

Upper Loup
Natural Resources District

HAZARD MITIGATION PLAN

2024



PLAN PREPARED BY
JEO CONSULTING GROUP



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LIST OF ACRONYMS

ACS – American Community Survey
CFR – Code of Federal Regulations
CRS – Community Rating System
DHS – Department of Homeland Security
DMA 2000 – Disaster Mitigation Act of 2000
EAB – Emerald Ash Borer
EAP – Emergency Action Plan
EPA – Environmental Protection Agency
ESL – English as Second Language
FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Map
FMA – Flood Mitigation Assistance Program
FR – FEMA’s Final Rule
GIS – Geographic Information Systems
HMA – Hazard Mitigation Assistance
HMGP – Hazard Mitigation Grant Program
HMP – Hazard Mitigation Plan
HPRCC – High Plains Regional Climate Center
IP – Office of Infrastructure Protection
JEO – JEO Consulting Group, Inc.
LEOP – Local Emergency Operations Plan
LGA – Liquid Gallon
LIP – Livestock Indemnity Program
MHSW – Mobile Home Single Wide
MPH – miles per hour
NCEI – National Centers for Environmental Information
NDA – Nebraska Department of Agriculture
NDEE – Nebraska Department of Environment and Energy
NDMC – National Drought Mitigation Center
NDOT – Nebraska Department of Transportation
NeDNR – Nebraska Department of Natural Resources
NEMA – Nebraska Emergency Management Agency
NFIP – National Flood Insurance Program
NFS – Nebraska Forest Service
NIPP – National Infrastructure Protection Plan
NOAA – National Oceanic and Atmospheric Administration
NPS – National Park Service
NRC – National Response Center
NRD – Natural Resources District
NWS – National Weather Service
PDSI – Palmer Drought Severity Index
PHMSA – U.S. Pipeline and Hazardous Material Safety Administration
RMA – Risk Management Agency
SBA – Small Business Administration
SFHA – Special Flood Hazard Area
SPIA – Sperry-Piltz Ice Accumulation Index

SURE – Supplemental Revenue Assistance Payments
TORRO – Tornado and Storm Research Organization
ULNRD – Upper Loup Natural Resources District
USACE – United States Army Corps of Engineering
USDA – United States Department of Agriculture
USGS – United States Geological Survey
WUI – Wildland Urban Interface

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SECTION ONE INTRODUCTION

Hazard Mitigation Planning

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

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

Natural hazards, such as severe winter weather, avalanche, severe wind, landslides, floods, lightning, and wildfires are part of the world around us. These hazard events can occur as a part of normal operation or because of human error. All jurisdictions participating in this planning process are vulnerable to a wide range of natural hazards that threaten the safety of residents and have the potential to damage or destroy both public and private property, cause environmental degradation, or disrupt the local economy and overall quality of life.

This plan is an update to the Upper Loup Natrual Resources District (NRD) Hazard Mitigation Plan (HMP) approved in 2019. The plan update was developed in compliance with the requiremets of the Disaster Mitigation Act of 2000 (DMA 2000). By preparing this plan, the Upper Loup NRD has demonstrated a commitment to reducing risks from hazards and to help decision makers establish mitigation activities and resources.

Hazard Mitigation Assistance

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

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

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



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

- **FMA:** This program provides grant funds to implement projects such as acquisition or elevation of flood-prone homes. Jurisdictions must be participating communities in the National Flood Insurance Program (NFIP) to qualify for this grant. The goal of FMA is to reduce or eliminate claims under the NFIP.
- **BRIC:** This program replaced the Pre-Disaster Mitigation Program beginning in 2020 and provides funds on an annual allocation basis to local jurisdictions for implementing programs and projects to improve resiliency and local capacity before disaster events.
- **PDM:** The PDM grant program makes federal funds available to state, local, tribal, and territorial governments to implement measures designed to reduce the risk to individuals and property from future natural hazards. The Consolidated Appropriations Act of 2023 authorizes funding for 100 projects with total funds of \$233,043,782 in 2023.
- **FMAG:** Section 404 of the Stafford Act allows FEMA to provide HMGP grants to any area that received a Fire Management Assistance Grant declaration even if no major Presidential declaration was made. FMAG aids communities in implementing long-term mitigation measures after a wildfire event.

For more information about these grant programs and other funding opportunities to help implement identified mitigation actions see the appendix *Hazard Mitigation Project Funding Guidebook*.

Plan Financing and Preparation

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

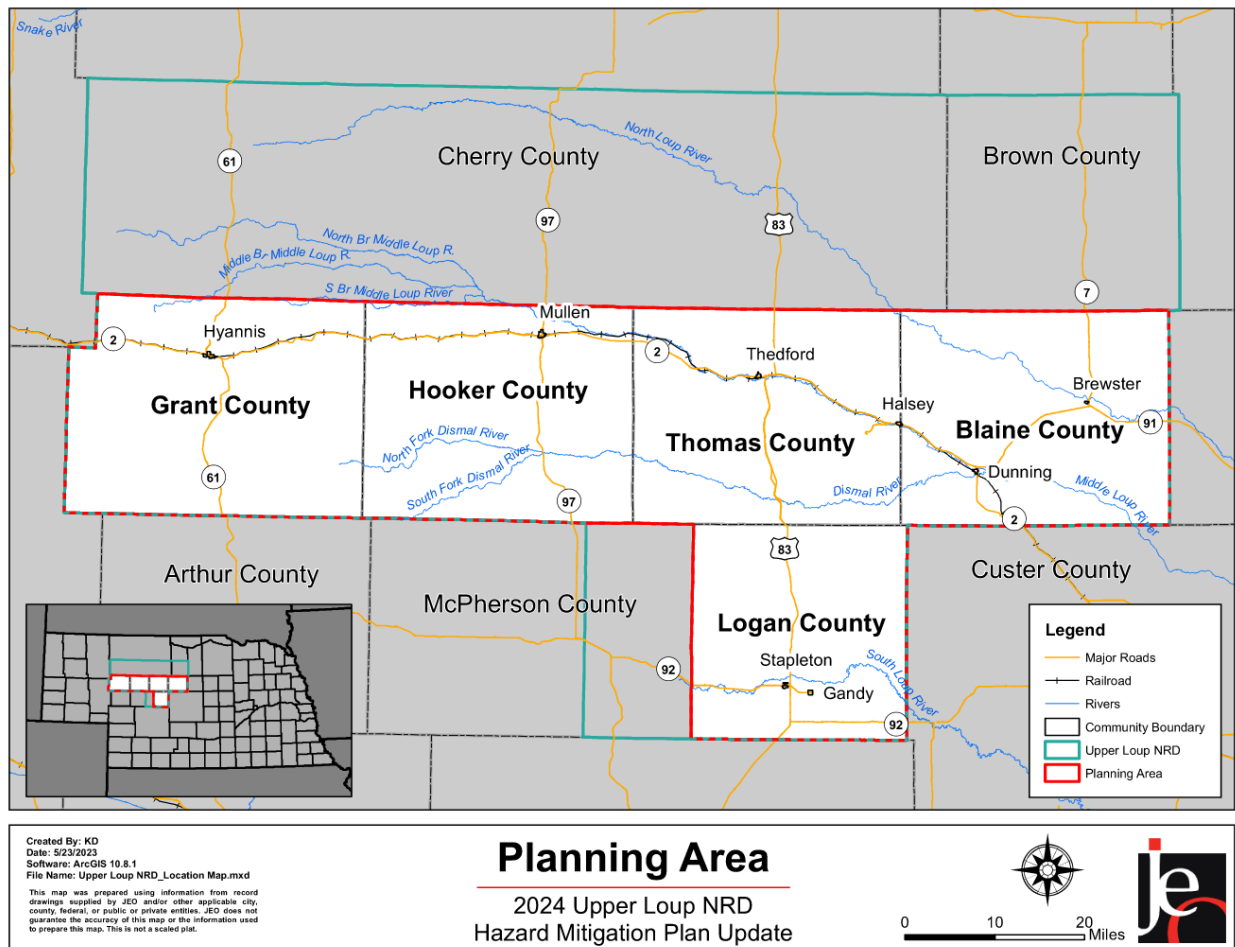
Participating Jurisdictions

The following table lists counties, communities, and special districts who participated in the 2024 Upper Loup NRD Hazard Mitigation Plan. All identified special districts in the five-county planning area were invited and encouraged to participate in the plan update as new participants including school districts, fire districts, local health departments, or natural resource districts (see *Section Two* for a full list of special jurisdictions invited). Jurisdictions who participated in this planning effort are noted in the table below.

Table 1: Participating Jurisdictions

PARTICIPATING JURISDICTIONS		
Upper Loup NRD	Logan County	Village of Hyannis*
Blaine County	Village of Gandy	Mullen Public Schools
Village of Brewster	Village of Stapleton	Theford Public Schools
Village of Dunning	Thomas County	Sandhills Public Schools
Hooker County	Village of Halsey	
Village of Mullen	Village of Theford	

Figure 1: Map of Planning Area



Goals and Objectives

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

Goals from the 2019 HMP were reviewed and the Planning Team made minor changes to the goals to better craft this agreed that they are still relevant and applicable for this plan update. Jurisdictions that participated in this plan update agreed that the goals identified in 2019 would be carried forward and utilized for the 2024 plan. The goals for this plan update are as follows:

GOAL 1: PROTECT HEALTH AND SAFETY OF RESIDENTS

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

GOAL 2: REDUCE FUTURE LOSSES FROM HAZARD EVENTS

- Objective 2.1: Provide protection for existing structures, future development, critical facilities, services, utilities, and trees to the greatest extent possible.
- Objective 2.2: Develop hazard specific plans, conduct studies or assessments, and retrofit jurisdiction to mitigate for hazards and minimize their impact.
- Objective 2.3: Minimize and control the impact of hazard events through enacting or updating ordinances, permits, laws, or regulations.

GOAL 3: INCREASE PUBLIC AWARENESS AND EDUCATION ON THE VULNERABILITY TO HAZARDS

- Objective 3.1: Develop and provide information to residents and businesses about the types of hazards they are exposed to, what the effects may be, where they occur, and what they can do to be better prepared.
- Objective 3.2: Enhance education and communication to increase resident preparedness before, during, and after hazard events.

GOAL 4: IMPROVE EMERGENCY MANAGEMENT CAPABILITIES

- Objective 4.1: Develop or improve Emergency Response Plans, Evacuation Plans, and other procedures and abilities; increase the capability to respond.
- Objective 4.2: Improve warning systems and ability to communicate to residents and businesses during and following a disaster or emergency.
- Objective 4.3: Evaluate and improve interlocal emergency response communication among communities and agencies.
- Objective 4.4: Evaluate and improve interoperability communication among emergency response personnel.

GOAL 5: ENHANCE OVERALL RESILIENCE AND PROMOTE SUSTAINABILITY

- Objective 5.1: Incorporate hazard mitigation and adaptation into updating other local planning endeavors (e.g., comprehensive plans, zoning ordinance, subdivision regulation, etc.)

GOAL 6: PURSUE MULTI-OBJECTIVE OPPORTUNITIES (WHENEVER POSSIBLE)

- Objective 6.1: When possible, use existing resources, agencies, and programs to implement the projects.
- Objective 6.2: When possible implement projects that achieve several goals

Summary of Changes

The hazard mitigation planning process should be revised and updated for each plan update process in order to best accommodate the planning area's priorities and specific conditions. Such priorities for the Upper Loup NRD's HMP update included an increased emphasis on public engagement and participant engagement. A major change for this plan updated included utilizing individual one-on-one meetings for each participating jurisdiction.

Other changes from the 2019 Hazard Mitigation Plan and planning process in this update included:

- An updated plan layout – changes to Section Three information included. Changes to Community/Jurisdictional profiles to streamline included demographic information and key sections.
- Expanded efforts for public engagement – kick-off meeting held as a public BBQ with all jurisdictions invited to attend; individual one-on-one meetings held with each participant; expanded social media outreach and public survey attempts for public engagement; and comprehensive public review period notification to all participants, stakeholders, and neighboring jurisdictions.
- Funding guidebook – Section Eight included with additional funding guides and options for project implementation.
- FEMA Regulatory Requirement Updates – specific inclusions to meet new FEMA requirements including public notification and engagement strategies; information regarding NFIP participation and flood risk hazards; updated hazards of top concern and identified mitigation actions to closely correlate with identified hazards; and identification of community lifelines (formerly critical facilities).

The plan was also updated to reflect changing priorities for each participating jurisdiction. Top hazards of concern were identified by each local planning team along with a review of mitigation actions. Each local planning team reviewed the mitigation actions from 2019 and updated the timeline, priority (high, medium, low), and status. Local planning teams were also able to add new mitigation actions to better fit any changing priorities and concerns. The 2019 HMP Plan Review Tool was reviewed for possible changes to incorporate into this plan update and were addressed where applicable. These changes are described in the table below.

Table 2: Plan Revisions

Comment/Revision from 2019 Review Tool	Location of Revision	Summary of Changes
Not clear what the point of Table 24 on pdf p. 39 is with repeated entries that indicate "various federal properties."	Section Three: State and Federally Owned Properties, Table 17	Table of properties has been condensed and clarified. "Various federal properties" has been removed due to ambiguity.
Historic sites listed on p. 40 do not have floodplain association.	Section Three: Historical Sites, Table 18	Floodplain status now included in table.
Dam data is publicly available in the National Dam Inventory; the inventory includes probabilities of failure and risk to local	Section Four: Dam Failure	Sources for dam locations, probabilities, and impacts included both USACE's National Inventory of

Comment/Revision from 2019 Review Tool	Location of Revision	Summary of Changes
populations. Please utilize this resource in further plan updates.		Dams and NeDNR's Dam Safety Division.
When identifying jurisdictions' critical facilities consider using lifelines/systems approach. This could provide stronger positioning in pursuing grant opportunities.	Section Seven: Community Profiles	Jurisdictional profiles include lifeline delineations per critical facility.
The drought profile would be improved by documenting the average rainfall for the planning area - as provided in Figure 24 of the Flooding Profile.	Section Four: Drought	Figure 24: Average Monthly Precipitation for the Planning Area included in the Drought profile.
The Hyannis profile refers to a Grant County profile which does not exist. This omission could be addressed by referencing Hooker County instead and validating that there are no significant differences in terms of risk between the two counties.	Hyannis Profile	Hyannis profile now references Hooker County or District wide risk assessment as an overall review due to similar hazard conditions.
Jurisdictions that are not currently participating in the NFIP and where an FHBM or FIRM has been issued may meet this requirement by describing the reasons why the community does not participate.	Section Four: Flooding Section Seven: Community Profiles	Further discussion of NFIP participation in Flooding Profile. Individual status of NFIP and concerns for flooding described in individual profiles.

SECTION TWO PLANNING PROCESS

The process utilized to develop a hazard mitigation plan is often as important as the final planning document. For this planning process, the ULNRD adapted the traditional four-step hazard mitigation planning process outlined by FEMA to fit the needs of the participating jurisdictions. The following section outlines the planning process for the 2024 Upper Loup NRD HMP including the meeting schedule for participating communities and public outreach methods.

Multi-Jurisdictional Approach

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

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

Both FEMA and NEMA recommend this multi-jurisdictional approach through the cooperation of counties, regional emergency management, and natural resources districts. The Upper Loup NRD utilized the multi-jurisdictional planning process recommended by FEMA resources (Local Mitigation Plan Review Guide¹, Local Mitigation Planning Handbook², and Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards³) to develop this plan.

Requirement §201.6(b): Planning process. An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

- (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
- (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
- (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Requirement §201.6(c)(1): The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

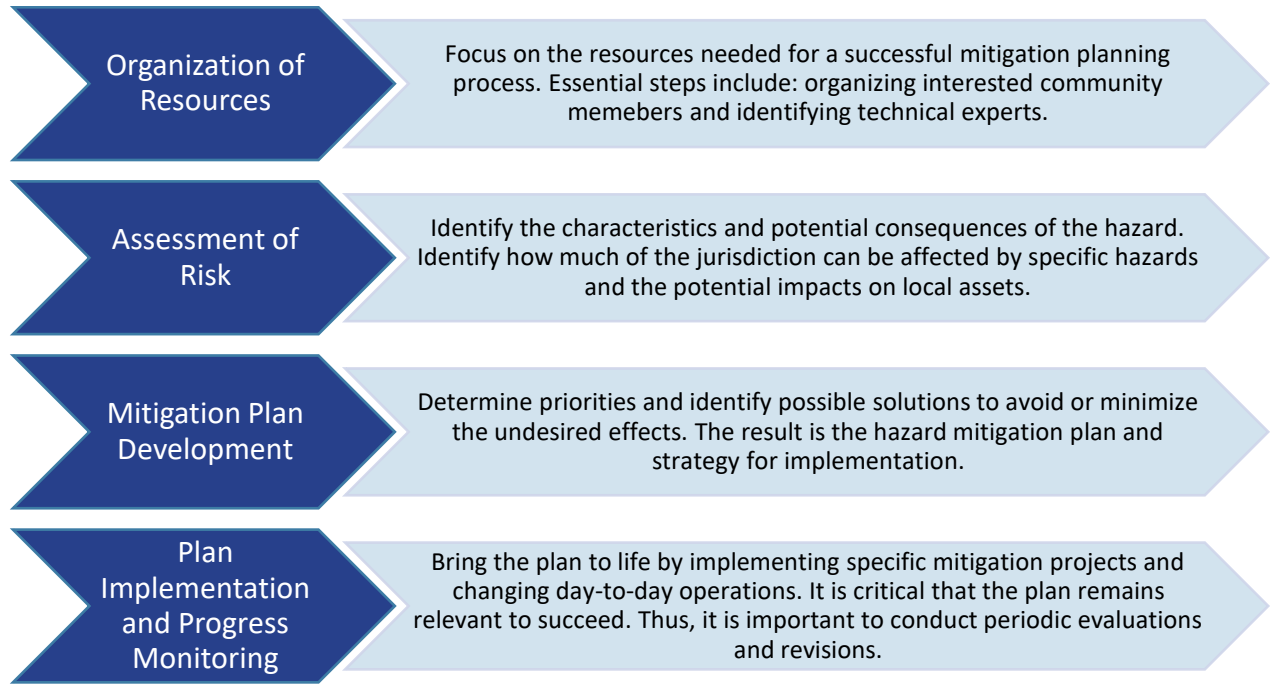
¹ Federal Emergency Management Agency. 2011. “Local Mitigation Plan Review Guide.” https://www.fema.gov/media-library-data/20130726-1809-25045-7498/plan_review_guide_final_9_30_11.pdf.

² Federal Emergency Management Agency. 2013. “Local Mitigation Planning Handbook.” https://www.fema.gov/media-library-data/20130726-1910-25045-9160/fema_local_mitigation_handbook.pdf.

³ Federal Emergency Management Agency. 2013. “Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards.” https://www.fema.gov/media-librarydata/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf.

Hazard Mitigation Planning Process

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



Plan Update Schedule

The Upper Loup NRD secured HMGP grant funding for their multi-jurisdictional hazard mitigation plan (HMP) during the 2022 fiscal year. JEO Consulting Group (JEO), was contracted in September 2022 to guide and facilitate the planning process and assemble the HMP. The Upper Loup NRD General Manager, Anna Baum, served as the primary point of contact throughout the project. A clear timeline of this plan update process is provided in the figure below.

Figure 2: Project Schedule



Kick-off Meeting



The Upper Loup NRD held a kick-off meeting BBQ in June 2023 to provide an overview of the planning process between JEO staff and participating jurisdictions. Preliminary discussion was held over hazards to be included in this plan, changes to be incorporated since the last plan, goals and objectives, identification of key stakeholders to include in the planning process, and a general schedule for the plan update. The goal from holding the kick-off meeting as a public BBQ was to encourage attendance and provide a more welcoming and casual environment to foster conversation regarding local priorities for the planning process. The NRD and JEO also hosted a Hazard Mitigation Bingo game throughout the event for door prizes and provided individual hazard ID handouts to help identify key local hazards of concern. The following table lists jurisdictions and entities which were invited to the Kick-off BBQ.

Table 3: Kick-off Meeting BBQ Invitees

KICK-OFF MEETING BBQ			
Upper Loup NRD			
Blaine County			
Village of Brewster	Village of Dunning	Sandhills Public Schools	
Brewster Rural Fire District*	Dunning Volunteer Fire Department*	Purdum Rural Fire Department*	
Grant County*			
Village of Hyannis	Hyannis Area Schools*	Sandhills Fire Protection District*	
Hooker County			
Village of Mullen	Mullen Public Schools	Mullen Volunteer Fire Department*	
Logan County			
Village of Gandy	Village of Stapleton	Stapleton Volunteer Fire Department*	
Thomas County			
Village of Halsey	Village of Thedford	Thedford Public Schools*	
Thedford Volunteer Fire Department*	Halsey Rural Fire District*	Thomas County Airport*	
Other Districts			

KICK-OFF MEETING BBQ		
West Central Health District*	Educational Service Unit #10*	Educational Service Unit #16*
Loup Basin Public Health Department	Panhandle Public Health District	

Jurisdiction: _____

UPPER LOUP NRD HAZARD MITIGATION PLAN



CIRCLE YOUR TOP 5 HAZARDS OF CONCERN

Animal & Plant Disease	Dam Failure	Drought	Earthquakes	Other: _____ _____ _____ _____ _____ _____ _____ _____ _____
Extreme Heat	Flooding	Hazardous Materials Release	Severe Thunderstorms	
Severe Winter Storms	Terrorism & Civil Disobedience	Tornadoes & High Winds	Wildfire	

The table below lists out all attendees to the Upepr Loup NRD HMP Kick-off Meeting BBQ.

Table 4: Kick-off Meeting Attendees

UPPER LOUP NRD KICK-OFF MEETING ATTENDEES		
Anna Baum	General Manager	Upper Loup NRD
Becky Appleford	Project Manager	JEO Consulting Group
Betty Akin	Chairperson	Village of Brewster
Bryan Gisp	County Commissioner	Thomas County
Cathy Williams	Village Clerk	Village of Brewster
Chris Higgins	Director	Upper Loup NRD
J.D. Furrow	Superintendent	Sandhills Schools
Jay Jones		Theford Fire
John Bryant	Resident	Resident of Theford
John Kraye	Board Member	Upper Loup NRD
Justin Sprague	Resource Technician	Upper Loup NRD
Kyon Neal	Resources Technician	Upper Loup NRD
Lexi Spurlin	Information and Education Coordinator	Upper Loup NRD HMP
Mary Baker	Client Manager	JEO Consulting Group
Miles Maseberg	Board Member	Upper Loup NRD
Nathan Hanson	AFMO	USFS Bessey RD
Rich Burnside	Board Member	Upper Loup NRD
Robert Mills	Village Maintenance	Village of Theford
Tom Johnson	Board Member	Upper Loup NRD

Key takeaways from the kick-off meeting are also listed out below.

- Major events since the 2019 HMP included impacts from drought conditions, heavy snow events in the winter of 2022-2023, and the Bovee Fire in 2023
- Major concerns exist for lack of available housing across the planning area
- Communication issues exist across the district due to distance and lack of signal. Identified methods to address this issue included mobile repeaters, mobile communication towers, or mass texts.
- Concerns exist for hazardous material transport through the district, especially by railroad.
- Dead and dying trees are a growing concern as the tree stock is aging.
- Updates to goals and hazards for evaluation – see Goals and Objectives in Section One or Hazard Identification in Section Four.

Participant Involvement

Participants play a key role in developing individual profiles with specific, meaningful, and measurable information pertaining to their community or jurisdiction. Participants were asked to review goals and objectives identifying hazards, provide a record of historical disaster occurrences and localized impacts, identify and prioritize potential mitigation projects and strategies, and the review or develop the annual review procedures. To be a participant in the development of this HMP update, jurisdictions were required to:

- Attend a one-on-one meeting with JEO staff,
- Provide relevant information throughout the plan update process, and
- Pass an *Adoption Resolution* for the approved HMP.

The one-on-one community specific meetings were scheduled to overlap with board or council meetings which were open to the public to the best availability. Attendees and representatives were also encouraged to take or share meeting materials with community members.

Outreach to eligible jurisdictions included notification prior to all public meetings, phone calls and email reminders of upcoming meetings, and invitations to complete surveys and worksheets required for the planning process. The table below lists the dates and attendees to each of the individual meetings.

Of note, specific entities or positions invited to each of the meetings included: clerk or administrative personnel, public works or utility superintendents, planning and zoning administrators, county emergency managers, local governing bodies (county commissioners or village boards), fire departments, county sheriffs, and/or other special entities such as local engineers, the NRD, dam owners, and local health care facilities. Due to the small and rural nature of this planning area, many jurisdictions do not have many of these positions filled or these representatives were not able to attend the scheduled one-on-one meeting. When that was the case, copies of the plan were emailed or mailed for review or comment as appropriate.

