

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.

HAZARD IDENTIFICATION

The identification of relevant hazards for the region began with a review of the 2021 Nebraska State Hazard Mitigation Plan. The Regional Planning Team reviewed, discussed, and determined the list of hazards to be profiled in this hazard mitigation plan update. The hazards for which a risk assessment was completed are listed below.

Table 1: Hazards Addressed in the Plan

Hazards Addressed in the Plan		
Dam Failure	Grass/Wildfire	Severe Thunderstorms
Drought	Hazardous Materials Release	Severe Winter Storms
Extreme Temperatures	High Winds & Tornadoes	Terrorism
Flooding	Levee Failure	

Hazards identified in the 2021 Nebraska State Hazard Mitigation Plan that were not identified in the LPSNRD Hazard Mitigation Plan update include Human Infectious Disease and Power Failure.¹ These hazards were reviewed by the Regional Planning Team and were chosen to not be included in this plan due to a variety of reasons. Power failure is discussed within the hazards that may cause the failure. The Regional Planning Team felt Human Infectious Disease would be better addressed in other planning documents or mechanisms.

Several changes were made to hazards from the 2020 LPSNRD HMP. Changes to hazards included:

- Combined Chemical Fixed Sites & Chemical Transportation into Hazardous Materials Release
- Changed Extreme Heat to Extreme Temperatures (including Heat and Cold)
- Combined Hail with Severe Thunderstorms
- Combined High Winds with Tornadoes
- Eliminated Earthquakes as a hazard due to lack of local concern and historical occurrences in the planning area.
- Eliminated Agricultural Plant and Animal Disease as was not identified as a hazard of concern for any participating jurisdiction within this planning process.

METHODOLOGY

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

When describing the hazard, this plan will examine the following items: previous occurrences of the hazard within the planning area; locations where the hazard has occurred in the past or is likely to occur in the future; extent of past events and likely extent for future occurrences; and probability of future occurrences. While the identification of vulnerable assets will be conducted across the entire planning area, Section

¹ Nebraska Emergency Management Agency. January 2021. "2021 Nebraska State Hazard Mitigation Plan". <https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf>.

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 in 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.

The following sections provide an overview of the data contained in the hazard profiles. There are five main pieces of data used within these tables.

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

$$\text{Historical Probability (\%)} = \frac{\text{Total Years with an Event Occuring (\#)}}{\text{Total Years of Record (\#)}} \times 100$$

- Future Likelihood:** This is the probability that a hazard will occur in the future. Future likelihood takes into account historical probability, climate change, and future development. It is broken down into the four categories listed below.

Very Unlikely = Hazard is expected to occur once every 50+ years.

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.

Unlikely = Hazard is expected to occur once every 10+ to 50 years.

Likely = Hazard is expected to occur once every 5+ to 10 years.

Very Likely = Hazard is expected to occur once every 1 to 5 years.

The following table provides loss estimates for hazards with sufficient data. It should be noted that 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 United States Department of Agriculture (USDA) Risk Management Agency (RMA) was utilized for this update of the plan. Data for all the hazards are not always available, so only those with an available dataset are included in the loss estimation.

AVERAGE ANNUAL DAMAGES AND FREQUENCY

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

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

HAZARD ASSESSMENT SUMMARY TABLES

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

Table 2: Regional Risk Assessment

HAZARD	PREVIOUS OCCURRENCE EVENTS/YEARS	APPROXIMATE ANNUAL PROBABILITY	LIKELY EXTENT
DAM FAILURE	3/110	<1%	Varies by Structure
DROUGHT	443/1,1550 months	29%	D1-D2
EXTREME TEMPERATURES	Heat - 5 days/yr Cold - 4 days/yr	66% 61%	Extreme Heat Range 100°F to 115°F Extreme Cold Range 0°F to -33°F
FLOODING	129/28	100%	Some inundation of structures and roads near streams. Some evacuations of people may be necessary (<1% of population) <8 acres
GRASS/WILDFIRES	1,295/24	100%	Some homes and structures threatened or at risk
HAZARDOUS MATERIALS – FIXED	210 /34	100%	~800 Liquid Gallons
HAZARDOUS MATERIALS – TRANSPORTATION	238 /35	100%	~0 to 23,000 Gallons
HIGH WINDS	52/28	100%	≤50 mph Avg 55mph; Range 35-57 EG
LEEVE FAILURE	3	~1%	Varies by Extent
SEVERE THUNDERSTORMS	956/28	100%	≥1” rainfall Avg 55 mph winds; Range 45-85 EG H2-H5 Avg 1.14”; Range 0.52-5.0”
SEVERE WINTER STORMS	167/28	100%	0.25” – 0.5” Ice 20°-40° below zero (wind chill) 4-8” snow 25-35 mph winds
TERRORISM	2/48	<1%	Unknown
TORNADOES	55/28	100%	Avg: EF0 Range EF0-EF4

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

Table 3: Loss Estimation for the Planning Area

HAZARD TYPE		Count	Property	Crop
Dam Failure		3	N/A	N/A
Drought		443/1,1550 months	\$0	\$136,719,893
Extreme Temperatures	Extreme Heat	Avg. 5 days/yr	\$0	\$9,039,795
	Extreme Cold	Avg. 4 days/yr	\$100,000	\$359,455
Flooding	Flash Flood	70	\$5,067,000	\$2,778,045
	Flood	59	\$122,051,000	
Grass/Wildfires		1,295	9,079 acres	\$31,023
Hazardous Materials	Chemical Fixed Sites ³	210	\$1,500,000	N/A
	Chemical Transportation ⁴	238	\$1,376,640	
High Winds & Tornadoes	High Winds	51	\$28,000	\$1,108,865
	Tornadoes	55	\$101,309,000	
Levee Failure		3	-	N/A
Severe Thunderstorms	Hail	581	\$2,049,000	\$17,413,215
	Heavy Rain	14	\$0	
	Lightning	13	\$1,236,400	
	Thunderstorm Wind	348	\$2,049,000	
Severe Winter Storms	Blizzard	18	\$-	\$568,924
	Heavy Snow	9	\$19,000,000	
	Ice Storm	6	\$-	
	Winter Storm	95	\$-	
	Winter Weather	39	\$75,000	
Terrorism		2	<\$1 million	N/A
Total		3,109	\$255,741,040	\$ 158,619,965

N/A: Data not available

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 in the last decade.

Table 4: SBA Declarations

Disaster Declaration Number	Declaration Date	Description	Primary Counties	Contiguous Counties
NE-00073	2019	Flooding	Cass	
NE-00067			Cass	

Disaster Declaration Number	Declaration Date	Description	Primary Counties	Contiguous Counties
NE-00065	6/25/2015	Severe Storms, Tornadoes, Straight-line Winds, and Flooding.	Cass, Lancaster	
NE-00064	5/27/2015	Severe Storms, Tornadoes, High Winds and Flooding		Lancaster
NE-00063	7/28/2014	Tornadoes, Straight-line Winds, and Flooding	Cass	
NE-00057	5/30/2014	Severe Weather and a Tornado		Lancaster
NE-00053		Drought	Cass, Lancaster	
NE-00052		Drought		Lancaster
NE-00051		Drought	Cass, Lancaster	
NE-00050		Drought		Cass, Lancaster
NE-00043	08/12/2011 & 12/12/2011	Flooding	Cass	
NE-00042	7/18/2011	Flooding	Cass	Lancaster
NE-00041	09/07/2011 & 08/12/2011 & 11/18/2011	Flooding	Cass	
NE-00040	10/21/2010	Severe Storms, Flooding, Tornado, and Straight-line Winds	Cass	
NE-00035	04/21/2010 & 6/10/2010	Severe Storms, Ice Jams, and Flooding.	Cass, Lancaster	
NE-00033	02/25/2010 & 3/26/2010	Severe Winter Storms and Snowstorm	Cass, Lancaster	
NE-00021	06/20/2008 & 06/24/2008 & 7/29/2008	Severe Storms, Tornadoes, and Flooding	Cass, Lancaster	
NE-00020	06/20/2008 / 06/24/2008 & 7/29/2008	Severe Storms, Tornadoes, and Flooding		Cass, Lancaster
NE-00013	06/06/2007 & 07/06/2007	Severe Storms, Flooding, and Tornadoes	Cass	

Source: Small Business Administration, 2005-2018²

At the time of this plan development historical state disasters for Nebraska were not available. An attempt was made to request such disaster data from the state but at this time, there is no database which records past Nebraska disasters which can be included for reference. Future plan updates should explore if such a database has been created for inclusion into HMP planning efforts.

PRESIDENTIAL DISASTER DECLARATIONS

The presidential disaster declarations involving the planning area from 1953 to December 2024 are summarized in the following table. Declarations prior to 1962 are not designated by county on the FEMA website and are not included below.

Table 5: Presidential Disaster Declarations

Disaster Declaration Number	Declaration Date	Title	Affected Counties	Total Public Assistance
228	7/18/1967	SEVERE STORMS & FLOODING	Cass, Lancaster	-

² Small Business Administration. 2005-2016. "SBA Disaster Loan Data." <https://www.sba.gov/loans-grants/see-what-sba-offers/sba-loan-programs/disaster-loans/disaster-loan-data>.

Disaster Declaration Number	Declaration Date	Title	Affected Counties	Total Public Assistance
406	10/20/1973	SEVERE STORMS & FLOODING	Cass, Lancaster	-
552	3/24/1978	STORMS, ICE JAMS, SNOWMELT & FLOODING	Cass	-
716	7/3/1984	TORNADOES & FLOODING	Cass	-
998	7/19/1993	SEVERE STORMS AND FLOODING	Cass, Lancaster	-
1190	11/1/1997	SEVERE SNOW STORMS, RAIN, AND STRONG WINDS	Cass, Lancaster	-
1517	5/25/2004	SEVERE STORMS, TORNADOES AND FLOODING	Cass, Lancaster	\$13,351,657.77
1706	6/6/2007	SEVERE STORMS, FLOODING, AND TORNADOES	Cass	\$6,109,252.52
1770	6/20/2008	SEVERE STORMS, TORNADOES, AND FLOODING	Cass, Lancaster	\$36,258,650.19
1878	2/25/2010	SEVERE WINTER STORMS AND SNOWSTORM	Cass, Lancaster	\$6,577,021.37
1902	4/21/2010	SEVERE STORMS, ICE JAMS, AND FLOODING	Cass, Lancaster	\$3,112,391.72
1924	7/15/2010	SEVERE STORMS AND FLOODING	Cass	\$49,926,354.50
1945	10/21/2010	SEVERE STORMS, FLOODING, TORNADO, AND STRAIGHT-LIN	Cass	\$2,138,551.99
3245	9/13/2005	HURRICANE KATRINA EVACUEES	Cass, Lancaster	\$393,813.27
3323	6/18/2011	FLOODING	Cass	-
4013	8/12/2011	FLOODING	Cass	\$62,808,331.04
4185	7/28/2014	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	Cass	\$3,837,595.30
4225	6/25/2015	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	Cass, Lancaster	\$14,309,444.52
4325	8/1/2017	SEVERE STORMS, TORNADOES, AND STRAIGHT-LINE WINDS	Cass	\$15,078,067.97
4420	3/21/2019	SEVERE WINTER STORM, STRAIGHT-LINE WINDS, AND FLOODING	Cass, Lancaster	\$1,858,661.84
4521	4/4/2020	COVID-19 PANDEMIC	Cass, Lancaster	-
4616	9/6/2021	SEVERE STORMS AND STRAIGHT-LINE WINDS	Cass	-
4641	2/23/2022	SEVERE STORMS, STRAIGHT-LINE WINDS, AND TORNADOES	Cass	-
4838	10/21/2024	SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING	Cass, Lancaster	-
5462	4/9/2023	WACONDA-BEAVER LAKE FIRE COMPLEX	Cass	-

Source: Federal Emergency Management Agency, 1953-2024³

³ Federal Emergency Management Agency. 2019. "Disaster Declarations." Accessed April 2019. <https://www.fema.gov/openfema-dataset-disaster-declarations-summaries-v1>.

FEMA NATIONAL RISK INDEX

FEMA's National Risk Index is an online tool that analyzes natural hazard and community risk factors to develop a risk measurement for each county in the United States. Eighteen natural hazards are given a score from very high to very low. The table below gives the National Risk Index ratings for Hamilton County, Seward County, and York County. Risk Index scores are calculated using an equation that combines scores for expected annual loss, social vulnerability, and community resilience. All values fall between 0 (lowest possible value) and 100 (highest possible value).

Table 6: National Risk Index

Hazard	Lancaster County	Cass County
Avalanche	N/A	N/A
Coastal Flooding	N/A	N/A
Cold Wave	Relatively Low (43.7)	Relatively Low (33.9)
Drought	Relatively Moderate (85.1)	Relatively Moderate (83.2)
Earthquake	Very Low (49.2)	Very Low (18.3)
Hail	Relatively Moderate (89.1)	Relatively Low (76.1)
Heat Wave	Relatively Low (31.8)	Relatively Low (31.7)
Hurricane	N/A	N/A
Ice Storm	Very High (99.9)	Relatively Moderate (72.7)
Landslide	Relatively Low (21.6)	Relatively Low (29.9)
Lightning	Relatively Low (57.0)	Very Low (27.5)
Riverine Flooding	Relatively High (97.1)	Relatively Low (62.6)
Strong Wind	Relatively High (92.8)	Relatively Moderate (60.6)
Tornado	Relatively High (98.9)	Relatively Moderate (71.0)
Tsunami	N/A	N/A
Volcanic Activity	N/A	N/A
Wildfire	Relatively Low (68.7)	Very Low (32.4)
Winter Weather	Very High (99.6)	Relatively Low (52.8)
Overall Score	Relatively Moderate (92.81)	Very Low (42.0)

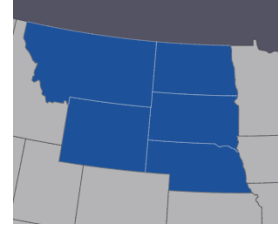
Source: FEMA⁴

⁴ FEMA. January 2024. "The National Risk Index". <https://hazards.fema.gov/nri/map>.

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. Changes in the regional climate is a growing concern impacting communities, Indian tribes, residents, local economies, and infrastructure throughout the planning area. Discussions on temperature, precipitation, and climate impacts are included below.

Figure 1: Great Plains Region



The planning area is in the Northern Great Plains region of the United States, which stretches from Montana and North Dakota southward to Wyoming and Nebraska. 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, and drought.

The Fourth National Climate Assessment has provided an overview of potential impacts within the planning area.⁵

- **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 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. These changes have 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.
- **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.

NEBRASKA'S CHANGING CLIMATE

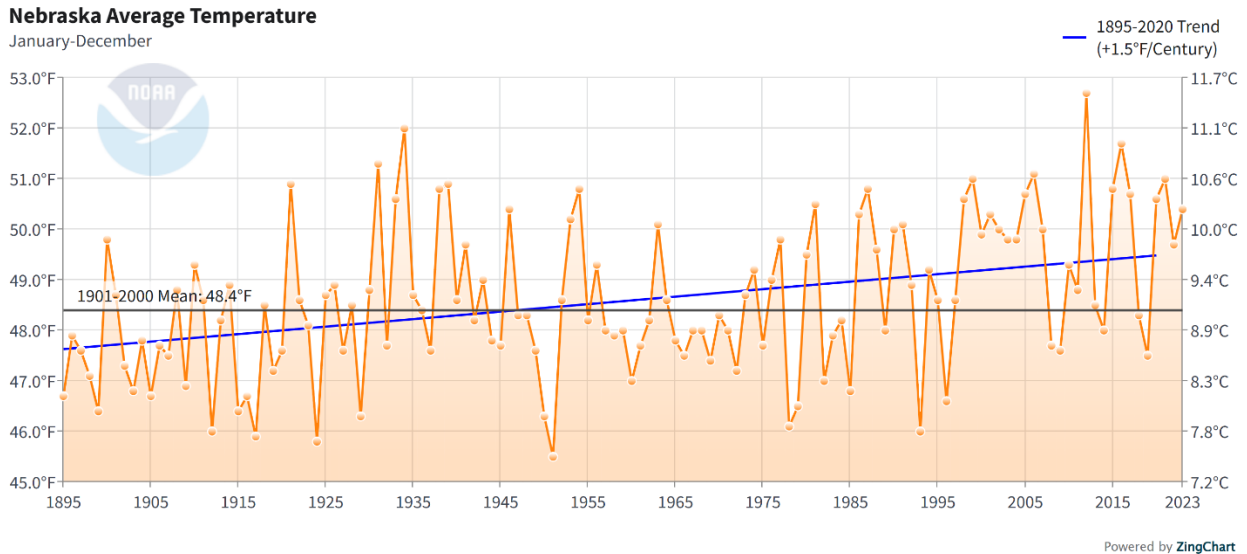
The United States is experiencing significant changes in temperature, precipitation, and severe weather events resulting from climate change. Long term climate trends will lead to an increase in the frequency and intensity of hazardous events, which will cause several significant economic, social, and environmental impacts on Nebraskans.

CHANGES IN TEMPERATURE

⁵ U.S. Global Change Research Program. 2018. "Fourth National Climate Assessment". <https://nca2018.globalchange.gov/>.

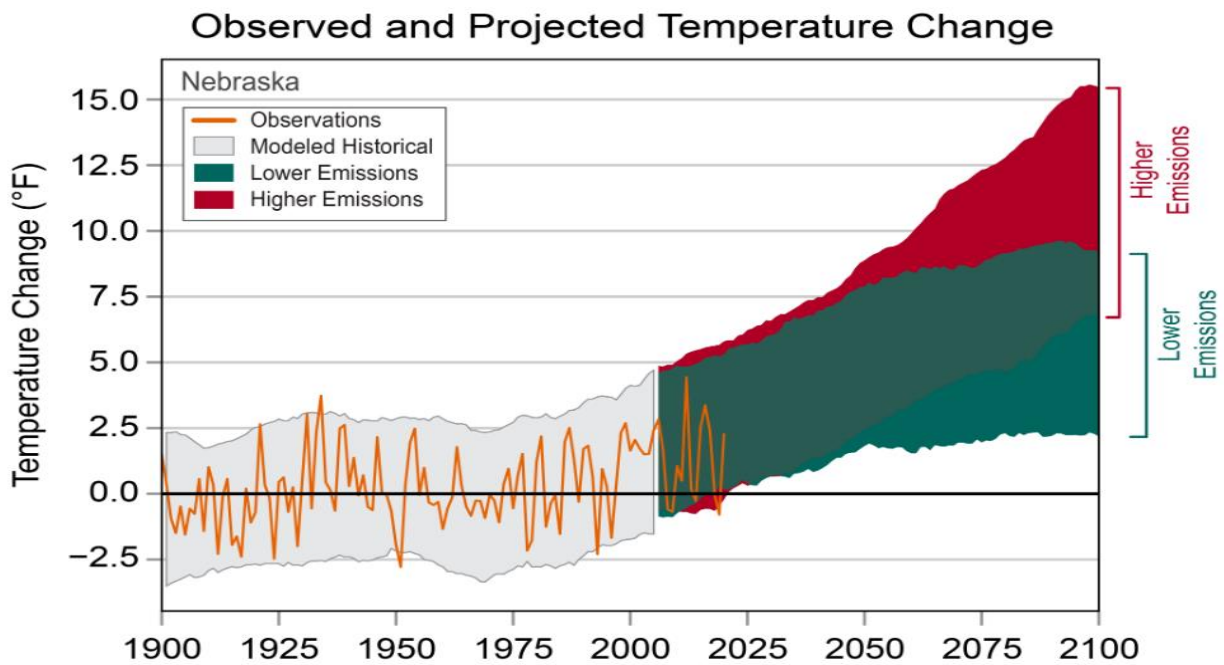
Since 1895, Nebraska’s overall average temperature has increased by about 1.5°F. Climate modeling suggests warmer temperature conditions will continue in the coming decades and rise steadily into mid-century. Warming has increased the most in winter and spring months with winter minimum temperatures rising 2-4°F. In addition, there is greater warming for nighttime lows than for daytime highs. Since 1985, the length of the frost season has increased by an average of more than one week across Nebraska, with the length likely to continue to increase in the future. Projected temperature changes range from 2-11°F by 2100 depending on emissions projects (Figure 3).⁶

Figure 2: Average Temperature (1895-2024)



Source: NOAA, 2024⁷

Figure 3: Observed and Projected Temperature Change - Nebraska

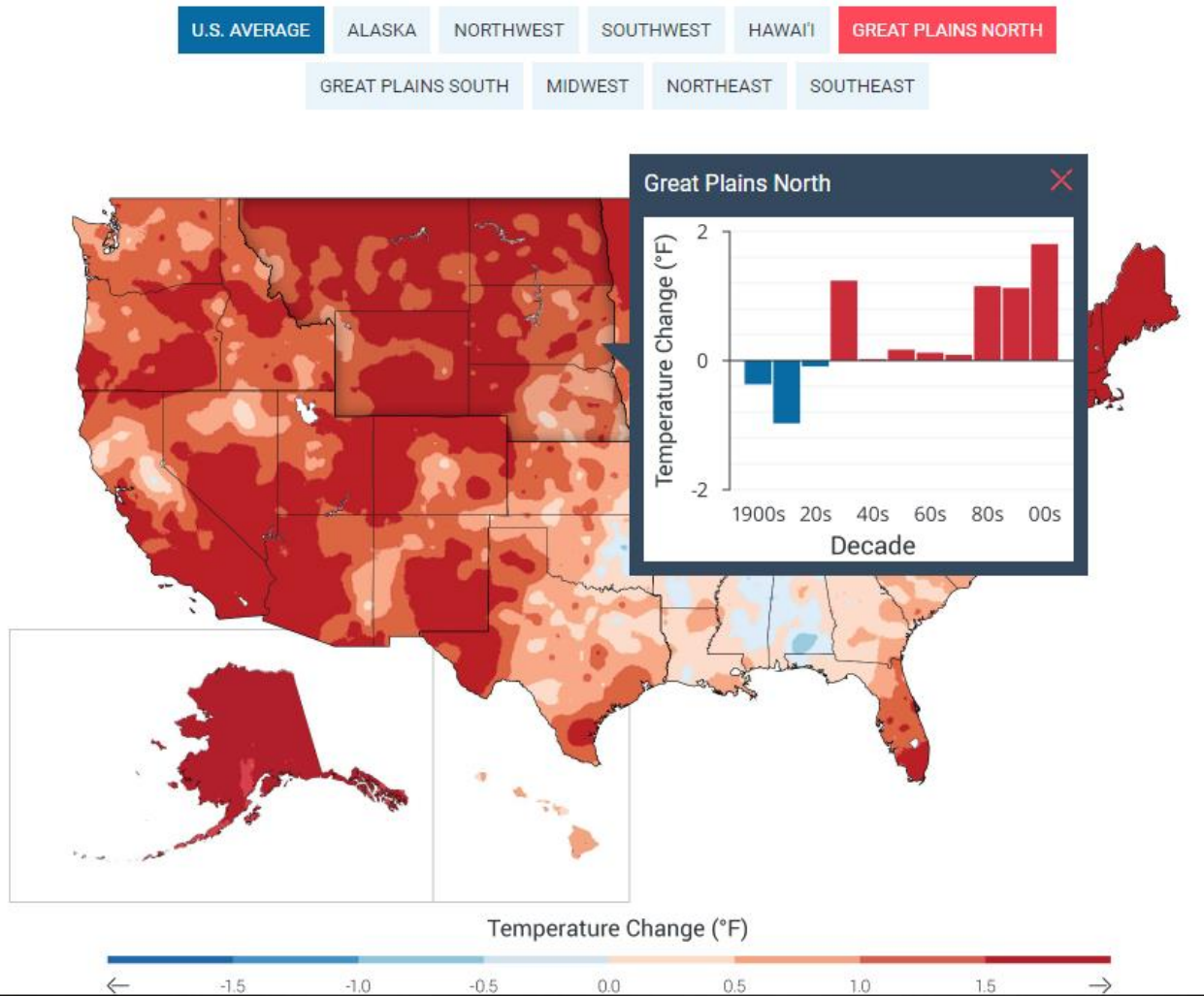


Source: NCEI

⁶ NCEI. 2022. "State Climate Summaries – Nebraska". [https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,\(1895%E2%80%932020\)%20averag.](https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,(1895%E2%80%932020)%20averag.)
⁷ NOAA. 2021. "Climate at a Glance: Statewide Time Series." Accessed March 2022. https://www.ncdc.noaa.gov/cag/statewide/time-series/25/tavg/12/12/1895-2020?base_prd=true&begbaseyear=1901&endbaseyear=2000&trend=true&trend_base=100&begtrendyear=1895&endtrendyear=2021.

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. On average, the Great Plains has seen an increase of ten days to the annual growing season.⁸

Figure 4: Observed U.S. Temperature Change



Source: National Climate Assessment, 2014⁹

CHANGES IN PRECIPITATION

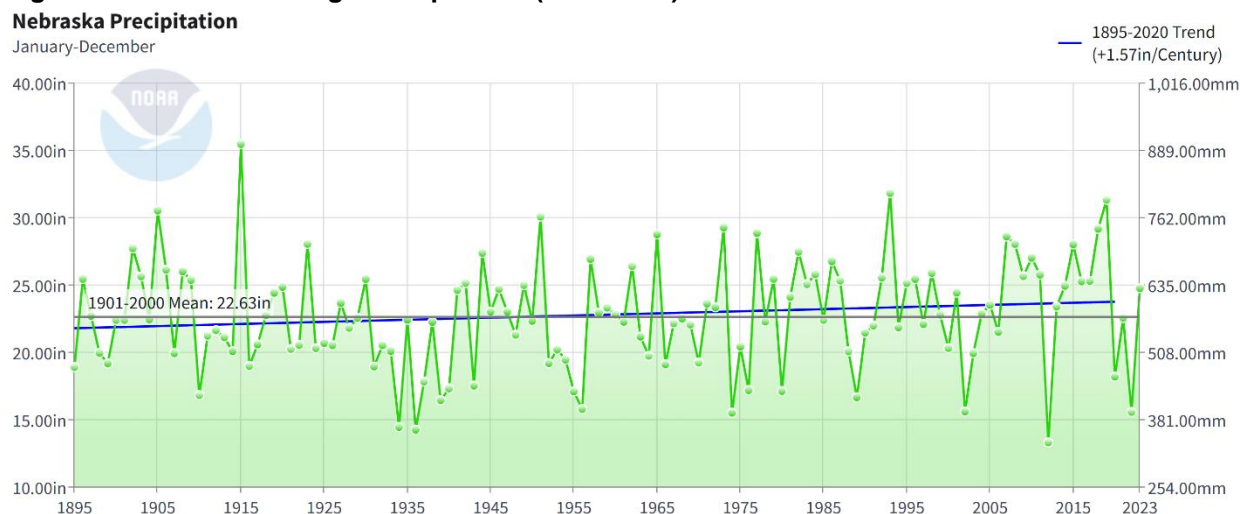
Changing extremes in precipitation are anticipated in the coming decades, with more significant rain and snowfall events and more intense drought periods. Seasonal variations will be heightened, with more frequent and more significant rainfall expected in the spring and winter and hotter, drier periods in the summer. Since 1895, yearly annual precipitation for Nebraska has increased slightly. With a changing climate, winter and spring precipitation is projected to increase across Nebraska. According to climate

⁸ U.S. Global Change Research Program. "2014 National Climate Assessment: Frost-free Season." Accessed 2020. <https://nca2014.globalchange.gov/report/our-changing-climate/frost-free-season#tab2-images>
⁹ U.S. Global Change Research Program. "2014 National Climate Assessment." Accessed 2020. <https://nca2014.globalchange.gov/>

projections, winter and spring will likely become 20 percent wetter, with summers becoming 10 percent drier.

Climate modeling may show only moderate precipitation and streamflow changes; however, most of the Northern 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 planning area to meet water needs during periods of shortage. Precipitation varies significantly across the state and moves in a longitudinal gradient. The east receives twice as much precipitation (35 inches annually) as the Nebraska Panhandle (15 inches) on average.¹⁰ The planning area is located on the northeastern side of the state with a lower overall precipitation total than the southeastern portion. Winter precipitation is projected to increase in intensity and may benefit Nebraska’s agricultural economy by improving soil moisture but could potentially delay crop planting in the summer. Increased spring precipitation may lead to heightened runoff and flooding, reducing water quality and eroding soils.¹¹

Figure 5: Nebraska Average Precipitation (1895-2024)



Source: NOAA, 2024¹²

IMPACTS FROM CLIMATE CHANGE

Observed changes in the intensity and frequency of extreme events are a significant concern now and in the future because of the social, environmental, and economic costs associated with their impacts. Challenges that are expected to affect communities, environments, and residents because of climate change include:

- Developing and maintaining sustainable agricultural systems
- Resolving increasing competition among land, water, and energy resources
- Conserving vibrant and diverse ecological systems
- Enhancing the resilience of the region’s people to the impacts of climatic extremes

Certain groups of people may face greater difficulty when dealing with the impacts of a changing climate. Older adults, immigrant communities, and those living in poverty are particularly susceptible. Additionally,

¹⁰ North Central Climate Collaborative. January 2020. "NC3 Nebraska Climate Summary." Accessed December 2022. https://northcentralclimate.org/files/2020/01/nc3-Nebraska-Climate-Summary-FINAL_2.12.pdf?x24082

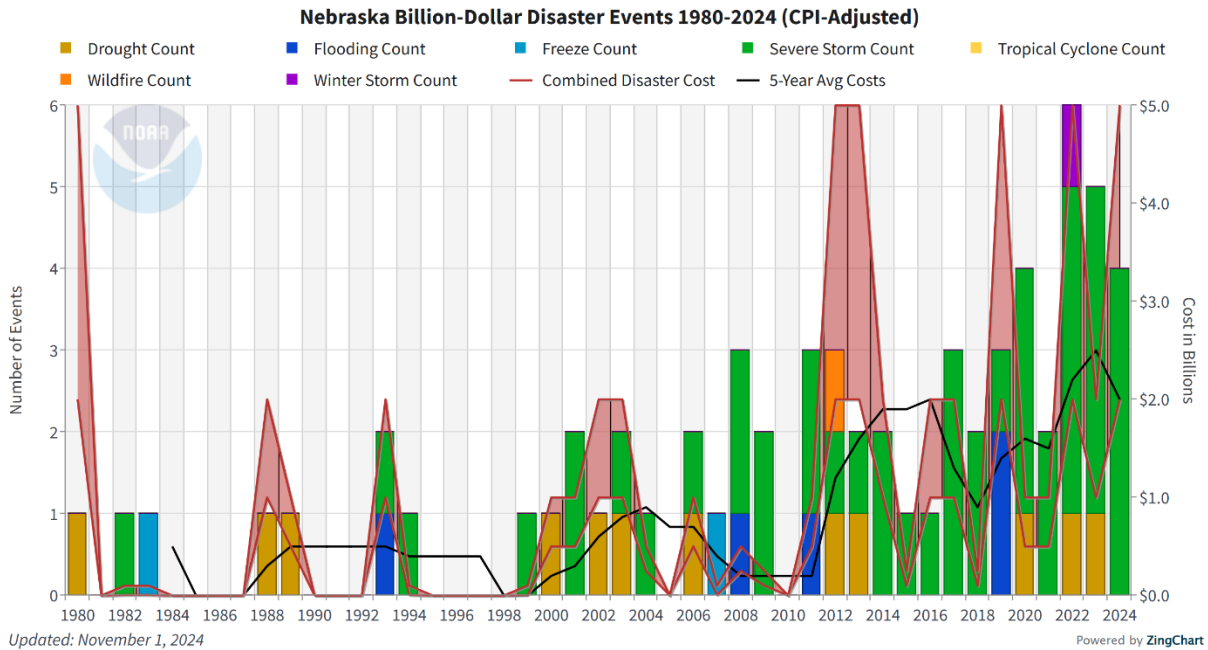
¹¹ NOAA NCEI. 2017. "Nebraska State Climate Summary." Accessed 2021. <https://statesummaries.ncics.org/chapter/ne/>

¹² NOAA. 2021. "Climate at a Glance: Statewide Time Series." Accessed December 2022. https://www.ncdc.noaa.gov/cag/statewide/time-series/25/pcp/12/12/1895-2020?base_prd=true&begbaseyear=1901&endbaseyear=2000&trend=true&trend_base=100&begtrendyear=1895&endtrendyear=2020

specific industries and professions tied to weather and climate, like outdoor tourism, commerce, and agriculture, are especially vulnerable.¹³

As seen in the figure below, Nebraska is experiencing an increase in the number of billion-dollar natural disasters.

Figure 6: Nebraska Billion Dollar Disasters



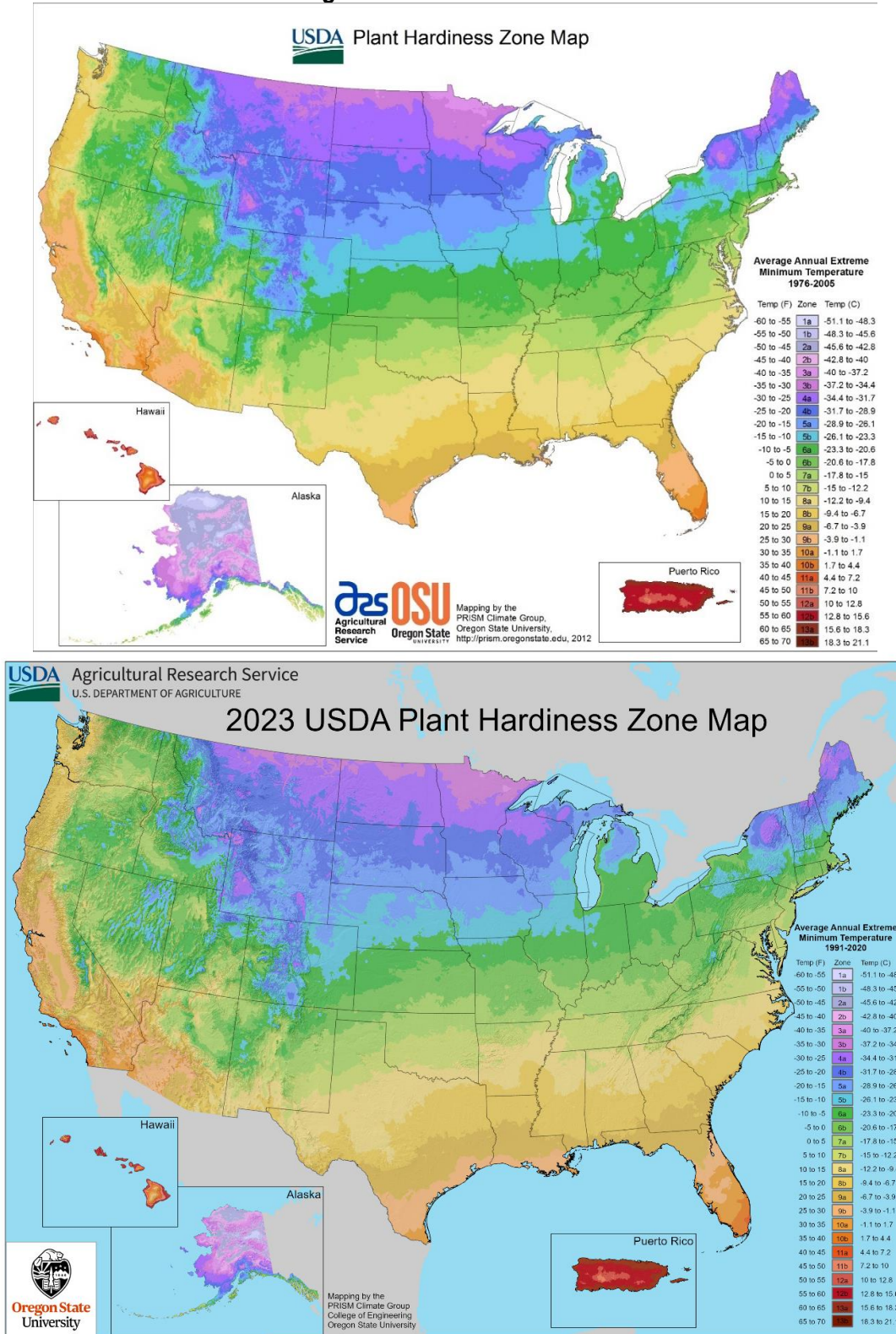
Source: NOAA, 2024¹⁴

Agriculture

The agricultural sector will experience an increase in droughts, an increase in grass and wildfire events, changes in the growth cycle as winters warm, an influx of new and damaging agricultural diseases or pests, and changes in the timing and magnitude of rainfall. As described in the Plant Hardiness Zone maps (Figure 7) available for the United States, these changes have shifted the annual growing season and expected agricultural production conditions. Nebraska is vulnerable to changes in growing season duration and growing season conditions as a heavily agriculturally dependent state. These added stressors on agriculture could have devastating economic effects if new agricultural and livestock management practices are not adopted.

¹³ U.S. Environmental Protection Agency. "Climate Impacts on Society." Accessed April 2021. https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-society_.html
¹⁴ NOAA National Centers for Environmental Information. December 2024. "Nebraska Billion-Dollar Weather and Climate Disasters". <https://www.ncei.noaa.gov/access/billions/time-series/NE>.

Figure 7: Plant Hardiness Zone Change – 2012 to 2023



Source: USDA, 2023¹⁵

¹⁵ United States Department of Agriculture. 2023. "2023 USDA Plant Hardiness Zone Map." <https://planthardiness.ars.usda.gov/>.

Air Quality

Rising temperatures will also impact air quality. Harmful air pollutants and allergens increase as temperatures increase. More extended periods of warmth contribute to longer pollen seasons that allow plant spores to travel farther and increase exposure to allergens. More prolonged exposure to allergens can increase the risk and severity of asthma attacks and worsen existing allergies in individuals.¹⁶ An increase in air pollutants can occur from the growing number of grass and wildfires. The public can be exposed to harmful particulate matter from smoke and ash that can cause various health issues. Depending on the length of exposure, age, and individual susceptibility, effects from wildfire smoke can range from eye and respiratory irritation to severe disorders like bronchitis, asthma, and aggravation of pre-existing respiratory and cardiovascular diseases.¹⁷

Water Quality

Increasing temperatures, shifting precipitation patterns, and extreme weather events impact water quality throughout the state. 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 and kill aquatic life. Nutrient enrichment can lead to toxic cyanobacterial harmful algae blooms (cyanoHABs), which can be harmful to animal and human health. CyanoHABs can cause economic damage such as decreasing property values, reducing recreational revenue, and increasing the costs for treating drinking water.¹⁸

With the increasing intensity and frequency of extreme precipitation events, impacts to water systems ultimately threaten human health. 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. Flooding impacts property, infrastructure, economies, and the ecology of water bodies.

Energy

Shifting climate trends will have a direct impact on water and energy demands. As the number of 100°F days increases, along with warming nights, the stress placed on the energy grid will likely increase and possibly lead to more power outages. Severe weather events also stress energy production, infrastructure transmission, and transportation. Roads, pipelines, and rail lines are all at risk of damages from flooding, extreme heat, erosion, or added stress from increased residential demands.¹⁹ Critical facilities and vulnerable populations that are not prepared to handle periods of power outages, particularly during heat waves, will be at risk.

Future Adaptation and Mitigation

The planning area will have to adapt to a changing climate and its impacts or experience an increase in economic loss, property damage, agricultural damage, and loss of life. The magnitude of expected changes will exceed those experienced in the last century. Past events have typically informed HMPs to be more resilient to future events. Existing adaptation and planning efforts are inadequate to respond to these projected impacts. This HMP includes strategies for the planning area to address these changes and increase resilience. However, each iteration and update of this HMP or other planning efforts should consider including adaptation as a core strategy to be better informed by “future” projections on the frequency, intensity, and distribution of hazards. Communities that are already the most vulnerable to weather and climate extremes will be stressed even further by more frequent extreme events occurring

¹⁶ Asthma and Allergy Foundation of America. 2010. “Extreme Allergies and Climate Change.” Accessed 2021. <https://www.aafa.org/extreme-allergies-and-climate-change/>

¹⁷ AirNow. 2019. “Wildfire Smoke: A Guide for Healthcare Professionals.” Accessed 2021. https://www.airnow.gov/sites/default/files/2020-10/wildfire-smoke-guide-revised-2019-chapters-1-3_0.pdf

¹⁸ USGS. “Nutrients and Eutrophication”. Accessed February 2021. https://www.usgs.gov/mission-areas/water-resources/science/nutrients-and-eutrophication?qt-science_center_objects=0#qt-science_center_objects

¹⁹ USGCRP, 2018: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Report-in-Brief [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 186 pp.

within an already highly variable climate system. Jurisdictions in the planning area should consider past and future climate changes and impacts when incorporating mitigation actions into local planning processes.

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). Jurisdictional local planning teams selected hazards from the regional hazard list as the prioritized hazards for the jurisdiction based on historical hazard occurrences, potential impacts, the jurisdictions' capabilities, and the capacity to pursue mitigation projects. 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 jurisdiction at any time and their selection is not a full indication of risk. The following table identifies the top hazards of concern for participating jurisdictions.

As identified by the participating jurisdictions, the overall top hazards of concern in the planning area from greatest concern to least concern are:

- High Winds and Tornadoes
- Severe Thunderstorms
- Flooding
- Hazardous Materials
- Severe Winter Storms
- Drought
- Dam Failure
- Levee Failure
- Terrorism
- Grass/Wildfire
- Extreme Temperatures

Table 7: Top Hazards of Concern by Jurisdiction

Jurisdiction	Dam Failure	Drought	Extreme Temperatures	Flooding	Grass or Wildfire	Hazardous Materials	High Winds & Tornadoes	Levee Failure	Severe Thunderstorm. Storms	Severe Winter Storms	Terrorism
Lower Platte South NRD	X	X		X				X	X		
Cass County		X		X		X	X		X	X	
Alvo						X	X				
Avoca				X					X		
Cedar Creek				X		X	X		X		
Eagle				X		X	X		X		X
Elmwood						X	X		X	X	
Greenwood						X	X		X		
Louisville				X			X		X		
Manley						X	X			X	
Murdock		X				X	X		X	X	
Murray						X	X			X	
Nehawka				X			X				
Plattsmouth				X		X			X	X	
South Bend				X						X	
Union		X					X		X		
Weeping Water				X					X	X	
Lancaster County			X	X			X		X	X	
Bennet		X		X		X	X		X		
Davey							X		X	X	
Denton				X		X	X		X		
Firth		X		X		X	X				
Hallam		X			X	X	X				
Hickman	X	X		X		X	X				
Lincoln	X			X		X	X	X	X	X	
Malcolm		X		X							
Panama							X		X	X	

Section Four | Risk Assessment

Jurisdiction	Dam Failure	Drought	Extreme Temperatures	Flooding	Grass or Wildfire	Hazardous Materials	High Winds & Tornadoes	Levee Failure	Severe Thunderstorm. Storms	Severe Winter Storms	Terrorism
Raymond				X			X		X		
Roca				X		X	X		X		
Sprague		X					X		X		
Waverly	X			X		X	X		X		
Brainard		X							X		
Ashland		X		X			X	X			
Ceresco						X	X		X	X	
Valparaiso				X		X					
Cass County Rural Water District #1		X		X							
Lincoln Public Schools						X	X		X	X	
Norris School District				X			X		X	X	
Raymond Central Public Schools					X		X		X	X	X
Weeping Water Public Schools							X		X	X	X

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.”²⁰

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 8: 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, 2013²¹

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. 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.

²⁰ 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.

²¹ 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 regulates dam safety and has classified dams by the potential hazard each poses to human life and economic loss. The following are classifications and descriptions for each hazard class:

- **Minimal Hazard Potential** - failure of the dam expected to result in no economic loss beyond the cost of the structure itself and losses principally limited to the owner's property.
- **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

Communities or areas downstream of a dam, especially high hazard dams, are at greatest risk of dam failure. In total, there are 208 dams located within the two-county planning area, and an additional 53 dams in the surrounding area within the LPSNRD boundaries. There are 31 high hazard dams in the planning area. Figure 8 maps the location of these dams.

