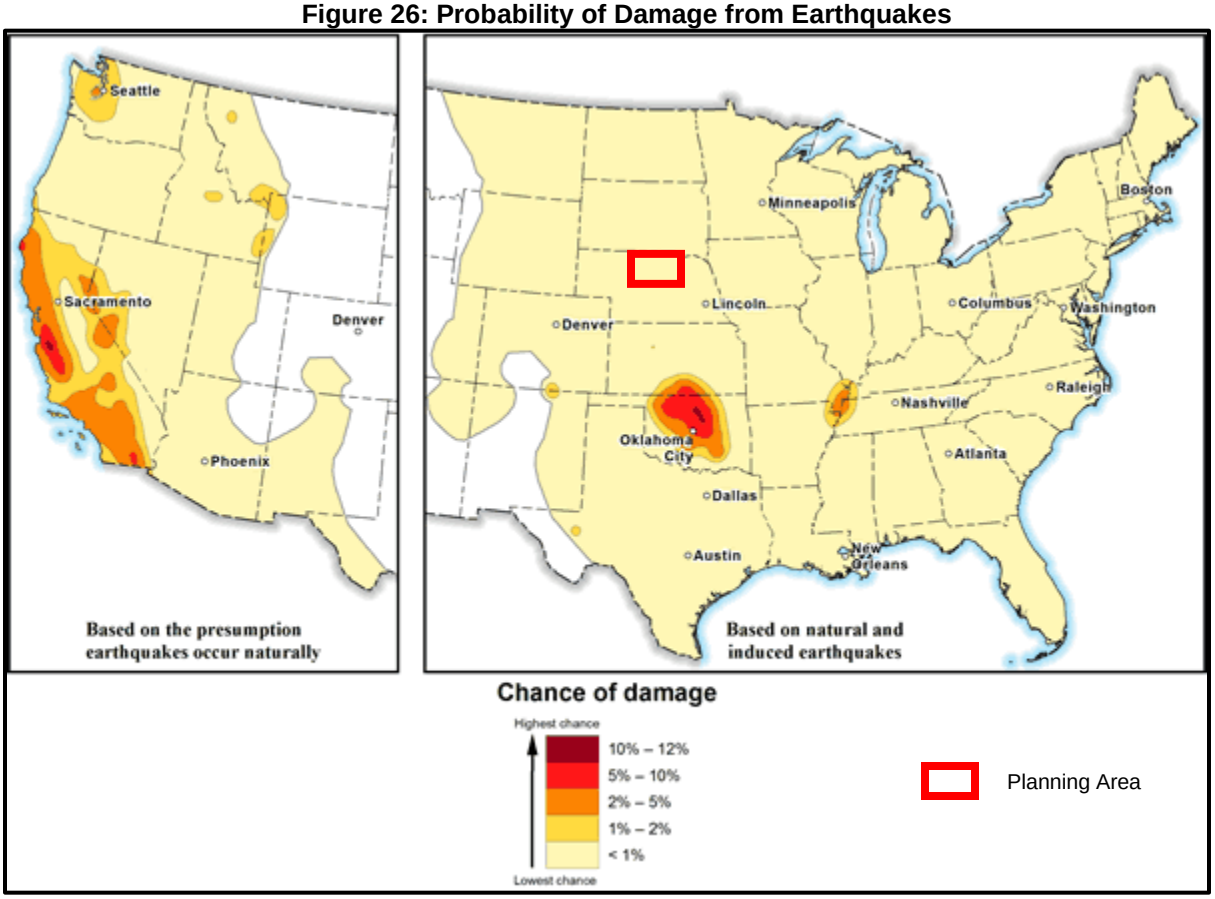
Figure 25: Earthquakes in Region 24



Average Annual Losses

Due to the lack of reported damages from earthquakes and low earthquake risk for the planning area, it is not feasible to utilize the 'event damage estimate formula' to estimate potential losses for the planning area. Figure 26 shows the probability of damage from earthquakes, according to the United States Geological Survey (USGS). The figure shows that the planning area has a less than one percent chance of damages from earthquakes.

Figure 26: Probability of Damage from Earthquakes



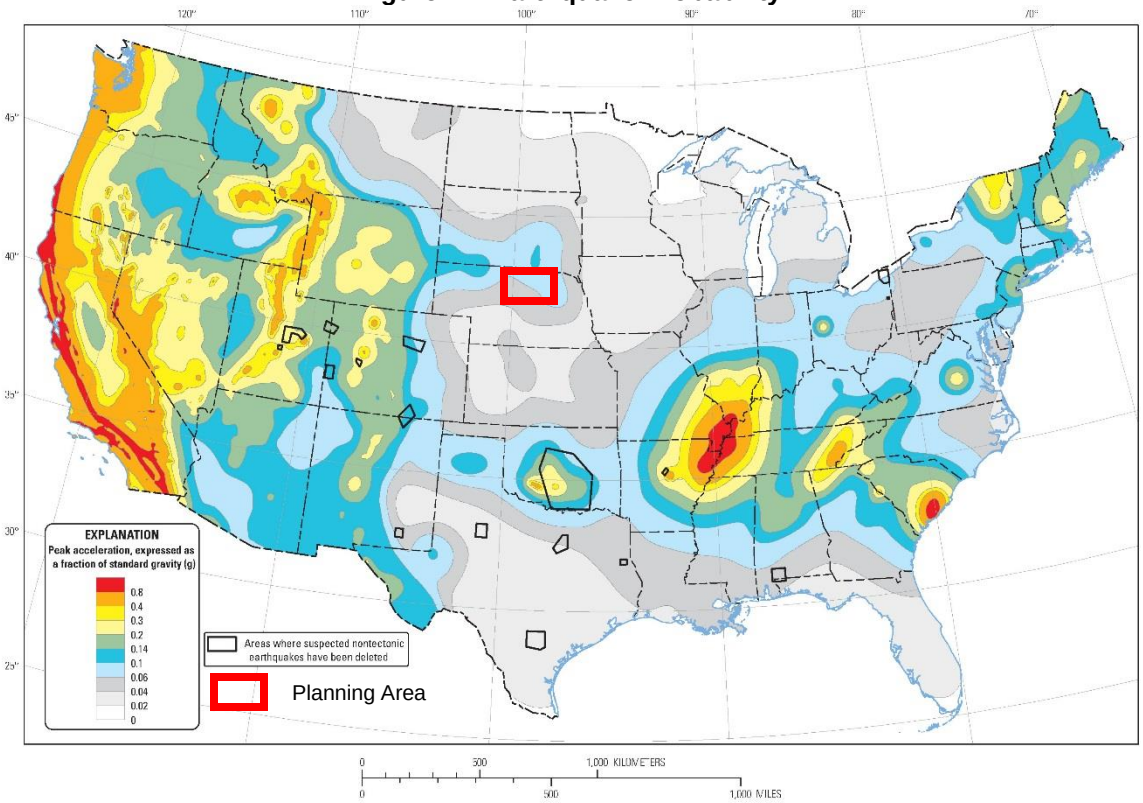
Source: USGS, 2017[69]

Probability

The following figure visualizes the probability of a 5.0 or greater earthquake occurring in the planning area within 50 years. Based on the 14 years with a recorded occurrence of an earthquake over a 121-year period, the probability of an earthquake in the five-county region in any given year is twelve percent.

69 United States Geological Survey. 2017. "Short-term Induced Seismicity Models: 2017 One-Year Model." https://earthquake.usgs.gov/hazards/induced/index.php#2017.

Figure 27: Earthquake Probability



Source: USGS 2009 PSHA Model
**Maps shows up to a ten-percent probability of exceedance in 50 years of peak ground acceleration.*

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 64: Regional Earthquake Vulnerabilities

Sector	Vulnerability
People	-Risk of injury or death from falling objects and structures
Economic	-Short term interruption of business
Built Environment	-Damage to buildings, homes, or other structures form foundation cracking, falling objects, shattered windows, etc.
Infrastructure	-Damage to subterranean infrastructure (i.e. waterlines, gas lines, etc.) -Damage to roadways
Critical Facilities	-Same as all other structures
Climate	-None

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.

Along with humans, animals also can be affected by high temperatures and humidity. 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 excess heat event in the next three to seven days. Excessive heat outlooks can be utilized by public utility staff, 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.

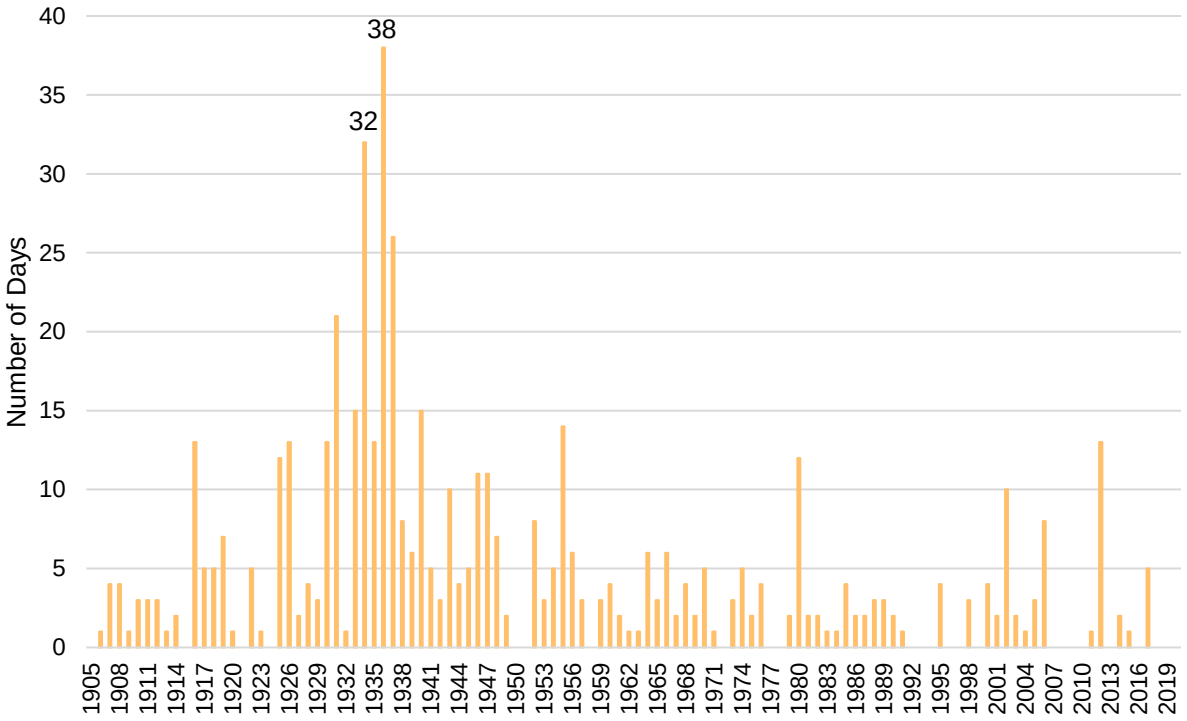
Location

The entire planning area is susceptible to extreme heat impacts.

Historical Occurrences

According to the NOAA Regional Climate Center, on average, the planning area experiences an average of five days above 100°F per year. The planning area experienced the most days on record above 100°F in 1936 with 38 days and in 1934 with 32 days. Conversely, 2019 was the most recent “coolest” year on record, with zero days above 100°F.

Figure 28: Number of Days Above 100°F



Source: NOAA, 1905-Jun 2020

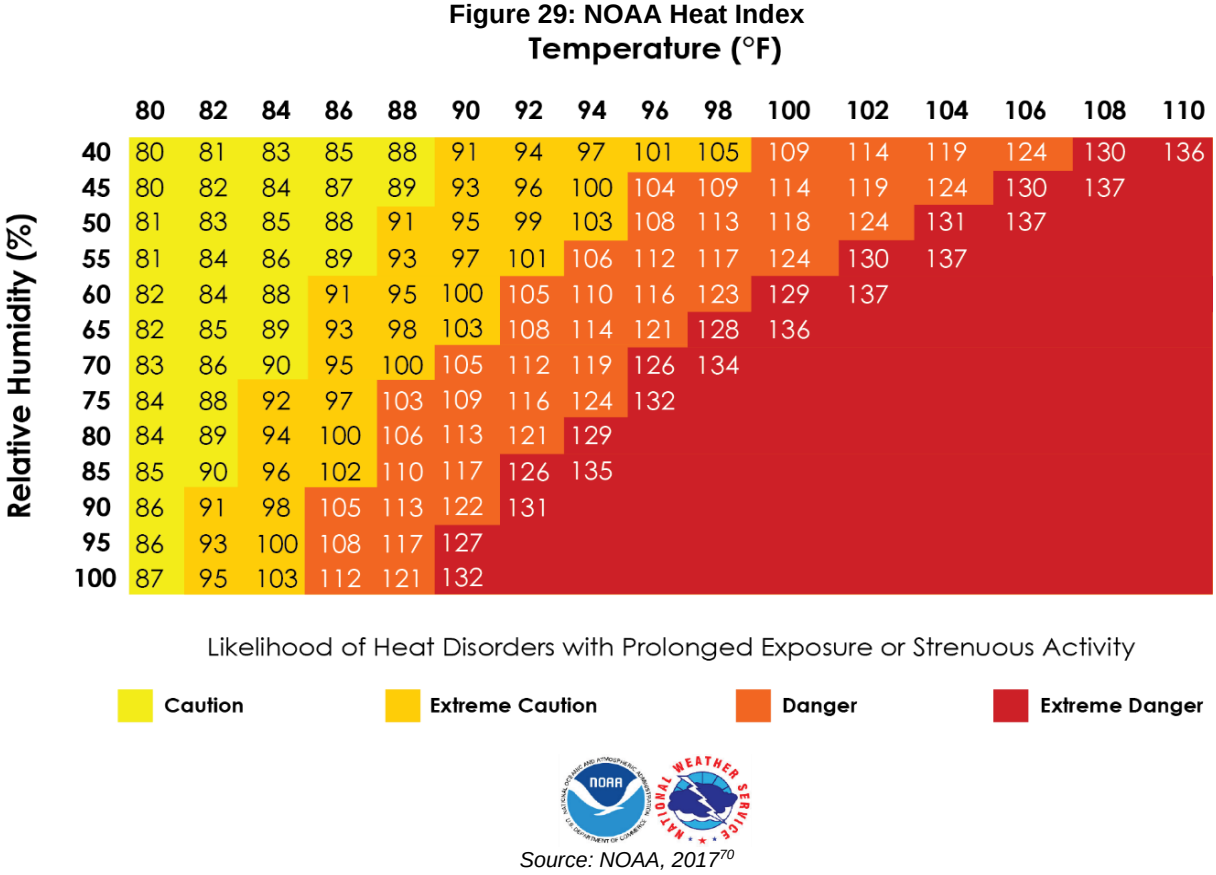
Extent

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, as the relative humidity increases, the temperature needed to cause a dangerous situation decreases. For example, for 100% relative humidity, dangerous levels of heat begin at 86°F whereas a relative humidity of 50%, require 94°F. The combination of relative humidity and temperature result in a heat index as demonstrated below:

100% Relative Humidity + 85°F = 112°F Heat Index

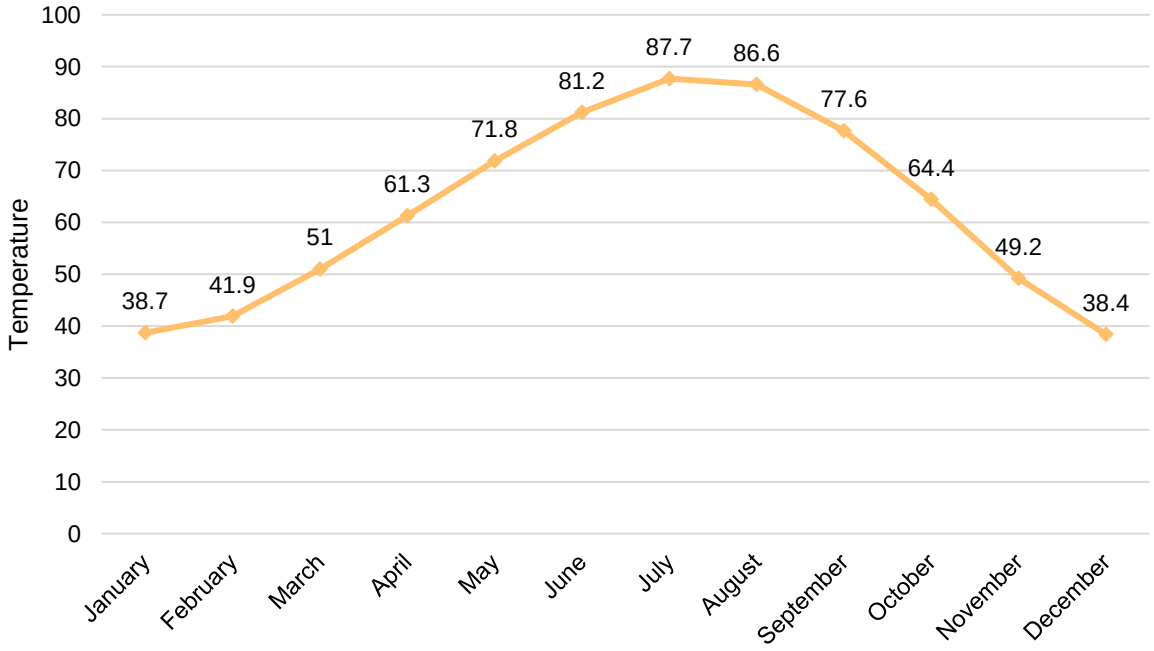
Figure 29 is designed for shady and light wind conditions. Exposure to full sunshine or strong winds can increase hazardous conditions and raise heat index values by up to 15°F. For the purposes of this plan, extreme heat is being defined as temperatures of 100°F or greater. In the planning area, the months with the highest temperatures are June, July, and August.

Figure 29: NOAA Heat Index



Source: NOAA, 2017[70]

Figure 30: Monthly Climate Normals Max Temperature (1981-2010)



Source: NCEI, 2020

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

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 damage infrastructure.

Table 65: 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	5	$0	$0	$6,271,141	$298,626

Source: 1 Indicates data is from NOAA (1905-June 2020); 2 Indicates data is from NCEI (Jan 1996-March 2020); 3 Indicates data is from USDA RMA (2000-June 2020)

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% of the population at a cost of $126 per person per day.[71] In rural areas, the percent of the population affected, and duration may increase during extreme events. The assumed damages do not consider physical damages to utility equipment and infrastructure.

Table 66: Loss of Electricity - Assumed Damage by County

County	2018 Population (est.)	Population Affected (Assumed)	Electric Loss of Use Assumed Damage Per Day
Boyd	2,042	204	$25,704
Brown	2,988	299	$37,674
Cherry	5,790	579	$72,954
Keya Paha	792	79	$9,954
Rock	1,350	135	$17,010
Total	**12,962**	**1,296**	**$163,296**

Probability

Extreme heat is a regular part of the climate for the planning area; with 101 years out of 121 having at least one day over 100°F. The average number of days above 100°F for those years was five. The probability that extreme heat will occur in any given year in the planning area is 80 percent.

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* which included predictions for extreme heat events in the future dependent on future climate actions.[72] The table below summarizes those findings for the planning area.

71 Federal Emergency Management Agency. June 2009. "BCA Reference Guide."
72 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.

Table 67: Extreme Heat Predictions for Days over 100°F

County	Historical Average 1971-2000 (days per Year)	Midcentury Prediction 2036-2065 (days per year)	Late Century Prediction 2070-2099 (days per year)
Boyd	4	27	51
Brown	2	19	43
Cherry	0	12	34
Keya Paha	2	22	45
Rock	2	20	44

Source: Union of Concerned Scientists, 1971-2019[73]

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 68: Regional Extreme Heat Vulnerability

Sector	Vulnerability
People	-Heat exhaustion and heat stroke Vulnerable populations include: -People working outdoors -People without air conditioning -Young children outdoors or without air conditioning -Elderly outdoors or without air conditioning
Economic	-Short-term interruption of business -Loss of power -Agricultural losses
Built Environment	-Damage to air conditioning/HVAC systems if overworked
Infrastructure	-Stressing electrical systems (burnouts during peak usage)
Critical Facilities	-Loss of power
Climate	-Increased risk of grass/wildfire events -increases in extreme heat conditions are likely, adding stress on livestock, crops, people, and infrastructure

73 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 due to rainfall can occur on a local level, sometimes affecting only a few streets, but can also extend throughout an entire region, impacting whole drainage basins and property in multiple states. Heavy accumulations of ice or snow can also cause flooding during the melting and freezing stage. There are four main types of flooding in the planning area: riverine flooding, flash flooding, stormwater flooding, and ice jam flooding.

Riverine Flooding

Riverine flooding, typically slower developing with a moderate to long warning time, 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 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 draining to a river and its tributaries.

Flash Flooding

Flash floods, typically rapidly developing with little to no warning time, result from convective precipitation usually due to intense thunderstorms or sudden releases due to a failure of 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 because of this shorter timescale. Flooding from excessive rainfall events in Nebraska usually occurs between late spring and early fall.

Stormwater 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 capacity. 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 stormwater flooding, is becoming increasingly prevalent as development exceeds the capacity of drainage infrastructure, therefore limiting its ability to convey stormwater. Flooding also occurs due to combined storm and sanitary sewers being overwhelmed by the high flows that often accompany storm events. Typical impacts range from dangerously flooded roads to water backing up into homes or 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 or winter freezing, 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. This type of flooding tends to ore frequently occur on wide, shallow rivers such as the Platte, although other rivers can be impacted.

Location

There are eight rivers that flow through the planning area: Missouri River, Niobrara River, Keya Paha River, North Loup River, Middle Loup River, Snake River, Calamus River, and Elkhorn River. These rivers as well as smaller streams and creeks are potential locations for flooding to occur.

Table 69 shows the current status of Flood Insurance Rate Map (FIRM) panels within the region. Very few jurisdictions throughout the planning area have FIRMS at the municipal level. Figure 31 shows the floodplain map for the Region 24 planning area. Note that only Boyd County is shown because it is the only county in the planning area that has a digital FIRM. For jurisdictional-specific vulnerabilities and available maps, refer to *Section Seven: Community Profiles*.