Table 5: One-on-One Meeting Attendees

UPPER LOUP NRD MEETING ATTENDEES		
HOOKER COUNTY		
OCTOBER 2, 2023 AT 2:00PM		
TODD YOST	Sheriff and County Emergency Manager	Hooker County
JESSICA HAMPTON	Clerk and County Assessor	Hooker County

UPPER LOUP NRD MEETING ATTENDEES		
BROOKE SEACHORD	Project Planner	JEO Consulting Group
VILLAGE OF THEDFORD OCTOBER 2, 2023 AT 7:00PM		
WADE NEBEN	Co-Chairman Village of Thedford	Village of Thedford
ROBERT MILLS	Village Maintenance	Village of Thedford
TERRY HIGGINS	Village Maintenance	Village of Thedford
RONDA HAUMANN	Village Clerk	Village of Thedford
ALBERT FISHER	Village Chairman	Village of Thedford
DANIEL WADAS	Village Board Member	Village of Thedford
KYLE HINTON	Village Board Member	Village of Thedford
DARREN RIYESTINE	Village Board Member	Village of Thedford
BROOKE SEACHORD	Project Planner	JEO Consulting Group
THOMAS COUNTY OCTOBER 3, 2023 AT 9:30AM		
LEWIS HERBAUGH	County Commissioner	Thomas County
CHARLES DALY	County Commissioner	Thomas County
PAMELA MOODY	County Commissioner	Thomas County
LORISSA HARTMAN	Clerk and Assessor	Thomas County
ANDREA THOMAS	Treasurer	Thomas County
BROOKE SEACHORD	Project Planner	JEO Consulting Group
BLAINE COUNTY OCTOBER 3, 2023 AT 1:00PM		
MICHAEL PETERSON	County Commissioner	Blaine County
ANN MARIE SHINN	Treasurer	Blaine County
TIM SIERKS	Sheriff and County Emergency Manager	Blaine County
BROOKE SEACHORD	Project Planner	JEO Consulting Group
UPPER LOUP NRD OCTOBER 3, 2023 AT 4:00PM		
ANNA BAUM	General Manager	Upper Loup NRD
BROOKE SEACHORD	Project Planner	JEO Consulting Group
VILLAGE OF DUNNING OCTOBER 3, 2023 AT 7:30PM		
LARRY STEELE	Village Engineer	Miller and Associates
ALICE SPRINGER	Village Clerk	Village of Dunning
DAN SHEETS	Board Chairman	Village of Dunning
CHET WALES	Board Member	Village of Dunning
JILL CADWALLADER	Board Member	Village of Dunning
BROOKE SEACHORD	Project Planner	JEO Consulting Group
VILLAGE OF HYANNIS OCTOBER 4, 2023 @ 10:00AM		
ALLISON FERGUSON	Village Clerk	Village of Hyannis
BROOKE SEACHORD	Project Planner	JEO Consulting Group
LOGAN COUNTY, VILLAGE OF GANDY, VILLAGE OF STAPLETON OCTOBER 4, 2023 @ 1:00PM		
KENNY JIVIDEN	Mayor	Village of Gandy

UPPER LOUP NRD MEETING ATTENDEES		
SEAN CARSON	Sheriff and County Emergency Manager	Logan County
RICHARD COOK	Highway Superintendent, Board Member	Logan County, Village of Stapleton
BROOKE SEACHORD	Project Planner	JEO Consulting Group
VILLAGE OF HALSEY OCTOBER 5, 2023 @ 9:30AM		
DIANNA RODOCKER	Village Clerk	Village of Halsey
BROOKE SEACHORD	Project Planner	JEO Consulting Group
VILLAGE OF BREWSTER OCTOBER 5, 2023 @ 1:00PM		
MARILYN RHOADES	Village Board Member	Village of Brewster
HELEN NORAS	Village Board Member	Village of Brewster
BETTY AKIN	Board Chairperson	Village of Brewster
CATHY WILLIAMS	Village Clerk	Village of Brewster
WALT RHOADES	Village Board Member	Village of Brewster
BROOKE SEACHORD	Project Planner	JEO Consulting Group
SCHOOLS MEETING - VIRTUAL OCTOBER 6, 2023 @ 11:00AM		
BLAKE DAHLBERG	Superintendent	Theford Public Schools
KARL DIETRICH	Planner	JEO Consulting Group
MULLEN SCHOOLS MEETING - VIRTUAL FEBRUARY 8, 2024 @ 10:00AM		
CHRIS KUNCL	Superintendent	Mullen Public Schools
BROOKE SEACHORD	Project Planner	JEO Consulting Group
SANDHILLS SCHOOLS MEETING - VIRTUAL FEBRUARY 13, 2024 @ 9:00AM		
JD FARROW	Superintendent	Sandhills Public Schools
BROOKE SEACHORD	Project Planner	JEO Consulting Group

At each meeting, representatives (i.e. the local planning teams) reviewed the hazards identified by attendees at the Kick-off Meeting and identified in the 2021 Nebraska State Hazard Mitigation Plan. Many of these hazards were also identified in the prior FEMA-approved HMP for each jurisdiction and was evaluated again for the 2024 HMP. Hazards were either added, removed, or carried forward based upon several factors: past historical occurrences of the hazard type impacting the jurisdiction; the severity or magnitude of impacts from the hazard on the jurisdiction; and the identification of a specific mitigation action to the hazard which is the responsibility of the jurisdiction.

Other key information discussed at meetings included a review and update of community lifelines or critical facilities; updates or revisions to other local planning mechanisms, budgets, or capabilities; brief discussions of flood risk and the NFIP program; and the overall project schedule and expectations. Many local planning team members were part of the 2019 HMP planning process and were familiar with the roles and responsibilities for a participating jurisdiction. The primary focus of discussion during each meeting was on the specific hazards of concern per jurisdiction and developing SMART-guided mitigation actions. These actions were developed to be Specific, Measurable, Achievable, Relevant, and Time-bound to the jurisdiction.

Public Outreach and Engagement

Stakeholders and Neighboring Jurisdictions

At the beginning of the planning process key stakeholder groups were identified that could provide other information or provide additional input to the planning process. Stakeholders can provide valuable information to regional risk assessment and community mitigation strategy implementation, while not directly eligible to participate in the HMP as a ‘Participant’. A wide range of potential stakeholders were contacted and encouraged to participate which included local and regional agencies, agencies that regulate development, nonprofit organizations, airports, health departments, local churches, economic development districts, and state agencies. As a note there are no hospitals or long term facilities in the planning area.

Figure 3: Social Media Graphic



The following tables lists stakeholder and neighboring communities or entities contacted and encouraged to participate or provide input in the planning process. A copy of the Project Announcement letter, invitation letter, and/or survey postcards were mailed to each listed stakeholder or the neighboring county clerks, county and regional emergency managers, and NRDs. Comments and information provided by stakeholders were incorporated into applicable community profiles or hazard descriptions as appropriate.

Table 6: Notified Stakeholder Groups

STAKEHOLDER GROUPS	
Amazing Grace Church	Ringgold Free Methodist Church
Assembly of God	Saint Joseph's Episcopal Church
Bethel Assembly of God	Sandhills Community Bible Church
Central Nebraska Economic Development District	Sandhills RC&D
Cornerstone Evangelical Presbyterian Church	St John the Evangelist Catholic Church
Custer County Public Power District	St Thomas Catholic Church
Gandy Community Bible Church	St. Mary's Catholic Church
Great Plains Family Medicine	Thedford Life Center
Greater Nebraska Medical & Surgical Services	Thedford United Church of Christ
NE Extension in Lincoln, Logan, and McPherson Counties	Thomas County Airport
NE Extension in the Central Sandhills Area	Trinity Lutheran Church LCMS
Nebraska Department of Natural Resources (NeDNR)	U.S. Forest Service - Bessey Ranger District
Nebraska Emergency Management Agency (NEMA)	United Methodist Church
Panhandle Rural Electric Membership	West Central Health District
Red Cross	West Central Nebraska Development District
Region 26 EMA	

Table 7: Notified Neighboring Jurisdictions

NEIGHBORING JURISDICTIONS		
Arthur County	Loup County	North Platte NRD

NEIGHBORING JURISDICTIONS		
Brown County	McPherson County	Twin Platte NRD
Cherry County	Rock County	Upper Elkhorn NRD
Custer County	Sheridan County	Upper Niobrara White NRD
Garden County	Lower Loup NRD	Region 23 EMA
Lincoln County	Middle Niobrara NRD	

The project sponsor and local planning team representatives was also asked to identify any underserved communities or vulnerable populations in the planning area not already identified, so they could have the opportunity to be involved in the planning process. Several small communities were identified as underserved or vulnerable due to their limited capabilities of staff including the Village of Brewster, Village of Halsey, and the unincorporated areas of Purdum and Whitman. The NRD and county Emergency Managers attempted to reach out and provide assistance to these areas to assist them in the planning process. The villages met one-on-one with JEO staff to meet planning process requirements.

Specific feedback was received from the following groups and incorporated:


- Loup Basin Public Health Department – Catie Larsen, Emergency Response Coordinator
Provided input on Blaine County as part of Health Departments district. Loup Basin Public Health Department participated in the 2022 Lower Loup NRD Hazard Mitigation Plan. While the Health Department did not participate fully in the Upper Loup NRD HMP, through the ULNRD HMP planning process the Health Department chose to update some mitigation actions in their profile in the LLNRD HMP.
- U.S. Forest Service – Bessey Ranger District – Ted Teahon, Bessey District Forest Ranger
Provided key input on the Bovee Fire in Halsey/Thedford NE and discussion of some fuels mitigation work the Forest Service is working on. See Wildfire section for more input on fire.

Table 8 provides a summary of other outreach activities utilized in this process.

Table 8: Outreach Activity Summary

ACTIVITY	INTENT
Project Website	To inform the public and local/planning team members of past, current, and future activities (https://www.jeo.com/ulnrhdmp) Links to the project website were included on all meeting invitations, flyers, email invitations, and plan sponsors websites.
Project Announcement	Project announcement letter mailed and emailed to potential participants, neighboring jurisdictions, and stakeholders
Project Flyer	A fact sheet flyer was developed and shared with all planning team members to post locally. Information included why and how to be involved in the process. Project flyer was posted at key locations including the NRD office, gas station, post office, county courthouses, local coffee shop (Anthem Coffee), and schools.
Social Media	The NRD shared information about the HMP update via local social media, NRD website, and in the newsletter (the Upper Loup Scoop).

Figure 4: Newsletter Blurb for HMP



Upper Loup Scoop

Upper Loup NRD January 2024

Hazard Mitigation Plan Survey


Disasters are devastating for communities. Effective mitigation planning can break the cycle of disaster: damage, reconstruction, and repeated damage. The ULNRD is currently working on the required 5-year update to its Hazard Mitigation Plan (HMP) which will expire in January 2025. Hazard Mitigation Plans are a requirement for any community, county, or other eligible jurisdiction to be qualified for FEMA disaster mitigation funding- for up to a 75% cost-share. For every \$1 spent on hazard mitigation, \$6 in post-storm cleanup and rebuilding is saved. A HMP is a community driven document that addresses how communities intend to build resilience and mitigate against hazards such as flood, drought, severe weather and wildfire. The plan sets priorities for mitigation activities that protect people, their property and the environment from the impacts of those hazards.

Public input will be gathered throughout the duration of the plan development through online tools and public meetings. All taxing authorities including the county, communities, and school districts are eligible to participate and provide feedback. Other entities such as healthcare facilities, chamber of commerce, utility providers, businesses, or non-profits can also provide critical input as stakeholders.

A public survey to gather local priorities or concerns from hazards is available at <https://forms.office.com/r/EZrUtrtyTg> . All those completing the survey, and leaving their name, will be submitted for a drawing to win a high grade rain gauge.

Figure 5: HMP Update Flyer

UPPER LOUP NRD REGIONAL HAZARD MITIGATION PLAN



JOIN THE CONVERSATION

You are invited to take part in a roundtable discussion that will directly impact the safety and resilience of your community. Your insights, concerns, and suggestions will be crucial in developing the Upper Loup Regional Hazard Mitigation Plan.

We encourage you to attend the session closest to you as each meeting is specific to its location. If you cannot attend but still want to provide input, visit forms.office.com/r/EZrUtrtyTg or scan the QR code.



OCTOBER 2-6, 2023

Monday, October 2

2:00 PM-4:00 PM	Hooker County Hooker County Courthouse 102 N Cleveland Ave Mullen, NE 69152
7:00 PM-9:00 PM	Thedford* Thomas County Library 503 Main St Thedford, NE 69166

Tuesday, October 3

9:30 AM-11:30 AM	Thomas County* Thomas County Courthouse Sheriff's Office 503 Main St Thedford, NE 69166
1:00 PM-3:00 PM	Blaine County Blaine County Courthouse 145 Lincoln Ave Brewster, NE 68821
7:30 PM-9:30 PM	Dunning* 311 Jewett Ave Dunning, NE 68833

Wednesday, October 4

9:00 AM-11:00 AM	Hyannis 300 S Main Ave Hyannis, NE 69350
2:00 PM-4:00 PM	Logan County/Gandy Logan County Courthouse 317 Main St Stapleton, NE 69163
4:30 PM-6:30 PM	Stapleton Logan County Courthouse 317 Main St Stapleton, NE 69163

Thursday, October 5

9:30 AM-11:30 AM	Halsey Community Center 507 Hwy 2 Halsey, NE 69142
1:00 PM-3:00 PM	Brewster 440 Lincoln Ave Brewster, NE 68821
5:00 PM-7:00 PM	Mullen* Mullen Village Clerk Office 111 NW 1st St Mullen, NE 69152

Friday, October 6

9:00 AM-10:30 AM	Upper Loup NRD Upper Loup Natural Resources District 39252 Highway 2 Thedford, NE 69166
11:00 AM-1:00 PM	Regional Schools Upper Loup Natural Resources District 39252 Highway 2 Thedford, NE 69166

* Board Meeting

Figure 6: HMP Update Social Media Graphic Schedule

UPPER LOUP NRD REGIONAL HAZARD MITIGATION PLAN 

JOIN THE CONVERSATION

Share your insights, concerns, and suggestions for the Upper Loup Regional Hazard Mitigation Plan at one of these roundtable discussions coming to your area in October:

Monday, October 2	
2:00 PM	Hooker County
7:00 PM	Thedford

Tuesday, October 3	
9:30 AM	Thomas County
1:00 PM	Blaine County
7:30 PM	Dunning

Wednesday, October 4	
9:00 AM	Hyannis
2:00 PM	Logan County/Gandy
4:30 PM	Stapleton

Thursday, October 5	
9:30 AM	Halsey
1:00 PM	Brewster
5:00 PM	Mullen

Friday, October 6	
9:00 AM	Upper Loup NRD
11:00 AM	Regional Schools

For more information, visit the project website: www.jeo.com/ulnr dhmp

Public Review Period

Once the draft of the HMP was completed, a public review period was opened to allow for participants and community members at large to review the plan and provide comments and changes. The public review period was open from Monday, March 4th to Friday, March 29th, 2024.. Participating jurisdictions were mailed a letter notifying them of this public review period and a draft adoption resolution to ensure the plan was brought before board or council during the review period. All other stakeholders and neighboring jurisdictions were also mailed a Public Review Period notice postcard to notify them of the review period and allow them an opportunity to review the draft plan or provide comments.

The HMP was made available on the project website (<https://www.jeo.com/ulnrdhmp>) to download the document, and a notification was posted to the ULNRD website. Received comments and suggested changes were incorporated into the plan.

Additionally, specific hazard profiles from Section Four were sent to state technical experts for review. These sections included:

- Drought sent to NeDNR – Drought Division
- Flooding sent to NeDNR – Floodplain Management Section
- Dam Failure sent to NeDNR Dam Safety Section

Received comments and suggested changes were incorporated into the plan. Examples of such revisions are listed in the table below.

Table 9: Public Review Revisions

NAME, TITLE, AND/OR AGENCY	PLAN SECTION	COMMENT/REVISION
CATRINA LARSEN LOUP BASIN PUBLIC HEALTH DEPARTMENT	Blaine County Profile – <i>Loup Basin Public Health Dept profile in the Lower Loup NRD HMP*</i>	Review of Blaine County’s profile for coverage of portion of the LBPHD’s district. Revisions and update to mitigation actions made in the Lower Loup NRD HMP.
ADELE PHILLIPS NE DNR FLOODPLAIN MANAGEMENT SECTION	Section Four – Flooding Profile	Review of Flood Hazard Profile for technical accuracy. Added clarification for various flood related terms and NFIP participation.
TYLER MARTIN, NE DNR DROUGHT DIVISION	Section Four – Drought Profile	Review of Drought Hazard Profile for technical accuracy. Provided grammatical review, revised figures, and noted incorporation of basinwide drought plan.
ALICE SPRINGER, CLERK, VILLAGE OF DUNNING	Village of Dunning Profile	Minor grammatical revisions, formatting updates, and updates to population discussion.

Plan Adoption

Based on FEMA requirements, this multi-jurisdictional hazard mitigation plan must be formally adopted by each participant’s governing body through the approval of an Adoption Resolution. The approval creates ‘individual ownership’ of the plan by each participating entity. Formal adoption provides evidence of a participant’s full commitment to implement the plan’s goals, objectives, and action items. A copy of the resolution draft submitted to participating jurisdiction is in Appendix A. Copies of community specific adoption resolutions may be requested from the State Hazard Mitigation Officer.

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

the project sponsor (Upper Loup NRD), their local County Emergency Management departments or the consultant (JEO) to document updates and revise the HMP as needed.

Additional implementation of the mitigation plan should include integrating HMP goals and mitigation and strategic actions into local planning mechanisms as available. Section Six describes the system that jurisdictions participating in the HMP have established to monitor the plan; provides a description of how, when, and by whom the HMP process and mitigation and strategic actions will be evaluated; presents the criteria used to evaluate the plan; and explains how the plan will be maintained and updated.

Data Sources and Information

Effective hazard mitigation planning requires the review and inclusion of a wide range of data, documents, plans, and studies. The following table identifies many of the sources utilized during this planning process. Individual examples of plan integration are identified in Section Seven. Additionally, sources and references are included throughout the document.

Table 10: Data, Plans, and Information used in HMP Development

DOCUMENTS	
DISASTER MITIGATION ACT OF 2000 HTTPS://WWW.CONGRESS.GOV/BILL/106TH-CONGRESS/HOUSE-BILL/707#:~:text=REQUIRES%20THE%20PRESIDENT%2C%20IN%20DETERMINING,FUTURE%20NATURAL%20DISASTERS%3B%20(3)	Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (2013) https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-ideas_02-13-2013.pdf
COMPREHENSIVE ECONOMIC DEVELOPMENT STRATEGY AND HAZARD MITIGATION PLAN ALIGNMENT GUIDE (2022) HTTPS://WWW.FEMA.GOV/SITES/DEFAULT/FILES/DOCUMENTS/FEMA_CEDS-HMP-ALIGNMENT-GUIDE_2022.PDF	Mitigation Planning and the Community Rating System Key Topics Bulletin (2018) https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-planning-and-the-community-rating-system-key-topics-bulletin_10-1-2018.pdf
HAZARD MITIGATION ASSISTANCE GUIDANCE AND ADDENDUM (2015) HTTPS://WWW.FEMA.GOV/SITES/DEFAULT/FILES/2020-07/FY15_HMA_ADDENDUM.PDF	National Flood Insurance Program Community Rating System https://www.fema.gov/floodplain-management/community-rating-system
LOCAL MITIGATION PLAN REVIEW GUIDE (2011) HTTPS://WWW.FEMA.GOV/SITES/DEFAULT/FILES/2020-06/FEMA-LOCAL-MITIGATION-PLAN-REVIEW-GUIDE_09_30_2011.PDF	National Flood Insurance Program Community Status Book (2023) https://www.fema.gov/flood-insurance/work-with-nfip/community-status-book
LOCAL MITIGATION PLANNING HANDBOOK (2013) HTTPS://WWW.FEMA.GOV/SITES/DEFAULT/FILES/2020-06/FEMA-LOCAL-MITIGATION-PLANNING-HANDBOOK_03-2013.PDF	National Response Framework (2019) https://www.fema.gov/emergency-managers/national-preparedness/frameworks/response
LOCAL MITIGATION PLANNING POLICY GUIDE (2022) HTTPS://WWW.FEMA.GOV/SITES/DEFAULT/FILES/DOCUMENTS/FEMA_LOCAL-MITIGATION-PLANNING-POLICY-GUIDE_042022.PDF	Robert T. Stafford Disaster Relief and Emergency Assistance Act (2021) https://www.fema.gov/sites/default/files/documents/fema_stafford_act_2021_vol1.pdf
PLANS AND STUDIES	
NEBRASKA STATE FLOOD HAZARD MITIGATION PLAN (2022) HTTPS://DNR.NEBRASKA.GOV/SITES/DNR.NEBRASKA.GOV/FILES/DOC/FLOODPLAIN/RESOURCES/2022_SFHMP_FINAL_20220630_VER2.PDF	Public Power in Nebraska (2018) https://nebraskalegislature.gov/pdf/reports/research/public_power_2018.pdf
FLOOD INSURANCE STUDIES HTTPS://MSC.FEMA.GOV/PORTAL/HOME	State of Nebraska Flood Hazard Mitigation Plan (2022) https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/floodplain/resources/2022_SFHMP_Draft_Published04112022.pdf
FOURTH NATIONAL CLIMATE ASSESSMENT (2018)	State of Nebraska Hazard Mitigation Plan (2021)

SECTION TWO: PLANNING PROCESS

HTTPS://NCA2018.GLOBALCHANGE.GOV/	https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmitplan2021.pdf
NATIONAL CLIMATE ASSESSMENT (2014) HTTPS://NCA2014.GLOBALCHANGE.GOV/	State of Nebraska Hazard Mitigation Plan (2019) https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmitplan2019.pdf
NEBRASKA STATE DROUGHT PLAN (2000) HTTPS://CARC.NEBRASKA.GOV/DOCS/NEBRASKADROUGHT.PDF	
TECHNICAL AND DATA RESOURCES	
ARBOR DAY FOUNDATION – TREE CITY DESIGNATION (2022) HTTPS://WWW.ARBORDAY.ORG/PROGRAMS/TREECITYUSA/DIRECTORY.CFM	Nebraska Flooding: March 2019 (Storymap) https://storymaps.arcgis.com/stories/9ce70c78f5a44813a326d20035cab95a
CDC SOCIAL VULNERABILITY INDEX HTTPS://WWW.ATSDR.CDC.GOV/PLACEANDHEALTH/SVI/INDEX.HTML	Nebraska Forest Service (NFS) http://www.nfs.unl.edu/
FEDERAL EMERGENCY MANAGEMENT AGENCY HTTPS://WWW.FEMA.GOV/	Nebraska Forest Service – Wildland Fire Protection Program http://nfs.unl.edu/fire
FEMA DISASTER DECLARATIONS HTTPS://WWW.FEMA.GOV/OPENFEMA-DATA-PAGE/DISASTER-DECLARATIONS-SUMMARIES-V1	Nebraska Local Health Departments http://dhhs.ne.gov/Pages/Local-Health-Departments.aspx
FEMA FLOOD MAP SERVICE CENTER HTTPS://MSC.FEMA.GOV/PORTAL/ADVANCESEARCH	Nebraska Power Review Board https://nprb.gworks.com/
HIGH PLAINS REGIONAL CLIMATE CENTER HTTP://CLIMOD.UNL.EDU/	Nebraska Rural Electric Association https://www.nrea.org/nrea-member-systems
MIDWEST REGIONAL CLIMATE CENTER HTTPS://MRCC.PURDUE.EDU/	NOAA – Billion Dollar Weather and Climate Disasters https://www.ncdc.noaa.gov/billions/overview
NATIONAL AGRICULTURAL STATISTICS SERVICE HTTP://WWW.NASS.USDA.GOV/	NWS – Seasonal Drought Outlook https://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php
NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION HTTPS://WWW.NCEI.NOAA.GOV/	PHMSA Incident Statistics https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics
NATIONAL DROUGHT MITIGATION CENTER – DROUGHT IMPACT REPORTER HTTP://DROUGHTREPORTER.UNL.EDU/MAP/	Small Business Administration – Disaster Loan Assistance https://disasterloan.sba.gov/ela/Declarations/Index
NATIONAL DROUGHT MITIGATION CENTER – DROUGHT MONITOR HTTP://DROUGHTMONITOR.UNL.EDU/	Storm Prediction Center Statistics http://www.spc.noaa.gov
NATIONAL FLOOD INSURANCE PROGRAM HTTPS://WWW.FEMA.GOV/FLOOD-INSURANCE	The Census of Agriculture (2012) https://www.nass.usda.gov/Publications/AgCensus/2012/
NATIONAL HISTORIC REGISTRY HTTPS://WWW.NPS.GOV/SUBJECTS/NATIONALREGISTER/INDEX.HTM	The Census of Agriculture (2017) https://www.nass.usda.gov/Publications/AgCensus/2017/index.php
NATIONAL OCEANIC ATMOSPHERIC ADMINISTRATION (NOAA) HTTP://WWW.NOAA.GOV/	Union of Concerned Scientists – Killer Heat Interactive Tool https://www.ucsusa.org/resources/killer-heat-interactive-tool?location=lanaster-county--ne
NEBRASKA DEPARTMENT OF NATURAL RESOURCES – DAM INVENTORY HTTPS://GIS.NE.GOV/PORTAL/APPS/WEBAPPVIEWER/INDEX.HTML?ID=2AAB04A13817421992DC5398AD462E22	
NEBRASKA DEPARTMENT OF TRANSPORTATION HTTP://DOT.NEBRASKA.GOV/	
NEBRASKA EMERGENCY MANAGEMENT AGENCY HTTP://WWW.NEMA.NE.GOV	

TECHNICAL AND DATA RESOURCES	
NATIONAL WEATHER SERVICE HTTPS://WWW.WEATHER.GOV/	United States Army Corps of Engineers – National Levee Database https://levees.sec.usace.army.mil/#/
NATIONAL WEATHER SERVICE STORMREADY AND TSUNAMIREADY HTTPS://WWW.WEATHER.GOV/STORMREADY/COMMUNITIES	United States Census Bureau https://data.census.gov/cedsci/
NATURAL RESOURCES CONSERVATION SERVICE WWW.NE.NRCS.USDA.GOV	United States Department of Agriculture http://www.usda.gov
NE DHHS ROSTERS OF FACILITIES AND SERVICES HTTP://DHHS.NE.GOV/LICENSURE/PAGES/ROSTERS-OF-FACILITIES-AND-SERVICES.ASPX	United States Department of Agriculture – Risk Management Agency http://www.rma.usda.gov
NEBRASKA ASSOCIATION OF RESOURCES DISTRICTS HTTP://WWW.NRDNET.ORG	United States Department of Transportation – Pipeline and Hazardous Materials Safety Administration https://www.phmsa.dot.gov/
NEBRASKA CLIMATE ASSESSMENT RESPONSE COMMITTEE HTTP://CARC.AGR.NE.GOV	United States Geological Survey http://www.usgs.gov/
NEBRASKA DEPARTMENT OF AGRICULTURE – LIVESTOCK DISEASE HTTPS://NDA.NEBRASKA.GOV/ANIMAL/REPORTING/INDEX.HTML	United States National Response Center http://www.nrc.uscg.mil/
NEBRASKA DEPARTMENT OF EDUCATION HTTP://NEP.EDUCATION.NE.GOV/	USACE National Inventory of Dams https://nid.sec.usace.army.mil/ords/f?p=105:1
NEBRASKA DEPARTMENT OF ENVIRONMENT AND ENERGY HTTP://WWW.DEQ.STATE.NE.US/	USDA – Disaster Assistance Programs https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/index
NEBRASKA DEPARTMENT OF HEALTH AND HUMAN SERVICES HTTP://DHHS.NE.GOV/PAGES/DEFAULT.ASPX	
NEBRASKA DEPARTMENT OF NATURAL RESOURCES HTTP://WWW.DNR.NE.GOV	
WILDFIRE RISK TO COMMUNITIES: HTTPS://WILDFIRERISK.ORG/	

SECTION THREE PLANNING AREA PROFILE

To identify jurisdictional vulnerabilities, it is vitally important to understand the people and built environment of the planning area. The following section is meant to provide a description of the characteristics of the planning area to create an overall profile. Many characteristics are covered in each jurisdiction’s community profile, including: demographics; transportation routes; and structural inventory. Redundant information will not be covered in this section. Therefore, this section will highlight at-risk populations and characteristics of the built environment that add to regional vulnerabilities.