Table 9: Dam Classification in the Planning Area and LPSNRD Boundary

County	Minimal Hazard	Low Hazard	Significant Hazard	High Hazard
Cass	2	39	17	8
Lancaster	6	99	15	22
Neighboring County Dams within LPSNRD Boundary				
Butler*	0	14	1	0
Otoe*	0	1	0	0
Saunders*	1	10	0	0
Seward*	1	22	1	2
Planning Area Total	101	185	34	32

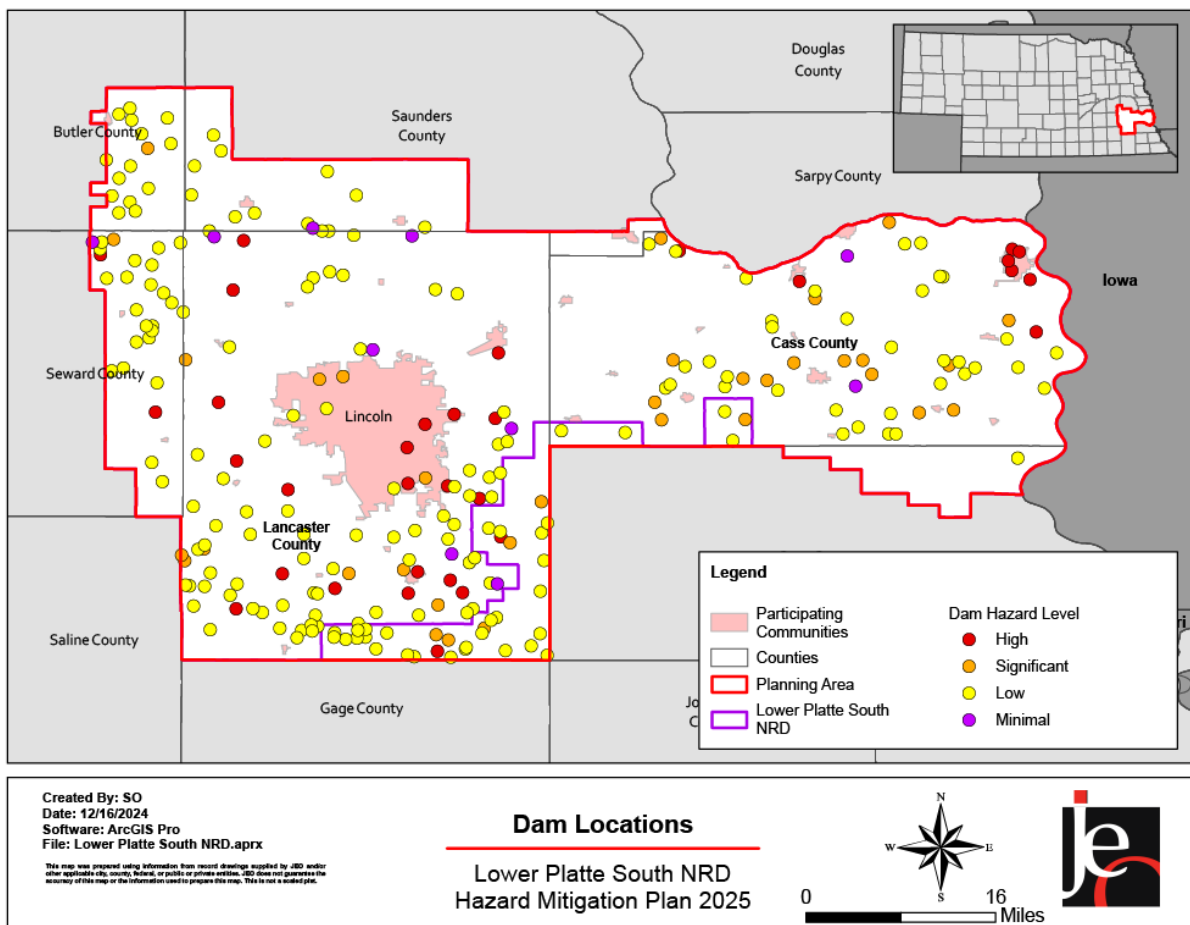
*Note: Only portions of Butler, Otoe, Saunders, and Seward Counties are located within the LPSNRD. Dams in these counties located outside of the LPSNRD boundaries are not included here.

Source: NeDNR, 2024²²

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.

Dam owners and the NeDNR have opted, at this time, to not include dam breach maps or inundation maps in hazard mitigation plans due to the sensitive nature of this information. Requests can be made of the dam owner or the Dam Safety Division of NeDNR to view an inundation to view an inundation map specific to a dam.

Figure 8: Dam Locations



Upstream Dams Outside the Planning Area

Several dams and reservoirs are located upstream from the LPSNRD boundary in the Missouri River basin. Of these dams and reservoirs, six are located on the main stem of the Missouri River and provide the majority of the flood peak discharge reduction along Cass County’s eastern border from the Missouri River. Data on these dams are provided in the following table.

²² Nebraska Department of Natural Resources. 2024. “Nebraska Dam Inventory.” <https://dnr.nebraska.gov/dam-safety/nebraska-dam-inventory>.

Table 10: Upstream Missouri River Dams

Dam Name	Location	Year Operational	Level of Risk
Big Bend	Fort Thompson, South Dakota	1964	High
Fort Peck	Fort Peck, Montana	1940	High
Fort Randall	Pickstown, South Dakota	1953	High
Garrison	Riverdale, North Dakota	1955	High
Gavins Point	Yankton, South Dakota	1955	High
Oahe	Pierre, South Dakota	1962	High

During significant flood events heightened releases from upstream dams may contribute to flooding impacts in the planning area. Of the dams listed above, only four are designed for significant flood control: Fort Peck, Garrison, Oahe, and Fort Randall. Notably during the 2011 and 2019 flood events, heightened dam release rates, including from Gavins Point, contributed to flooding impacts. The March 2019 flood event saw significant rainfall and snowmelt upstream of the dams which filled the dam reservoirs to capacity and necessitated release. Unfortunately, additional precipitation was also entering Missouri River from heavy flows on the Platte River. The combination of heightened flows on the Missouri, including the released water from the dams, and the flood waters from the Platte River likely exacerbated flood conditions along the Missouri River bordering Cass County and primarily in the City of Plattsmouth. These dams have not been tested significantly again since 2019.

An additional dam is located in western Nebraska on the North Platte River and would impact areas along the Platte River in the planning area if it were to fail.

Table 11: Upstream Platte River Dam

Dam Name	Location	Year Operational	Level of Risk
Kingsley Dam (Lake McConaughy)	Keystone, Nebraska	1941	High

Historically, no dams listed above have experienced failure events. Each dam is inspected on a regular basis and after flash flood events. If problems are found during an inspection, the proper course of action is taken to ensure the structural integrity of the dam is preserved. In the event that dam failure is imminent, the EAP for the dam governs the course of action.

HISTORICAL OCCURRENCES

According to the Stanford University National Performance of Dams Program, there have been three dam failure events within the planning area.²³ According to the NeDNR Inventory of Dams, there are no recorded dam failures in the planning area. The following table lists information about failure events with available data. No events resulted in reported damages, injuries, or fatalities.

Table 12: Dam Failure Events

Dam Name	County	Incident Date	Incident Type	Level of Risk
Beaver Lake Dam	Cass County	7/23/1993	Inflow Flood – Hydrologic Event	High
Hurt Dam	Butler County	6/19/1995	Seepage; Piping	Low
Hurt Dam	Butler County	5/17/2000	Seepage; Piping	Low

Source: Stanford University, 2019

During the March 2019 flood event, Spencer Dam (Boyd/Holt Counties) failed due to significant ice and debris buildup. The water released from the dam traveled downstream into the Niobrara and Missouri rivers,

²³ Stanford University. 1911-2019. "National Performance of Dams Program Dam Incident Database." Accessed March 2019. http://npdp.stanford.edu/dam_incidents.

overwhelming the systems and contributing to widespread inundation and flooding across eastern Nebraska. While this dam was not located in the planning area, its failure likely significantly impacted subsequent flooding for communities along the Missouri River in Cass County.

EXTENT

While a breach of a high hazard dam would certainly impact those in inundation areas, the total number of people and property exposed to this threat would vary based on the dam location. Inundation maps are not made publicly available for security reasons.

AVERAGE ANNUAL DAMAGES

Due to lack of data and the sensitive nature of this hazard, potential losses are not calculated for this hazard. Community members in the planning area that wish to quantify the threat of dam failure should contact their County Emergency Management, the LPSNRD, or the NeDNR.

HISTORICAL PROBABILITY AND FUTURE LIKELIHOOD

According to the 2021 Nebraska State Hazard Mitigation Plan and Tim Gokie, Chief Dam Safety Section at NeDNR, *“The probability of failure of a well-maintained, well-designed dam is low. Nevertheless, with over 2,900 dams in Nebraska of varying age and condition, there is typically at least one dam failure in the State each year. Large storm systems that result in regional flooding, like the widespread flood events of 2010 and 2019, often result in several dam failures. The majority of the dams that fail are small, low hazard potential dams located in rural areas where the resulting damage is mostly limited to the dam itself and the dam owners’ property. Low and minimal hazard potential dams are typically designed to safely pass either a 50-year or 100-year design flood event, so larger events will overtop the dam, which can result in dam failure. Dams that are classified as significant and high hazard potential are required to meet higher standards and failure of these dams is rare.”*

The NeDNR has stated that there is typically at least one dam failure in the State of Nebraska each year. For the purpose of this plan, the probability of dam failure will be stated at less than one percent annually as three dam failure events has occurred in the planning area (Unlikely). It should be noted that dam failure events are more likely to occur concurrently with extensive flooding or other dam failure events as systems are stressed by consecutive failures. As excessive rainfall events are likely increase due to the impacts of climate change in the coming decades, the probability of future dam failure events is also likely to increase.

Table 13: Historical Probability & Future Likelihood - Dam Failure

Hazard	Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
Dam Failure	<1%	Increase in Frequency	Neither Increase nor Decrease in Frequency. Increase in Exposure	Unlikely

FUTURE DEVELOPMENT

Any future growth in significant hazard dam inundation areas increases the impacts from dam failure. Additionally, any increase in development downstream of any existing dams may elevate these dams to a high hazard rating. As many dam inundation areas are also identified floodplain locations, developing outside these areas will reduce vulnerability to both hazards. Closer to the dam, the breach inundation zone is frequently larger than the identified floodplain, so caution should be used when developing areas just downstream of a dam. Communities or counties could implement requirements for any new development or substantial improvements in dam inundation areas similar to floodplain ordinances to minimize the number of people and property impacted during a dam failure event.

However, overall flood risk and risk from dam failure events in the Lower Platte South NRD area is moderate. Future development will may occur in areas at risk from dam failure as the majority of dams in the area are used for recreational or flood control purposes.

CLIMATE CHANGE IMPACTS

While climate change does not directly affect dam failure events, changes in precipitation and temperature swings and extremes are highly likely to impact the planning area. Increased rainfall events, either in frequency and/or in magnitude, will lead to exacerbated stress on infrastructure systems including dams. Additionally, past streamflow records are typically used to design or determine dam construction requirements and maintenance requirements. Climate change may impact dam systems in the following ways:

- Drought/Extreme Heat – land subsidence, erosion, embankment settling, or foundation cracking
- Flooding – increased embankment erosion, sloughing, overtopping risk, or damage from ice jams

COMMUNITY TOP HAZARD STATUS

The following jurisdictions identified Dam Failure as a top hazard of concern.

- Lower Platte South NRD
- City of Lincoln
- City of Hickman
- City of Waverly

REGIONAL VULNERABILITIES

Regional vulnerabilities to dam failure vary based on surrounding development and other flood control measures. As communities and the region develop, considerations should be made to a variety of local vulnerabilities. The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 14: Regional 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 period 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 stores

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.

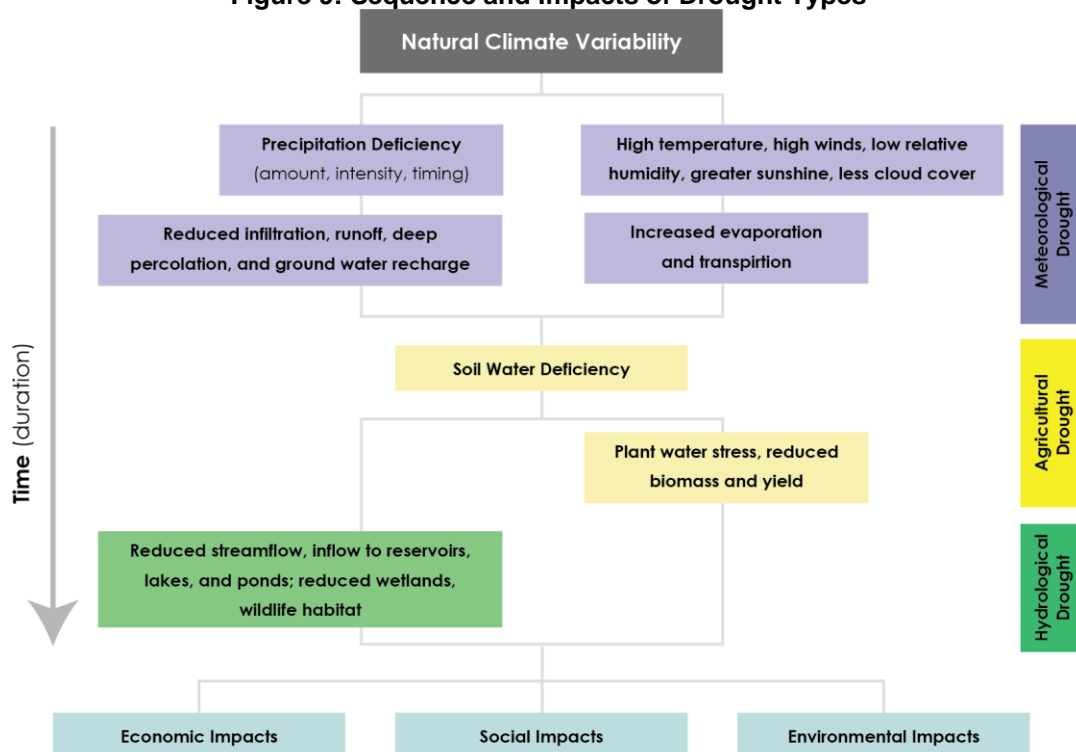
~National Drought Mitigation Center

- **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.
- **Hydrologic Drought** – occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives average precipitation. This is due to the reserves diminishing from increased water usage, usually from agricultural use or high levels of evapotranspiration, resulting from prolonged high temperatures. Hydrological drought often is identified later than meteorological and agricultural drought. Impacts from hydrological drought may manifest themselves in decreased hydropower production and loss of water based recreation.
- **Socioeconomic Drought** – occurs when the demand for an economic good exceeds supply due to a weather-related shortfall in water supply. The supply of many economic goods includes, but are not limited to, water, forage, food grains, fish, and hydroelectric power.²⁴

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

²⁴ National Drought Mitigation Center. 2017. "Drought Basics." <http://drought.unl.edu/DroughtBasics.aspx>.

Figure 9: Sequence and Impacts of Drought Types

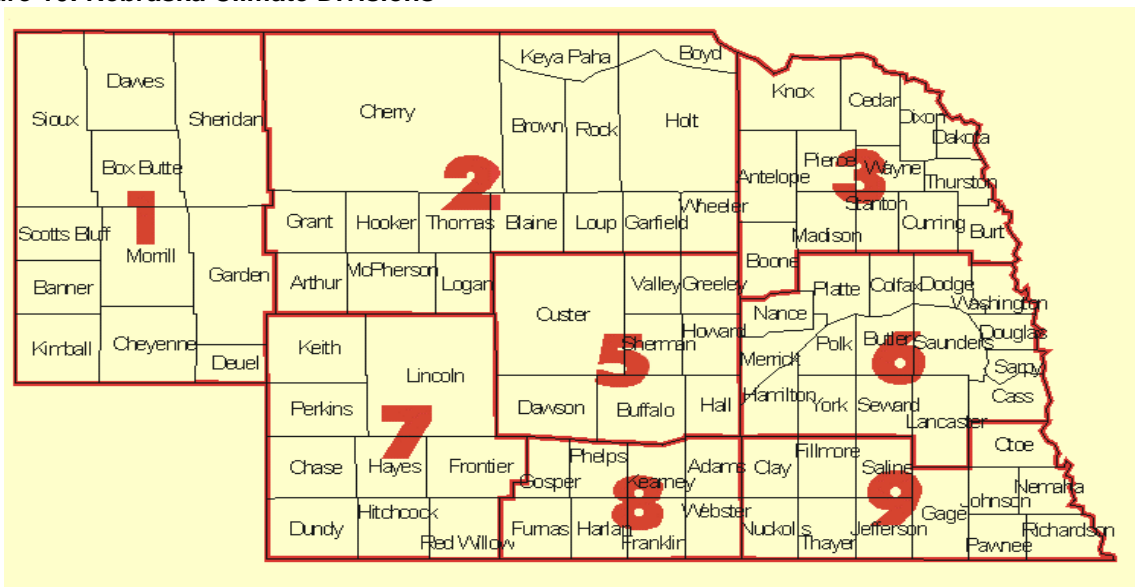


Source: National Drought Mitigation Center, University of Nebraska-Lincoln, 2017²⁵

LOCATION

The entire planning area is susceptible to impacts resulting from drought. 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 6, which includes the planning area.

Figure 10: Nebraska Climate Divisions



Source: Climate Prediction Center

²⁵ National Drought Mitigation Center. 2017. "Types of Drought." <http://drought.unl.edu/DroughtBasics/TypesofDrought.aspx>.

HISTORICAL OCCURRENCES

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 6, which includes the planning area. This particular station’s period of record started in 1895. **Error! Reference source not found.** shows the data from this time period. The negative Y axis represents a drought, for which ‘-2’ indicates a moderate drought, ‘-3’ a severe drought, and ‘-4’ an extreme drought. Table 15 shows the details of the Palmer classifications.

Table 15: 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

Table 16: Historic Droughts

DROUGHT MAGNITUDE	MONTHS IN DROUGHT	PERCENT CHANGE
-1 MAGNITUDE (MILD)	183/1,550	12%
-2 MAGNITUDE (MODERATE)	104/1,550	7%
-3 MAGNITUDE (SEVERE)	59/1,550	4%
-4 MAGNITUDE OR GREATER (EXTREME)	97/1,550	6%

Source: NCEI, Jan 1895-Feb 2024²⁶

The 2012 drought event is the most recent significant event for the planning area; however, the overall event did not warrant a presidential disaster declaration within Nebraska. The whole state of Nebraska was in severe drought conditions from the middle of July in 2012 to the end of May in 2013 and over 70% of the state was in exceptional drought conditions for over eight months. Numerous communities and water providers across the state implemented mandatory water restrictions, and some encouraged voluntarily water conservation during that timeframe. As many as 81 municipal water systems in the state experienced drought-related water supply issues in 2012 according to the Nebraska Department of Health and Human Services.²⁷

The images on the next pages show a general timeline of worsening drought conditions from the 2012 drought in Nebraska from the state’s 2012 Annual Summary Report. The planning area experienced intermittent impacts from January 2012 to June 2021, before being in severe drought conditions through 2013.

²⁶ National Centers for Environmental Information. 1895-2024. Accessed December 2024. <https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp>.

²⁷ Nebraska Department of Health and Human Services. 2012. “Nebraska’s Public Water System Program 2012 Annual Report – January 1 to December 31, 2012.” <https://dhhs.ne.gov/Reports/Public%20Water%20System%20Annual%20Report%202012.pdf>.

Figure 11: 2012 Drought Timeline

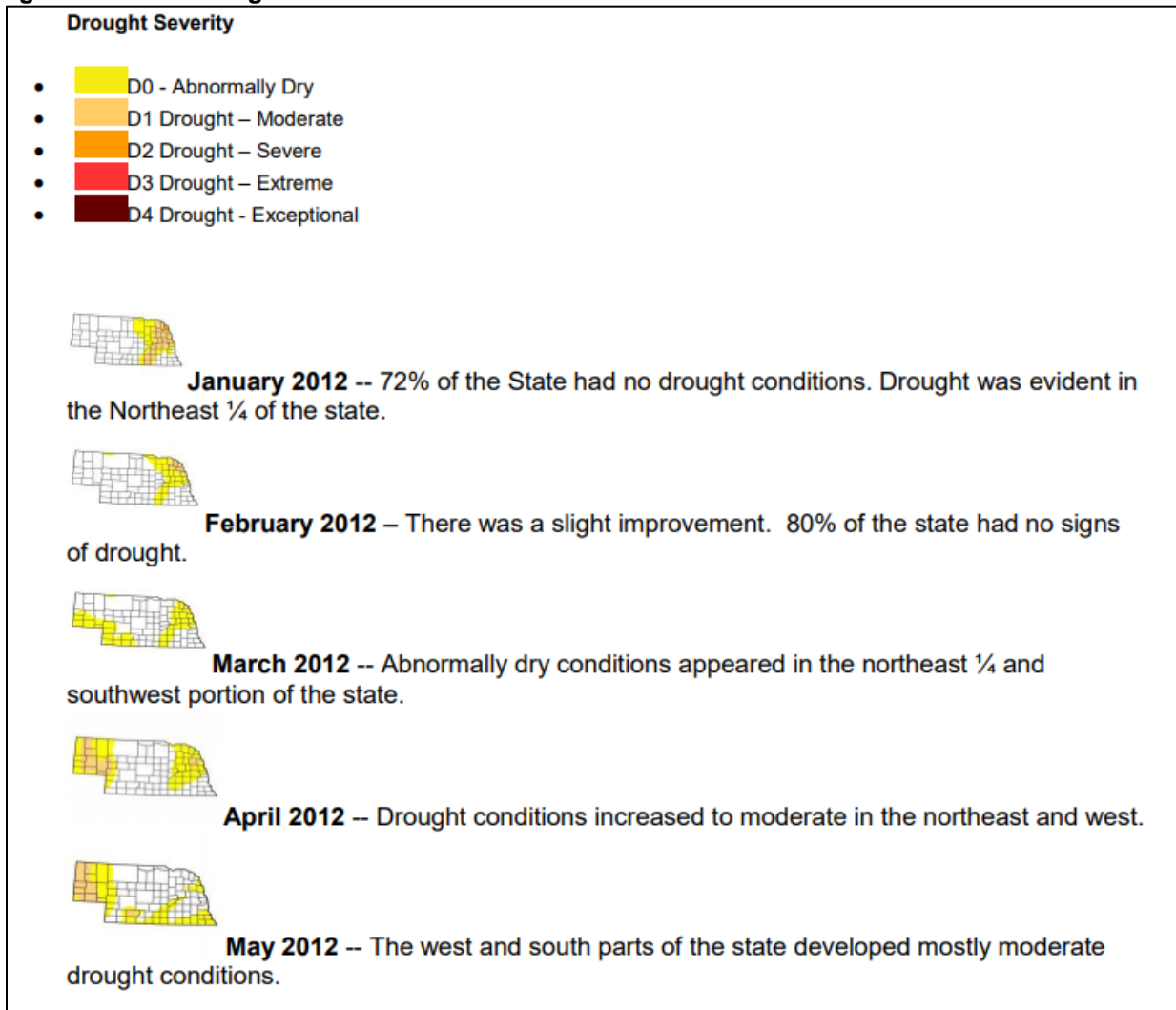
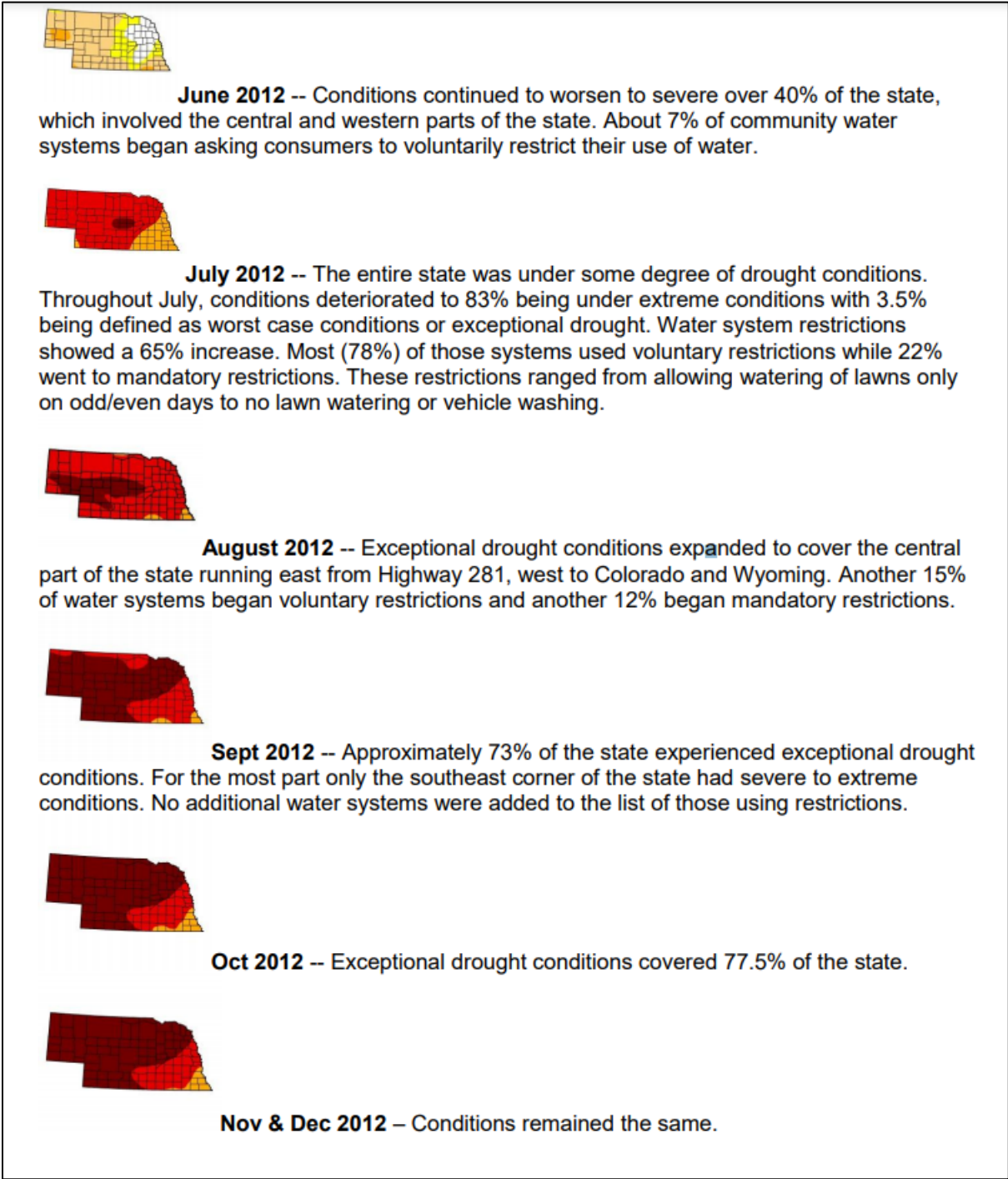


Figure 12: 2012 Drought Timeline (cont.)



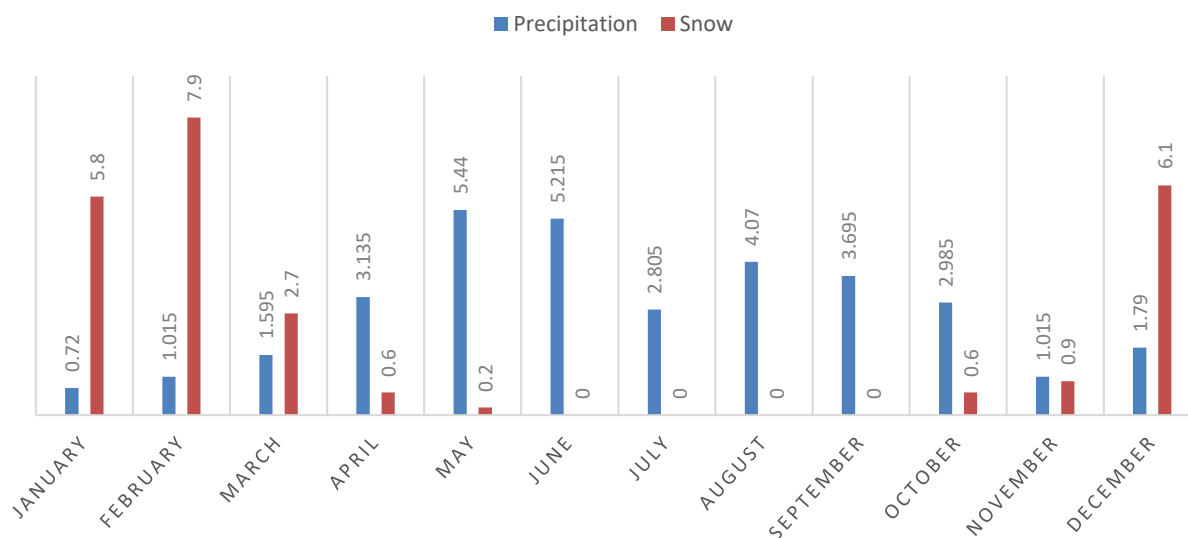
Nebraska in 2012 was the driest on record for the state, with record dryness occurring between June and August. The area will remain vulnerable to periodic drought as most projected increases in precipitation are anticipated to occur during the winter months, while increasing temperatures lead to increased soil drying.

EXTENT

It is reasonable to expect drought conditions to occur roughly 29% of all months (443 months out of 1,550 total months). Non-drought conditions (incipient dry spell, near normal, or incipient wet spell conditions) occurred in 1107 months, or 71% percent of months.

The figure below 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. Prolonged negative deviations from the norm showcase drought conditions, which influenced growing conditions for producers at those times. The overall extent of impact from drought on communities in the planning area is anticipated to be consistent. Communities with limited water resources may be at greater vulnerability to drought impacts such as those with only one well or those with water quality issues. Several communities in the planning area do not have a central water system but rely on individual or private wells.

Table 17: Average Monthly Precipitation



Source: NCEI, 2024

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 NCEI database reported \$0 in total property damage. The RMA listed over \$136 million in crop damage from drought. The direct and indirect effects of drought are difficult to quantify. Potential losses such as power outages could affect businesses, homes, and critical facilities. High demand and intense use of air conditioning or water pumps can overload the electrical systems and cause damage to infrastructure.

Table 18: 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	\$0	\$0	\$136,719,893	\$5,696,662

Source: 1 Indicates data is from NCEI (Jan 1996 to Oct 2023); 2 Indicates data is from USDA RMA (2000 to 2023)

The extreme drought in 2012 significantly affected the agricultural sector of the state. The USDA reported over \$150 million in drought relief to Nebraska from 2008 to 2011 for all five disaster programs: Supplemental Revenue Assistance Payments (SURE); Livestock Forage Disaster Assistance Program (LFD); Emergency Assistance for Livestock, Honeybees, and Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish Program (ELAP); Livestock Indemnity Program (LIP); and Tree Assistance Program (TAP). According to the PDSI for the planning area, 2012’s average severity index was ranked at a -2.79, with extremes in September and November of -4.81 and -4.70 respectively.

HISTORICAL PROBABILITY AND FUTURE LIKELIHOOD

The following table summarizes the magnitude of drought and monthly probability of occurrence as summarized and calculated using the PDSI index. Nearly 29% of the time, a part or all of the planning area is likely to be experiencing drought (Likely). Due to the anticipated impacts from climate change and future development, the future likelihood of drought events is very likely in the planning area.

Table 19: Period of Record in Drought

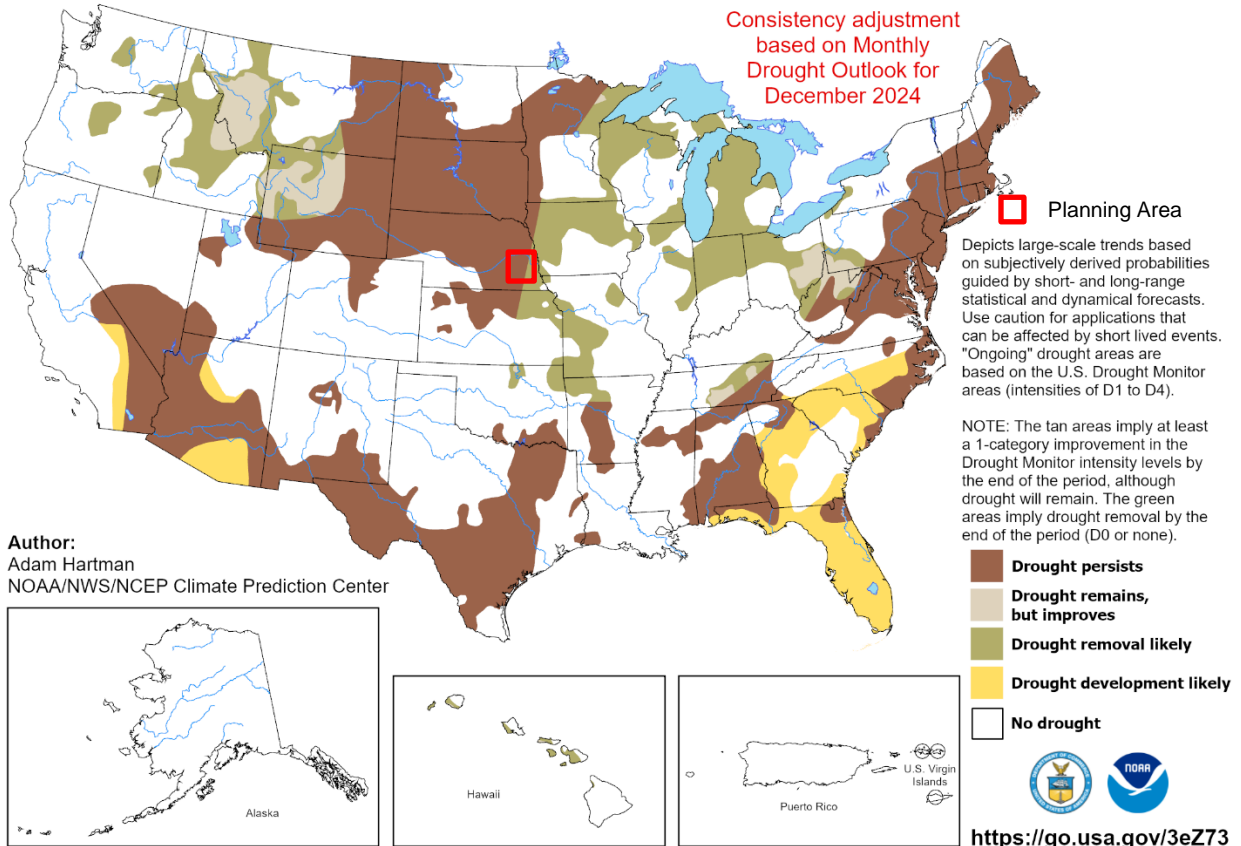
PDSI Value	Magnitude	Drought Occurrences by Month	Monthly Probability
4 or more to -0.99	No Drought	1,107/1,550 months	71.4%
-1.0 to -1.99	Mild Drought	183/1,550 months	6.7%
-2.0 to -2.99	Moderate Drought	104/1,550 months	3.8%
-3.0 to -3.99	Severe Drought	59/1,550 months	6.3%
-4.0 or less	Extreme Drought	97/1,550 months	11.8%

Source: NCEI, Jan 1895-Feb 2024

The U.S. Seasonal Drought Outlook (Figure 13) provides a short-term drought forecast that can be utilized by local officials and residents to examine the likelihood of drought developing or continuing depending on the current situation. The following figure provides the drought outlook for December 1, 2024 through February 2025. As of December 2024, the planning area was experiencing persistent drought with some areas with anticipated drought removal likely.

Figure 13: U.S. Seasonal Drought Outlook

U.S. Seasonal Drought Outlook Valid for December 1, 2024 - February 28, 2025
 Drought Tendency During the Valid Period Released November 30, 2024



Source: NCEI, 2024

FUTURE DEVELOPMENT

Any future developments are likely to increase water demand, increase travel on local transportation routes, and influence continued growth on economic sectors at risk from the impacts of drought. Growing communities will need to adapt and account for increased water demands for residential, commercial, and industrial development.

CLIMATE CHANGE IMPACTS

An increase in average temperatures will contribute to the rise in the frequency and intensity of hazardous events like drought, which will cause significant economic, social, and environmental impacts on Nebraskans. Although drought is a natural part of the climate system, increasing temperatures will increase evaporation rates, decrease soil moisture, and lead to more intense droughts in the future, having negative impacts on dryland farming. This will cause significant economic, social, and environmental impacts on farming and community water systems in the planning area. The increase in droughts will also lead to an increased risk of wildfire events as vegetation become drier.²⁸ Increasing temperatures and drought may reduce the potential for aquifers to recharge, which has long-term implications for the viability of agriculture in Nebraska.

COMMUNITY TOP HAZARD STATUS

The following jurisdictions identified Drought as a top hazard of concern:

- Lower Platte South NRD
- Cass County
- Village of Murdock
- Village of Union
- Village of Bennet
- Village of Firth
- Village of Hallam
- City of Hickman
- Village of Malcolm
- Village of Sprague
- Village of Brainard
- City of Ashland
- Cass County Rural Water District #1

REGIONAL VULNERABILITIES

Drought causes significant economic, environmental, and social impacts. Drought impacts several sectors including agriculture, rural and municipal water supplies, fish and wildlife, tourism, recreation, water quality, soil erosion, the incidence of wildfires or flash floods, electricity demand, and other sectors. Drought can also indirectly impact personal and business incomes, tax revenues, unemployment, and other social or economic areas as well.

The National Drought Mitigation Center's (NDMC) Drought Impact Reporter documents the impacts of drought throughout the United States. The following table summarizes, by category, the impacts within the ULNRD from January 2010 to December 2024. Many of these reported impacts have been in the agricultural sector. According to the Drought Impact Reporter, since 2010 there have been 44 impacts reported in the planning area. While a valuable means of recording some drought impacts, the Drought Impact Reporter does not account for every impact from drought. Therefore, while there were 44 *reported* impacts, the actual number of drought impacts since 2010 is likely much higher.

²⁸ NCEI. 2022. "State Climate Summaries – Nebraska". [https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,\(1895%E2%80%932020\)%20averag.](https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,(1895%E2%80%932020)%20averag.)

Table 20: Drought Impacts in Planning Area

Area	Agricultural	Business & Industry	Energy	Fire	Plant & Wildlife	Relief, Response, & Restrictions	Society & Public Health	Tourism & Recreation	Water Supply & Quality
Lancaster County	11	2	0	6	6	15	2	6	12
Cass County	6	0	0	4	4	5	2	3	3

Source: NDMC, 2000-2024²⁹

The following table provides information related to regional vulnerabilities. For jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 21: 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.) -Loss of tourism dollars -Decrease of land prices → jeopardizes educational funds
BUILT ENVIRONMENT	-Cracking of foundations (residential and commercial structures) -Damages to landscapes
INFRASTRUCTURE	-Damages to waterlines below ground -Damages to roadways (prolonged extreme events)
CRITICAL FACILITIES	-Stressing of electrical systems (brownouts during peak usage) -None
CLIMATE	-Changes in annual precipitation can be detrimental to agriculture and energy production sectors -Changes in annual normal temperatures and weather patterns can exacerbate drought conditions

²⁹ National Drought Mitigation Center. 2018. "U.S. Drought Impact Reporter." <http://droughtreporter.unl.edu/map/>.

EXTREME TEMPERATURES

Extreme temperatures include durations of time at both the low and high ends of the thermometer. What constitutes extreme cold varies from region to region but is generally accepted as being temperatures that are significantly lower than the average low temperature. For the purposes of this plan, extreme cold is defined as temperatures being 10°F or below while extreme heat is defined as temperatures being 100°F or higher. Conditions for extreme heat are also defined by temperatures substantially hotter and/or more humid than average for a location at that time of year. This includes temperatures (including heat index) in excess of 100 degrees Fahrenheit or at least three successive days of 90-plus degrees Fahrenheit.

Extreme cold can be dangerous to the well-being of people and animals as prolonged exposure to cold causes the human body to lose heat faster than it can be produced and use up the body's stored energy. As a result, abnormally low body temperature can lead to hypothermia and frostbite. Cold can cause fuel to congeal in storage tanks and supply lines, stopping electric generators, overpower a building's heating system, and cause water and sewer pipes to freeze and rupture. Extreme cold also increases the likelihood of ice jams on flat rivers or streams. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is extremely hazardous to health and safety.

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 including heatstroke, sunstroke, cramps, exhaustion, and fatigue may arise when a person is overexposed to heat.

Extreme temperatures can also cause people to overuse furnaces and air conditioners, which can lead to power failures. Power outages for prolonged periods increase the risk of health events such as heat stroke or hypothermia and subsequent fatalities. The planning area includes both rural and metropolitan areas, which presents an added vulnerability to extreme events as the population of unhoused people is much higher in large cities.

Other secondary concerns connected to extreme temperatures hazards include water shortages brought on by drought-like conditions and high demand during heat spells or from interrupted utility services from broken pipes during extreme cold periods. Government authorities report that civil disturbances and riots are more likely to occur during heat waves or water shortages. 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.

LOCATION

The entire planning area is subject to extreme temperatures – both heat and cold and all participating jurisdictions are affected.

HISTORICAL OCCURRENCES

According to the High Plains Regional Climate Center (HPRCC), on average, the planning area experiences five days above 100°F per year or four days with a high of 10°F or below. The planning area experienced the most days on record above 100°F in 1979 with 15 days while the most days below 10°F occurred in 1936 with 26 days. Two events recorded injuries associated with extreme cold and excessive heat in 2024. Descriptions of these events are included below:

- **Extreme Cold (1/12/2024)** – On the evening of January 12th, an arctic cold front associated with a powerful winter storm pushed south across eastern Nebraska and western Iowa. Behind this front, a strong cold-core high pressure system moved into the central and northern Plains. This ushered in a prolonged period of well below average temperatures characterized by extremely cold wind chills that lasted through the morning of January 17th. In advance of this cold air outbreak, long-fuse wind chill warnings were issued for the entire county warning area. Daytime high temperatures struggled to climb above zero degrees with wind chills remaining below minus 20 for the duration of the event. The coldest wind chills were observed region-wide on the night of January

13th into the morning of January 14th. Wind chills below minus 40 degrees were widespread with a few locations recording wind chills as low as minus 50 degrees. Strong winds that contributed to these extremely low wind chills also caused areas of blowing and drifting snow to persist one to three days after the winter storm that marked the start of this extreme cold event. Continued blowing and drifting of snow kept many county roads across eastern Nebraska and western Iowa closed for days after snow had stopped falling. Wind chills across the county dropped under 35 degrees below zero every night during the duration of this event. The coldest wind chills were felt on January 13th and 14th. The coldest recorded wind chill in the county was minus 40 degrees, observed in Hallam on the evening of the 13th and again in Firth on the morning of the 14th. A newspaper article reported 12 admissions into the CHI Health St. Elizabeth Regional Burn and Wound Center in Lincoln due to severe frostbite, and an additional 12 admissions to hospitals across the Omaha metro due to severe frostbite.

- **Excessive Heat (7/15/2024)** – Upper-level flow the evening of the 13th features a low-amplitude shortwave trough that had ejected out into the northern Great Plains. At the surface, a weakening stationary front was noted on WPC surface analysis to extend from northwest Nebraska into southeast Nebraska. Isolated strong thunderstorms that developed along this boundary brought a single severe wind gust in Knox County. However, the primary impact of this episode was the excessive heat that impacted much of southeast Nebraska and southwest Iowa. Heat indices the afternoon of the 15th in this area peaked between 110 and 115 degrees. The highest heat index was 117 degrees, observed by an AWOS station in Harlan, Iowa. A maximum heat index of 114 degrees was observed the afternoon of the 15th. There were 8 hospitalizations from heat-related illness reported in Lancaster County as well.

ESTIMATED LOSS OF ELECTRICITY

According to the FEMA publication “What is a Benefit: Guidance on Benefit-Cost Analysis of Hazard Mitigation Project (June 2009)”, if an extreme heat event occurred within the planning area, the following table assumes the event could potentially cause a loss of electricity for 10 percent of the population at a cost of \$126 per person per day. In rural areas, the percentage 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 22: Extreme Heat Predictions for Days over 100F

COUNTY	2023 (est) Population	Population Affected (assumed 10%)	Electric Loss of Use Assumed Damage Per Day
Cass	27,446	2,745	\$345,870
Lancaster	326,716	32,672	\$4,116,672
Saunders*	23,463	2,346	\$295,596
Butler*	8,459	846	\$106,596
Seward*	17,671	1,767	\$222,642
Otoe*	16,335	1,634	\$205,884

**only portion of county included in the NRD planning area, full population data included here*

EXTENT

The National Weather Service (NWS) is responsible for issuing excessive heat or cold temperature outlooks, forecasts, watches, or warnings. The NWS’ definitions are provided below.^{30,31}

- **Heat Advisories: Be Aware.** A Heat Advisory is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this advisory is when the maximum heat index temperature is expected to be 100° or higher for at least 2 days, and nighttime air temperatures will not drop below 75°; however, these criteria vary across the country, especially

³⁰ National Weather Service. 2024. “Understanding Cold Weather Alerts”. <https://www.weather.gov/safety/cold-ww>.

³¹ National Weather Service. 2024. “Heat Watch vs. Warning”. <https://www.weather.gov/safety/heat-ww>.

for areas that are not used to dangerous heat conditions. Take precautions to avoid heat illness. If you don't take precautions, you may become seriously ill or even die.

- **Cold Weather Advisory: Be Aware.** A Cold Weather Advisory is issued when seasonably cold air temperatures or wind chill values, but not extremely cold values, are expected or occurring. Be sure you and your loved one's dress appropriately and cover exposed skin when venturing outdoors.
- **Excessive Heat Watches: Be Prepared.** Heat watches are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. A Watch is used when the risk of a heat wave has increased but its occurrence and timing is still uncertain.
- **Extreme Cold Watch: Be Prepared.** An Extreme Cold Watch is issued when dangerously cold air temperatures or wind chill values are possible. As with a Warning, adjust your plans to avoid being outside during the coldest parts of the day. Make sure your car has at least half a tank of gas and update your winter survival kit.
- **Excessive Heat Warnings: Take Action!** An Excessive Heat Warning is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this Warning is when the maximum heat index temperature is expected to be 105° or higher for at least 2 days and nighttime air temperatures will not drop below 75°; however, these criteria vary across the country, especially for areas not used to extreme heat conditions. If you don't take precautions immediately when conditions are extreme, you may become seriously ill or even die.
- **Extreme Cold Warning: Take Action!** An Extreme Cold Warning is issued when dangerously cold air temperatures or wind chill values are expected or occurring. If you are in an area with an Extreme Cold Warning, avoid going outside. If you have to go outside, dress in layers, cover exposed skin, and make sure at least one other person knows your whereabouts. Update them when you arrive safely at your destination.

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% starts at 94°F. The figure below 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.