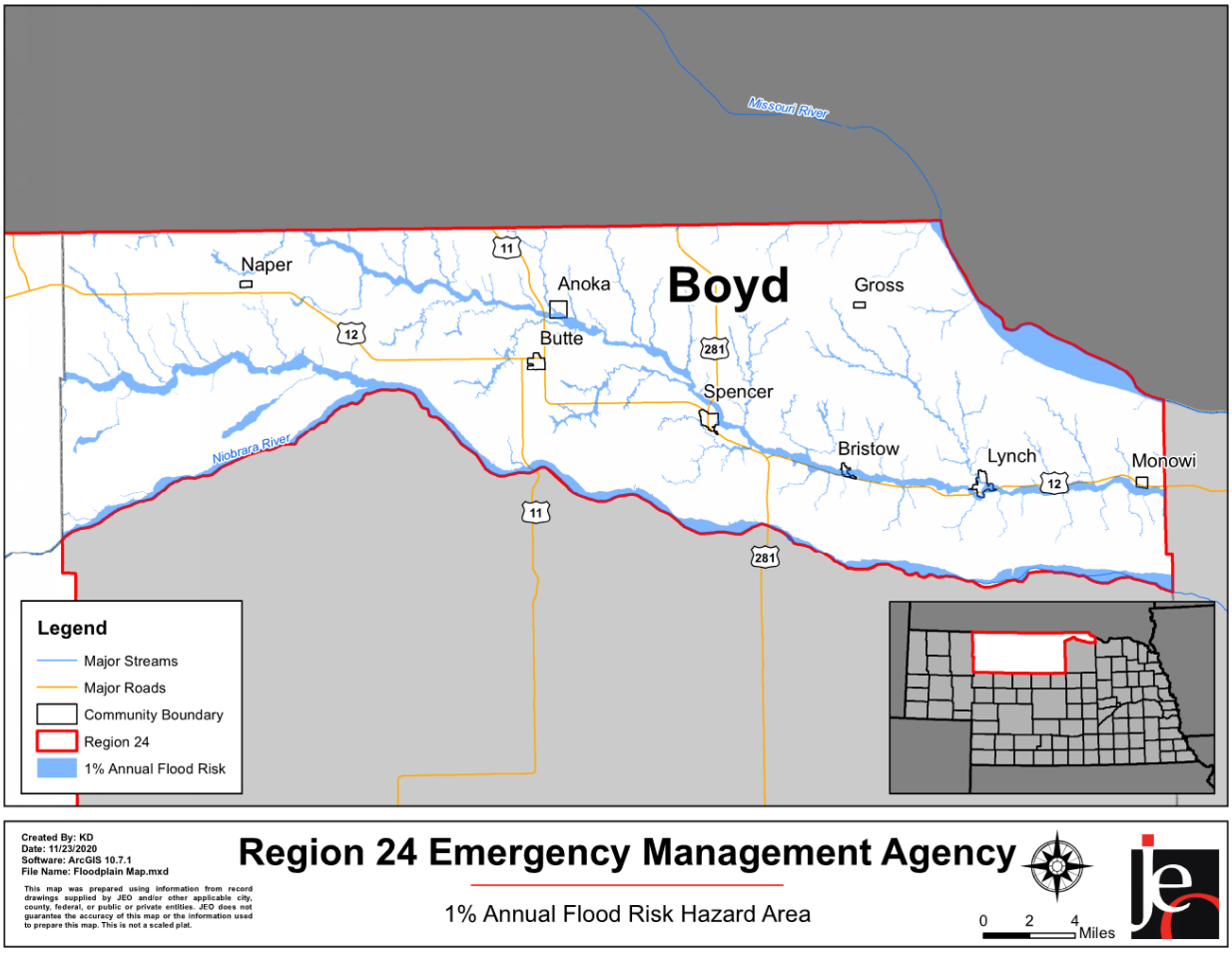
Table 69: FEMA FIRM Panel Status

Jurisdiction	Panel Numbers	Effective Date
Boyd County	31015CIND0A, 31015C0025C, 31015C0050C, 31015C0100C, 31015C0100C, 31015C0125C, 31015C0150C, 31015C0175C, 31015C0200C, 31015C0225C, 31015C0250C, 31015C0275C, 31015C0300C, 31015C0325C, 31015C0350C, 31015C0375C, 31015C0400C, 31015C0425C, 31015C0450C	08/18/2005
Anoka	31015CIND0A, 31015C0125C	08/18/2005
Bristow	31015IND0A, 31015C0400C	08/18/2005
Butte	31015CIND0A, 31015C0125C	08/18/2005
Gross	31015CIND0A, 31015C0175C	08/18/2005
Lynch	31015CIND0A, 31015C0425C	08/18/2005
Monowi	31015CIND0A, 31015C0450C	08/18/2005
Naper	31015CIND0A, 31015C0075C	08/18/2005
Spencer	31015CIND0A, 31015C0150C, 31015C0375C	08/18/2005
Brown County	Unmapped	N/A
Ainsworth	Unmapped	N/A
Johnstown	Unmapped	N/A
Long Pine	Unmapped	N/A
Cherry County	Unmapped	N/A
Cody	310263	03/26/1976
Crookston	Unmapped	N/A
Kilgore	Unmapped	N/A
Merriman	Unmapped	N/A
Nenzel	Unmapped	N/A
Valentine	Unmapped	N/A
Wood Lake	Unmapped	N/A
Keya Paha County	Unmapped	N/A
Burton	Unmapped	N/A
Springview	Unmapped	N/A
Rock County	Unmapped	N/A
Bassett	Unmapped	N/A
Newport	Unmapped	N/A

Source: FEMA[74]

74 Federal Emergency Management Agency. 2020. “FEMA Flood Map Service Center.” http://msc.fema.gov/portal/advanceSearch”.

Figure 31: 1% Annual Flood Risk Hazard Area



Risk Map Products

Risk Mapping, Assessment, and Planning (Risk MAP) is a FEMA program that provides communities with flood information and additional flood risk data (e.g. flood depth grids, percent chance grids, areas of mitigation interest, etc.) that can be used to enhance their mitigation plans and better protect their citizens. A small area in northeastern Boyd County is currently going through the discovery mapping process with NeDNR, so it will have Risk MAP products available in the near future. In addition, most of Rock County and a small portion of Brown County currently have a mapping process that is on hold with NeDNR. This will include the City of Bassett and Village of Newport. FEMA Region 7 hosts the Risk MAP products on an interactive web map, which can be viewed on their webpage: https://www.fema.gov/about/organization/region-7.

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, 33 flash flooding events resulted in $13,602,000 in property damage, while 19 riverine flooding events caused $11,070,000 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 $327,796. Descriptions of the most damaging flood events from the NCEI are below:

- **February 19, 1997 – Flood – Boyd and Keya Paha Counties**: Several days of temperatures above freezing caused snow to melt and ice to break up on Ponca Creek and Keya Paha River. The extra runoff from snowmelt combined with ice jams along the waterways caused flooding of homes, businesses, roads, and bridges. Total property damage from the event was $750,000. In addition, considerable soil erosion occurred to agricultural land.
- **June 30, 1997 – Flash Flood – Brown County:** Flash flooding washed out a bridge near Long Pine and caused evacuations along Long Pine Creek. Damage for the flood was $500,000.
- **July 19, 1999 – Flash Flood – Boyd, Keya Paha, and Rock Counties:** Heavy rainfall caused flood damages to roads and culverts across all three counties. Total damage across all three counties was $205,000.
- **July 16, 2001 – Flash Flood – Rock County:** Heavy rains resulted in flash flooding in northern Rock County and two feet of water flowing over roadways. There were $250,000 in reported damages.
- **May 5, 2007 – Flash Flood – Brown and Keya Paha Counties:** Heavy rains from thunderstorms caused flash flooding and washed out $120,000 worth of bridges, roads, and culverts. Emergency management reported that 67 miles of roads were closed in the counties.
- **August 11, 2008 – Flash Flood – Boyd County:** Five inches of rain in a short amount of time caused rapid runoff and $100,000 of damage to roads. In addition, crops were also damaged from the runoff.
- **June 12, 2010 – Flood – Boyd, Brown, Cherry, and Rock Counties:** Prolonged heavy rain caused widespread flooding across all four counties. Total damage from roads and power poles totaled $395,000.
- **July 22, 2010 – Flash Flood – Boyd County:** Six to nine inches of rain caused several roads to close between Bristow and Lynch including Highway 12. Spencer Dam authorities announced that the dam had reached capacity resulting in high releases of water downstream of the dam. Damages from the event totaled $100,000.
- **March 13-16, 2019 – Flood/Flash Flood – Body, Brown, Keya Paha, and Rock Counties:** See event narrative below.
- **September 11, 2019 – Flash Flood – Brown County:** Heavy rains in the county caused a bridge over Long Pine Creek to wash out, resulting in $150,000 in damages.

March 2019 Flood Event

The March 2019 flood event significantly impacted the planning area, primarily Boyd and Rock Counties. Winter Storm Ulmer developed on March 12 and slowly moved across the Midwest including all of Nebraska. Due to heavy precipitation on frozen ground and melting snowpack, numerous water systems were overwhelmed and failed. Along the Niobrara River ice jams were released and ice chunks that were 18 to 24 inches thick destroyed roads, bridges, and dams. One critical emergency route, Highway 281 between O'Neill and Spencer was washed away completely (Figure 32). A new permanent highway opened in October 2020. Spencer Dam on the Niobrara River was breached by ice and record stream flows (Figure 33). This breach exacerbated flooding in Boyd County along the Niobrara River. Flooding in other areas of Boyd County caused damages to roads, agricultural land, homes, and businesses and forced the Village of Lynch to be evacuated. The NCEI reported an estimated $21,890,000 in damages occurred in the planning area. In addition, one was fatality in the planning area was reported due to the Spencer Dam failure. In total, 104 cities, 84 counties (including all five counties in the

planning area), and five tribal nations in Nebraska received State and/or Federal Disaster Declarations due to the 2019 flood events, as seen in Figure 34.

The NeDNR has collected and reviewed extensive data records from the flood event. An event-wide ArcGIS Story Map has been developed and provides an excellent resource to understand the cause, duration, impacts, and recovery efforts from this event. The ArcGIS Story Map can be viewed at: https://storymaps.arcgis.com/stories/9ce70c78f5a44813a326d20035cab95a.

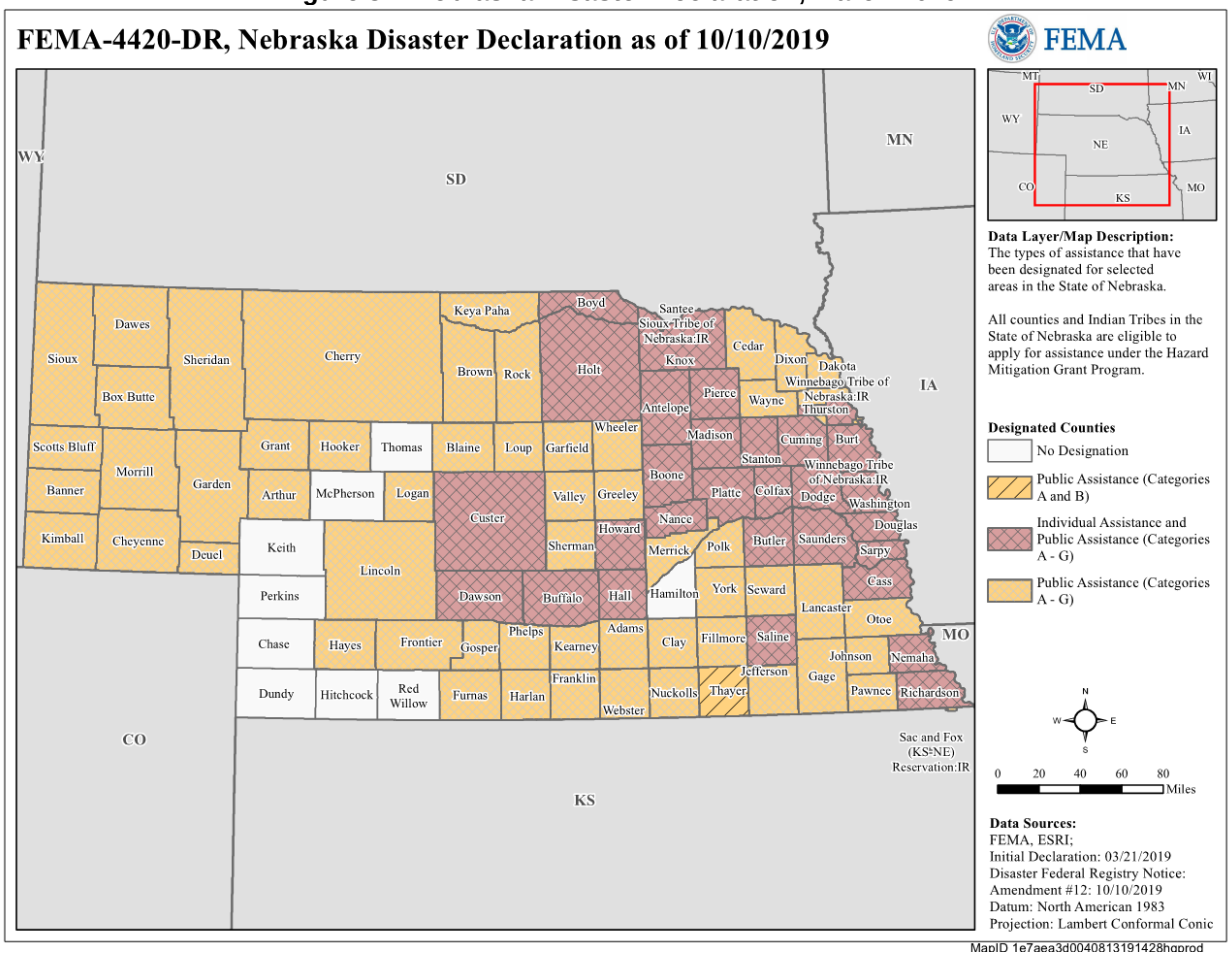
Figure 32: Washed Out Highway 281

Source: KHGI

Figure 33: Spencer Dam After Breach

Source: Lincoln Journal Star

Figure 34: Nebraska Disaster Declaration, March 2019



Source: FEMA, 2020

There were numerous impacts from the flood, many of which lasted several months, with many repairs still ongoing. Communities along the Niobrara River in Boyd County were particularly affected. Below is a brief summary of impacts provided by local planning teams. Refer to the *Community Profiles* in *Section Seven* for additional details.

Table 70: Select Community March 2019 Flood Impacts

Community	March 2019 Flood Impacts
Ainsworth	Damaged Streets, downed trees, flooded basements, loss of potable water, and broken water mains
Bassett	Flooding in the north parts of the city
Bristow	Damage to several houses, washed out streets, sand in the sewer system, and damage to the park
Butte	Property damage and economic impacts
Johnstown	Street damage
Kilgore	Flooded streets for several months
Long Pine	Raised water table, damaged bridge, and flooded basements
Lynch	Damaged homes, damaged businesses, loss of potable water, damaged roads, wastewater system damage, evacuations
Nenzel	Flooded basements, damaged water wells, and standing water in several areas
Newport	Standing water in several areas
Spencer	Transportation impacts from a nearby damaged highway

Community	March 2019 Flood Impacts
Springview	Flooded and damaged streets
Valentine	Flooding on south side of the community and bank erosion

Extent

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

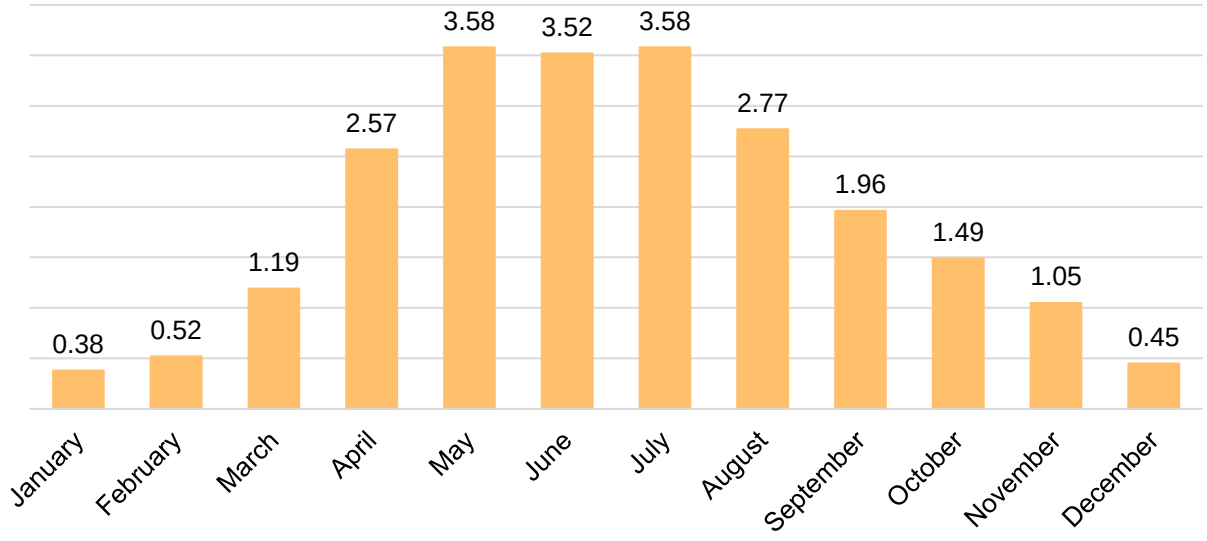
Table 71: Flooding Stages

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, 2019[75]

Figure 35 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 36, the most common month for flooding within the planning area is in June, followed by March. While it is possible that major flood events will occur, the likely extent of flood events within the planning area is classified as moderate.

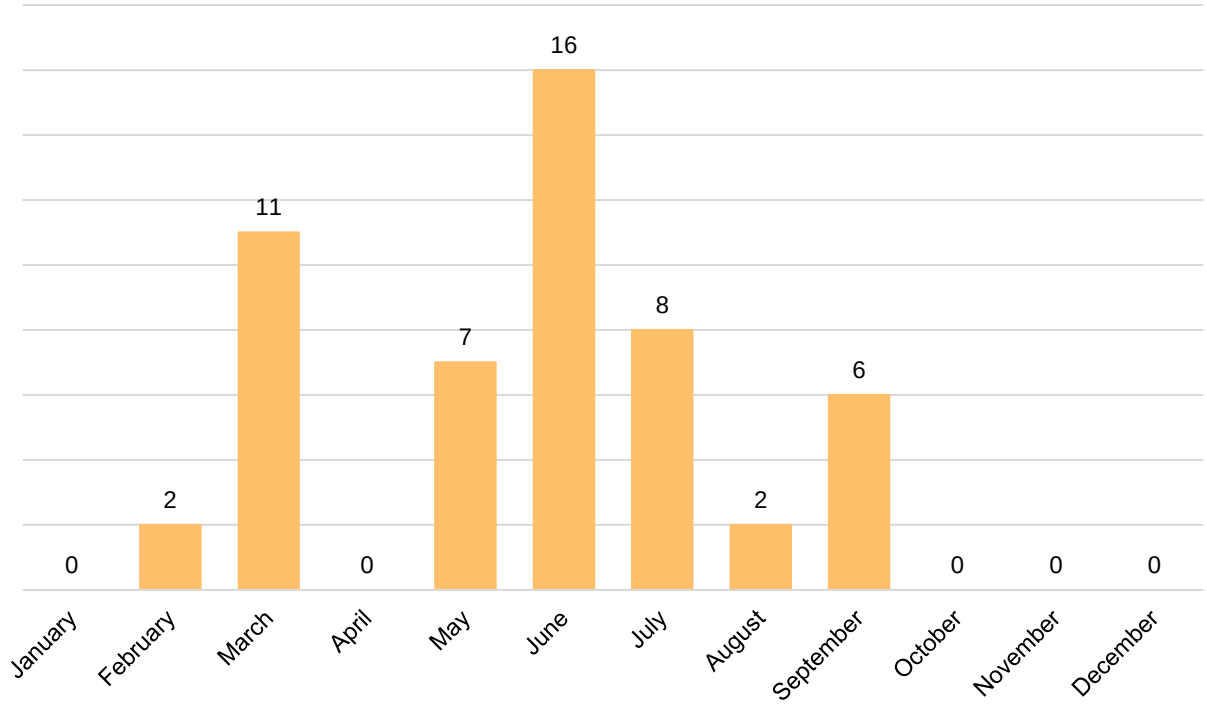
Figure 35: Average Monthly Precipitation



Source: NCEI, 2020

75 National Weather Service. 2020. "Severe Weather 101- Floods." https://www.nssl.noaa.gov/education/svrwx101/floods/faq/.

Figure 36: Monthly Events for Floods/Flash Floods



Source: NCEI, 1996-March 2020

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. The following tables summarize NFIP participation and active policies within the planning area.

Table 72: NFIP Participants

Jurisdiction	Participation in NFIP	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded
Boyd County	Yes	08/18/05	08/18/05	-	-	-
Anoka	No		08/18/05	08/18/06	-	-
Bristow	Yes	06/03/86	08/18/05	-	-	-
Butte	No	-	-	-	-	-
Gross	No	-	-	-	-	-
Lynch	Yes	06/15/88	08/18/05	-	-	-
Monowi	No	-	08/18/05	08/18/06	-	-
Naper	No	-	-	-	-	-
Spencer	Yes	09/24/84	08/18/05	-	-	-
Brown County	No	-	-	-	-	-

Jurisdiction	Participation in NFIP	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded
Ainsworth	Yes	09/10/84	(NSFHA)	-	-	-
Johnstown	No	-	-	-	-	-
Long Pine	No	-	-	-	-	-
Cherry County	No	-	-	-	-	-
Cody	No	-	03/26/76	03/26/77	-	-
Crookston	No	-	-	-	-	-
Kilgore	No	-	-	-	-	-
Merriman	No	-	-	-	-	-
Nenzel	No	-	-	-	-	-
Valentine	Yes	01/29/10	(NSFHA)	-	-	-
Wood Lake	No	-	-	-	-	-
Keya Paha County	No	-	-	-	-	-
Burton	No	-	-	-	-	-
Springview	No	-	-	-	-	-
Rock County	No	-	-	-	-	-
Bassett	Yes	09/10/84	(NSFHA)	-	-	-
Newport	No	-	-	-	-	-

Source: Federal Emergency Management Agency, National Flood Insurance Program, 2020
NSFHA indicates No Special Flood Hazard Area – All Zone C

The NFIP Emergency Program allows a community to voluntarily participate in the NFIP if: no flood hazard information is available for their area; the community has a Flood Hazard Bound Map but no FIRM; or the community has been identified as flood-prone for less than a year.

Table 73: NFIP Policies In-Force and Total Payments

Jurisdiction	Policies In-Force	Total Premiums	Total Coverage	Total Losses	Total Payments
Boyd County	8	$9,876	$896,000	9	$100,904
Anoka	N/P	N/A	N/A	N/A	N/A
Bristow	2	$837	$45,000	1	$2,615
Butte	N/P	N/A	N/A	N/A	N/A
Gross	N/P	N/A	N/A	N/A	N/A
Lynch	8	$5,810	$444,000	7	$205,184
Monowi	N/P	N/A	N/A	N/A	N/A
Naper	N/P	N/A	N/A	N/A	N/A
Spencer	0	$0	$0	0	$0
Brown County	N/P	N/A	N/A	N/A	N/A
Ainsworth	0	$0	$0	0	$0
Johnstown	N/P	N/A	N/A	N/A	N/A
Long Pine	N/P	N/A	N/A	N/A	N/A
Cherry County	N/P	N/A	N/A	N/A	N/A
Cody	N/P	N/A	N/A	N/A	N/A
Crookston	N/P	N/A	N/A	N/A	N/A
Kilgore	N/P	N/A	N/A	N/A	N/A
Merriman	N/P	N/A	N/A	N/A	N/A
Nenzel	N/P	N/A	N/A	N/A	N/A
Valentine	0	$0	$0	0	$0

Jurisdiction	Policies In-Force	Total Premiums	Total Coverage	Total Losses	Total Payments
Wood Lake	N/P	N/A	N/A	N/A	N/A
Keya Paha County	N/P	N/A	N/A	N/A	N/A
Burton	N/P	N/A	N/A	N/A	N/A
Springview	N/P	N/A	N/A	N/A	N/A
Rock County	N/P	N/A	N/A	N/A	N/A
Bassett	1	$310	$105,000	0	$0
Newport	N/P	N/A	N/A	N/A	N/A

Source: HUDEX, July 2019
N/A: Not Applicable; N/P: Not a Participant

This plan recommends and strongly encourages plan participants to enroll, participate, and remain in good standing with the NFIP. Compliance with the NFIP should remain a top priority for each participant, regardless of whether a flooding hazard area map has been delineated for the 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).[76] Currently no jurisdictions in the planning area 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. There is one NFIP repetitive loss (RL) property located in the planning area.

Table 74: Repetitive Loss and Severe Repetitive Loss Properties

Jurisdiction	NFIP Repetitive Loss (RL)	HMA RL	HMA RL Types	HMA Severe RL (SRL)	HMA SRL Types
Lynch	1	-	-	-	-

Source: NeDNR, February 2020

NFIP RL: Repetitive Loss Structure refers to a structure covered by a contract for flood insurance under the NFIP that has incurred flood-related damage on two occasions during a 10-year period, each resulting in at least a $1,000 claim payment.

NFIP SRL: Severe Repetitive Loss Properties are defined as single or multifamily residential properties that are covered under an NFIP flood insurance policy and:

(1) That have incurred flood-related damage for which four or more separate claims payments have been made, with the amount of each claim (including building and contents payments) exceeding $5,000, and with the cumulative amount of such claim payments exceeding $20,000; or

(2) For which at least two separate claims payments (building payments only) have been made under such coverage, with cumulative amount of such claims exceeding the market value of the building.

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

(3) In both instances, at least two of the claims must be within 10 years of each other, and claims made within 10 days of each other will be counted as one claim.

HMA RL: A repetitive loss property is a structure covered by a contract for flood insurance made available under the NFIP that:

(1) Has incurred flood-related damage on two occasions, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the structure at the time of each such food event; and

(2) At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.

HMA SRL: A severe repetitive loss property is a structure that:

(1) Is covered under a contract for flood insurance made available under the NFIP.