Planning Area Geographic Summary

The ULNRD is located in central Nebraska and covers 6,690 square miles and includes all of Grant, Hooker, Thomas, Blaine, and Logan Counties and parts of McPherson, Brown, and Cherry Counties. For the purposes of this plan update, the planning area covers Blaine, Hooker, Logan, and Thomas Counties and the Village of Hyannis, which resides within Grant County. However, Grant County opted to not participate in the plan, and McPherson, Brown, and Cherry Counties are covered under other neighboring multi-jurisdictional HMPs.

The majority of the over four million acres of land in the NRD lies within the Nebraska Sandhills region, with some small areas in the southeast corner including valleys and dissected plains topography. Dissected plains are represented by hilly land with moderate to steep slopes and sharp ridge crests. Valleys are flat-lying land along major streams and include stream-deposited silt, clay, sand, and gravel materials. There are five main rivers in the planning area, which include the North Loup, Middle Loup, South Loup, Calamus, and Dismal Rivers, as well as several important tributaries: Goose Creek, Calf Creek, Big Creek, Wild Horse Creek, and Rifle Creek. The planning area is comprised of primarily pasture and rangeland, with small amounts of cropland, national forest, and water bodies.

Demographics

As noted above, the planning area includes all of Blaine, Hooker, Logan, and Thomas Counties. While neither the NRD or U.S. Census Bureau collects specific demographic information for the NRD, it serves an estimated population of 3,400. This population includes a range of demographics and persons at risk to natural and human-made disasters.

Table 11: Estimated Population for the Planning Area

COUNTY	2000 POPULATION	2010 POPULATION	2020 POPULATION
BLAINE	583	539	431
GRANT	747	661	611
HOOKER	783	690	711
LOGAN	774	682	716
THOMAS	729	756	669
TOTAL	3,616	3,328	3,138

Source: U.S. Census Bureau⁴

Table 12: Estimated Population for the Planning Area by Cohort

AGE	PLANNING AREA	STATE OF NEBRASKA
<5	5.6%	6.8%
5 – 19	18.9%	20.7%
20 – 64	50.6%	56.8%

⁴ U.S. Census Bureau. 2000/2010/2017. "Age and Sex: 2017 American Community Survey (ACS) 5-year estimates." <https://data.census.gov/cedsci/>.

AGE	PLANNING AREA	STATE OF NEBRASKA
>64	31.5%	21.9%
Median	42.9	36.6

Source: U.S. Census Bureau

The population for the planning area has been declining since the 2000 regional population census. The region accounts for approximately 0.6% of the total population for the state in 2020.

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

- Not all people who are considered “at-risk” are at-risk;
- Outward appearance does not necessarily mark a person as at-risk;
- A hazard event will, in many cases, impact at-risk populations in different ways.

The National Response Framework defines at-risk populations as “...populations whose members may have additional needs before, during, and after an incident in functional areas, including but not limited to: maintaining independence, communication, transportation, supervision, and medical care.”¹³

Dependent children under 19 years old are one of the most vulnerable populations to disasters.¹⁴ The majority of people in this age group do not have access to independent financial resources, transportation, or cellular telephones. They also lack practical knowledge necessary to respond appropriately during a disaster. Despite this vulnerability, children are generally overlooked in disaster planning because the presence of a care-taker is assumed. With over a quarter of the planning area’s population younger than 19, children are a key vulnerable group to address in the planning process. Nearly a quarter of these children are under the age of five, further exacerbating their vulnerability.

Schools house a high number of children within the planning area during the daytime hours of weekdays, as well as during special events on evenings and weekends. The following table identifies the various school districts located within the planning area, and Figure 7 is a map of the school district boundaries. This list is comprehensive and does not represent only the school districts participating in this plan.

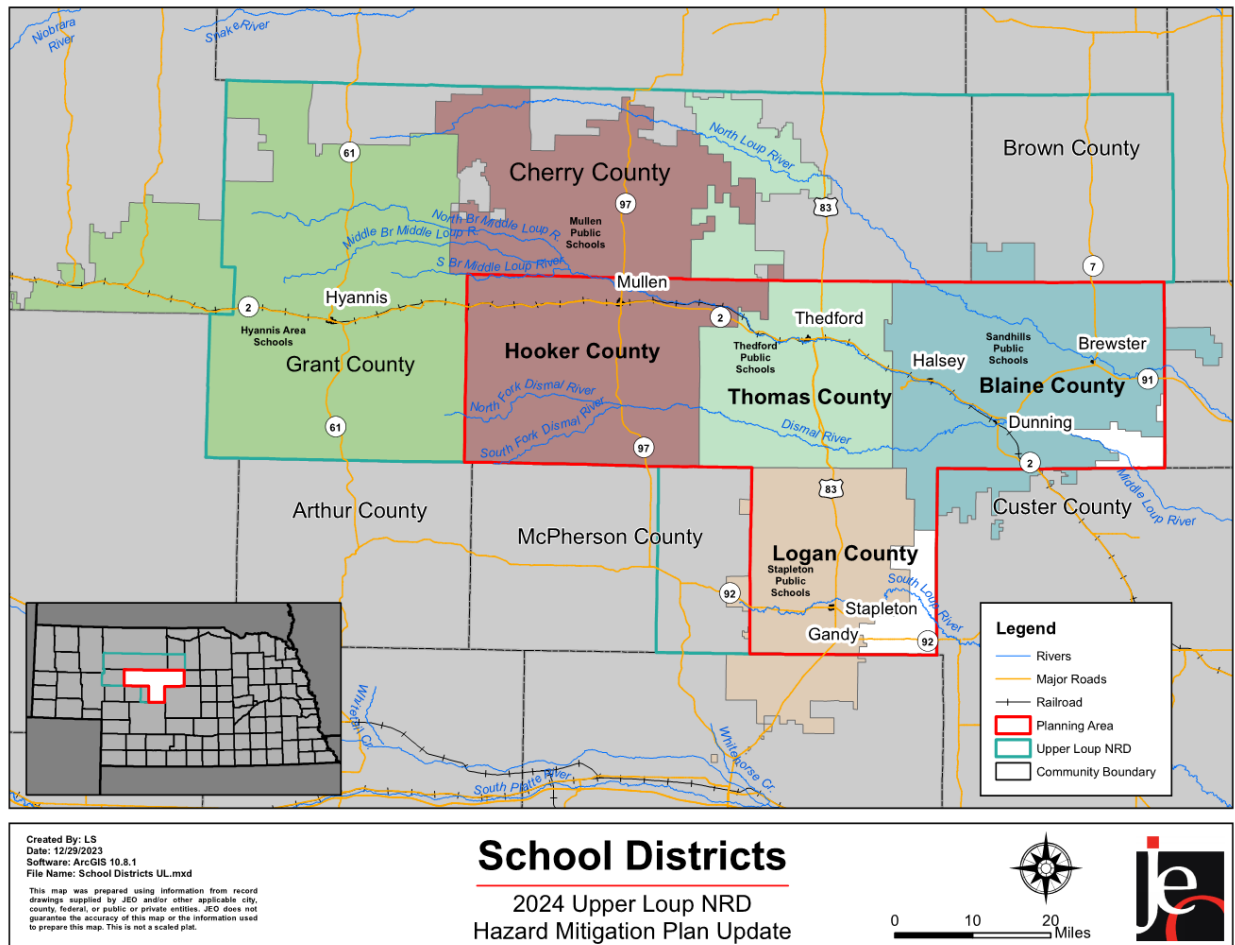
Table 13: School Inventory

SCHOOL DISTRICT	TOTAL ENROLLMENT (2021-2022)
Mullen Public Schools	175
Sandhills Public Schools	90
Hyannis Area Schools	152
Theadford Public Schools	130
Stapleton Public Schools	188

Source: Nebraska Department of Education⁵

⁵ Nebraska Department of Education. 2020. “Nebraska Education Profile: District and School Data.” Accessed August 2020. <http://nep.education.ne.gov/>

Figure 7: Regional School Districts



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

There are currently no hospitals or long-term care facilities in the five county planning area. The one long-term care facility located in Mullen recently closed (since 2019) causing a dearth of adequate health facilities in the Upper Loup NRD area. Many families now care for medically ill family members either at home or in surrounding communities such as Broken Bow.

In addition to residents being classified as at-risk by age, there are other specific groups within the planning area that experience vulnerabilities related to their ability to communicate or their economic status. Table 14 provide statistics per county regarding households with English as a second language (ESL) and population reported as in poverty within the past 12 months.

Table 14: ESL and Poverty At-risk Populations

COUNTY	PERCENT THAT SPEAK ENGLISH AS A SECOND LANGUAGE	FAMILIES BELOW POVERTY LEVEL
Blaine County	1.3%	4.1%
Grant County	0.2%	17.4%
Hooker County	1.2%	11.5%
Logan County	2%	11.0%
Thomas County	0.9%	11.1%

Source: U.S. Census Bureau^{6,7}

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

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

Similar to residents below the poverty line, racial minorities tend to have access to fewer financial and systemic resources that would enable them to implement hazard mitigation projects and to respond and recover from hazard events, including residence in standard housing and possession of financial stability. The mostly homogenous racial profile of the planning area indicates that racial inequity will not significantly affect the community's vulnerability to hazards.

Table 15: Racial Composition in the Planning Area

RACE	YEAR	COUNTY				
		BLAINE	GRANT	HOOKER	LOGAN	THOMAS
White, Non-Hispanic	2010	99.2%	98.4%	98.9%	98.4%	98.1%
	2020	92.1%	94.9%	93.5%	94.4%	94.2%
Black	2010	0.2%	0.0%	0.0%	0.1%	0.2%
	2020	0.2%	0.8%	0.6%	0.0%	0.0%
	2010	0.0%	0.2%	0.5%	0.9%	0.2%

⁶ U.S. Census Bureau. 2022. "Language Spoken at Home: 2020 American Community Survey (ACS) 5-year estimates." <https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=#>.

⁷ U.S. Census Bureau. 2022. "Selected Economic Characteristics: 2020 ACS 5-year estimate." <https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=#>.

RACE	YEAR	COUNTY				
		BLAINE	GRANT	HOOVER	LOGAN	THOMAS
American Indian and Alaskan Native	2020	0.0%	2.0%	0.7%	0.1%	0.6%
	2010	0.0%	0.2%	0.0%	0.1%	0.3%
Asian	2020	0.7%	0.2%	0.1%	0.6%	0.1%
	2010	0.0%	0.0%	0.0%	0.0%	0.0%
Native Hawaiian & Other Pacific Islander	2020	0.0%	0.0%	0.0%	0.0%	0.0%
	2010	0.0%	0.5%	0.0%	0.1%	0.2%
Other Races	2020	1.4%	0.2%	0.1%	0.0%	0.6%
	2010	0.6%	0.8%	0.5%	0.3%	1.1%
Two Or More Races	2020	5.6%	2.0%	4.9%	4.9%	4.5%

Source: U.S. Census Bureau^{8,9}

Built Environment and Structural Inventory

Data related to the built environment is an important component of a hazard mitigation plan. It is essential that during the planning process communities and participating jurisdictions display an understanding of their built environment and work to identify needs that may exist within their planning area. The US Census provides information related to housing units and potential areas of vulnerability.

Table 16: Selected Housing Characteristics

	BLAINE	GRANT	HOOVER	LOGAN	THOMAS
TOTAL HOUSING UNITS	294	396	414	371	370
Occupied housing units	201 (68.4%)	281 (71.0%)	292 (70.5%)	307 (82.7%)	306 (82.7%)
Lacking complete kitchen facilities	0%	0.7%	0%	0%	1.1%
Housing unit with no vehicles available	0.4%	1.0%	6.6%	N/A	1.1%
Mobile homes	12.5%	15.4%	9.6%	13.6%	3.9%

Source: U.S. Census Bureau¹⁰

Approximately 11 percent of housing units in the planning area are mobile homes. While unincorporated Grant County has the highest rate of mobile homes, many of these are not located within the Village of Hyannis who is participating in this HMP. For the purpose of this plan, Grant County has the highest rate of mobile homes in its housing stock at 15.4 percent. Mobile homes have a higher risk of sustaining damages during high wind events, tornadoes, severe thunderstorms, and severe winter storms. Mobile homes that are either not anchored or are anchored incorrectly can be overturned by 60 mph winds. A thunderstorm is classified as severe when wind speeds exceed 58 mph, placing improperly anchored mobile homes at risk.

Blaine County has the highest percentage of unoccupied housing units. Unoccupied homes may not be maintained as well as occupied housing, thus adding to their vulnerability. Furthermore, approximately one percent of all housing units in the planning area do not have a vehicle available. Households without

⁸ U.S. Census Bureau. 2022. "Race: 2020 ACS 5-year estimates." <https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#>.

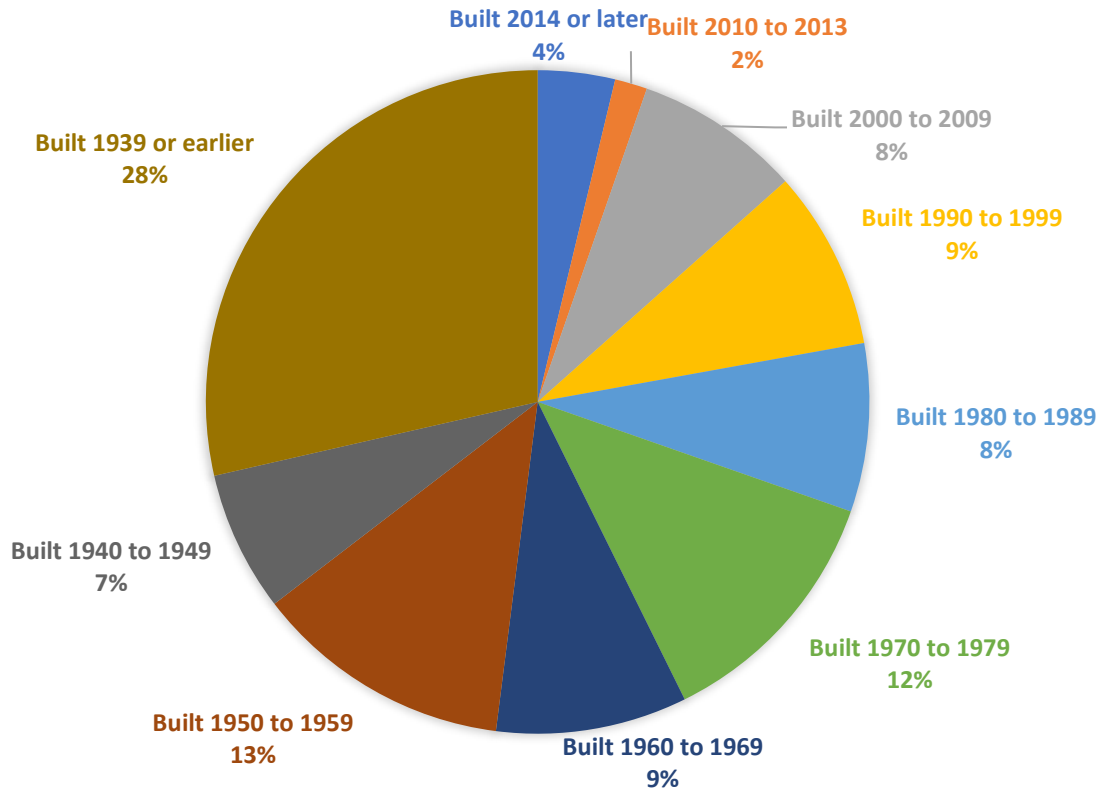
⁹ U.S. Census Bureau. 2022. "Race: 2010 ACS 5-year estimate." <https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#>.

¹⁰ U.S. Census Bureau. 2022. "Selected Housing Characteristics: 2020 ACS 5-year estimates." <https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#>.

vehicles may have difficulty evacuating during a hazardous event and a reduced ability to access resources in time of need.

The majority of homes within the planning area were built prior to 1970, with 28% of homes built prior to 1939. Housing age can serve as an indicator of risk, as structures built prior to state building codes being developed may be more vulnerable. Residents living in these homes maybe at higher risk to the impacts of high winds, tornadoes, severe winter storms, and thunderstorms.

Figure 8: Housing Age in Planning Area



Source: U.S. Census Bureau

Communications

Access to various communication methods is a key component for residents to receive, interpret, and share information regarding mitigation activities taking place in their community as well as hazard events as they unfold. Two of the primary ways to receive such communications are through local cell coverage and internet access. Internet and cellular services have become critical resources to share and receive information regarding hazardous events and disseminate important information including storm warnings, evacuation orders, or weather updates.

Most homes have access to landline phones (less than two percent of housing units lack access to landline telephone service); however, cellular telephones are increasingly a primary form of telephone service. However, homes without either landlines or cellphones do represent a population at increased risk to disaster impacts. Reverse 911 systems are designed to contact households via landline services and as a result, some homes in hazard prone areas may not receive notification of potential impacts in time to take protective actions. Emergency managers should continue to promote the registration of cell phone

numbers with emergency alert systems and utilize systems which automatically ping cellphones by triangulating cell towers.

Table 17: Selected Communications

	BLAINE	GRANT	HOOKER	LOGAN	THOMAS
No telephone service available	0%	0.7%	0%	2.2%	0%
No access to Broadband/Internet	8.4%	25.3%	29.4%	19.7%	10.5%

Source: U.S. Census Bureau^{11,12}

Social Vulnerability Index

All communities have some vulnerability to natural and human-caused hazard events. Various social conditions such as poverty rates, vehicle access, language, or housing stock contribute to a community's overall social vulnerability. The Center for Disease Control (CDC) has developed a Social Vulnerability Index to help public health officials and emergency responders identify communities at greater risk before, during, and after major hazardous events. The index evaluates 15 social factors and breaks down vulnerability into four domains: socioeconomic status; household composition and disability; minority status and language; housing and transportation. Several of these factors have been discussed in more depth earlier in this section. The following table lists the overall Social Vulnerability Index score for counties in the planning area.

An additional tool used to identify social vulnerability is FEMA's National Risk Index. Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

$$\frac{\text{Expected Annual Loss} \times \text{Social Vulnerability}}{\text{Community Resilience}} = \text{Risk Index}$$

Risk Index scores are presented as a composite score for the 18 hazard types evaluated, as well as individual scores for each hazard type.

Table 18: Social Vulnerability Index Score by County

COUNTY	CDC SVI	FEMA NRI			RISK INDEX
	VULNERABILITY LEVEL	EXPECTED ANNUAL LOSS	SOCIAL VULNERABILITY	COMMUNITY RESILIENCE	
Blaine	Low Risk	Very Low	Very Low	Very Low	Very Low
Grant	Low-Medium Risk	Very Low	Relatively Low	Very Low	Very Low
Hooker	Low Risk	Very Low	Very Low	Very Low	Very Low
Logan	Low-Medium Risk	Very Low	Very Low	Very Low	Very Low
Thomas	Medium-High Risk	Very Low	Very Low	Relatively Moderate	Very Low

Source: CDC Social Vulnerability Index, 2018¹³, FEMA National Risk Index, 2020

¹¹ U.S. Census Bureau. 2022. "Selected Housing Characteristics: 2020 ACS 5-year estimates." <https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#>.

¹² U.S. Census Bureau. 2022. "Families and Household Characteristics: 2020 ACS 5-year estimates. (S2801)" <https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#>.

¹³ Center for Disease Control Social Vulnerability Index. 2018. "CDC's Social Vulnerability Index (SVI): SVI Interactive Map" <https://svi.cdc.gov/map.html>

Hazard specific vulnerabilities from FEMA’s National Risk Index for the five counties in the planning area are included in the regional vulnerabilities section of each hazard profile (*Section Four*). Community specific information about social vulnerabilities and rural capabilities is discussed in *Section Seven’s* individual jurisdictional profiles.

State and Federally Owned Properties

The following table provides an inventory of state or federally owned properties within the planning area by county. Note that this list includes Cherry, Brown, and McPherson Counties which have parts of the county within the Upper Loup NRD’s jurisdictional boundaries. Only properties located within the NRD boundaries are included here.

Table 19: State and Federally Owned Properties

PROPERTY	COUNTY
Avocet Wildlife Management Area	Grant County - Hyannis
Frye Lake WMA	Grant County - Hyannis
Nebraska Department of Roads	Highways/roads/right of ways across all of Blaine, Grant, Logan, Hooker, Thomas Counties
Nebraska Game and Parks	Grant County
Nebraska State Forest	Thomas County --Thedford and Halsey
US Forest Service	Blaine County – Brewster; Thomas County -- Thedford and Halsey
De Fair Lake WMA	Grant County
Cottonwood Steverson WMA	Cherry County
Milburn Dam WMA	Blaine County
Willow Lake B.C. WMA	Brown County
American Game Marsh WMA	Brown County
Yellowthroat WMA	Brown County
South Pine WMA	Brown County

Source: Nebraska Game and Parks¹⁴, County Assessors

Historical Sites

According to the National Register of Historic Places for Nebraska by the National Park Service (NPS), there are five historic sites located in the planning area.

Table 20: Historical Sites

SITE NAME	DATE LISTED	NEAREST COMMUNITY	IN FLOODPLAIN
BESSEY NURSURY	5/24/1978	HALSEY, THOMAS COUNTY	N
HOTEL DEFAIR	10/29/1976	HYANNIS, GRANT COUNTY	N
HOOKE COUNTY COURTHOUSE	1/10/1990	MULLEN, HOOKER COUNTY	N
HUMPHREY ARCHEOLOGICAL SITE	1/21/1974	MULLEN, HOOKER COUNTY	N
KELSO SITE	1/21/1974	MULLEN, HOOKER COUNTY	N

Source: National Parks Service¹⁵

¹⁴ Nebraska Game and Parks. 2020. "Public Access ATLAS." [Web Map]. Accessed July 2022. <http://outdoornebraska.gov/publicaccessatlas/>.

¹⁵ National Park Service. Accessed June 2022. "National Register of Historic Places NPGallery Database." <https://npgallery.nps.gov/nrhp>.

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SECTION FOUR RISK ASSESSMENT

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

Table 21: Term Definitions

TERM	DEFINITION
Hazard	A potential source of injury, death, or damage
Asset	People, structures, facilities, and systems that have value to the community
Risk	The potential for damages, loss, or other impacts created by the interaction of hazards and assets
Vulnerability	Susceptibility to injury, death, or damages to a specific hazard
Impact	The consequences or effect of a hazard on the community or assets
Historical Occurrence	The number of hazard events reported during a defined period of time
Extent	The strength or magnitude relative to a specific hazard
Historical Probability	Likelihood of a hazard occurring based on historical occurrences
Future Likelihood	The probability of a hazard occurring based on historical occurrences, climate change, and future development

***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.*

Methodology

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

When describing the hazard, this appendix 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 Eight* will discuss jurisdictional-specific assets at risk for relevant hazards. Analysis for planning area 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).

For each of the hazards profiled, the best and most current appropriate data available have been considered. Further discussion relative to each hazard is discussed in the hazard profile portion of this appendix. Unless specifically stated otherwise, each hazard's extent scale(s) apply to all jurisdictions within the planning area.

Average Annual Damages and Probability

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 robust historic record and for which monetary damages are recorded. There are three main pieces of data used in this formula.

- **Total Damages in Dollars:** This is the total dollar amount of all property or crop damages as recorded in federal, state, and local data sources. The limitation to these data sources is that dollar figures usually are estimates and often do not include all damages from every event, but only officially recorded damages from reported events.
- **Total Years on Record:** This is the span of years there is data available for recorded events. During this planning process, vetted and cleaned up National Centers for Environmental Information (NCEI) was primarily used between January 1996 and January 2022. Although some data is available back to 1950, this plan update only utilizes the more current and accurate data available. Other periods of record for data are supplied where appropriate.

An example of the Event Damage Estimate is found below:

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

Historical Probability

Historical probability can be calculated based on the total years of record and the total number of years in which an event occurred. It is important to note for this formula that the number of total events is not used because multiple events may take place in a single year. This would skew the historical probability higher than it actually is. An example of the historical probability estimate is found below:

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

Future Likelihood

Future likelihood is the probability that a hazard will occur in the future. While historical probability tells us how often a hazard occurred in the past, it does not provide a full picture of what could happen in the future. Future conditions are likely to change the probability of hazard events. Climate change and future changes in development will bring changes probability, risk, and vulnerability. For this hazard mitigation plan historical probability, climate change, and future development will be taken into account when determining the future likelihood of a hazard event occurring. Because future conditions are difficult to quantify with percentages, future likelihood is broken down into the four categories below.

Table 22: Probability Rating and Categories

RATING	LIKELIHOOD	FREQUENCY OF OCCURRENCE	YEARLY INTERVAL
1	Unlikely	0%-5% probability to occur based on historical record	25+ years
2	Possible	6%-49% probability to occur based on historical record	Every 10-25 years
3	Likely	50%-79% probability to occur based on historical record	Every 5-10 years
4	Highly Likely	80%-100% probability to occur based on historical record	Every 1-5 years
5	Unknown	No data available for determination	

FEMA Standard Economic Values

As part of FEMA’s Benefit-Cost Analysis Toolkit, standard economic values were developed to better help estimate the avoided loss of services when implementing a hazard mitigation project. These standard economic values can also be used to help estimate potential future economic impacts from a hazard event. Table 23 shows the economic value for traffic delays on roads and bridges, loss of electric services, loss of wastewater services, loss of potable water services, and loss of communications/IT services. The assumed damages do not consider physical damage to utility equipment and infrastructure but do consider the impact on economic activity and impact on residential customers. To learn more about how these values were calculated visit https://www.fema.gov/sites/default/files/documents/fema_standard-economic-values-methodology-report_092022.pdf.