Wind chill is a key factor to consider regarding extreme cold situations. The Wind Chill Index was developed by the NWS to determine the decrease in air temperature felt by the body on exposed skin due to wind. The wind chill is always lower than the air temperature and can quicken the effects of hypothermia or frost bite as it gets lower. The figure on the next page shows the Wind Chill Index used by the NWS.

Figure 14: NOAA Heat Index Temperature (°F)

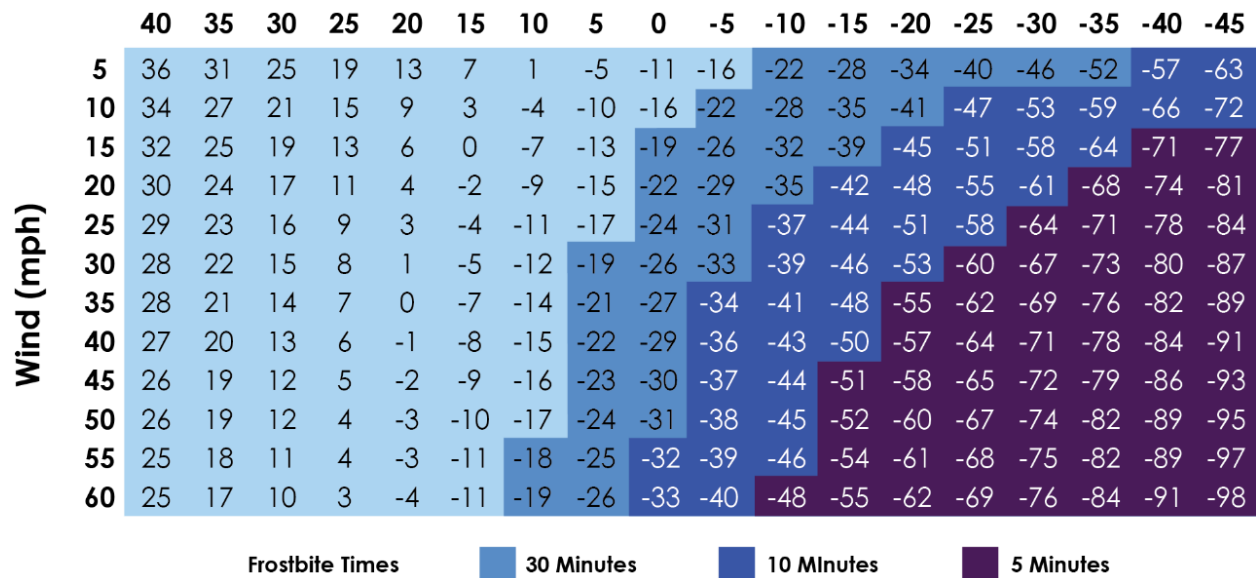


Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity



Source: NOAA³²

Figure 15: NOAA Wind Chill Index Chart Temperature (°F)



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

T = Air Temperature (°F) V = Wind Speed (mph)

Source: NWS³³

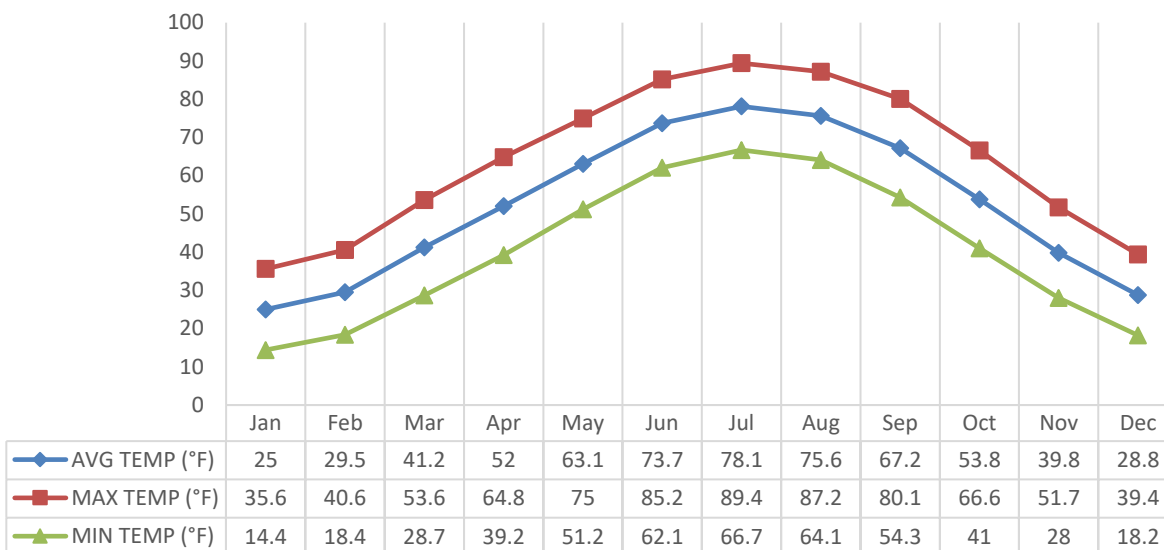
For the planning area, the coldest months of the year are December, January, and February. The average low temperatures for these months are all below freezing (average low for the three months 17.0°F). The

³² National Oceanic and Atmospheric Administration, National Weather Service. 2020. "Heat Index". http://www.nws.noaa.gov/om/heat/heat_index.shtml.

³³ NOAA National Weather Service. 2001. "Wind Chill Chart". http://www.nws.noaa.gov/om/cold/wind_chill.shtml.

average high temperature for these months is 38.5°F. In the planning area, the months with the highest temperatures are June, July, and August. The average high temperature for these months is approximately 87.3°F while the average low temperature for these months is 64.3°F.

Figure 16: NCEI Climate Normal Temps (1991-2020)



The impacts of extreme temperatures, specifically extreme heat, are exacerbated by other risk factors such as diabetes, obesity, heart disease, or other health equity concerns. Many vulnerable communities and populations at-risk face greater exposure to heat or cold, have fewer resources to respond or escape conditions, and are more likely to suffer severe consequences if left unassisted. Populations at highest risk are those without shelter or who are stranded, or who live in a home that is poorly insulated or without adequate HVAC systems. Other impacts of extreme temperatures include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters; household fires, which can be caused by fireplaces and emergency heaters; and frozen/burst pipes. Elderly populations are considered particularly vulnerable to the impacts of extreme temperatures events. Extreme temperatures can also cause people to overuse furnaces and air conditioners, which can lead to power failures. Power outages for prolonged periods increase the risk of health events such as heat stroke or hypothermia and subsequent fatalities.

AVERAGE ANNUAL DAMAGES

Average annual property and crop loss is available through the NCEI Storm Events Database and USDA RMA. The direct and indirect effects of extreme temperatures are difficult to fully quantify. Potential losses such as power outages could affect businesses, homes, and community lifelines. High demand and intense use of air conditioning, heaters, and water pumps can overload the electrical systems and damage infrastructure.

Table 23: Extreme Temperatures Loss Estimation

Hazard Type	Avg. # Days ¹	Total Property Loss ²	Average Annual Property Loss	Total Crop Loss ³	Average Annual Crop Loss
Extreme Heat	Avg. 5 days per year	\$0	\$0	\$9,039,795	\$376,658
Extreme Cold	Avg. 4 days per year	\$100,000	\$3,571	\$359,455	\$14,977

Source: 1 indicates the data is from HPRCC; 2 NCEI; 3 USDA RMA

HISTORICAL PROBABILITY AND FUTURE LIKELIHOOD

Extreme temperatures are a regular part of the climate for the planning area. Extreme heat events of over 100°F occur three days annually and extreme cold events occur on average four times a year. Extreme heat has been recorded in 51 out of the past 77 years indicated a 66% chance of occurring annually (Likely); while extreme cold has occurred in 47 out of the 77 years for the period of record (61%, Likely). Due to the anticipated impacts from climate change, the likelihood of future extreme temperature events will increase in frequency and magnitude.

Table 24: Historical Probability & Future Likelihood – Extreme Temperatures

Hazard	Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
Extreme Heat	66%	Increase in Frequency and Extent	Increase in Frequency	Likely
Extreme Cold	61%	Increase in Frequency and Extent	Increase in Frequency	Likely

FUTURE DEVELOPMENT

Any increases in population and development will elevate exposure levels to extreme heat and extreme cold. There are several ways for communities to minimize the impacts of extreme heat. Communities can plant trees and other vegetation to provide more natural shade and make green infrastructure improvements. Many of these options can be required during new development but can also be added to areas that are already developed. Facilities such as nursing homes, hospitals, clinics, and day cares should be designed with access to back up power generation. Public cooling or warming centers should be established across the planning area for residents.

CLIMATE CHANGE IMPACTS

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

Table 25: Extreme Heat Predictions for Days over 100F

COUNTY	WHERE WE ARE NOW	WHERE WE ARE CURRENTLY HEADED	
	Historical 1971-2000 Avg	Mid-Century Anticipated 2036-2065 Avg	Late Century Anticipated 2070-2099 Avg
Cass	7 days/yr	39 days/yr	65 days/yr
Lancaster	7 days/yr	39 days/yr	66 days/yr
Saunders	6 days/yr	36 days/yr	62 days/yr
Butler	7 days/yr	35 days/yr	61 days/yr
Seward	7 days/yr	38 days/yr	65 days/yr
Otoe	8 days/yr	42 days/yr	68 days/yr

Source: Union of Concerned Scientists, 2024³⁵

Impacts from climate change will significantly affect the prevalence and extent of extreme temperature conditions. The Fourth National Climate Assessment noted numerous impacts including increasing health risks from extreme heat conditions or increased severe wildfire events with hot dry conditions. Jurisdictions across the planning area may also experience more than one climate related impact simultaneously such

³⁴ Union of Concerned Scientists. 2019. "Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days". <https://www.ucsusa.org/sites/default/files/attach/2019/07/killer-heat-analysis-full-report.pdf>.
³⁵ Union of Concerned Scientists. 2022. "Extreme Heat and Climate Change: Interactive Tool". <https://www.ucsusa.org/resources/killer-heat-interactive-tool>.

as drought and extreme heat. The season length of heat waves in many U.S. cities has increased by over 40 days since the 1960s.

Extreme heat and cold poses a significant risk to human health and labor productivity in the agricultural, construction, and other outdoor sectors. The elderly, pregnant women, and children are most vulnerable to negative health impacts during extreme temperature conditions. Heatwaves may also impact plant health, with negative effects on crops during essential growth stages. Increasing temperatures and drought may reduce the potential for aquifers to recharge, which has long-term implications for the viability of agriculture in Nebraska.

More frequent and severe temperature waves are also expected to increase stresses on the energy systems and local resources; rising temperatures are expected to reduce electricity generation capacity while increasing energy demands and costs, which can in turn lead to power outages and blackouts. Rising temperatures are leading to increased demand for water and energy. In parts of the region, this will constrain development, stress natural resources, and increase competition for water among communities, agriculture, energy production, and ecological needs.

COMMUNITY TOP HAZARD STATUS

The following jurisdictions identified Drought as a top hazard of concern:

- Lancaster County

REGIONAL VULNERABILITIES

The nonprofit First Street Foundation has developed a Risk Factor tool to help understand risks from a changing climate at the county or community level. Risk Factor provides an overview for heat risk at the county level. The following table outlines each county’s heat factor risk. Those at greatest risk for temperature-related illness include infants and children up to four years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. Area elder care facilities, senior housing facilities, and childcare facilities are vulnerable to extreme temperatures. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather. In agricultural areas, the exposure of farm workers, as well as livestock, to extreme temperatures is a major concern.

Most notably, power failure during an extreme heat or cold event could shut down these facilities’ HVAC systems if back-up power capabilities were not available. Additionally, infrastructure damage such as road damage can occur as a result of extreme heat. When asphalt is exposed to prolonged extreme heat, it can cause buckling of asphalt-paved roads, driveways, and parking lots.

Table 26: County Heat Factor Risk

		Cass	Lancaster	Butler	Otoe	Saunders	Seward
Overall Heat Factor Risk		Moderate Heat Factor	Moderate Heat Factor	Moderate Heat Factor	Moderate Heat Factor	Moderate Heat Factor	Moderate Heat Factor
# Properties at Risk	Minimal	0	0	0	0	0	0
	Minor	0	0	553	0	197	4
	Moderate	20,736	117,760	8,019	12,914	17,719	11,218
	Major	0	0	0	0	0	0
	Severe	0	0	0	0	0	0
	Extreme	0	0	0	0	0	0
Number of Days per Year >100°F	30 yrs ago	8 days	8 days	7 days	9 days	7 days	8 days
	Now	16 days	17 days	14 days	18 days	15 days	16 days
	In 30 yrs	30 days	30 days	26 days	33 days	28 days	30 days

Source: Risk Factor, 2024³⁶

³⁶ First Street Foundation. "Risk Factor: Heat Factor." Accessed December 2024. <https://riskfactor.com/>.

Note: Health caution days = days where “feels like” temperature exceeds 90F; Dangerous days = days where “feels like” temperature exceeds 100F; Hot days = days where “feels like” temperature exceeds 101F.

The following tables provide information related to regional vulnerabilities and FEMA’s National Risk Index values for Heat Waves and Cold Waves. For jurisdictional specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 27:Regional Drought Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	<ul style="list-style-type: none"> -Human Health impacts including: Heat exhaustion, Heat stroke, Hypothermia, Heart Disease, Asthma -Elderly citizens are at higher risk to injury or death -Citizens without adequate heat or air conditioning at higher risk of injury or death -Workers required to be outside for extended periods of time
ECONOMIC	<ul style="list-style-type: none"> -Short-term interruption of business -Loss of power -Agricultural losses
BUILT ENVIRONMENT	<ul style="list-style-type: none"> -Damage to HVAC systems if overworked
INFRASTRUCTURE	<ul style="list-style-type: none"> -Damages to roadways (prolonged extreme events) -Stressing electrical systems (brownouts during peak usage) -Stressing water systems
CRITICAL FACILITIES	<ul style="list-style-type: none"> -Loss of power
CLIMATE	<ul style="list-style-type: none"> -Increased risk of wildfire events -Increases in extreme temperature conditions are likely, adding stress on livestock, crops, people, and infrastructure

FLOODING

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

RIVERINE FLOODING

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

FLASH FLOODING

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

SHEET FLOODING

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

ICE JAM FLOODING

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

LOCATION

Major waterways in the planning area include the Missouri River, Platte River, Salt Creek, Oak Creek, Weeping Water Creek, Branched Oak Lake, Pawnee Lake, Wagon Train Lake, and Beaver Lake. These rivers and creeks are potential locations for flooding to occur. Flooding is most likely to occur in communities or areas directly near waterways including floodways, floodplain, and other flood risk hazard areas. Flooding in this section is primarily addressing riverine or fluvial flooding, whereas flooding from heavy rain events (pluvial) which commonly overwhelm stormwater management systems is most likely to occur with Severe Thunderstorms.

The Federal Emergency Management Agency and state agencies such as the Nebraska Department of Natural Resources develop mapped floodplain maps which identify the areas at greatest risk to flooding in Nebraska. These maps are called Flood Insurance Rate Map (FIRM) panels. Most of the jurisdictions throughout the planning area also have FIRMs at the municipal level. Figure 17 shows the preliminary firm data for the planning area. For jurisdictional-specific maps as well as an inventory of structures in the floodplain, please refer to *Section Seven*.

Table 28: FEMA FIRM Panel Status

Jurisdiction	Panel Number	Effective Date
Butler County	31023CIN0A	08/16/2011
Brainard	31023CIN0A, 31023C0260C, 31023C0270C, 31023C0290C	08/16/2011
Cass County	31025C0120E, 31025C0115E, 31025C0095E, 31025CIND0B	8/14/2024
Alvo	31025CIND0B, 31025C0175D, 31025C0200D, 31025C0325D, 31025C0350D	8/14/2024 & 11/26/2010
Avoca	31025CIND0B, 31025C0360D, 31025C0375D, 31025C0380D, 31025C0390D	8/14/2024 & 11/26/2010
Cedar Creek	31025CIND0B, 31025C0070D, 31025C0090D	8/14/2024 & 11/26/2010
Eagle	31025CIND0B, 31025C0325D	8/14/2024 & 11/26/2010
Elmwood	31025CIND0B, 31025C0350D	8/14/2024 & 11/26/2010
Greenwood	31025CIND0B, 31025C0155D, 31025C0160D	8/14/2024 & 11/26/2010
Louisville	31025CIND0B, 31025C0070D, 31025C0205D, 31025C0210D	8/14/2024 & 11/26/2010
Manley	31025CIND0B, 31025C0220D	8/14/2024 & 11/26/2010
Murdock	31025CIND0B, 31025C0200D	8/14/2024 & 11/26/2010
Murray	31025CIND0B, 31025C0275D	8/14/2024 & 11/26/2010
Nehawka	31025CIND0B, 31025C0385D, 31025C0405D, 31025C0415D	8/14/2024 & 11/26/2010
Plattsmouth	31025CIND0B, 31025C0115D, 31025C0120D, 31025C0140D, 31025C0255D, 31025C0260D, 31025C0300D	8/14/2024 & 11/26/2010
South Bend	31025CIND0B, 31025C0050D, 31025C0065D	8/14/2024 & 11/26/2010
Union	31025CIND0B, 31025C0410D, 31025C0420D	8/14/2024 & 11/26/2010
Weeping Water	31025CIND0B, 31025C0220D, 31025C0250D, 31025C0360D, 31025C0380D	8/14/2024 & 11/26/2010
Lancaster County	31109CIND0B	04/16/2013
Bennet	31109CIND0B, 3109C0459G, 31109C0467G, 31109C0478G, 31109C0486G	04/16/2013
Davey	31109CIND0B, 31109C0070G, 31109C0177G, 31109C0183G, 31109C0184G, 31109C0185G	04/16/2013
Denton	31109CIND0B, 31109C0290G, 31109C0405G	04/16/2013
Firth	31109CIND0B, 31109C0575G, 31109C0586G, 31109C0588G, 31109C0600G	04/16/2013
Hallam	31109CIND0B, 31109C0550G	04/16/2013

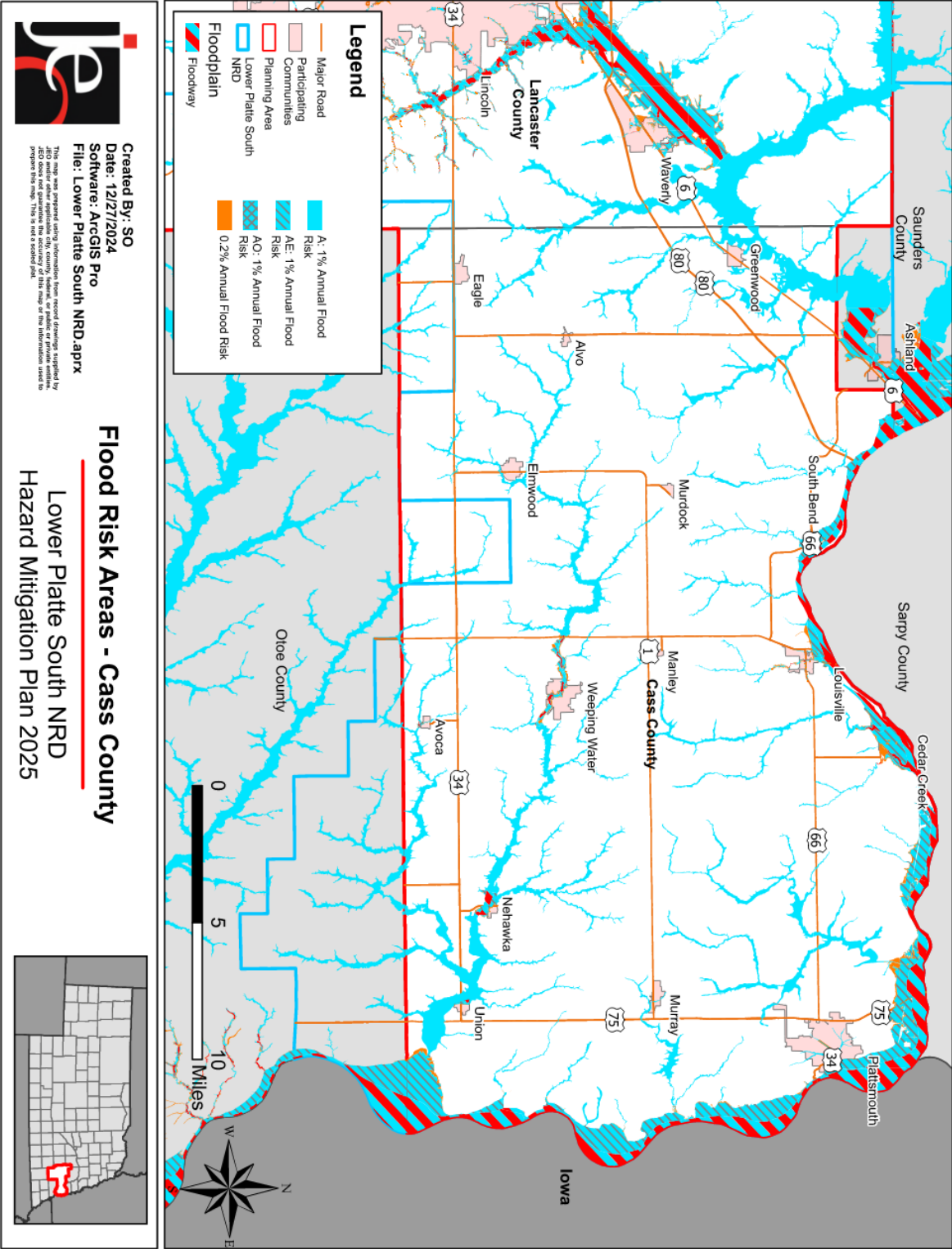
Jurisdiction	Panel Number	Effective Date
Hickman	31109CIND0B, 31109C0444G, 31109C0445G, 31109C0463G, 31109C0557G, 31109C0575G, 31109C0576G	04/16/2013
Lincoln	31109CIND0B, 31109C0165G, 31109C0170G, 31109C0183G, 31109C0184G, 31109C0186G, 31109C0187G, 31109C0188G, 31109C0189G, 31109C0191G, 31109C0192G, 31109C0193G, 31109C0194G, 31109C0205G, 31109C0215G, 31109C0216F, 31109C0218G, 31109C0280G, 31109C0285F, 31109C0290G, 31109C0295G, 31109C0305F, 31109C0310F, 31109C0315F, 31109C0316F, 31109C0317F, 31109C0318F, 31109C0319F, 31109C0326F, 31109C0327G, 31109C0328F, 31109C0329F, 31109C0331G, 31109C0332G, 31109C0333F, 31109C0334F, 31109C0336F, 31109C0337F, 31109C0338F, 31109C0339F, 31109C0341F, 31109C0342F, 31109C0343F, 31109C0344F, 31109C0407G, 31109C0409G, 31109C0410G, 31109C0420G, 31109C0430G, 31109C0431F, 31109C0432F, 31109C0435G, 31109C0440G, 31109C0445G, 31109C0451F, 31109C0452F, 31109C0453G, 31109C0454G, 31109C0456F, 31109C0457F, 31109C0458G, 31109C0459G, 31109C0465G	4/16/2013, 2/18/2011
Malcolm	31109CIND0B, 31109C0145G, 31109C0165G	04/16/2013
Panama	31109CIND0B, 31109C0600G, 31109C0625G	04/16/2013
Raymond	31109CIND0B, 31109C0156, 31109C0157G, 31109C0158G, 31109C0159G	04/16/2013
Roca	31109CIND0B, 31109C0444G, 31109C0445G	04/16/2013
Sprague	31109CIND0B, 31109C0420G, 31109C0440G, 31109C0535G, 31109C0555G	04/16/2013
Waverly	31109CIND0B, 31109C0210G, 31109C0215G, 31109C0216F, 31109C0217G, 31109C0218G, 31109C0219G, 31109C0240G	04/19/2013, 02/18/2011
Otoe County	31131CIND0B	02/18/2011
Saunders County	31155CIND0B	08/03/2016
Ashland	31155CIND0B, 31155C0535D, 31155C0545D, 31155C0555D, 31155C0565D	08/03/2016, 04/05/2010
Ceresco	31109CIND0B, 31155CIND0B, 31109C0070G, 31109C0090G, 3155C0500D, 31155C0525D	04/16/2013, 08/03/2016, 04/05/2010
Valparaiso	31155CIND08, 31155C0475D	08/03/2016, 04/05/2010
Seward County	31159CIND0A	05/01/2020

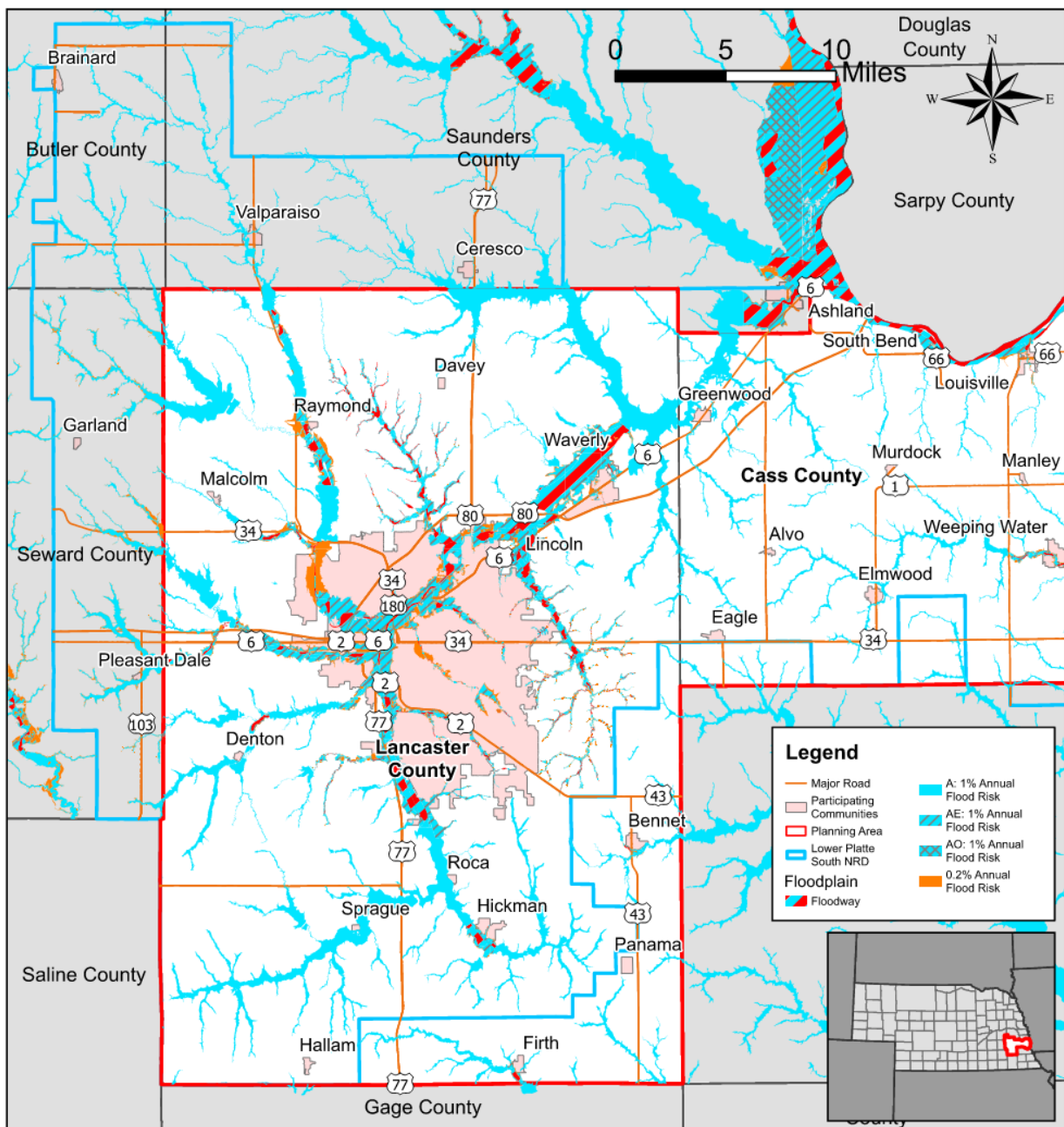
Source: FEMA, 2024³⁷

The map below shows mapped flood risk hazard areas including the 100-yr and 500-yr floodplains across the planning area. For jurisdictional specific flood risk hazard areas, please see individual profiles in *Section Seven*.

³⁷ Federal Emergency Management Agency. 2024. "FEMA Flood Map Service Center." <http://msc.fema.gov/portal/advanceSearch>.

Figure 17: 1% Annual Flood Risk Hazard Area





Created By: JR
 Date: 01/09/2025
 Software: ArcGIS Pro
 File: Lower Platte South NRD.aprx

Flood Risk Areas - Lancaster County

Lower Platte South NRD
 Hazard Mitigation Plan 2025



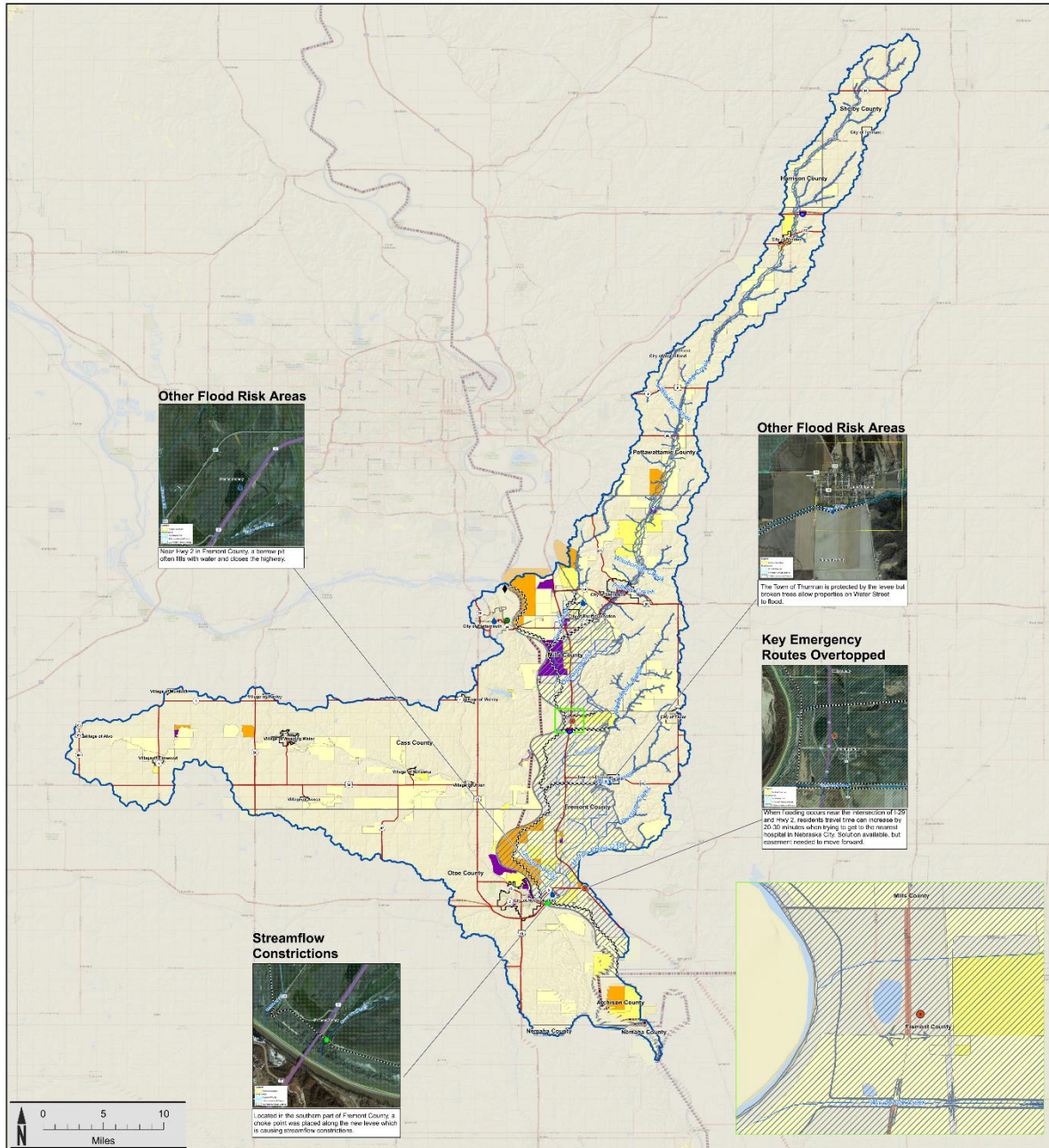
This map was prepared using information from record drawings supplied by JEO and/or other applicable city, county, federal, or public or private entities. JEO does not guarantee the accuracy of this map or the information used to prepare this map. This is not a scaled plot.

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 better protect their citizens. The Keg-Weeping Water Watershed has gone through the Risk MAP process, which included areas of Cass County (Plattsmouth, Murray, Nehawka, Weeping Water, Avoca, Manley, Murdock, Elmwood, and Alvo). The majority of analysis done during the Risk Map is along the Missouri River and tributaries on the Iowa side of the river.

As part of that process, a HAZUS analysis was performed for the Risk MAP areas. HAZUS is a risk model that estimates the physical, economic, and social impacts from flooding. The figures below show the HAZUS analysis results and boundary of the Risk MAP project. There are currently no additional planned Risk MAP projects in the planning area. NeDNR hosts the Risk MAP products on an interactive web map, which can be viewed on their webpage: <https://dnr.nebraska.gov/floodplain>.

Flood Risk Map: Keg-Weeping Water Watershed



Other Flood Risk Areas

Near Hwy 2 in Franklin County a borrow pit often fills with water and closes the highway.

Other Flood Risk Areas

The Town of Thurman is protected by the levee but borrow trees along properties on Water Street is flood.

Key Emergency Routes Overtopped

When flooding occurs near the intersection of 200 and Hwy 2 residents travel time can increase by 20-30 minutes when trying to get to the nearest hospital in Nemaha Co. Spoken available, but assessment needed to move forward.

Streamflow Constrictions

Located in the southern part of Fremont County, a crackle joint was placed along the new levee which is causing streamflow constrictions.

MAP SYMBOLOLOGY

Base Data	Flood Data	Flood Risk Avg. Annualized Loss	Areas of Mitigation Interest Data
<ul style="list-style-type: none"> Corporate Limits Major Roads State Boundary Watershed Boundary Levees 	<ul style="list-style-type: none"> Rivers and Streams Roadway Area New SFHA 	<ul style="list-style-type: none"> Very Low Low Medium High Very High 	<ul style="list-style-type: none"> Stream Flow Constrictions At-Risk Essential Facilities Other Non-Accredited Levees Significant Land Use Changes (within the past 5 years and looking forward 5 years) Other Flood Risk Areas Areas of Mitigation Success Key Emergency Routes Overtopped

PROJECT LOCATOR



Risk Mapping, Assessment, and Planning (Risk MAP)

FRM FLOOD RISK MAP

Keg-Weeping Water Watershed, Iowa

HUC-8 Code: 10240003
Version ID: 2.1.2.1
RELEASE DATE: 8/29/2014

For more information of data used for this non-regulatory map, please consult the Watershed USA Flood Risk Database and Flood Risk Report.

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 29: NFIP Participants

Jurisdiction	Eligible- Regular Program	Date Current Map	Sanction	Suspension	Rescinded	Participation in NFIP
Butler County	08/16/11	08/16/11	No	No	No	Yes
Brainard	-	-	-	-	-	No
Cass County	09/02/82	11/26/10	No	No	No	Yes
Alvo	-	-	-	-	-	No
Avoca	08/03/79	11/26/10	No	No	No	Yes
Cedar Creek	09/15/78	11/26/10	No	No	No	Yes
Eagle	08/26/77	11/26/10	No	No	No	Yes
Elmwood	-	-	-	-	-	No
Greenwood	06/03/80	11/26/10	No	No	No	Yes
Louisville	03/04/80	11/26/10	No	No	No	Yes
Manley	-	-	-	-	-	No
Murdock	-	-	-	-	-	No
Murray	01/05/78	11/26/10	No	No	No	Yes
Nehawka	02/15/78	11/26/10	No	No	No	Yes
Plattsmouth	03/01/78	08/14/24	No	No	No	Yes
South Bend	07/20/84	11/26/10	No	No	No	Yes
Union	04/03/78	11/26/10	No	No	No	Yes
Weeping Water	12/01/77	11/26/10	No	No	No	Yes
Lancaster County	02/03/82	04/16/13	No	No	No	Yes
Bennet	03/02/81	04/16/13	No	No	No	Yes
Davey	-	-	-	-	-	No
Denton	09/21/01	04/16/13	No	No	No	Yes
Firth	04/15/81	04/16/13	No	No	No	Yes
Hallam	-	-	-	-	-	No
Hickman	02/03/82	04/16/13	No	No	No	Yes
Lincoln	04/23/71	04/16/13	No	No	No	Yes
Malcolm	03/30/09	04/16/13(M)	No	No	No	Yes
Panama	-	-	-	-	-	No

Jurisdiction	Eligible- Regular Program	Date Current Map	Sanction	Suspension	Rescinded	Participation in NFIP
Raymond	04/18/85	04/16/13	No	No	No	Yes
Roca	01/28/14	04/16/13(M)***	No	No	No	Yes
Sprague	09/21/01	04/16/13(M)*	No	No	No	Yes
Waverly	04/15/82	04/16/13	No	No	No	Yes
Saunders County	12/01/78	08/03/16	No	No	No	Yes
Ashland	11/03/82	04/05/10	No	No	No	Yes
Ceresco	07/03/86	04/16/13	No	No	No	Yes
Valparaiso	06/03/86	04/05/10(M)*	No	No	No	Yes

Source: Federal Emergency Management Agency, National Flood Insurance Program, 2019

*(M) indicates No Elevation Determined – All Zone A, C, and X.

This plan highly 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 or not 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).³⁸ Currently the City of Lincoln and the City of Waverly participate in the CRS program. Since the prior plan, City of Waverly joined the CRS program and is now a Class 9 community. Lincoln is currently a Class 5 jurisdiction within the CRS program.

NFIP REPETITIVE LOSS STRUCTURES

NeDNR and FEMA Region VII were contacted to determine if any existing buildings, infrastructure, or critical facilities are classified as NFIP Repetitive Loss Structures. The table below describes Repetitive Loss or Severe Repetitive Loss properties located in the planning area.

Table 30: Repetitive Loss and Severe Repetitive Loss Properties

Jurisdiction	# of Repetitive Loss Properties	Repetitive Loss Type	# of Severe Repetitive Loss Properties	Severe Repetitive Loss Type
Cass County	28	27 Single Family; 1 Other non- residence	3	2 Single Family; 1 Other non-residence
City of Ashland	3	3 Single Family	1	1 Other non-residence
City of Lincoln	6	4 Single Family; 2 Other non- residence	1	1 Business
City of Weeping Water	2	2 Single Family		
City of Plattsmouth	0	-	1	1 Single Family
Lancaster County	1	1 Single Family		
Village of Cedar Creek	7	7 Single Family		

³⁸ Federal Emergency Management Agency. May 2017. "National Flood Insurance Program Community Rating System: Coordinator's Manual FIA-15/2017." Accessed August 2017. <https://www.fema.gov/media-library/assets/documents/8768>.

Jurisdiction	# of Repetitive Loss Properties	Repetitive Loss Type	# of Severe Repetitive Loss Properties	Severe Repetitive Loss Type
Village of Nehawka	5	4 Single Family; 1 Other non-residence		
Village of Roca	1	1 Single Family		

Source: NeDNR, 2023

As of December 2024, several properties throughout the planning area were in the discussion and planning phase of flood mitigation. NeDNR provided outreach to all communities with RL/SRL properties to notify them of opportunities available through Flood Mitigation Assistance. Properties in Nehawka, Plattsmouth, and South Bend were in the discussion phase to elevate or remove RL properties from the floodplain.

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, 70 flash flooding events resulted in \$5,067,000 in property damage, while 59 riverine flooding events caused \$122,051,000 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 \$2,778,045.

The events summarized below were significant in loss of life, injuries, or the amount of damages.

- June 21, 2010: In the Village of Avoca the creek flooded, and water was standing on the streets. The flooding caused damage to the Village Wastewater Plant, bridges, parks, and some residential buildings.
- September 2010: In the City of Weeping Water the campgrounds and its amenities and park facilities flooded.
- June-July 2011: Flooding along the Missouri and Platte Rivers caused property damage to residents on lots in Buccaneer Bay along the Platte River and Four Mile Creek. No damage was caused to the water and wastewater infrastructure, though a number of preventative steps were required, such as plugs in manhole covers.
- June 4, 2013: In the City of Hickman large flooding filled basements and impacted the first floor of structures in the floodplain. It also largely impacted the City of Hickman Main Park.
- Mary 29, 2013: In the Village of Ceresco, a flooding event occurred that flooded the bridges and highways and disturbed traffic for several hours.
- May 6, 2015: Record rainfall of 5 to 10 inches fell across Lancaster County, and the Salt Creek basin on the evening of the 6th into the early morning of the 7th. This led to significant flooding along the creek, from near Roca north through the Lincoln metro area. The flooding resulted in numerous road closures, water rescues, and some mandatory evacuations. The flooding was largely contained within the levee system within Lincoln, but many parks and low-lying areas were flooded.
- June 12, 2017: Thunderstorms developed in the early morning along a front that extended from southwest Nebraska to northwest Iowa. Some of these thunderstorms produced large hail and also created heavy rain and flooding in the Lincoln area. Portions of Rokeby Road and South 14th Street were closed due to flooding due to heavy rain.
- May 9, 2016: Numerous reports from a variety of sources of flash flooding in the southeast part of the city of Lincoln. Rainfall reports of 3.5 to over 5 inches of rainfall were received. This along with areas of several inches accumulation of hail led to widespread street flooding in the area. Small streams and creeks in the area also overflowed including Stevens Creek. Water was flowing over

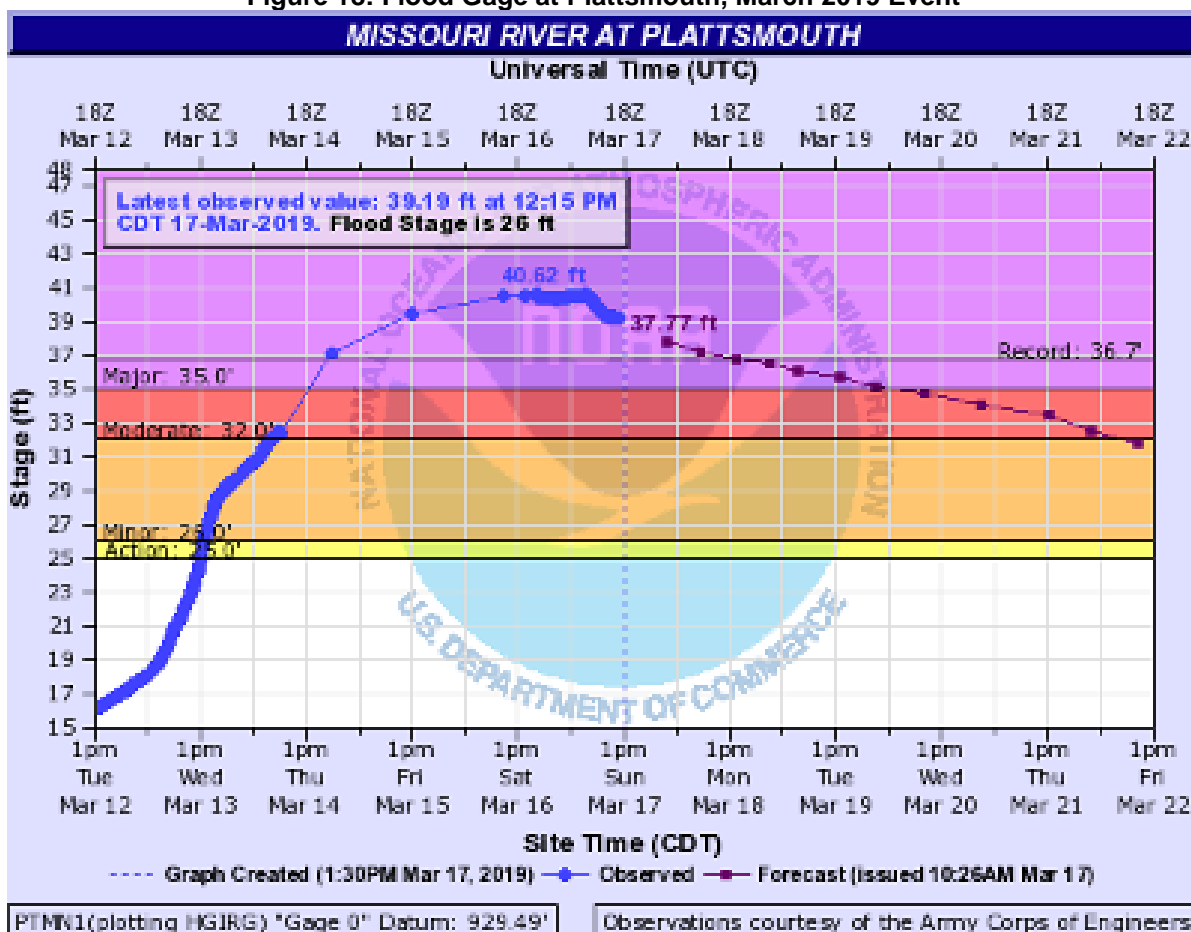
the bridge where Holdredge Street crosses Stevens Creek. Severe water rescues were performed from stranded motorists.