(2) Has incurred flood related damage –

(a) For which four or more separate claims payments (includes building and contents) have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claim payments exceeding $20,000; or

(b) For which at least two separate claims payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

Purpose of the HMA definitions: The HMA definitions were allowed by the Biggert-Waters Flood Insurance Reform Act of 2012 to provide an increased federal cost share under the FMA grant when a property meets the HMA definition.

Average Annual Losses

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 caused an average of $986,880 in property damages and $15,609 in crop losses per year for the planning area.

Table 75: Flood Loss Estimate

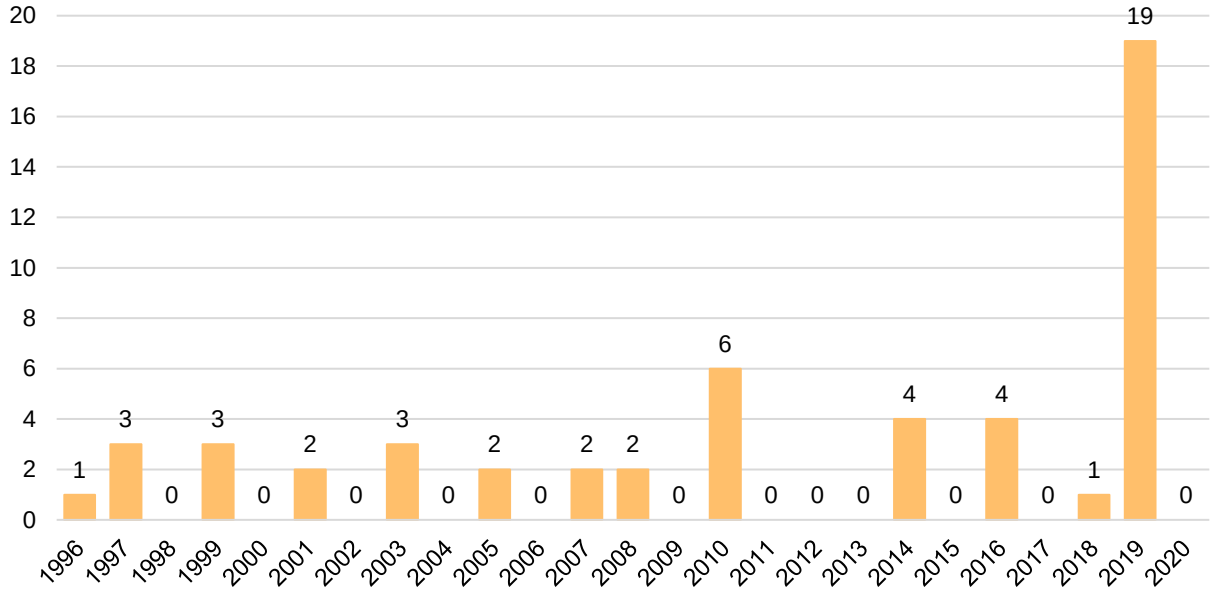
Hazard Type	Number of Events[1]	Average Events Per Year[1]	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Flash Flood	33	1.32	$13,602,000	$544,080	$327,796	$15,609
Flood	19	0.76	$11,070,000	$442,800		
Total	**52**	**2.08**	**$24,672,000**	**$986,880**	**$327,796**	**$15,609**

Source: 1 Indicates data is from NCEI (Jan 1996-March 2020); 2 Indicates data is from NCEI (Jan 2000-June 2020)

Probability

The NCEI reports 33 flash flood and 19 flood events for a total of 52 events from January 1996 to March 2020. Some years had multiple flooding events. Figure 37 shows the events broken down by year. Based on the historic record and reported incidents by participating communities, there is a 52 percent probability that flooding will occur annually in the planning area.

Figure 37: Yearly Events for Floods/Flash Floods



Source: NCEI, 1996-March 2020

Regional Vulnerabilities

Low-income and minority populations are disproportionately vulnerable to flood events.[77] 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

77 Cutter, Susan and Finch, Christina. February 2008. "Temporal and Spatial Changes in Social Vulnerability to Natural Hazards".

- More diverse population in floodplain
- Much higher percentage of Hispanic/Latino populations in the floodplain

To analyze parcels and populations located in the floodplain, GIS parcel data were acquired from each County 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 for the five-county planning area is provided in the following table. Specific jurisdictional parcel improvements in the floodplain can be found in the corresponding community profiles in *Section Seven*.

Table 76: Planning Area 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
Boyd	1,555	$58,154,345	436	$17,253,500	28.0%
Brown	1,956	$139,769,663	N/A	N/A	N/A
Cherry	3,003	$288,917,091	N/A	N/A	N/A
Keya Paha	553	$23,879,770	N/A	N/A	N/A
Rock	1,012	$55,740,450	N/A	N/A	N/A
Total	**8,079**	**$566,461,319**	**436**	**$17,253,500**	**5.4%**

Source: County Assessors, 2018
N/A: The county does not have a mapped floodplain, so it is not known how many improvements are in the floodplain.

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 77: 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, cattle loss, and soil erosion -Closed roads and railways would impact commercial transportation of goods
Built Environment	-Buildings may be damaged
Infrastructure	-Damages to roadways and railways
Critical Facilities	-Wastewater facilities are at risk, particularly those in the floodplain -Critical facilities, especially those in the floodplain, are at risk to damage (critical facilities are noted within individual community profiles)
Climate	-Changes in seasonal and annual precipitation normals will likely increase frequency and magnitude of flood events

Grass/Wildfires

Wildfires, also known as brushfires, forest fires, grassfires, 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 38).

> Lightning starts approximately 10,000 forest fires each year, yet ninety percent of forest fires are started by humans.
>
> ~National Park Service

Grass/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.

Grass/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 39).

To help respond to wildfires, a permanent Single Engine Air Tanker (SEAT) base is located in the City of Valentine. This is one of five permanent SEAT bases in Nebraska. A SEAT can help quickly attack small fires located in difficult terrain and keep them from growing into larger wildfires. In addition, the Nature Conservancy Conducts the Niobrara Valley Prescribed Fire Training Exchange. This annual training is also a resource for help with priority prescribed fire, fuels treatment, and other projects.[78]

The Nebraska Forest Service updated the North Central Nebraska Community Wildfire Protection Plan (CWPP) in 2020. This plan includes all of Region 24 EMA and Holt County. The purpose of the CWPP is to help effectively manage wildfires and increase collaboration and communication among organizations who manage fire. The CWPP discusses county specific historical wildfire occurrences and impacts, identifies areas most at risk from wildfires, discusses protection capabilities, and identifies wildfire mitigation strategies. This document is updated every five years and has been integrated with this hazard mitigation plan.

78 Nebraska Forest Service. November 2020. “North Central Nebraska Community Wildfire Protection Plan”. https://nfs.unl.edu/documents/CWPP/NCCWPP.pdf.

Figure 38: Wildland-Urban Interface

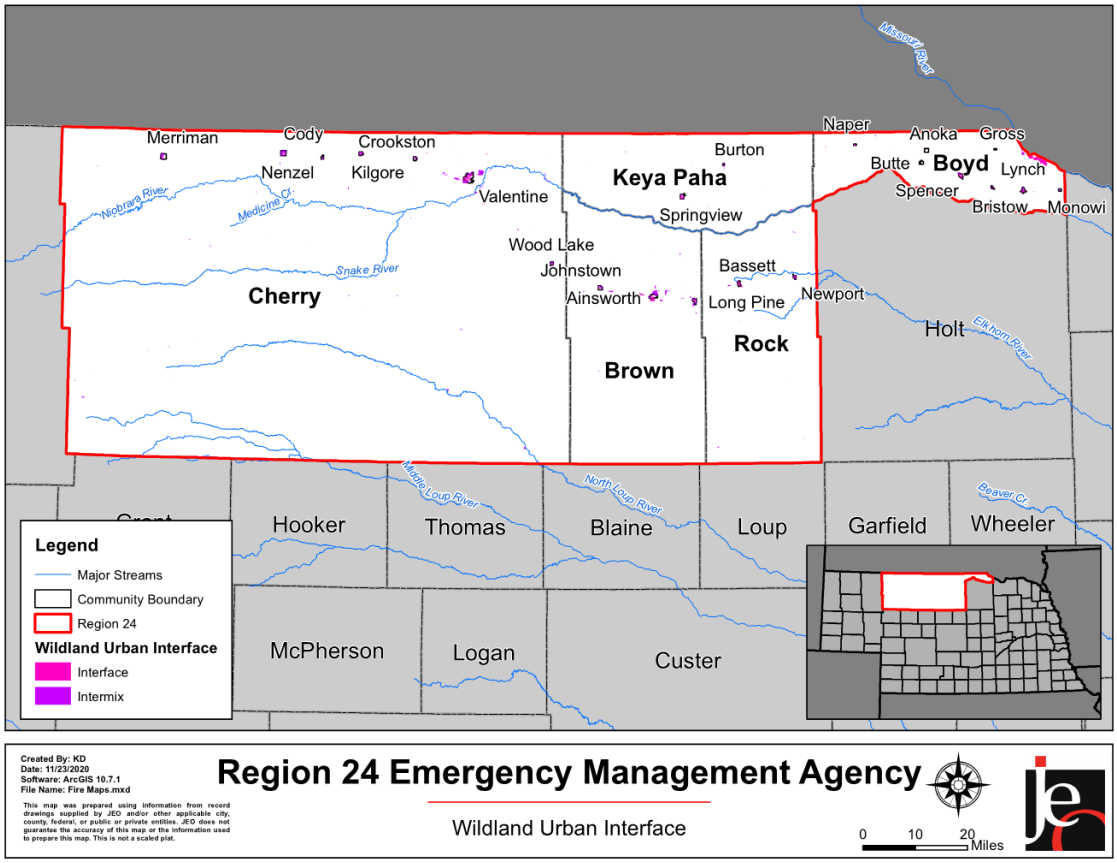
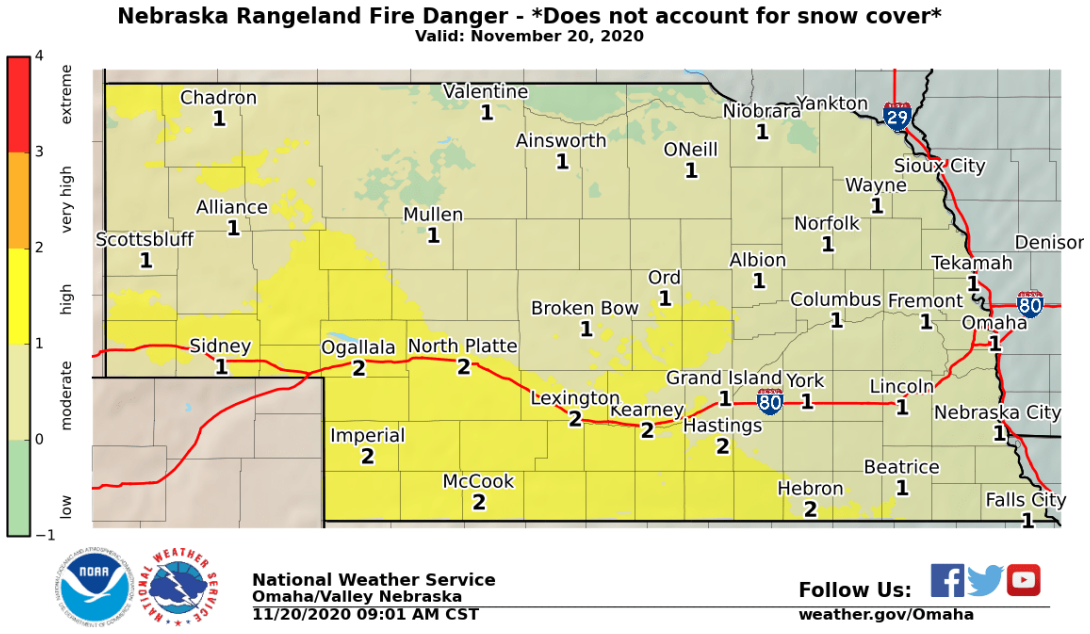


Figure 39: Rangeland Fire Danger



Source: NWS, 2020[79]

79 National Weather Service. November 20, 2020. "Nebraska Fire Danger Map." https://www.weather.gov/oax/fire. Accessed November 2020.

Location

As the number of reported grass/wildfires by county indicates, Cherry County had the greatest number of fires, but Brown County had the greatest number of acres burned at 70,603 acres.

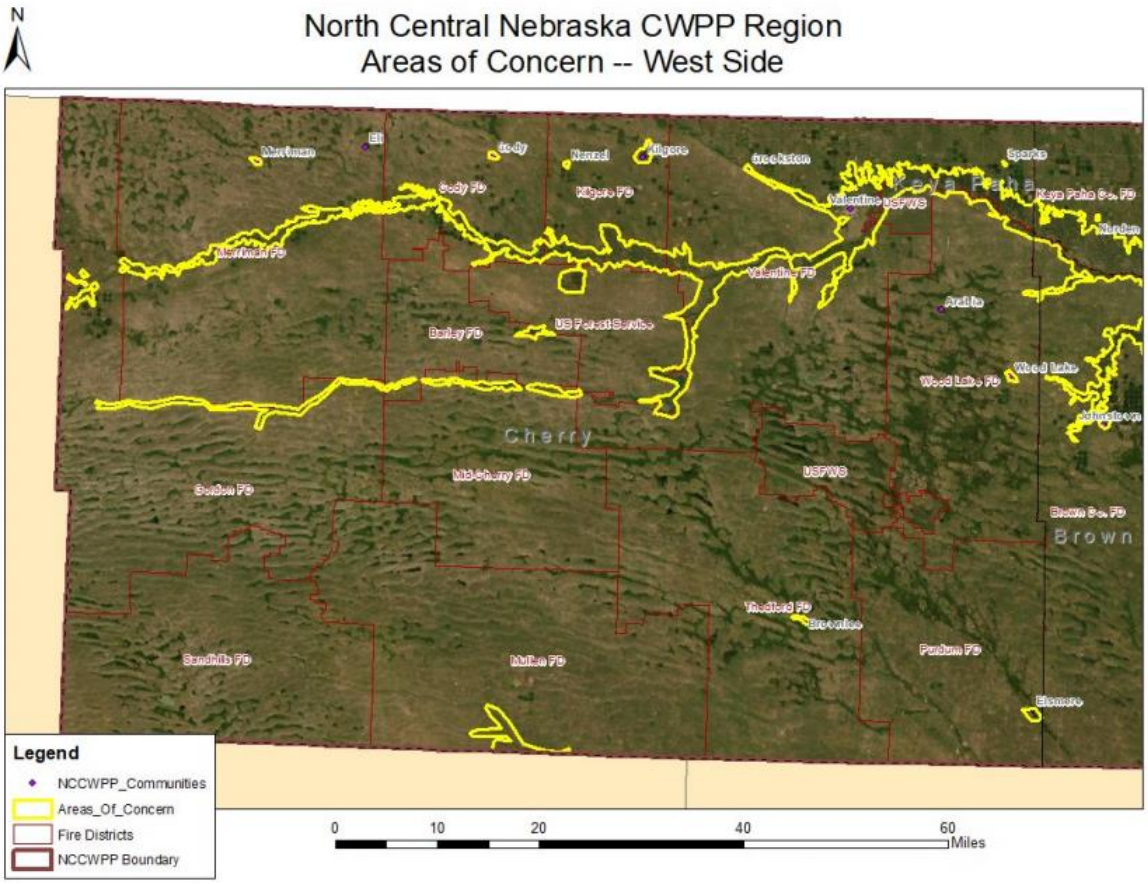
Table 78: Reported Wildfires by County

County	Reported Wildfires	Acres Burned
Boyd	145	11,140
Brown	97	70,603
Cherry	356	29,879
Keya Paha	44	9,567
Rock	76	9,190
Total	**718**	**130,379**

Source: Nebraska Forest Service, 2000-April 2020[80]

The CWPP identified areas of concern for the region, as shown in Figure 40 and Figure 41. These locally identified areas of concern are specific sites that are at greatest risk for wildfire and where vegetative fuels reduction activities can be targeted.[81] This does not mean that areas outside mapped areas of concern do not have their own fire risk, but rather the areas identified are of greater concern for fire risk reduction.

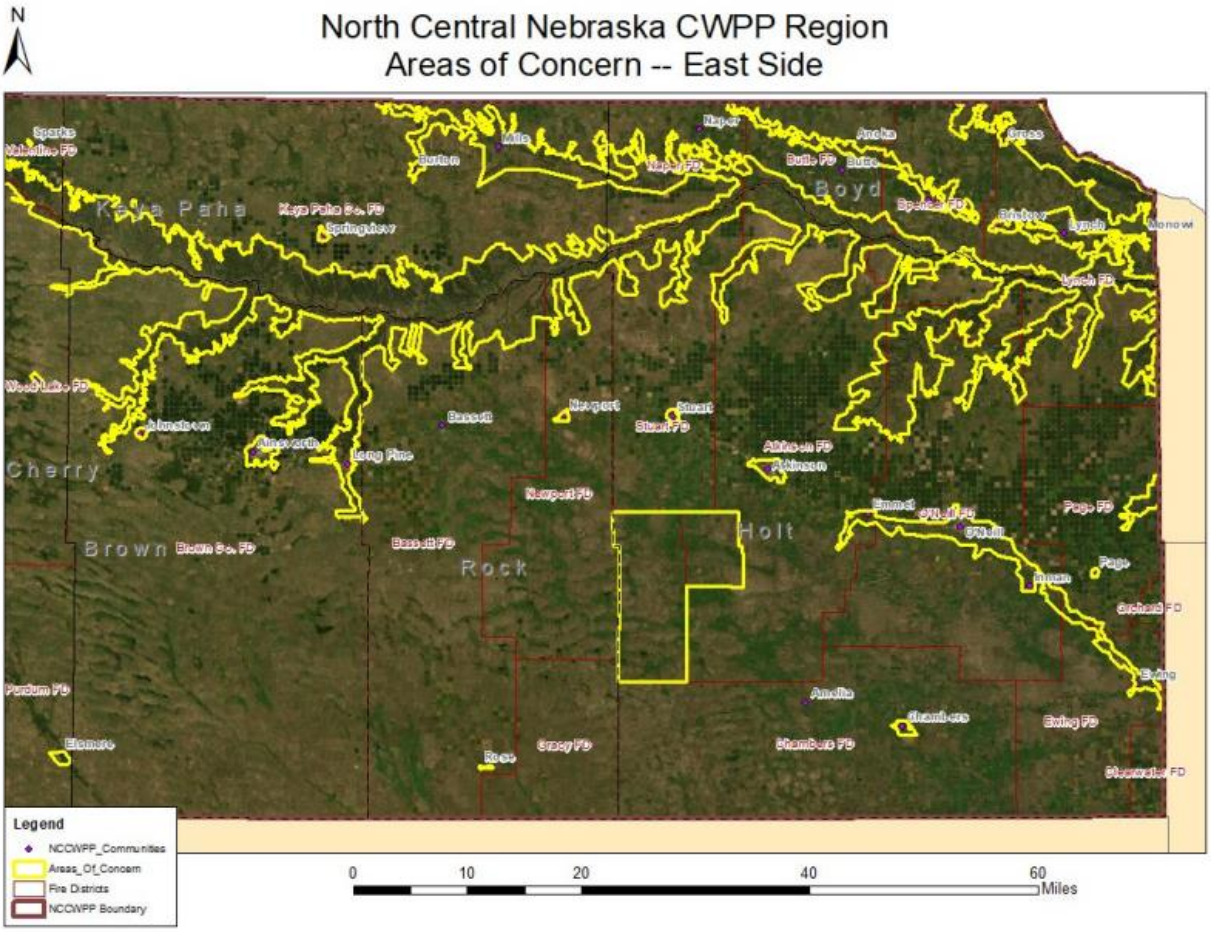
Figure 40: Areas of Concern - West Side



Source: Nebraska Forest Service, Nov. 2020

80 Nebraska Forest Service. 2020. "NFS All Fires by Year: 2000-2020." [datafile].
81 Nebraska Forest Service. November 2020. "North Central Nebraska Community Wildfire Protection Plan". https://nfs.unl.edu/documents/CWPP/NCCWPP.pdf.

Figure 41: Areas of Concern - East Side



Source: Nebraska Forest Service, Nov. 2020

Historical Occurrences

For the planning area, 19 different fire departments (Figure 42) reported a total of 1,225 wildfires, according to the Nebraska Forest Service from January 2000 to April 2020. The reported events burned 130,379 acres and caused $116,359 in crop loss. Most fires occurred in 2002 and 2012 (Figure 43). The majority of wildfires in the planning area were caused by lightning (Figure 44). The planning area has had some of the most noteworthy wildfires in the State of Nebraska. Significant fires are outlined below:

- **Rock County – 1904:** A historical marker near the Village of Newport identified a 40-mile-wide fire that threatened the community.[82]

- **Cherry County – 1999:** A 10-mile wide sandhills prairie fire burned from Thedford to Valentine, killing one firefighter.[83]

82 Nebraska Forest Service. November 2020. "North Central Nebraska Community Wildfire Protection Plan". https://nfs.unl.edu/documents/CWPP/NCCWPP.pdf.

83 Ibid.

- **Cherry County – July 16, 2006:** On the edge of Valentine, near the South Dakota state line, a large canyon fire destroyed six homes. Two hundred people and a hospital were told to evacuate.

- **Brown, Cherry, and Keya Paha Counties – July 20, 2012:** Known as the Region 24 Complex fire, it started when lightning ignited a wildfire in northwest Brown County north of Johnstown, along the Fairfield Creek, a tributary of the Niobrara River. The fire's initial seven-mile-wide reach was fanned by strong winds that spread the fire north and jumped the Niobrara River into southwest Keya Paha County. The fire burned a total of 75,872 acres and charred rangeland and woodland within Brown County, 14 homes, 17 associated outbuildings in Keya Papa County, and additional range and crop lands in eastern Cherry and southeast Keya Paha Counties. Four injuries were reported, but none were life threatening. As the wildfire spread north toward Highway 12, officials closed the highway and announced volunteer evacuations for Meadville and Norden that were rescinded on July 25th. On July 26th, the Niobrara River was closed downstream of Smith Falls State Park. The wildfire was reported 100 percent contained by July 30th, 2012.

- **Cherry County – October 19, 20212:** A 6,717-acre fire burned into Cherry County from South Dakota and caused the evacuation of the Village of Crookston.