Table 23: FEMA Standard Economic Values

SERVICE LOST	ECONOMIC VALUE
Traffic Delays on Roads and Bridges	\$35.60/Vehicle/Hour
Loss of Electric Services	\$182/Person/Day
Loss of Wastewater Services	\$60/Person/Day
Loss of Potable Water Services	\$116/Person/Day
Loss of Communications/IT Services	\$130/Person/Day

Source: FEMA, 2022¹⁶

Also included in FEMA's Benefit-Cost Analysis Toolkit are life safety economic values. Life safety is the value of lives saved and injuries prevented resulting from mitigation measures. Table 24 shows the six different severity levels, their economic value, and common injuries associated with each level.

Table 24: FEMA Life Safety Economic Values

INJURY SEVERITY LEVEL	SELECTED COMMON INJURIES	ECONOMIC VALUE
Minor	Superficial abrasion or laceration of skin; digit sprain; first degree burn; head trauma with headache or dizziness (no other neurological signs).	\$35,000
Moderate	Major abrasion or laceration of skin; cerebral concussion (unconscious less than 15 minutes); finger or toe crush/amputation; closed pelvic fracture with or without dislocation.	\$545,000
Serious	Major nerve laceration; multiple rib fracture (but without flail chest); abdominal organ contusion; hand, foot, or arm crush/amputation.	\$1,218,000
Severe	Spleen rupture; leg crush; chest-wall perforation; cerebral concussion with other neurological signs (unconscious less than 24 hours).	\$3,086,000
Critical	Spinal cord injury (with cord transection); extensive second- or third-degree burns; cerebral concussion with severe neurological signs (unconscious more than 24 hours).	\$6,879,000
Un-Survivable	Injuries, which although not fatal within the first 30 days after an accident, ultimately result in death.	\$11,600,000

Source: FEMA, 2022

FEMA's standard economic values and life safety economic values will not be used to determine average annual damages and average damage per event estimates for each hazard profile. Past hazard events do not list the total number of people or vehicles impacted, and thus it is impossible to retroactively calculate the total economic impact using these values. While injuries and fatalities may be given it is not known the severity of those injured during the event. The values are provided in this plan so that participants can better estimate potential losses and determine the benefits of potential future mitigation actions.

¹⁶ FEMA. September 2022. "Benefit-Cost Analysis Sustainment and Enhancement". https://www.fema.gov/sites/default/files/documents/fema_standard-economic-values-methodology-report_092022.pdf.

Hazard Identification

The identification of relevant hazards for the planning area began with a review of the 2014 State of Nebraska Hazard Mitigation Plan. The Regional Planning Team and participating jurisdictions reviewed the list of hazards addressed in the state mitigation plan and determined which hazards were appropriate for discussion relative to the planning area. The hazards for which a risk assessment was completed are included in the following table.

Table 25: Hazards Addressed in the Plan

HAZARDS ADDRESSED IN THE 2024 UPPER LOUP NRD HMP		
ANIMAL AND PLANT DISEASE	DAM FAILURE	DROUGHT
EARTHQUAKE	EXTREME TEMPERATURES (HEAT AND COLD)	FLOODING
HAZARDOUS MATERIALS RELEASE	SEVERE THUNDERSTORMS	SEVERE WINTER STORMS
TERRORISM & CIVIL DISOBEDIENCE	TORNADOES & HIGH WINDS	WILDFIRE

While no hazards were eliminated or added during the 2024 Upper Loup NRD HMP; several changes were made for hazards. Changes to hazards included:

- Combined Chemical Fixed Sites & Chemical Transportation into Hazardous Materials Release
- Changed Civil Disorder to Terrorism & Civil Disorder
- Changed Extreme Heat to Extreme Temperatures to include Cold
- Combined Hail with Severe Thunderstorms
- Combined High Winds with Tornadoes

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 26: Regional Risk Assessment

HAZARD	PREVIOUS OCCURRENCES	APPROXIMATE ANNUAL PROBABILITY	LIKELY EXTENT
AGRICULTURAL ANIMAL DISEASE	32	8/9 = 89% <i>Highly Likely</i>	Avg. 2 animals per event
AGRICULTURAL PLANT DISEASE	0	<i>Unlikely</i>	Unavailable Likely to occur despite lack of reported occurrences
DAM FAILURE	0	<i>Unlikely</i>	Varies by structure, inundation of floodplain downstream from dam
DROUGHT	474/1,539 months	31% <i>Possible</i>	Mild Drought (D1)
EARTHQUAKES	4	4/123 = 3.3% <i>Unlikely</i>	<4.0 magnitude
EXTREME HEAT	Avg. 3 days per year	84/130 = 65% <i>Likely</i>	>100°F
EXTREME COLD	Avg. 10 days per year	10/28 = 36%	<10°F

SECTION FOUR: RISK ASSESSMENT

		<i>Possible</i>	
FLOODING (FLASH AND RIVERINE)	14	9/28 = 32% <i>Possible</i>	Inundation of land or roads near waterways likely. Minimal flooding extent anticipated.
HAZARDOUS MATERIALS – FIXED SITE	0	<i>Unlikely</i>	Localized to the facilities and adjacent surroundings.
HAZARDOUS MATERIALS – TRANSPORTATION	17	5/52 = 10% <i>Possible</i>	Avg. ~1,125 LGA Limited (<0.5 mile) from release site
HIGH WINDS	126	20/28 = 71% <i>Likely</i>	9 BWF (Avg 47-54mph)
SEVERE THUNDERSTORMS (INCLUDES HAIL, HEAVY RAIN, LIGHTNING, AND THUNDERSTORM WIND)	1,072	28/28 = 100% <i>Highly Likely</i>	>1" rainfall Avg 1.19 hail Wind 50-87 knts
SEVERE WINTER STORMS (INCLUDES BLIZZARDS, EXTREME COLD, ICE STORMS, WINTER STORMS)	296	28/28 = 100% <i>Highly Likely</i>	0.25-0.5" ice 30°-40° below zero (wind chill) 6-9" snow 20-30 mph winds
TERRORISM AND CIVIL DISORDER	0	<i>Unlikely</i>	Unavailable
TORNADOES	26	17/28 = 61% <i>Likely</i>	Range EF0-EF2 Avg. EF0
WILDFIRE	372	24/24 = 100% <i>Highly Likely</i>	Avg 250 acres

Table 27: Loss Estimation for the Planning Area

HAZARD		COUNT	PROPERTY	CROP	OTHER IMPACTS
Agricultural Disease	Animal Disease	32	99 animals	N/A	
	Plant Disease	0	N/A	\$0	
Dam Failure		0	\$0	N/A	
Drought		474/1,539 months	\$5,000,000	\$4,728,459	
Earthquakes		4	\$0	\$0	
Extreme Heat		Avg. 3 days per year	\$0	\$598,315	
Extreme Cold		Avg. 10 days per year	\$0	\$245,944	
Flooding	Flash Flood	8	\$535,000	\$15,286	
	Flood	6	\$480,000		
Hazardous Materials	Fixed Site	0	\$0	N/A	
	Transportation	7	\$80,826		
Severe Thunderstorms	Hail	851	\$1,822,000	\$	
	Heavy Rain	3	\$0	\$	
	Lightning	2	\$3,000	N/A	
	Thunderstorm Wind	216	\$536,000	N/A	

Severe Winter Storms	Blizzards	49	\$255,000	\$57,083	2 fatalities, 1 injury
	Heavy Snow	22	\$10,000		
	Ice Storms	2	\$16,000		
	Winter Storms	223	\$315,000		
	Winter Weather	0	\$0		
Tornadoes & High Winds	High Winds	126	\$7,000	\$259,921	
	Tornadoes	26	\$104,500	\$0	
Terrorism and Civil Disorder		0	\$0	N/A	
Wildfire		372	95,672 acres	\$139,538	1 fatality 20 homes threatened, 16 structures threatened, 3 homes destroyed, 4 structures destroyed
Total		1,949	\$9,164,326	\$10,228,287	3 fatalities, 1 injury 20 homes threatened, 16 structures threatened, 3 homes destroyed, 4 structures destroyed

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 28: SBA Declarations

DISASTER DECLARATION NUMBER	DECLARATION YEAR	DESCRIPTION	PRIMARY COUNTIES	CONTIGUOUS COUNTIES
NE-00049	8/1/2012	Drought	Statewide	Statewide
NE-00021	6/20/2008	Severe Storms, Tornadoes, and Flooding	Blaine, Logan, Thomas	
NE-00020	6/20/2008	Severe Storms, Tornadoes, and Flooding		Blaine, Logan
NE-00014	7/24/2007	Severe Storms and Flooding	Logan	

DISASTER DECLARATION NUMBER	DECLARATION YEAR	DESCRIPTION	PRIMARY COUNTIES	CONTIGUOUS COUNTIES
NE-00013	6/6/2007	Severe Storms, Tornadoes, and Flooding	Thomas	
NE-00011	1/7/2007	Severe Winter Storms	Blaine, Logan	
NE-00007	7/13/2006	High Temperatures, High Winds, Excessive Heat, and Ongoing Drought	Blaine, Hooker, Logan, Thomas	
NE-00006	7/13/2006	High Temperatures, High Winds, Excessive Heat, and Ongoing Drought		Blaine

Source: Small Business Administration, 2001-2022¹⁷

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

Presidential disaster declarations are available via FEMA from 1953 to 2019. Declarations prior to 1962 are not designated by county on the FEMA website and are not included below. The following table describes presidential disaster declarations within the planning area for the period of record. Note that while data is available from 1953 onward, the planning area has only received 15 presidential disaster declarations since 2001.

Table 29: Presidential Disaster Declarations

DISASTER DECLARATION NUMBER	DECLARATION DATE	TITLE	AFFECTED COUNTIES	TOTAL PUBLIC ASSISTANCE
1373	5/16/2001	Severe Winter Storms, Flooding, and Tornadoes	Hooker, Thomas, Logan, Blaine	\$2,982,075.51
1517	5/25/2004	Severe Storms, Tornadoes, and Flooding	Blaine	\$13,351,657.77
3245	9/13/2005	Hurricane Katrina Evacuees	Grant, Logan, Blaine, Thomas, Hooker	\$393,813.27
1627	1/26/2006	Severe Winter Storms	Logan	\$5,444,137.27
1674	1/7/2007	Severe Winter Storms	Blaine, Logan	\$124,357,843.32
1706	6/6/2007	Severe Storms, Flooding, and Tornadoes	Thomas, Blaine	\$6,109,252.52
1714	7/24/2007	Severe Storms and Flooding	Logan	\$2,306,258.82
1770	6/20/2008	Severe Storms, Tornadoes, and Flooding	Blaine, Logan, Thomas	\$36,258,650.19

¹⁷ Small Business Administration. 2001-2018. "SBA Disaster Loan Data." Accessed December 2019. <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
1924	7/15/2010	Severe Storms and Flooding	Logan, Hooker, Thomas, Blaine	\$49,926,354.50
2900	4/22/2011	Theford Fire	Thomas	N/A
4014	8/12/2011	Severe Storms, Tornadoes, Straight Line Winds, and Flooding	Logan	\$3,362,468.45
4321	6/26/2017	Severe Winter Storms and Straight-Line Winds	Blaine	\$2,653,954.12
4375	6/29/2018	Severe Winter Storms and Straight-Line Winds	Logan, Blaine	\$83,371.64
4387	8/27/2018	Severe Winter Storms, Straight Line Winds, and Flooding	Thomas, Logan	\$252,445.02
4420	3/21/2019	Severe Winter Storms, Straight Line Winds, and Flooding	Blaine, Logan	\$1,872,997.37
4521	4/4/2020	Nebraska COVID-19 Pandemic	Blaine, Grant, Hooker, Logan, Thomas	\$281,829,946.43
4616	9/6/2021	Nebraska Severe Storms and Straight-Line Winds	Grant	\$28,136,444.65
4662	7/27/2022	Nebraska Severe Storms and Straight-Line Winds	Logan	\$10,051,999.97

Source: FEMA, 1953-2023¹⁸

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.

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.

Figure 9: Great Plains Region



¹⁸ Federal Emergency Management Agency. 2022. "Disaster Declarations." Accessed October 2023. <https://www.fema.gov/openfema-dataset-disaster-declarationsummaries-v1>.

The Fourth National Climate Assessment has provided an overview of potential impacts within the planning area.¹⁹

- **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

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 11).²⁰

¹⁹ U.S. Global Change Research Program. 2018. “Fourth National Climate Assessment”. <https://nca2018.globalchange.gov/>.

²⁰ 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).

Figure 10: Average Temperature (1895-2021)

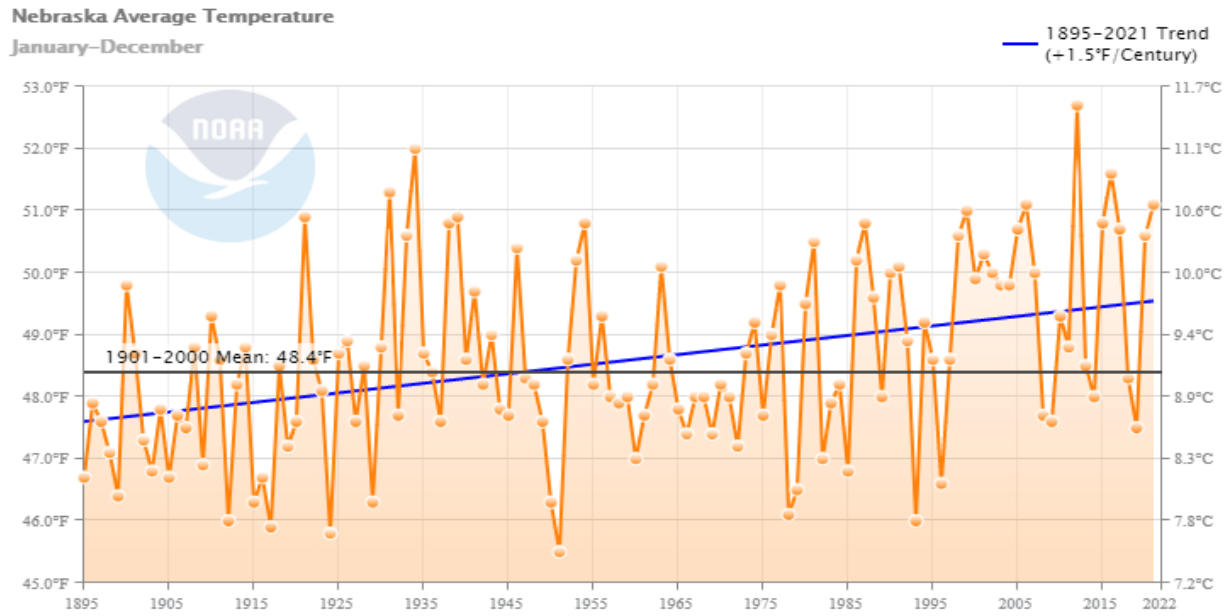
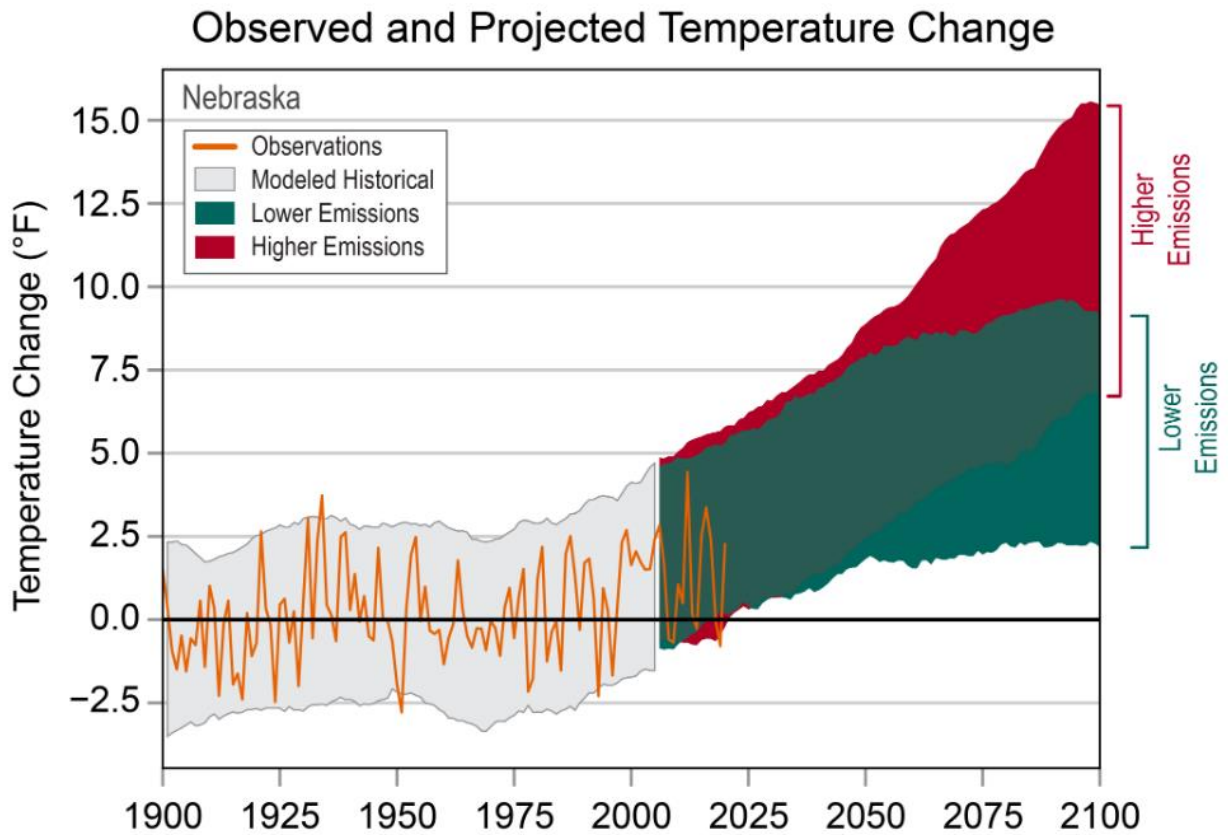


Figure 11: Observed and Projected Temperature Change - Nebraska

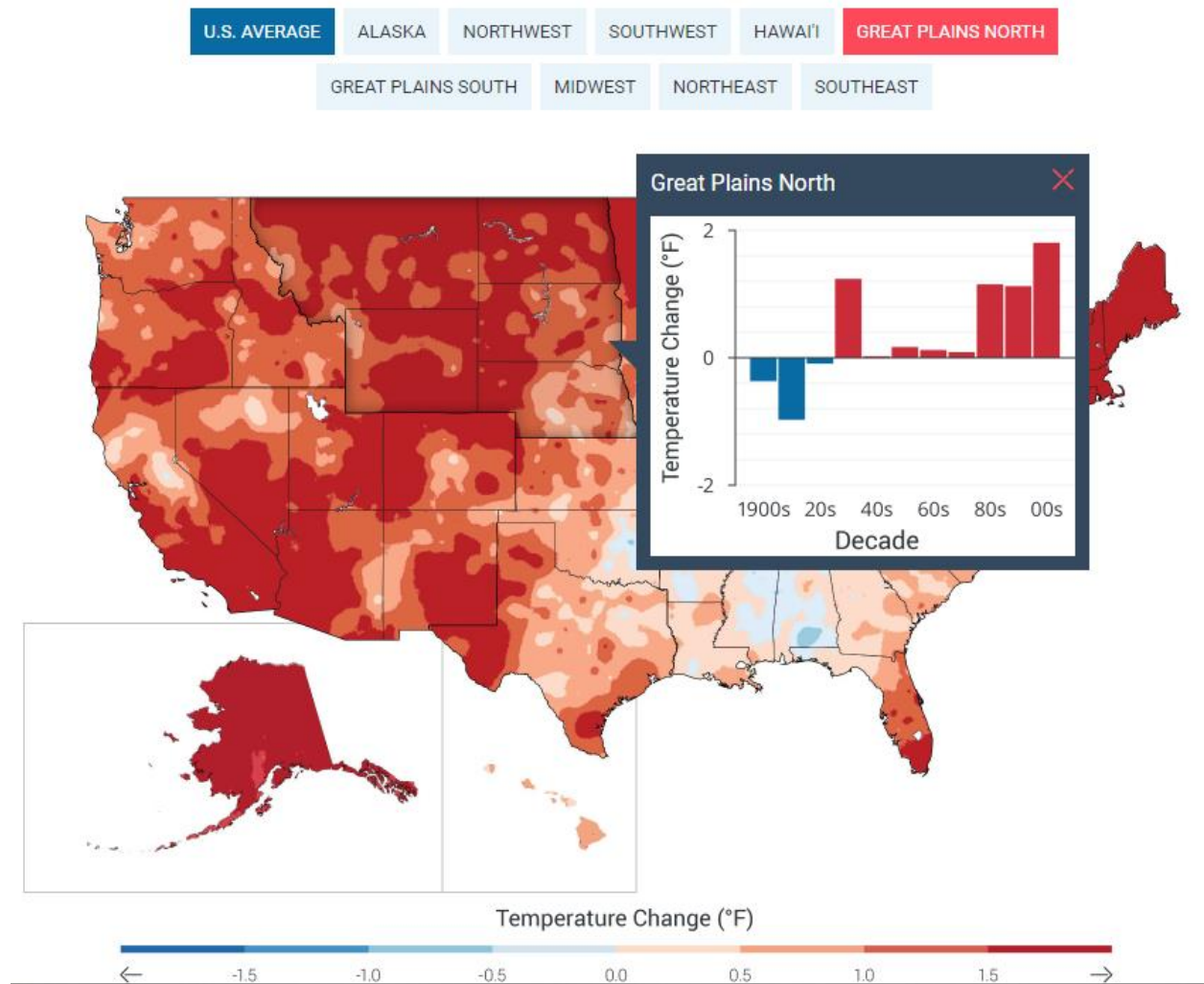


Source: NCEI

²¹ 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.²²

Figure 12: Observed U.S. Temperature Change



Source: National Climate Assessment, 2014²³

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

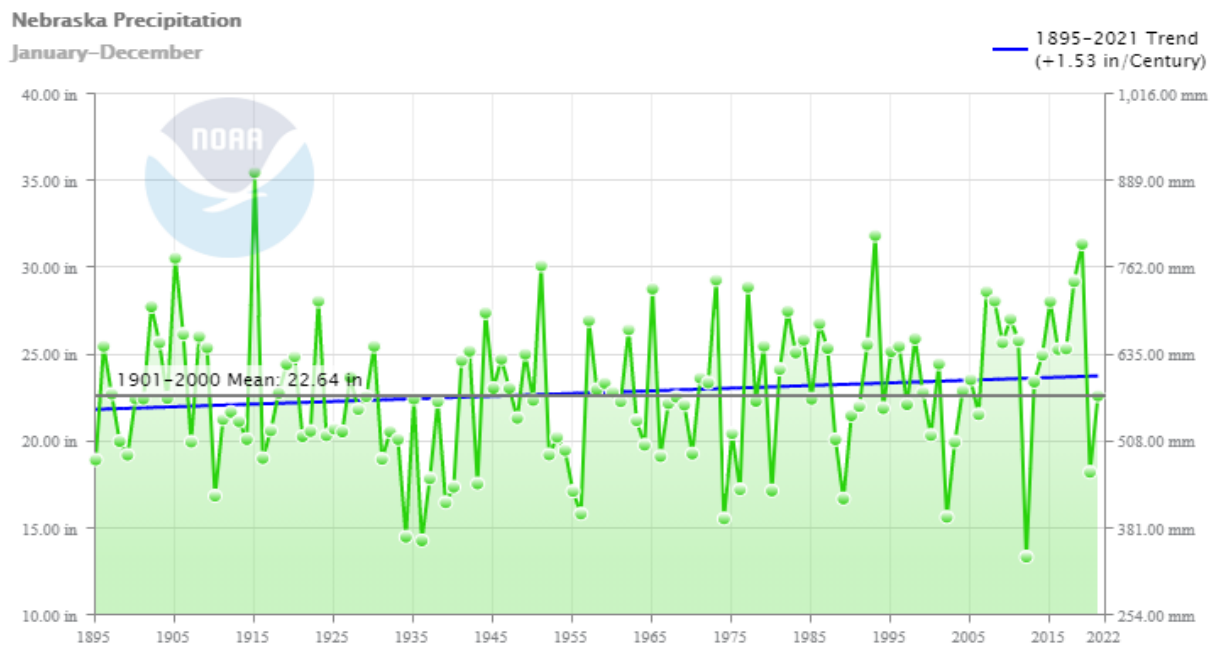
²² U.S. Global Change Research Program. "2014 National Climate Assessment: Frost-free Season." Accessed 2020. <https://nca2014.globalchange.gov/report/our-changing-climate/frost-free-season#tab2-images>

²³ U.S. Global Change Research Program. "2014 National Climate Assessment." Accessed 2020. <https://nca2014.globalchange.gov/>

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 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 seasonal 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.²⁴ 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.²⁵

Figure 13: Nebraska Average Precipitation (1895-2021)



Source: NOAA, 2022²⁶

²⁴ 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

²⁵ NOAA NCEI. 2017. "Nebraska State Climate Summary." Accessed 2021. <https://statesummaries.ncics.org/chapter/ne/>