MARCH 2019 FLOOD EVENT

The March 2019 flood event significantly impacted the entire planning area and most of the eastern side of the State of Nebraska. Winter Storm Ulmer developed on March 12th and slowly moved across the Midwest including Nebraska. Due to heavy precipitation on frozen ground and melting snowpack, numerous water systems were overwhelmed and failed. In other areas, released ice jams destroyed roads, bridges, and levees. Several stream gauges in the planning area reached all-time record levels including Louisville and Plattsmouth. The Missouri River at Plattsmouth recorded a crest of 40.62 feet of water, nearly seven feet above the previous record. In total, 104 cities, 81 counties, and 5 tribal nations in Nebraska received State or Federal Disaster Declarations due to the flood events.

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

Figure 18: Flood Gauge at Plattsmouth, March 2019 Event

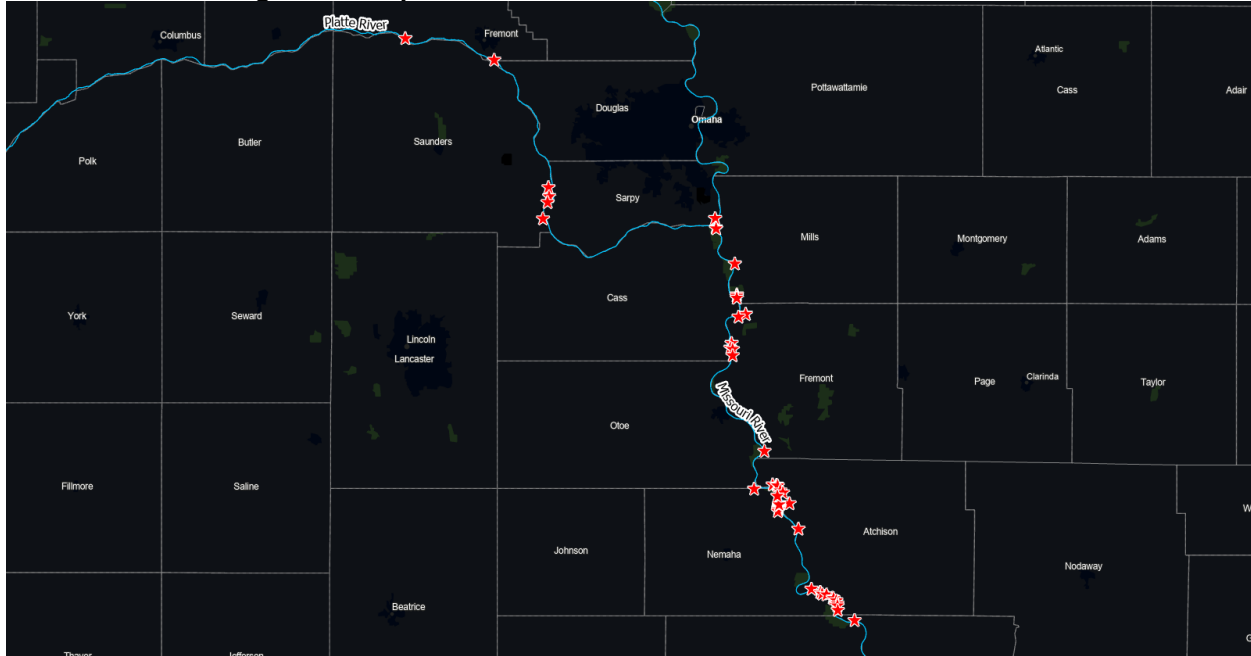


Impacts from this event included significant damage to homes, commercial buildings, agriculture, bridges, and roads. Agriculturally, hundreds of acres of pastureland and fields were destroyed by several inches to feet of sand and silt left behind by receding flood waters. The flooding event also occurred in the midst of calving season, resulting in the loss of hundreds of calves for ranchers across the state. Roads and critical transportation routes across the state were blocked by flood waters or washed out entirely. At least three fatalities occurred during the flood event while the Nebraska National Guard performed dozens of rescues

in inundated areas. No fatalities were reported within the LPSNRD and two-county planning area during this event.

In total, the U.S. Army Corps of Engineers reported 41 breaches to federal and non-federal levees across the state of Nebraska. The failure of these structures significantly impacted subsequent flooding in neighboring communities.

Figure 19: Reported Levee Breaches – March 2019 Flood Event



Source: USACE

Several communities in the planning area enforced evacuations including South Bend, Louisville, Cedar Creek, and Plattsmouth. Additional specific impacts felt within the planning area include:

- City of Lincoln: wellfields located along the Platte River were inundated with flood waters and ice jams causing power loss and intermittent drops in water production capacity.
- Camp Ashland: the Nebraska National Guard base was severely flooded with extensive damages to administrative buildings, classrooms, barracks, trails, and roads. A breach on the Clear Creek Levee led to floodwaters five feet deep across the camp and uprooted power poles and wellheads.
- City of Plattsmouth: significant damage occurred to city infrastructure during the flood event as the confluence of the Platte and Missouri Rivers occurs directly northeast of the City. Heavy flows cut through a portion of the City approximately one mile west of the confluence; prevented access to the water treatment plant; destroyed a local municipal well; flooded and destroyed numerous residential homes; and severely damaged the other city wells, the boat ramp, city park, and other infrastructure.
- Cedar Creek: heightened water levels on the Platte River reached the top of the berm around the Village and caused damage to a local primary road. Sandbagging efforts prevented significant damage to roads, water systems, and infrastructure.

Additional community specific impacts reported by affected communities are included in *Section Seven: Community Profiles* as appropriate.

EXTENT

The National Weather Service (NWS) has four flood severity categories as displayed in the table below. Actual impacts will vary by community depending on severity of flood event and local conditions such as total developed area in the floodplain or existing flood risk reduction structures.

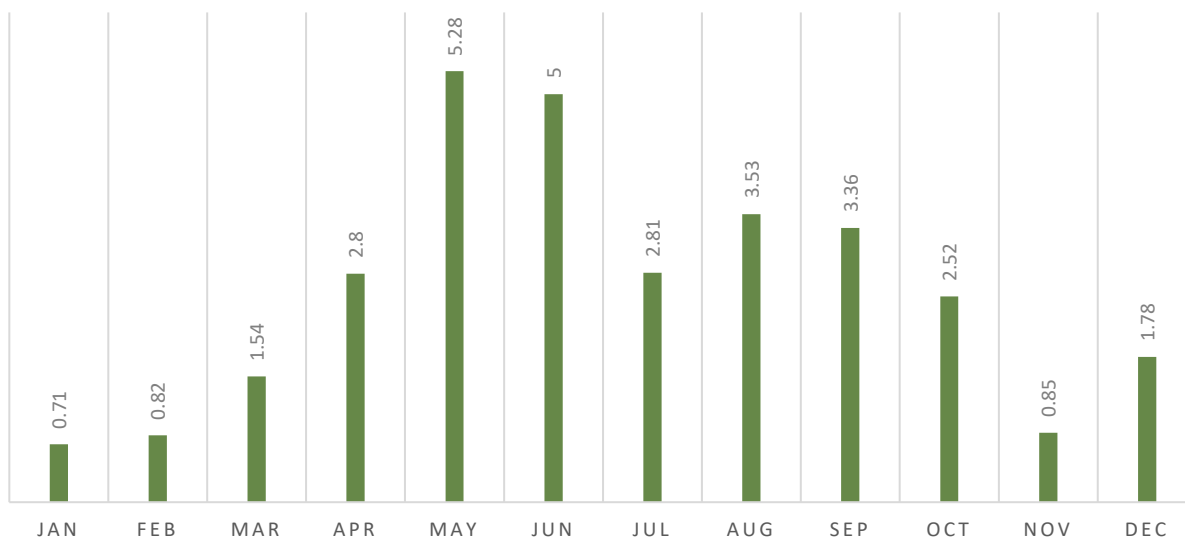
Table 31: Flooding Stages

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, 2017³⁹

Figure 20 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 21, the most common month for flooding within the planning area is in the springtime (May and June).

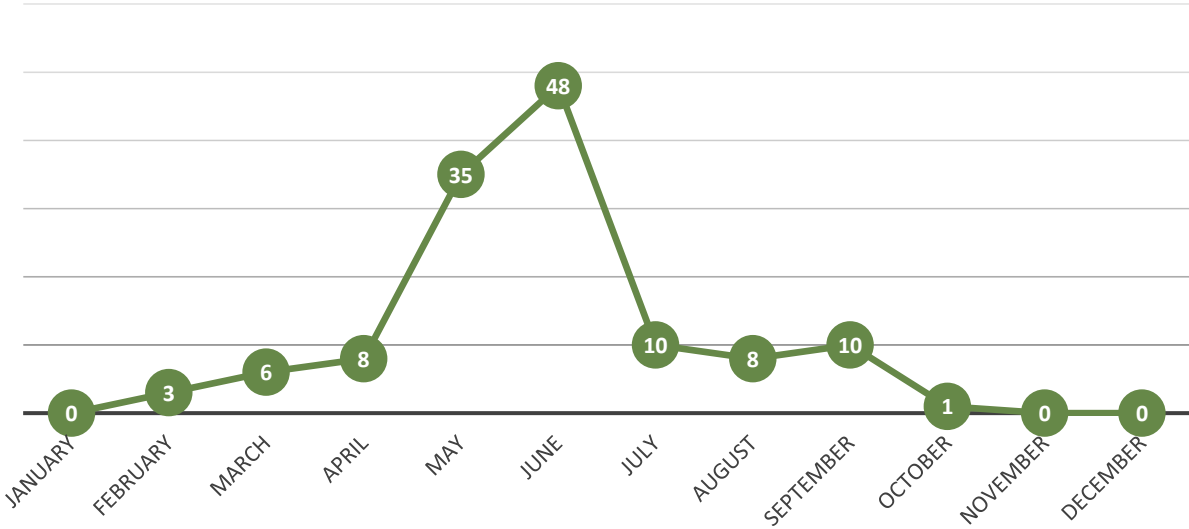
Figure 20: LPSNRD Average Monthly Precipitation



Source: NCEI

³⁹ National Weather Service. 2017. "Flood Safety." <http://www.floodsafety.noaa.gov/index.shtml>.

Figure 21: Monthly Events for Floods/Flash Flood in the LPSNRD



Source: NCEI, 1996-2023

AVERAGE ANNUAL DAMAGES

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

Table 32: Flood Loss Estimate

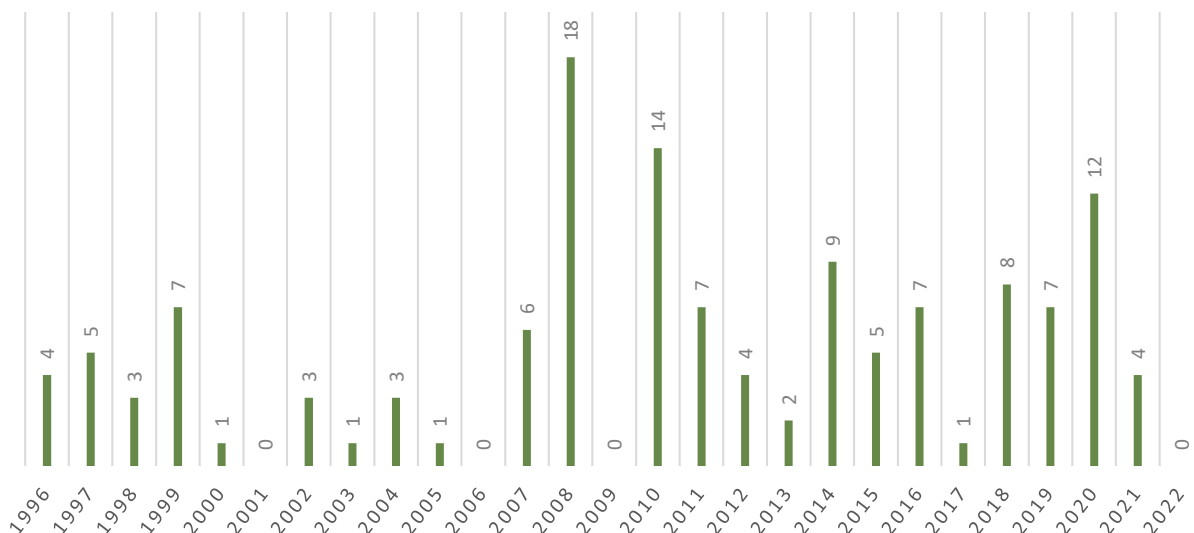
Hazard Type	Number of Events ¹	Average Events Per Year	Total Property Loss ¹	Average Annual Property Loss ¹	Total Crop Loss ²	Average Annual Crop Loss ²
Flood Events	129	4.6	\$122,051,000	\$4,358,964	\$2,778,045	\$115,752

Source: 1 Indicates data is from NCEI (Jan 1996 to Dec 2018); 2 Indicates data is from USDA RMA (2000 to 2023)

HISTORICAL PROBABILITY AND FUTURE LIKELIHOOD

The NCEI reports 59 flooding and 70 flash flooding events from 1996 to 2023. Some years had multiple flooding events. The following figure shows the events broken down by year. Based on the historic record and reported incidents by participating communities with nine out of 28 years with a reported flood event, there is a 32 percent probability that flooding will occur annually in the planning area (Likely).

Figure 22: Flood Events by Year



Source: NCEI, 2023

Table 33: Historical Probability & Future Likelihood – Flooding

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
86%	Increase in Frequency and Intensity	Increase in Frequency. Increase Exposure	Likely

FUTURE DEVELOPMENT

Any future development in floodplains should be evaluated to ensure it minimizes risk to future assets. Land-use regulations should be used to limit development in floodplains and other flood prone areas as well as protecting natural flood mitigation features. Communities can also consider incorporating “Green Infrastructure” to address flooding concerns. Examples of this would include using permeable surfaces for parking areas, using rainwater retention swales, developing rain gardens, developing green roofs, and establishing greenways. To further reduce future risk to flooding, communities can implement stormwater management plans, participate in the National Pollutant Discharge Elimination System program, or participate in the NFIP or Community Rating System programs.

Nebraska’s minimum standards for floodplain management require that all new construction and substantial improvements of residential structures shall have the lowest floor (including basements) elevated at least one foot above the base flood elevation. Nebraska standards prohibit new structures for human habitation in the floodway.⁴⁰ These requirements will help reduce flood impacts and damages by requiring a one foot “freeboard” to allow for known flood hazards and result in lower premiums for those participating in the NFIP.

CLIMATE CHANGE IMPACTS

In the warmer months, convective storms are common and include flash flood-producing rainstorms. As temperatures continue to rise, more water vapor evaporates into the atmosphere, creating increased humidity, which can increase the frequency and intensity of these storms. An increase in heavy rain events will lead to more flooding and larger magnitude flood events. NOAA has created the Climate Mapping for Resilience and Adaptation tool that looks at how different emission scenarios affect climatological hazards. Table 34 shows that the annual total precipitation is expected to increase in both low emissions and high

⁴⁰ Nebraska Department of Natural Resources. June 27, 2008. “Rules and regulations Concerning Minimum Standards for Floodplain Management Programs”. https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/desk-reference/legal-authority/Title_455_0708.pdf.

emission scenarios. Changes will likely occur in timing and intensity. Winter and spring will be 15-25% wetter, summer will be 5-15% drier, and fall will be 5% wetter.⁴¹

Table 34: Average Annual Total Precipitation

County	Emission Scenario	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
Cass	Lower Emissions	31.5	31.7	31.7
	Higher Emissions	31.3	31.9	32.5
Lancaster	Lower Emissions	30.2	30.3	30.3
	Higher Emissions	29.9	30.5	30.9
Butler	Lower Emissions	28.6	28.7	28.9
	Higher Emissions	28.3	28.9	29.4
Otoe	Lower Emissions	32.3	32.4	32.5
	Higher Emissions	32.1	32.6	33.3
Saunders	Lower Emissions	30.3	30.4	30.4
	Higher Emissions	30.0	30.4	30.9
Seward	Lower Emissions	28.5	28.6	28.6
	Higher Emissions	28.1	28.6	29.1

Source: NOAA⁴²

COMMUNITY TOP HAZARD STATUS

The following jurisdictions identified Flooding as a top hazard of concern.

- Lower Platte South NRD
- Cass County
- Avoca, Village of
- Cedar Creek, Village of
- Eagle, Village of
- Louisville, City of
- Nehawka, Village of
- South Bend, Village of
- Weeping Water, City of
- Lancaster County
- Bennet, Village of
- Denton, Village of
- Firth, Village of
- Hickman, City of
- Lincoln, City of
- Malcolm, Village of
- Raymond, Village of
- Waverly, City of
- Ashland, City of
- Valparaiso, Village of
- Cass County Rural Water District #1

REGIONAL VULNERABILITIES

A 2008 national study examining social vulnerability as it relates to flood events found that low-income and minority populations are disproportionately vulnerable to flood events. These groups may lack needed resources to mitigate potential flood events as well as resources that are necessary for evacuation and response. In addition, low-income residents are more likely to live in areas vulnerable to the threat of

⁴¹ NCEI. 2022. "State Climate Summaries – Nebraska". [https://statesummaries.ncics.org/chapter/ne/#:::text=The%20state%20is%20located%20for,\(1895%E2%80%932020\)%20averag.](https://statesummaries.ncics.org/chapter/ne/#:::text=The%20state%20is%20located%20for,(1895%E2%80%932020)%20averag.)

⁴² NOAA. August 2022. "Climate Mapping for Resilience and Adaptation". <https://livingatlas.arcgis.com/assessment-tool/explore/details>.

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 done some interesting work, studying who lives in special flood hazard areas. According to the NeDNR, floodplain areas have a few unique characteristics which differ from non-floodplain areas:

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

The following table is a summary of regional vulnerabilities. For jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 35:Regional Flooding Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Low income and minority populations may lack the resources needed for evacuation, response, or to mitigate the potential for flooding -Elderly or residents with decreased mobility may have trouble evacuating -Residents in low-lying areas, especially campgrounds, are vulnerable during flash flood events -Residents living in the floodplain may need to evacuate for extended periods
ECONOMIC	-Business closures or damages may have significant impacts -Agricultural losses from flooded fields or cattle loss -Closed roads and railways would impact commercial transportation of goods
BUILT ENVIRONMENT INFRASTRUCTURE	-Building may be damaged -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/WILDFIRE

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

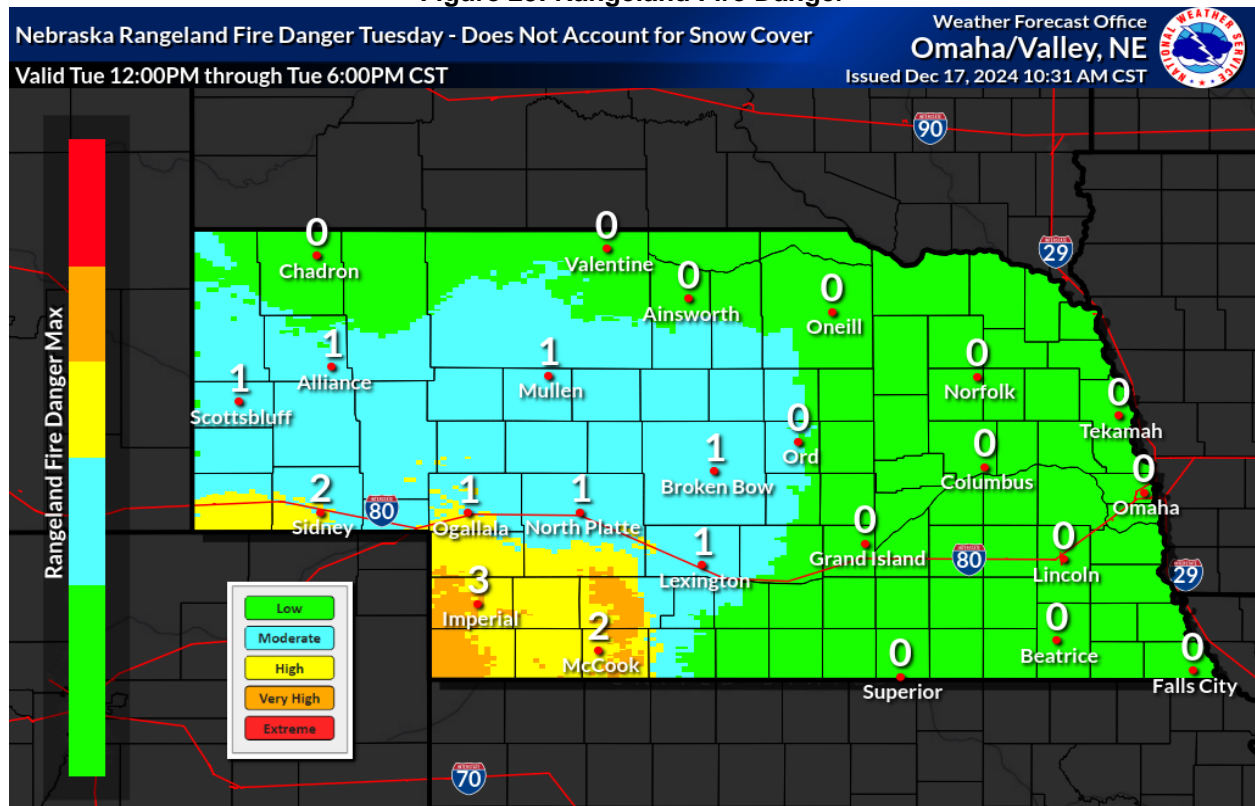
Wildfires are a growing hazard in most regions of the United States, posing a threat to life and property, particularly where rural lands meet developed areas or where local economies are heavily dependent on open agricultural land. Fire is a natural and often beneficial process; fire suppression can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

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

~National Park Service

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, and weather. Most mitigation efforts target fuels reduction and structure hardening. 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. Fire danger predictions are updated regularly and should be reviewed frequently by community leaders and fire department officials (Figure 23).

Figure 23: Rangeland Fire Danger



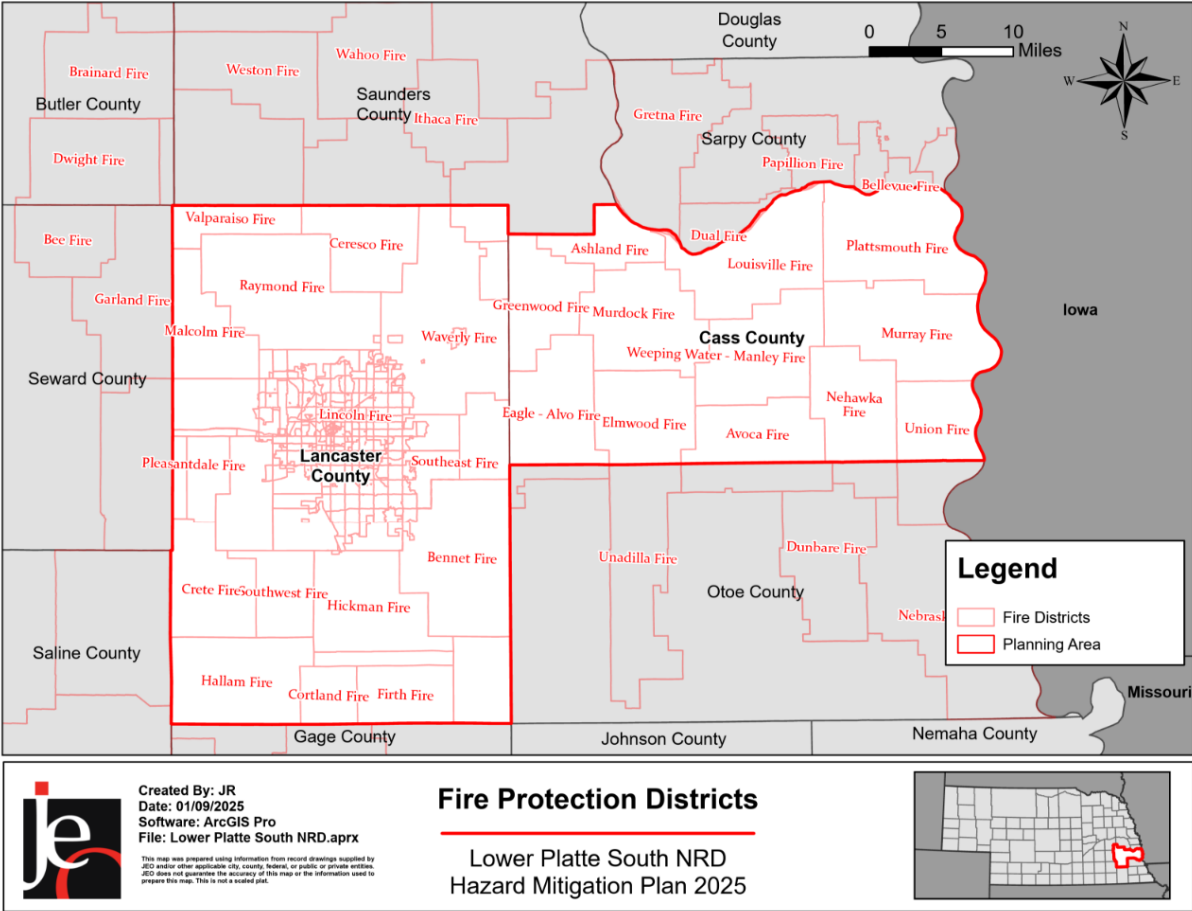
Source: NWS, 2024⁴³

⁴³ National Weather Service. January 2019. "Nebraska Fire Danger Map." <https://www.weather.gov/oax/fire> . Accessed April 2019.

FIRE PROTECTION

There are 24 local volunteer or rural fire districts identified in the planning area. The following is a list of fire districts located in the planning area.

- ALVO VOL FIRE DEPT
- AVOCA RURAL FIRE DIST 5
- BENNET RURAL FIRE DEPT
- CEDAR CREEK VOL FIRE DEPT
- EAGLE FIRE & RESCUE
- ELMWOOD VOL FIRE DEPT
- FIRTH RURAL FIRE DIST
- GREENWOOD VOL FIRE & RESCUE
- HALLAM RURAL FIRE & RESCUE
- HICKMAN RURAL FIRE & RESCUE
- LINCOLN FIRE & RESCUE
- LOUISVILLE VOL FIRE & RESCUE
- MALCOLM FIRE AND RESCUE
- MANLEY FIRE DEPT
- MURDOCK VOL FIRE DEPT
- MURRAY FIRE & RESCUE
- NEHAWKA RURAL VOL FIRE DEPT
- PLATTSMOUTH VOL FIRE DEPT
- RAYMOND VOL FIRE DEPT
- SOUTHEAST RURAL FIRE DIST
- SOUTHWEST RURAL FIRE DEPT
- UNION VOL FIRE DEPT
- WAVERLY FIRE & RESCUE DEPT
- WEEPING WATER VOL FIRE DEPT



LOCATION

Wildfire events can occur throughout the planning area. As the number of reported wildfires by the county indicates, Lancaster County has both reported the greatest number of fires and had the greatest amount of acres burned.

Table 36: Reported Wildfires by County

County	Reported Wildfires	Acres Burned
Cass County	449	2,634
Lancaster County	846	6,445
Total	1,295	9,079

Source: Nebraska Forest Service, 2000- 2024⁴⁴

The United States Department of Agriculture Forest Service created the interactive web resource *Wildfire Risk to Communities* to help communities and jurisdictions understand, explore, and reduce wildfire risk. Low, Medium, High, or Very High Risk is determined by the Risk to Homes national percentile rank of the selected community, county, tribal area, or state. Low is less than 40th percentile, Medium is 40th-70th percentile, High is 70th-90th percentile, and Very High is equal to or greater than 90th percentile.

- Risk to Homes – The relative risk to a house for every location on the landscape, whether a house currently exists there or not
- Wildfire Likelihood – The probability of a wildfire burning in any given year
- Exposure – Whether homes may be subjected to wildfire directly or indirectly (such as from embers)

⁴⁴ Nebraska Forest Service. 2000-2014. "Fire Incident Type Summary." Data Files 2000-2024.

- Vulnerable Populations – People that may be disproportionately impacted by wildfire because of social and economic factors

The following tables describe other specific risks and vulnerabilities seen across the planning area.

Table 37: Wildfire Vulnerabilities by County

County	Risk To Homes	Wildfire Likelihood	Vulnerable Populations	Overall Risk
Lancaster	Medium	Medium	Medium	Medium
Cass	Medium	Medium	Medium	Medium
Otoe	Medium	Medium	High	Medium
Butler	Medium	Medium	High	Medium
Saunders	Medium	Medium	High	Medium
Seward	Medium	Medium	Low	Medium

Source: *Wildfire Risk to Communities, 2024*⁴⁵

Table 38: Wildfire Vulnerable Populations by County

County	Families in Poverty	People with Disabilities	People over 65	Difficulty with English	Households with no Vehicle	Mobile Homes
Lancaster	5,120 (6.7%)	35,733 (11.3%)	46,984 (14.6%)	6,486 (2.1%)	6,560 (5.1%)	1,877 (1.4%)
Cass	213 (2.8%)	3,341 (12.6%)	4,827 (18%)	55 (0.2%)	359 (3.5%)	403 (3.9%)
Otoe	421 (102%)	2,306 (14.6%)	3,240 (20.3%)	339 (2.2%)	245 (3.8%)	170 (2.7%)
Butler	133 (5.9%)	964 (11.7%)	1,719 (5.6%)	178 (2.3%)	93 (2.7%)	155 (44%)
Saunders	267 (4.3%)	2,725 (12.4%)	4,085 (18.3%)	85 (0.4%)	310 (3.5%)	228 (2.6%)
Seward	197 (4.2%)	2,029 (11.7%)	3,090 (17.5%)	22 (0.1%)	301 (4.6%)	124 (1.9%)

Source: *Wildfire Risk to Communities, 2024*

COMMUNITY WILDFIRE PROTECTION PLANS

In recent decades, as the population of the United States has decentralized and residents have moved farther away from the center of villages and cities, the area known as the wildland urban interface (WUI) has developed significantly, in both terms of population and building stock. The Nebraska Forest Service (NFS) develops Community Wildfire Protection Plans for regions across the state. Lancaster and Cass Counties are within the Southwest Community Wildfire Protection Plan.⁴⁶

The purpose of the CWPPs is to help effectively manage wildfires and increase collaboration and communication among organizations who manage fire. The CWPPs discuss county-specific historical wildfire occurrences and impacts, identify areas most at risk from wildfires, discuss protection capabilities, and identify wildfire mitigation strategies. The CWPPs which encompass the planning area define the WUI as the entirety of the counties. The expansion of the WUI increases the likelihood that wildfires will threaten people and homes, making it the focus of the majority of wildfire mitigation efforts.

The Southwest CWPP noted the following areas of concern:

- Cass County - There are no federal lands within Cass County. State lands include 3,787 acres in five NGPC WMAs, 1,289 acres in four NGPC state parks, trails and recreation areas, 235 acres at the NFS Horning State Farm, and approximately 80 acres in school lands. There is a 113-acre property managed by the Lower Platte South NRD. The lands most at-risk from wildfire are in the northern and eastern parts of the county, along the Missouri and Platte Rivers, where topography is rough and woody fuels are dense in some areas, creating high fire hazard. The Ashland Fire

⁴⁵ United States Department of Agriculture, United States Forest Service. Accessed January 2024. "Wildfire Risk to Communities." <https://wildfirerisk.org/>.

⁴⁶ Nebraska Forest Service. 2022. "Community Wildfire Protection Plans." <https://nfs.unl.edu/publications/community-wildfire-protection-plans>.

Department listed lake communities with high home density, infrastructure or other resources at high risk, or populated areas with one way in/out as areas of primary concern in their district.

- Lancaster County - Public lands in Lancaster County include 15,262 acres in 15 state WMAs and seven SRAs; 2,158 acres in 24 NRD properties; 178 Department of Defense acres; and 534 acres of state school lands. There are 1,402 acres in five large municipally-owned or managed areas, plus many smaller municipal and county-owned parks. Locations of special concern include population centers adjacent to wildlands and wooded areas along the rivers and streams. The Bennet fire chief expressed concern about “acreage subdivisions” and said that most developments, including one in the Village of Bennet, only have one way in and out. The Crete VFD said there is a lot of subdivision moving out from Lincoln. Many have only one-way in/out and have wildland conditions within 20 feet of structures. They have mapped these. The Hickman VFD identified several subdivisions in their district with a WUI between CRP grassland and acreage developments (Meadowlark Hills Addition-Blocks 1 & 2, Whitetail Ridge Addition, Poe Estates-Blocks 1 & 2, Cedar Woods Estates Addition); CRP surrounded by cropland and wooded drainageways vulnerable to harvest season ignition; rural acreages bordering wooded state recreation areas; and suburban subdivisions which directly abut cropland susceptible to harvest season ignitions. The Ashland Fire Department listed lake communities with high home density, infrastructure or other resources at high risk, or populated areas with one way in/out as areas of primary concern in their district. Lincoln Fire and Rescue stated that they are experiencing an increasing problem with urban/wildland interface due to “common areas” in new neighborhoods. They have experienced structural damage due to fire originating in these vegetation areas. LFR lacks wildland equipment and PPE for wildland firefighting. LSR must mutual aid these resources from mutual aid departments. This delay increases risk. Issues in these areas include multiple structures, difficult access, rough terrain, one way in/out, heavy fuels, lack of water within effective distance, and lack of wildland firefighting equipment. The Southwest Rural Fire Protection District is concerned about Wilderness Park, on the west edge of Lincoln, due to multiple structures, difficult access, rough terrain, one way in/out, and heavy fuels. The US Army Corps of Engineers, Missouri River Project staff noted that Holmes Lake in Lincoln is surrounded by dense urban housing. It has better access than the Omaha Lakes but still has a high risk. The Lower Platte South NRD noted some of their saline wetlands adjacent to residential areas.
- Saunders County - Besides municipal lands, public lands in Saunders County include 559 acres in six NGPC WMAs and two SRAs; 2,419 acres in four NRD properties; and 1,830 US Department of Defense acres. There are no state school lands. Locations of special concern include population centers adjacent to wildlands, croplands, and wooded areas along the rivers and streams. The Saunders County section of the 2015 Lower Platte North NRD plan states that “Wildfire has become more of a concern recently in agricultural areas as a result of crop residue.” The plan also listed wildfire as a top concern for the Village of Cedar Bluffs. The Lower Platte North NRD has concerns about the campgrounds at their Czechland Lake and Wanahoo Lake campgrounds and the bluff homes neighboring Wanahoo Lake on the west side. The Mead VFD identified several locations in and near the Village of Mead as having multiple structures, difficult access, and many residents. These include the National Guard training facility, Joyce Circle, and the ethanol plant south of Mead. The Weston fire chief identified the village of Weston as at-risk due to multiple structures, high home density, and infrastructure. The Yutan fire department listed several developments in their district that have multiple structures, difficult access, rough terrain, one way in/out, heavy fuels, and/or lack of water within an effective distance. The Ashland VFD said that area lake communities with high home density, infrastructure or other resources at high risk, some with one way in/out are concerns.
- Otoe County - Besides municipal lands, public lands include 2,335 acres in five NGPC WMAs, one SRA and one State Historical Park; 39 acres in one NRD property; and 240 acres in state school lands. There is one 14-acre non-profit conservation property managed by Audubon. Locations of special concern include population centers adjacent to wildlands and wooded areas along the rivers and streams. In the 2015 Nemaha NRD plan, participants listing wildfire as a top concern included Otoe County and the municipalities of Douglas, Nebraska City, Palmyra, Syracuse, and Unadilla.

The Douglas VFD identified an area southwest of Douglas with difficult access, rough terrain, one way in and out, heavy fuels, and lack of water within an effective distance. The Bennet fire chief expressed concern about “acreage subdivisions” and said that most developments only have one way in and out. The Talmage fire chief said that in the village of Lorton there are several dead end streets.

- Seward County - Public lands in Seward County include 187 acres in one USFWS Waterfowl Production Area; 2,870 acres in eight NGPC WMAs and one SRA; 791 acres in three NRD properties; and 399 acres of state school lands. Locations of special concern include population centers adjacent to wildlands and wooded areas along the rivers and streams. The Seward section of the 2019 Upper Big Blue NRD plan suggested and gave high priority to the following mitigation for the Village of Bee: “Participate in the Nebraska Forest Service Wildland Fire Protection Program which provides services in wildfire suppression training, equipment, pre-suppression planning, wildfire preventions, and aerial fire suppression.” The plan said Village of Garland identified wildfire as a top hazard, but did not recommend specific mitigations. The Tamora VFD noted that the Village of Tamora is a concern because multiple structures on its south side lie adjacent to 140 acres of grassland with heavy fuels and lack of water within an effective distance. A fire with a south wind would push it into town. The Crete VFD (abuts the southeast corner of the county and responds to fires in the area) said there is a lot of subdivision moving out from Lincoln. Many have only one-way in or out and have wildland conditions within 20 feet of structures.
- Butler County - There are no federal lands within the county. State lands include 324 acres in three NGPC WMAs, and approximately 480 acres in school lands. There are 437 acres in three properties managed by three NRDs. Nonprofit conservation lands include 166 acres in two Ducks Unlimited properties. The areas most at-risk from wildfire are the lands surrounding municipalities and recreational and residential areas along the rivers where there are heavy fuels and limited access. The Rising City Fire Department identified Summit Township, Adamy Addition and all along the south bluffs of the Platte River Valley east of Adamy Addition as areas of particular concern due to multiple structures, difficult access, rough terrain, one way in/out, heavy fuels, and lack of water within effective distance.

HISTORICAL OCCURRENCES

It is important to note that there is no comprehensive fire event database. Fire events, magnitude, and local responses were reported voluntarily by local fire departments and local reporting standards can vary between departments. Actual fire events and their impacts are likely underreported in the available data. Updated wildfire data was requested and provided by the Nebraska Forest Service from January 2000 to November 2023. Unofficial reports from a fire near Lake Waconda in April 2023 is also included. As the number of reported wildfires by county indicates, wildfire events can occur in any county within the planning area.

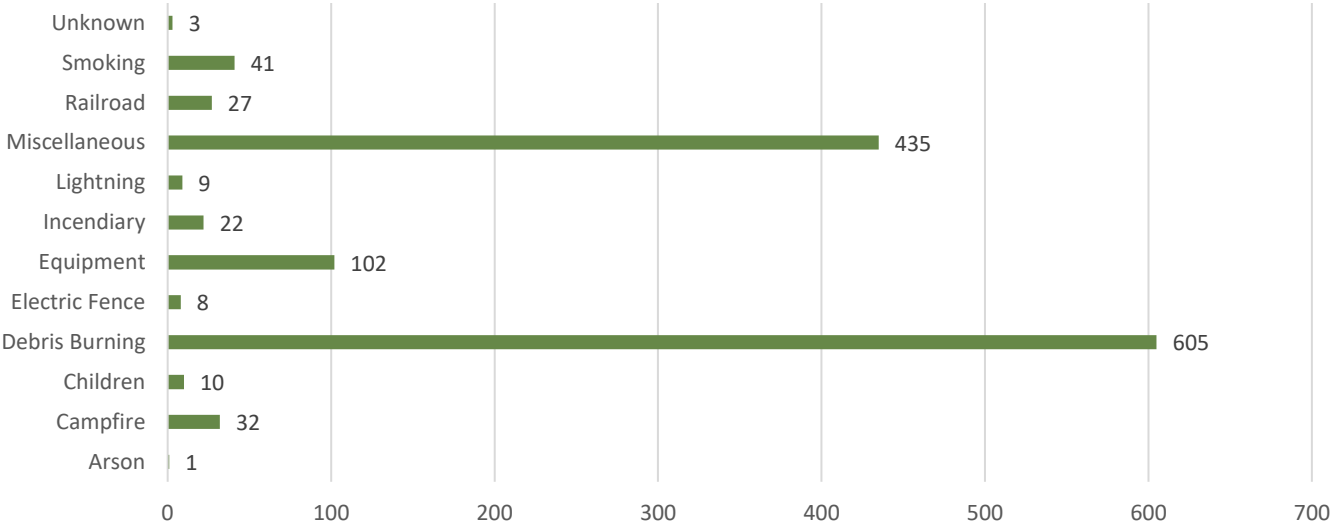
Of note two recent fires occurred in the planning area and are described below:

- October 2022 – A wildfire in southern Lancaster County and northern Gage County destroyed homes, closed roads, and prompted evacuations. The fire was fueled by southern high winds (up to 55mph) and dry conditions. Two firefighters were injured fighting the fire and three houses were destroyed.
- April 2023 – A wildfire in Cass County burned 697 acres near the Village of Union and Lake Waconda. Fires had started in Iowa early April with sparks blown by high winds across the river to ignite in Nebraska. The fast moving fire event quickly grew and required response from numerous fire protection districts. Water was pulled from Lake Waconda via helicopter to drop on the blaze.

For the planning area, 20 different fire departments reported a total of 1,295 wildfires, according to the National Forest Service (NFS), from January 2000 to November 2023. Most fires occurred in 2005 (Figure 25). While the RMA lists no damages from fire in the planning area, the NFS reported \$31,023 in crop loss.

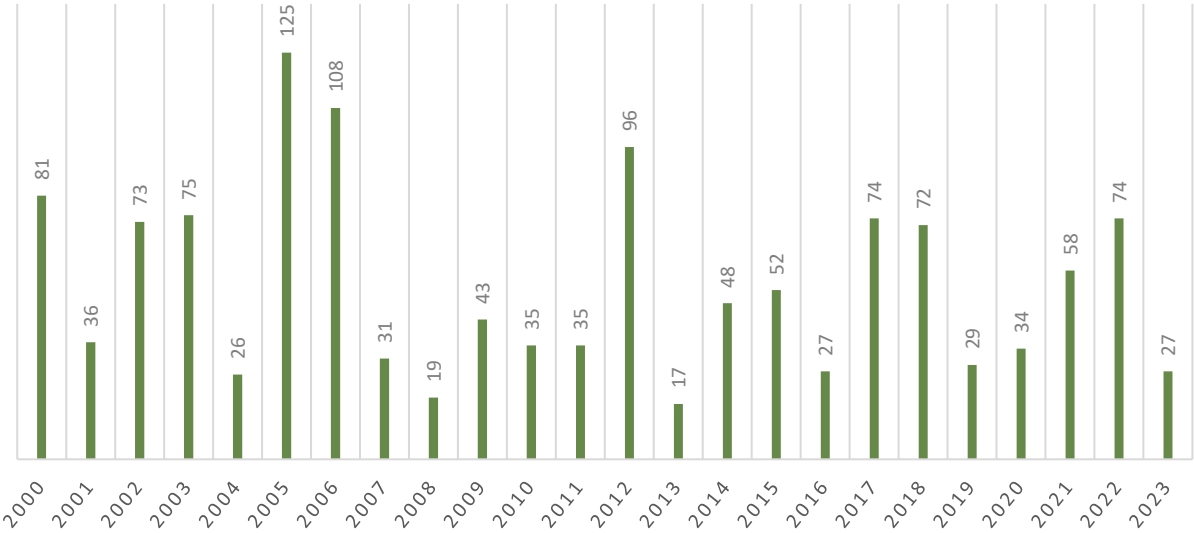
The majority of wildfires in the planning area were caused by debris burning (Figure 24). Wildfires in the planning area have ranged from zero to 2,000 acres, with an average event burning 8 acres.