Figure 42: Fire Districts in the Planning Area

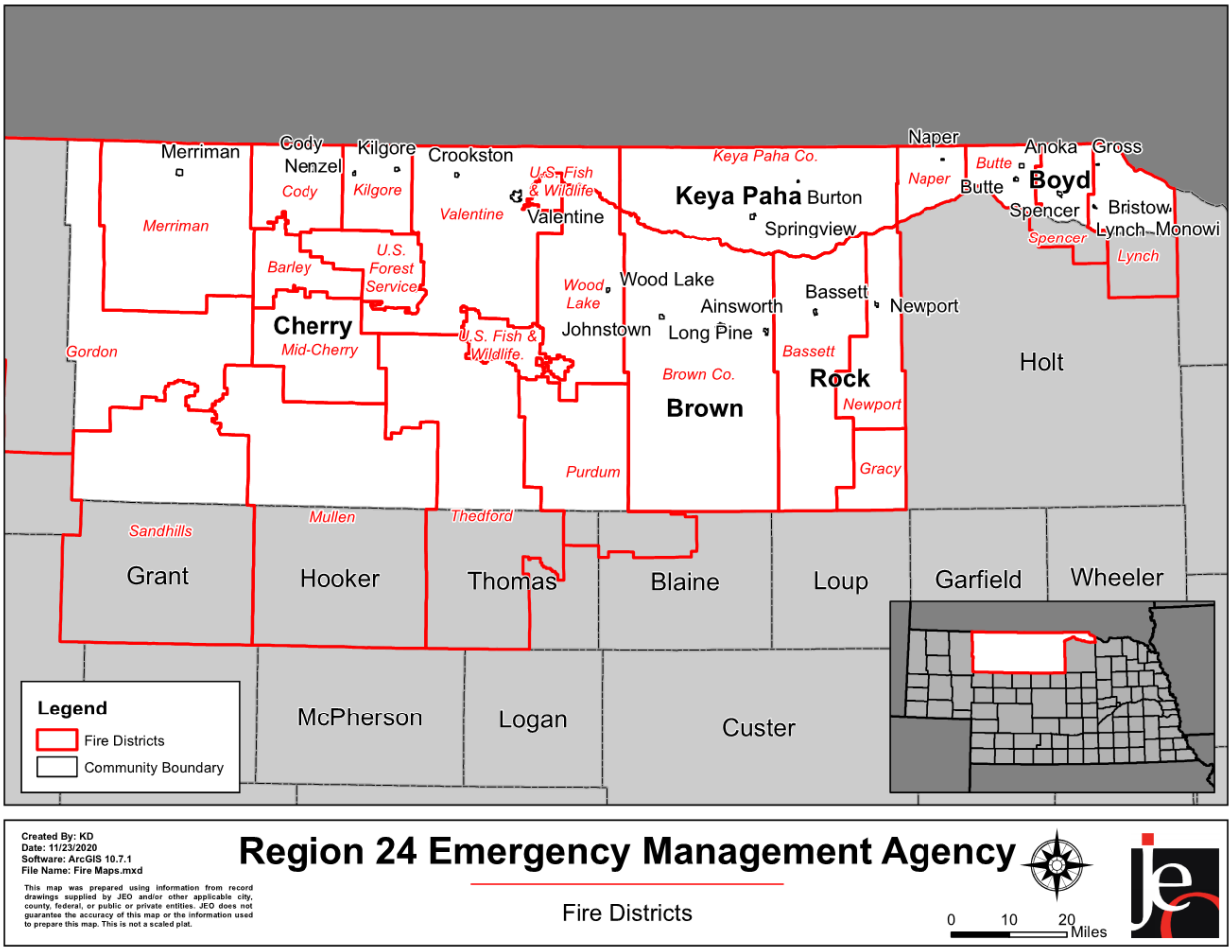
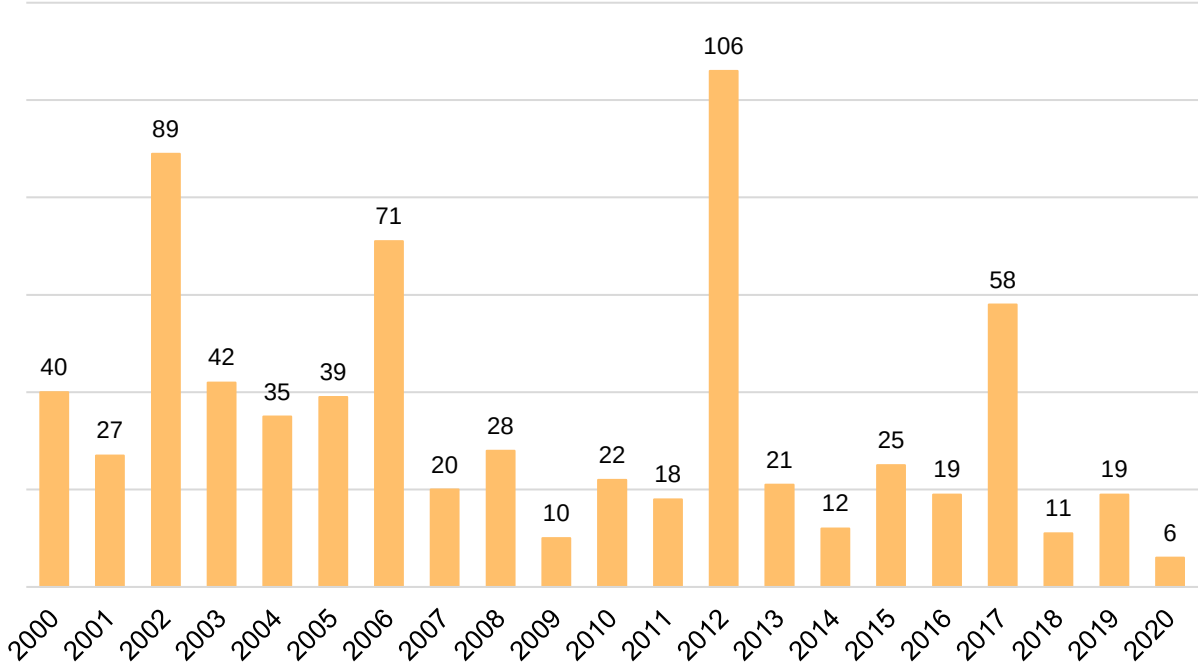
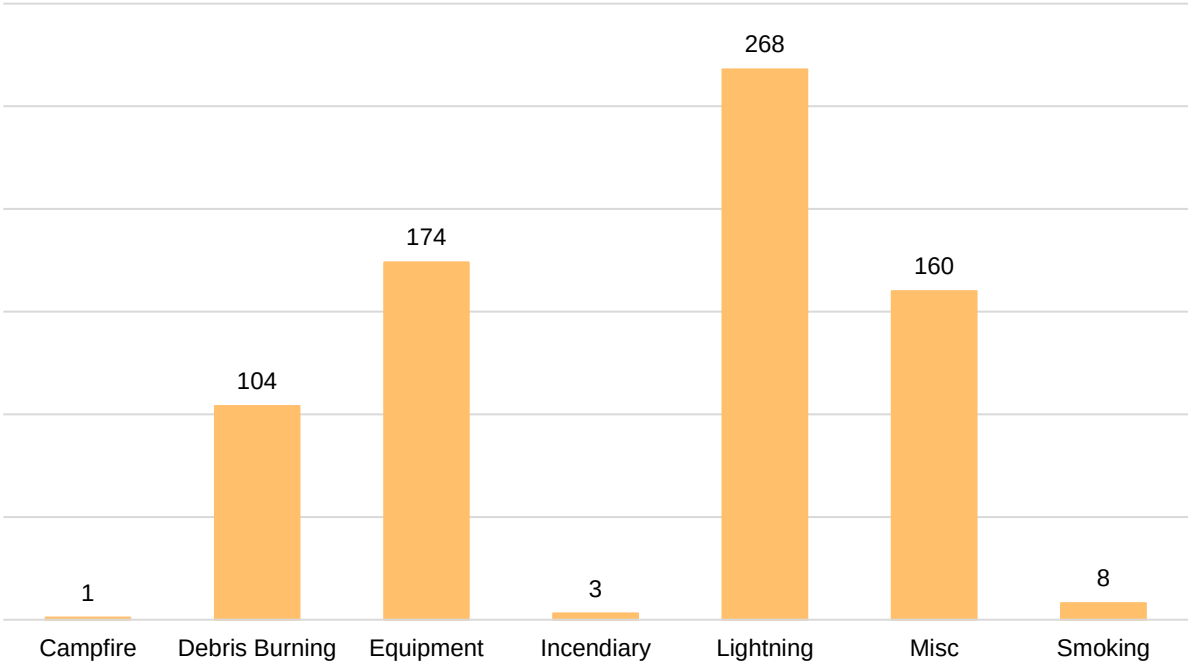


Figure 43: Number of Wildfires by Year in the Planning Area



Source: Nebraska Forest Service, 2000-April 2020

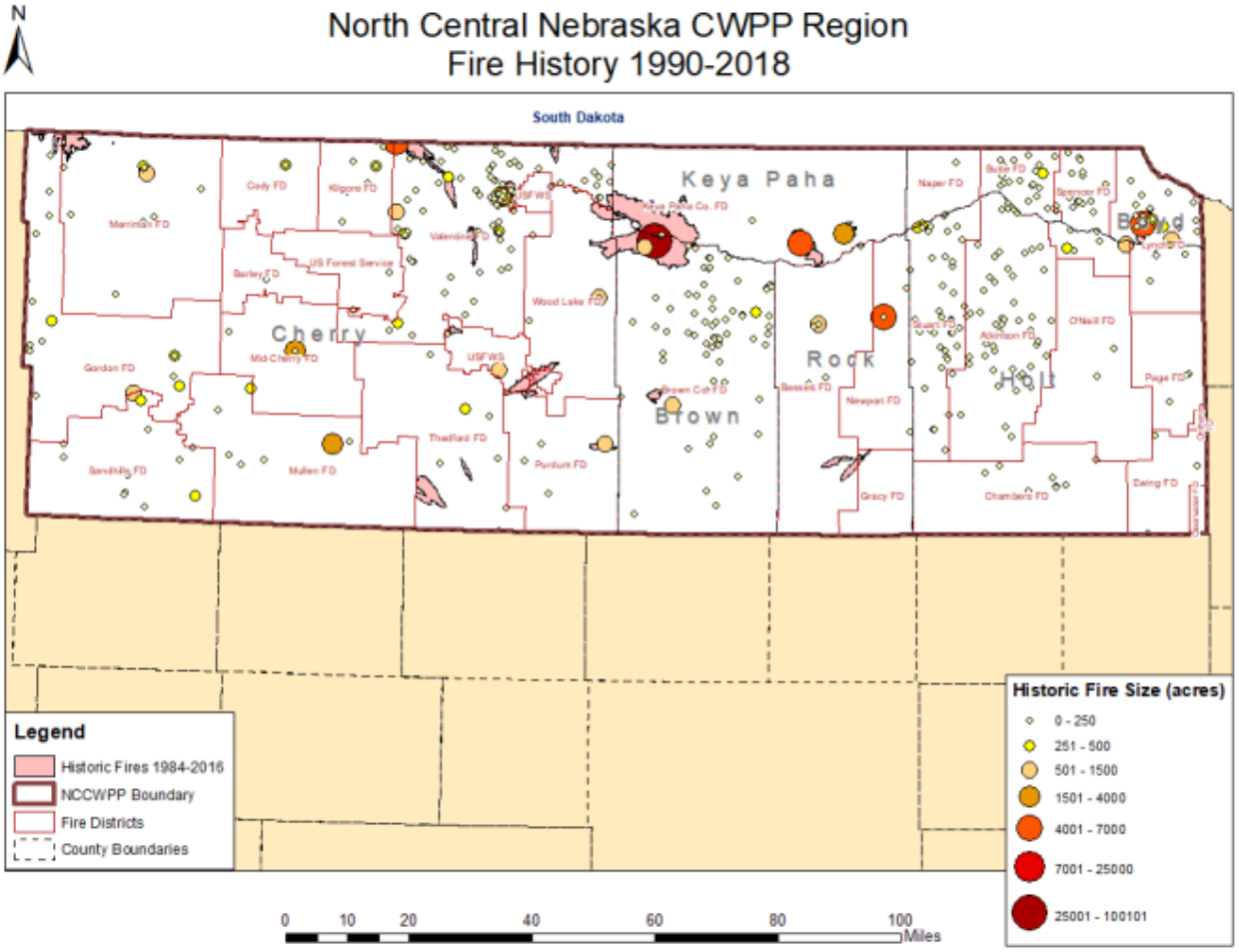
Figure 44: Wildfires by Cause in the Planning Area



Source: Nebraska Forest Service, 2000-April 2020

Figure 45 shows the location and general size of wildfires from 1990 to 2018. Note that Holt County is included in the map but is not part of the planning area for this plan.

Figure 45: Fire History 1990-2018



Nebraska Forest Service, Nov. 2020

Extent

Figure 44 illustrates the number of wildfires by cause in the planning area from January 2000 to April 2020, which burned 130,379 acres in total. Overall, 718 wildfires were reported in the planning area. Of these, 67 fires burned 100 acres or more, with the largest wildfire burning 66,745 acres in Brown County in July 2012.

Grass/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.

Figure 46 shows the USGS's 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 occur in each area under natural conditions.

Figure 46: Mean Fire Return Interval

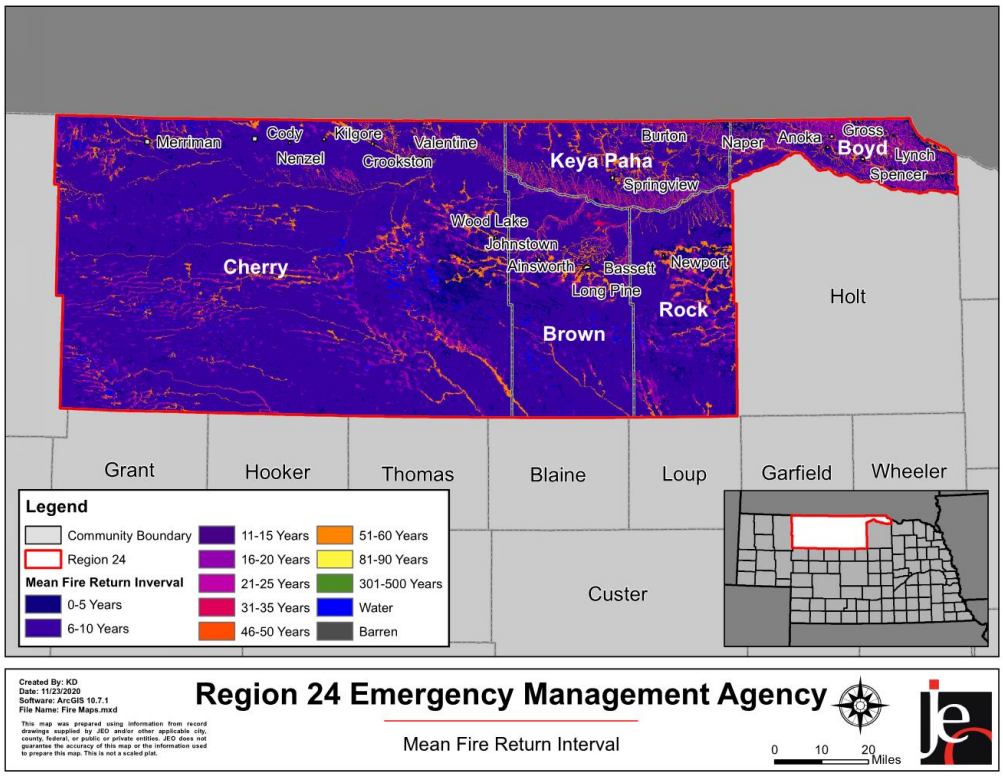
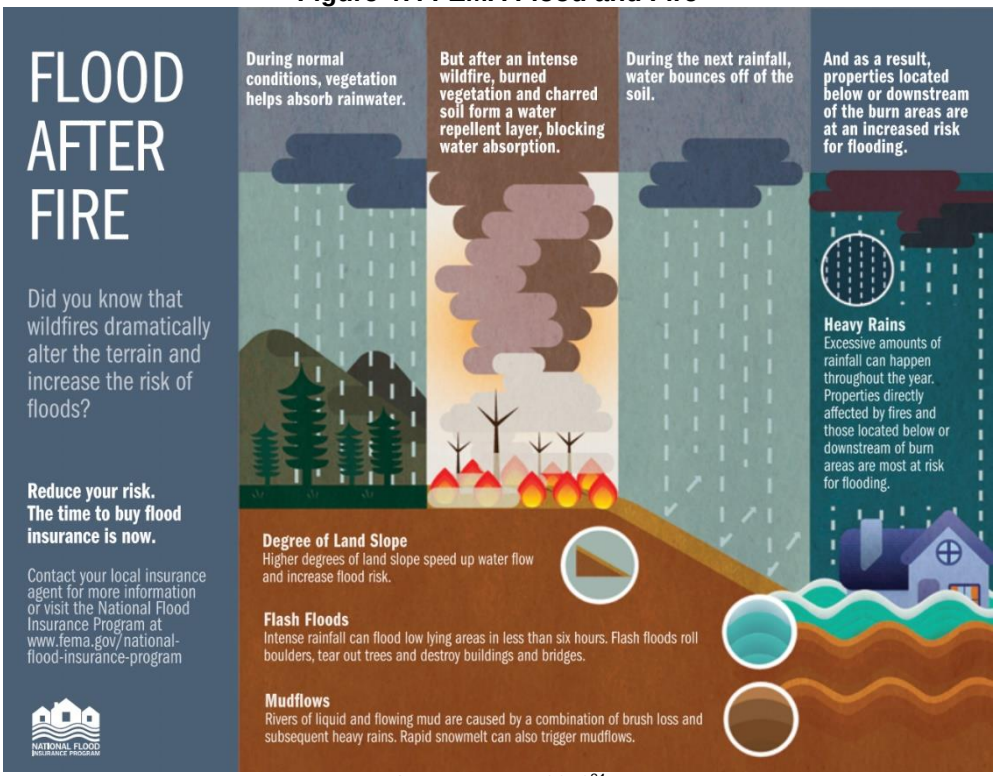


Figure 47: FEMA Flood and Fire



Source: FEMA, 2018[84]

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

Average Annual Losses

The average damage per event estimate was determined based upon records from the Nebraska Forest Service Wildfires Database from January 2000 to April 2020 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. During the 21-year period, 718 wildfires burned 130,379 acres and caused $116,359 in crop damage in the planning area. NFS records are based on voluntary reports submitted by fire departments. Not all departments report consistently, so actual numbers are likely higher.

Table 79: Grass/Wildfire Loss Estimation

Hazard Type	Number of Events	Events Per Year	Average Acres per Fire	Total Property Loss	Total Crop Loss	Average Annual Crop Loss
Grass/Wildfire	718	34	182	130,379 acres	$116,359	$5,541

Source: Nebraska Forest Service, 2000-April 2020

Table 80: Wildfire Threats

Hazard Type	Injuries	Fatalities	Homes Threatened or Destroyed	Other Structures Threatened or Destroyed
Grass/Wildfire	5	0	45	31

Source: Nebraska Forest Service, 2000-April 2020

Probability

Probability of wildfire occurrence is based on the historic record provided by the Nebraska Forest Service and reported potential by participating jurisdictions. With a grass/wildfire occurring each reported year (Figure 43), there is a 100 percent annual probability of wildfires occurring in the planning area each year.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 81: Regional Grass/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 to business owners -Loss of businesses
Built Environment	-Property damages
Infrastructure	-Damage to power lines and utility structures
Critical Facilities	-Risk of damages
Climate	-Changes in seasonal temperature and precipitation normals can increase frequency and severity of wildfire events -Changes in climate can help spread of invasive species, changing potential fuel load in wildland areas

Hail

According to the NWS, hail is defined as a showery precipitation in the form of irregular pellets or balls of ice more than five millimeters in diameter, falling from a cumulonimbus cloud. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight; they fall as precipitation, in the form of balls or irregularly shaped masses of ice. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size.

Location

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

Historical Occurrences

The NCEI reports events as they occur in each community. A single hail 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 hail event covering a large portion of the planning area could be reported by the NCEI as several events. The NCEI reports a total of 1,427 hail events in the planning area between January 1996 and March 2020. These events were responsible for $4,681,600 in property damages and $24,192,791 in crop damages. The following narratives are NCEI descriptions of the two events which caused the most property damage in the planning area.

- **Brown County (Ainsworth/Long Pine) – June 30, 1997:** Scattered supercells with winds in excess of 60 mph moved southeast across north central Nebraska. The severe thunderstorms produced large hail which severely damaged crops and property. Estimated property damages totaled $1,800,000.

- **Cherry County (Valentine) – July 30, 2013:** Severe thunderstorms developed over the northwestern Sandhills and moved east during the late afternoon and evening hours of July 30th. Hail to the size of golf balls and winds estimated to 70 MPH broke windows out of cars and homes near Crookston. Media reported nearly 300 cars damaged at a car dealership on the west side of Valentine. Estimated property damages totaled $400,000.

Extent

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 82 outlines the TORRO Hail Scale.

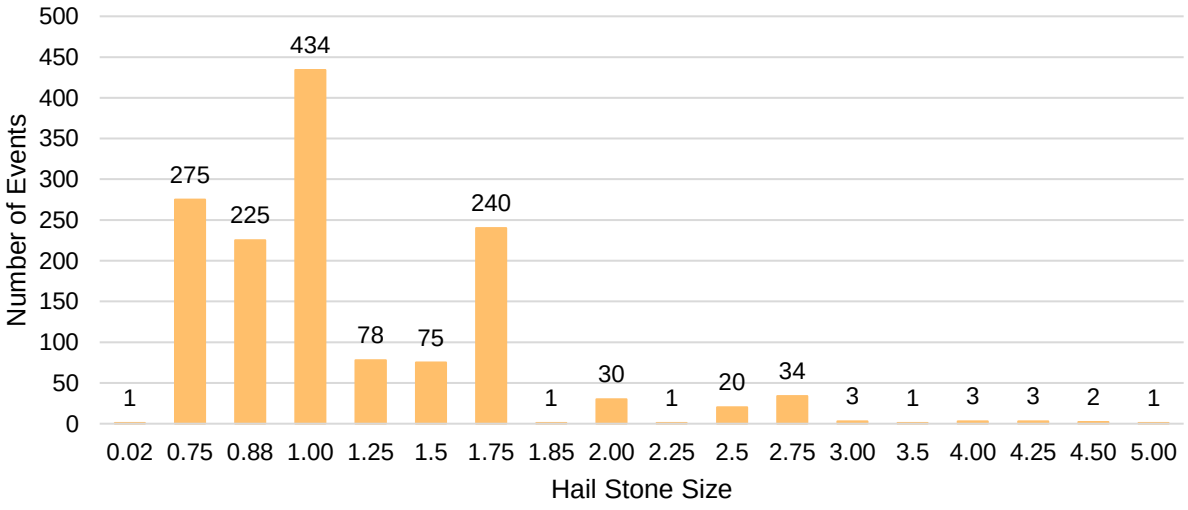
Table 82: TORRO Hail Scale

TORRO Classification / Intensity	Typical Hail Diameter	Typical Damage Impacts
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
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	>100mm (Melon); >4.0 in	Extensive structural damage; risk of severe or even fatal injuries to persons outdoors

Source: TORRO, 2019[85]

Of the 1,427 hail events reported for the planning area, the average hailstone size was 1.21 inches. Events of this magnitude correlate to an H4 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 nine H10 hail events (>4.0 inches) during the period of record. Figure 48 shows hail events based on the size of the hail.