²⁶ 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

Impacts from Climate Change

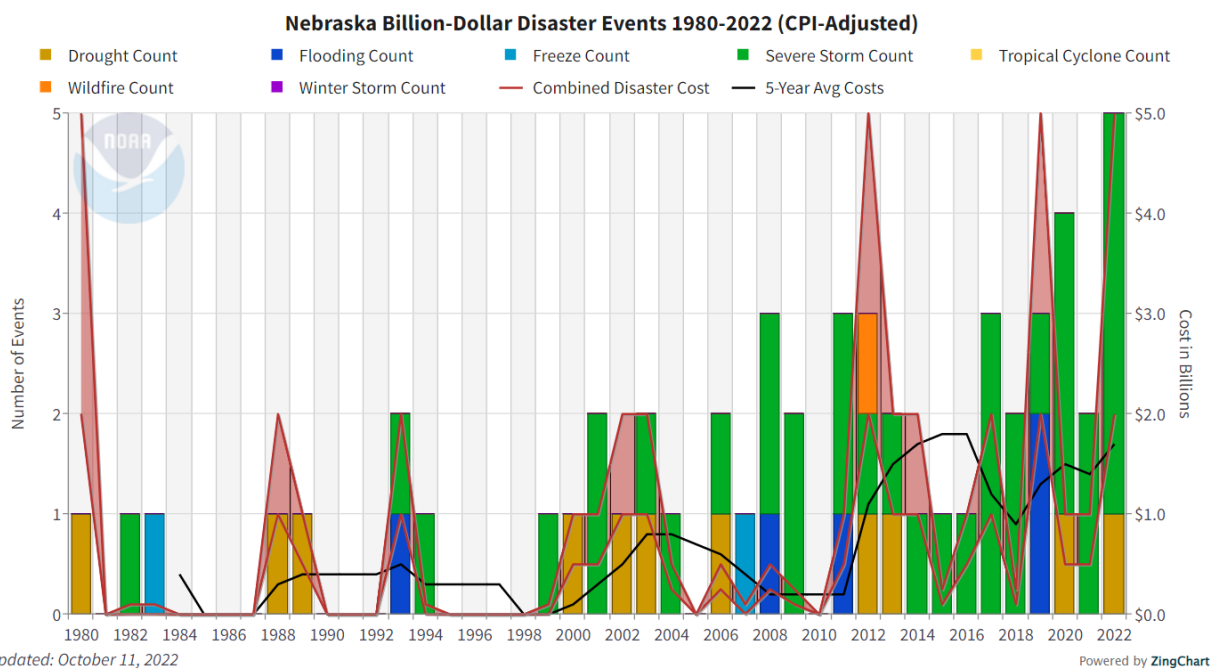
Observed changes in the intensity and frequency of extreme events are a significant concern now and in the future because of the social, environmental, and economic costs associated with their impacts. Challenges that are expected to affect communities, environments, and residents because of climate 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, specific industries and professions tied to weather and climate, like outdoor tourism, commerce, and agriculture, are especially vulnerable.²⁷

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

Figure 14: Nebraska Billion Dollar Disasters (1980-2022)



Agriculture

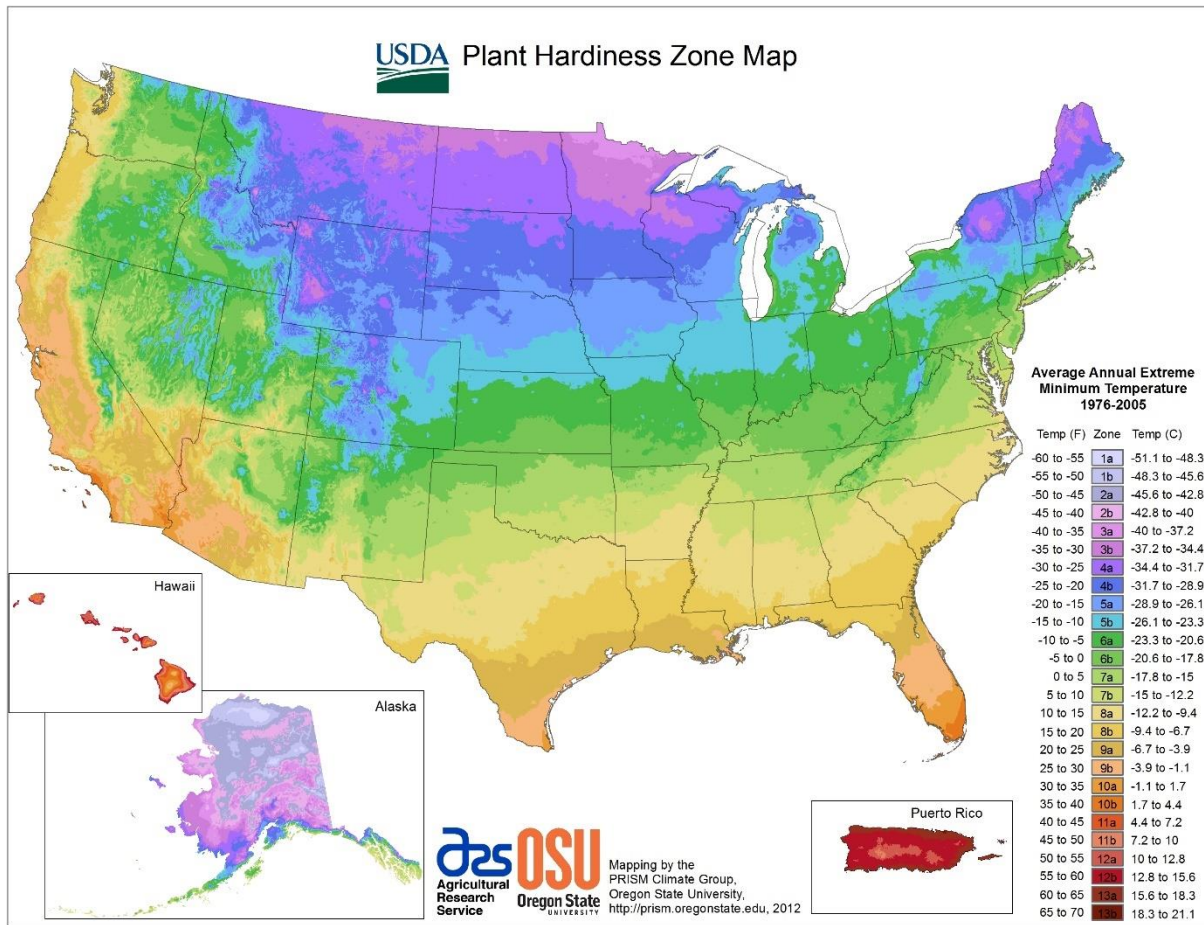
The agricultural sector will experience an increase in droughts, an increase in grass and wildfire events, changes in the growth cycle as winters warm, an influx of new and damaging agricultural diseases or pests,

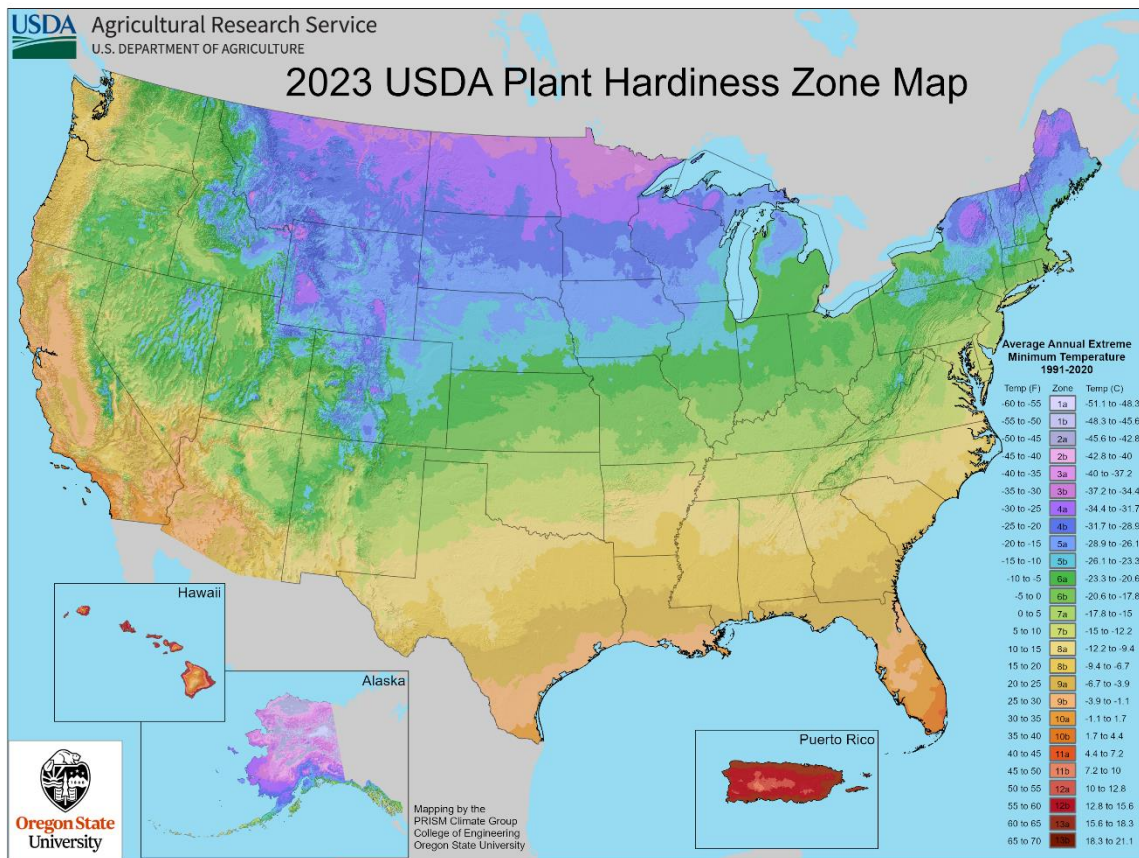
²⁷ U.S. Environmental Protection Agency. “Climate Impacts on Society.” Accessed April 2021. https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-society_.html

²⁸ NOAA National Centers for Environmental Information. October 2022. “Nebraska Billion-Dollar Weather and Climate Disasters”. <https://www.ncei.noaa.gov/access/billions/time-series/NE>.

and changes in the timing and magnitude of rainfall. As described in the Plant Hardiness Zone maps (Figure 15) 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.

Figure 15: Plant Hardiness Zone Change – 2012 to 2023





Source: USDA, 2023²⁹

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.³⁰ 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.³¹

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

²⁹ United States Department of Agriculture. 2023. "2023 USDA Plant Hardiness Zone Map." <https://planthardiness.ars.usda.gov/>.

³⁰ Asthma and Allergy Foundation of America. 2010. "Extreme Allergies and Climate Change." Accessed 2021. <https://www.aafa.org/extreme-allergies-and-climate-change/>

³¹ 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

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.³²

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.³³ 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 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.

³² 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

³³ 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.

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, and the jurisdictions' capabilities. However, it is important to note that while a jurisdiction may not have selected a specific hazard to be profiled, hazard events can impact any 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:

- Severe Thunderstorms
- Severe Winter Storms
- Tornadoes and High Winds
- Wildfire
- Drought
- Hazardous Materials
- Extreme Temperatures

Hazards not identified as top concern:

- Agricultural Plant and Animal Disease
- Terrorism and Civil Disorder
- Dam Failure
- Earthquakes
- Flooding

Table 30: Top Hazards of Concern by Jurisdiction

JURISDICTION	ANIMAL & PLANT DISEASE	DAM FAILURE	DROUGHT	EARTHQUAKES	EXTREME TEMPS	FLOODING	HAZARDOUS MATERIALS	SEVERE THUNDERSTORMS	SEVERE WINTER STORMS	TERRORISM & CIVIL DISOBEDIENCE	TORNADOES AND HIGH WINDS	WILDFIRES
Upper Loup NRD			X		X			X	X		X	
Blaine County			X								X	X
Brewster								X			X	
Dunning								X	X			
Grant County	-	-	-	-	-	-	-	-	-	-	-	-
Hyannis								X	X			X
Hooker County			X					X	X		X	X
Mullen					X			X	X		X	
Logan County								X	X			X
Gandy								X	X			
Stapleton								X			X	
Thomas County			X						X		X	X
Halsey								X	X			X
Theford								X	X			
Mullen Public Schools								X	X		X	
Sandhills Public School							X	X	X		X	X
Theford Public Schools								X	X		X	X

AGRICULTURAL PLANT AND ANIMAL DISEASE

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

The economy of the state of Nebraska is heavily vested in both livestock and crop sales. According to the Nebraska Department of Agriculture (NDA) in 2012, the market value of agricultural products sold was estimated at more than \$23 billion; this total is split between crops (estimated \$11.37 billion) and livestock (estimated \$11.69 billion). For the planning area, the market value of sold agricultural products exceeded \$145 million. The tables below show the population of livestock within the planning area. This count does not include wild populations that are also at risk from animal diseases.

Table 31: Livestock Inventory

COUNTY	MARKET VALUE OF 2017	CATTLE AND	HOGS AND	SHEEP AND	POULTRY EGG
	LIVESTOCK SALES	CALVES	PIGS	LAMBS	LAYERS
Nebraska	\$12,672,422,000	6,759,945	3,584,756	63,043	7,353,761
Blaine	\$29,925,000	43,246	-	146	73
Grant	(D)	35,721	-	-	141
Hooker	(D)	23,282	(D)	(D)	(D)
Logan	\$18,436,000	27,209	-	(D)	139
Thomas	\$22,369,000	27,981	(D)	-	(D)
Total	\$70,730,000	157,439	0	146	353

Source: U.S. Census of Agriculture, 2017; (D) – data not available

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

Table 32: Land and Value of Farms in the Planning Area

COUNTY	NUMBER OF FARMS	LAND IN FARMS (ACRES)	MARKET VALUE OF 2017 CROP SALES
Nebraska	46,332	44,986,821	\$9,311,007,000
Blaine	101	366,649	\$2,130,000
Grant	64	495,096	(D)
Hooker	97	427,028	(D)
Logan	117	298,017	\$10,178,000
Thomas	90	388,140	\$2,027,000
Total	469	1,974,930	\$14,335,000

Source: U.S. Census of Agriculture, 2017

Table 33: Crop Values

COUNTY	CORN		SOYBEANS		WHEAT	
	ACRES HARVESTED	VALUE	ACRES HARVESTED	VALUE	ACRES HARVESTED	VALUE
Blaine	2,098	\$1,483,000	360	\$108,000	-	-
Grant	-	-	-	-	-	-
Hooker	(D)	(D)	-	-	-	-
Logan	12,768	\$7,096,000	4,067	\$2,023,000	413	\$66,000
Thomas	(D)	(D)	-	-	-	-

COUNTY	CORN		SOYBEANS		WHEAT	
	ACRES HARVESTED	VALUE	ACRES HARVESTED	VALUE	ACRES HARVESTED	VALUE
Total	14,866	8,579,000	4,427	2,131,000	413	66,000

Source: U.S. Census of Agriculture, 2017

Location

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

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

Historical Occurrences

Animal Disease

The NDA provides reports on diseases occurring in the planning area. There were 32 instances of animal diseases reported between January 2014 and March 2023 by the NDA. These outbreaks affected 99 animals.

Table 34: Livestock Diseases Reported in the Planning Area

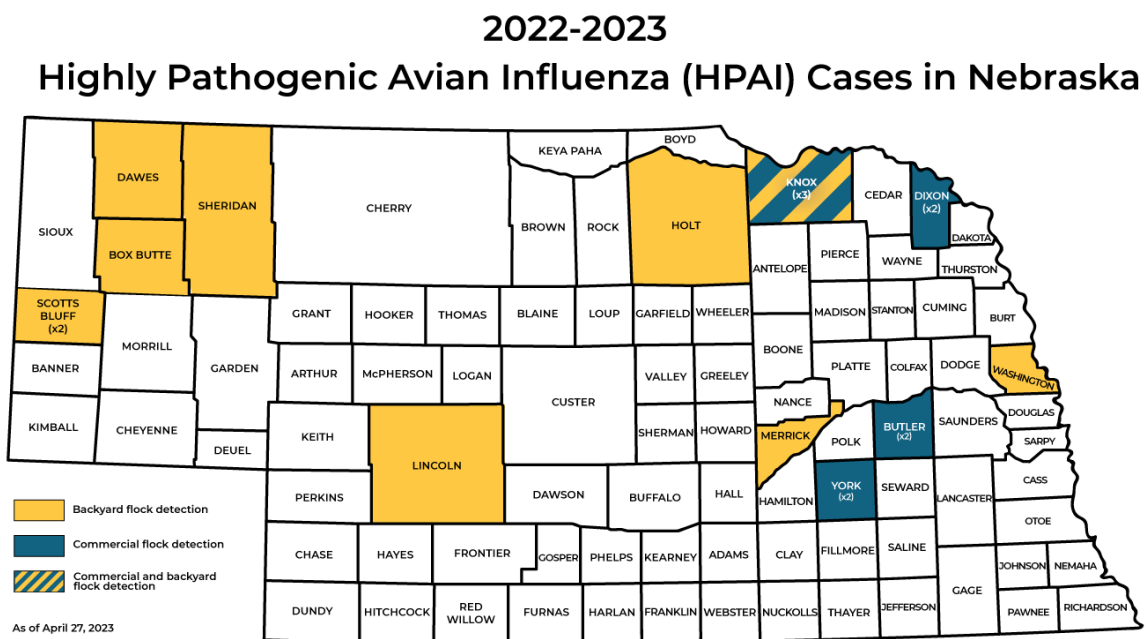
YEAR	COUNTY	DISEASE	POPULATION IMPACTED
2014	Grant	Blue Tongue	1
	Grant	Paratuberculosis	1
	Logan	Enzootic Bovine Leukosis	1
2015	Blaine	Paratuberculosis	1
	Grant	Blue Tongue	1
	Grant	Bovine Viral Diarrhea	1
	Grant	Paratuberculosis	1
	Logan	Enzootic Bovine Leukosis	1
	Logan	Vesicular Stomatitis	1
2016	Grant	Paratuberculosis	3
	Grant	Leptospirosis	1
	Hooker	Blue Tongue	1
	Hooker	Paratuberculosis	1
	Logan	Enzootic Bovine Leukosis	1
2017	Grant	Paratuberculosis	5
	Logan	Enzootic Bovine Leukosis	1
2018	Grant	Paratuberculosis	5
	Grant	Leptospirosis	1
	Thomas	Paratuberculosis	40
	Thomas	Leptospirosis	1
2019	Grant	Leptospirosis	1
	Grant	Paratuberculosis	2
	Hooker	Anaplasmosis	2
	Hooker	Blue Tongue	15
	Hooker	Bovine Viral Diarrhea	4

YEAR	COUNTY	DISEASE	POPULATION IMPACTED
2020	Blaine	Blue Tongue	1
	Blaine	Porcine Reproductive and Respiratory Syndrome	4
	Grant	Paratuberculosis	1
	Hooker	Paratuberculosis	1
2022	Grant	Leptospirosis	1
	Logan	Paratuberculosis	1
2023	Hooker	Enzootic Bovine Leukosis	1

Source: U.S. Census of Agriculture, 2014-March 2023³⁴

Avian Influenza is a viral disease that affects chickens, turkeys, pheasants, quail, waterfowl, swans, peafowl, and guinea fowl. The virus is highly transferable between birds and can cause decreased egg production, respiratory issues, and death within the bird population. Avian Influenza was first detected in Nebraska in a non-commercial backyard flock in March 2022. As of September 2023 there is no Avian Influenza outbreak in the planning area.³⁵

Figure 16: Avian Flu in Nebraska



Source: Nebraska Department of Agriculture, 2023

Plant Disease

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

³⁴ Nebraska Department of Agriculture. 2022. "Livestock Disease Reporting." <http://www.nda.nebraska.gov/animal/reporting/index.html>.

³⁵ Nebraska Department of Agriculture. October 20, 2022. "Avian Influenza". Accessed October 28, 2022. <https://nda.nebraska.gov/animal/avian/index.html>.

Table 35: Common Crop Diseases by Crop Type

CROP	DISEASE	
Corn	Anthracnose	Southern Rust
	Bacterial Stalk Rot	Stewart's Wilt
	Common Rust	Common Smut
	Fusarium Stalk Rot	Gross's Wilt
	Fusarium Root Rot	Head Smut
	Gray Leaf Spot	Physoderma
	Maize Chlorotic Mottle Virus	
Soybeans	Anthracnose	Pot and Stem Blight
	Bacterial Blight	Purple Seed Stain
	Bean Pod Mottle	Rhizoctonia Root Rot
	Brown Spot	Sclerotinia Stem Rot
	Brown Stem Rot	Soybean Mosaic Virus
	Charcoal Rot	Soybean Rust
	Frogeye Leaf Spot	Stem Canker
	Phytophthora Root and Stem Rot	Sudden Death Syndrome
Wheat	Barley Yellow Dwarf	Leaf Rust
	Black Chaff	Tan Spot
	Crown and Root Rot	Wheat soy-borne Mosaic
	Fusarium Head Plight	Wheat Streak Mosaic
Sorghum	Ergot	Zonate Leaf Spot
	Sooty Stripe	
Trees	Burr Oak Blight	Dutch Elm Disease
	Powdery Mildew	Leaf Spot and Blight
	Canker (various types)	Root Rot
	Pine Wilt Disease	Crown Gall

In addition to the viral and bacterial diseases that could impact crops, pests can also result in crop loss or detract from crop quality. Pests present in the planning area include:

- Japanese Beetles
- Grasshoppers
- Western Bean Cutworm
- European Corn Borer
- Corn Rootworm
- Corn Nematodes
- Soybean Aphids
- Rootworm Beetles

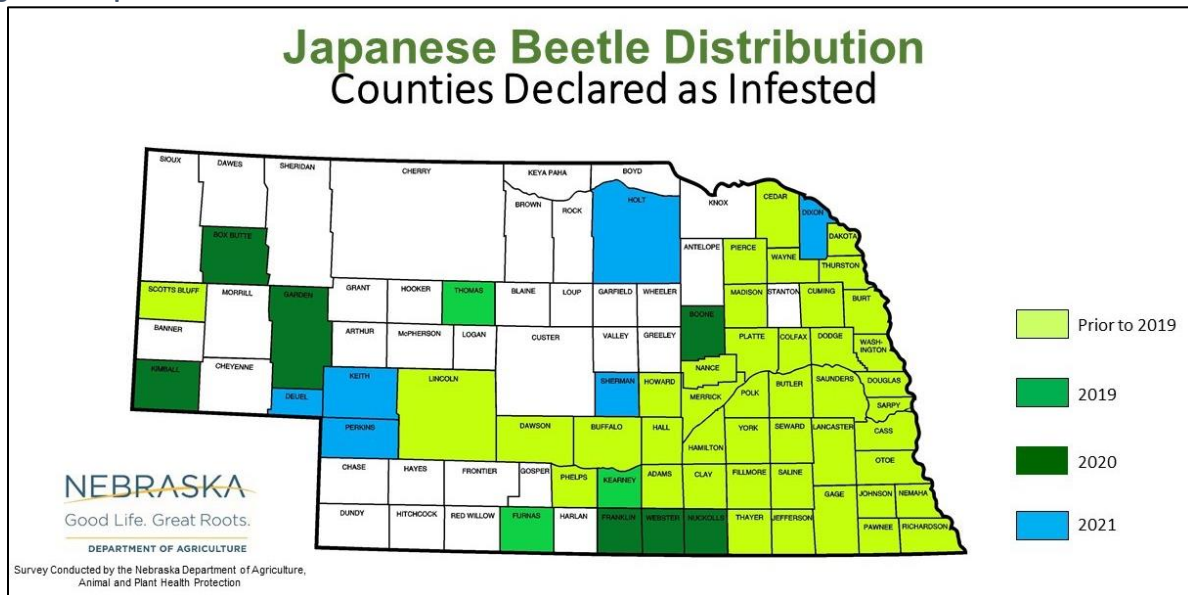
The RMA provides data on plant disease events and plant losses in the planning area. There were no instances of plant diseases reported from 2000-2023 by the RMA.

Japanese Beetles

Japanese beetles are a rising concern in the state and planning area. Japanese beetles are highly destructive invasive pests found in many counties across Nebraska. The figure shows counties declared as infested by the beetles. Thomas County declared infestation in 2019. These beetles cause damage in the larval state (root damage) and adult stage (defoliation). Adult Japanese beetles can defoliate a tree quickly

as other beetles are attracted to feeding sites by both the scent of the plant and pheromones sent out by other beetles. Chemical pesticides provide temporary protection however there are no long-range protection measures.

Figure 17: Japanese Beetle Distribution in Nebraska



Average Annual Losses

According to the USDA RMA (2000-2018) there were no plant disease events or damages for the planning area. This does not mean that plant disease outbreaks did not occur, simply that they were not recorded. Additionally, Grant County and Hooker County do not have RMA data available. The RMA also does not track losses for livestock, so it is not possible to estimate losses due to animal disease.

Table 36: Agricultural Disease Losses

HAZARD TYPE	NUMBER OF EVENTS	EVENTS PER YEAR	TOTAL LOSS	AVERAGE ANNUAL LOSS
Plant Disease	0	0	\$0	\$0
Animal Disease	32	3.2	99 animals	9.9 animals/yr

Source: RMA, 2000-2023; NDA, 2014-2023

Extent

There is no standard for measuring the magnitude of agricultural disease. Historical events have impacted a relatively small numbers of livestock and/or crops. The planning area is heavily dependent on the agricultural economy and the extent scale for this hazard applies the same to each jurisdiction in the plan. Any severe plant or animal disease outbreak which may impact this sector would negatively impact the entire planning area.

Historical Probability and Future Likelihood

Given the historical record of agricultural plant disease (no disease outbreaks reported out of 22 years) the annual probability of plant disease is stated at less than one percent (Unlikely). Given the historical record for animal disease events (one disease outbreak reported in 9 of 10 years), for the purposes of this plan, the annual probability of animal disease occurrence is 90 percent (Highly Likely). The likelihood of agricultural disease outbreaks is likely to remain consistent or increase as future development occurs; particularly if agricultural production remains the driving economic sector in the planning. Higher

production demand will lead farmers, ranchers, or other producers to increase population densities of livestock and crops.

Table 37: Historical Probability & Future Likelihood – Agricultural Disease

Hazard	Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
Animal Disease	90%	Increase in Frequency and Extent	Consistent to increase in Frequency	Highly Likely
Plant Disease	>1%	Increase in Frequency and Extent	Increase in Frequency	Unlikely

Future Development

The likelihood of agricultural disease outbreaks is likely to remain consistent or increase as future development occurs; particularly if agricultural production remains a driving economic sector in the planning area. Higher production demand will lead farmers, ranchers, or other producers to increase population densities of livestock and crops. For communities, diversification of trees and other landscape vegetation will help reduce the impacts and likelihood of invasive species and plant disease outbreaks. Communities can require new developments to only have a certain percentage of trees from one specific species.