Figure 24: Wildfires by Cause in the Planning Area



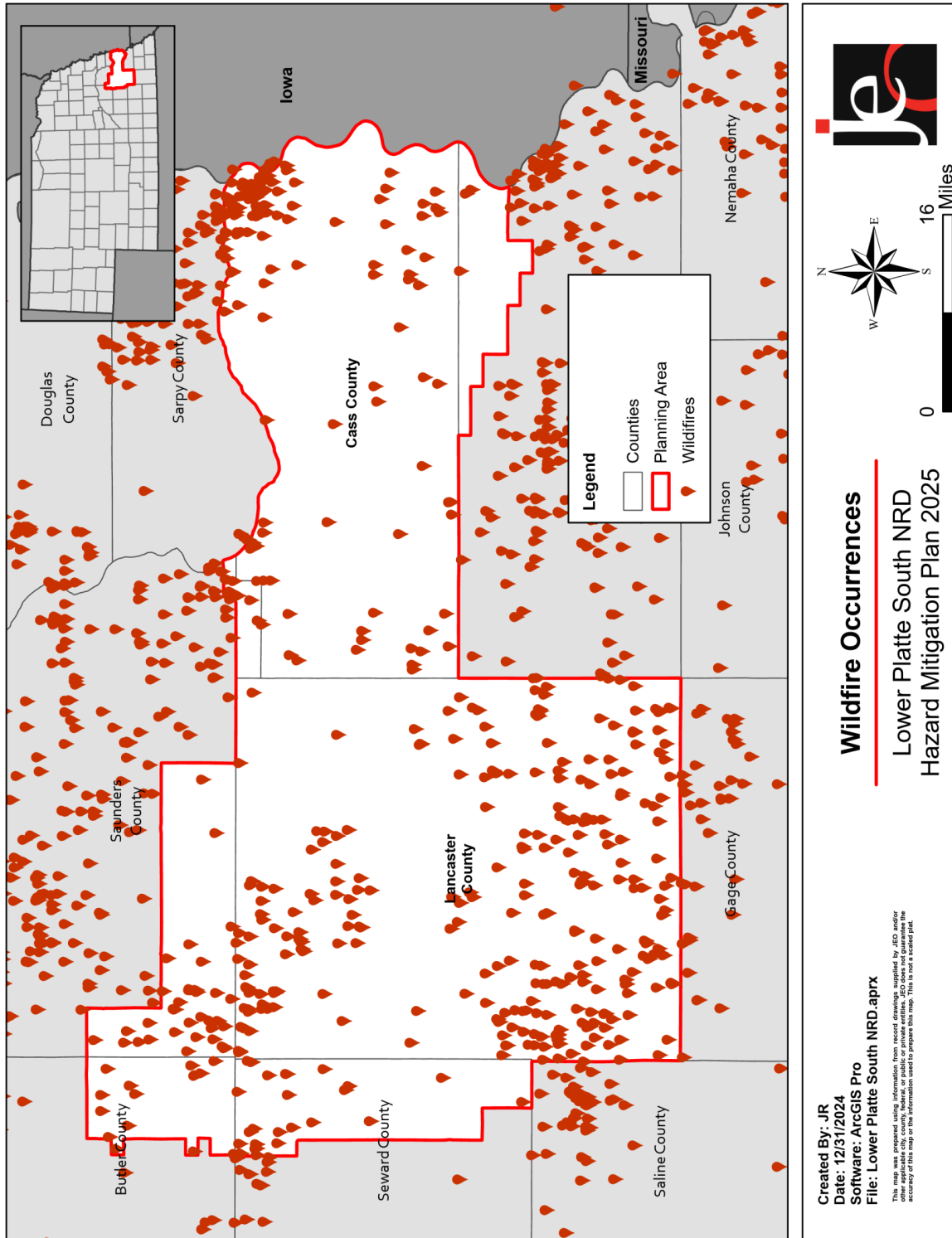
Source: Nebraska Forest Service, 2000-2023

Figure 25: Number of Wildfires by Year in the Planning Area



Source: Nebraska Forest Service, Jan 2000- Nov 2023

Figure 26: Wildfire Occurrence in the Planning Area



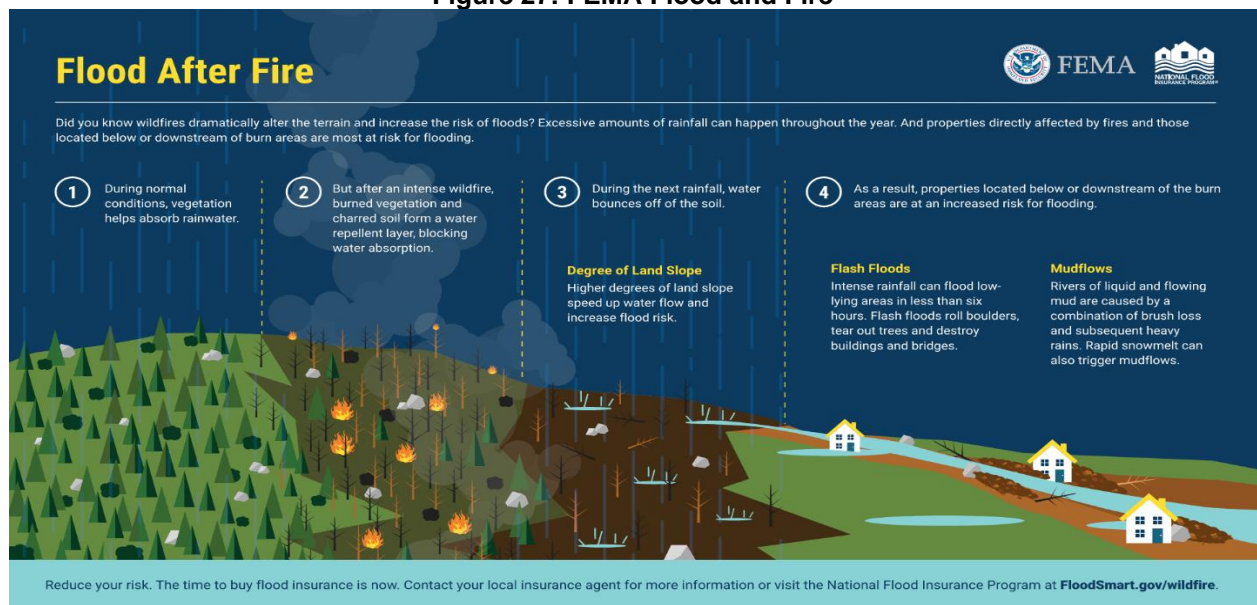
Note that numerous fires are reported as occurring in the same location (i.e. on top of communities), however, these locations are likely placeholders of the nearest location, rather than the actual location of the fire event. More specific fire location data was not available during this analysis.

EXTENT

Overall, 1,295 wildfires were reported in the planning area and burned 9,079 acres in total. Of these, 15 fires burned more than 100 acres, with the largest wildfire burning 2,000 acres in Lancaster County in March of 2014.

Wildfire also contributes to an increased risk from other hazard events, compounding damage and straining resources. FEMA has provided additional information in recent years detailing the relationship between wildfire and flooding (**Error! Reference source not found.**). 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 27: FEMA Flood and Fire



Source: FEMA, 2020⁴⁷

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon records from the Nebraska Forest Service Wildfires Database from January 2000 to November 2023 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. During the 24-year period, 1,295 wildfires burned 9,079 acres and caused \$31,023 in crop damages and \$483,559 in property damages according to NFS.

Table 39: Wildfire Loss Estimation

Hazard Type	Number of Events	Average Acres Per Fire	Total Property Loss	Total Crop Loss	Injuries	Fatalities	Structures Threatened/ Destroyed
Grass/Wildfires	1,295	8	\$483,559	\$31,023	1	2	111/1,013

Source: Nebraska Forest Service, Jan 2000- Nov 2023

HISTORICAL PROBABILITY AND FUTURE LIKELIHOOD

⁴⁷ FEMA and NFIP. 2020. "Flood After Fire." Accessed September 2020. https://www.fema.gov/media-library-data/1573670012259-3908ab0344ff8fbf5d537ee0c6fb531d/101844-019_FEMA_FAF_Infographic-ENG-web_v8_508.pdf.

The probability of wildfire occurrence is based on the historic record provided by the Nebraska Forest Service and reported potential by participating jurisdictions. With a wildfire event occurring at least once in each reported year (2000-2023) there is a 100 percent annual probability of wildfires occurring in the planning area in any given year (Highly Likely).

Table 40: Historical Probability & Future Likelihood – Wildfire

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
100%	Increase in Frequency and Intensity	Neither Increase nor Decrease in Frequency. Increase Exposure	Highly Likely

FUTURE DEVELOPMENT

Development across the planning area would be located within the WUI. Of most concern would be development on the edges of communities or other areas that encroach on wildland or natural areas. Local officials can adopt codes and ordinances that can guide growth in ways to mitigate potential losses from wildfires, but more likely for the planning area the onus falls on private landowners to ensure their properties mitigate fuels and minimize wildfire risk. Problems can arise if new development increases without coordinated fuels reduction and the creation of defensible space around homes. Other notable vulnerabilities exist for fire departments which service rural areas, as many fire districts lack adequate staff to respond to multi-fire complexes or multiple fire events occurring simultaneously in separate areas. The utilization and development of mutual aid agreements or memoranda of understanding are an important tool for districts to share resources and/or coverage.

CLIMATE CHANGE IMPACTS

Rising temperatures will likely increase the frequency and intensity of grass/wildfires. Warmer temperatures cause snow to melt sooner and create drier soils and forests, which can ignite fires quickly and cause them to spread rapidly. Additionally, warmer nighttime temperatures contribute to the continued spread of wildfires over multiple days.⁴⁸

As mentioned in the drought section, climate change will likely contribute to the increase in the frequency and intensity of drought, especially during the summer months.⁴⁹ Periods of drought can occur throughout the year, while extreme heat conditions during summer months greatly increases the potential for and magnitude of wildland fires. Drought has a high probability of occurring in the planning area and the planning area sees, on average, five days above 100°F each year. With increased drought conditions, wildfires will also likely increase due to dry vegetation and less access to water. Additionally, changes in climate can lead to the spread of invasive species, increasing potential fuel loads in wildland areas.

COMMUNITY TOP HAZARD STATUS

The following jurisdictions identified Grass/Wildfire as a top hazard of concern:

- Village of Hallam
- Raymond Central Public Schools

REGIONAL VULNERABILITIES

Wildfire poses a threat to a range of demographic groups. Wildfire and urban fire could result in major evacuations of residents in impacted and threatened areas. Groups and individuals lacking reliable transportation could be trapped in dangerous locations. Lack of transportation is common among the elderly, low-income individuals, and racial minorities. Wildfires can cause extensive damage to buildings and improvements, including community lifelines. Wildfires also impact agricultural producers who support the local economy. Damaged homes can reduce available housing stock for residents, causing them to leave the area. Additionally, fire events threaten the health and safety of residents and emergency response

⁴⁸ NASA Global Climate Change. September 2019. "Satellite Data Record Shows Climate Change's Impact on Fires." Accessed 2022. <https://climate.nasa.gov/news/2912/satellite-data-record-shows-climate-changes-impact-on-fires/>.
⁴⁹ NCEI. 2022. "State Climate Summaries – Nebraska". [https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,\(1895%E2%80%932020\)%20averag.](https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,(1895%E2%80%932020)%20averag.)

personnel. Recreation areas, timber and grazing land, wildlife habitat, and scenic views can also be threatened by wildfires.

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Wildfire. It is important to note that while FEMA's National Risk Index indicates an overall lower risk to wildfire events, and this data contradicts Wildfire specific risk indices from the *Wildfire Risk to Communities* dataset provided by the United States Department of Agriculture Forest Service. In this circumstance, the data utilized by the USDA Forest Service is tailored specifically for wildfire risk factors and provides a more fine-scale analysis for the counties. Local planning team members also noted significant limiting factors to adequately respond and mitigate wildfire events in the area including aging or inadequate equipment, and extremely limited staff capacity as volunteer rosters continue to decline.

Table 41: Risk Index Wildfire Vulnerabilities

Source	Risk Factor	Lancaster	Cass	Otoe	Butler	Saunders	Seward
FEMA National Risk Index	Risk Index	Relatively Moderate	Very Low	Very Low	Very Low	Very Low	Very Low
	Expected Annual Loss	Relatively Moderate	Very Low	Very Low	Very Low	Very Low	Very Low
USDA Forest Service Wildfire Risk to Communities	Overall Risk	Medium	Medium	Medium	Medium	Medium	Medium

Source: FEMA National Risk Index, 2024

Table 42: Regional Wildfire Vulnerabilities

Sector	Vulnerability
People	-Risk of injury or death for residents and firefighting personnel -Displacement of people and loss of homes -Lack of transportation poses risk to low-income individuals, families, and elderly
Economic	-Transportation routes may be blocked by fire, preventing evacuation efforts -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 normal can increase frequency and severity of wildfire events -Changes in climate can help spread invasive species, changing potential fuel loads in wildland areas
Other	-Increase chance of landslides, erosion, and land subsidence -May lead to poor water quality -Post fire, flash flooding events may be exacerbated

HAZARDOUS MATERIALS RELEASE

The following description for 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.⁵⁰

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, and hazardous materials waste sites. Varying quantities of hazardous materials are manufactured, used, or stored at 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 material 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. A large number of spills also occur during the loading and unloading of chemicals.

Fixed sites are those that involve chemical manufacturing sites and stationary storage facilities. 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.

Likewise, the U.S. Department of Transportation, through the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA), has broad jurisdiction to regulate the transportation of hazardous materials, including the discretion to decide which materials shall be classified as hazardous. The transportation of hazardous materials is defined by 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..." These materials are placed into one of nine hazard classes based on their chemical and physical properties. The hazard schedules may be further subdivided into divisions based on their characteristics. Because the properties and characteristics of materials are crucial in understanding the dynamics of a spill during a transportation incident, it is important for response personnel to understand the hazard classes and their divisions.

According to PHMSA, hazardous materials traffic in the U.S. now exceeds 1,000,000 shipments per day. Nationally, the U.S. has had 108 fatalities associated with the transport of hazardous materials between 2007 through 2016. 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.

⁵⁰ Federal Emergency Management Agency. 2017. "Hazardous Materials Incidents." <https://www.ready.gov/hazardous-materials-incidents>.

Table 43: Hazardous Material 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	

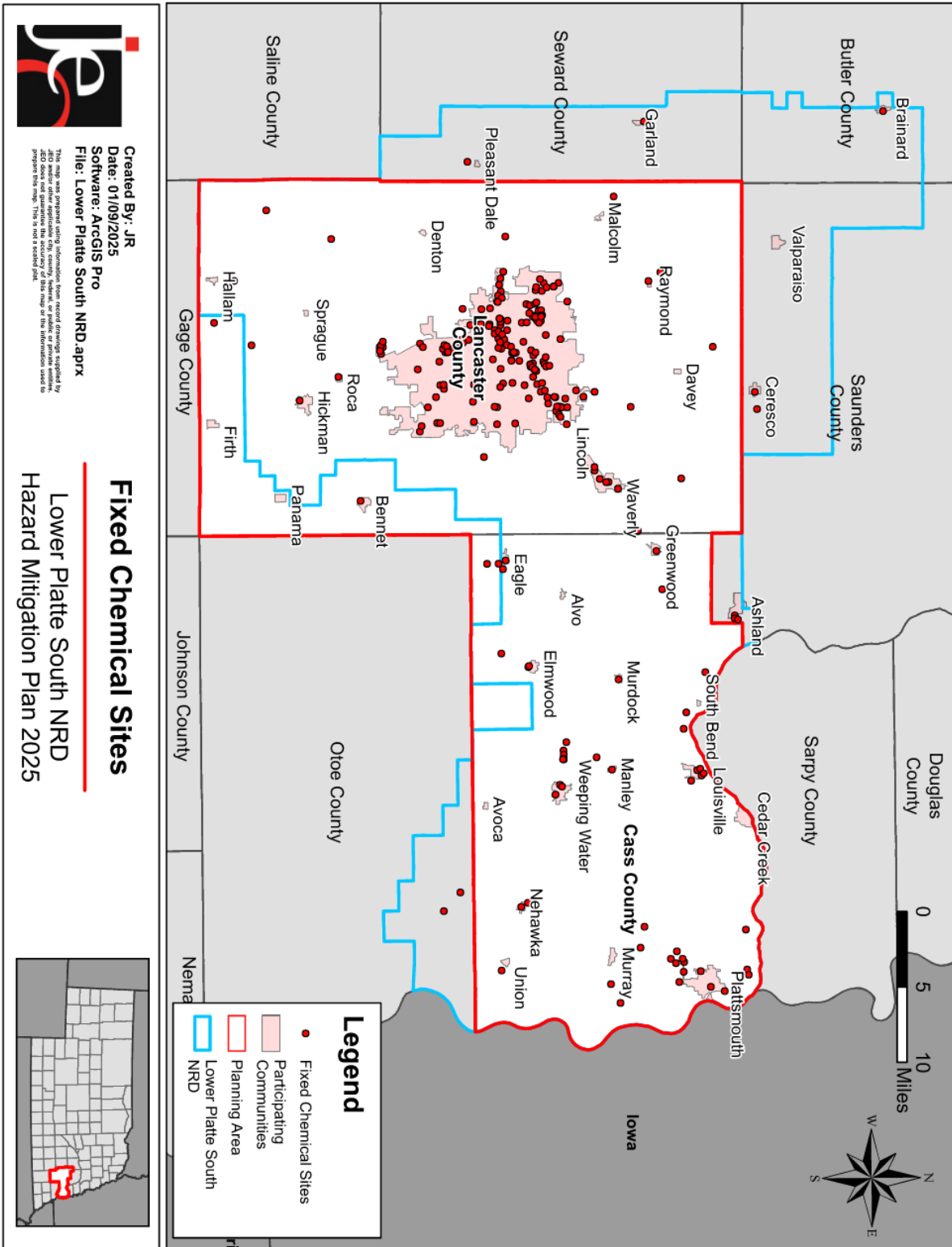
Source: *Emergency Response Guidebook, 2016*⁵¹

LOCATION

Nebraska has nearly 3,000 facilities across the state that house hazardous materials according to the Tier II reports submitted to the Nebraska Department of Environment and Energy (NDEE) annually. There are 235 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 2023.

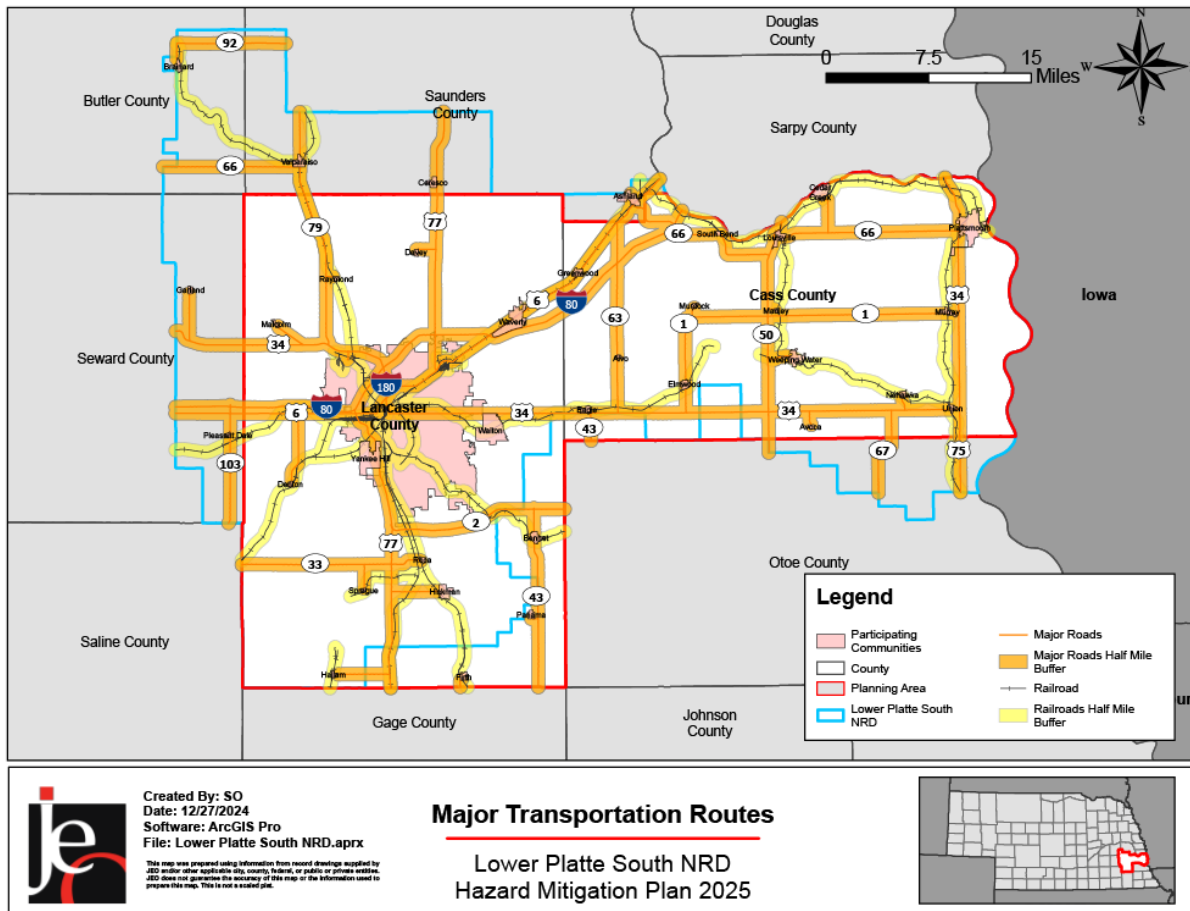
⁵¹ U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration. 2016. "2016 Emergency Response Guidebook." <https://www.phmsa.dot.gov/hazmat/outreach-training/erg>.

Figure 28: Fixed Chemical Sites in the Planning Area



Hazardous material releases during transportation primarily occur on major transportation routes as identified in the figure below. Railroads providing service through the planning area have developed plans to respond to chemical releases along rail routes. Many spills occur during the loading and unloading of chemicals for highway and pipeline chemical transport. Major transportation corridors in the planning area include County Highways and Interstate routes. According to PHMSA, there are several gas transmission and hazardous liquid pipelines located in the planning area.⁵²

Figure 29: Major Transportation Routes



⁵² Pipeline and Hazardous Materials Safety Administration. 2020. "National Pipeline Mapping System." <https://www.npms.phmsa.dot.gov/>.

Figure 30: Gas and Transmission Lines – Cass County

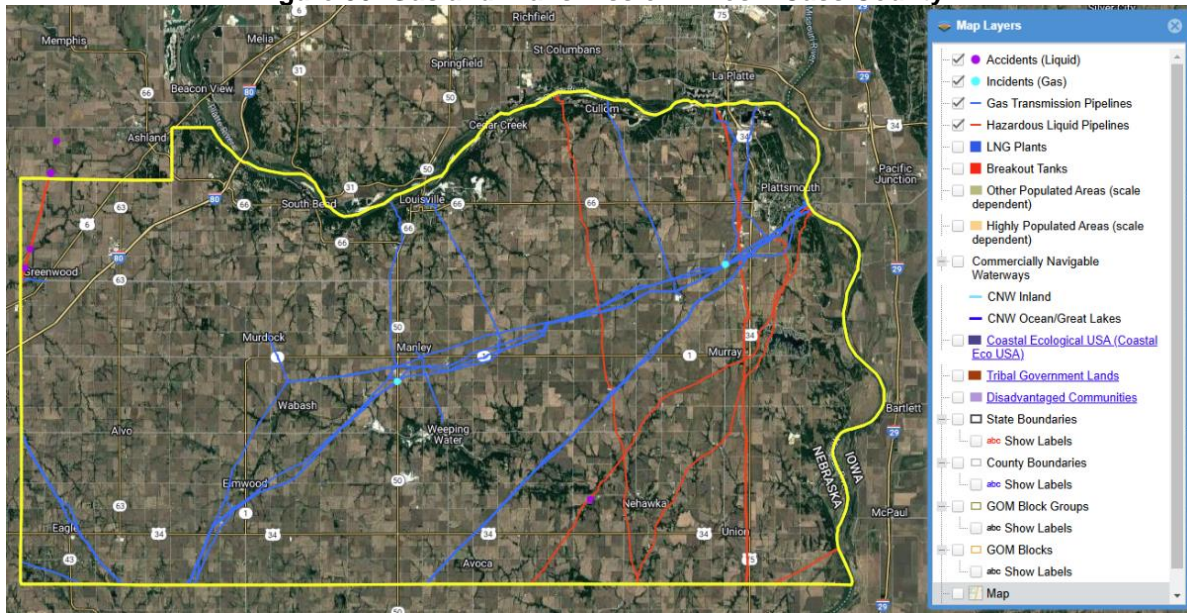
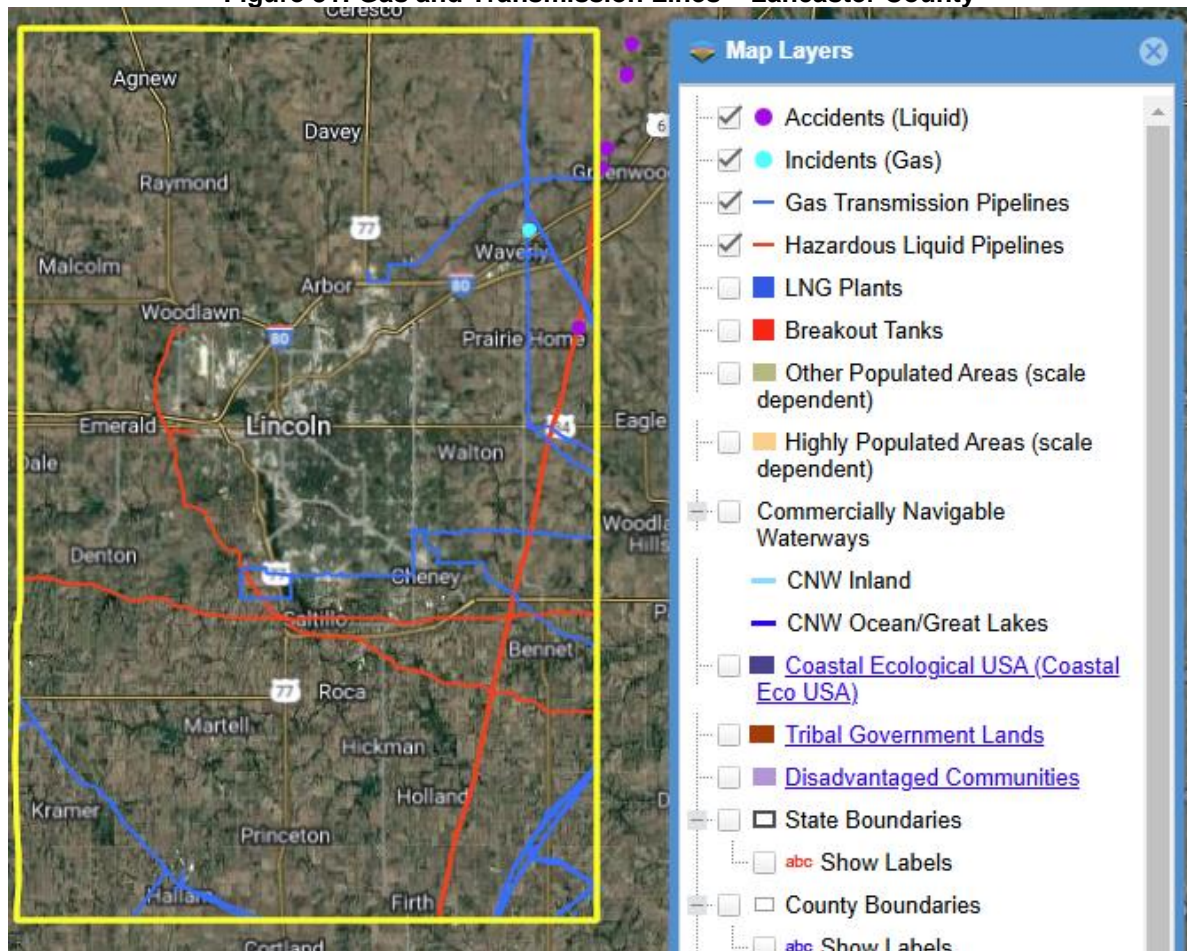
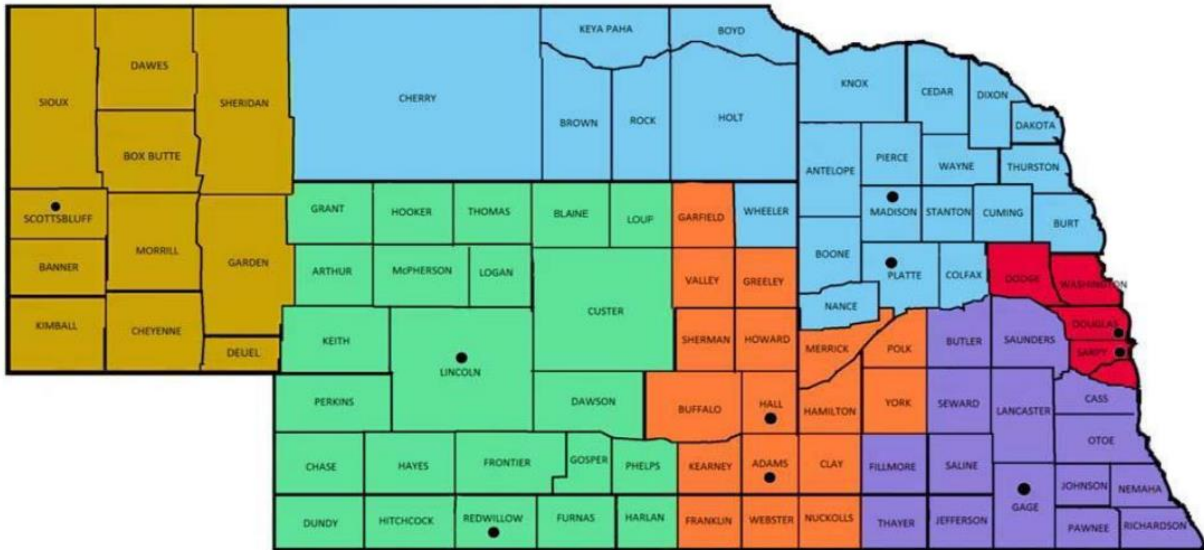


Figure 31: Gas and Transmission Lines – Lancaster County



There are ten State Emergency Response Teams (SERTs) stationed across the State of Nebraska which are trained to respond to large scale hazardous material incidents. Each department includes personnel at the technical, incident commander, and safety officer levels. There are SERT district which covers the entire planning area with the nearest team located in Sarpy or Gage County.⁵³

Figure 32: Nebraska SERTs Map



HISTORICAL OCCURRENCES

According to the NRC database, there have been 210 fixed site chemical spills between January 1990 – December 2023 in the planning area. The following table lists only those events with the largest quantity of material released, incidents with injuries or evacuations involved, and largest property damages.

Table 44: Chemical Fixed Site Incidents

Year of Event	Location of Release	Quantity Spilled	Material Involved	Number of Injuries	Number Evacuated	Property Damage
1992	Lincoln	0	Anhydrous Ammonia	0	3	\$0
1994	Greenwood	50 gals	Anhydrous Ammonia	0	1	\$0
1995	Lincoln	3,000 lbs	Anhydrous Ammonia	2	50	\$0
1996	Lincoln	10,000 gals	Oil	0	0	\$0
1998	Lincoln	100,000 gals	Oil	0	0	\$0
1999	Murdock	Unknown	Anhydrous Ammonia	1	0	\$0
2000	Lincoln	Unknown	Foam, Mineral Spirits	0	300	Unknown
2003	Lincoln	55 gals and 12 lbs	Pesticides and Water-Soluble Powder	0	0	\$750,000
2005	Lincoln	3 gals	Gasoline	1	0	\$0

⁵³ NEMA. June 2020. "Nebraska: Emergency Assistance to a Hazardous Materials Incident." <https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmat-blue-book.pdf>.

Year of Event	Location of Release	Quantity Spilled	Material Involved	Number of Injuries	Number Evacuated	Property Damage
2015	Lincoln	Unknown	Anhydrous Ammonia	0	150	\$0
2022	Lincoln	2,575 gals	Heptane	0	200	Unknown
2019	Lincoln	2,500 gals	Hexane	0	0	Unknown

Source: National Response Center, 1990-2023

PHMSA reports that 238 chemical spills have occurred during transportation in the planning area between 1990 and 2024. During these events, there were no fatalities, one injury, and \$1,376,640 in damages. The following table provides a list of the most significant historical chemical spills during transportation in the planning area.

Table 45: Historical Chemical Spills 1990-2024

Date of Event	Location of Release	Failure Description	Material Involved	Method of Transportation	Amount in Gallons	Total Damage	Injuries (Yes/No)
1994	Lincoln	Derailment; Rollover Accident	Denatured Alcohol	Rail	23,000	\$101,050	No
1996	Ashland	Fire Temperature or Heat	Sodium Hydroxide Solid	Highway	2	\$173,000	No
1996	Ashland	Fire Temperature or Heat	Potassium Hydroxide Solution	Highway	1	\$173,000	No
1996	Ashland	Fire Temperature or Heat	Hydrochloric Acid Solution	Highway	<1	\$173,000	No
1996	Ashland	Fire Temperature or Heat	Corrosive Liquids N.O.S.	Highway	<1	\$173,000	No
1998	Lincoln	Equipment Malfunction	Caustic Alkali Liquids N.O.S.	Highway	2	\$0	Yes - 1
1998	South Bend	Derailment	Elevated Temperature Liquid N.O.S. at or above 100 C and below its flash point	Rail	18,000	\$23,000	No
2004	Waverly	Equipment Malfunction	Environmentally Hazardous Substances Solid N.O.S.	Highway	15,650	\$3,531	No
2004	Lincoln	Derailment; Vehicular Crash or Accident Damage	Flammable Liquids Toxic N.O.S.	Rail	10,200	\$500,000	No
2011	Lincoln	Vehicular Crash or Accident Damage	Corrosive Liquids N.O.S.	Highway	250	\$231,000	No
2012	Lincoln	Vehicular Crash or Accident Damage	RADIOACTIVE MATERIAL	Highway	0	\$86,371	No
2012	Roca	Equipment Malfunction	ALCOHOLS, N.O.S.	Highway	767	\$1,726	No
2017	Roca	Vehicular Crash or Accident Damage	GASOLINE	Highway	100	\$88,330	No
2024	Lincoln	Equipment Malfunction	ALCOHOLS, N.O.S.	Rail	500	\$64,500	No

Source: PHMSA, 1990-2024⁵⁴

⁵⁴ Pipeline and Hazardous Materials Safety Administration. 2018. "Office of Hazardous Materials Safety: Incident Reports Database Search." Accessed December 6, 2018. <https://www.phmsa.dot.gov/hazmat/library/data-stats/incidents>.

EXTENT

Transportation spills ranged from no material released to 23,000 liquid gallons of material with an average quantity spilled of 343 liquid gallons. Based on historic records, it is likely that any spill involving hazardous materials will not affect an area larger than a half mile from the spill location. The extent scale for this hazard will vary depending on the community, with greatest possible extent applying to those with either railroads through or near town or communities with a major highway bisecting the area. The probable extent of chemical spills during transportation is difficult to anticipate and depends on the type and quantity of chemical released.

The extent of chemical spills at fixed sites varies and depends on the type of chemical that is released. According to the U.S. Coast Guard’s National Response Center (NRC) database, there have been 210 fixed site releases in the planning area and the total amount spilled ranged from 0 gallons or pounds to 100,000 gallons of pollutant. On average, approximately 800 gallons of pollutant are spilled per occurrence. Of the 210 chemical spills, one spill led to the evacuation of 300 individuals in 2000, a spill in 2022 led to an evacuation of 200 people, two spills led to one injury each in 1999 and 2005, and one spill in 1995 injured two individuals. Based on historic records, it is likely that any spill involving hazardous materials will not affect an area larger than a quarter mile from the spill location.

AVERAGE ANNUAL DAMAGES

The following table estimates average annual damage from hazardous material spills.

Table 46: Chemical Fixed Site Losses

Hazard Type	Number of Events	Total Injuries	Total Evacuated	Total Damages	Average Annual Damages
Fixed Site	210	3	704	\$1,500,000	
Transportation	238	1	25	\$1,376,640	

Source: NRC, 1990-2023, PHMSA 1990-2024

HISTORICAL PROBABILITY AND FUTURE LIKELIHOOD

Given the historic record of occurrence for hazardous material spill events (one event occurring in all years for fixed sites and transportation spills), for the purposes of this plan, the annual probability of hazardous material spill occurrence is 100% (Very Likely).

Table 47: Historical Probability & Future Likelihood – Hazardous Materials

Hazard	Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
Fixed Spills	100%	Neither Increase nor Decrease in Frequency	Increase in Frequency and Exposure	Very Likely
Transportation Spills	100%	Neither Increase nor Decrease in Frequency	Increase in Frequency and Exposure	Very Likely

FUTURE DEVELOPMENT

To reduce the risk to people and property damage, future development should encourage chemical storage and manufacturing facilities to be built away from community lifelines such as schools, daycares, nursing homes, and other residential areas. Likewise, residential development and locations that house vulnerable populations should be built away from major transportation corridors used for chemical transportation.

CLIMATE CHANGE IMPACTS

Climate trends are not anticipated to have a direct impact on hazardous materials releases. However, as events continue to impact infrastructure used by and for hazardous materials, future spills will likely occur.

For example, flooding is likely to increase,⁵⁵ which could damage roadways and pipelines causing more spills to occur.

COMMUNITY TOP HAZARD STATUS

The following jurisdictions identified Hazardous Materials as a top hazard of concern:

- Alvo, Village of
- Bennet, Village of
- Cass County
- Cedar Creek, Village of
- Ceresco, Village of
- Denton, Village of
- Eagle, Village of
- Elmwood, Village of
- Firth, Village of
- Greenwood, Village of
- Hallam, Village of
- Hickman, City of
- Lincoln Public Schools
- Lincoln, City of
- Manley, Village of
- Murdock, Village of
- Murray, Village of
- Waverly, City of
- Valparaiso, Village of

REGIONAL VULNERABILITIES

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

Table 48: Regional Chemical Fixed Site Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Those in close proximity could have minor to moderate health impacts -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 -A chemical plant shutdown in smaller communities would have significant impacts to the local economy -A long-term evacuation of the emergency planning zone (EPZ) would have a negative effect on the economy in the area
BUILT ENVIRONMENT INFRASTRUCTURE	-Risk of fire or explosion -Transportation routes can be closed during evacuations
CRITICAL FACILITIES	-Critical facilities are at risk of evacuation -Critical facilities near major transportation corridors are at risk
CLIMATE	-None

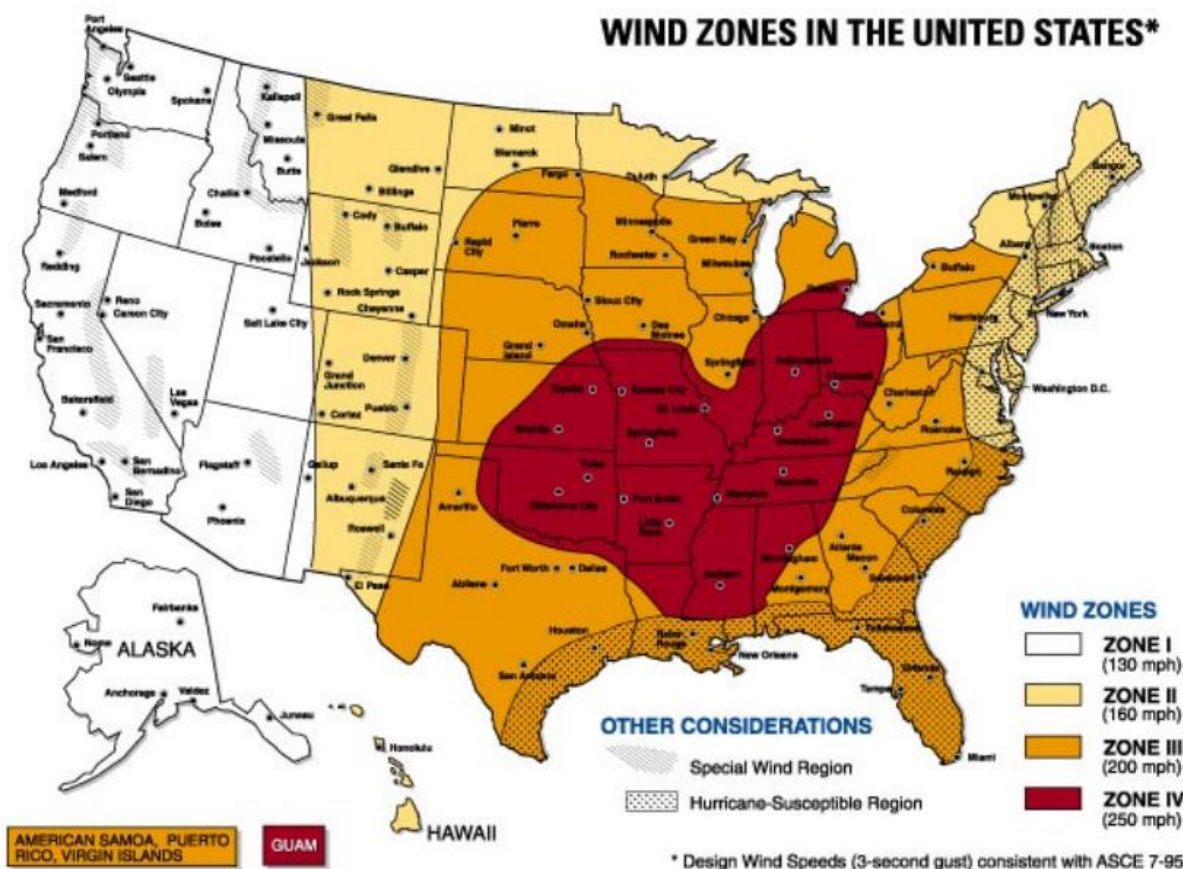
⁵⁵ NOAA. August 2022. "Climate Mapping for Resilience and Adaptation". <https://livingatlas.arcgis.com/assessment-tool/explore/details>.

HIGH WINDS & TORNADOES

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

The National Weather Service (NWS) defines high winds as sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration.⁵⁶ The NWS issues High Wind Advisories when there are sustained winds of 25 to 39 miles per hour and/or gusts to 57 mph. The figure below shows the wind zones in the United States. The wind zones are based on the maximum wind speeds that can occur from a tornado or hurricane event. The planning area is located in Zone III which has maximum winds of 200 mph equivalent to an EF4/5 tornado.

Figure 33: Wind Zones in the U.S.



Source: FEMA

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

- There must be a microscale rotating area of wind, ranging in size from a few feet to a few miles wide;
- The rotating wind, or vortex, must be attached to a convective cloud base and must be in contact with the ground; and,

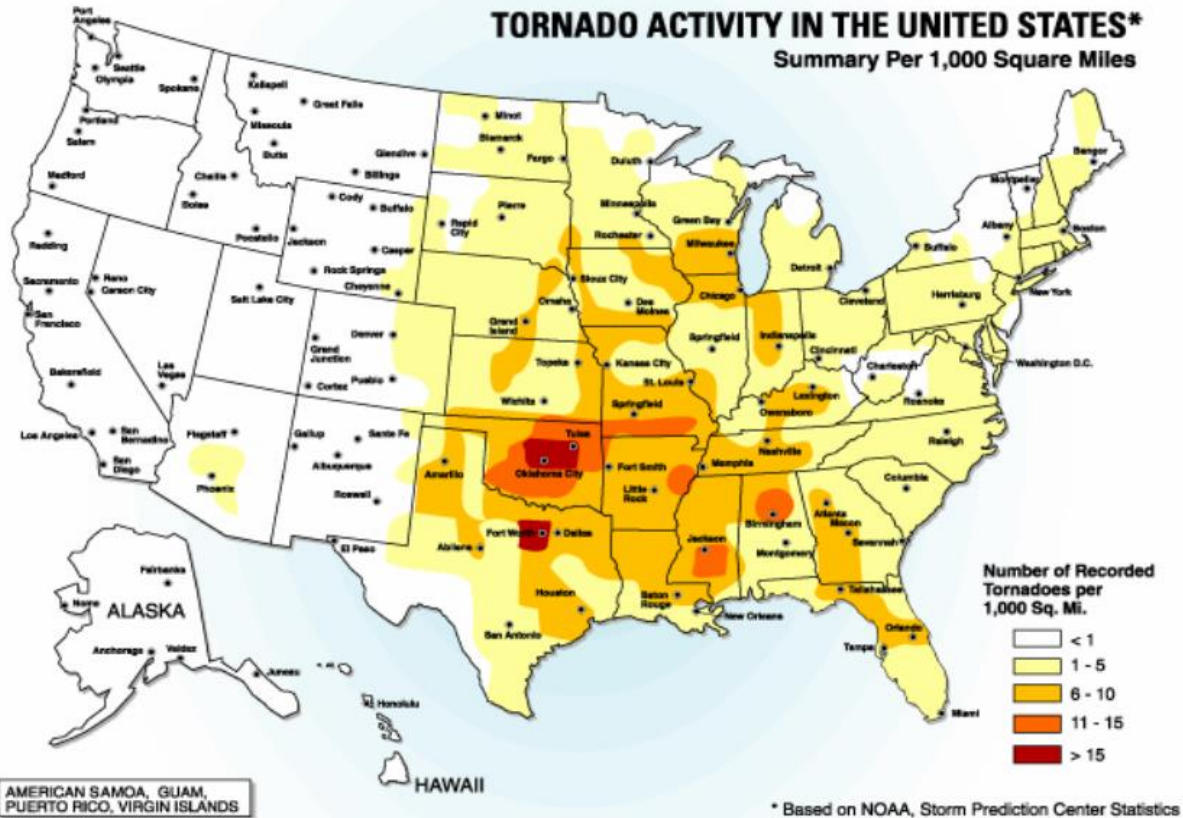
⁵⁶ National Weather Service. 2017. "Glossary." <http://w1.weather.gov/glossary/index.php?letter=h>.

- 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 of over 100 miles and reach over 11 miles above ground. Tornadoes usually stay on the ground for 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 and 2010.⁵⁷

Figure 34: Tornado Activity in the United States



Source: FEMA

LOCATION

High winds and tornadoes can occur throughout the planning area. The impacts on residents would be greater in more densely populated areas with the greatest impacts to the local economy occurring in communities and major transportation routes. The following map shows the historical track locations across the region according to the Midwestern Regional Climate Center. Several significant tornado events have directly impacted communities located in the planning area, but touchdowns and tornado events can occur anywhere within the planning area. Note that this map shows tornado tracks both within or that cross into the boundaries of the Lower Platte South NRD.

⁵⁷ National Centers for Environmental Information. 2013. “U.S. Tornado Climatology.” <https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornadoclimatology>.