Figure 48: Hail Events by Magnitude



Source: NCEI, 1996-March 2020

85 Tornado and Storm Research Organization. 2019. "Hail Scale." http://www.torro.org.uk/hscale.php.

Average Annual Losses

The average per event estimate was based on the NCEI Storm Events Database since 1996 and number of historical occurrences as described above. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 83: Hail Loss Estimate

Hazard Type	Number of Events[1]	Events Per Year[1]	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Hail	1,427	57	$4,681,600	$187,264	$24,192,791	$1,152,038

Source: 1 Indicates the data is from NCEI (1996-March 2020)2 Indicates data is from USDA RMA (2000-June 2020)

Probability

Based on historic records and reported events, hail is likely to occur several times annually within the planning area. The NCEI reported 1,427 hail events between 1996 and March 2020, or approximately 57 hail occurrences per year. Based on at least one hail event every year on record, the annual probability of occurrence for hail is 100 percent.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 84: Regional Hail Vulnerabilities

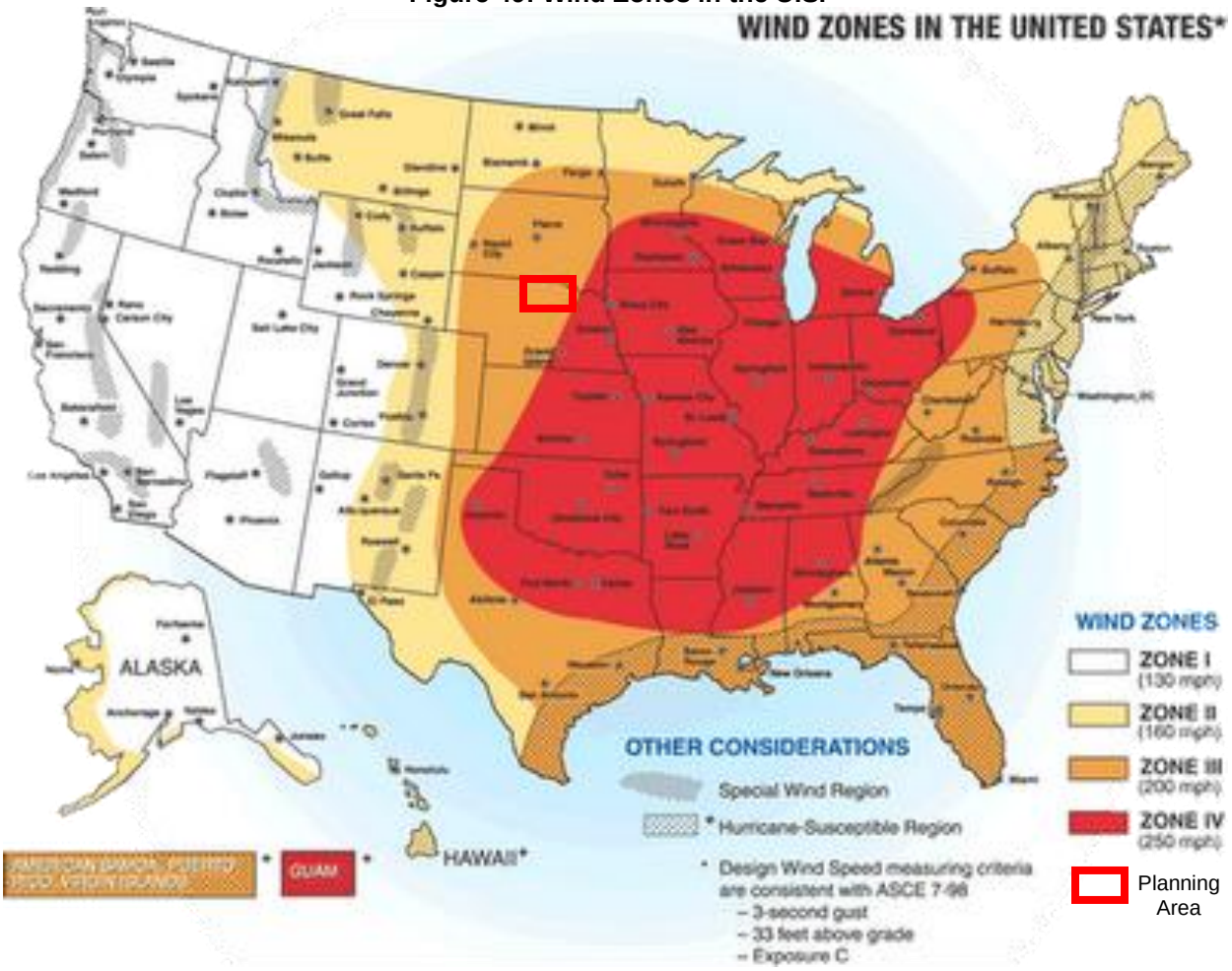
Sector	Vulnerability
People	-Injuries can occur from: not seeking shelter, standing near windows, and shattered windshields in vehicles
Economic	-Damages to buildings and property can cause significant losses to business owners
Built Environment	-Roofs, siding, windows, gutters, HVAC systems, etc. can incur damage
Infrastructure	-Power lines and utilities can be damaged
Critical Facilities	-Property damages and power outages
Climate	-Changes in seasonal precipitation and temperature normal can increase frequency and magnitude of hail and severe storm events
Other	-High winds, lightning, heavy rain, and possibly tornadoes can occur with this hazard

High Winds

High winds typically accompany severe thunderstorms, severe winter storms, 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 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.[86] 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 49 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 tornado.

Figure 49: Wind Zones in the U.S.



Source: FEMA, 2016

86 National Weather Service. 2009. "Glossary." http://w1.weather.gov/glossary/index.php?letter=h.

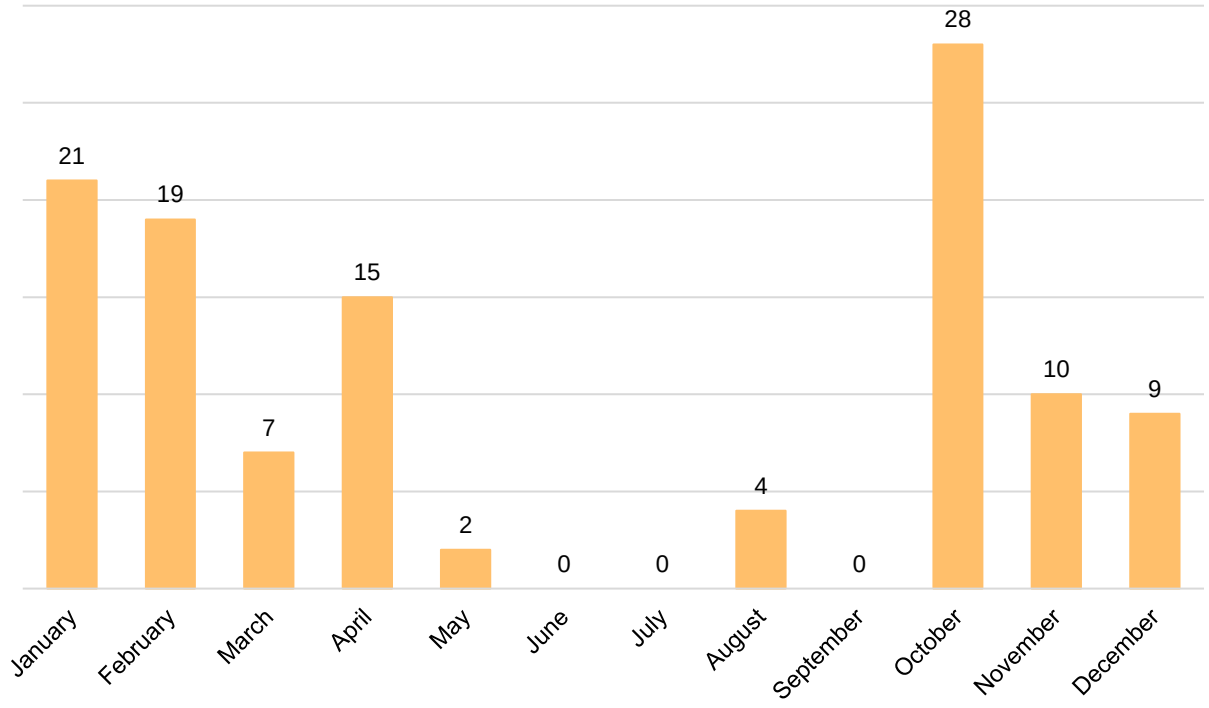
Location

High winds commonly occur throughout the planning area. The impacts would likely be greater in more densely populated areas.

Historical Occurrences

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 118 high wind events that occurred between January 1996 and March 2020. These events were responsible for $91,000 in property damages and $3,510,436 in crop damages. As seen in Figure 50, most high wind events occur in the late fall and winter months.

Figure 50: High Wind Events by Month



Source: NCEI, 1996-March 2020

Extent

The Beaufort Wind Scale can be used to classify wind strength, and the Enhanced Fujita Scale measures the magnitude of tornadoes. Table 85 outlines the Beaufort Scale, provides wind speed ranking, range of wind speeds per ranking, and a brief description of conditions for each ranking.

Table 85: 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

Beaufort Wind Force Ranking	Range of Wind	Conditions
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[87]

Using the NCEI reported events, the most common high wind event is ranked a level 9 on the Beaufort Wind Force Scale. The reported high wind events had an average of 48 mph winds. High wind is likely to occur annually in the planning area.

Average Annual Losses

The average damage per event estimated 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 can cause an average of $3,640 per year in property damage, and an average of $167,162 per year in crop damage for the planning area.

Table 86: High Wind Loss Estimate

Hazard Type	Number of Events[1]	Events Per Year[1]	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
High Wind	118	4.7	$91,000	$3,640	$3,510,436	$167,162

Source: 1 Indicates the data is from NCEI (1996-March 2020)2 Indicates data is from USDA RMA (2000-June 2020)

Probability

Based on historical records and reported events, 23 out of the 25 years examined experienced a high wind event. This means the annual probability of a high wind event is 92%.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

87 Storm Prediction Center: National Oceanic and Atmospheric Administration. 1805. “Beaufort Wind Scale.” http://www.spc.noaa.gov/faq/tornado/beaufort.html.

Table 87: Regional High Wind Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations include those living in mobile homes, especially if they are not anchored properly -People outdoors during events
Economic	-Agricultural losses -Damages to businesses and prolonged power outages can cause significant impacts to the local economy
Built Environment	-All building stock are at risk to damages from high winds
Infrastructure	-Downed power lines and power outages -Downed trees blocking road access
Critical Facilities	-All critical facilities are at risk to damages from high winds
Climate	-Changes in seasonal precipitation and temperature normal can increase frequency and magnitude of high wind and severe storm events

Landslides

According to the USGS a landslide can include but is not limited to rock falls, deep failure slopes, and shallow debris flows. According to the Landslide Hazards Program, landslides occur primarily because the force of gravity acts on steep slopes. However, landslides can occur due to the following factors:

- "erosion by rivers, glaciers, or ocean waves create over steepened slopes
- rock and soil slopes are weakened through saturation by snowmelt or heavy rains
- earthquakes create stresses that make weak slopes fail
- earthquakes of magnitude 4.0 and greater have been known to trigger landslides
- volcanic eruptions produce loose ash deposits, heavy rain, and debris flows
- excess weight from accumulation of rain or snow, stockpiling of rock or ore, from waste piles, or from man-made structures may stress weak slopes to failure and other structures"

Landslides also occur when the ground becomes saturated after heavy rains or snow falls causing debris flow or mud flow. These flows can cause a wave of mud and debris that can knock down trees, damage houses, creating "dams" that cause localized flooding.

According to Professor Duane Eversoll from the University of Nebraska at Lincoln, "the three elements needed for a landslide to occur are geological formations susceptible to landslide, a slope and precipitation. According to the University of Nebraska, "landslides have occurred throughout Nebraska, they are more common in the eastern and northeastern parts of the state." According to the book "Nebraska Landslides" glaciers covered the eastern portion of the state approximately two million years ago creating a terrain with slopes. Over time, these slopes have been covered with sediment deposits and other porous ground materials that are susceptible to saturation from precipitation which causes landslides.

Location

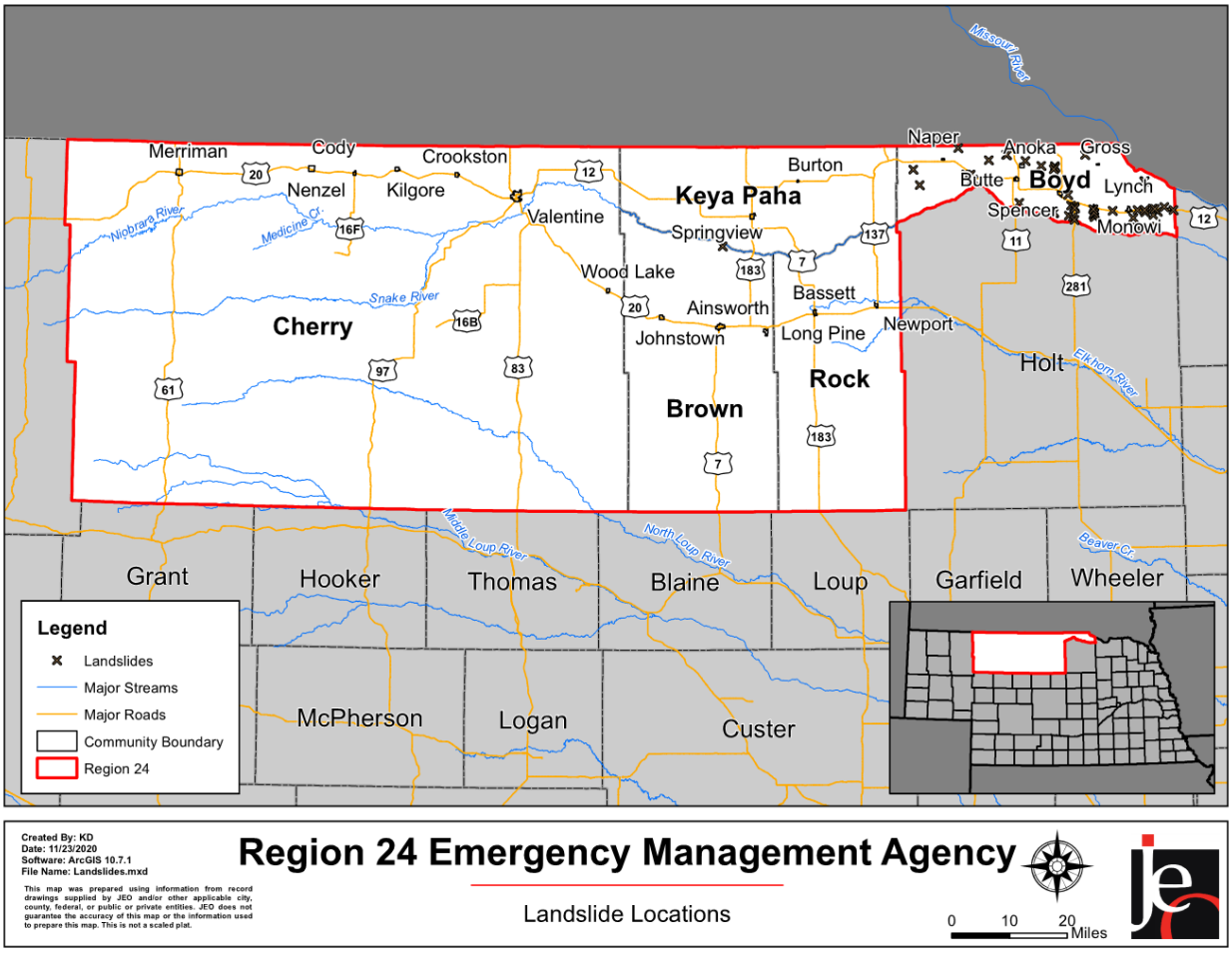
The area's most vulnerable to this hazard are the rural sections of the planning area, used primarily for ranching. Area in the planning area that have development near land slopes may be more susceptible to this hazard.

Historical Occurrences

The University of Nebraska's *Collection of Nebraska Landslides* reports events as they occur in each county. There were 57 landslide events that occurred between 1960 and 2013.[88] One event occurred in Brown County with the rest occurring in Boyd County. Figure 51 shows the locations of the landslides. There were no reported damages from these events. An additional landslide was reported by a plan participant in 2019 located in Boyd County. This event broke a water line, but exact damages are not known. There are likely more landslides that have occurred in the planning area but have not been reported.

88 University of Nebraska-Lincoln School of Natural Resources. 1960-2013. "Collection of Nebraska Landslides". http://snr.unl.edu/data/geologysoils/landslides/landslidedatabase.aspx.

Figure 51: Landslide Locations



Extent

Given the unique geographical landscape of the sandhills region of the planning area, there are many large slopes which are conducive for landslide to occur. Given a lack of reported landslide impacts, no reported economic damages, and the rural nature of this region, the extent of a landslide event is likely minimal. Further, the most vulnerable locations for landslides in Boyd County are in non-developed, rural areas. Communities in the planning area are located away from areas most vulnerable to landslide. The average length of the reported landslides was 198 feet, and the average width was 305 feet. Lengths ranged from 30 to 1,400 feet and widths ranged from 50 to 1,100 feet.

Average Annual Losses

The average damage per event estimated was determined based upon the University of Nebraska's *Collection of Nebraska Landslides* from 1960 to 2013 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. There were no report property or crop damages from these events.

Table 88: Landslide Loss Estimate

Hazard Type	Number of Events	Events Per Year	Total Property Loss	Average Annual Property Loss	Total Crop Loss	Average Annual Crop Loss
Landslide	57	1.1	$0	$0	$0	$0

Source: University of Nebraska, 1960-2013

Probability

The University of Nebraska reports 57 landslide events from 1960 to 2013. However, some years had multiple events. Out of the 54 years, only seven years had a landslide event occur. This makes the annual probability thirteen percent.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 89: Regional Landslide Vulnerabilities

Sector	Vulnerability
People	-Potential injury to people nearby
Economic	-Agricultural losses -Damages to infrastructure could impact businesses and the local economy
Built Environment	-Minimal risk to buildings and foundations
Infrastructure	-Damage to roads, power lines, and water lines
Critical Facilities	-Potential damage to infrastructure
Climate	-Increases in severe weather (heavy rain and drought) could lead to additional landslides

Levee Failure

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 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 USACE, who is responsible for federal levee oversight and inspection of levees, has three ratings for levee inspections.

Table 90: USACE Levee Rating Categories

Ratings	Description
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

Location

According to USACE's National Levee Database, there are no levees in the planning area or neighboring jurisdictions. However, there may be some unmapped private levees or berms that exist that could result in some flood risk if they were to fail.

Historical Occurrences

There have been no recorded instances of levee failure in the planning area.

Extent

Given that there are no mapped levees within the planning area, we are not able to identify the exact impacts of levee failure. If any unmapped levees or berms were to fail, they would likely result in minor flooding of farm or ranchland.

Average Annual Losses

There are no recorded instances of levee failure in the planning area, so average annual losses are $0.

Probability

With no mapped levees in the planning area, there is a less than 1% chance that levee failure will occur in the planning area annually.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 91: Regional Vulnerabilities

Sector	Vulnerability
People	-Minimal risk from unmapped private levees and berms
Economic	-Minimal impact to agricultural lands
Built Environment	-All buildings within leveed areas are at risk to damages
Infrastructure	-Minimal impact to infrastructure. Likely to be localized
Critical Facilities	-None. There are no critical facilities in leveed areas
Climate	-Changes in seasonal precipitation and temperature normals can increase strain on any unmapped private levees and berms

Public Health Emergency

According to the World Health Organization (WHO), a public health emergency is:

> "an occurrence or imminent threat of an illness or health condition, caused by bio terrorism, epidemic or pandemic disease, or (a) novel and highly fatal infectious agent or biological toxin, that poses a substantial risk of a significant number of human facilities or incidents or permanent or long-term disability" (WHO, 2001). The declaration of a state of public health emergency permits the governor to suspend state regulations and change the functions of state agencies.[89]

The number of cases that qualifies as a public health emergency depends on several factors including the illness, its symptoms, ease in transmission, incubation period, and available treatments or vaccinations. With the advent of sanitation sewer systems and other improvements in hygiene since the 19th century, the spread of infectious disease has greatly diminished. Additionally, the discovery of antibiotics and the implementation of universal childhood vaccination programs have played a major role in reducing human disease impacts. Today, human disease incidences are carefully tracked by the Centers for Disease Control and Prevention (CDC) and state organizations for possible epidemics and to implement control systems. Novel illnesses or diseases have the potential to develop annually and significantly impact residents and public health systems.

Some of the best actions or treatments for public health emergencies are nonpharmaceutical interventions (NPI). These are readily available behaviors or actions, and response measures people and communities can take to help slow the spread of respiratory viruses such as influenza. Understanding NPIs and increasing the capacity to implement them in a timely way, can improve overall community resilience during a pandemic. Using multiple NPIs simultaneously can reduce influenza transmission in communities even before vaccination is available.[90]

Pandemics are global or national disease outbreaks. These types of illnesses, such as influenza, can easily spread person-to-person, cause severe illness, and are difficult to contain. An especially severe pandemic can lead to high levels of illness, death, social disruption, and economic turmoil. Past pandemic events include:

- 1918 Spanish Flu: the H1N1 influenza virus spread world-wide during 1918 and 1919. It is estimated that at least 50 million people worldwide died during this pandemic with about 675,000 deaths alone in the United States. No vaccine was ever developed, and control efforts included self-isolation, quarantine, increased personal hygiene, disinfectant use, and social distancing.

- 1957 H2N2 Virus: a new influenza A (H2N2) virus emerged in Eastern Asia and eventually crossed into coastal U.S. cities in summer of 1957. In total 1.1 million people worldwide died of the flu with 116,000 of those in the United States.

89 World Health Organization. 2008. Accessed April 2020. "Glossary of humanitarian Terms." https://www.who.int/hac/about/definitions/en/.
90 U.S. Department of Health and Human Services. 2017. "Pandemic Influenza Plan: 2017 Update." https://www.cdc.gov/flu/pandemic-resources/pdf/pan-flu-report-2017v2.pdf.

- 1968 H3N2 Virus: an influenza A virus discovered in the United States in September 1968 which killed over 100,000 citizens. The majority of deaths occurred in people 65 years and older.

- 2009 H1N1 Swine Flu: a novel influenza A virus discovered in the United States and spread quickly across the globe. This flu was particularly prevalent in young people while those over 65 had some antibody resistance. The CDC estimated the U.S. had over 60.8 million cases and 12,469 deaths.

- 2019 COVID-19: the novel influenza A virus which originated in Wuhan China and spread globally. As of December 2, 2020, the CDC reported over 13,626,022 cases and 269,763 deaths in the U.S. attributed to COVID-19. Efforts to control and limit the virus included self-isolation, quarantine, increased cleaning measures, and social distancing. Significant impacts to the national and global economy have been caused by COVID-19.

The State of Nebraska Department of Health and Human Services (DHHS) requires doctors, hospitals, and laboratories to report on many communicable diseases and conditions to monitor disease rates for epidemic events. Additionally, regional or county health departments monitor local disease outbreaks and collect data relevant to public health. The North Central District Health Department covers the entire planning area plus Holt, Knox, Antelope, and Pierce Counties.

Location

Human disease outbreaks can occur anywhere in the planning area. Public heath emergencies or pandemic threshold levels are dependent on the outbreak type, transmission vectors, location, and season. Normal infectious disease patterns are changing due to increasing human mobility and climate change. Rural populations are particularly at risk for animal-related diseases while urban areas are at greater risk from community spread type illnesses. All residents throughout the planning area are at risk during public health emergencies. All areas within the planning area experienced impacts from COVID-19 specifically during 2020.

Historical Occurrences

Cases and fatalities associated with Public Health Emergencies vary between illness types and severity of outbreak. Past major outbreaks in Nebraska have specifically included the H1N1 Swine Flu in 2009 and COVID-19 in 2020.

- H1N1 Swine Flu (2009) – outbreaks were first reported in mid-April 2009 and spread rapidly. The new flu strand for which immunity was nonexistent in persons under 60 years old was similar in many ways to typical seasonal influenza. Symptoms of H1N1 included fever greater than 100°F, cough, and sore throat. County specific counts of H1N1 are not available, however a total of 71 confirmed cases were reported by June 12, 2009.[91] Outbreaks in Nebraska were typically seen sporadically with occasional cluster outbreaks at summer camps for youth. The U.S. Public Health Emergency for the H1N1 Influenza outbreak expired on June 23, 2010. The CDC developed and encouraged all US residents to receive a yearly flu vaccination to protect against potential exposures. The H1N1 continues to appear annually and persons in the planning area are at risk of infection in the future.

91 Centers for Disease Control and Prevention. June 2009. “Novel H1N1 Flu Situation Update.” https://www.cdc.gov/h1n1flu/updates/061209.htm.

- COVID-19 (2020) – In January 2020, the CDC confirmed the first case of COVID-19 in the United States and it quickly spread across the country. By March 2020, the World Health Organization declared COVID-19 a pandemic and travel bans were instituted around the globe. Primary symptoms of the infection included cough, fever or chills, shortness of breath or difficulty breathing, fatigue, muscle and body aches, headache, loss of taste or smell, sore throat, and others. The first confirmed case of COVID-19 in the State of Nebraska was a 36-year-old Omaha resident in early March. Counties and cities throughout the planning area have instituted directed health measures to protect residents from the spread of COVID-19.

The table below displays COVID-19 confirmed cases and deaths as of December 2020. This data will likely increase as time goes on until the entire population can be vaccinated.

Table 92: COVID-19 Cases in the Planning Area

County	Total Number of Tests	Confirmed Cases	Fatalities
Boyd	464	162	2
Brown	858	203	1
Cherry	1,544	245	4
Keya Paha	139	38	0
Rock	365	98	2
Total	**3,370**	**746**	**9**

Source: Nebraska Department of Health and Human Services[92]

Extent

Those most affected by public heath emergencies are typically the very young, the very old, the immune-compromised, the economically vulnerable, and the unvaccinated. Roughly 21% of the planning area's population is 18 years or younger, and 24% of the planning area is 65 years or older. These factors increase vulnerability to the impacts of pandemics. Refer to *Section Three: Planning Area Profile* for further discussion of age and economic vulnerability in the planning area. It is not possible to determine the extent of individual public health emergency events, as the type and severity of a novel outbreak cannot be predicted. However, depending on the disease type, a significant portion of residents may be at risk to illness or death.

The extent of a public health emergency is also closely tied to the proximity or availability of health centers. The following table identifies hospitals in the planning area.

Table 93: Hospitals in the Planning Area

County	Facility Name	Nearest Community	Total Licensed Beds
Boyd	Niobrara Valley Hospital	Lynch	15
Brown	Brown County Hospital	Ainsworth	23
Cherry	Cherry County Hospital	Valentine	21
Rock	Rock County Hospital	Bassett	24

Source: Nebraska Department of Health and Human Services[93]

92 Nebraska Department of Health and Human Services. December 22, 2020. "Coronavirus COVID-19 Nebraska Cases by the Nebraska Department of Health and Human Services (DHHS)". https://experience.arcgis.com/experience/ece0db09da4d4ca68252c3967aa1e9dd.