Climate Change Impacts

The distribution and severity of agricultural disease outbreaks will likely increase alongside climate change impacts. Shifting climatic conditions will stress existing agricultural populations and plant species, creating vulnerability for new diseases to take hold. The perceived trend toward higher average temperatures and increased periods of severe drought increases the stress levels on animal populations, increasing the risk of disease taking hold. Additionally, uncommon diseases may return at higher amounts as changes in the environment cause the release of previously contained diseases or promote the mutation of diseases.

As noted by the Fourth National Climate Assessment: *“rural communities, where economies are more tightly interconnected with agriculture than with other sectors, are particularly vulnerable to the agricultural volatility related to climate... Crop and livestock production in certain regions will be adversely impacted both by direct effects of climate change (such as increasing trends in daytime and nighttime temperatures; changes in rainfall patterns; and more frequent climate extremes, flooding, and drought) and consequent secondary effects (such as increased weed, pest, and disease pressures; reduced crop and forage production and quality; and damage to infrastructure). While climate change impacts on future agricultural production in specific regions of the United States remain uncertain, the ability of producers to adapt to climate change through planting decisions, farming practices, and use of technology can reduce its negative impact on production.”*³⁶

Changes to crop growth cycles due to warming winters and alterations in the timing and magnitude of rainfall events have already been observed as these trends continue, they will require new agriculture and livestock management practices.

Community Top Hazard Status

No jurisdiction identified Agricultural Plant and Animal Disease as a top hazard of concern.

³⁶ Fourth National Climate Assessment. 2018. “Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II. <https://nca2018.globalchange.gov/>.

Regional Vulnerabilities

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

Table 38: Regional Agricultural Vulnerabilities

SECTOR	VULNERABILITY
People	-Those in direct contact with infected livestock -Potential food shortage during prolonged events -Residents in poverty if food prices increase
Economic	-Local and regional economic power tied to the agricultural industry -Large scale or prolonged events may impact tax revenues and local capabilities -Land values may largely drive population changes within the planning area
Built Environment	-None
Infrastructure	-Transportation routes can be closed during quarantine
Critical Facilities	-None
Climate	-Changes in seasonal normals can promote spread of invasive species and agricultural disease

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.”³⁷

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 39: Dam Size Classification

SIZE	EFFECTIVE HEIGHT (FT) X EFFECTIVE STORAGE (ACRE-FT)	EFFECTIVE HEIGHT
Small	≤ 3,000 acre-ft ²	And ≤ 35 feet
Intermediate	> 3,000 acre-ft ² to < 30,000 acre-ft ²	Or > 35 feet
Large	≥ 30,000 acre-ft ²	Regardless of height

Source: NeDNR, 2013³⁸

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.

³⁷ 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.

³⁸ 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 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
- 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

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. According to the USACE National Inventory of Dams, there are three dams located within the planning area, all classified as Low Hazard. According to the Dam Safety Division of NeDNR, there are three dams in total – one Low hazard and two Minimal hazard. Figure 18 maps the location of these dams in the planning area.

Table 46: Dams in the Planning Area

COUNTY	LOW/MINIMAL HAZARD	SIGNIFICANT HAZARD	HIGH HAZARD
Blaine	1*	0	0
Grant	0	0	0
Hooker	0	0	0
Logan	0	0	0
Thomas	2*	0	0
Total	3	0	0

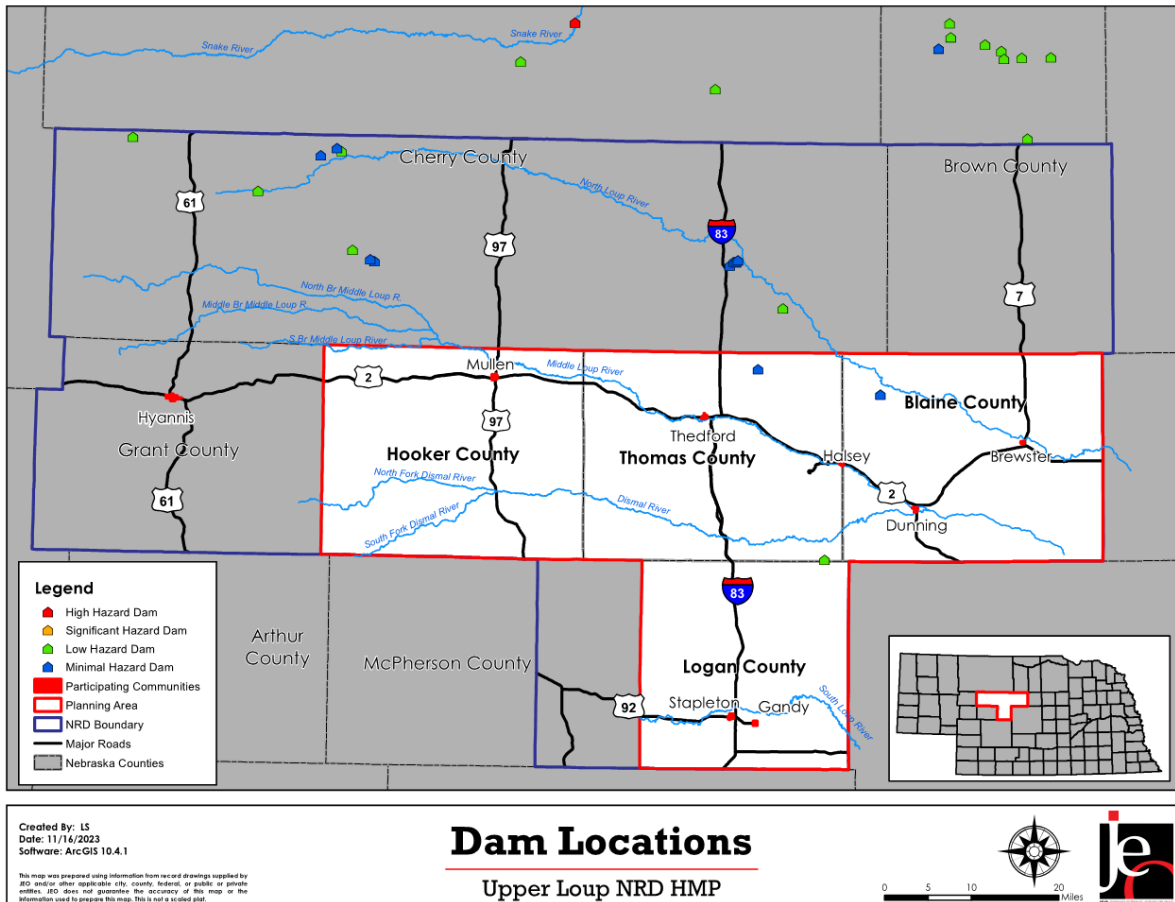
Source: National Inventory of Dams, 2023 and NeDNR, 2023³⁹ Note: NeDNR classifies Blaine County dam as “Minimal Hazard” and one Thomas County dam as “Minimal Hazard”.

³⁹ Nebraska Department of Natural Resources. 2022. “Nebraska Dam Inventory.” <https://dnr.nebraska.gov/dam-safety/nebraska-dam-inventory>.

**The southern portions of Cherry County and Brown County are located within the NRD boundary, but outside of the planning area. Dams in these counties located outside of the Upper Loup NRD are not included here.*

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 18: Dam Locations in the Planning Area



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. While there are no high hazard dams located within the planning area, there is one high hazard dam in Cherry County north of the planning area.

If a high hazard dam is built or a significant dam is reclassified as high hazard, then the dam would require the creation of an Emergency Action Plan (EAP). The EAP defines responsibilities and provides guidance

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. The EAP includes information regarding the efficiency of emergency response entities so that proper action can be taken to prevent the loss of life and property. Local emergency response entities generally included in an EAP include but are not limited to 911 Dispatch, County Sheriffs, Local Fire Departments, Emergency Management Agency Director, County Highway Department, and the National Weather Service (NWS).

Upstream Dams Outside the Planning Area

According to the Dam Safety Section of the Nebraska DNR and county specific Local Emergency Operations Plans, there are currently no high hazard upstream dams (upstream of the planning area) which could affect the planning area.

Historical Occurrences

According to the Stanford University National Performance of Dams Program, there have been no dam failure events within the planning area. Additionally, no dams of concern upstream of the planning area have experienced failure events. All dams should be inspected by the owner on a regular basis and after heavy rainfall events. If problems are found during an inspection, the dam should be repaired to ensure the structural integrity of the dam is preserved. NeDNR provides periodic inspections of dams and recommendations for repair to the dam owners.

Average Annual Losses

Due to a 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 or the NeDNR.

Extent

Inundation maps are not made publicly available for security reasons and there are no high hazard dams in the planning area. Any dam that were to fail in the planning area would likely produce minimal damages. 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. Since inundation maps are not made publicly available for security reasons, it is difficult to quantify the full extent of dam failure impacts across the planning area. However, as there are no high hazard dams located in the planning area, the likely extent of damages from dam failure to all communities in the planning area is minimal.

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 no dams have failed in the planning area over the past 100 years (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 40: 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 Upper Loup NRD area is low. Future development will likely not occur in areas at risk from dam failure as the majority of dams in the area are used for agricultural purposes only.

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

No jurisdictions identified Dam Failure as a top hazard of concern.

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 41: Regional Dam Failure Vulnerabilities

SECTOR	VULNERABILITY
People	<ul style="list-style-type: none"> -Those living downstream of any dam -Evacuations likely with high hazard dams -Hospitals, nursing homes, children, and the elderly at greater risk due to low mobility
Economic	<ul style="list-style-type: none"> -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	<ul style="list-style-type: none"> -Damage to homes and buildings
Infrastructure	<ul style="list-style-type: none"> -Transportation routes could be closed for extended periods of time -Utilities and utility infrastructure could be damaged or destroyed
Critical Facilities	<ul style="list-style-type: none"> -Critical facilities in inundation areas are vulnerable to damages
Climate	<ul style="list-style-type: none"> -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 inaccurately consider drought a rare and random event, it is actually a normal, recurrent feature of climate. Drought can occur in virtually all climatic zones, but its characteristics can vary significantly from one region to another. A drought often coexists with periods of extreme heat, which together can cause significant social stress, economic losses, and environmental degradation. The planning area is largely rural, which presents an added vulnerability to drought events; drought conditions can significantly and negatively impact the agricultural economic base.

Drought is typically a slow onset, creeping phenomenon that can affect a wide range of people, livestock, and industries. However, in some cases “flash droughts” can occur quickly and last for shorter periods of time as seen in 2012-2013 across Nebraska. While many impacts of these hazards are non-structural, there is the potential that during prolonged drought events structural impacts like foundation cracking can occur from dry soil. Drought normally affects more people than other natural hazards, and its impacts are spread over a larger geographical area. Detection and early warning signs of drought conditions have improved recently but are still more difficult to identify than that of quick-onset natural hazards (e.g., flood, winter storms, tornadoes). 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

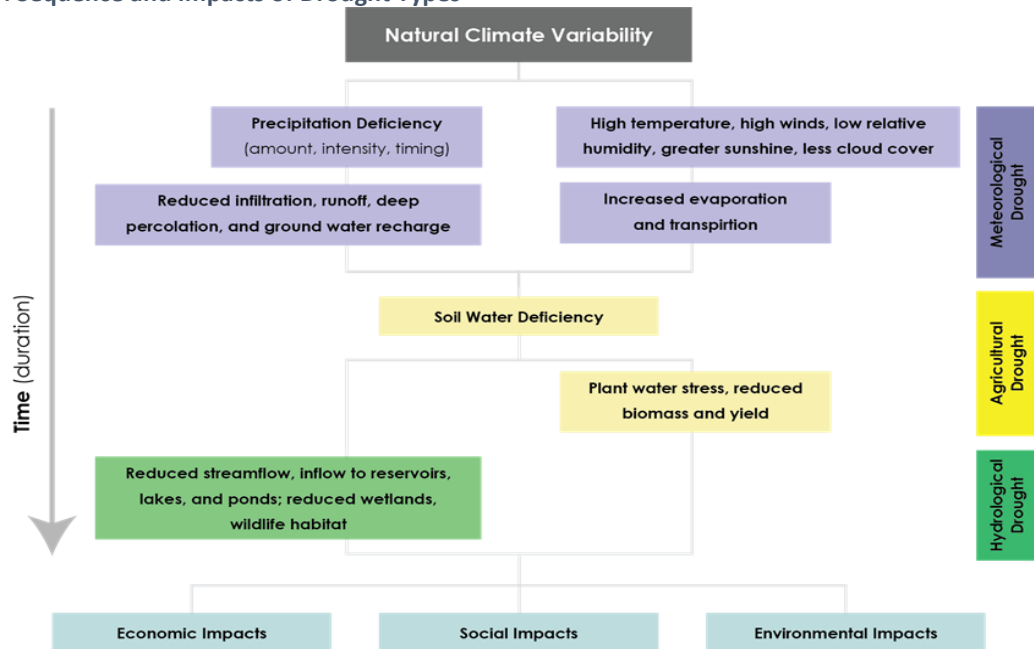
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- **Meteorological Drought** is defined based on the degree of dryness and the duration of the dry period. Meteorological drought is often the first type of drought to be identified and should be defined regionally as precipitation rates, frequencies (norms), and winds 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. Livestock can also become stressed during a prolonged drought.
- **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.⁴⁰

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

⁴⁰ National Drought Mitigation Center. 2017. “Drought Basics.” <https://drought.unl.edu/>.

Figure 19: Sequence and Impacts of Drought Types



Source: National Drought Mitigation Center, University of Nebraska-Lincoln, 2017⁴¹

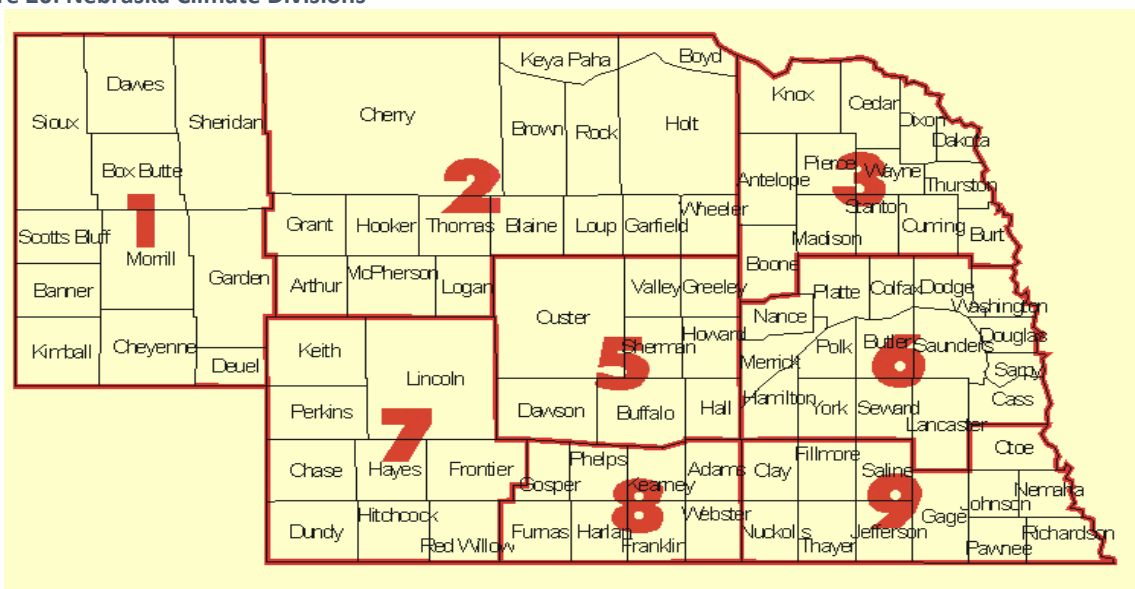
Location

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

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 2, which includes the planning area. Table 48 shows the details of the Palmer classifications.

Figure 20: Nebraska Climate Divisions



Source: Climate Prediction Center

⁴¹ National Drought Mitigation Center. 2017. "Types of Drought." <https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx>.

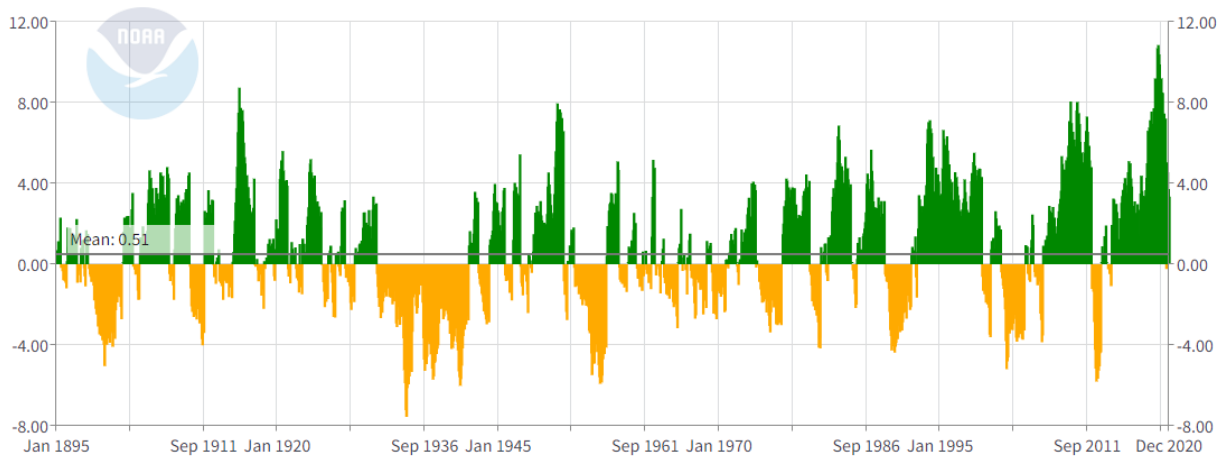
Table 42: Palmer Drought Severity Index Classification

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 Center⁵⁷

This climate division's period of record started in 1895 and Figure 21 showcases the historical trend for drought or non-drought conditions for this division. The negative Y axis represents a drought, for which '-1' indicates a mild drought, '-2' a moderate drought, '-3' a severe drought, and '-4' an extreme drought.

Figure 21: Palmer Drought Severity Index
Nebraska, Climate Division 2 Palmer Drought Severity Index (PDSI)



Source: NCEI, Climate Division 2

Drought is a cyclical event with periods of drought followed by periods of wet or non-drought conditions. Table 43 shows the data quantitatively (i.e., number of months in drought by PDSI classification) for the same time period shown in Figure 21. The planning area has experienced several extreme droughts and moderate, severe, and extreme droughts are likely in the future.

Table 43: Historical Months in Drought

DROUGHT MAGNITUDE	DROUGHT CLASSIFICATION	MONTHS IN DROUGHT	PERCENT CHANCE
-1 Magnitude	Mild Drought	191/1,539	12.4%
-2 Magnitude	Moderate Drought	107/1,539	7.0%
-3 Magnitude	Severe Drought	72/1,539	4.7%
-4 Magnitude	Extreme Drought	104/1,539	6.8%

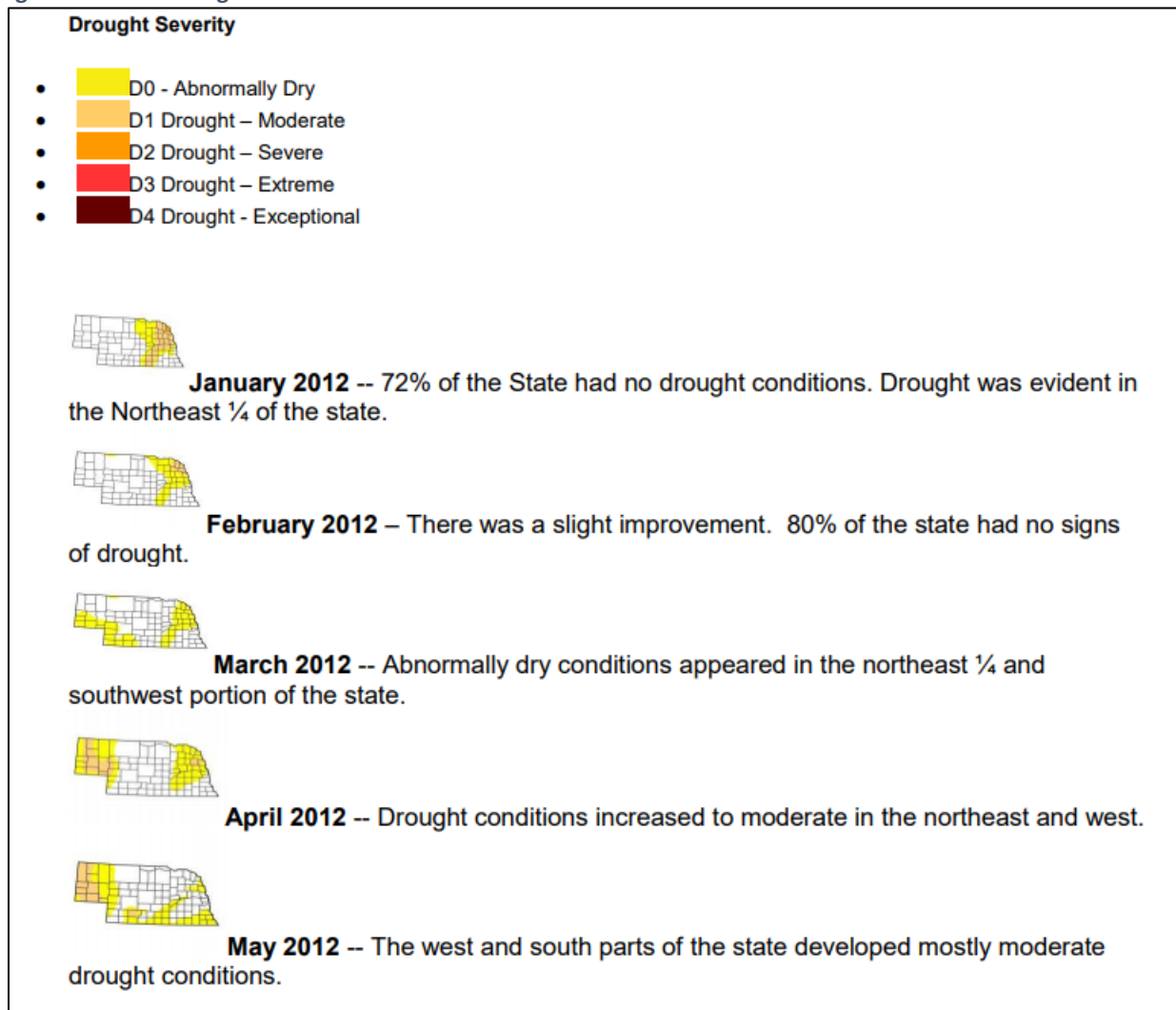
Source: NCEI

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.⁴²

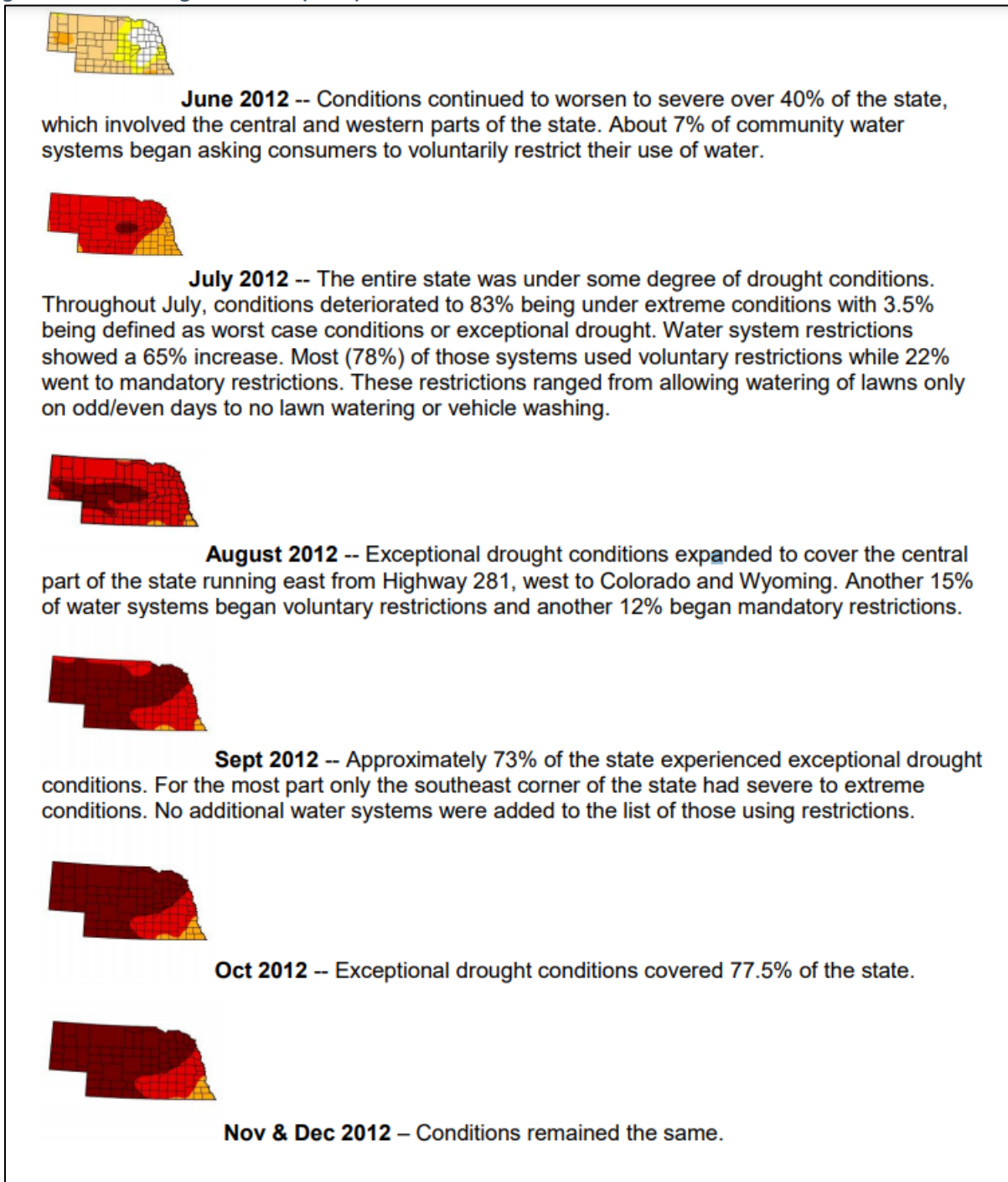
The images on the next pages show a general timeline of worsening drought conditions from the 2012 drought in Nebraska from the state’s 2012 Annual Summary Report. The planning area truly experienced impacts from June 2012 through the winter of 2014.