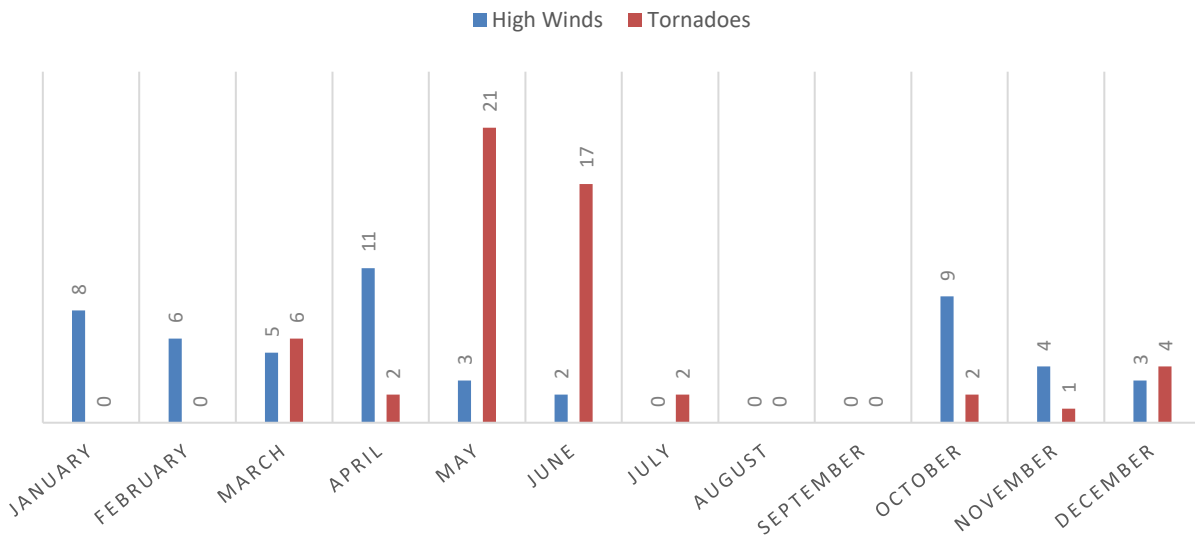
HISTORICAL OCCURRENCES

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 51 high wind events and 55 tornadic events ranging from magnitude of E/EF0 to EF4 that occurred between January 1996 and November 2023.

These events were responsible for \$101,337,000 in property damages and \$1,108,865 in crop damages. These events reported two deaths and 39 injuries. The most damaging tornado occurred in Hallam in 2004, leading to 30 injuries, one death, and \$100,000,000 in damages.

As seen in the following figures, the majority of high wind events occur in the spring and winter months, while most tornado events occur in the summer. Significant hazard events with direct impacts to communities are discussed in more detail in the applicable *Community Profiles*.

Figure 36: Events by Month



Source: NCEI, 1996-2023

Event descriptions from NCEI for the most damaging events (those including injuries, fatalities, or greatest property damage estimates) are provided below.

- **F4 Tornado 2024- \$100,000,000 in property damages**

This long tracked tornado is often referred to as the Hallam tornado. It initially touched down 3 miles west of Daykin in northern Jefferson County. The tornado was rated an f0 or f1 in Jefferson County damaging farm outbuildings, grain bins and trees. From there the tornado crossed into Saline County southwest of Western and remained an f0 or f1 until it struck the southern portion of Wilber where it strengthened to f2. Roofs were blown off of homes just southeast of Wilber. The tornado traveled from Wilber into Gage County, crossing the county line west of Clatonia where it grew to its most intense stage, f4. The tornado remained nearly at this strength as it crossed into Lancaster County near Hallam with a damage path of around 2 1/2 miles. Many well-built homes were demolished from Clatonia to Hallam, along with grain bins, farm sheds, and outbuildings. Many trees were destroyed or uprooted. Although Hallam itself escaped the strongest winds from the storm, which occurred just south of town, 95 percent of the buildings in town were either destroyed or severely damaged. The lone fatality from the tornado occurred in Hallam. The storm also toppled several hopper cars from a freight train on the west edge of town. In total 55 railroad cars were derailed.

From Hallam the tornado traveled east for several miles prior to turning northeast again just north of Cortland. The storm then tracked 2 miles north of Firth, severely damaging the Firth-Norris high

school and a nearby middle school. School buses were tossed in this area. Several homes northeast of the schools were flattened as the tornado regained its f4 strength.

The damage path continued northeast to Holland and then to 2 miles north of Panama where the tornado weakened to around an f2 and the damage path began to narrow. The track then curved more toward the north, passing just south of Bennet where a few homes sustained f3 damage. After passing south of Bennet, the storm moved back to the northeast and began to weaken to f0 or f1 strength as it crossed into Otoe county southwest of Palmyra. The tornado finally dissipated 1 miles west southwest of Palmyra.

In total the tornado was on the ground for around 54 miles with a maximum intensity of f4. Besides the fatality, 38 people sustained injuries, 158 homes were leveled and 57 others were seriously damaged. The dollar amount of damage was estimated at 160 million, with 60 million of that agricultural including 100 cattle and 50 hogs lost. Some 150,000 acres of crop land sustained significant damage. The 5 counties were declared national disaster areas by FEMA.

- **EF1 Tornado 2009- 8 injuries**

An intense upper-level low pressure system tracked from eastern Colorado into southeast South Dakota from March 23rd into March 24th. This caused a surface low pressure system to move from western Nebraska into southeast South Dakota during that time. As the low tracked northeast, a dry-line moved into eastern Nebraska during the afternoon of March 23rd. With surface temperatures in the 60s and 70s, and dewpoint temperatures in the 50s, ample instability was in place to allow a line of severe thunderstorms to develop as the dry-line punched eastward. Several fast moving low-topped supercell thunderstorms were embedded in the line, and one cell produced cyclic tornadoes from southeast of Lincoln into western Iowa. The storms in the line were moving north northeast at 50 to 60 mph. In addition to the severe weather, strong southerly gradient winds prevailed ahead of the low pressure. In some cases the winds gusted between 50 and 65 mph for several hours across parts of eastern Nebraska.

- **Tornado Outbreak of April 2024 – Summary from NWS**

A tornado outbreak occurred across Nebraska and Iowa during the afternoon and evening hours of Friday, April 26, 2024. Several significant, long-tracked tornadoes damaged or destroyed hundreds, if not thousands, of homes and businesses across the region. People across the region were deeply impacted, several were injured, and there was one fatality.

Historically speaking, these are the strongest tornadoes in eastern Nebraska or western Iowa (the NWS Omaha/Valley coverage area) in nearly 10 years, when four EF-4 tornadoes impacted northeast Nebraska (including Pilger) on June 16, 2014.

- **Widespread Damaging Winds of July 2024 – Summary from NWS**

A line of intense thunderstorms brought 70-90+ mph winds and widespread damage to portions of southeast Nebraska and southwest Iowa including the Omaha and Lincoln areas. Despite the widespread wind damage, this line of storms did not meet the criteria to be classified as a derecho. A derecho wind damage swath must extend either continuously or intermittently more than 400 miles (about 650 km) with a width of at least 60 miles (about 100 km). This criterion is used to eliminate more common, shorter-lived, and generally less-organized wind-producing convective systems. This particular line of storms produced damage for about 230 miles.

Figure 37: Photos of Tornado Outbreak – April 2024



EXTENT

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

Table 49: Beaufort Wind Ranking

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

Source: Storm Prediction Center, 2017⁵⁸

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.⁵⁹

Table 50: Enhanced Fujita Scale

Storm Category	3 Second Gust (mph)	Damage Level	Damage Description
EF0	65-85	Gale	Some damages to chimneys; break branches off trees; pushes over shallow-rooted trees; damages to sign board
EF1	86-110	Weak	The lower limit is the beginning of hurricane wind speed; peels surface off rooms; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages might be destroyed
EF2	110-135	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	Severe	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	166-200	Devastating	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown, and large missiles generated.
EF5	200+	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 EF5 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.

Table 51: 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 homes (MHSW)	17	Low-rise (1-4 story) buildings
4	Double-wide mobile homes (MHDW)	18	Mid-rise (5-20 story) buildings

⁵⁸ Storm Prediction Center: National Oceanic and Atmospheric Administration. 1805. "Beaufort Wind Scale." <http://www.spc.noaa.gov/faq/tornado/beaufort.html>.

⁵⁹ 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."

Number	Damage Indicator	Number	Damage Indicator
5	Apartment, condo, townhouse (3 stories or less)	19	High-rise (over 20 stories)
6	Motel	20	Institutional buildings (hospital, government, or university)
7	Masonry apartment or motel	21	Metal building systems
8	Small retail buildings (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 building	26	Free standing pole (light, flag, luminary)
13	Automobile showroom	27	Tree- hardwood
14	Automotive service building	28	Tree -softwood

Using the NCEI reported events, the most common high wind event in the planning area is a level 10 on the Beaufort Wind Ranking scale. The reported high wind events ranged from 35 mph to 68 mph, with an average speed of 48.9 mph. Based on the historical record, it is most likely that tornadoes that occur within the planning area will be of F0 strength. Of the 55 reported tornado events, 25 were EF/F0, 19 were EF/F1, 9 was EF/F2, one was F4, and one was EFU. The extent of damage felt by high wind or tornado events will vary depending on the severity of event and the amount of infrastructure and development within a community. Due to the nature of how tornadic events are categorized, significant tornado events will occur in areas with more infrastructure.

The extent of damage felt by high wind or tornado events will vary depending on the severity of the event and amount of infrastructure and development within a community or area. Due to the nature of how tornadic events are categorized, significant tornado events will occur in areas with more infrastructure. Small communities with limited staff and fiscal capability are more likely to have a prolonged recovery period and the extent of damages would be felt more severely.

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCEI Storm Events Database number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury or loss of life. Damages from high winds and tornadoes vary greatly depending on the severity or magnitude of each event.

Table 52: High Wind and Tornado Loss Estimate

Hazard Type	Number of Events ¹	Average Events Per Year	Total Property Loss ¹	Average Annual Property Loss ¹	Total Crop Loss ²	Average Annual Crop Loss ²
High Winds	52	1.9	\$28,000	\$1,000	\$1,108,865	\$46,203
Tornado	55	2.0	\$101,309,000	\$3,618,179		

Source: 1 Indicates data is from NCEI (January 1996 to November 2023); 2 Indicates data is from USDA RMA (2000 to 2023)

HISTORICAL PROBABILITY AND FUTURE LIKELIHOOD

Based on historical records and reported events, it is likely that high winds and tornadic events will occur within the planning area regularly. Given the historic record of occurrence for high wind events (17 out of 28 years with reported events), for the purposes of this plan, the annual probability of wind event occurrence is 59 percent (Likely). However, high wind events may be more common than presented here but have simply not been reported in past years. Given the historic record of occurrence for tornado events (21 out of 28 years with reported events), for the purposes of this plan, the annual probability of tornado occurrence is 75 percent (Likely).

Table 53: Historical Probability & Future Likelihood – Tornadoes and High Winds

Hazard	Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
High Winds	59%	Uncertain	Neither Increase nor Decrease in Frequency. Increase in Exposure	Likely
Tornadoes	75%	Uncertain	Neither Increase nor Decrease in Frequency. Increase in Exposure	Likely

FUTURE DEVELOPMENT

Any future development and population growth elevates exposure of property and people to the impacts of tornadoes and high wind. Future development should take steps to reduce potential damage from tornadoes and high winds. Building codes for new structures can be strengthened, requiring increased rebar in foundations, enhanced nailing patterns for wall sheathing, the use of Simpson Strong Ties and Straps, and require the use of anchors and tie-downs of mobile homes. Additionally, individuals can choose to build to an option Code Plus Standard, such as Fortified for Safer Living. The installation of public shelters to protect residents caught outside or in vulnerable areas, such as mobile home parks, can increase safety of residents in those areas. Development regulations that require safe rooms, basements, warning sirens, or other structures that reduce risk to people would also help decrease vulnerability.

CLIMATE CHANGE IMPACTS

For extreme events like tornadoes and high winds there is “considerable uncertainty about how projected changes in the climate will affect these events”. However, “tornadoes and severe storms will continue to be a normal feature for Nebraska.”⁶⁰

COMMUNITY TOP HAZARD STATUS

The following jurisdictions identified High Winds and Tornadoes as a top hazard of concern:

- Cass County
- Alvo, Village of
- Cedar Creek, Village of
- Eagle, Village of
- Elmwood, Village of
- Greenwood, Village of
- Louisville, City of
- Manley, Village of
- Murdock, Village of
- Murray, Village of
- Nehawka, Village of
- Union Village of
- Lancaster County
- Bennet, Village of
- Davey, Village of
- Denton, Village of
- Firth, Village of
- Hallam, Village of
- Hickman, City of
- Lincoln, City of
- Panama, Village of
- Raymond, Village of
- Sprague, Village of
- Waverly, City of
- Ashland, City of
- Ceresco, Village of
- Lincoln Public Schools
- Raymond Central Public Schools
- Weeping Water Public Schools

REGIONAL VULNERABILITIES

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

Table 54: Regional High Wind Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Vulnerable populations include those living in mobile homes (especially if improperly anchored), nursing homes, schools, or in substandard housing

⁶⁰ University of Nebraska-Lincoln. 2014. “Understanding and Assessing Climate Change: Implications for Nebraska”. <http://snr.unl.edu/download/research/projects/climateimpacts/2014ClimateChange.pdf>.

SECTOR	VULNERABILITY
	<ul style="list-style-type: none"> -People outside during events -Citizens without access to shelter below ground or in reinforced rooms -Elderly with decreased mobility or poor hearing may be at higher risk -Lack of multiple ways to receive weather warnings, especially at night
ECONOMIC	<ul style="list-style-type: none"> -Agricultural losses to both crops and livestock -Damages to businesses and prolonged power outages can cause significant impacts to the local economy, especially with EF3 tornadoes or greater
BUILT ENVIRONMENT	<ul style="list-style-type: none"> -All building stock is at risk of significant damages
INFRASTRUCTURE	<ul style="list-style-type: none"> -Downed power lines and power outages -All above ground infrastructure at risk to damages -Impassable roads due to debris blocking roadways
CRITICAL FACILITIES	<ul style="list-style-type: none"> -All critical facilities are at risk to damages and power outages
CLIMATE	<ul style="list-style-type: none"> -Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of events

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 actually sinks into a liquefied subsurface below.

Another way a levee failure can occur is when the water overtops the crest of the levee. This happens when the flood waters simply exceed the lowest crest elevation of the levee. An overtopping can lead to significant erosion of the backside of the levee and can result to a breach and thus a levee failure.

LOCATION

There are 11 federal levees and five non-federal levees located within the two-county and LPSNRD planning area as reported in USACE’s National Levee Database. The Clear Creek Levee System, located just north of Ashland, is outside of the two-county planning area; however, a small portion of the Levee System falls within the LPSNRD boundary, and it provides flood risk reduction for the City of Lincoln wellfield and the Nebraska Army National Guard Camp.

Beyond the USACE’s National Levee Database, there is no known comprehensive list of levees that exists in the planning area especially for private agricultural levees. Thus, it is not possible at this time to document the location of non-federal levees, the areas they protect, nor the potential impact of these levees.

HISTORICAL OCCURRENCES

As there is no formal database of historical levee failures, the following sources were consulted: members of the Planning Team, local newspapers and media outlets, and the USACE. After the March 2019 flood event, USACE reported 41 breaches and numerous damages to federal and non-federal levees across the State of Nebraska. The failure of these structures significantly impacted subsequent flooding in neighboring communities. As reported by USACE and the Planning Team, the Clear Creek Levee System was breached, but as noted above, does not fall within the two-county planning area. Three additional levee systems were damaged. Descriptions of these levees from USACE are found below:⁶¹

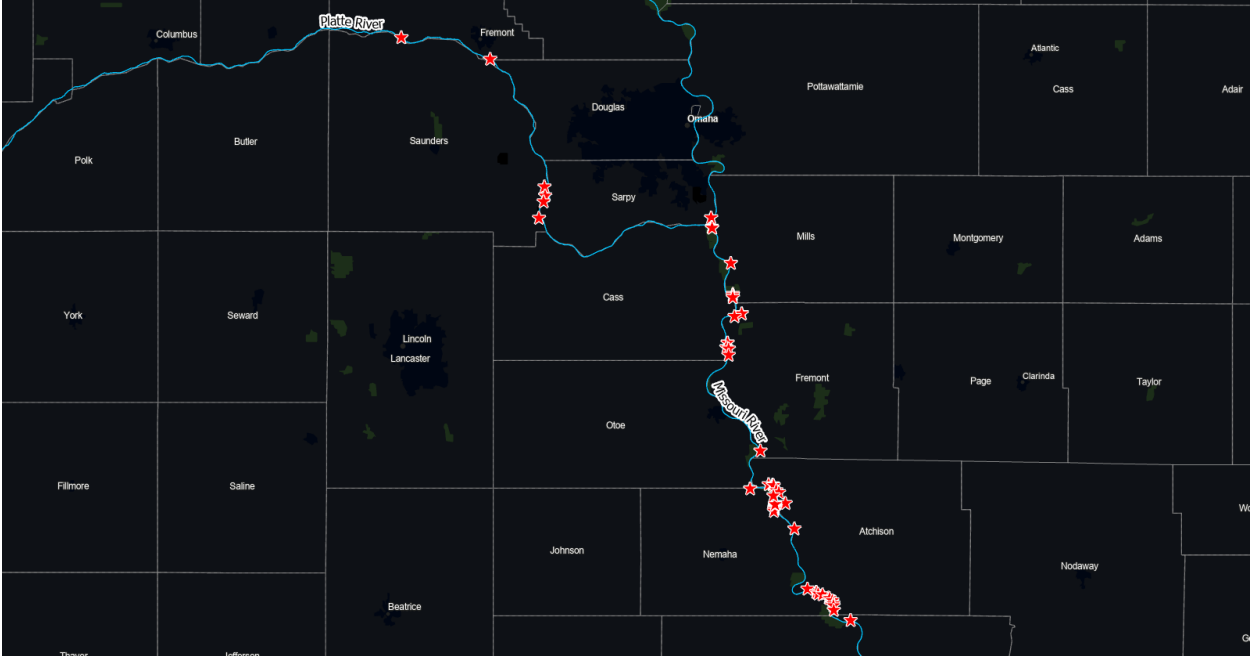
- Salt Creek System Restoration Information. Background: Many of the seven (7) Salt Creek Levee Systems were damaged during the 2019 Flood Event, leading to the Project Sponsor submitting Public Law (PL) 84-99 Rehabilitation Assistance requests to the US Army Corps of Engineers – Omaha District. Current Action: Design funding has been received to begin the engineering and design work on the levee repair project. The purpose of this rehabilitation project is to repair the levee system to the authorized level of flood risk management.
- Lake Wa Con-Da Levee Restoration Information. Background: The Lake Wa Con-Da – Missouri River Right Bank Levee System was damaged during the 2019 Flood Event, leading to the Levee Sponsor submitting a Public Law (PL) 84-99 Rehabilitation Assistance request to the US Army

⁶¹ U.S. Army Corps of Engineers. 2019. “Omaha District System Restoration Team: Levee System Status as of October 3, 2019.” <https://www.nwo.usace.army.mil/Omaha-District-System-Restoration-Team/>.

Corps of Engineers – Omaha District. Current Action Design funding has been received to begin work on the Lake Wa Con-da levee repair project. The purpose of this rehabilitation project is to repair the levee system to its authorized level of flood risk management.

- **Cedar Creek Omaha (F&W) Restoration Information. Background:** The Cedar Creek (Omaha F&W) – Platte River Right Bank Levee System was damaged during the 2019 Flood Event, leading to the Project Sponsor submitting a Public Law (PL) 84-99 Rehabilitation Assistance request to the US Army Corps of Engineers – Omaha District. Current Action: Design funding has been received to begin the engineering and design work on the levee repair project. The purpose of this rehabilitation project is to repair the levee system to the authorized level of flood risk management.
- **Clear Creek Levee Restoration Information. Background:** The Clear Creek – Platte River Right Bank Levee System experienced significant damage during the 2019 Flood Event. This led to four breaches, along with substantial other damages, occurring throughout the Levee System. Current Action: A priority breach impacting the property and infrastructure behind the Clear Creek Levee System was identified for initial repairs. This construction contract was awarded on 29 March 2019. These initial repairs were directed at stopping the flow from the Platte River into the area behind the levee system and providing an incremental level of flood risk management. Follow-on actions to further repair the levee system and provide additional flood risk management are being coordinated within the PL 84-99 program.

Figure 38: Reported Levee Breaches – March 2019 Flood Event



Source: USACE

Table 55: Levee Information

Levee Name	Sponsor	Condition	Last Inspection Date	Buildings at Risk	People at Risk	Property Value	Acres of Farmland	Communities in Area
Salt Creek LB & Haines RB	LPSNRD	In Progress	11/21/2017	7	32	4,000,000	2.7	2
Salt Creek RB	LPSNRD	Moderate Risk Due to Overtopping 84% Loaded	2/28/2018	440	1,063	160,000,000	16	2
Salt Creek LB & Haines LB & Middle Cr RB	LPSNRD	In Progress	11/29/2018	103	387	130,000,000	16.5	1
Salt Creek LB & Middle Creek LB	LPSNRD	Moderate Risk Due to Overtopping 80% Loaded	11/21/2017	76	701	220,000,000	2.2	1
Salt Creek LB & Oak Creek LB	LPSNRD	Channel & Culvert Erosion has led to unacceptable conditions	11/21/2017	123	827	150,000,000	3.3	1
Salt Creek RB to Dead Man’s Run	LPSNRD	Moderate Risk due to unknown embankment conditions	11/21/2017	146	965	110,000,000	1.1	1
Salt Creek RB & Dead Man’s Run RB	LPSNRD	In Progress	11/29/2018	203	655	59,000,000	41.1	1
YMCA Camp Kitaki – Platte River RB (NF)	YMCA Camp Kitaki	Low Risk	2/28/2018	2	0	49,000	0.7	1

Levee Name	Sponsor	Condition	Last Inspection Date	Buildings at Risk	People at Risk	Property Value	Acres of Farmland	Communities in Area
Cedar Creek (Omaha F&W) – Platte RB	Omaha Fish and Wildlife Club	In Progress	8/14/2020	386	4	4,000,000	9.6	1
Lake Waconda – Missouri River RB	Cass County SID 1 Lake Waconda	Moderate Risk due to sand boils ; chances of embankment failure	5/10/2016	206	540	47,000,000	107	1
Clear Creek – Platte River RB*								
Oak Creek Levee 1	LPSNRD	N/A	N/A	6	261	46,000,000	124	1
Schilling Refuge Levee 1								
Schilling Refuge Levee 2	FEMA Region 7		N/A	1	0	290,000	1.1	1
Schilling Refuge Levee 3	FEMA Region 7		N/A	0	0	0	96.7	2
YMCA Camp Kataki Levee	FEMA Region 7		N/A	0	0	0	0.4	2

Source: USACE Levee Database

Name	Sponsor	Location	River	Length (miles)	Type of Protection	Protected Area (sq miles)	Risk Level
Salt Creek LB & Haines RB	LPSNRD	Lincoln, Lancaster County	Salt Cr, Haines Cr	1.25	Urban	0.19	Low
Salt Creek RB	LPSNRD	Lincoln, Lancaster County	Salt Creek	4.71	Urban	1.33	Moderate
Salt Creek LB & Haines LB & Middle Cr RB	LPSNRD	Lincoln, Lancaster County	Salt Cr, Haines CR	2.49	Urban	0.47	Low
Salt Creek LB & Middle Creek LB	LPSNRD	Lincoln, Lancaster County	Salt Cr, Middle Cr	1.5	Urban	0.47	Moderate

Name	Sponsor	Location	River	Length (miles)	Type of Protection	Protected Area (sq miles)	Risk Level
Salt Creek LB & Oak Creek LB	LPSNRD	Lincoln, Lancaster County	Salt Cr, Oak Cr	1.72	Urban	0.45	Low
Salt Creek RB to Dead Man's Run	LPSNRD	Lincoln, Lancaster County	Salt Creek	1.62	Urban	0.44	Low
Salt Creek RB & Dead Man's Run RB	LPSNRD	Lincoln, Lancaster County	Salt Creek	1.6	Urban	0.38	Low
YMCA Camp Kitaki – Platte River RB (NF)	YMCA Camp Kitaki	South Bend, Cass County	Platte River	0.22	Structural	0.047	Low
Cedar Creek (Omaha F&W) – Platte RB	Omaha Fish & Wildlife Club and LPSNRD (co-sponsors)	Cedar Creek, Cass County	Platte River	1.56	Residential	0.38	Not Screened
Lake Waconda – Missouri River RB	Cass County SID #1	Cass County	Missouri River and Lake Waconda	2.53	Residential	0.6	Moderate
Clear Creek – Platte River RB*	LPNNRD and LPSNRD (co-sponsors)	Wann, Saunders County	Platte River	12.25	Urban	28.04	Not Screened

Source: USACE Levee Database

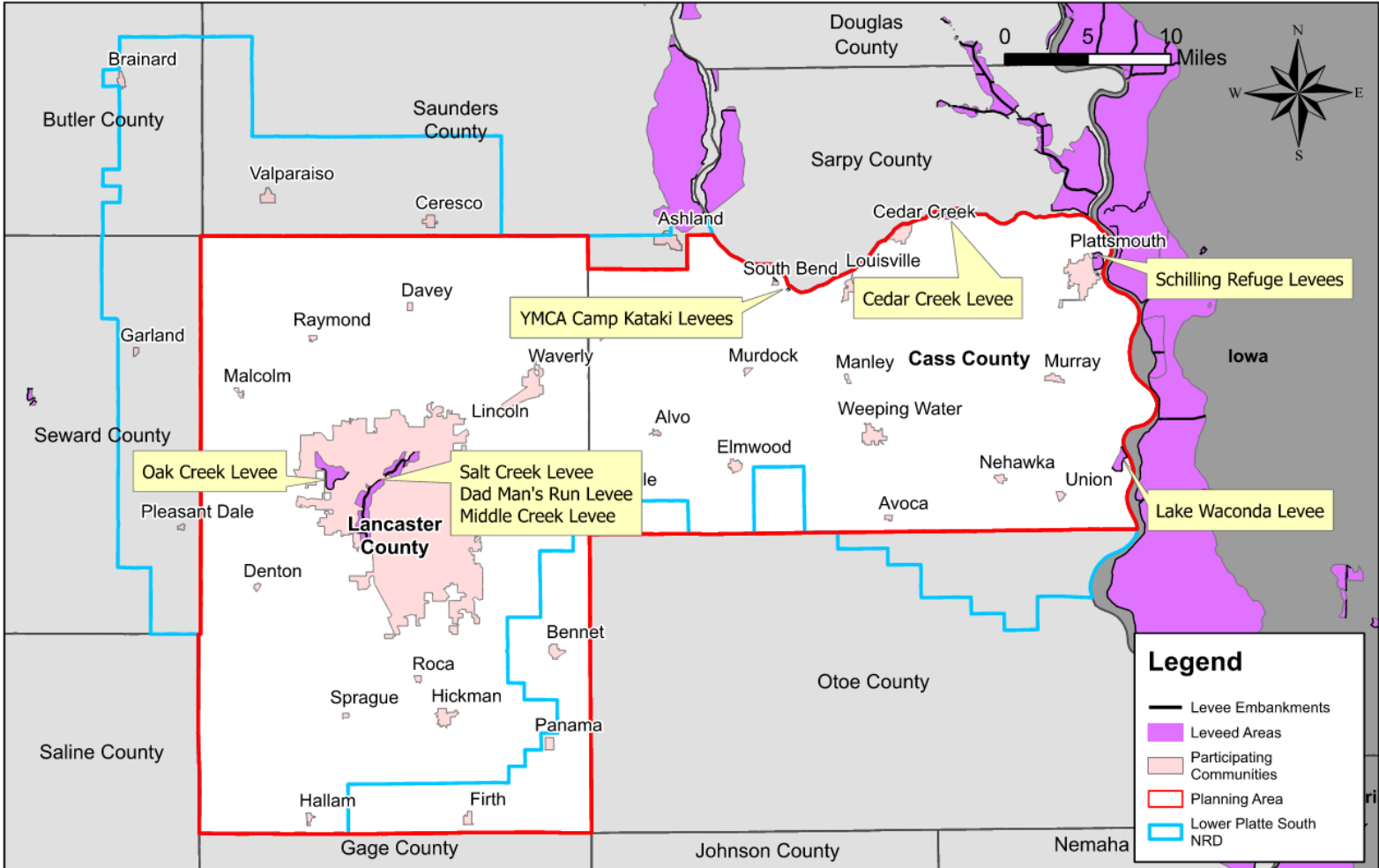
*Note: The Clear Creek Levee System is outside of the two-county planning area. However, a small portion of the levee falls within the LPSNRD area.


Table 56: LPSNRD Non-USACE Levees

Name	Sponsor	Location	River	Length (miles)	Type of Protection	Protected Area (sq miles)	Risk Level
Oak Creek Levee 1	N/A	Lincoln, Lancaster	Oak Creek	3.32	Commercial	1.62	Not Screened
Schilling Refuge Levee 1	N/A	Plattsmouth, Cass	Schilling Lake	2.29	WMA	0.11	Not Screened
Schilling Refuge Levee 2	N/A	Plattsmouth, Cass	Schilling Lake	0.21	Commercial	0.013	Not Screened
Schilling Refuge Levee 3	N/A	Plattsmouth, Cass	Schilling Lake	2.31	Urban	0.57	Not Screened
YMCA Camp Katakai Levee	N/A	South Bend, Cass	Platte River	0.4	Agricultural	0.062	Not Screened

Source: USACE Levee Database

Figure 39: Leveed Area in the Planning Area



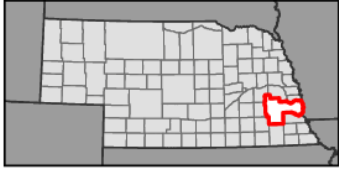


Created By: JR
Date: 01/09/2025
Software: ArcGIS Pro
File: Lower Platte South NRD.aprx

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Levee Locations

Lower Platte South NRD Hazard Mitigation Plan 2025



EXTENT

The USACE, who is responsible for federal levee oversight and inspection of levees, has three ratings for levee inspections. Any levee failure events in the planning area will fall within USACE’s rating system; however it is not currently possible to determine what level of damage each levee system will experience.

Table 57: 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

HISTORICAL PROBABILITY AND FUTURE LIKELIHOOD

While three levees within the planning area (Salt Creek, Cedar Creek, and Lake Waconda Levee Systems) were damaged and one outside of the planning area but within the LPSNRD region (Clear Creek Levee System) was breached during the 2019 March flood event, no other historical records of levee failure were found. While it is possible for levee failure to occur in the future, this is considered a low probability. For the purposes of this plan, the probability of levee failure will be stated as one percent annually. It should be noted that until permanent repairs are made to damaged levee systems, there is an increased risk of failure. As outlined in the historical occurrences section, the USACE is currently overseeing repairs and working with contractors to complete permanent repairs as soon as practical.

FUTURE DEVELOPMENT

Any future growth in significant levee protected areas increases the impacts from levee failure. As many levee systems are developed in areas to reduce flood risk impacts, changes to waterways and flood risk hazard areas may affect protected areas. Closer to the levee system, breach zones are frequently larger than the identified floodplain, so caution should be used when developing areas adjacent to or downstream of levee systems. Communities or counties could implement requirements for any new development or substantial improvements in levee protected areas similar to floodplain ordinances to minimize the number of people and property impacted during a levee failure event.

CLIMATE CHANGE IMPACTS

While climate change does not directly affect levee failure events, changes in precipitation and temperature swings and extremes are highly likely to impact the planning area. Increased rainfall events, either in frequency and/or in magnitude, will lead to exacerbated stress on infrastructure systems including levee systems. Climate change may impact dam systems in the following ways:

- Drought/Extreme Heat – land subsidence, erosion, embankment settling, or foundation cracking
- Flooding – increased embankment erosion, sloughing, overtopping risk, or damage from ice jams

COMMUNITY TOP HAZARD STATUS

The following jurisdictions identified Dam Failure as a top hazard of concern.

- Lower Platte South NRD
- City of Lincoln
- City of Ashland

REGIONAL VULNERABILITIES

The following table provides information related to regional vulnerabilities; for jurisdictional specific vulnerabilities, refer to *Section Seven: Participant Sections*.

Table 58: Regional Levee Failure Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	<ul style="list-style-type: none"> -Those living in federal levee protected areas -Residents with low mobility or with no access to a vehicle are more vulnerable during a levee failure
ECONOMIC	<ul style="list-style-type: none"> -Businesses and industries protected by levees are at risk during failures
BUILT ENVIRONMENT	<ul style="list-style-type: none"> -All buildings within levee protected areas are at risk to damages
INFRASTRUCTURE	<ul style="list-style-type: none"> -Major transportation corridors and bridges at risk during levee failures
CRITICAL FACILITIES	<ul style="list-style-type: none"> -Critical facilities in levee protected areas are at risk
CLIMATE	<ul style="list-style-type: none"> -Changes in seasonal precipitation and temperature normals can increase strain on infrastructure

SEVERE THUNDERSTORMS

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

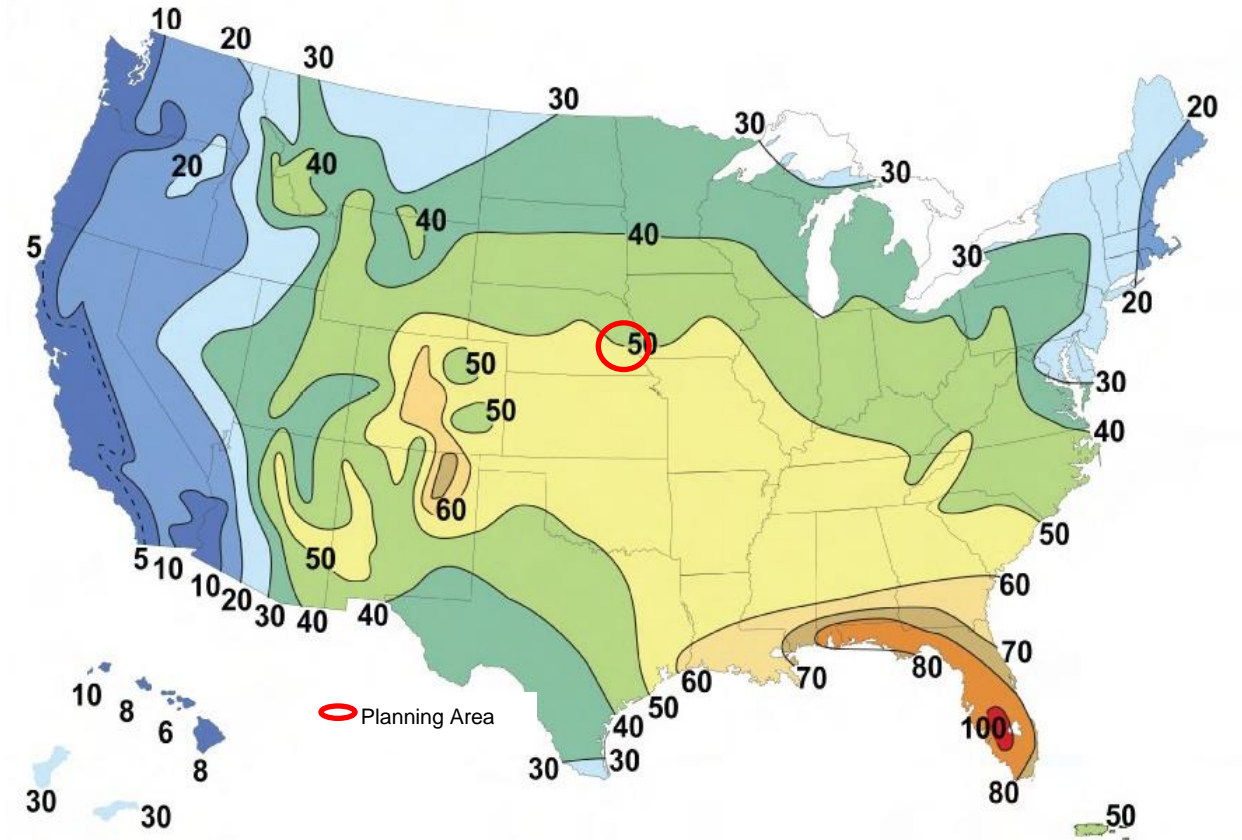
Thunderstorms can develop in fewer than 30 minutes and can grow to an elevation of eight miles into the atmosphere. Lightning, by definition, is present in all thunderstorms and can cause harm to humans and animals, fires to buildings and agricultural lands, and electrical outages in municipal electrical systems. Lightning can strike up to 10 miles from the portion of the storm depositing precipitation. There are three primary types of lightning: intra-cloud, inter-cloud, and cloud to ground. While intra and inter-cloud lightning are more common, communities are potentially impacted when lightning comes in contact with the ground. Lightning generally occurs when warm air mixes with colder air masses resulting in atmospheric disturbances necessary for polarizing the atmosphere.

Economically, thunderstorms are generally beneficial in that they provide moisture necessary to support Nebraska’s largest industry, agriculture. The majority of thunderstorms do not cause damage, but when they escalate to severe storms, the potential for damages increases. Damages can include: crop losses from wind and hail; property losses due to building and automobile damages from hail; high wind; flash flooding; and death or injury to humans and animals from lightning, drowning, or getting struck by falling or flying debris. Figure 40 displays the average number of days with thunderstorms across the country each year. The planning area experiences an average of 40 to 50 thunderstorms over the course of one year.

Hail is commonly associated with severe thunderstorms, and this association makes hail just as unpredictable as severe thunderstorms. Additionally, hail events in thunderstorms often occur in series, with one area having the potential to be hit multiple times in one day. Severe thunderstorms usually occur in the evening during the spring and summer months. These, often large, storms can include heavy rain, hail, lightning, and high winds. Hail can destroy property and crops with sheer force, as some hail stones can fall at speeds up to 100 mph.

While the moisture from thunderstorms associated with hail events can be beneficial, when thunderstorms do produce hail, there is potential for crop losses, property losses due to building and automobile damages, injury or death to cattle and other livestock, and personal injury from people not seeking shelter during these events or standing near windows. The potential for damages increases as the size of the hail increases.

Figure 40: Average Number of Thunderstorms



Source: NWS, 2017⁶²

LOCATION

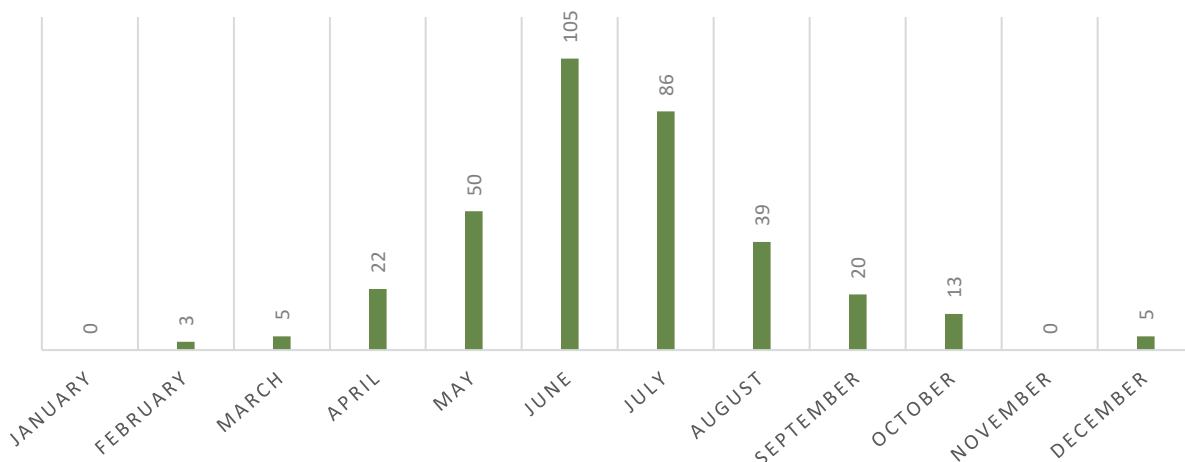
The entire planning area is at risk of severe thunderstorms and associated damages from heavy rain, lightning, hail, and thunderstorm level winds.

HISTORICAL OCCURRENCES

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. Severe thunderstorms in the planning area usually occur in the afternoon and evening during the summer months (Figure 41).

⁶² National Weather Service. 2017. "Introduction to Thunderstorms." http://www.srh.noaa.gov/jetstream/tstorms/tstorms_intro.html.

Figure 41: Thunderstorm Wind Events by Month



Source: NCEI, 1996-2023

The NCEI reports a total of 956 total severe thunderstorm events. Of those there were:

- Hail 581 events
- Heavy Rain 14 events
- Lightning 13 events
- Thunderstorm Wind 348 events

Severe thunderstorm events were responsible for over \$6 million in property damage. 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 \$9,639,944 and hail caused \$7,773,271 in crop damages. There were three injuries, and no deaths reported in association with these storms.

EXTENT

The geographic extent of a severe thunderstorm event may be large enough to impact the entire planning area (such as in the case of a squall line, derecho, or long-lived supercell) or just a few square miles, in the case of a single cell that marginally meets severe criteria.

The NWS defines a thunderstorm as severe if it contains hail that is one inch in diameter or capable of winds gusts of 58 mph or higher. The Tornado and Storm Research Organization (TORRO) scale is used to classify hailstones and provides some detail related to the potential impacts from hail. Table 59 outlines the TORRO Hail Scale.

Table 59: TORRO Hail Scale

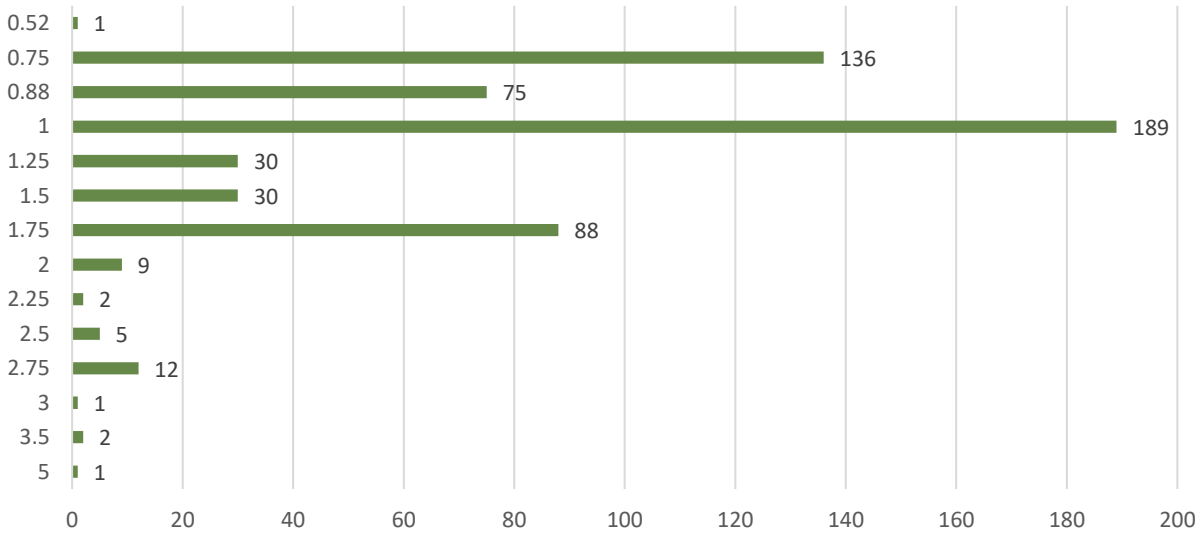
CLASS	TYPE OF MATERIAL	DIVISIONS
H0: Hard Hail	5 mm; (Pea size); 0.2 in	No damage
H1: Potentially Damaging	5 -15 mm (Marble); 0.2 – 0.6 in	Slight general damage to plants and crops
H2: Significant	10 -20 mm (Grape); 0.4 – 0.8 in.	Significant damage to fruit, crops, and vegetation
H3: Severe	20 -30 mm (Walnut); 0.8 – 1.2 in	Severe damage to fruit and crops, damage to glass and plastic structures

CLASS	TYPE OF MATERIAL	DIVISIONS
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	>100 mm (Melon); > 4.0 in	Extensive structural damage; risk or severe or even fatal injuries to persons outdoors

Source: TORRO, 2017⁶³

Of the 581 hail events reported across the planning area, the average hailstone size was 1.16 inches. Events of this magnitude correlate to an H3 classification. It is reasonable to expect H3 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 one H10 hail events (>4.0 inches) during the period of record. Figure 42 shows hail events based on the size of the hail.

Figure 42: Hail Events by Magnitude



Source: NCEI, 1996-2023

⁶³ Tornado and Storm Research Organization. 2017. "Hail Scale." <http://www.torro.org.uk/hscale.php>.

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon recorded damages from NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 60: Severe Thunderstorms Loss Estimate

Hazard Type	Number of Events ¹	Total Property Loss ¹	Average Annual Property Loss	Total Crop Loss ²	Average Annual Crop Loss
Hail	581	\$2,049,000	\$73,179	\$7,773,271	\$277,617
Heavy Rain	14	\$0	\$0	\$9,639,944	\$344,284
Lightning	13	\$1,236,400	\$44,157	-	
Thunderstorm	348	\$2,049,000	\$73,179	-	
Wind					
Total	956	\$6,285,400	\$224,479	\$17,413,215	\$621,901

Source: 1 Indicates data is from NCEI (January 1996 to November 2023); 2 Indicates data is from USDA RMA (2000 to 2023)

HISTORICAL PROBABILITY AND FUTURE LIKELIHOOD

Based on historical records and reported events, severe thunderstorms events and storms with hail are likely to occur on an annual basis. The NCEI reported a total of 956 severe thunderstorm events between 1996 and 2023 and at least one event occurring each year within the period of record. Thus, resulting in a 100 percent chance annually for thunderstorms (Highly Likely).

Table 61: Historical Probability & Future Likelihood – Severe Thunderstorms

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
100%	Uncertain	Neither Increase nor Decrease in Frequency. Increase Exposure	Highly Likely

FUTURE DEVELOPMENT

All future development could be impacted by severe thunderstorms. The ability to withstand major damage lies in sound land use practices and consistent enforcement of building codes and regulations for new construction. Municipalities that have adopted the current International Building Codes have a lower risk for damage as the code has sections designed to deal with the impacts of hail events. Lightning rods, protected rooftop utilities, and surge protectors, are possible steps new developments can take to reduce impacts from lightning and severe thunderstorms.