93 Department of Health and Human Services. October 2020. "Hospitals." http://dhhs.ne.gov/licensure/Documents/Hospital%20Roster.pdf.

Immunodeficiency disorders (such as diabetes), obesity, or other pre-existing health complications reduce the ability of the body to fight infection. Diabetes prevalence per county and for the state are listed in the table below.

Table 94: Diabetes Prevalence in the Planning Area

County	Diagnosed Diabetes Rate (Total Adults Age 20+)
Boyd	6.9%
Brown	7.6%
Cherry	6.0%
Keya Paha	9.9%
Rock	9.7%
State of Nebraska*	8.0%

Source: Centers of Disease Control and Prevention, 2017[94]
**State data is from 2016.*

Nebraska state law (Title 173) requires all students have the following vaccinations: poliomyelitis, Diphtheria, pertussis, tetanus, measles, mumps, rubella, Hepatitis B, and varicella (chicken pox). The Vaccines for Children program is a federally funded and state-operated vaccine supply program that provides free vaccines to children under 18 who are of American Indian or Alaska Native descent, enrolled in Medicaid, uninsured, or underinsured. Additionally, the HPV vaccination series is recommended for teenagers and influenza vaccinations are recommended yearly for those over six months old. Individuals without vaccinations are at greater risk of contracting diseases or carrying diseases to others.

Average Annual Losses

The national economic burden of influenza medical costs, medical costs plus lost earnings, and total economic burden was $10.4 billion, $26.8 billion, and $87.1 billion respectively in 2007.[95] However, associated costs with pandemic response are much greater. Current estimated costs for COVID-19 in the United States exceed $16 trillion. Specific costs do not include losses from displacement, functional downtime, economic loss, injury, or loss of life. The direct and indirect effects of significant health impacts are difficult to quantify.

Probability

There is no pattern as to when public health emergencies will occur. Based on historical records, it is likely that small-scale disease outbreaks will occur annually within the planning area. However, large scale emergency events (such as seen with COVID-19) cannot be predicted.

94 Centers for Disease Control and Prevention. 2017. “Diagnosed diabetes prevalence – Nebraska.” https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html.

95 Molinari, N.M., Ortega-Sanchez, I.R., Messonnier, M., Thompson, W.W., Wortley, P.M., Weintraub, E., & Bridges, C.B. April 2007. “The annual impact of seasonal influenza in the US: measuring disease burden and costs.” DOI: 10.1016/j.vaccine.2007.03.046.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 95: Regional Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations include the very young, the very old, the unvaccinated, the economically vulnerable, and those with immunodeficiency disorders. -Institutional settings such as prisons, dormitories, long-term care facilities, day cares, and schools are at higher risk to contagious diseases -Poverty, rurality, underlying health conditions, and drug or alcohol use increase chronic and infectious disease rates
Economic	-Large scale or prolonged events may cause businesses to close, which could lead to significant revenue loss and loss of income for workers
Built Environment	-Increased number of unoccupied business structures
Infrastructure	-Transportation routes may be closed if a quarantine is put in place -Healthcare facilities in the planning area may be overwhelmed quickly by widespread events
Critical Facilities	-Healthcare facilities in the planning area may be overwhelmed quickly by widespread events -Critical facilities could see suspended action or reduced resources due to sick staff
Climate	-Climate change impacts on extreme weather, air quality, transmission of disease via insects and pests, food security, and water quality increase threats of disease

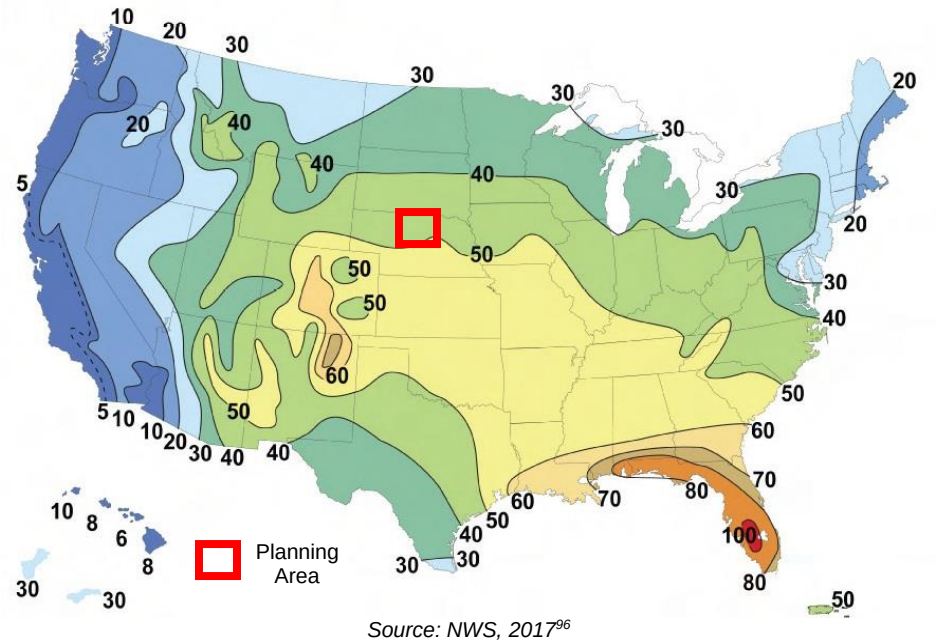
Severe Thunderstorms

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, set fire to buildings and agricultural lands, and cause 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 contacts the ground. Lightning generally occurs when warm air mixes with colder air masses resulting in atmospheric disturbances necessary for polarizing the atmosphere. Severe thunderstorms usually occur in the evening during the spring and summer months.

Economically, thunderstorms are generally beneficial in that they provide moisture necessary to support Nebraska's largest industry, agriculture. Most thunderstorms do not cause damage, but when they escalate to severe storms, the potential for damages increases. Damages can include crop losses from wind; property losses due to building and automobile damages from high wind, flash flooding, and death or injury to humans and animals from lightning, drowning, or getting struck by falling or flying debris. Figure 52 displays the average number of days with thunderstorms across the country each year. The planning area experiences an average of 40 thunderstorms over the course of one year.

Figure 52: Average Number of Thunderstorms



Source: NWS, 2017[96]

96 National Weather Service. 2017. "Introduction to Thunderstorms." http://www.srh.noaa.gov/jetstream/tstorms/tstorms_intro.html.

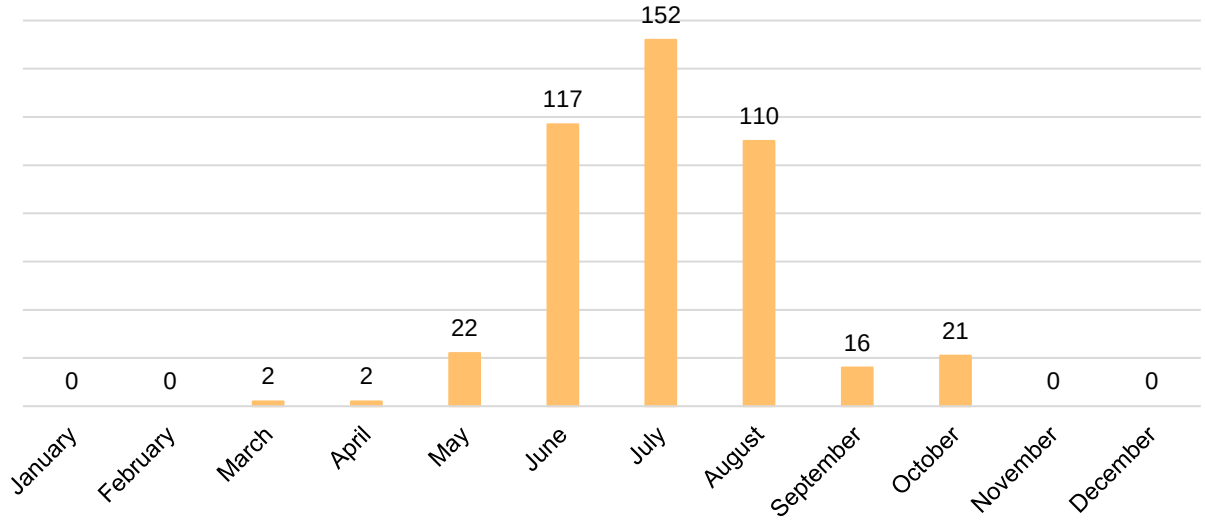
Location

The entire planning area is at risk of severe thunderstorms.

Historical Occurrences

Severe thunderstorms in the planning area usually occur in the afternoon and evening during the summer months (Figure 53).

Figure 53: Severe Thunderstorm Events by Month



Source: NCEI, 1996-March 2020

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 412 thunderstorm wind, 13 heavy rain, and eight lightning events in the planning area from January 1996 to March 2020. In total, these events were responsible for $4,125,450 in property damages. The USDA RMA data does not specify severe thunderstorms as a cause of loss, however heavy rains which may be associated with severe thunderstorms caused $15,453,591 in crop damages. There was one reported injury from a lightning 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 is capable of winds gusts of 58 mph or higher.

Average Annual Losses

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 $165,018 per year in property damages and $735,885 in crop damage.

Table 96: Severe Thunderstorm Loss Estimate

Hazard Type	Number of Events[1]	Events Per Year[1]	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Heavy Rain	13	0.5	$0	$0	$15,453,591	$735,885
Lightning	8	0.3	$49,850	$1,994		
Thunderstorm Wind	412	16.5	$4,075,600	$163,024		
Total	**433**	**17.3**	**$4,125,450**	**$165,018**	**$15,453,591**	**$735,885**

Source: 1 Indicates data is from NCEI (1996-March 2020); 2 Indicates data is from USDA RMA (2000-June 2020)

Probability

Based on historical records and reported events, severe thunderstorm events are likely to occur on an annual basis. The NCEI reported a severe thunderstorm event in every year, resulting in 100 percent chance annually for thunderstorms.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 97: Regional Severe 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 to business owners
Built Environment	-Buildings are at risk to wind damage -Downed trees and tree limbs
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 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 temperatures for these months are all below freezing (average low for the three months is 17.1°F). The average high temperatures for the months of January, February, and December are near 39.7°F.[97]

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

A blizzard occurs when there are sustained wind gusts of 35 mph or greater and blowing snow reduces visibility to less than a fourth of a mile for three hours or longer.[98] Blizzards are particularly dangerous due to drifting snow and the potential for rapidly occurring whiteout conditions, which greatly inhibits vehicular traffic. Heavy snow is usually the most defining element of a winter storm. Large snow events can cripple an entire jurisdiction 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.

Historical Occurrences

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 434 severe winter storm events for the planning area from January 1996 to March 2020. These recorded events caused a total of

97 NOAA National Centers for Environmental Information. 2020. “Data Tools: 1981-2010 Normals.” [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

98 NOAA National Weather Service. 2009. “Glossary – Blizzard”. https://w1.weather.gov/glossary/index.php?word=blizzard.

$10,723,000 in property damages and $3,236,580 in crop damages. The events were responsible for one fatality in the planning area.

According to the NCEI, 241 winter storm events were reported since January 1996 causing $10,223,000 in property damage. The most damaging event occurred in early April 2001 when a snowstorm dropped between four and eight inches of wet snow accompanied by 60 mph wind gusts knocked down power poles, lines, and damaged trees. The event caused $ 10,000,000 in property damages in Cherry County.

Additional information from these events from NCEI and reported by each community are listed in *Section Seven: Community Profiles*.

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 54 shows the SPIA Index.

Figure 54: 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	

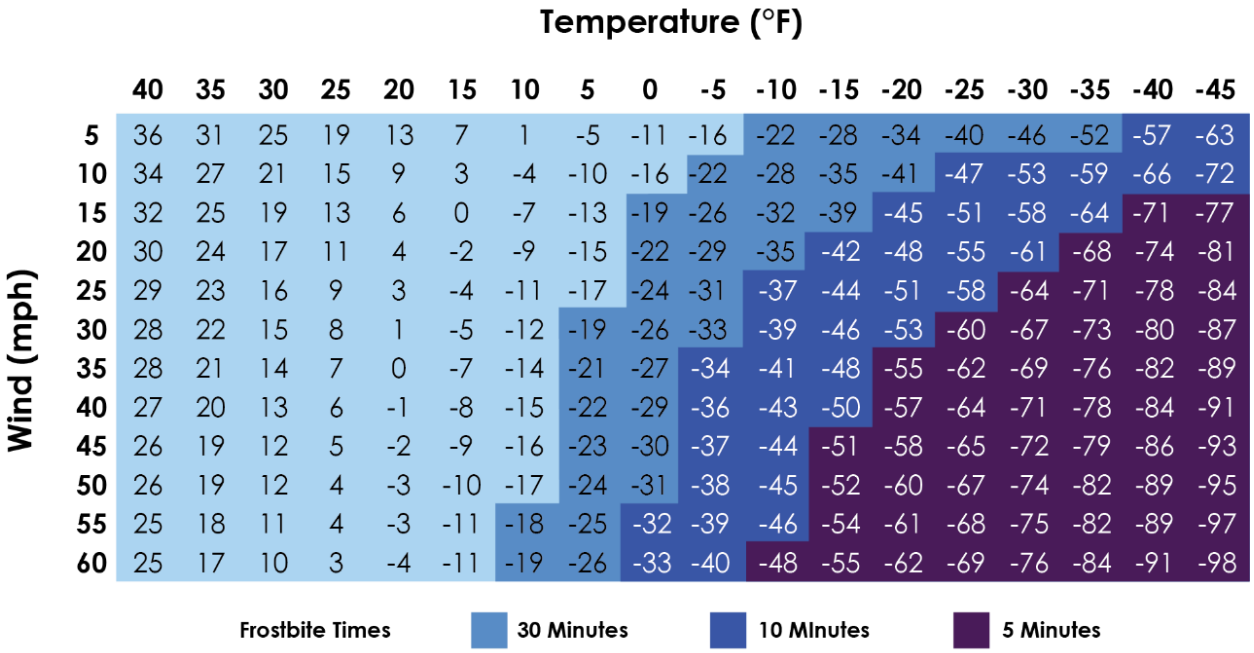
(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Source: SPIA-Index, 2017[99]

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

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 bit as it gets lower. Figure 55 shows the Wind Chill Index used by the NWS.

Figure 55: Wind Chill Index Chart



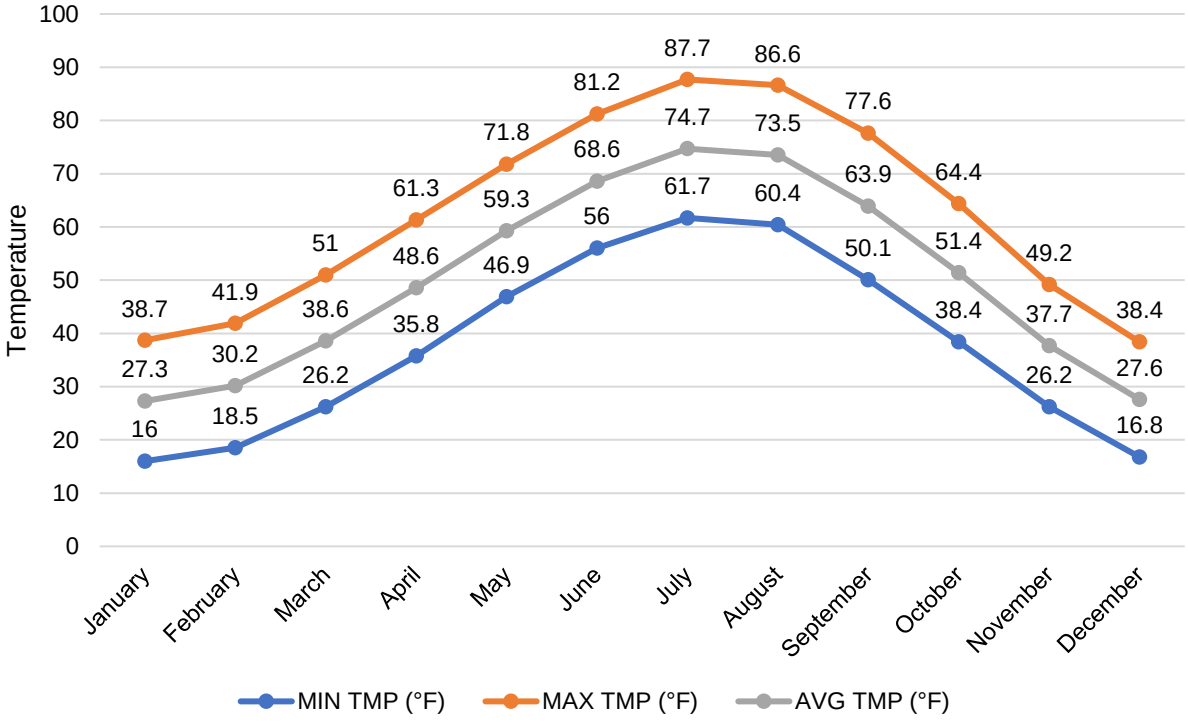
Source: NWS, 2017[100]

Figure 56 shows the monthly climate normals for the planning area. December, January, and February are the coldest months. The average low temperatures for these months are all below freezing (average low for the three months is 17.1°F). The average high temperatures for the months of January, February, and December are near 39.7°F.

Average monthly snowfall for the planning area is shown in Figure 57, 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 six 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.

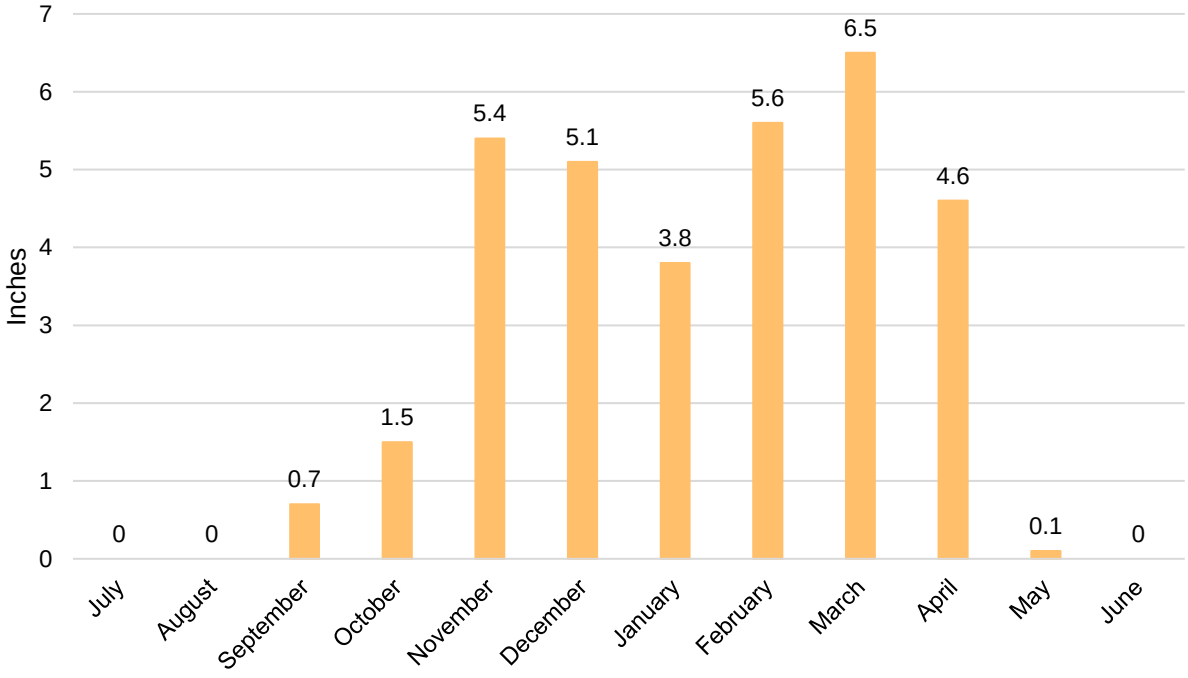
100 National Weather Service. 2001. "Wind Chill Chart." http://www.nws.noaa.gov/om/cold/wind_chill.shtml.

Figure 56: Monthly Climate Normals Temperature



Source: NCEI, 1981-2010

Figure 57: Monthly Normal Snowfall in Inches



Source: High Plains Regional Climate Center, 1981-2010[101]

101 High Plains Regional Climate Center. 1981-2010. "Monthly Climate Normal". http://climod.unl.edu/. Accessed November 2020.

Average Annual Losses

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 $428,920 per year in property damage and $154,123 per year in crop damages for the planning area.

Table 98: Severe Winter Storm Loss Estimate

Hazard Type	Number of Events[1]	Events Per Year[1]	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Blizzard	77	3.1	$500,000	$20,000		
Extreme Cold/Wind Chill	85	3.4	$0	$0		
Heavy Snow	26	1	$0	$0	$3,236,582	$154,123
Ice Storm	5	0.2	$0	$0		
Winter Storm	241	9.6	$10,223,000	$408,920		
Winter Weather	0	0	$0	$0		
Total	**434**	**17.4**	**$10,723,000**	**$428,920**	**$3,236,582**	**$154,123**

Source: 1 Indicates data is from NCEI (1996-March 2020); 2 Indicates data is from USDA RMA (2000-June 2020)

Probability

Based on historical records and reported events, severe winter storm events are likely to occur on an annual basis. The NCEI reported a severe winter storm event in every year, resulting in 100 percent chance annually for thunderstorms.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 99: 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 storm events

Terrorism

According to the Federal Bureau of Investigation (FBI), there is no single, universally accepted definition of terrorism. Terrorism is defined in the Code of Federal Regulations as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives" (28 C.F.R. Section 0.85)[102]. Terrorist activities are also classified based on motivation behind the event (such as religious fundamentalism, national separatist movements, and social revolutionary movements). Terrorism can also be random with no ties to ideological reasoning.

The FBI further describes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. For this plan, 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 attached, which are:

- Political Terrorism
- Bio-Terrorism
- Cyber-Terrorism
- Eco-Terrorism
- Nuclear Terrorism
- Narco-Terrorism

Threat assessment, mitigation, and response to terrorism are federal and state directives that work in conjunction with local law enforcement. Terrorism is addressed at the federal level by the US Department of Homeland Security and at the state level by the Nebraska Emergency Management Agency.

102 Terrorism, 28 U.S. Code Section 0.85

Location

Terrorist activity within the planning area is possible throughout the region. Urban areas, schools, and government buildings are more likely to see terroristic activity. However, water systems of any size could be vulnerable as well as computer systems from cyber-terrorism.

Historical Occurrences

For any incidents of terroristic events, the University of Maryland and National Consortium for the START database, maintained from 1970 to 2018, was consulted.[103] According to this source, no terrorism events have been reported in the planning area.

Extent

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

Average Annual Losses

The START Global Terrorism (1970-2018) reported no events or damages from events.

Probability

Due to the lack of reported events in a 49-year period, the annual probability will be stated as less than one percent for the purposes of the plan.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 100: Regional Terrorism Vulnerabilities

Sector	Vulnerability
People	-Police officers and first responders at risk of injury or death -Civilians at risk of injury or death -Students and staff at school facilities at risk of injury or death from school shootings
Economic	-Damaged business can cause loss of revenue and loss of income for workers -Agricultural attacks could cause significant economic losses for the region -Risk of violence in an area can reduce income flowing into and out of that area
Built Environment	-Targeted buildings may sustain heavy damage
Infrastructure	-Water supply, power plants, utilities all at risk of damage
Critical Facilities	-Police stations and governmental offices are at higher risk
Climate	-None

103 National Consortium for the Study of Terrorism and Responses to Terrorism (START). 1970-2018. Global Terrorism Database [Data file]. Retrieved from https://www.start. umd.edu/gtd. Accessed 2020.

Tornadoes

A tornado is typically associated with a supercell thunderstorm. For a rotation to be classified as a tornado, three characteristics must be met.

- 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.
- 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.