Figure 22: 2012 Drought Timeline



⁴² 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 23: 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.

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. Grant County and Hooker County do not have RMA data available. The NCEI database reported \$50,000,000 in total property damage as \$1,000,000 in property damages was listed for each of the five counties during the 2012 drought event. The RMA listed over \$4,000,000 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 44: 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	\$5,000,000	\$178,571	\$4,728,459	\$197,019

1 Indicates the data is from NCEI (1996 to 2023); 2 Indicates data is from USDA RMA (2000 to 2022)

The extreme drought in 2012 significantly affected the agricultural sector across the State of Nebraska and for the planning area. According to the PDSI index, 2012's average severity calculation was ranked at a -4.47, with extremes in August and September of -7.35 and -7.57 respectively. The Farm Credit Services reported total indemnity payments across the State of Nebraska totaling \$1.49 billion from crop loss from this year of drought. Cattle ranching is a large driver of the local planning area's economy. The 2012 drought forced ranchers to cull herds by as much as 60% to cope with reduced forage production with an estimated loss of \$200 per head by taking cattle to market earlier than normal. Neighborhood plots and small organic farms up to large-scale corn and soybean productions and ranches all faced agricultural declines during 2012 and in the subsequent years. Hay production was down 28%, corn was down 16%, and soybean production dropped by 21% in 2012.⁴³

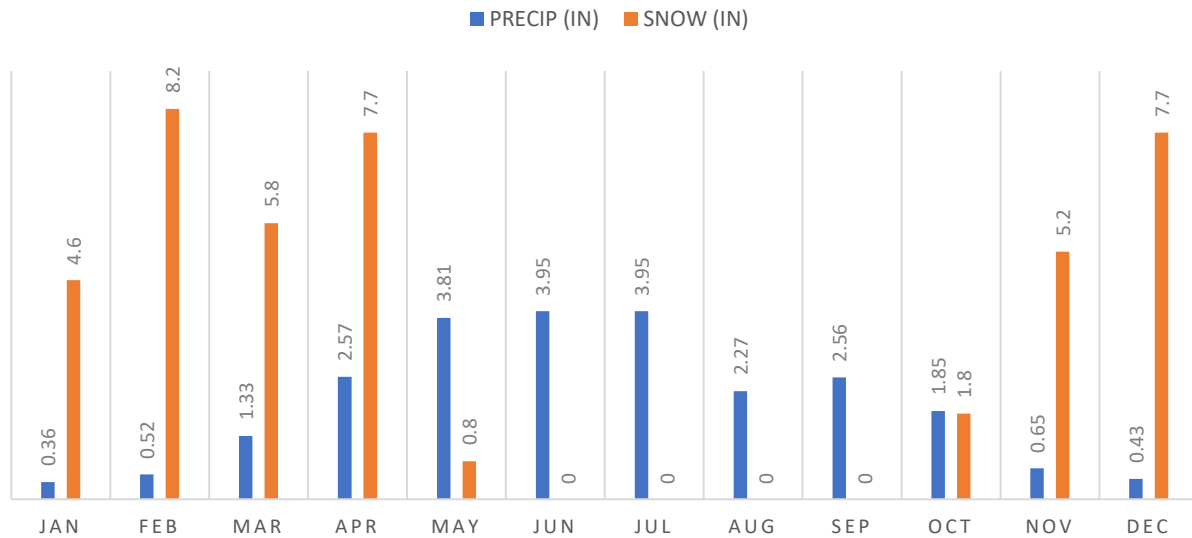
Extent

Using the data from below it is reasonable to expect extreme drought to occur in 6.8 percent of years of months for the planning area (104 extreme drought months in 1,539 months). Severe drought occurred in 72 months of the 1,539 months of record (4.7 percent of months). Moderate drought occurred in 107 months of the 1,539 months of record (7.0 percent of months), and mild drought occurred in 191 of the 1,539 months of record (12.4 percent of months). Non-drought conditions (incipient dry spell, near normal, or incipient wet spell conditions) occurred in 319 months, or 20.7% percent of months. These statistics show that the drought conditions of the planning area are highly variable.

Figure 24 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.

⁴³ Fuchs, Brian & Wood, Deborah & Ebbeka, Dee & Bergantino, Antony. (2015). From Too Much to Too Little: How the central U.S. drought of 2012 evolved out of one of the most devastating floods on record in 2011. https://www.researchgate.net/publication/319542349_From_Too_Much_to_Too_Little_How_the_central_US_drought_of_2012_evolved_out_of_one_of_the_most_devastating_floods_on_record_in_2011

Figure 24: Average Monthly Precipitation for the Planning Area



Source: NCEI 2021

Table 45: Palmer Drought Severity Index Classification

NUMERICAL VALUE	DESCRIPTION	HISTORICAL PERCENTAGE	NUMERICAL VALUE	DESCRIPTION	
4.0 or more	Extremely wet	13.2%	-0.5 to -0.99	Incipient dry spell	6.8%
3.0 to 3.99	Very wet	10.8%	-1.0 to -1.99	Mild drought	12.4%
2.0 to 2.99	Moderately wet	13.1%	-2.0 to -2.99	Moderate drought	7.0%
1.0 to 1.99	Slightly wet	11.4%	-3.0 to -3.99	Severe drought	4.7%
0.5 to 0.99	Incipient wet spell	4.9%	-4.0 or less	Extreme drought	6.8%
0.49 to -0.49	Near normal	9.1%	--	--	

Source: NCEI

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.

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 31% of the time, a part or all of the planning area is likely to be experiencing drought (Possible). 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 46: Period of Record in Drought

MAGNITUDE	DROUGHT OCCURRENCES BY MONTH	MONTHLY PROBABILITY
No Drought	1,065/1,539	69.2%
Mild Drought	191/1,539	12.4%
Moderate Drought	107/1,539	7.0%

MAGNITUDE	DROUGHT OCCURRENCES BY MONTH	MONTHLY PROBABILITY
Severe Drought	72/1,539	4.7%
Extreme Drought	104/1,539	6.8%
Total Months in Drought	474/1,539	30.8%

Source: NCEI, 1895-2023

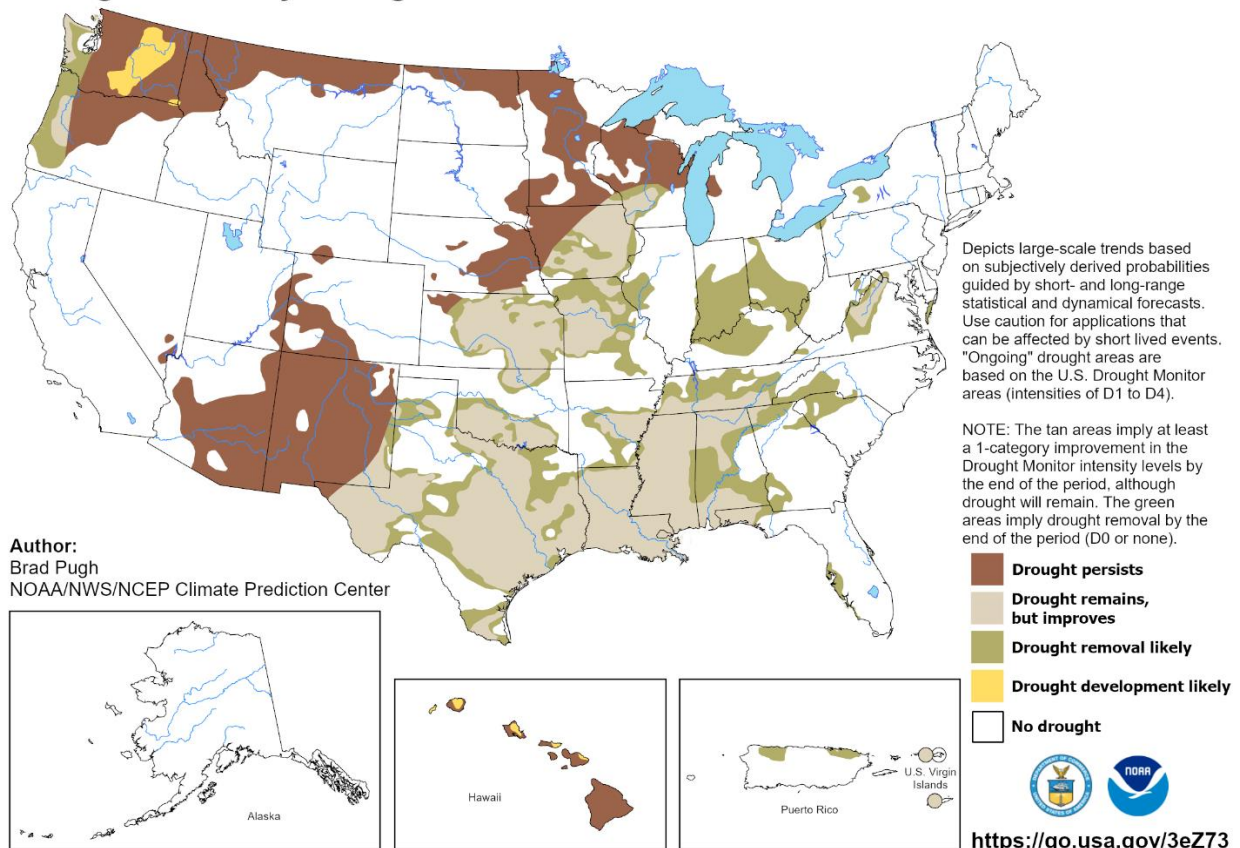
The U.S. Seasonal Drought Outlook (Figure 25) provides a short-term drought forecast that can be utilized by local officials and residents to examine the likelihood of drought developing or continuing within three months as based on existing conditions. The drought outlook is updated consistently throughout the year and should be reviewed on an ongoing basis. The following figure provides the drought outlook from October 2023 through January 2024 as an example. The U.S. Drought Monitor also provides a state overview of drought conditions (Figure 26). As of October 2023, the planning area was experiencing either D0 (Abnormally Dry) to D1 (Moderate Drought) conditions.

Figure 25: U.S. Seasonal Drought Outlook

U.S. Seasonal Drought Outlook

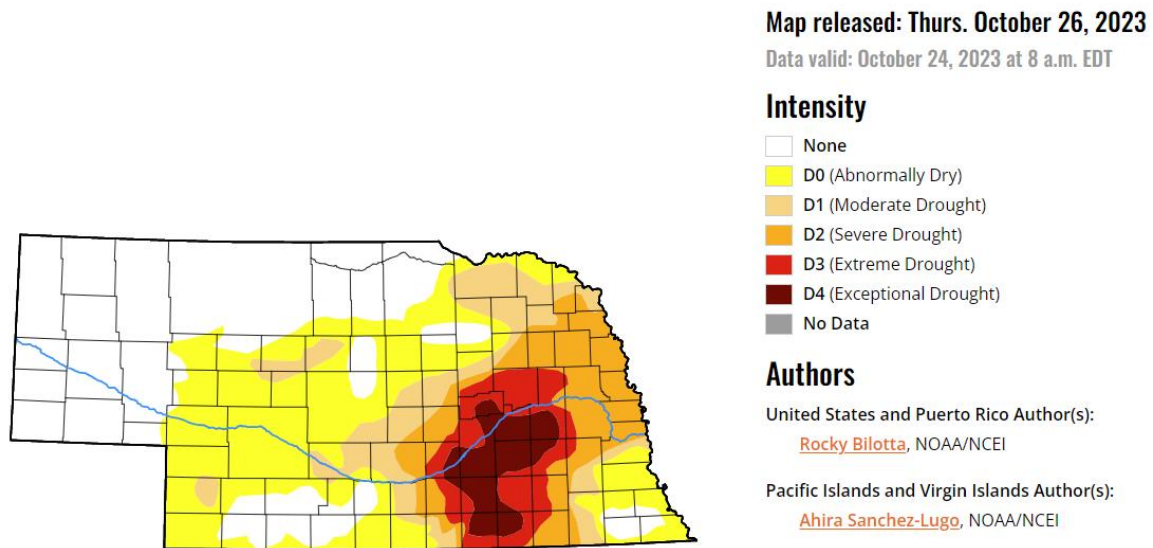
Drought Tendency During the Valid Period

Valid for October 19, 2023 - January 31, 2024
Released October 19, 2023



Source: NCEI, October 2023

Figure 26: U.S. Drought Monitor – Nebraska



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.⁴⁴ 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:

- Upper Loup NRD
- Blaine County
- Hooker County
- Thomas County

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

⁴⁴ 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.)

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 2010 to 2023. 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.

Table 47: Reported Drought Impacts (2010-2023)

AREA	AGRICULTURAL	BUSINESS & INDUSTRY	ENERGY	FIRE	PLANT & WILDLIFE	RELIEF, RESPONSE, & RESTRICTIONS	SOCIETY & PUBLIC HEALTH	TOURISM & RECREATION	WATER SUPPLY & QUALITY
ULNRD	27	0	0	12	21	15	1	5	10

Source: NDMC – Drought Impact Reporter Dashboard, 2023

During the 2012 drought more than 1,100 surface irrigators across the state received a notice to stop pumping from the Nebraska Department of Natural Resources.⁴⁵ However, the NRD did not receive any reports of well issues during the 2012 drought.

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

Table 48: National Risk Index Drought Vulnerabilities

RISK INDEX FACTOR	BLAINE	GRANT	HOOKER	LOGAN	THOMAS
Risk Index	Very Low	Very Low	Very Low	Relatively Low	Very Low
Expected Annual Loss	Very Low	Very Low	Very Low	Relatively Low	Very Low

Source: FEMA National Risk Index, 2022

Table 49: 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 -Livestock loss
Built Environment	-Cracking of foundations (residential and commercial structures) -Damages to landscapes

⁴⁵ Lincoln Journal Star: https://journalstar.com/news/state-and-regional/govt-and-politics/state-orders-irrigators-to-stop-pumping-water/article_98391404-9487-50b1-9820-323a19f94f42.html

SECTOR	VULNERABILITY
Infrastructure	<ul style="list-style-type: none"> -Damages to waterlines below ground -Damages to roadways (prolonged extreme events) -Stressing of electrical systems (brownouts during peak usage)
Critical Facilities	<ul style="list-style-type: none"> -None
Climate	<ul style="list-style-type: none"> -Increased risk of wildfire events, damaging buildings and agricultural land -Wildlife and species loss

EARTHQUAKES

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

Table 50: Richter Scale

RICHTER MAGNITUDES	EARTHQUAKE EFFECTS
<i>Less than 3.5</i>	Generally not felt, but recorded
<i>3.5 – 5.4</i>	Often felt, but rarely causes damage
<i>Under 6.0</i>	At most, slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions
<i>6.1 – 6.9</i>	Can be destructive in areas up to about 100 kilometers across where people live
<i>7.0 – 7.9</i>	Major earthquake. Can cause serious damage over larger areas
<i>8 or Greater</i>	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: FEMA, 2016⁴⁶

Table 51: Modified Mercalli Intensity Scale

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER SCALE MAGNITUDE
<i>I</i>	Instrumental	Detected only on seismographs	
<i>II</i>	Feeble	Some people feel it	< 4.2
<i>III</i>	Slight	Felt by people resting, like a truck rumbling by	
<i>IV</i>	Moderate	Felt by people walking	
<i>V</i>	Slightly Strong	Sleepers awake; church bells ring	< 4.8
<i>VI</i>	Strong	Trees sway; suspended objects swing, objects fall off shelves	< 5.4
<i>VII</i>	Very Strong	Mild alarm; walls crack; plaster falls	< 6.1
<i>VII</i>	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	
<i>IX</i>	Ruinous	Some houses collapse; ground cracks; pipes break open	< 6.9
<i>X</i>	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	< 7.3

⁴⁶ Federal Emergency Management Agency. 2020. "Earthquake Risk." <https://www.fema.gov/emergency-managers/risk-management/earthquake>

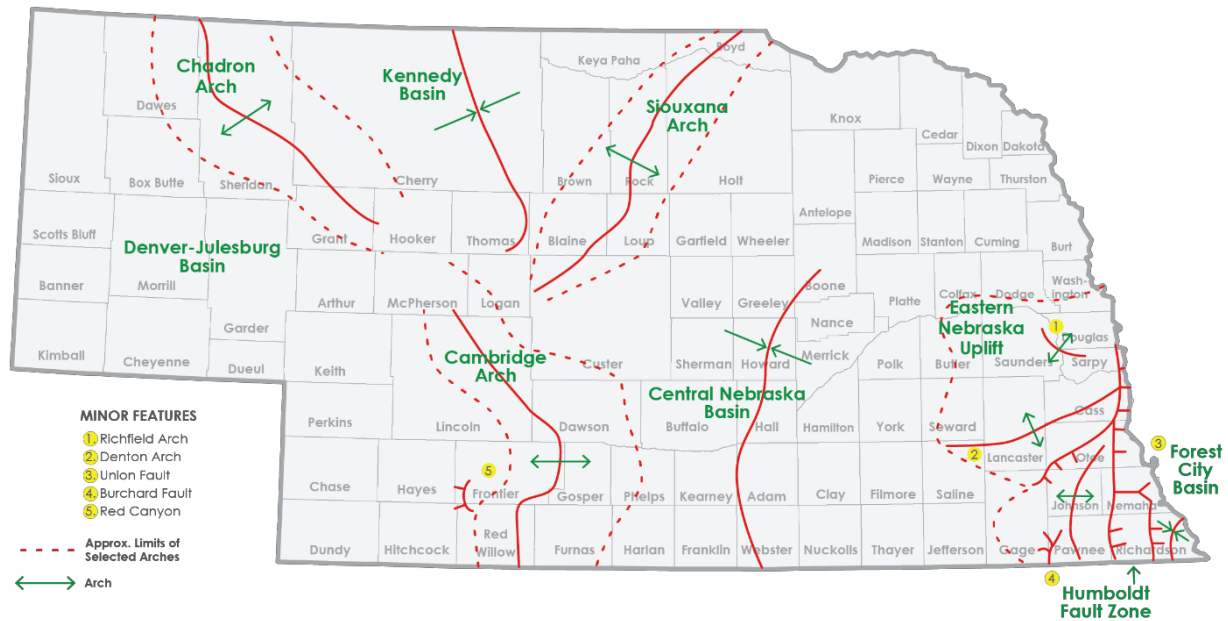
SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER SCALE MAGNITUDE
XI	Very Disastrous	Most Buildings and bridges collapse; roads, railways, pipes, and cables destroyed; general triggering of other hazards	< 8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	> 8.1

Source: FEMA, 2020

Location

The most likely locations in the planning area to experience an earthquake are near a fault line (Figure 27). The Kennedy Basin, Chadron Arch, Siouxana Arch, and Cambridge Arch fault lines would affect the planning area.

Figure 27: Fault Lines in Nebraska

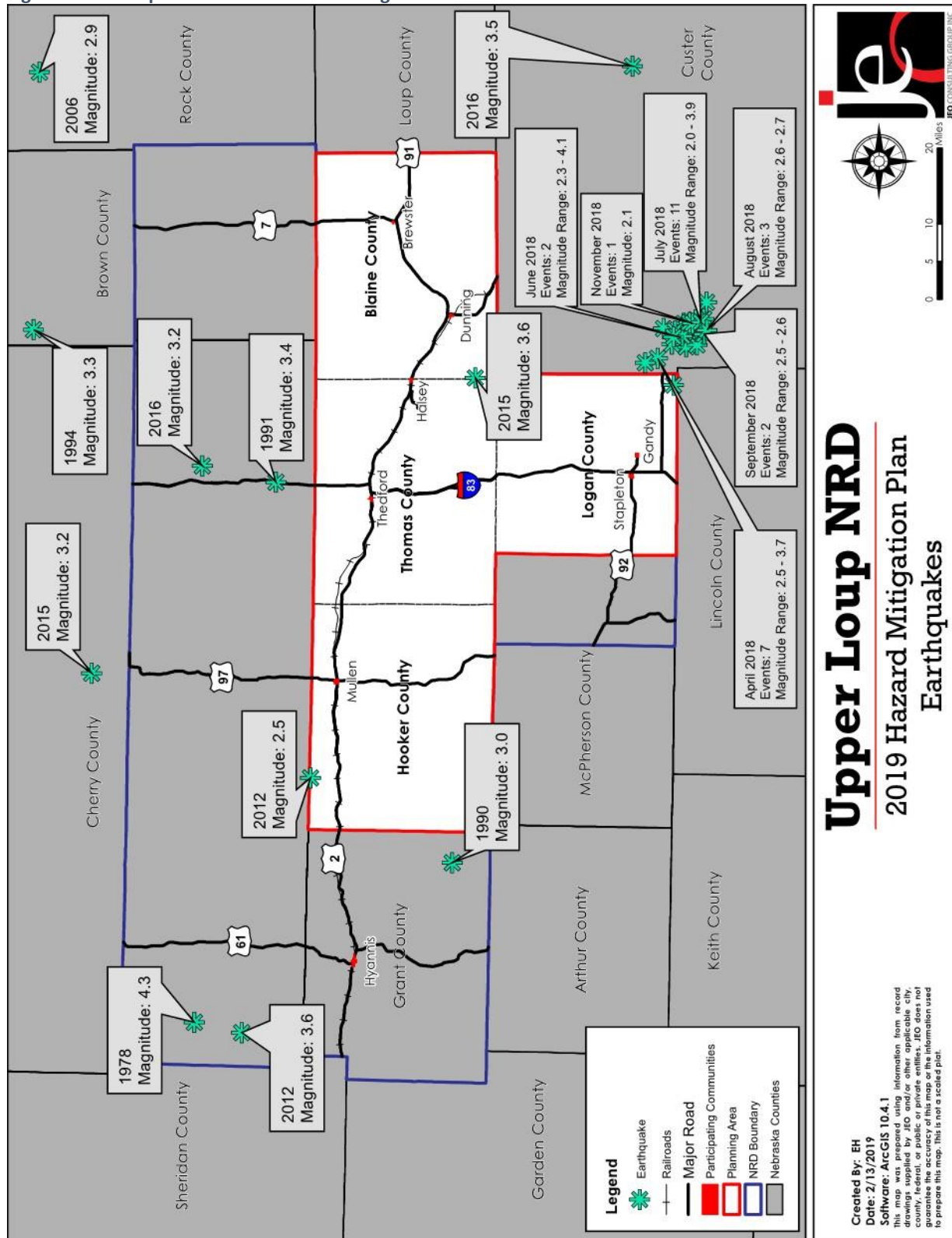


Historical Occurrences

According to the United States Geological Survey (USGS), there have been a handful of earthquakes that have occurred within the planning area since 1900, only four occurred within the participating county planning area.⁴⁷ The next figure shows past earthquake locations and magnitudes. The strongest earthquake felt was a magnitude 3.6 in 2015 in Blaine County. There was no reported damage from any historical earthquake events.

⁴⁷ United States Geological Survey. 2020. "Information by Region – Nebraska." <https://earthquake.usgs.gov/earthquakes/byregion/nebraska.php>.

Figure 28: Earthquake Events in the Planning Area



Of note, the State of Nebraska Hazard Mitigation Plan does not include Earthquakes as a profiled hazard with the following discussion:

Historically, Nebraska has seen less than one earthquake per year between 1866 and 1990. However, from 1990 to December 2018, Nebraska had experienced a total of 60 earthquakes. The majority of them, 29 or 48%, happened in 2018 alone in the area around Arnold, NE. The magnitudes range from 2.1-4.1, based on the Richter scale, with an average of 2.96 for these 28 quakes. The average magnitude for the 59 quakes from 1990 to 2018 is 3.1.

While this is a large increase in the number of earthquakes, it is too early to tell whether the trend will continue. What is clear is the fact that in 43 years (1975 - 2018), Nebraska has experienced only 3 quakes that were a 4.0 or larger. This is only 4% of earthquakes for that period and occurring once per 14.33 years. Earthquakes with magnitudes 4.0- 4.9 are described to cause minimal damage and unlikely to cause moderate/significant damage. Nearly all earthquakes in Nebraska, 96%, have been weak with many not able to be felt by residents. Only a couple have produced minor damage to buildings.

The most recent earthquake reported was a minor tremor registered as 2.9 in magnitude, located about 18 miles south-southwest of O'Neill, in Holt County. Despite this most recent event, the most likely earthquake situation that would impact Nebraska would be a strong earthquake on the New Madrid Seismic Zone. However, the majority of current activity is on the Humboldt Fault that extends from Kansas into the southeastern region of Nebraska. These impacts would not be in the form of damages but in assisting impacted states and residents. Given the low chance of impact to the state, earthquakes were not further profiled.