CLIMATE CHANGE IMPACTS

For extreme events like severe thunderstorms there is “considerable uncertainty about how projected changes in the climate will affect these events”. However, severe thunderstorms will “continue to be a normal feature for Nebraska.”⁶⁴ Projected trends for precipitation and temperature indicate more favorable conditions for severe thunderstorms to develop more readily and grow larger. According to the Fourth National Climate Assessment, “modeling studies consistently suggest that the frequency and intensity of severe thunderstorms in the United States could increase as climate changes.”⁶⁵ There is also some suggestion in the models that the atmosphere will become more favorable to severe thunderstorm development and increased intensity.

⁶⁴ University of Nebraska-Lincoln. 2014. “Understanding and Assessing Climate Change: Implications for Nebraska”. <http://snr.unl.edu/download/research/projects/climateimpacts/2014ClimateChange.pdf>.

⁶⁵ Fourth National Climate Assessment. 2018. “Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Chapter 2”. <https://nca2018.globalchange.gov/chapter/2/>.

COMMUNITY TOP HAZARD STATUS

The following jurisdictions identified Severe Thunderstorms as a top hazard of concern:

- Lower Platte South NRD
- Cass County
- Avoca, Village of
- Cedar Creek, Village of
- Eagle, Village of
- Elmwood, Village of
- Greenwood, Village of
- Louisville, City of
- Murdock, Village of
- Union Village of
- Weeping Water, City of
- Lancaster County
- Bennet, Village of
- Davey, Village of
- Denton, Village of
- Lincoln, City of
- Panama, Village of
- Raymond, Village of
- Sprague, Village of
- Waverly, City of
- Brainard, Village of
- Ceresco, Village of
- Lincoln Public Schools
- Raymond Central Public Schools
- Weeping Water Public Schools

REGIONAL VULNERABILITIES

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

Table 62: Regional Thunderstorm Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Elderly citizens with decreased mobility may have trouble evacuating or seeking shelter -Mobile home residents are risk of injury and damage to their property if the mobile home is not anchored properly -Injuries can occur from: not seeking shelter, standing near windows, and shattered windshields in vehicles
ECONOMIC	-Damages to buildings and property can cause significant losses to business owners and employees
BUILT ENVIRONMENT	-Buildings are at risk to hail damage -Downed trees and tree limbs -Roofs, siding, windows, gutters, HVAC systems, etc. can incur damages
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 -Power lines and utilities can be damaged
CRITICAL FACILITIES	-Power outages are possible -Critical facilities may sustain damage from hail, lightning, and wind -Property damages and power outages

SECTOR	VULNERABILITY
CLIMATE	<ul style="list-style-type: none"> -Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of severe storm events -Increased likelihood of more frequent and severe storm events, including hail
OTHER	<ul style="list-style-type: none"> -High winds, lightning, heavy rain, and possibly tornadoes can occur with this hazard

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.

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

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 and associated damage from blizzards, heavy snow, ice storms, winter weather, and 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 167 severe winter storm events for the planning area from January 1996 to November 2023. These recorded events caused a total of \$19,075,000 in property damage and \$568,924 in crop damage. No injuries or fatalities were associated with any severe winter storm events; however, it is reasonable to assume car accidents and injuries were sustained due to slick conditions or poor visibility from winter weather throughout the planning area.

The most damaging event occurred on December 25th, 1997 when six to 14 inches of heavy wet snow fell in the area causing power outages, tree damage, and \$16,000,000 in property damage in Lancaster County and \$3,000,000 in property damage in Cass County. The NCEI reported *“A major early season snowstorm struck the area. A heavy wet snowfall of 6 to 14 inches fell on trees, many of which were still fully or partially leafed, and caused extensive damage and/or total destruction. At least 205,000 residents in the affected area were without power just after the storm, many of the outages lasted for several days. Omaha Public Power District estimated that it was the worst outage in 50 years. Nearly 85% of the trees in the Omaha area and 25% of the trees in the Lincoln area sustained damage or were totally destroyed. Many emergency shelters in and around the Omaha and Lincoln areas were opened for use by those who suffered a hardship from the storm.”*

Additional information from these events from NCEI and reported by each community are listed *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. Ice Storm Warnings are issued when accumulation of at least 0.25 inches is

expected from a storm, which controlling for high winds, would tend to classify ice storms in Nebraska as SPIA Level 2 or higher. The most common accumulation during ice storms was a quarter of an inch. The following figure shows the SPIA index.

Figure 43: SPIA Index

ICE DAMAGE INDEX	*AVERAGE ICE AMOUNT (in inches) <i>Revised: Oct. 2011</i>	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 weeks in some areas. Shelters needed.
	0.75 – 1.00	> – 25	
	1.00 – 1.50	> – 15	
	> 1.50	Any	

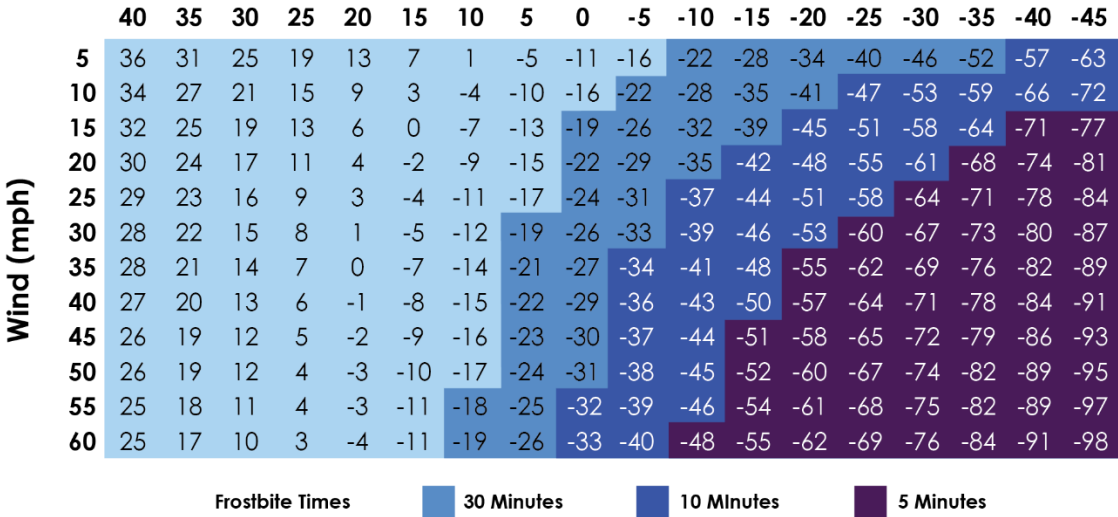
(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Source: SPIA-Index, 2017⁶⁶

The Wind Chill Index was developed by the NWS to determine the decrease in air temperature felt by the body on exposed skin due to wind. The wind chill is always lower than the air temperature and can quicken the effects of hypothermia or frost bite as it gets lower. Figure 44 shows the Wind Chill Index used by the NWS.

⁶⁶ SPIA-Index. 2009. "Sperry-Piltz Ice Accumulation Index." Accessed June 2017. <http://www.spia-index.com/index.php>.

Figure 44: Wind Chill Index Chart
Temperature (°F)



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

T = Air Temperature (°F) V = Wind Speed (mph)



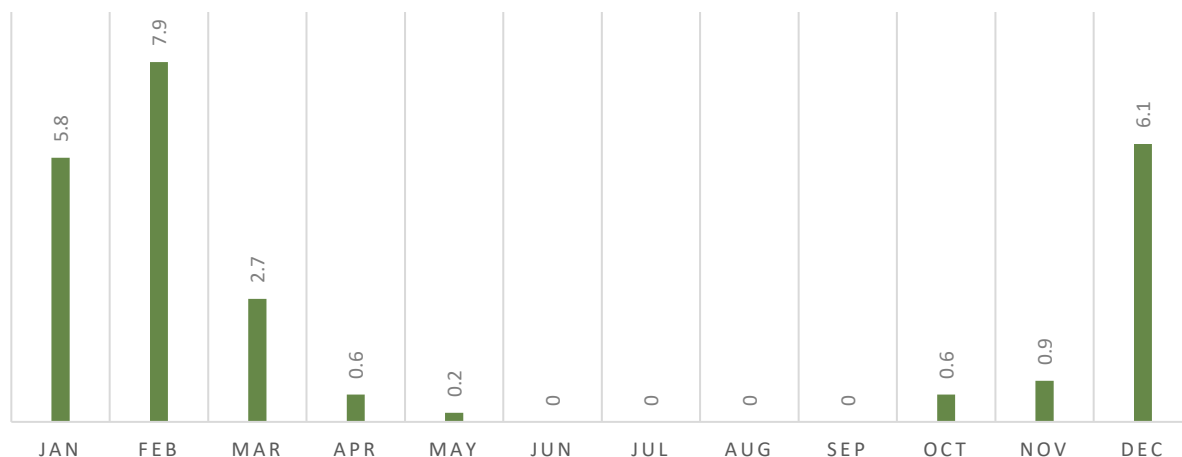
Source: NWS, 2017⁶⁷

The likely extent from severe winter storms would apply the same to each jurisdiction in the planning area as each individual event will have different impacts.

Average monthly snowfall for the planning area is shown in Figure 45, which shows the snowiest months are December, January, and February. A common snow event (likely to occur annually) will result in accumulation totals between one to three 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 10°F to 30°F below zero.

⁶⁷ National Weather Service. 2001. "Wind Chill Chart." http://www.nws.noaa.gov/om/cold/wind_chill.shtml.

Figure 45: Monthly Normal Snowfall in Inches (2006-2020)



Source: NCEI, 2024

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and includes aggregated calculations for each of the six types of winter weather as provided in the database. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe winter storms have caused an average of \$681,250 per year in property damage for the planning area.

Table 63: Severe Winter Storm 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
Blizzard	18	0.6	\$-	\$-		
Heavy Snow	9	0.3	\$19,000,000	\$678,571		
Ice Storm	6	0.2	\$-	\$-		
Winter Storm	95	3.4	\$-	\$-	\$568,924	\$23,706
Winter Weather	39	1.4	\$75,000	\$2,679		
Severe Winter Storms	167	6.0	\$19,075,000	\$681,250	\$568,924	\$23,706

Source: 1 Indicates data is from NCEI (January 1996 to December 2018); 2 Indicates data is from USDA RMA (2000 to 2018)

HISTORICAL PROBABILITY AND FUTURE LIKELIHOOD

Based on the historical record and reported events, severe winter storms are likely to occur on an annual basis. The NCEI reported 167 severe winter storms between 1996 and 2023, with at least one hazard event occurring in each year resulting in a 100 percent chance annually for severe winter storms (Highly Likely).

Table 64: Historical Probability & Future Likelihood – Severe Winter Storms

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
100%	Uncertain	Neither Increase nor Decrease in Frequency. Increase Exposure	Highly Likely

FUTURE DEVELOPMENT

All future development will be affected by severe winter storms. Increased development or infrastructure in the planning area creates a higher probability of damage to occur from winter weather as more property is exposed to risk. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction.

CLIMATE CHANGE IMPACTS

For extreme events like severe winter storms “it is difficult to know what will happen to the frequency and intensity” of these events. However, winter storms will “continue to be a normal feature for Nebraska.”⁶⁸ Some studies indicate that atmospheric circulation patterns in the Arctic could affect winter storms in midlatitude regions, and there may be a link between arctic warming and the frequency and intensity of severe winter storms in the United States.⁶⁹ Cold temperatures are likely to be impacted by climate change. The table below shows the number of freezing days in three-county region with different warming scenarios.

Table 65: Number of Freezing Days

	Warming Scenarios			
	1° C	1.5° C	2° C	3° C
Number of Freezing Days	31-90 Days per Year Avg. 38	31-90 Days per Year Avg. 32	8-30 Days per Year Avg. 29	8-30 Days per Year Avg. 23

Source: *Probable Futures*⁷⁰

COMMUNITY TOP HAZARD STATUS

The following jurisdictions identified Severe Winter Storms as a top hazard of concern:

- Cass County
- Elmwood, Village of
- Manley, Village of
- Murdock, Village of
- Murray, Village of
- South Bend, Village of
- Weeping Water, City of
- Lancaster County
- Davey, Village of
- Lincoln, City of
- Panama, Village of
- Ceresco, Village of
- Lincoln Public Schools
- Raymond Central Public Schools
- Weeping Water Public Schools

REGIONAL VULNERABILITIES

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

Table 66: 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

⁶⁸ University of Nebraska-Lincoln. 2014. “Understanding and Assessing Climate Change: Implications for Nebraska”. <http://snr.unl.edu/download/research/projects/climateimpacts/2014ClimateChange.pdf>.

⁶⁹ Fourth National Climate Assessment. 2018. “Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Chapter 2”. <https://nca2018.globalchange.gov/chapter/2/>.

⁷⁰ Probable Futures. “Maps of Temperature”. Accessed December 2024. <https://probablefutures.org/>.

SECTOR	VULNERABILITY
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).

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

- Domestic terrorism is the unlawful use, or threatened use, of force or violence by a group or individual based and operating entirely within the United States or Puerto Rico without foreign direction committed against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives.
- International terrorism involves violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or any state, or that would be a criminal violation if committed within the jurisdiction of the United States or any state. These acts appear to be intended to intimidate or coerce a civilian population, influence the policy of a government by intimidation or coercion, or affect the conduct of a government by assassination or kidnapping. International terrorist acts occur outside the United States or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to coerce or intimidate, or the locale in which their perpetrators operate or seek asylum.

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

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

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

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

- A terrorist *incident* is a violent act or an act dangerous to human life, in violation of the criminal laws of the United States, or of any state, to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.
- Terrorism *prevention* is a documented instance in which a violent act by a known or suspected terrorist group or individual with the means and a proven propensity for violence is successfully interdicted through investigative activity.

Primarily, threat assessment, mitigation, and response to terrorism are federal and state directives and work in conjunction with local law enforcement.

Note: The FBI investigates terrorism-related matters without regard to race, religion, national origin, or gender. Reference to individual members of any political, ethnic, or religious group in this report is not meant to imply that all members of that group are terrorists. Terrorists represent a small criminal minority in any larger social context.

LOCATION

Terrorist activities could occur throughout the entire planning area. Concerns are primarily related to agro-terrorism, tampering with water supplies, or potential violence on school campuses.

HISTORICAL OCCURRENCES

Previous accounts of terrorism in the planning area were gathered from the Global Terrorism Database, maintained by the University of Maryland and the National Consortium for the Study of Terrorism and Responses to Terrorism (START). This database contains information for over 140,000 terrorist attacks. According to this database, there have been two terrorist incidents in the planning area between 1970 - 2018.⁷¹

Table 67: Terrorism Occurrences

Year	Location	Injuries	Deaths	Property Damage	Description ¹
1979	Lincoln	0	0	Unknown	Bombing/Explosion
2016	Lincoln	0	0	Minor (likely <\$1 million)	Assailants set fire to the Belmont Baptist Church in Lincoln, Nebraska, United States. There were no reported casualties. This was one of two arson attacks targeting the church on this date. No group claimed responsibility for the incident.

Source: Global Terrorism Database, 1970 - 2018

EXTENT

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

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon the START Global Terrorism Database information since 1970. This does not include losses from displacement, functional downtime, or economic loss. If a terrorist event were to occur damages would likely be minor (<\$1 million).

HISTORICAL PROBABILITY AND FUTURE LIKELIHOOD

Given two incidences over the available period of record, the annual probability for terrorism in the planning area has a less than 1 percent chance of occurring during any given year. This does not indicate that a terrorist event will never occur within the planning area, only that the likelihood of such an event is incredibly low (Unlikely).

Table 68: Historical Probability & Future Likelihood – Terrorism & Civil Disobedience

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
>1%	Neither Increase nor Decrease in Frequency	Neither Increase nor Decrease in Frequency. Increase Exposure	Unlikely

FUTURE DEVELOPMENT

Future community development should promote transparent and accountable governance, allowing residents to have a say in decisions that affect their lives. Investing in public infrastructure, healthcare, and social services can further enhance community well-being. Best practices for future development will reduce the likelihood of unrest, such as prioritizing inclusivity, economic opportunity, and social stability. Communities in the planning area may focus on access to quality education, job opportunities, and affordable housing to reduce the sense of disenfranchisement that often fuels civil unrest. The largest

⁷¹ National Consortium for the Study of Terrorism and Responses to Terrorism (START). 2016. Global Terrorism Database [Data file]. Retrieved from <https://www.start.umd.edu/gtd>.

concern for future development and increasing risk of terrorism events exists for growing school districts and water districts.

CLIMATE CHANGE IMPACTS

Climate change and terrorism or civil disobedience can be indirectly related. The impacts of climate change are likely to exacerbates the risk of hazard events such as drought, extreme heat, or extreme storms. Impacts from hazards including water insecurity, rising costs of insurance, declining mental health, and storm-induced stress will increase the prevalence of civil unrest. These conditions can strain critical resources such as water and food, disrupt livelihoods, and lead to social unrest in vulnerable regions. In some cases, unrest can create fertile ground for extremist ideologies and recruitment efforts, potentially contributing to terrorism.

COMMUNITY TOP HAZARD STATUS

The following jurisdictions identified Terrorism as a top hazard of concern.

- Raymond Central Public Schools
- Weeping Water Public Schools
- Eagle, Village of

REGIONAL VULNERABILITIES

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

Table 69: Regional Terrorism Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Police officers and first responders at risk of injury or death
ECONOMIC	-Damaged business can cause loss of revenue and loss of income for workers -Agricultural attacks could cause significant economic losses for the region
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	-Activism pertaining to climate can place first responders and residents at risk

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SECTION FIVE

MITIGATION STRATEGY

INTRODUCTION

The primary focus of the mitigation strategy is to identify action items to reduce the effects and impacts from the identified top hazards of concern per community. These action items should help reduce impacts on existing infrastructure and property in a cost effective and technically feasible manner. Mitigation strategy development is also based upon the established Goals and Objectives as determined by the Planning Team at the Kick-off meeting.

At the Kick-off Meeting the Planning Team reviewed the goals from the 2020 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. Each goal and set of objectives is followed by 'mitigation alternatives,' or actions.

GOALS

Below is the list of goals and objectives as determined by the Planning Team. These goals and objectives provided specific direction to guide participants in reducing future hazard related losses and in their selection of mitigation actions.

- **Goal 1: Protect Health and Safety of the General Public**
 - *Objective 1.1: Reduce or prevent damage to property or 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, community lifelines, services, utilities, and the natural environment to the greatest extent possible.*
 - *Objective 2.2: Develop hazard specific plans and conduct studies or assessments to identify opportunities for mitigation from hazards to minimize their impacts.*
 - *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 Education Regarding Vulnerability to Hazards**
 - *Objective 3.1 Develop and provide information to the general public about their risk and vulnerability to hazard types and impacts, what they can do to be better prepared, and what their communities are doing to protect against these risks.*
 - *Objective 3.2: Identify and foster relationships with local organizations and stakeholders to leverage capabilities, resources, and build awareness to hazards.*
- **Goal 4: Improve Emergency Management Capabilities**
 - *Objective 4.1: Develop or improve Emergency Response Plan, procedures, and personnel abilities.*
 - *Objective 4.2: Develop or improve Evacuation Plan and procedures.*
 - *Objective 4.3: Improve warning systems and ability to communicate with the public before, during, and after a significant hazard event.*
- **Goal 5: Enhance Overall Resilience and Promote Sustainability**

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.

- *Objective 5.1: Incorporate hazard mitigation and adaptation into updating other existing planning endeavors (e.g., comprehensive plans, zoning ordinance, subdivision regulation, etc.)*
- *Objective 5.2: Expand and incorporate hazard mitigation planning process across other preparedness, response, and recovery planning efforts.*

MITIGATION ALTERNATIVES (ACTION ITEMS)

Local planning teams evaluated, prioritized, and identified mitigation actions with the guidance of established goals and through an in-depth discussion of local capabilities and relevance. Actions included in the plan include both the mitigation actions identified by participating jurisdictions in the previous plan and new mitigation actions identified per hazard of top concern during the planning process. Participants were encouraged to think of actions that may need FEMA grant assistance and to review their hazard prioritization section for potential mitigation actions. These suggestions helped participants determine which actions would best assist their respective jurisdiction in alleviating damage in the event of a disaster.

The local planning teams were instructed that each hazard of top concern must have an action that addresses it. Mitigation actions must be specific activities that are concise and can be implemented individually; however, other capability and resilience building activities may also be included in the plan even if they do not specifically address a mitigation need.

During the update of previous identified actions and the identification of new actions, each local planning team prioritized each identified mitigation action as high, medium, or low. A strategy presented to assist participants in prioritizing actions was the STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, Environmental) feasibility review. Jurisdictions were also highly encouraged and led through a process to determine individual responsibility for mitigation actions, such as for infrastructure at risk to determine if outside partnerships would be necessary for implementation.

The listed priority rating does not indicate which actions will be implemented first. Generally, high priority actions either address a major concern for the jurisdiction, have few to no challenges in implementation, and/or garner large support from the public and administration. Low priority actions either address a minor concern for the jurisdiction, have many challenges in implementation, and/or may not have support from the public or administration at this time. Medium priority actions may only have one or two of the items listed above. A mitigation action's priority may change very quickly as circumstances change.

It is also important to note that not all the mitigation actions identified by a jurisdiction 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. Participants have not committed to undertaking identified mitigation actions in the plan. The cost estimates, priority ranking, potential funding, and identified agencies are used to give communities an idea of what actions may be the 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. Such actions should be discussed and noted in the HMP during the annual plan maintenance process.

Finally, not all mitigation actions may be eligible for funding through the Hazard Mitigation Assistance programs (HMGP, BRIC, or FMA). It is important to note that not all identified mitigation actions are solely for mitigation but may also address response or recovery activities. These mitigation actions are also a way for communities to address local vulnerabilities in response and recovery capabilities. Many of these types of projects are ineligible for HMA funding. Ineligibility for these grant programs should not preclude a community from identifying or pursuing such an action or project. Numerous funding sources have been identified across the state and planning area to assist jurisdictions fund projects. All mitigation strategies aimed at reducing risk to natural or human-caused hazards should be identified and discussed in the HMP.

PARTICIPANT MITIGATION ALTERNATIVES

Mitigation alternatives identified by participants of the Lower Platte South NRD HMP are found in the Mitigation Alternative 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 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, and ongoing or new mitigation alternatives for each participating jurisdiction can be found in *Section Seven: Community Profiles*.

Table 70: Mitigation Alternatives Selected by Each Jurisdiction – Cass County

Mitigation Actions	Cass County	Alvo	Avoca	Cedar Creek	Eagle	Elmwood	Greenwood	Louisville	Manley	Murdock	Murray	Nehawka	Plattsmouth	South Bend	Union	Weeping Water
Acquire Identification Resources						X										
Alert Siren															X	
Alternate Water Sources								X								
Anchor Fertilizer, Fuel, and Propane Tanks				X												
Backup Generator			X			X		X	X					X	X	
Backup Municipal Records		X		X	X											
Bury Main Power Lines							X									
Civil Service Improvements		X		X	X											
Complete Citywide Flood Project Master Plan				X												
Comprehensive Disaster/Emergency Response Plan		X														
Continuity Planning	X	X			X		X				X					X
Designate Snow Routes										X						
Develop Automated Messages for Evacuation						X										
Emergency Fuel Supply Plan		X														
Evacuation Planning											X					
Hazard Education									X							
Hazardous Tree Removal						X				X		X				
Improve Construction Standards and Building Survivability							X									
Improve Emergency Communication				X												
Improve Water Supply and Redundancies			X													
Improve/Provide Facilities for Vulnerable Populations		X														
Infrastructure Assessment Study				X												

Mitigation Actions	Cass County	Alvo	Avoca	Cedar Creek	Eagle	Elimwood	Greenwood	Louisville	Manley	Murdock	Murray	Nehawka	Plattsmouth	South Bend	Union	Weeping Water
Infrastructure Hardening					X											
Investigate New Sources of Water	X															
Join the Community Rating System																X
New Fire Station				X												
Obtain Tree City Designation														X		
Participate in the Community Rating System	X							X								
Power and Service Lines				X												
Prepare Sample Water Conservation Ordinances	X															
Preserve Natural and Beneficial Functions	X															X
Promote Use of Higher Codes and Standards										X						X
Property Acquisition/Elevation														X		
Provide Short Term Residency Shelters		X														
Public Education											X					
Safe Rooms				X												
Sanitary Sewer Improvements												X				
Siren Upgrades								X								
Snow Fences									X							
Storm Shelter Identification					X											
Storm Shelters	X						X	X			X					
Stormwater System and Drainage Improvements	X				X			X		X						X
Transportation Route				X												
Tree Planting						X										
Update Comprehensive Plan				X												

Mitigation Actions	Cass County	Alvo	Avoca	Cedar Creek	Eagle	Elimwood	Greenwood	Louisville	Manley	Murdock	Murray	Nehawka	Plattsmouth	South Bend	Union	Weeping Water
Utilize Low-Impact Development and Green Infrastructure	x															
Vehicular Barriers	x						x				x					
Vulnerable Population Assistance Database					x											x
Water System Improvements							x								x	
Water Treatment Plant Improvements						x										
Weather Radios										x						
Well Improvements										x						
Windbreaks									x							

Table 71: Mitigation Alternatives Selected by Each Jurisdiction – Lancaster County

Mitigation Actions	Lancaster County	Bennet	Davey	Denton	Firth	Hallam	Hickman	Malcolm	Panama	Raymond	Roca	Sprague	Waverly
Alert Sirens	x												
Automated Telephone Dialer									x				
Backup Generators	x		x				x		x		x	x	x
Bury Main Power Lines			x	x						x			
Complete City-wide Flood Project Master Plan		x											
Comprehensive Village Disaster/Emergency Response Plan					x								
Continuity Planning	x							x	x				
Develop Dam Failure Emergency Action and Evacuation Plans													x
Educate Local Businesses about Continuity Planning									x				

Mitigation Actions	Lancaster County	Bennet	Davey	Denton	Firth	Hallam	Hickman	Malcolm	Panama	Raymond	Roca	Sprague	Waverly
Educate Public and Businesses on Flood Mitigation Projects		x											
Elevate Infrastructure							x						
Emergency Action Plan											x		
Emergency Exercise: Dam Failure							x						
Emergency Exercise: Hazardous Material Spill							x						
Emergency Operations Center	x												
Evacuation Planning					x	x			x				x
Evaluate/Elevate Lift Station										x			
Hail Resistant Roofing	x												
Hazardous Tree Inventory													x
Hazardous Tree Removal			x							x			
Improve Water Supply												x	
Install Weather Station	x												
Investigate New Sources of Water		x											
Join Community Rating System		x											
Lagoon Expansion and Elevation				x									
New Fire Hall													x
Obtain Tree City USA Designation						x							
Preserve Natural and Beneficial Functions	x	x						x					x
Promote Use of High Codes and Standards		x	x					x					
Public Education				x		x		x	x				x
Rural Drainage Study	x												
Shelter in Place Training		x											x
Source Water Contingency Plan							x						
Storage Facility							x						
Storm Shelter	x			x		x	x		x		x		x

Mitigation Actions	Lancaster County	Bennet	Davey	Denton	Firth	Hallam	Hickman	Malcolm	Panama	Raymond	Roca	Sprague	Waverly
Stormwater System and Drainage Improvements	x	x			x				x		x	x	x
Stream Stabilization	x												
Surge Protectors			x										
Update Comprehensive Plan									x				
Update Drought Ordinance					x								
Utilize Low Impact Development and Green Infrastructure	x												
Vulnerable Population Assistance Database	x								x				

Table 72: Mitigation Alternatives Selected by Each Jurisdiction – Special Districts

Mitigation Actions	LPSNRD	Brainard	Ashland	Ceresco	Valparaiso	Cass County RWD #1	Lincoln Public Schools	Norris Public School District	Raymond Central Public Schools	Weeping Water Public Schools
Alert Sirens		x								
Backup Generators			x	x			x		x	x
Backup Municipal Records				x						
Backup Power		x								
City Wide Master Plan			x							
Constructing an Academic, Activity, and Athletic Facility									x	
Continue & Expand Water Conservation Awareness Programs, such as pamphlets		x								
Dead Mans Run Flood Reduction Project		x								
Drought Education			x							
Drought Feasibility Study		x								
Drought Response Plan and Drought Contingency Plan		x								

Mitigation Actions	LPSNRD	Brainard	Ashland	Ceresco	Valparaiso	Cass County RWD #1	Lincoln Public Schools	Norris Public School District	Raymond Central Public Schools	Weeping Water Public Schools
Early Warning Systems										X
Education Program for Chemical Releases				X						
Elevate Infrastructure						X				
Emergency Action Plans and Exercises	X									
Emergency Exercise: Hazardous Spill				X						
Evacuation Planning			X							
Facilities Analysis/Assessment								X		
Green Mitigation	X									
Hail Resistant Roofing							X	X		
Hazard Education	X									
Hazard Risk Reduction- DNR Collaborative Dam Improvements	X									
Hazardous Tree Inventory					X					
Hazardous Tree Removal	X			X						
Improve Construction Standards and Building Survivability					X					
Improve Security Measures										X
Increase Fence Post Gauge							X			
Infrastructure Hardening	X									
Integrated Water Management Plan (IMP)	X									
Lightning Rods							X			X
New Secondary Entrance/Exit									X	
Preserve Floodplain	X									
Promote Use of Higher Codes and Standards			X							
Safety Action Plan								X		
Shelter-in-Place Training			X		X					
Staff Safety Training								X		
Storm Shelters	X									

Section Five | Mitigation Strategy

Mitigation Actions	LPSNRD	Brainard	Ashland	Ceresco	Valparaiso	Cass County RWD #1	Lincoln Public Schools	Norris Public School District	Raymond Central Public Schools	Weeping Water Public Schools
Storm Shelters		X								
Stormwater System and Drainage Improvements			X							
Surge Protectors				X						
Utilize Low-Impact Development and Green Infrastructure			X							
Vehicular Barriers				X						
Vulnerable Population Assistance Database					X					
Water Conservation Awareness						X				
Wellfield Improvements			X							

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SECTION SIX: PLAN IMPLEMENTATION AND MAINTENANCE

MONITORING, EVALUATING, AND UPDATING THE PLAN

Participants of the LPSNRD HMP will be responsible for monitoring (annually at a minimum), evaluating, and updating the plan during its five-year lifespan. Hazard mitigation projects will be prioritized by each participant's governing body and/or local planning team with support and suggestions from the public, business owners, and stakeholders. Unless otherwise specified by each participant's governing body, the governing body will be responsible for implementation of 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.

PLAN UPDATE AND MAINTENANCE

FEMA requires a full update of this plan at least every five years, to prevent the risk of the HMP expiring. Updates may be incorporated more frequently, especially in the event of a major hazard. The Lower Platte South NRD who serves as the project sponsor will begin discussion of plan update at least 12 months prior to the deadline for completing the plan update. Some questions to consider when evaluating the plan for updates or when developing a scope for future plan updates may include:

- 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 there public engagement barriers identified to be addressed in future plan updates?
- Are current resources appropriate to implement the plan?
- Did the plan partners participate as originally planned?
- Are there other agencies or stakeholders which should be included in the revision process?

At the discretion of each governing body, updates may be incorporated more frequently, especially in the event of a major hazard. The governing body will start meeting to discuss mitigation updates at least six months prior to the deadline for completing the plan review. The persons overseeing the evaluation process will review the goals and objectives of the previous plan and evaluate them to determine whether they are still pertinent and current. In addition, the governing body will be responsible for ensuring that the HMP's goals are incorporated into applicable revisions of each participant's comprehensive plan and any new planning projects undertaken by the participant. The HMP will also consider any changes in comprehensive plans, and incorporate the information accordingly in its next update.

CONTINUED PUBLIC INVOLVEMENT

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

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.

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

Further discussion on plan maintenance and engagement strategies are outlined in applicable jurisdictional profiles.

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. The LPSNRD will compile a list of proposed amendments received annually and prepare a report for NEMA, by providing applicable information for each proposal, and recommend action on the proposed amendments.

PLAN AMENDMENTS

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. The applicable jurisdictions' Planning Team will compile a list of proposed amendments received annually and prepare a report for NEMA, who will file it with FEMA. Re-adoption of the plan would not be needed until the normal five-year update. Such amendments should include all applicable information for each proposed action, including description of changes, identified funding, responsible agencies, etc. For an amendment template, see Appendix C.

INCORPORATION INTO EXISTING PLANNING MECHANISMS

The Planning Team utilized a variety of plan integration tools to help communities determine how their existing planning mechanisms were related to the Hazard Mitigation Plan. According to FEMA's Local Mitigation Planning Policy Guide (2021) and the Local Mitigation Planning Policy Guide (2023), incorporation of planning mechanisms means to reference or include information from other existing sources to form the content of the mitigation plan. Local communities utilized FEMA's *Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan*⁷² guidance, FEMA's *2015 Plan Integration*⁷³ guide, as well as the *Comprehensive Economic Development Strategy and Hazard Mitigation Plan Alignment Guide*⁷⁴ to identify plans or documents in which plan integration could take place. During the planning process, specific questions which highlighted hazard mitigation principles from various types of planning mechanisms were discussed. This process offered an easy way for participants to notify the Planning Team of existing planning mechanisms and if they interface with the Hazard Mitigation Plan.

Summaries of plan integration are found in each participant's individual profile. For these communities that lack existing planning mechanisms, especially smaller villages, the Hazard Mitigation Plan may be used as a guide for future activity and development in the community. Each local review team will be responsible for ensuring that the HMP's goals are incorporated into applicable revisions of each participant's relevant planning documents. The current HMP should be reviewed for including during any available document's next update period or development.

⁷² 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/20130726-1908-25045-0016/integrating_hazmit.pdf.

⁷³ Federal Emergency Management Agency. July 2015. "Plan Integration: Linking Local Planning Efforts." https://www.fema.gov/media-librarydata/1440522008134-ddb097cc285bf741986b48fdcef31c6e/R3_Plan_Integration_0812_508.pdf.

⁷⁴ Federal Emergency Management Agency. September 2022. "Comprehensive Economic Development Strategy and Hazard Mitigation Plan Alignment Guide." https://www.fema.gov/sites/default/files/documents/fema_ceds-hmp-alignment-guide_2022.pdf.

SECTION SEVEN: COMMUNITY PROFILES

PURPOSE OF COMMUNITY PROFILES

Community Profiles contain information specific to jurisdictions participating in the LPSNRD 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 communities 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/Geography
- Demographics
- Capabilities
- Plans and Studies
- Future Development Trends
- Parcel Improvements and Valuations
- NFIP Involvements
- Community Lifelines
- Hazard Prioritization
- 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, in *Section Seven: Community Profiles* 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 area wide throughout the entire planning area. A discussion of certain hazards selected for each Community Profile were 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*.

SECTION EIGHT FUNDING GUIDEBOOK

The following *Hazard Mitigation Project Funding Guidebook* is intended to provide initial guidance on hazard mitigation project funding opportunities and where to find more information on grants. The information included is consistent with established processes for hazard mitigation planning. However, it is important to note the following in terms of the context for this guidebook relative to the overall planning process.

Project identification includes identifying all possible options (or alternatives) to address planning objectives; at this stage, all options are viable. At times, the best option may be to work with other stakeholders in the community to design solutions that are in line with community values while reducing risk (e.g., a bike path or ball field that can double as a retention area, or the preservation of an animal habitat that also serves as a natural buffer). These types of solutions can often be funded in very innovative ways, including solutions which increase local industry and revenue (e.g., tapping into the entrepreneurial community). For information on the broad range of mitigation project types and how projects have been implemented in communities across the country, please refer to FEMA's Mitigation Best Practices webpage at <https://www.fema.gov/mitigation-best-practices-portfolio>.

It should be noted that the grant programs listed in this guidebook are not the only ones that could support hazard mitigation project implementation. Additionally, many of these programs are dependent on yearly funding allocations, resulting in fluctuations in their fund availability. However, at this point, it is more important to be aware of the potential for various avenues of support for a broad array of project types. As needs and potential hazard mitigation project options are identified, more information can begin to be gathered on the range of programs which might be utilized. It will be more efficient to start with project options and then follow up with the identification of potential matches, working with the full range of available programs and agencies as part of a comprehensive project evaluation process.

When the current FEMA hazard mitigation planning program was formulated in the late 1990s as part of the Disaster Mitigation Act of 2000, there was an assumption that federal funding would be provided on a substantial, on-going basis for implementing hazard mitigation projects. However, the level of funding has varied from year to year and future prospects are unclear. Additionally, some communities have not been successful in their pursuit of these grants and have not seen the value of their investment in mitigation planning. While participation in a hazard mitigation plan is required for a jurisdiction to be eligible for FEMA funds, those are not the only funding source available for mitigation actions. Depending on the type of mitigation project being pursued, FEMA funding is not always the best option either, so it is increasingly important to look for other opportunities.

Opportunities for funding and technical assistance exist in various federal, state, and local agencies. Non-governmental funding opportunities are available at the regional or local level with private sector businesses, private foundations, and other non-governmental organizations (NGOs). In order to fully map out the range of local and state options, it is necessary to undertake a detailed stakeholder analysis – something which has not been done at this time. The following contains an overview of key federal and state programs that may include opportunities for hazard mitigation project funding, as well as additional information on suggested alternative funding routes.

FEDERAL FUNDING RESOURCES

Information about federal hazard mitigation project funding opportunities is organized by agency. Under each agency heading, applicable grant programs are listed with a description of the grant and, when available, information on typical funds available, eligibility, examples of past projects funded, and any additional relevant information. Agencies covered in this guidebook include:

- FEMA
- US Army Corps of Engineers
- US Bureau of Reclamation – WaterSMART
- US Department of Agriculture
- US Department of Agriculture Rural Development Funding
- US Department of Energy

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- US Department of Housing and Urban Development
- US Economic Development Administration
- US Environmental Protection Agency
- US Fish and Wildlife Service
- US Forest Service

Note: This is not a complete list of all federal funding opportunities. These grant programs have been chosen for their applicability to popular mitigation actions. The websites and reference materials used to provide this information are as current as possible; however, it is important to note that funding programs are dynamic and subject to frequent changes. While it is helpful to be familiar with the current information, it is equally as important to engage candidate federal and state agencies in a dialog as soon as possible.

FEMA

Building Resilient Infrastructure and Communities Program

Description	This FEMA program aims to focus on research-supported, proactive investment in community resilience. Through BRIC, FEMA invests in a variety of mitigation activities with an added focus on infrastructure projects benefitting disadvantaged communities, nature-based solutions, climate resilience and adaption, and adopting hazard resistant building codes.
Funds Available	For Fiscal Year 2023, FEMA will distribute up to \$1billion through the BRIC program in the following manner.
Eligibility	Eligible states, territories and federally recognized tribal governments can submit applications on behalf of subapplicants for BRIC funding. Applicants may have their own priorities or requirements when screening their subapplications. Subapplicants cannot submit these directly to FEMA. Subapplicants must submit them to their applicant for review and submission. Subapplicants are local governments, including cities, townships, counties, special district governments, state agencies and federally recognized tribal governments and must submit subapplication to their state, territory, or tribal applicant agency.
Examples	The top five types of projects funded in Fiscal Year 2022 included Flood Control, Utility/Infrastructure Protection, Stabilization and Restoration, Wildfire Management, and Saferoom/Shelter.
Additional Information	A cost share is required for all subapplications funded under BRIC. The non-federal cost share funding may consist of cash; donated or third-party in-kind services and materials; or any combination thereof. Generally, the cost share for this program is 75% federal cost share funding/25% non-federal cost share funding. Additional information can be found at https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities/before-apply#funding

Fire Management Assistance Grant (FMAG) Program

Description	FMAG is available to states, local and tribal governments, for the mitigation, management, and control of fires on publicly or privately-owned forests or grasslands, which threaten such destruction as would constitute a major disaster.
Funds Available	The individual fire cost threshold is based on total eligible costs for the declared fire. The individual fire cost threshold for a state is the greater of \$100,000 or 5 percent times the statewide per capita indicator, multiplied by the state population (the statewide per capita indicator is adjusted annually for inflation [e.g., the FY21 indicator is \$1.55]).
Eligibility	Eligible applicants are entities legally responsible for the firefighting activities that reimbursement is being requested for, this includes states, local governments, and tribal governments.
Examples	Eligible firefighting costs may include expenses for field camps, repair and replacement tools, mobilization and demobilization activities, equipment use, materials and supplies.
Additional Information	https://www.fema.gov/assistance/public/fire-management-assistance

Flood Mitigation Assistance Program	
Description	FMA is a competitive program that provides funding for projects that reduce or eliminate the risk of repetitive flood damages to buildings insured by the National Flood Insurance Program. Projects must be cost effective, located in a participating NFIP community in good standing, align with the current hazard mitigation plan, and meet all environmental and historical preservation requirements.
Funds Available	Fiscal Year 2023 had \$1.8billion available for distribution which was more than five times the amount available for Fiscal Year 2021.
Eligibility	States, territories, and federally recognized tribes are eligible. Local governments are considered sub-applicants and must apply to the State, territory, or tribe.
Examples	Projects include: project scoping, technical assistance, community flood mitigation projects, individual structure/property-level flood mitigation projects, and management costs.
Additional Information	Cost share is required for all subapplications funded by the Flood Mitigation Assistance program. Generally, the cost share for this program is 75% federal / 25% non-federal. Contributions of cash, third-party in-kind services, materials, or any combination thereof, may be accepted as part of the non-federal cost share. More information can be found at https://www.fema.gov/grants/mitigation/floods

HMGP-Post Fire	
Description	This program provides funding to help communities implement hazard mitigation measures focused on reducing the risk of harm from wildfire. Provides hazard mitigation grant funding to state, local, tribal, and territorial governments in areas receiving a Fire Management Assistance Grant (FMAG) declaration. The FMAG is the Disaster Declaration required and funding amounts are determined by FEMA based on an annual national aggregate calculation of the past 10 year’s FMAG declarations.
Funds Available	Funds available each year are based on an average of historical Fire Management Assistance Grant declarations from the past 10 years. Total funding available for each FMAG declaration in Fiscal Year 2022 is \$786,552 for applicants with a standard hazard mitigation plans and \$1,048,736 for those with an enhanced hazard mitigation plan. Multiple event funding will be aggregated into one grant under the first declaration.
Eligibility	Eligible projects include defensible space initiatives, ignition-resistant construction, hazardous fuels reduction, erosion control measures, slope failure prevention measures and flash flooding prevention measures.
Examples	Defensible space, reducing hazardous fuels, removing standing burned trees, ignition-resistant construction, installing warning signs, strengthen or harden water systems that were burned and caused contamination, reseeding ground cover, planting grass to prevent noxious weeds, erosion barriers on slopes, modify/remove culverts, drainage dips and emergency spillways.
Additional Information	The application period opens with the state or territory's first FMAG declaration of the fiscal year and closes six months after the end of that fiscal year. Application extensions may be requested. https://www.fema.gov/grants/mitigation/post-fire

HMGP	
Description	FEMA’s Hazard Mitigation Grant Program provides funding to state, local, tribal and territorial governments so they can develop hazard mitigation plans and rebuild in a way that reduces, or mitigates, future disaster losses in their communities. Funding is available when authorized under a Presidential major disaster declaration and in areas of the state requested by the Governor. Federally recognized tribes may also submit a request for a Presidential major disaster declaration within their impacted areas. All state, local, tribal and territorial governments must develop and adopt hazard mitigation plans to receive funding for their hazard mitigation projects.
Funds Available	Amount of funding is based on the estimated total or aggregate cost of disaster assistance: Up to 15% of the first \$2 billion; Up to 10% for amounts between \$2 billion and \$10 billion; Up to 7.5% for amounts between \$10 billion and \$35.333 billion; States with enhanced mitigation plans: Up to 20%, not to exceed \$35.333 billion.
Eligibility	Project eligibility under HMGP can be limited by the State as part of the HMGP Administrative Plan developed post-disaster. For example, funding may only be made available for projects that are related to the type of disaster, i.e., HMGP related to a significant flood disaster declaration may only be designated for flood mitigation projects like acquisitions of repetitively flooded properties.
Examples	Retrofitting existing buildings to make them less susceptible to damage from a variety of natural hazards. Purchasing hazard prone property to remove people and structures from harm’s way. Drainage improvement projects to reduce potential for flood damage. Eligible project types do not have to coincide with the type of disaster declaration, as the state decides funding prioritization accordingly.
Additional Information	In this program, private homeowners and businesses cannot apply for a grant. However, a local community or other public entity may apply for funding on their behalf. Generally, the cost share is 75% federal and 25% non-federal funding. The 25% can come from any non-federal source, such as the state or local government, an individual, private contributions, Increased Cost of Compliance (ICC) funds from a flood insurance policy, or Small Business Administration loans. Additional information can be found at: https://www.fema.gov/grants/mitigation/hazard-mitigation/before-you-apply