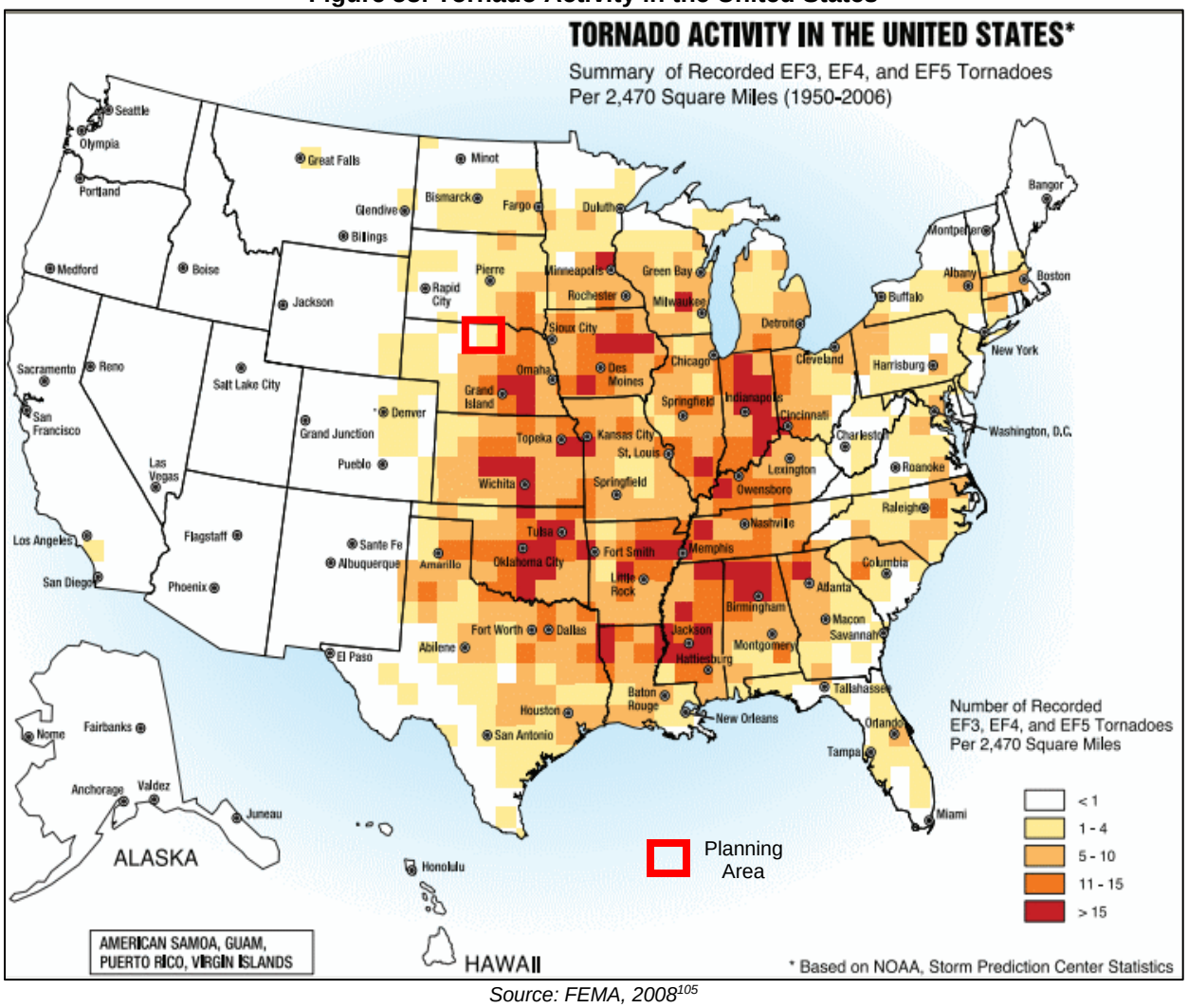
Nebraska is ranked fifth in the nation for tornado frequency with an annual average of 57 tornadoes between 1991 to 2010.[104] The following figure shows the tornado activity in the United States as a summary of recorded EF3, EF4, and EF5 tornadoes per 2,470 square miles from 1950 through 2006.

Location

Tornadoes can occur anywhere in the planning area. The impacts would likely be greater in more densely populated areas. The following map shows the historical track locations across the region from 1950 to 2017 according to the Midwestern Regional Climate Center.

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

Figure 58: Tornado Activity in the United States



Source: FEMA, 2008[105]

Historical Occurrences

The NCEI reported a total of 88 tornado events from January 1996 to March 2020. The events caused an estimated $2,215,750 in property damage and resulted in one injury. In June 1999 an EF1 tornado caused $750,000 to irrigation systems, power poles, and a large grain bin facility near Bassett.

The following figure shows that the month of June is the busiest month of the year followed by July and May with the highest number of tornadoes in the planning area.

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

Figure 59: Historic Tornado Tracks

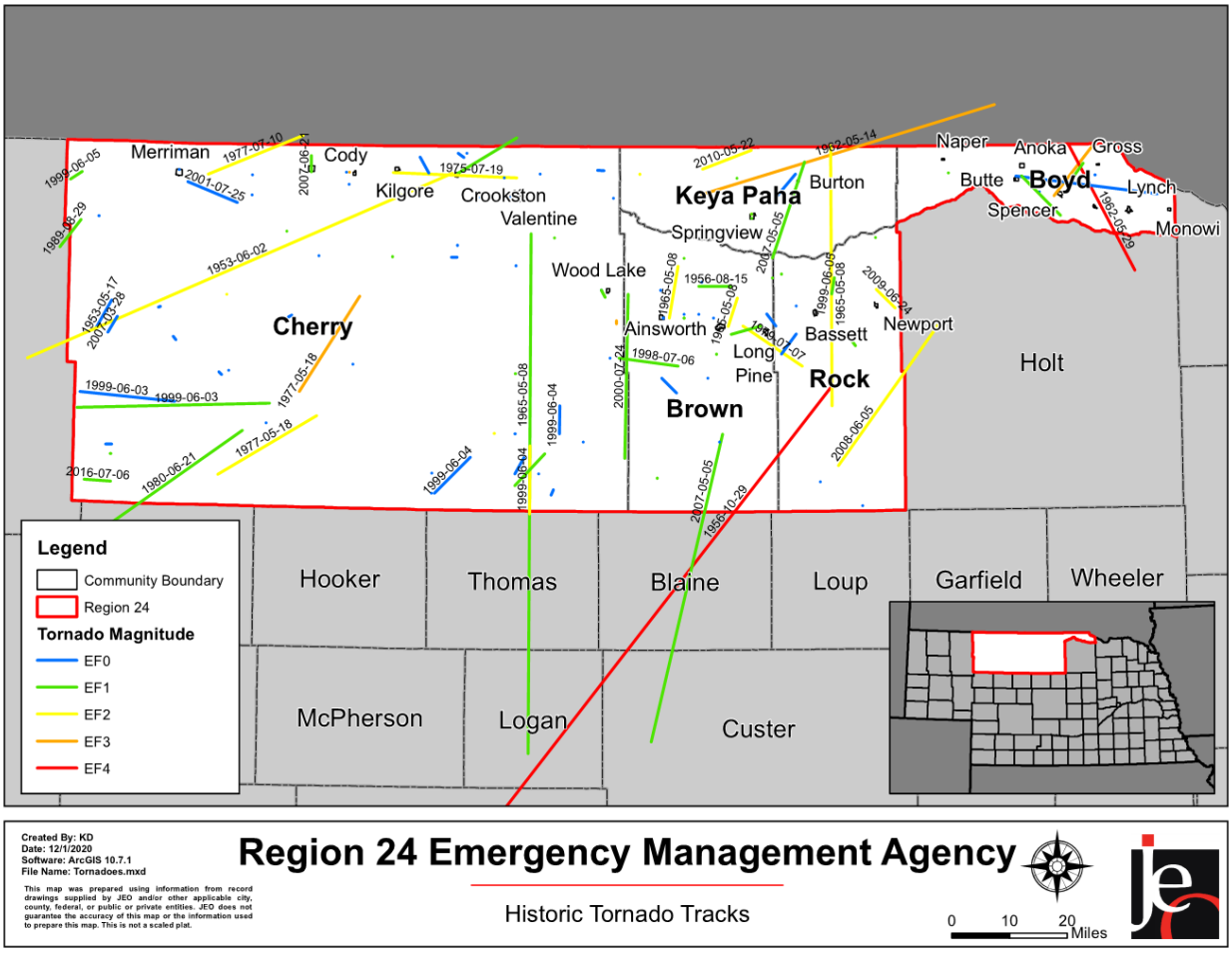
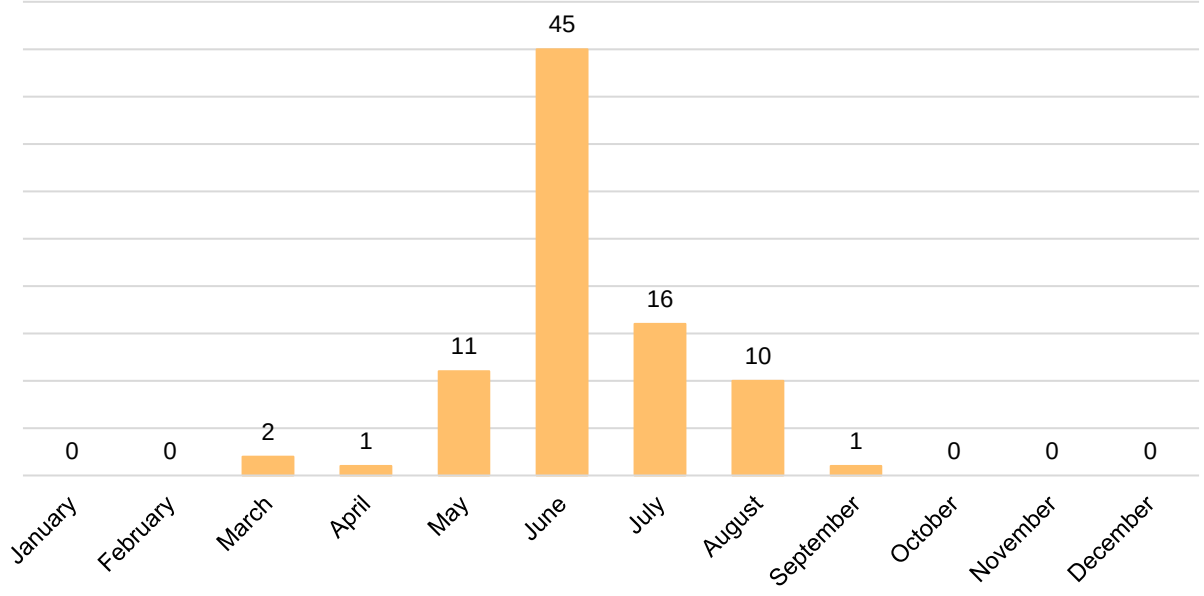


Figure 60: Tornadoes by Month in the Planning Area



Source: NCEI, 1996-March 2020

Extent

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.[106]

Table 101: Enhanced Fujita Scale

Storm Category	Three 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

106 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 102: 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	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

Based on historic record, it is most likely that tornadoes within the planning area will be of EF0 strength. Of the 88 reported tornado events, 13 were EF1, six were EF2, one was EF3, and the rest were EF0.

Average Annual Losses

The average damage per event estimated was determined based upon NCEI Storm Events Database since 1996. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Tornadoes cause an average of $88,630 per year in property damage. The RMA did not report any crop damages due to tornadic events.

Table 103: Tornado Loss Estimate

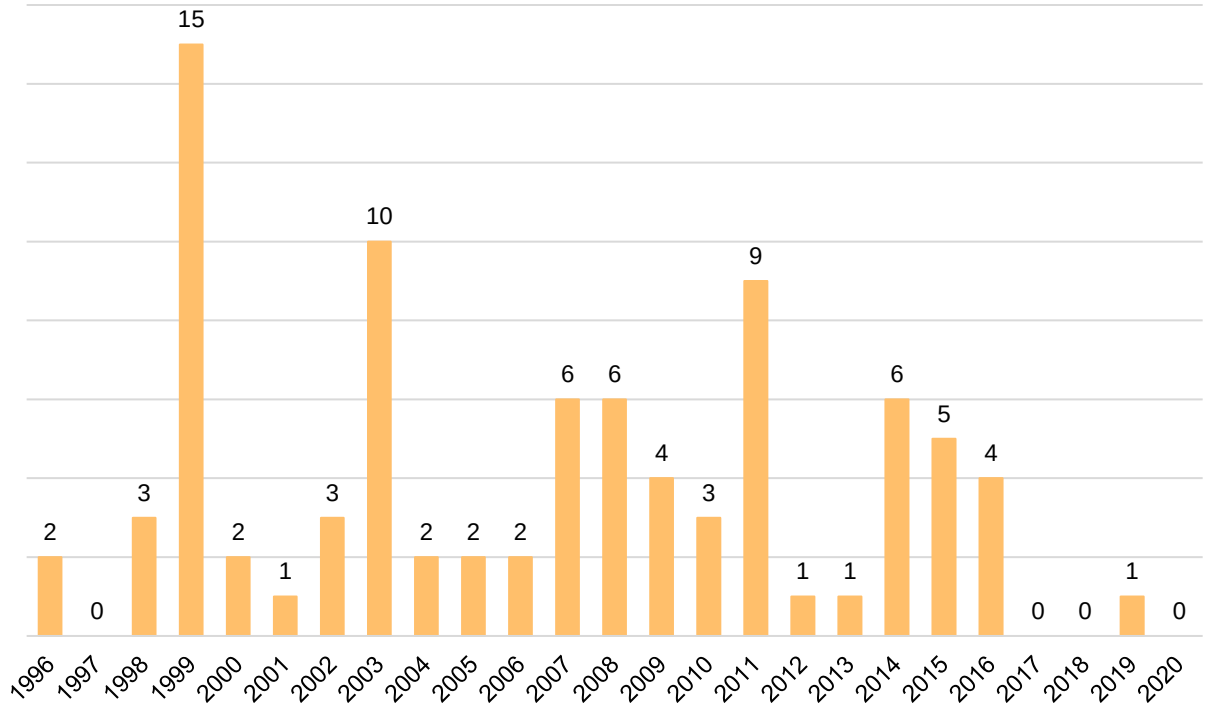
Hazard Type	Number of Events[1]	Events Per Year[1]	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Tornado	88	3.5	$2,215,750	$88,630	$0	$0

Source: 1 Indicates data is from NCEI (1996-March 2020); 2 Indicates data is from USDA RMA (2000-June 2020)

Probability

Based on historical records and reported events, it is likely that tornadic events will occur within the planning area almost annually. For the 25 years examined, 21 had a reported tornado event making the annual probability 84%.

Figure 61: Tornado Events Per Year



Source: NCEI, 1996-March 2020

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 104: Regional 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 a safe room -Elderly with decreased mobility or poor hearing may be higher risk -Lack of multiple ways of receiving weather warnings, especially at night
Economic	-Agricultural losses to both crops and livestock -Damages to businesses and prolonged power outages can cause significant impacts to the local economy
Built Environment	-All building stock are at risk of significant damages
Infrastructure	-Downed power lines and power outages -Downed trees blocking road access -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 normal can increase frequency and magnitude of severe storm events

Transportation Incidents

A transportation accident involves an incident 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 no rail lines, and few airports. In addition, most of the airports in the planning area are smaller with very few takeoffs and landings.

Location

Transportation incidents can occur anywhere along transportation routes in the planning area but are most likely to occur along major highways due to increased speeds and the higher number of vehicles. Table 105 lists the location of the public and private airports in the planning area. Figure 62 shows the location of the major transportation routes in the planning area.

Table 105: Airports Location in the Planning Area

Airport	Nearest Community	County
Ainsworth Regional Airport	Ainsworth	Brown
Woolf Brothers Airport	Lynch	Boyd
Cole Memorial Airport	Merriman	Cherry
Miller Field Airport	Valentine	Cherry
Rock County Airport	Bassett	Rock

Source: AirNav[107]

Historical Events

Automobile

The 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 2,342 crashes, 932 injuries, and 58 fatalities.

107 AirNav. 2020. “Browse Airports”. https://www.airnav.com/airports/us/NE.

Figure 62: Transportation Corridors

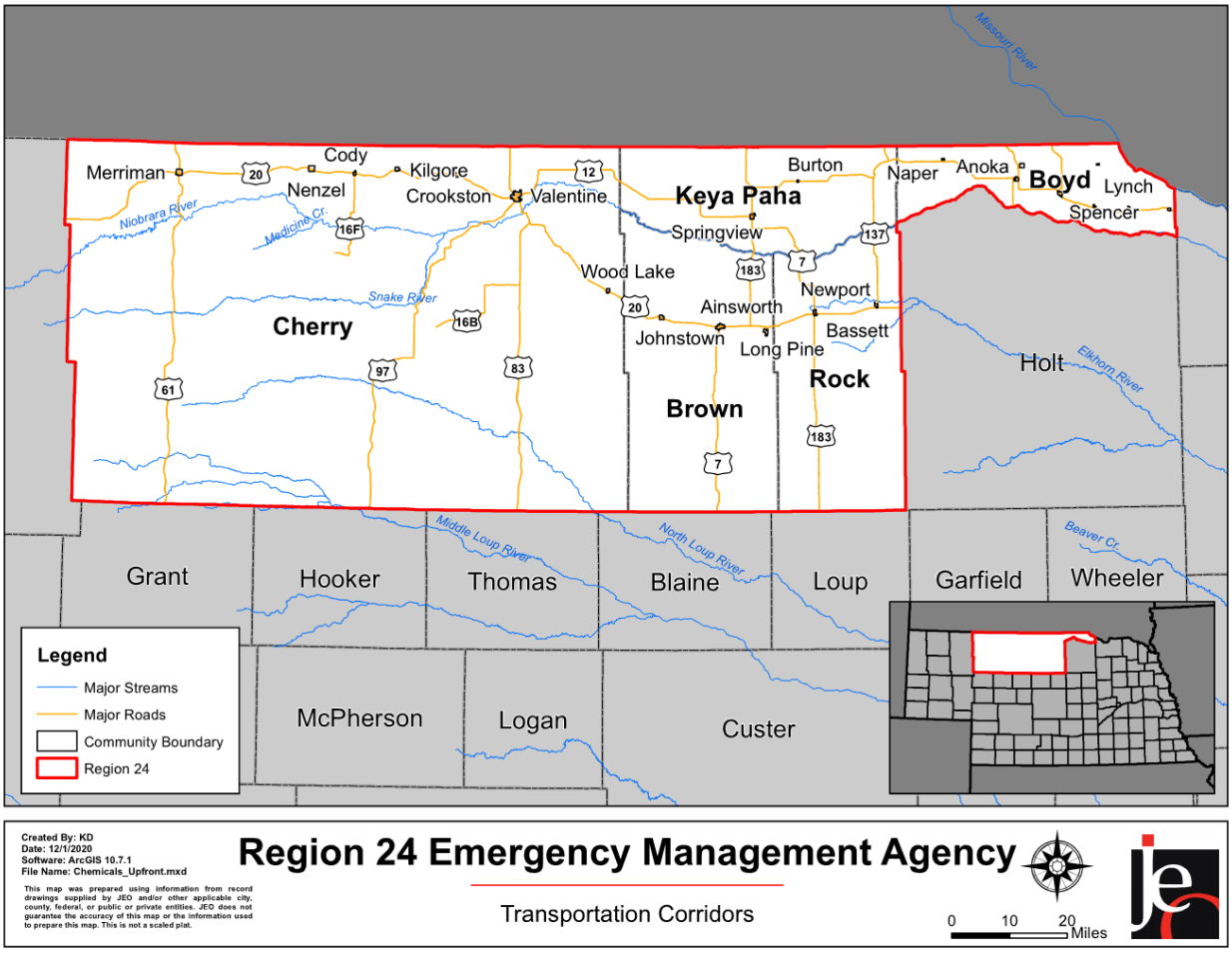
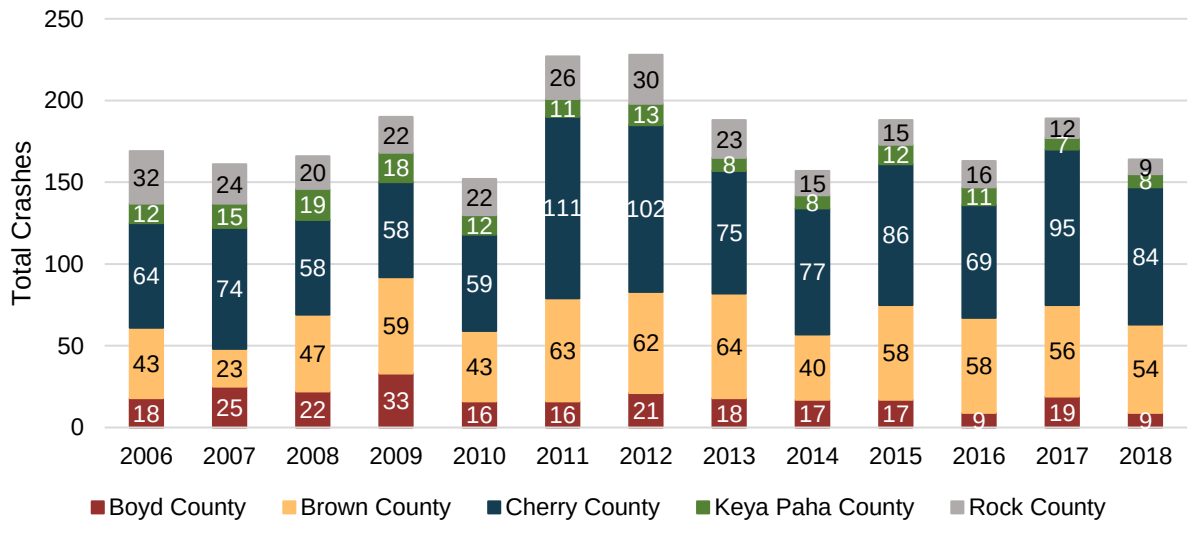


Figure 63: Automobile Crashes



Source: NDOT[108]

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

Railway

The Federal Railroad Administration (FRA) keeps data on all railway accidents since 1975. Table 106 shows the number of railway accidents by county since 1975. Ten injuries and no fatalities resulted from these events. Although there are currently no rail lines in the planning area, in the past rail lines did travel through the planning area. Since then, the lines have been removed and converted into walking and biking trails.

Table 106: Historical Railway Incidents

County	Number of Incidents	Injuries	Fatalities
Boyd	0	0	0
Brown	2	0	0
Cherry	16	9	0
Keya Paha	0	0	0
Rock	2	1	0
Total	**20**	**10**	**0**

Source: Federal Railroad Administration, 1975-2020[109]

Aviation

From 1962 through June 2020, there have been 65 aviation accidents in the planning area, as reported by the National Transportation Safety Board (NTSB) database. The events resulted in 18 injuries and 14 fatalities. Incidents with an injury or fatality are listed in the table below.

Table 107: Historical Aviation Incidents

Date	County	Phase of Flight	Injuries	Fatalities	Nearest Community
12/20/1985	Brown	Cruise	0	3	Ainsworth
04/27/1989	Brown	Climb	0	3	Ainsworth
05/23/1989	Cherry	Go-Around	2	0	Valentine
09/17/1989	Boyd	Takeoff	1	1	Lynch
08/14/1992	Cherry	Approach	4	0	Valentine
11/01/1992	Cherry	Cruise	0	2	Valentine
03/20/1994	Rock	Cruise	2	0	Bassett
02/18/1998	Cherry	Cruise	0	1	Wood Lake
09/19/2000	Cherry	Takeoff	1	0	Valentine
02/07/2001	Brown	Approach	1	1	Ainsworth
01/01/2005	Brown	Approach	2	0	Ainsworth
07/23/2006	Brown	Landing	1	0	Ainsworth
03/04/2009	Cherry	Takeoff	2	0	Wood Lake
07/27/2012	Cherry	Landing	1	1	Valentine
07/27/20012	Cherry	Landing	1	1	Valentine
09/23/2017	Brown	Takeoff	0	1	Ainsworth

Source: National Transportation Safety Board, 1962-June 2020[110]

Extent

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

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

Average Annual Losses

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 $987 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.

Table 108: Transportation Incidents Loss Estimate

Hazard Type	Number of Events	Events Per Year	Total Property Loss	Average Annual Property Loss
Automobile[1]	2,342	180.2	N/A	N/A
Aviation[2]	65	1.1	N/A	N/A
Railway[3]	20	0.4	$45,400	$987
Total	**2,427**	**181.7**	**$45,400**	**$987**

Source: 1 NDOT, 2006-2018; 2 NTSB 1962-June 2020; 3 FRA 1975-2020

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% annual probability of auto incidents and a 58% annual probability of aviation incidents (34 out 59 years with an event). Although there have been railway incidents in the past, there are no longer any rail lines in the planning area. Therefore, the annual probability of incidents is 0%.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 109: 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 nearby 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

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 HMP's established goals and objectives. These actions should consider the most cost effective and technically feasible manner to address risk.

The plan's goals and objectives were established during the kick-off meeting with the Hazard Mitigation Planning Team. Meeting participants reviewed the goals from the 2015 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 Hazard Mitigation Planning Team voted to maintain the same list of goals from the 2015 HMP. These goals and objectives were then shared with all planning team members at the Round 1 public meetings.

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, updated status or removal of past mitigation actions, and revisions to the mitigation alternative selection process or descriptions of mitigation actions for consistency across the planning area.

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 Health and Safety of Residents

Goal 2: Reduce Future Losses from Hazard Events

Goal 3: Increase Public Awareness and Educate on the Vulnerability to Hazards

Goal 4: Improve Emergency Management Capabilities

Goal 5: Pursue Multi-Objective Opportunities (Whenever Possible)

Goal 6: Enhance Overall Resilience and Promote Sustainability

Selected Mitigation Actions

After establishing the goals, local planning teams evaluated and prioritized mitigation actions. These actions included: the mitigation actions identified per jurisdiction in the previous plan and additional mitigation actions discussed during the planning process. The Planning Team provided each participant a link to the FEMA Handbook as a list of mitigation actions to be used as a starting point. Participants were also encouraged to think of actions that may need FEMA grant assistance and to review their hazard prioritization for potential mitigation actions. These suggestions helped participants determine which actions would best assist their respective jurisdiction in alleviating damages in the event of a disaster. The listed priority rating does not indicate which actions will be implemented first but serves as a guide in determining the order in which each action should be implemented. Participants were informed of the STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, Environmental) feasibility review process and were encouraged to use it when determining priorities.

These projects are the core of a hazard mitigation plan. The planning teams were instructed that each alternative must directly relate to the goals of the plan and the hazards of top concern for their jurisdiction. Alternatives must be specific activities that are concise and can be implemented individually. Mitigation actions were evaluated based on referencing the community's risk assessment and capability assessment. Communities were encouraged to choose mitigation actions that were realistic and relevant to the concerns identified.

A final list of alternatives was established including the following information: description of action; which hazard(s) the action mitigates; responsible party; priority; cost estimate; potential local funding sources; and estimated timeline. This information was established through input from participants and determination by the Planning Team.

It is important to note that not all the mitigation actions identified by a community may ultimately be implemented due to limited capabilities, prohibitive costs, low benefit-cost ratio, or other concerns. These factors may not be identified during this planning process. The cost estimates, priority rating, potential funding, and identified agencies are used to give communities an idea of what actions may be most feasible over the next five years. This information will serve as a guide for the participants to assist in hazard mitigation for the future. Additionally, some jurisdictions may identify and pursue additional mitigation actions not identified in this HMP.

Participant Mitigation Actions

Mitigation actions identified by participants of the Region 24 EMA HMP are found in the Mitigation Action Project Matrix below. Additional information about selected actions can be found in *Section Seven: Community Profiles.* Each action includes the following information in the respective community profile.

- 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 for the appropriate jurisdiction.
- Potential funding – a list of any local 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 between each community, mostly dependent on funding capabilities and the size of the local tax base.
- Lead agency – listing of agencies or departments which may lead or oversee the implementation of the action item.
- Status – a description of what has been done, if anything, to implement the action item.

Implementation of the actions will vary between individual plan participants based upon the availability of existing information, funding opportunities and limitations, and administrative capabilities of communities. Establishment of a cost-benefit analysis is beyond the scope of this plan and could potentially be completed prior to submittal of a project grant application or as part of a five-year update. Completed, removed, continued, and new mitigation actions for each participating jurisdiction can be found in *Section Seven: Community Profiles*.

Mitigation Action Project Matrix

During public meetings, each participant was asked to review mitigation projects listed in the 2015 HMP and identify new potential mitigation actions, if needed, to reduce the effects of hazards. Selected projects varied per jurisdiction depending upon the significance of each hazard. The information listed in the following tables is a compilation of new and continued mitigation actions identified by jurisdiction. Completed and removed mitigation actions can be found in the respective community profile.

Table 110: Mitigation Actions Selected by Each Jurisdiction 1 of 3

Mitigation Actions	Goal	Boyd County	Village of Bristow	Village of Butte	Village of Lynch	Village of Naper	Village of Spencer	Brown County	City of Ainsworth	Village of Johnstown	City of Long Pine	Cherry County	Village of Cody	Village of Crookston	Village of Kilgore
Adopt a No Adverse Impact	2.3	X					X								
Alert/Warning Sirens	1.1, 4.3, 5.2	X	X	X		X	X	X				X		X	
Backup and Emergency Generators	1.1	X	X			X	X	X	X	X	X	X			
Business Continuity Plans	2.2, 4.3, 5.2	X	X	X			X		X						
Civil Service Improvements	1.1, 2.1, 4.3, 5.2	X	X				X		X	X	X		X	X	X
Comprehensive Plan	2.2, 2.3, 5.2, 6.1						X								
Continuity Plan	2.2, 4.3, 5.2	X	X		X		X		X						
Dam Engineering Analysis / Improvements and Reinforcement	1.1, 2.1, 5.1, 5.2						X								
Drainage Study / Stormwater Master Plan	2.2	X	X		X		X		X				X		X
Drought Monitoring Plan and Procedures	2.2	X					X								
Elevator for Courthouse	2.1	X													
Emergency Communications	1.1, 4.1, 4.3, 5.2	X	X				X		X			X	X		
Expand Water Storage Capacity / Emergency Water Supplies / Dry Hydrants	1.1	X	X	X			X		X	X					X

Mitigation Actions	Goal	Boyd County	Village of Bristow	Village of Butte	Village of Lynch	Village of Naper	Village of Spencer	Brown County	City of Ainsworth	Village of Johnstown	City of Long Pine	Cherry County	Village of Cody	Village of Crookston	Village of Kilgore
Facilities for Vulnerable Populations	1.1	X					X								
Firewise Community	2.2, 2.3, 5.1, 5.2	X					X		X		X		X		
Flood-Prone Property Acquisition	1.1, 2.1, 5.2	X	X				X		X				X		
Floodplain Management	2.3, 5.2, 6.1	X	X		X		X		X						
Groundwater / Irrigation / Water Conservation Management Plan	2.2	X	X				X		X					X	
Hail Resistant Roofing	1.1, 2.1, 5.2	X	X				X								
Hazardous Fuels Reduction	1.1, 2.1, 5.2						X		X		X				
Hazardous Tree Removal	1.1, 2.1, 5.2	X	X				X		X	X					
Improve Snow / Ice Removal Program / Snow Fence	1.1	X					X		X				X		
Infrastructure Upgrades	1.1, 2.1, 5.2						X								
Install Vehicular Barriers	1.1, 2.1, 5.2	X					X								
Levee / Dike Construction	1.1, 2.1, 5.1, 5.2				X										
Low Impact Development	2.3	X					X								
Participate in the National Flood Insurance Program	2.2, 2.3, 5.1, 5.2					X							X		

Mitigation Actions	Goal	Boyd County	Village of Bristow	Village of Butte	Village of Lynch	Village of Naper	Village of Spencer	Brown County	City of Ainsworth	Village of Johnstown	City of Long Pine	Cherry County	Village of Cody	Village of Crookston	Village of Kilgore
Power, Service, Electrical, and Water Distribution Lines	1.1, 2.1, 5.2	X	X	X	X		X		X	X	X		X		
Preserve Natural Floodplain	2.3, 5.2, 6.1	X					X								
Promote First Aid	1.1, 3.1, 5.2	X	X	X			X		X				X		
Promote Higher Codes	2.3, 5.2, 6.1	X					X		X						
Public Awareness/Education	1.1, 3.1, 3.2, 5.2	X	X				X	X	X		X	X	X		
Safe Rooms and Storm Shelters	1.1	X			X		X		X	X		X			
Sheltering in Place Outreach	1.1, 3.1, 5.2		X						X						
Source Water Contingency Plan	2.2, 5.2, 6.1	X		X			X		X	X			X	X	X
Stabilize / Anchor Fertilizer, Fuel, and Propane Tanks	1.1	X	X		X		X				X	X			
Stormwater System and Drainage Improvements	2.1	X	X	X	X	X	X	X	X	X	X		X		X
Stream Bank Stabilization / Grade Control Structures / Channel Improvements	2.1	X			X		X	X	X			X			
Tree City USA	2.2, 2.3, 5.1, 5.2	X					X		X						
Vulnerable Population Support Database	1.1, 2.2, 5.2	X	X				X		X						
Warning Systems	1.1, 5.1, 5.2	X					X		X			X			
Weather Radios	4.3	X					X		X			X			

Mitigation Actions	Goal	Boyd County	Village of Bristow	Village of Butte	Village of Lynch	Village of Naper	Village of Spencer	Brown County	City of Ainsworth	Village of Johnstown	City of Long Pine	Cherry County	Village of Cody	Village of Crookston	Village of Kilgore
Windbreaks / Living Snow Fence	1.1, 2.1, 5.2						X								

Table 111: Mitigation Actions Selected by Each Jurisdiction 2 of 3

Mitigation Actions	Goal	Village of Nenzel	City of Valentine	Keya Paha County	Village of Springview	Rock County	City of Bassett	Village of Newport	Ainsworth Community Schools	Boyd County Rural Water District #2	Boyd County Schools	Brown County Rural Fire Protection District
Alert/Warning Sirens	1.1, 4.3, 5.2	X	X	X		X	X	X			X	
Backup and Emergency Generators	1.1		X		X	X	X	X	X			X
Business Continuity Plans	2.2, 4.3, 5.2						X					
Civil Service Improvements	1.1, 2.1, 4.3, 5.2		X	X		X	X	X				
Continuity Plan	2.2, 4.3, 5.2	X	X			X	X					
Ditch Improvements	1.1, 2.1, 5.2					X						
Drainage Study / Stormwater Master Plan	2.2			X			X	X				
Drought Monitoring Plan and Procedures	2.2					X						
Emergency Communications	1.1, 4.1, 4.3, 5.2	X	X	X		X	X		X		X	
Expand Water Storage Capacity / Emergency Water Supplies / Dry Hydrants	1.1		X			X	X	X				

Mitigation Actions	Goal	Village of Nenzel	City of Valentine	Keya Paha County	Village of Springview	Rock County	City of Bassett	Village of Newport	Ainsworth Community Schools	Boyd County Rural Water District #2	Boyd County Schools	Brown County Rural Fire Protection District
Firewise Community	2.2, 2.3, 5.1, 5.2					X						
Floodplain Management	2.3, 5.2, 6.1						X					
Groundwater / Irrigation / Water Conservation Management Plan	2.2					X	X					
Hazardous Fuels Reduction	1.1, 2.1, 5.2		X	X		X	X					
Hazardous Tree Removal	1.1, 2.1, 5.2	X	X	X		X		X			X	
Improve Snow / Ice Removal Program / Snow Fence	1.1		X				X					
Install Vehicular Barriers	1.1, 2.1, 5.2						X		X			
New Fire Barn	1.1											X
New Well	1.1									X		
Participate in the National Flood Insurance Program	2.2, 2.3, 5.1, 5.2					X		X				
Power, Service, Electrical, and Water Distribution Lines	1.1, 2.1, 5.2	X	X			X	X	X	X		X	
Promote First Aid	1.1, 3.1, 5.2			X		X	X		X			
Promote Higher Codes	2.3, 5.2, 6.1		X				X					
Public Awareness/Education	1.1, 3.1, 3.2, 5.2			X		X		X	X			
Safe Rooms and Storm Shelters	1.1		X	X		X	X	X	X			

Mitigation Actions	Goal	Village of Nenzel	City of Valentine	Keya Paha County	Village of Springview	Rock County	City of Bassett	Village of Newport	Ainsworth Community Schools	Boyd County Rural Water District #2	Boyd County Schools	Brown County Rural Fire Protection District
School Continuity Plan	2.2, 4.3, 5.2								X			
Source Water Contingency Plan	2.2, 5.2, 6.1		X			X	X					
Stabilize / Anchor Fertilizer, Fuel, and Propane Tanks	1.1	X				X	X					
Stormwater System and Drainage Improvements	2.1	X	X	X		X	X	X				
Stream Bank Stabilization / Grade Control Structures / Channel Improvements	2.1			X		X				X		
Transportation Drainage Improvements	2.1					X						
Variable Frequency Drives on Wells	2.1		X									
Vulnerable Population Support Database	1.1, 2.2, 5.2					X						
Warning Systems	1.1, 5.1, 5.2			X		X						
Weather Radios	4.3					X	X				X	X
Windbreaks / Living Snow Fence	1.1, 2.1, 5.2					X						

Table 112: Mitigation Actions Selected by Each Jurisdiction 3 of 3

Mitigation Actions	Goal	Keya Paha County Fire District	Lower Niobrara NRD	Middle Niobrara NRD	Naper Rural Fire District	Region 24 EMA	Rock County Public Schools	Valentine Rural Fire District
Alert/Warning Sirens	1.1, 4.3, 5.2					X		
Backup and Emergency Generators	1.1	X	X	X	X	X	X	
Boiler System	1.1			X				
Civil Service Improvements	1.1, 2.1, 4.3, 5.2				X	X		X
Emergency Communications	1.1, 4.1, 4.3, 5.2					X	X	
Expand Water Storage Capacity / Emergency Water Supplies / Dry Hydrants	1.1					X		
Firewise Community	2.2, 2.3, 5.1, 5.2					X		
Hazardous Fuels Reduction	1.1, 2.1, 5.2					X		
New Fire Barn	1.1				X			
Power, Service, Electrical, and Water Distribution Lines	1.1, 2.1, 5.2					X	X	
Prescribed Burns	1.1	X						
Promote First Aid	1.1, 3.1, 5.2						X	
Public Awareness/Education	1.1, 3.1, 3.2, 5.2	X				X		
Safe Rooms and Storm Shelters	1.1			X		X		
School Continuity Plan	2.2, 4.3, 5.2						X	

Mitigation Actions	Goal	Keya Paha County Fire District	Lower Niobrara NRD	Middle Niobrara NRD	Naper Rural Fire District	Region 24 EMA	Rock County Public Schools	Valentine Rural Fire District
Sheltering in Place Outreach	1.1, 3.1, 5.2					X		
Stream Crossing Upgrades	2.1		X					
Vulnerable Population Support Database	1.1, 2.2, 5.2					X		
Warning Systems	1.1, 5.1, 5.2					X	X	
Weather Radios	4.3						X	

Section Six
Plan Implementation and Maintenance

Monitoring, Evaluating, and Updating the Plan

Each participating jurisdiction in the Region 24 EMA HMP is responsible for monitoring (annually at a minimum), evaluating, and updating the plan during its five-year lifespan. Hazard mitigation projects will be prioritized by each participant's governing body with support and suggestions from the public and business owners. Unless otherwise specified by each participant's local planning team, the governing body will be responsible for implementing the recommended projects. The responsible party for the various implementation actions will report on the status of all projects and include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies could be revised.

As projects or mitigation actions are implemented, a detailed timeline of how that project was completed should be written and attached to the plan in a format selected by the governing body. Information that will be included will address project timelines, agencies involved, area(s) benefited, total cost (if complete), etc. At the discretion of each governing body, local planning team members, and other identified relevant stakeholders should review the original draft of the mitigation plan and recommend applicable changes.

Plan review and updates will occur every five years at the minimum. At the discretion of each governing body, updates may be incorporated more frequently, especially in the event of a major hazard or as additional mitigation needs are identified. Local planning team members should engage with the public, other elected officials, and multiple departments as they review and update the plan. 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:

- 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?
- Are current resources appropriate to implement the plan?

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.

- Were the outcomes as expected?
- Did the plan partners participate as originally planned?
- Should other agencies be included in the revision process?

Plan update worksheets in *Appendix C* may also be used to assist communities in reviewing and updating the plan.

In addition, the governing body will be responsible for ensuring that the HMP's goals are incorporated into applicable revisions of other planning mechanisms per jurisdiction. These plans may include: Comprehensive Plan, Capital Improvement Plans, Zoning Ordinances, Floodplain Ordinances, Building Codes, and/or Watershed Management Plans. Future updates of this HMP will review and update discussions of plan integration per community as appropriate.

Continued Public Involvement

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

- Public spaces around the jurisdiction
- City/Village Hall
- Websites
- Social media
- Local radio stations
- Local newspapers
- Regionally distributed newsletters

Any amendments to the HMP as determined through public involvement or community actions must be submitted to NEMA for inclusion in the final HMP.

Integrating Other Capabilities

There are a number of state and federal agencies with capabilities that can be leveraged during HMP updates or mitigation action implementation. A description of some regional resources is provided below.

Nebraska Emergency Management Agency

NEMA is an agency that is a part of the Military Department in the State of Nebraska. NEMA is responsible for emergency management, which is usually divided into four phases: preparedness, response, recovery, and mitigation.

NEMA is responsible for developing the state hazard mitigation plan, which serves as a comprehensive set of guidelines for hazard mitigation across the state. The state hazard mitigation officer (SHMO) and other mitigation staff members play an active role in assisting in the development local hazard mitigation plans. Representatives from the state hazard mitigation program serve as technical guides to local planning teams and regularly participate in local mitigation planning meetings. The state hazard mitigation staff also oversees the hazard mitigation assistance programs: HMGP and BRIC; and works with the Governor's taskforce to prioritize projects requesting funding assistance through the HMGP and BRIC.

The main objective in NEMA's preparedness process is to develop plans and procedures to help facilitate any response that may need to occur during a hazard event. NEMA assists communities in the development of county or city/village planning documents; assists with the development of exercises for existing plans and procedures; conducts trainings for community officials, assist emergency management related groups (Citizen Emergency Response Teams, Citizen Corps, Medical Reserve Corps, Fire Corps, and other interest groups); and provide technical resources and expertise throughout the state.

NEMA's role during a response is to assist communities in responding to hazard events *when the need for assistance exceeds the local capabilities and resources*. This includes facilitating and tracking grants, coordinating local needs, providing state and federal level assistance through activation of Emergency Operation Centers, Mass Critical Shelters, Emergency Alert Systems and providing technical, logistical, and administrative resources and expertise before, during, and after incidents. The main purpose of the recovery phase is to perform actions that allow the return of normal living, or better conditions. The secondary role of the recovery phase is grant administration and tracking, project monitoring, damage assessment, collaborating with communities on effective recovery options and opportunities, serving as liaison between federal level entities and local representatives, and serving as a technical resource throughout the recovery process. For more information regarding the plans and NEMA's responsibilities as well as their ongoing projects, please go to http://www.nema.nebraska.gov/.

Nebraska Department of Natural Resources

The NeDNR is committed to providing Nebraska's citizens and leaders with the data and analyses they need to make appropriate natural resource decisions for the benefit of all Nebraskans both now and in the future. This state agency is responsible in the area of surface water, groundwater, floodplain management, dam safety, natural resource planning, integrated water management, storage of natural resources and related data, and administration of state funds.

NeDNR plays a significant role in protecting and conserving water resources through the oversight of surface and groundwater status and integrated water management. The NeDNR is also responsible for a non-structural program of floodplain management, coordination and assistance with the National Flood Insurance Program as well as the FMA grant program, reviewing and approving engineering plans for new dams, rehabilitating old dams, and high hazard dam emergency preparedness plans. NeDNR was active throughout the hazard planning process and provided extensive resources and technical support for hazard risk and vulnerability analysis such as flood and dam failure. NeDNR also works with communities in many capacities including assisting in flood mapping needs and the completion of Benefit Cost Analysis. For more information regarding NeDNR's responsibilities as well as their ongoing projects, please go to http://dnr.nebraska.gov/.

Silver Jackets Program

The Silver Jackets program is also worth mentioning for their extensive role in providing a formal and consistent strategy for an interagency approach to planning and implementing measures to reduce the risks associated with flooding and other natural hazards. It brings together multiple state, federal, and sometimes tribal and local agencies to learn from one another and apply their knowledge to reduce risk. Both NEMA and NeDNR play an active role on the Nebraska Silver Jackets team. At this time the Silver Jackets do not have any projects taking place in the Region 24 planning area.

Nebraska Forest Service

The agency's mission statement is "To enrich the lives of all Nebraskans by protecting, restoring, and utilizing Nebraska's tree and forest resources. The state agency provides resources, information, and facilitates research to promote healthy forests.

The NFS achieves these goals through a variety of programs. The Rural Forestry Assistance program aids landowners in need of forest management help. Some of these services include assistance and advice on forest and woodlot management, windbreak establishment and management, reforestation, and other forestry related issues. The forest health program is responsible for maintaining a list of the most prominent pest problems in Nebraska along with the trees affected, control recommendations, and timing. The wildland fire protection program is responsible for protecting wildlands from fire. The state does not have a fire suppression force within the forest service like other states. They rely on local firefighters to handle the suppression of these fires. The agency does provide air support and equipment to the local firefighters if the assistance is needed. The agency also assists Nebraska's communities to be ready for wildfire by helping them prepare Community Wildfire Protection Plans. CWPPs gather local resources to enhance wildfire mitigation and preparedness. The plans identify steps for communities to take to help reduce the risk of damage from wildfires. For more information regarding the NFS's responsibilities as well as their ongoing projects, please go to http://nfs.unl.edu/.

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. Region 24 EMA, as the plan sponsor, provides an opportunity for jurisdictions to compile proposed amendments annually and send them to NEMA, and subsequently to FEMA, for a plan amendment. Such amendments should include all applicable information for each proposal including description of changes, identified funding, responsible agencies, etc.

Incorporation Into Existing Planning Mechanisms

The Hazard Mitigation Planning Team utilized a variety of plan integration tools to help communities determine how their existing planning mechanisms were related to the Region 24 Emergency Management Agency Hazard Mitigation Plan. Utilizing FEMA's *Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan*[111] guidance, as well as FEMA's *2015 Plan Integration*[112] guide, each jurisdiction engaged in a plan integration discussion. This discussion was facilitated by a Plan Integration Worksheet, created by the Hazard Mitigation Planning Team. This document offered an easy way for participants to notify the Hazard Mitigation Planning Team of existing planning mechanisms, and if they interface with the HMP.

Each jurisdiction referenced all relevant existing planning mechanisms and provided information on how these did or did not address hazards and vulnerability. Summaries of plan integration are found in each participant's *Community Profile*. For jurisdictions that lack existing planning mechanisms, especially smaller villages, the HMP may be used as a guide for future activity and development in the jurisdiction.

111 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.

112 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.

Section Seven
Community Profiles

Purpose of Community Profiles

Community Profiles contain information specific to jurisdictions participating in the Region 24 EMA planning effort. Community Profiles were developed with the intention of highlighting each jurisdiction's unique characteristics that affect its risk to hazards. Community Profiles may serve as a short reference of identified vulnerabilities and mitigation actions for a jurisdiction as they implement the mitigation plan. Information from individual jurisdictions was collected at public and one-on-one meetings and used to establish the plan. Community Profiles may include the following elements:

- Local Planning Team
- Location and Geography
- Transportation
- Demographics
- Employment and Economics
- Housing
- Future Development Trends
- Parcel Improvements and Valuation
- Community Lifelines
- Historical Occurrences
- Hazard Prioritization
- Governance
- Capability Assessment
- Plan Integration
- Mitigation Strategy

In addition, maps specific to each jurisdiction are included, such as jurisdiction identified critical facilities, flood-prone areas, and a future land use map (when available).

The hazard prioritization information, as provided by individual participants, varies due in large part to the extent of the geographical area, the jurisdiction's designated representatives (who were responsible for completing meeting worksheets), identification of hazards, and occurrence and risk of each hazard type.

The overall risk assessment for the identified hazard types represents the presence and vulnerability to each hazard type throughout the entire planning area. A discussion of certain hazards selected for each Community Profile was prioritized by the local planning team based on the identification of hazards of greatest concern, hazard history, and the jurisdiction's capabilities. The hazards not examined in depth can be found in *Section Four: Risk Assessment*.