Pre-Disaster Mitigation (PDM)	
Description	The Pre-Disaster Mitigation grant program makes federal funds available to state, local, tribal, and territorial governments to plan for and implement sustainable cost-effective measures. These mitigation efforts are designed to reduce the risk to individuals and property from future natural hazards, while also reducing reliance on federal funding from future disasters.
Funds Available	On March 1, 2023, FEMA published a Notice of Funding Opportunity (NOFO) for FY23 Pre-Disaster Mitigation grant program. The total amount of funds that are being made available to 100 congressionally directed projects will be \$233,043,782. Applicants may request up to an additional 5% of project costs for management and administration of the program from a separate pool of funds.
Eligibility	Only states, territories, or federally recognized tribal governments identified by Congress in the Consolidated Appropriations Act and enumerated in the accompanying Joint Explanatory Statement for Division F are identified in this Notice of Funding Opportunity (NOFO) and are eligible to apply. All applicants and subapplicants must have a FEMA-approved Hazard Mitigation Plan by the application deadline
Examples	Storm Shelters, Wildfire Prevention Project, Bridge Rehabilitation, Drainage Improvements, Water Storage Tanks, Flood Mitigation Planning Projects, Evacuation Center, and more.
Additional Information	https://www.fema.gov/grants/mitigation/pre-disaster
Recovery and Resilience Resource Library	
Description	FEMA developed library to navigate the numerous programs available to the United States and its territories to help recover from a disaster. Tool helps users to find and research federal disaster recovery resources that would be beneficial to pre-disaster recovery planning or in the wake of a disaster.
Funds Available	Varies
Eligibility	Resources are intended for state, local, territorial, and tribal governments as well as non-profits, businesses, healthcare institutions, schools, individuals, and households.
Examples	Evidence-based or evidence-informed interventions to strengthen rural and urban communities.
Additional Information	https://www.fema.gov/emergency-managers/practitioners/recovery-resilience-resource-library

State and Local Cybersecurity Grant Program	
Description	Funding to help states, local governments, rural areas, and territories address cybersecurity risks and cybersecurity threats to information systems.
Funds Available	\$183.5 million is available under the SLCGP, with varying funding amounts allocated over four years from the Infrastructure Investment and Jobs Act. The recipient contribution can be cash (hard match) or third-party in-kind (soft match).
Eligibility	All U.S. states and territories are eligible to apply. The designated State Administrative Agency (SAA) for each state and territory is the only entity eligible to apply for SLCGP funding.
Examples	Planning, equipment, exercises, management & administration, organization, and training. This year, each state and territory will receive a funding allocation as determined by the statutory formula:
Additional Information	<ul style="list-style-type: none"> • Allocations for states and territories include a base funding level as defined for each entity: 1% for each state, the District of Columbia, and Puerto Rico; and 0.25% for American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, and the U.S. Virgin Islands. • State allocations include additional funds based on a combination of state population and rural population totals. • 80% of total state allocations must support local entities, while 25% of the total state allocations must support rural entities; these amounts may overlap.
Safeguarding Tomorrow through Ongoing Risk Mitigation Revolving Loan Fund (STORM-RLF)	
Description	FEMA is making \$50 million available to fund capitalization grants that enable eligible entities to administer revolving loan funds and provide direct loans to local governments for projects and activities that mitigate the impacts of drought, intense heat, severe storms (including hurricanes, tornados, windstorms, cyclones, and severe winter storms), wildfires, floods, earthquakes, and other natural hazards. FEMA will work closely with participating entities and gather best practices on topics such as entity administrative burden and capacity, achieving resilience and equity goals, and common project and activity types for loans under this program. FEMA's goal is to increase entity participation with higher funding levels in future grant cycles.
Funds Available	FEMA intends to award \$472 million of the funds available under the new program to address climate change and create a more equitable and resilient nation.
Eligibility	Eligible entities are States, Federally recognized tribes that received a major disaster declaration, Territories, and the District of Columbia. State entities must enroll in this program for it to be an option to local public entities.
Examples	This is an opportunity to prioritize low-impact development, wildland-urban interface management, conservation areas, reconnection of floodplain and open space projects. Funding can be utilized for building code adoption and enforcement. Allowable uses include: Mitigation Activities, Non-Federal Cost-Share, Local Government Technical Assistance, and Entity Administrative Costs.
Additional Information	https://www.fema.gov/grants/mitigation/storm-rlf

U.S. Army Corps of Engineers

Planning Assistance to States

Description	Provides assistance in the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources. Typical studies are only planning level of detail, not design for project construction. Program can encompass many types of studies dealing with water resource issues. PAS program has two types of efforts-comprehensive plans and technical assistance: Comprehensive Plans and Technical Assistance. Comprehensive Plan Assistance includes planning for the development, utilization, and conservation of the water and related resources of drainage basins, watersheds, or ecosystems located within the boundaries of that State, including plans to comprehensively address water resources challenges such as the state water plan. Comprehensive plans can extend across state boundaries provided both States agree. Technical Assistance provided through the PAS program includes support of planning efforts related to the management of state water resources, including the provision and integration of hydrologic, economic, or environmental data and analysis in support of the State's water resources management and related land resources development plans identified in the state water plan or other water resources management related state planning documents, such as state hazard mitigation, preparedness, response, and recovery plans and plans associated with changing hydrologic conditions, climate change, long-term sustainability, and resilience.
Funds Available	Comprehensive planning activities through the PAS program are cost shared (50 per cent) with the study partner, and voluntarily contributed funds in excess of cost share may be provided by the non-Federal partner. The non-Federal cost share for preparation of a state comprehensive water resources plan may be provided by funds or through the provision of services, materials, supplies, or other in-kind services. Technical assistance activities through the PAS program are cost shared (50 per cent) with the study partner, and voluntarily contributed funds in excess of cost share may be provided by the non-Federal partner. The cost-share for technical assistance must be provided by funds (not in-kind).
Eligibility	States, local governments, other non-Federal entities, and eligible Native American Indian tribes.
Examples	Types of studies in recent years include water supply/demand, water conservation, water quality, environmental/conservation, wetlands evaluation/restoration, dam safety/failure, flood damage reduction, coastal zone protection, and harbor planning.
Additional Information	https://www.nae.usace.army.mil/missions/public-services/planning-assistance-to-states/

U.S. Bureau of Reclamation – WaterSMART**Small Scale Water Efficiency Projects**

Description	Funding for small-scale on-the-ground water management projects that conserve, better manage, or otherwise increase efficient use of water supplies. Projects supported by an existing water management and conservation plan, System Optimization Review, or other planning effort led by the applicant are prioritized.
Funds Available	Applicants may request up to \$100,000 in federal funding, with a non-federal cost-share of 50% or more of total project costs for projects with total project costs no more than \$225,000.
Eligibility	Eligible applicants for all WaterSMART Grants funding opportunities include states; tribes; irrigation districts; water districts; state, regional, or local authorities, whose members include one or more organization with water or power delivery authority; other organizations with water or power delivery authority; and nonprofit conservation organizations that are acting in partnership with and with the agreement of an entity previously described. To be eligible, applicants must be located in the Western United States or U.S. Territories. Entities located in Alaska and Hawaii are also eligible to apply.
Examples	Example projects include Canal lining/piping, municipal metering, irrigation flow measurement, SCADA and automation, landscape irrigation measures, high-efficiency indoor appliances and fixtures, commercial cooling systems.
Additional Information	https://www.usbr.gov/watersmart/swep/index.html

Water Marketing Strategy Grants

Description	Financial assistance for the development of water marketing strategies to facilitate water markets as a tool for helping willing buyers and sellers meet water demands efficiently in times of shortage and prevent water conflicts.
Funds Available	Program funding is allocated through a competitive process. Applicants may request federal funding up to \$400,000 for projects to be completed within three years with a non-Federal cost share of 50% or more of the total project cost.
Eligibility	Eligible applicants for all WaterSMART Grants funding opportunities include states; tribes; irrigation districts; water districts; state, regional, or local authorities, whose members include one or more organization with water or power delivery authority; other organizations with water or power delivery authority; and nonprofit conservation organizations that are acting in partnership with and with the agreement of an entity previously described. To be eligible, applicants must be located in the Western United States or U.S. Territories. Entities located in Alaska and Hawaii are also eligible to apply.
Examples	Funding awarded under Water Marketing Strategy Grants can be used for outreach and partnership building, planning activities (e.g., hydrologic, economic, legal and other types of analysis), pilot activities, and the development of a “water marketing strategy” document.
Additional Information	https://www.usbr.gov/watersmart/watermarketing/index.html

Water and Energy Efficiency Grants

Description	Focuses on projects that result in quantifiable and sustained water savings, including canal lining and piping projects, municipal metering projects, and Supervisory Control and Data Acquisition (SCADA) and automation projects.
Funds Available	Applicants may request federal funding: (I) up to \$500,000 for projects to be completed within two years, (II) up to \$2 million for projects to be completed within three years; and (III) up to \$5 million for projects to be completed within three years, with a non-Federal cost share of 50% or more of the total project cost. No more than \$5,000,000 in total WaterSMART Water and Energy Efficiency Grants funds will be awarded to any single applicant under this Funding Opportunity per fiscal year (i.e., an applicant may receive up to \$5.0M in FY 2023 funds).
Eligibility	Eligible applicants for all WaterSMART Grants funding opportunities include states; tribes; irrigation districts; water districts; state, regional, or local authorities, whose members include one or more organization with water or power delivery authority; other organizations with water or power delivery authority; and nonprofit conservation organizations that are acting in partnership with and with the agreement of an entity previously described. To be eligible, applicants must be located in the Western United States or U.S. Territories. Entities located in Alaska and Hawaii are also eligible to apply.
Examples	Projects conserve and use water more efficiently; increase the production of hydropower; mitigate conflict risk in areas at a high risk of future water conflict; and accomplish other benefits that contribute to water supply reliability in the western United States.
Additional Information	https://www.usbr.gov/watersmart/weeg/faq.html

U.S. Department of Agriculture

Conservation Innovation Grants (CIG)

Description	Competitive program that supports the development of new tools, approaches, practices, and technologies to further natural resource conservation on private lands. Through creative problem solving and innovation, CIG partners work to address our nation's water quality, air quality, soil health and wildlife habitat challenges, all while improving agricultural operations. Public and private grantees develop the tools, technologies, and strategies to support next-generation conservation efforts on working lands and develop market-based solutions to resource challenges.
Funds Available	Applications made a CIG funding notice is announced each year. Funds for single- or multi-year projects, not to exceed three years, are awarded through a nationwide competitive grants process. Grantees must match the CIG investment at least one to one.
Eligibility	The natural resource concerns eligible for funding through CIG are identified in the funding announcement and may change annually to focus on new and emerging, high-priority natural resource concerns. National and State CIG – all non-Federal entities and individuals are eligible to apply. All CIG projects must involve EQIP-eligible producers.
Examples	Projects may be watershed-based, regional, multi-state or nationwide in scope.
Additional Information	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/

Emergency Watershed Protection Program	
Description	The EWP Program offers technical and financial assistance to help local communities relieve imminent threats to life and property caused by floods, fires, windstorms, and other natural disasters that impair a watershed. EWP does not require a disaster declaration by federal or state government officials for program assistance to begin.
Funds Available	NRCS may provide technical assistance as services and/or funds to plan, design, and contract the emergency measures, subject to an agreement between NRCS and the Sponsor. Installation/Construction costs are not to exceed 75% or 90% for limited resource areas. Engineering/Technical Assistance is not to exceed 100%. No funds are available for real property rights.
Eligibility	Project criteria requires the project to provide protection from flooding or soil erosion; reduce threats to life and property; restore the hydraulic capacity to the natural environment; and economically and environmentally defensible. Eligible local sponsors for recovery projects include cities, counties, towns, conservation districts, or any federally-recognized Native American tribe or tribal organization.
Examples	Removal of debris from stream channels, road culverts, and bridges; reshaping and protection of eroded streambanks; correction of damaged or destroyed drainage facilities; establishing vegetative cover on critically eroding lands; repair of levees and structures; repair of certain conservation practices; and purchase of floodplain easements.
Additional Information	https://www.nrcs.usda.gov/programs-initiatives/ewp-emergency-watershed-protection
Small Business Innovation Research	
Description	The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs at the U.S. Department of Agriculture (USDA) offer competitively awarded grants to qualified small businesses to support high quality research related to important scientific problems and opportunities in agriculture that could lead to significant public benefits. This program has two phases, Phase I is open to any small business concern that meets the SBIR/STTR eligibility requirements and Phase II is open only to previous Phase I awardees.
Funds Available	Funds are offered across 10 topic areas including: Forests and Related Resources, Plant Production and Protection-Biology, Animal Production and Protection, Conservation of Natural Resources, Food Science and Nutrition, Rural and Community Development, Aquaculture, Biofuels and Biobased Products, Small and Mid-size Farms, and Plant Production and Protection-Engineering
Eligibility	The SBIR/STTR programs do not make loans and do not award grants for the purpose of helping a business get established. The program seeks to stimulate technological innovation in the private sector, strengthen the role of small businesses in meeting federal research and development needs, increase private sector commercialization of innovations derived from USDA-supported research and development efforts, and foster and encourage participation by women-owned and socially and economically disadvantaged small business firms in technological innovations
Examples	Salary and wages for company employees, associated fringe benefits, materials and supplies, and a number of other direct costs needed to conduct the proposed R&D
Additional Information	https://www.nifa.usda.gov/grants/programs/small-business-innovation-research-technology-transfer-programs-sbirsttr

Watershed Rehabilitation Program

Description	The Watershed Rehabilitation Program helps project sponsors rehabilitate aging dams that are reaching the end of their design life and/or no longer meet federal or state standards. NRCS provides technical and financial assistance to local project sponsors to rehabilitate aging dams that protect lives and property, and infrastructure.
Funds Available	Across the Nation, watershed REHAB projects provide over \$2.2 billion in reduced flooding and erosion damage while improving wildlife habitat, recreation, water quality and supply for an estimated 47 million people. Costs associated with additional or new water supply storage purposes added to the rehabilitation project may be cost-shared with watershed rehabilitation funds. Eligible project costs are covered 65% Federal/35% Local of total eligible project cost, not to exceed 100% of actual construction cost. No more than 100% of the engineering/Technical Assistance will be covered.
Eligibility	Eligible projects are dams that were originally constructed through a NRCS Watershed Program, no longer meet current safety and performance standards, including dams past their evaluated life, and has current operation and maintenance.
Examples	<i>Information not available</i>
Additional Information	https://www.nrcs.usda.gov/programs-initiatives/watershed-rehabilitation

Watershed and Flood Prevention Operations Program

Description	The WFPO program provides technical and financial assistance to help plan and implement authorized watershed projects for the purpose of flood prevention, watershed protection, public recreation, public fish and wildlife, agricultural water management, municipal and industrial water supply, water quality management, and watershed structure rehabilitation. The WFPO Program helps units of federal, state, local and tribal of government (project sponsors) protect and restore watersheds up to 250,000 acres. Nebraska Natural Resources Conservation Service (NRCS) has assisted public sponsors with construction of nearly 900 dams for the primary purposes of flood reduction and grade stabilization.
Funds Available	Nebraska has had over 60 approved WFPO plans providing over \$80 million in average annual benefits. The percentage of a project that will be covered by the federal cost-sharing varies by project purpose. Engineering and Technical Assistance is covered 100% for most project, except for Municipal and Industrial Water Supply projects. The percentage of installation/construction costs that are covered are as follows: Flood prevention-100%, Watershed Protection - Variable, Public Fish and Wildlife or Public Recreational Development - No more than 50%, Agricultural Water Management - Up to 75%, Municipal and Industrial Water Supply - no more than 50%, Water Quality Management - To be determined, Rehabilitation - No more than 100%.
Eligibility	Project criteria requires public sponsorship, be a watershed project of 250,000 acres or less, and have agricultural benefits that, including rural communities, must be 20% or more of the total benefits for the project. Eligible project sponsors include States, local governments, and tribal organizations.
Examples	Watershed Plans, flood prevention projects, drainage, irrigation, reservoir structure, dams.
Additional Information	https://www.nrcs.usda.gov/conservation-basics/conservation-by-state/nebraska/nebraska-watershed-and-flood-prevention-program

U.S. Department of Agriculture Rural Development Funding**Community Facilities Loans and Grants**

Description	This program provides affordable funding to develop essential community facilities in rural areas, an essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial, or business undertakings.
Funds Available	<i>Information not available</i>
Eligibility	Eligible for areas 20,000 or less in population. Applicants are municipalities, non-profits, special purpose districts, and federally recognized Indian tribes. Eligible borrowers include public bodies, community based non-profit corporations, and federally recognized tribes.
Examples	Funds can be used to purchase, construct, and/or improve essential community facilities, purchase equipment, and pay related project expenses
Additional Information	https://www.rd.usda.gov/programs-services/community-facilities/community-facilities-direct-loan-grant-program/ne

Community Facility Rural Community Development Initiative Grants

Description	RCDI grants are awarded to help non-profit housing and community development organizations, low-income rural communities and federally recognized tribes support housing, community facilities, and community and economic development projects in rural areas. Funds may be used to improve housing, community facilities, and community and economic development projects in rural areas.
Funds Available	Grants are awarded with a minimum amount of \$50,000 and maximum of \$250,000. Funds are limited and are awarded through a competitive process. Matching fund requirement equal to amount of grant but in-kind contributions cannot be used as matching funds. Partnerships with other federal, state, local, private, and nonprofit entities are encouraged.
Eligibility	Open to public bodies, non-profit organizations, and qualified private organizations. Rural and rural areas other than a city or town with a population of greater than 50,000 people and the urbanized area contiguous and adjacent to such city or town.
Examples	RCDI grants may be used for but are not limited to training sub-grantees and providing technical assistance to sub-grantees on strategic plan developments, accessing alternative funding sources, board training, developing successful child care facilities, creating training tools, and effective fundraising techniques.
Additional Information	https://www.rd.usda.gov/programs-services/community-facilities/rural-community-development-initiative-grants#overview

Community Facility Technical Assistance and Training Grant	
Description	Provide associations Technical Assistance and/or training with respect to essential community facilities programs. The Technical Assistance and/or training will help identify and plan for community facility needs that exist in the area. Once those needs have been identified, the Grantee can assist in identifying public and private resources to finance those identified community facility needs.
Funds Available	Maximum grant award of \$150,000. Grant funds are limited and are awarded through a competitive process. Matching funds are not required, in-kind contributions cannot be used as matching funds, partnerships with other entities are encouraged.
Eligibility	Open to public bodies, non-profit organizations, and federally recognized tribes. Rural areas including cities, villages, townships, towns, and Federally Recognized Tribal Lands outside the boundaries of a city of 20,000 or more.
Examples	Webster County purchased a new ambulance and equipment with Rural Development funds (and other sources) and South Sioux City was able to build a new fire station with funding from USDA Rural Development (and other sources).
Additional Information	https://www.rd.usda.gov/programs-services/community-facilities/community-facilities-technical-assistance-and-training-grant#overview
Emergency Community Water Assistance Grants (ECWAG)	
Description	This program helps eligible communities prepare for, or recover from, an emergency that threatens the availability of safe, reliable drinking water. A federal disaster declaration is not required, and this grant covers events such as drought or flood, earthquake, tornado or hurricane, disease outbreak, chemical spill, leak, or seepage, or other disasters.
Funds Available	Up to \$150,000 for water transmission line projects. Water Source grants up to \$1,000,000.
Eligibility	Primarily for residential purposes and are eligible for 10,000 or less population areas. Applicants are municipalities, special purpose districts (RWS), non-profits, and Recognized Indian Tribes. Applications are accepted year-round online through the RD Apply or through local RD office
Examples	Construction of waterline extensions, repair breaks or leaks in existing water distribution lines, and address related maintenance necessary to replenish the water supply. Water Source Grants are to construct a water source, intake, or treatment facility.
Additional Information	https://www.rd.usda.gov/programs-services/water-environmental-programs/emergency-community-water-assistance-grants/ne

U.S. Department of Energy**Grid Innovation Program**

Description	This program provides support for projects that use innovative approaches to transmission, storage, and distribution infrastructure to enhance grid resilience and reliability. Projects selected under this program will include interregional transmission projects, investments that accelerate interconnection of clean energy generation, and utilization of distribution grid assets to provide backup power and reduce transmission requirements. Innovative approaches can range from use of advanced technologies to innovative partnerships to the deployment of projects identified by innovative planning processes.
Funds Available	The Grid Innovation Program will invest up to \$5 billion (\$1 billion/year for Fiscal Years 2022-2026) in innovation and new approaches to transmission, distribution, storage, and regional resilience. The first funding cycle will include both FY22 and FY23, up to \$2 billion. Projects are subject to a 50% cost share minimum.
Eligibility	Eligible entities include a state, a combination of 2 or more states, an Indian Tribe, a unit of local government, or a public utility commission.
Examples	Transmission, storage, and distribution infrastructure to enhance grid resilience and reliability.

Grid Resilience Utility and Industry Grants

Description	Grants provide funding to support activities that will modernize the electric grid to reduce impacts from extreme weather and natural disasters. This grant program will fund comprehensive transformational transmission and distribution technology solutions that will mitigate weather hazards across a region or within a community that can cause a disruption to the power system. Grants awarded under the program will fund transmission and distribution technology projects that seek to address hazards within a region or a community that can disrupt the power system, such as wildfires, floods or hurricanes.
Funds Available	Funding of \$2.5 Billion over five years from FY 22-26 with \$500 million available per year. Funding is capped at the amount the eligible entity has spent in the previous three years on hardening efforts. There is a 100% cost match for this program. The program includes a small utility set aside for those entities selling no more than 4 million MWh of electricity per year.
Eligibility	This funding opportunity is available to electric grid operators, electricity storage operators, electricity generators, transmission owners or operators, distribution providers, and fuel suppliers.
Examples	Infrastructure upgrades to strengthen and modernize the power grid against natural disasters that are exacerbated by the climate crisis.
Additional Information	https://www.energy.gov/gdo/grid-resilience-utility-and-industry-grants

Smart Grid Grants	
Description	Smart Grid Grants is designed to increase the flexibility, efficiency, and reliability of the electric power system, with particular focus on: increasing capacity of the transmission system, preventing faults that may lead to wildfires or other system disturbances, integrating renewable energy at the transmission and distribution levels, and facilitating the integration of increasing electrified vehicles, buildings, and other grid-edge devices. Smart grid technologies funded and deployed at scale through this program must demonstrate a pathway to wider market adoption.
Funds Available	The Smart Grid Grant program will invest up to \$3 billion (\$600 million/year for Fiscal Years 2022-2026) in grid resilience technologies and solutions. The first funding cycle will include both FY22 and FY23, up to \$1.2 billion. Recipients must provide a cost-share of at least 50% of the grant.
Eligibility	This program is open to domestic entities including institutions of higher education; for-profit entities; non-profit entities; and state and local governmental entities, and tribal nations.
Examples	Grid enhancing technologies such as dynamic line rating, flow control devices, advanced conductors, and network topology optimization, to improve system efficiency and reliability. Investments in optical ground wire, dark fiber, operational fiber, and wireless broadband communications networks.
Additional Information	https://www.energy.gov/gdo/grid-innovation-program

U.S. Department of Housing and Urban Development

Community Development Block Grants	
Description	Provides annual grants on a formula basis to states, cities, and counties to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons.
Funds Available	HUD determines the amount of each entitlement grantee’s annual funding allocation by a statutory dual formula which uses several objective measures of community needs, including the extent of poverty, population.
Eligibility	Eligible grantees include principal cities of Metropolitan Statistical Areas, Other metropolitan cities with populations of at least 50,000, qualified urban counties with populations of at least 200,000 (excluding the population of entitled cities), States and insular areas. Eligibility for participation as an entitlement community is based on population data provided by Census. Each activity must meet one of the following national objectives for the program: benefit low- and moderate-income persons; prevention or elimination of slums or blight, or address community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community for which other funding is not available.
Examples	CDBG funds may be used for activities which include, but are not limited to: Acquisition of real property; Relocation and demolition; Rehabilitation of residential and non-residential structures; Construction of public facilities and improvements, such as water and sewer facilities, streets, neighborhood centers, and the conversion of school buildings for eligible purposes; Public services, within certain limits; Activities relating to energy conservation and renewable energy resources; Provision of assistance to profit-motivated businesses to carry out economic development and job creation/retention activities
Additional Information	HUD does not provide CDBG assistance directly to individuals, businesses, nonprofit or organizations or other non-governmental entities. https://www.hud.gov/program_offices/comm_planning/cdbg

CDBG Disaster Recovery Assistance

Description	The Community Development Block Grant (CDBG) Program has Disaster Recovery grants to rebuild the affected areas and provide crucial seed money to start the recovery process. These flexible grants help cities, counties, and States recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations. Since CDBG Disaster Recovery (CDBG-DR) assistance may fund a broad range of recovery activities, HUD can help communities and neighborhoods that otherwise might not recover due to limited resources.
Funds Available	Varies according to the state plan outlined by the state department of economic development.
Eligibility	CDBG-DR funds are provided to the most impacted and distressed areas for Disaster Relief, Long-Term Recovery, Restoration of Infrastructure, Housing, and Economic Revitalization. HUD will notify eligible States, cities and counties if they are eligible to receive CDBG-DR grants. Those who receive grant money include state agencies, non-profit organizations, economic development agencies, citizens and businesses
Examples	Funding can be provided to cover unmet needs such as local cost share funding from public assistance projects or hazard mitigation grant projects.
Additional Information	https://www.hud.gov/program_offices/comm_planning/cdbg-dr

Neighborhood Stabilization Program

Description	The Neighborhood Stabilization Program (NSP) was established for the purpose of providing emergency assistance to stabilize communities with high rates of abandoned and foreclosed homes, and to assist households whose annual incomes are up to 120 percent of the area median income (AMI). NSP funds were used for activities which included: Establish financing mechanisms for purchase and redevelopment of foreclosed homes and residential properties; Purchase and rehabilitate homes and residential properties abandoned or foreclosed; Establish land banks for foreclosed homes; Demolish blighted structures; Redevelop demolished or vacant properties.
Funds Available	\$4 billion nationwide. Iowa receives \$21.6 million in NSP funding while Nebraska receives \$19.6 million.
Eligibility	States, certain local governments, and other organizations.
Examples	The NSP provides grants to every state, certain local communities, and other organizations to purchase foreclosed or abandoned homes and to rehabilitate, resell, or redevelop these homes in order to stabilize neighborhoods and stem the decline of house values of neighboring homes.
Additional Information	https://www.hud.gov/program_offices/comm_planning/nsp

U.S. Economic Development Administration

Public Works and Economic Adjustment Assistance (EAA)

Description	The EAA provides funding to help plan, build, innovate, and put people into quality jobs in hundreds of communities across the nation. The Economic Adjustment Assistance program is EDA’s most flexible program, and grants made under this program will help hundreds of communities across the nation plan, build, innovate, and put people back to work through construction or non-construction projects designed to meet local needs.
Funds Available	Total Program Funding of \$500 Million with an award ceiling of \$10 Million and a floor of \$100,000.
Eligibility	A wide range of technical, planning, workforce development, entrepreneurship, and public works and infrastructure projects are eligible for funding under this program. Eligible applicants for EDA’s Economic Adjustment Assistance program include a(n): District Organization of an EDA-designated Economic Development District; Indian Tribe or a consortium of Indian Tribes; State, county, city, or other political subdivision of a State, including a special purpose unit of a State or local government engaged in economic or infrastructure development activities, or a consortium of political subdivisions; Institution of higher education or a consortium of institutions of higher education; Public or private non-profit organization or association acting in cooperation with officials of a political subdivision of a State. Individuals or for-profit entities are not eligible.
Examples	Public infrastructure related to economic development.
Additional Information	As part of the \$300 million Coal Communities Commitment, EDA will allocate at least \$200 million of the Economic Adjustment Assistance funding to support coal communities.

U.S. Environmental Protection Agency

Clean Waters Act Section 319 Grants

Description	Clean Water Act Section 319(h) funds are provided only to designated state and tribal agencies to implement their approved nonpoint source management programs. State and tribal nonpoint source programs include a variety of components, including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and regulatory programs.
Funds Available	Each year EPA awards Section 319(h) funds to states in accordance with a state-by-state allocation formula that EPA has developed in consultation with the states. Grant totals increased from \$155.9 million in 2013 and \$178 million in 2022.
Eligibility	<i>Information not available</i>
Examples	<i>Information not available</i>
Additional Information	https://www.epa.gov/sites/default/files/2015-09/documents/319-guidelines-fy14.pdf

Environmental Justice Collaborative Problem-Solving

Description	This cooperative agreement program provides financial assistance to eligible organizations working on or planning to work on projects to address local environmental and/or public health issues in their communities. The program assists recipients in building collaborative partnerships with other stakeholders to develop solutions that will significantly address environmental and/or public health issue(s) at the local level. Selected applicants, or recipients, are required to use the EPA’s Environmental Justice Collaborative Problem Solving Model as part of their projects.
Funds Available	The EJCPS Program anticipates awarding approximately \$30,000,000 of Inflation Reduction Act funding through 83 cooperative agreements, organized in two tracks of funding. \$25,000,000 for CBOs proposing projects for up to \$500,000 each. Approximately 50 awards for up to \$500,000 each are anticipated under this track. \$5,000,000 for qualifying small CBOs

with 5 or fewer full-time employees proposing projects for up to \$150,000 each. For more details about this opportunity, please review closely the “Small Community-based Nonprofit Set Aside”. Approximately 33 awards for up to \$150,000 each are anticipated under this track.

Cooperative agreements will be funded for a three-year performance period.

Eligibility	Eligible entities include incorporated non-profit organizations, US Territories, Tribal government, either federally or state recognized, tribal organizations, and freely associated states.
Examples	In 2003 the Pacific Basin Development Council received this grant to build community resiliency.
Additional Information	https://www.epa.gov/environmentaljustice/environmental-justice-collaborative-problem-solving-cooperative-agreement-5

Urban Waters Small Grants

Description	The mission of this program is to help local residents and their organizations, particularly those in underserved communities, restore their urban waters in ways that also benefit community and economic revitalization. The program recognizes that healthy and accessible urban waters can help grow local businesses and enhance educational, recreational, social, and employment opportunities in nearby communities. Projects should meet the following four objectives: address local water quality issues related to urban runoff pollution; provide additional community benefits; actively engage underserved communities; and foster partnership.
Funds Available	Urban Waters Small Grants are competed and awarded every two years with individual award amounts of up to \$60,000.
Eligibility	Eligible applicants include States, local governments, Indian Tribes, public and private universities and colleges, public or private nonprofit institutions/organizations, intertribal consortia, and interstate agencies.
Examples	An example of a past grant awarded was to the University of Nebraska-Lincoln in 2015-2016 to provide technical assistance and training on stormwater and green infrastructure to small businesses and residents of under-served communities.
Additional Information	https://www.epa.gov/urbanwaterspartners/urban-waters-small-grants

Water Infrastructure Finance and Innovation Act of 2014 (WIFIA)

Description	The WIFIA program provides long-term, low-cost supplemental loans for regionally and nationally significant water and wastewater infrastructure projects. Borrowers benefit from a single fixed interest rate that is equal to the US Treasury rate of a similar maturity, an interest rate that is not impacted by the borrower's credit or loan structure, custom long-term repayment schedules with options to defer payment for up to 5 years.
Funds Available	\$20 million minimum project size for large communities, \$5 million minimum for small communities of 25,000 or less. WIFIA can fund a maximum of 49% of eligible project costs.
Eligibility	Eligible borrowers are 1) local, state, tribal, and federal government entities; 2) Partnerships and joint ventures; 3) Corporations and trusts; 4) Clean Water and Drinking Water State Revolving Fund (SRF) programs.
Examples	Wastewater conveyance and treatment projects. Drinking water treatment and distribution projects. Enhanced energy efficiency projects at drinking water and wastewater facilities.
Additional Information	Total federal assistance may not exceed 80% of a project's eligible costs. https://www.epa.gov/wifia/what-wifia

U.S. Fish and Wildlife Services

North American Wetlands Conservation Standard and Small Grant

Description	A competitive matching grants program that supports public-private partnerships carrying out projects in the United States that further the goals of the North American Wetlands Conservation Act. These projects must involve long-term protection, restoration, and/or enhancement of wetlands and associated uplands habitat for the benefit of all wetlands-associated migratory birds.
Funds Available	US Small Grants may not exceed \$100,000 and require a 1-to-1 ratio match for awarded grant amount. The US Standard Grant is for grants larger than \$100,000 and requires a 1-to-1 match ratio.
Eligibility	US Small Grants proposals are due in October or else will be considered an early submission for the next Fiscal Year. The US Standard Grant has a two deadline for proposals, one in February and one in July. Proposal submitted after July are considered ineligible unless clearly marked as an early submission for the next Fiscal Year.
Examples	Acquisition of land for the purposes of wetlands conservation, wetland restoration projects, wetland enhancement projects, wetland establishment, or other direct long-term wetland conservation work.
Additional Information	https://www.fws.gov/sites/default/files/documents/north-american-wetlands-conservation-act-us-eligibility-criteria_0.pdf

U.S. Forest Service

Forestry Legacy Program

Description	Focuses on private forest land that is faced by threats of conversion to non-forest land by urbanization, residential development. Providing economic incentives to landowners to keep forests as forest encourages sustainable forest management and supports strong markets for forest products. Landowners participate in the FLP by either selling property outright or by retaining ownership and selling only a portion of the property’s development rights; both are held by state agencies or another unit of government. Use of a conservation easement allows land to remain in private ownership while ensuring that its environmental values are retained. Program funded by Land and Water Conservation Fund, which invests a small percentage of federal offshore drilling fees towards the conservation of important land, water, and recreation areas for all Americans.
Funds Available	Fiscal Year 2022 totaled \$88,878,955 across 14 projects.
Eligibility	Private Lands
Additional Information	https://www.fs.usda.gov/managing-land/private-land/forest-legacy/program

STATE OF NEBRASKA FUNDING RESOURCES

In addition to federal grants, there are a number of state agencies and programs with potential applicability to supporting funding and implementation of mitigation projects. Many federal hazard mitigation grant programs are administered at the state level by NEMA and NeDNR, as noted above. These agencies will also likely be important in earlier stages of the hazard mitigation planning process by providing current hazard and risk assessment data.

While this section of the funding guidebook attempts to list as many funding options as possible, it is by no means a complete list of programs in Nebraska that could have the potential to support hazard mitigation project implementation. Similar to federal grant programs, many of these programs are dependent on yearly funding allocations, which results in fluctuations in their availability. The websites and reference materials used to provide this information are as current as possible; however, it is important to note that funding programs are dynamic and subject to frequent changes. While it is helpful to be familiar with the current information, it is equally as important to engage candidate federal and state agencies in a dialog as soon as possible.

Nebraska Department of Natural Resources**Flood Mitigation Assistance**

Description	The Flood Mitigation Assistance Grant Program (FMA) is administered by NeDNR and provides financial assistance for either planning or projects that assist in decreasing long-term risk of flood damage to structures insured under the National Flood Insurance Program. The FMA program has priorities to mitigate structures that have suffered repeated flood claims and those with severe repetitive loss.
Funds Available	Approximately \$800 million nationwide in 2022. Nebraska did not receive any FMA in 2022.
Eligibility	Municipalities
Examples	Project (structural or non-structural) to reduce or eliminate repetitive flood damage. This includes: Capability and capacity building activities, localized flood risk reduction projects, and individual flood mitigation projects.
Additional Information	http://dee.ne.gov/Publications.nsf/PubsForm.xsp?documentId=56E958FDC603A27A862588B50052EF8E&action=openDocument

Water Sustainability Fund

Description	The Water Sustainability Fund (WSF) is a source of financial support to help local project sponsors achieve the goals set out in Neb. Rev. Stat. § 2-1506. The Nebraska Natural Resources Commission (NRC) oversees WSF operations including application review, scoring & ranking, and awarding funding to successful applicants.
Funds Available	Of the annual funding appropriated by the Nebraska Legislature, ten percent is designated by statute for projects separating storm and sewer water. The NRC also reserves ten percent for projects requesting \$250,000 or less. A 40% local cost match is required of local project sponsors.
Eligibility	Political subdivisions
Examples	Projects that meet the goals and objectives of an approved integrated management plan or ground water management, projects that mitigate the threats to drinking water, improves water quality, contributes to water sustainability goals and water supply initiatives, reduces threats to property damage or critical infrastructure systems.
Additional Information	WSF applications are filed electronically between March 16th and 31st each year. The applications are typically reviewed during the second quarter with final determination made on each application during the third quarter. https://nrc.nebraska.gov/water-sustainability-fund-0

Nebraska Forest Service**Forest Fuels Reduction**

Description	Thinning of dense forests and removal of ladder fuels (ground vegetation that allows a fire to spread into the tree canopy).
Funds Available	Nebraska Forest Service reimburses landowners up to 75% of the costs for tree removal, piling and pile burning (if necessary); remainder paid by landowner.
Eligibility	State and private forest landowners are eligible to apply.
Examples	Thinning of dense forests and removal of hazardous "ladder fuels" from beneath trees.
Additional Information	https://nfs.unl.edu/fuels-assistance

Hazardous Fuels Reduction

Description	Thinning of dense forests and removal of ladder fuels (ground vegetation that allows a fire to spread into the tree canopy) from private or state land adjacent to United States Forest Service (USFS) property.
Funds Available	NFS reimburses the landowner up to 100 percent of the costs for tree removal, piling and burning (if necessary). No landowner cost on eligible properties.
Eligibility	Eligible Locations must be adjacent to USFS property. Eligible Applicants are State and private forest landowners
Examples	Thinning of dense forests and removal of hazardous "ladder fuels" from beneath trees.
Additional Information	https://nfs.unl.edu/fuels-assistance

The Nebraska Environmental Trust**NET Grants**

Description	The Nebraska Environmental Trust (NET) project will fund any project or portion of a project that achieves one or more of the trusts categories. These categories include habitat, surface and ground water, waste management, air quality, and soil management.
Funds Available	In 2023 the NET Board approved the NET Grants Committee's recommendation to fund 23 projects for a total of \$11,347,203. Grants are funded through the proceeds of the Nebraska Lottery, which determines the amount available to applicants.
Eligibility	There are no restrictions on applicants or project sponsors as long as the project falls within the eligibility criteria. Individuals, private organizations, and public entities may apply. For-profit organizations must demonstrate that the project results in public benefit and does not pay for private benefits. See our eligibility criteria for more information.
Examples	Mobile Prescribed Burn Unit and Education Outreach, Increase Fire Capacity & Rangeland Impact - Sandhills, Early warning: Monitoring for agricultural pests and disease vectors in western Nebraska
Additional Information	The Nebraska Environmental Trust accepts grant applications annually. Applications open around July and are due on or before the first Tuesday after Labor Day in September. Applications need to be submitted through our online grant application portal located at the following address: https://environmentaltrustgrants.org/

Silver Jackets

The Silver Jackets	
Description	The Silver Jackets are collaborative state-led interagency teams, continuously working together to reduce flood risk at the state level. Through the Silver Jackets program, the U.S. Army Corps of Engineers, the Federal Emergency Management Agency, additional federal, state and sometimes local and Tribal agencies provide a unified approach to addressing a state's priorities. The Silver Jackets team is the forum where all relevant agencies come together with the state to collaboratively plan and implement that interagency solution. Through partnerships, Silver Jackets optimizes the multi-agency utilization of federal resources by leveraging state/ local/ Tribal resources, including data/information, talent and funding, and preventing duplication of effort.
Funds Available	Varies
Eligibility	Anyone impacted by flooding
Examples	Education and outreach, risk assessments, hydrologic studies
Additional Information	https://floods.nebraska.gov/index.html

Nebraska Department of Economic Development

CDBG Program	
Description	The Small Cities Community Development Block Grant (CDBG) Program, administered through the Nebraska Department of Economic Development, helps smaller local governments fund community projects that might not otherwise be financially feasible. Through funding from the United States Department of Housing and Urban Development, the program allows each community to determine which projects are most needed, with a focus on Housing, Neighborhood Revitalization, Commercial Revitalization and Economic Development
Funds Available	Annually, Nebraska receives \$10.6± million for distribute to eligible applicants, plus prior year resources not obligated and program income. Congress may, at their discretion, appropriate supplemental CDBG funds in response to a natural disaster where a Presidential Declaration has been authorized.
Eligibility	Communities and counties whose residents are 51% or more low- to moderate-income, based on the American Community Survey Five-Year Estimate 2011-2015.
Examples	Flood control, drainage improvements, property buyout and relocation.
Additional Information	https://opportunity.nebraska.gov/programs/community/cdbg/

Nebraska Department of Environment and Energy**Clean Water State Revolving Fund Program**

Description	With the passage of the Amendments to the Clean Water Act (CWA) in 1987, Congress provided for the replacement of the federal Construction Grants program with the Clean Water State Revolving Fund (CWSRF) program and Drinking Water State Revolving Fund (DWSRF) Program. The program provides capitalization grants to state to be used as the basis (along with a required twenty percent state match), to create revolving loan funds which provide low-interest loans to publicly owned water and wastewater systems to finance water and wastewater infrastructure projects, and including, stormwater management.
Funds Available	\$28.2± million for DWSRF Program, plus \$28.35 million for Lead Service Line Replacement, and \$7.56 million for Emerging Contaminants. \$17.7± million for CWSRF Program.
Eligibility	Publicly-owned water and wastewater systems
Examples	Municipal water and wastewater systems, and stormwater management.
Additional Information	http://dee.ne.gov/Publications/PubsForm.xsp?documentId=56E958FDC603A27A862588B50052EF8E&action=openDocument

Alternative Funding Resources

In recent years, states and communities across the country have sought and developed innovative funding sources as alternatives to traditional government grant programs. These funding sources fall into three main categories: Local Funding Options, Public-Private Partnerships, and Private Foundations. These funding sources will be important for current and future hazard mitigation planning efforts for several reasons including:

- Decreases in funding for pre-disaster mitigation grant and assistance programs at the federal level and for state agencies - While technical assistance and other related support functions are still actively supported across federal and state agencies, and in some cases are increasing, allocations for “bricks and mortar” pre-disaster hazard mitigation projects will be competing with a broad range of government funding needs. These funds may not completely disappear, but the need will continue to outstrip the supply in the foreseeable future.
- Opportunities to fund projects that might not qualify or align with traditional grant and assistance programs. Funding programs seek solutions that reduce risk for a particular threshold (i.e., 1-percent flood) and meet absolute cost-benefit criteria that the agencies themselves must adhere to. Therefore, these programs, by their basic nature, are not able to support efforts that may help most of the time but don’t meet these thresholds, e.g., a homeowner installed flood wall in a repetitive loss area that prevents annual floods, but not larger magnitude events that come along every few years. There is a related concept that can be referred to as “cumulative risk reduction”. For example, a homeowner with limited resources (and no real access to grant funds) might be willing to spend a little time and money each year getting just a little bit safer.

LOCAL FUNDING OPTIONS

Local funding options are just what they sound like, using local funds for local mitigation projects. Local funds are also needed as the non-federal share or “matching funds” for federal grant programs but can also be used independently to fund a range of project types. Local funding options include the following:

Capital Improvement Programs – Ongoing civic improvements can include prioritized hazard mitigation projects or mitigation can be included as one aspect of a larger project. For example, improving the hydraulic capacity of a culvert or bridge to prevent upstream flooding while undertaking periodic replacements for end of service considerations is one example. Replacing windows in a school with shatter resistant glass as part of an overall renovation is another example. Capital improvement programs are generally funded with local tax revenues and municipal bonds.

Permits, Fees, and Developer Contributions- Communities can establish fees, earmark a portion of existing permit and fee structures, and/or establish requirements for developer contributions for new developments in hazard prone areas that can then be used to fund local mitigation projects. The proceeds can be accumulated in what is often referred to as a Mitigation Trust Fund and the uses are typically tied to specific project types and/or relationships with projects already identified in specific plans or documents such as an HMP. These types of funds can also be used to create vouchers or other incentives for individual action.

Force Account / In-Kind Services – Although there is a cost associated with activities of public employees, there are a wide range of activities that can be undertaken by local government staff and officials as well as interested parties on their behalf that would yield significant benefits. Some of the obvious examples are public outreach and education for individual property owners, businesses, and institutions to reduce their risk through correspondingly inexpensive or essential activities. This would include tapping into available education resources, promoting individual action, etc.

Property Owners – For a project that directly benefits one or more specific properties, the property owner can be asked to contribute. Through the HIRA process, property owners can become better aware of their risks and options. Owners that recognize they have a real flood problem may be willing to pay a portion of the cost. In recent years, property owners have voluntarily agreed to pay the non-federal share (up to 25 percent of the total project cost) for FEMA HMA grants in some states. In some cases, the owners have paid even higher percentages of the cost. In addition, after a flood, owners may have cash from insurance

claims or disaster assistance that they will be using to repair their homes and properties. By including the right floodproofing and mitigation project components into the repairs, the resilience of the property to future flooding may be improved. Having property owners contribute to the project can help stretch available local funds and gives the property owner an enhanced stake in the outcome of the project and incentive to make sure the property is properly maintained.

Individual Participation – Although mitigation is ultimately intended to benefit individuals, HMPs often neglect to integrate participation of potential beneficiaries into the process. The participation by individuals, including small business owners, is important for making sure the resulting HMP reflects community needs and priorities, but it also allows for the planning team to identify measures and options that individuals can take to reduce their own risk at a cost they can afford.

PUBLIC-PRIVATE PARTNERSHIPS

Developing a public-private partnership is a phrase used frequently in a wide range of government programs and for good reason, especially in the context of hazard mitigation. Participation of private sector organizations in solving their own hazard risk situations can be a low-cost and effective method. The phrase also encompasses finding opportunities for public and private sector partners to share costs equitably for larger projects that require substantial funds to implement. Private sector businesses and organizations have their own cost-benefit calculations to perform but joint efforts may make the balance sheets work for both sides.

PRIVATE FOUNDATIONS

Cultivating relationships with local, regional, or even national foundations with interests or missions consistent with hazard mitigation, community sustainability, climate change adaptation, and other related topics can yield successful results in terms of funding and other means of support.

There are many local foundations around the State of Nebraska, many of which fund programs that can be utilized for components of hazard mitigation projects. Many of these foundations only support non-profit organizations, so the applicability of these funds to projects depends upon the partners involved.