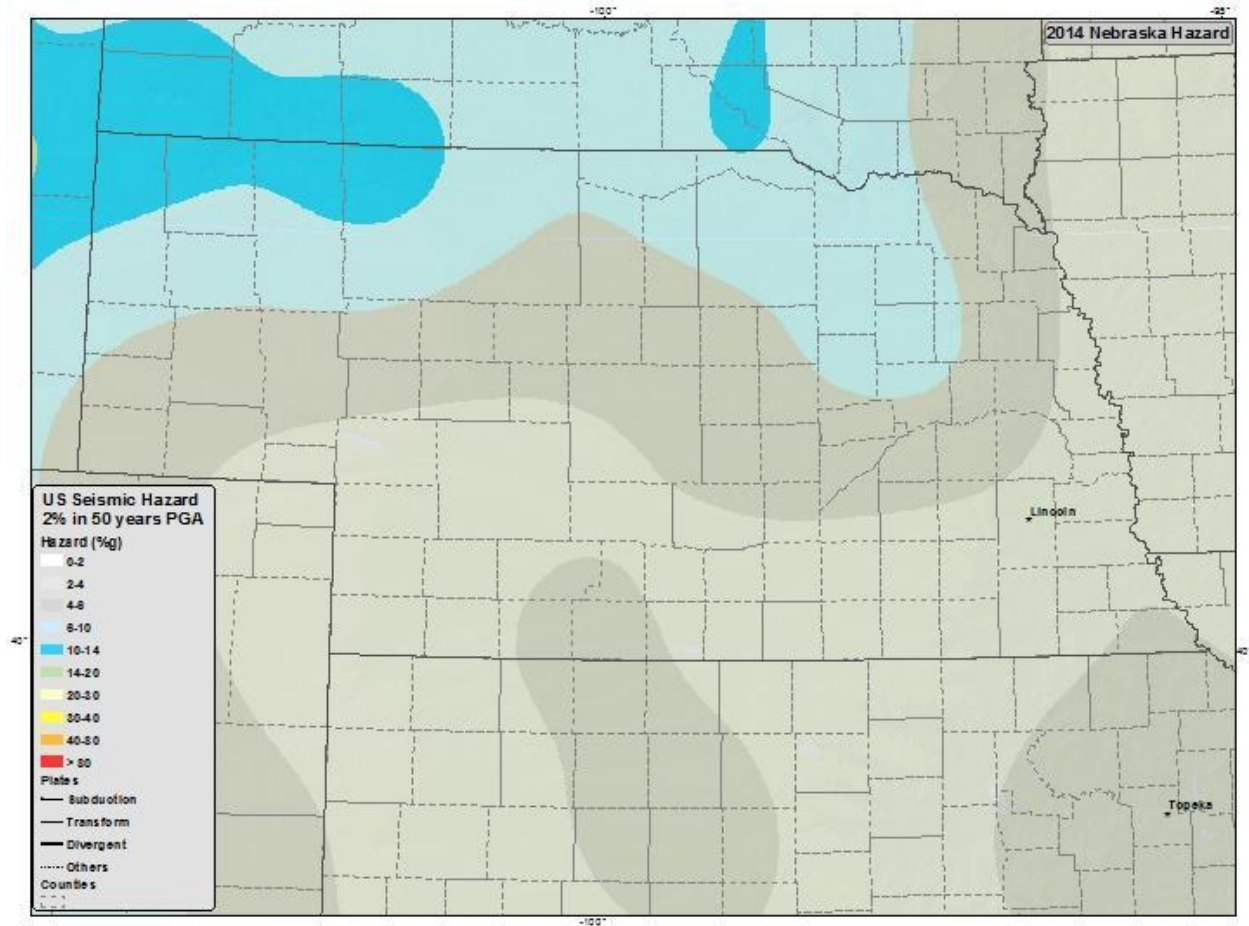
Average Annual Losses

Due to the lack of sufficient earthquake data, limited resources, low earthquake risk for the area, and no recorded damages, it is not feasible to utilize the 'event damage estimate formula' to estimate potential losses for the planning area. The figure below

SECTION FOUR: RISK ASSESSMENT

Figure 29 shows the State of Nebraska's seismic hazard risk across the state. According to the USGS, the planning area has a less than 0.2 percent change of damages from earthquakes.

Figure 29: 2014 Seismic Hazard Map – Nebraska



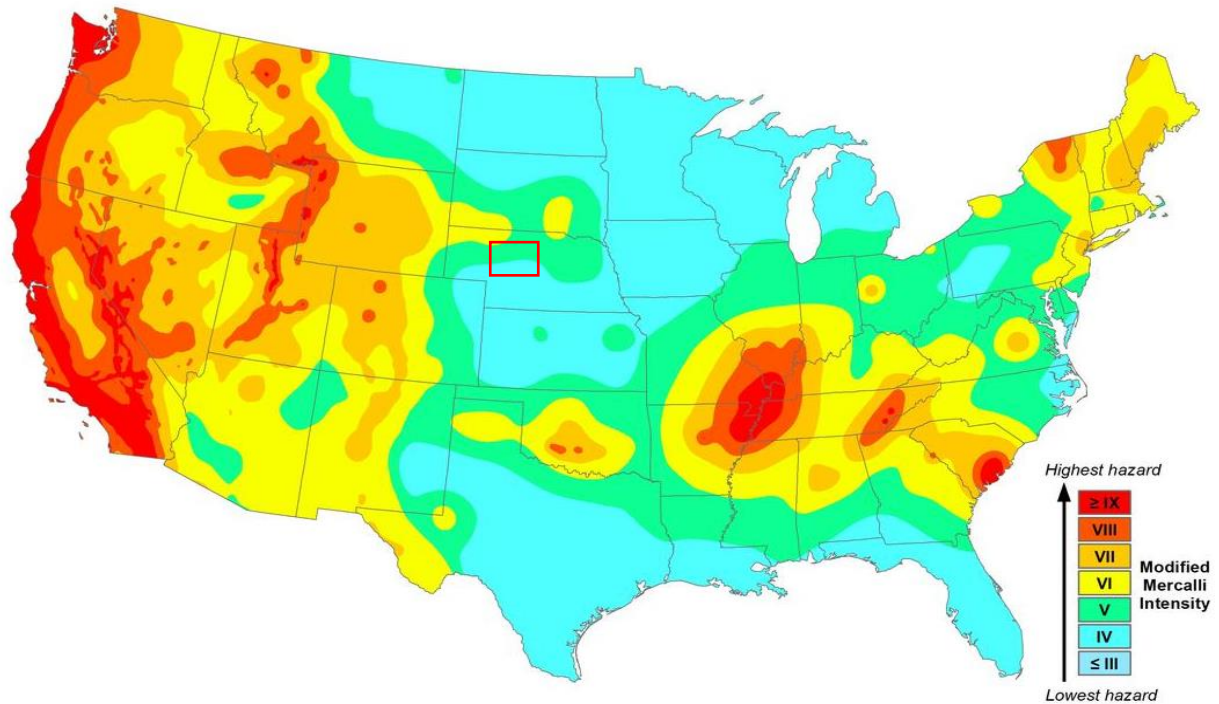
Source: USGS, 2020⁴⁸

Extent

The extent of damage from earthquakes is often limited to areas near fault lines. If an earthquake were to occur in the planning area, it would likely measure 5.0 or less on the Richter Scale as shown by the figure below from USGS. Based on past historical events the likely extent of earthquakes in the planning area are likely to measure between 4.0 and 5.0 on the Richter Scale. Jurisdictions closest to the earthquake epicenter are the most likely to be impacted by earthquake events. The overall extent of damage cannot be determined for earthquakes; however, very little to no damage is anticipated from events of these magnitudes.

⁴⁸ USGS. 2014. "2014 Seismic Hazard Map – Nebraska." Accessed September 2020. <https://www.usgs.gov/media/images/2014-seismic-hazard-map-nebraska>.

Figure 30: Earthquake Extent



USGS map showing the intensity of potential earthquake ground shaking that has a 2% chance of occurring in 50 years

Source: USGS, 2016

Historical Probability and Future Likelihood

The planning area has experienced four earthquakes with no damages reported in 124 years, for the purposes of this plan, there is a three percent chance of an earthquake occurring in any given year (Unlikely). However, as recently stated by the USGS during the 7.8 magnitude earthquake which impacted Turkey and Syria in February 2023, it is not possible to fully predict when an earthquake will occur. Rather, “USGS scientists can only calculate the probability that a significant earthquake will occur (shown on our hazard mapping) in a specific area within a certain number of years.”⁴⁹

Table 52: Historical Probability & Future Likelihood - Earthquake

Hazard	Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
Earthquake	3%	Unknown impact on Frequency	Neither Increase nor Decrease in Frequency. Increase in Exposure	Unknown

⁴⁹ USGS. N.d. “Can you predict earthquakes?” <https://www.usgs.gov/faqs/can-you-predict-earthquakes>.

Future Development

Any future developments which occur near or alongside fault lines are likely to be at increased risk to earthquake events. Growing communities at risk should adapt and adopt stricter building requirements for new developments or substantial improvements to infrastructure.

Climate Change Impacts

At this time, there is no scientific consensus on the correlation between climate change and frequency or magnitude of earthquakes. According to the U.S. Geological Survey, Statistically, there is approximately an equal distribution of earthquakes in cold weather, hot weather, rainy weather, etc. Very large low-pressure changes associated with major storm systems (typhoons, hurricanes, etc.) are known to trigger episodes of fault slip (slow earthquakes) in the Earth's crust and may also play a role in triggering some damaging earthquakes. However, the numbers are small and are not statistically significant.⁵⁰

Community Top Hazard Status

No jurisdictions identified Earthquakes as a top hazard of concern.

Regional Vulnerabilities

Particularly vulnerable populations for earthquake include, but are not limited to:

- *Low-income individuals*
 - Often, low-income individuals and families live in lower cost homes (older homes, mobile homes) that are less able to withstand disaster.
- *Older homes and mobile homes*
 - These may not have been constructed using the most advanced building codes or have received updates and retrofits that would have increased their stability and ability to withstand seismic events. Damages resulting from the 1994 Northridge earthquake in California were disproportionately focused on low- and moderate- income rental housing units that were older and thus more vulnerable to seismic damages.
- *Elderly citizens*
 - Senior citizens living on a fixed income may lack the disposable income necessary to upgrade their homes to withstand seismic events. In addition, senior citizens may lack the mobility required to implement low-cost mitigation measures. A 2006 Census Bureau report found that 20-percent of the US Population age 65 and older report some level of disability.

Future development and growth would likely increase the intensity of earthquake impacts across the planning area. Future development and growth would have impacts including increased development near dams, increased density in urban areas, and new structures built without reinforcements.

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

Table 53: National Risk Index Earthquake Vulnerabilities

RISK INDEX FACTOR	BLAINE	GRANT	HOOVER	LOGAN	THOMAS
Risk Index	Very Low	Very Low	Very Low	Very Low	Very Low
Expected Annual Loss	Very Low	Very Low	Very Low	Very Low	Very Low

⁵⁰ USGS. N.d. "Is there earthquake weather?" Accessed November 2022. https://www.usgs.gov/faqs/there-earthquake-weather?qt-news_science_products=0#qt-news_science_products.

SECTION FOUR: RISK ASSESSMENT

Source: FEMA National Risk Index, 2022

Table 54: Regional Earthquake Vulnerabilities

SECTOR	VULNERABILITY
People	-Risk of injury or death from falling objects and structures
Economic	-Short-term to long-term interruption of business
Built Environment	-Cracking of foundations (residential and commercial structures) -Damage to structures
Infrastructure	-Damages to subterranean infrastructure (e.g., waterlines, gas lines, etc.) -Damages to roadways
Critical Facilities	-Same as all other structures
Climate	-None

EXTREME TEMPERATURES - HEAT & COLD

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 being defined as the high temperature being 10°F or below while extreme heat is defined as low temperatures being 100°F or higher. Conditions for extreme heat are 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 is largely rural, which presents an added vulnerability to extreme events; those medically suffering from extreme temperature conditions may be farther away from medical resources as compared to those living in an urban setting.

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

Other secondary concerns connected to extreme 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 three days above 100°F per year or 10 days with a high of 10°F or below. The planning area experienced

the most days on record above 100°F in 1936 with 15 days while the most days below 10°F occurred in 1936 with 30 days.

Average Annual Losses

The direct and indirect effects of extreme heat are difficult to quantify. There is no way to place a value on the loss of human life. Potential losses such as power outages could affect businesses, homes, and critical facilities. High demand and intense use of air conditioning can overload the electrical systems and cause damage to infrastructure. The NCEI database did not report any property damage due to extreme heat events.

Table 55: 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. 3 days per year	\$0	\$0	\$598,315	\$26,014
Extreme Cold	Avg. 4 days per year	\$0	\$0	\$245,944	\$10,693

Source: 1 indicates the data is from HPRCC (1895-2023); 2 NCEI; 3 USDA RMA (2000-2022)

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 56: Loss of Electricity - Assumed Damage by Jurisdiction

COUNTY	2020 (EST) POPULATION	POPULATION AFFECTED (ASSUMED 10%)	ELECTRIC LOSS OF USE ASSUMED DAMAGE PER DAY
Blaine	431	43	\$5,418
Grant	611	61	\$7,686
Hooker	711	71	\$8,946
Logan	716	72	\$9,072
Thomas	669	67	\$8,442
Total	3,138	314	\$39,564

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.⁵¹:

- **Heat Advisories** are issued when temperatures of at least 100°F or Heat Index values of at least 105°F are expected generally within the next 24 hours.

⁵¹ National Weather Service. 2023. “Heat Information Page”. Accessed September 2023. <https://www.weather.gov/dmx/dsheat>

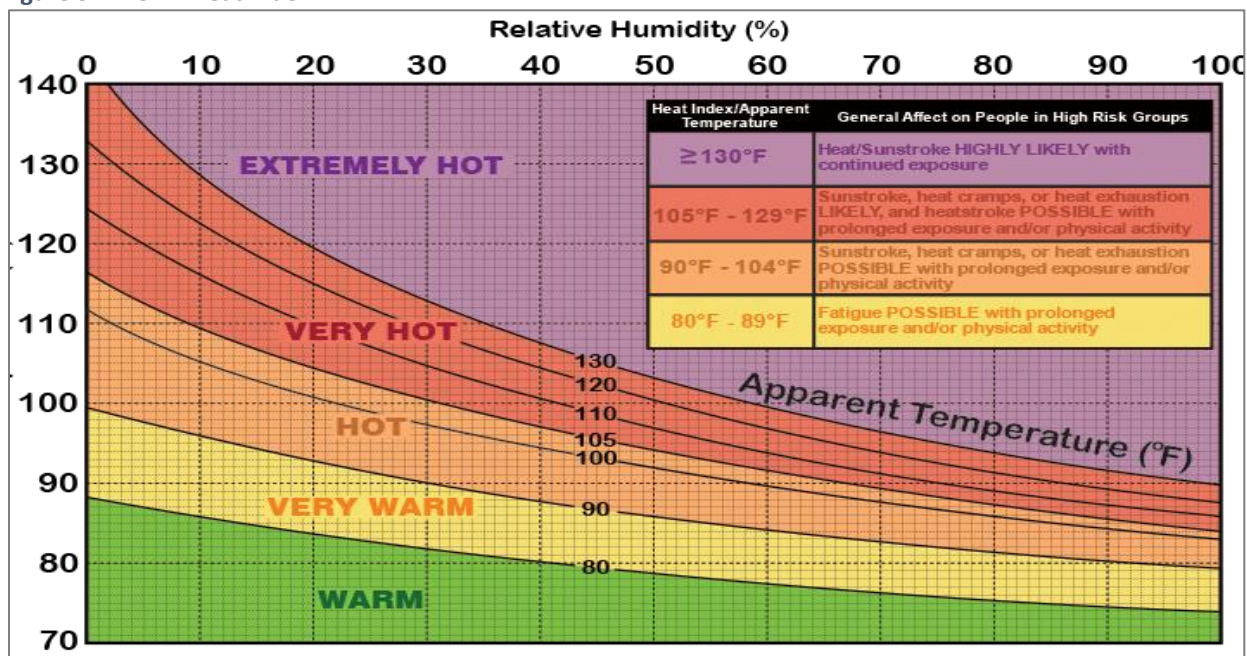
- **Wind Chill Advisory** means that wind chill values are expected to fall to between -20° and -29°F within the next 24 to 36 hours. Please exercise caution and wear appropriate clothing if heading outdoors for any prolonged period of time.
- **Excessive Heat Watches** are issued when the Heat Index values are expected to reach or exceed 110°F and not fall below 75°F for at least a 48-hour period, beginning in the next 12 to 48 hours.
- **Wind Chill Watch** means that wind chill values are expected to fall to -30°F or lower within the next two to three days. Start planning to limit any outdoor activity during this time.
- **Excessive Heat Warnings** are issued when Heat Index values are expected to reach or exceed 110°F and not fall below 75°F for at least a 48-hour period, beginning in the next 24 hours.
- **Wind Chill Warning** means that wind chill values are expected to fall to -30°F or lower within the next 24 to 48 hours. Please refrain from any unnecessary outdoor activities and wear protective clothing if you must venture outdoors. You can get frostbite in 10-15 min on unprotected skin.

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% requires 94°F. The combination of relative humidity and temperature result in a heat index as demonstrated below:

$$100\% \text{ Relative Humidity} + 86^\circ\text{F} = 112^\circ\text{F Heat Index}$$

The figure below is designed for shady and light wind conditions. Exposure to full sunshine or strong hot winds can increase hazardous conditions and raise heat index values by up to 15°F.

Figure 31: NOAA Heat Index

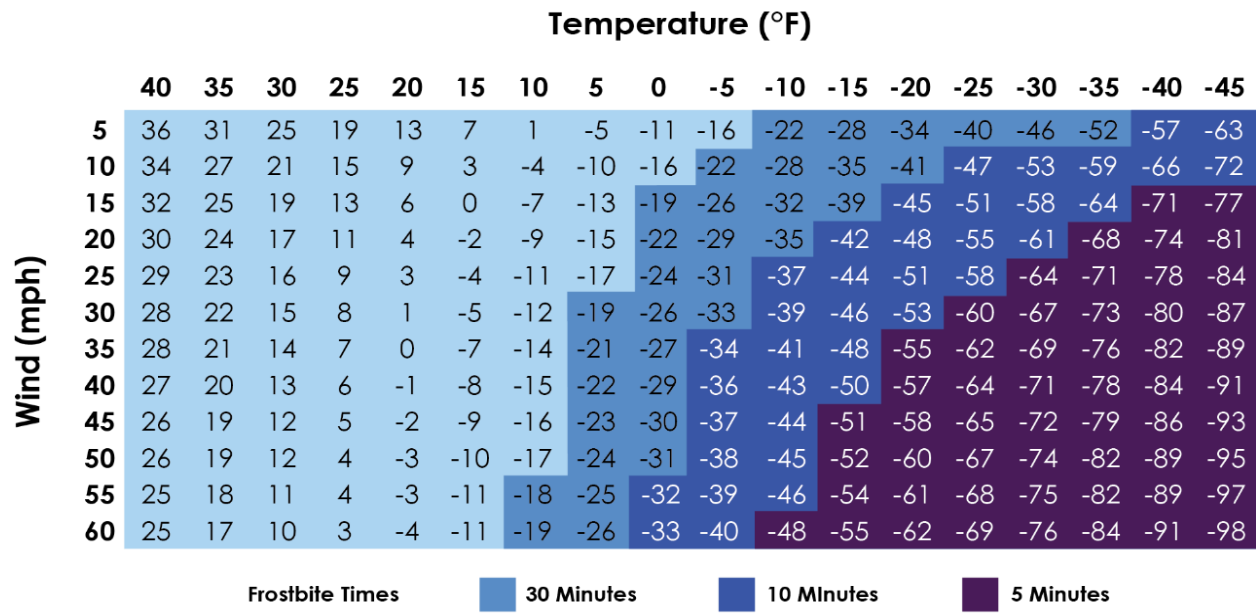


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Source: NOAA, 2022⁵²

A key factor to consider regarding extreme cold situations is the wind chill. 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 frostbite as it gets lower. The figure below shows the Wind Chill Index used by the NWS.

Figure 32: Wind Chill Index Chart



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

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

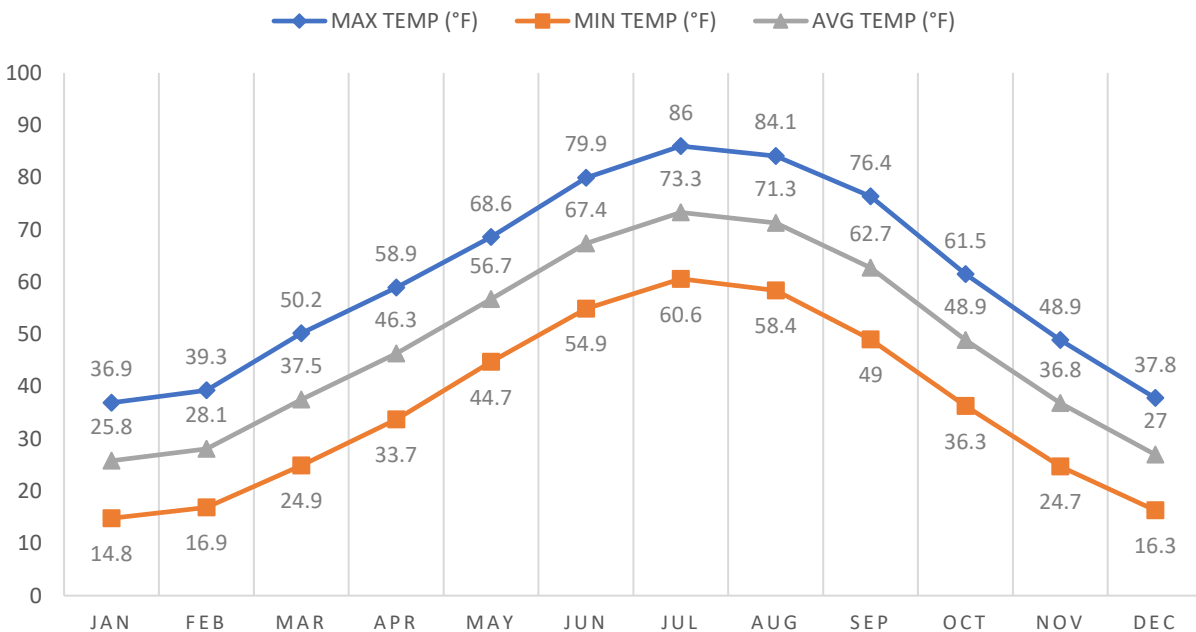
Source: NWS⁵³

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 16.0°F). The average high temperature for these months is 41.2°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 83.3°F while the average low temperature for these months is 57.9°F.

⁵² National Oceanic and Atmospheric Administration, National Weather Service. 2020. "Heat Index". http://www.nws.noaa.gov/om/heat/heat_index.shtml.

⁵³ National Weather Service. 2001. "Wind Chill Chart." <https://www.weather.gov/safety/cold-wind-chill-chart>.

Figure 33: Monthly Climate Normals Max Temperatures



Source: NCEI, 2022

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.

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 84 out of the past 130 years indicated a 65% chance of occurring annually (Likely); while extreme cold has occurred in 10 out of the 28 years for the period of record (36%, Possible). Due to the anticipated impacts from climate change, the likelihood of future extreme temperature events will increase in frequency and magnitude.

Table 57: Historical Probability & Future Likelihood – Extreme Temperatures

Hazard	Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
Extreme Heat	65%	Increase in Frequency and Extent	Increase in Frequency	Likely
Extreme Cold	36%	Increase in Frequency and Extent	Increase in Frequency	Possible

Future Development

Any increases in population and development will elevate exposure levels to extreme heat or 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 district for residents.

Climate Change Impacts

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*⁵⁴ 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 58: Extreme Heat Predictions for Days over 100F

COUNTY	WHERE WE ARE NOW	WHERE WE ARE CURRENTLY HEADED	
	Historical 1971-2000 Avg	Mid-Century 2036-2065 Avg	Late Century 2070-2099 Avg
Blaine	1	18	43
Grant	0	8	28
Hooker	0	12	35
Logan	1	17	43
Thomas	1	16	40
Total	3	71	189

Source: Union of Concerned Scientists, 2022⁵⁵

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 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

⁵⁴ 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>.

⁵⁵ Union of Concerned Scientists. 2022. "Extreme Heat and Climate Change: Interactive Tool". <https://www.ucsusa.org/resources/killer-heat-interactive-tool>.

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 Extreme Temperatures as a top hazard of concern:

- Upper Loup NRD
- Village of Mullen

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.

Table 59: County Heat Factor Risk

	BLAINE	GRANT	HOOKER	LOGAN	THOMAS
Overall Heat Factor Risk	Moderate Heat Factor	Minor Heat Factor	Moderate Heat Factor	Moderate Heat Factor	Moderate Heat Factor
Total Properties at Risk	1,548	1,726	1,867	1,530	2,212
Likelihood of 3+ day heat wave (>101F)	-56% likelihood this year -82% likelihood in 30 years	-55% likelihood this year -83% likelihood in 30 years	-54% likelihood this year -84% likelihood in 30 years	-54% likelihood this year -83% likelihood in 30 years	-64% likelihood this year -83% likelihood in 30 years
Health Caution Days	-39 days this year -54 days in 30 years	-29 days this year -44 days in 30 years	-36 days this year -51 days in 30 years	-42 days this year -56 days in 30 years	-39 days this year -54 days in 30 years
Dangerous Days	-5 days this year -12 days in 30 years	-1 days this year -4 days in 30 years	-3 days this year -8 days in 30 years	-5 days this year -12 days in 30 years	-4 days this year -11 days in 30 years
Hot Days	-7 days this year -16 days in 30 years	-7 days this year -17 days in 30 years	-7 days this year -17 days in 30 years	-7 days this year -17 days in 30 years	-7 days this year -17 days in 30 years
Number of cooling days (requiring AC)	-152 days this year -161 days in 30 years	-146 days this year -158 days in 30 years	-135 days this year -145 days in 30 years	-156 days this year -164 days in 30 years	-153 days this year -163 days in 30 years

Source: Risk Factor, 2022⁵⁶

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*.

⁵⁶ First Street Foundation. "Risk Factor: Heat Factor." Accessed November 2022. <https://riskfactor.com/>.

Table 60: National Risk Index Heat/Cold Wave Vulnerabilities

RISK INDEX FACTOR	BLAINE	GRANT	HOOVER	LOGAN	THOMAS
Risk Index	Cold - Very Low Heat - Very Low	Cold - Relatively Low Heat - Very Low	Cold - Relatively Low Heat - Very Low	Cold - Relatively Low Heat - Very Low	Cold - Very Low Heat - Very Low
Expected Annual Loss	Cold - Very Low Heat - Very Low	Cold - Relatively Low Heat - Very Low	Cold - Relatively Low Heat - Very Low	Cold - Relatively Low Heat - Very Low	Cold - Relatively Low Heat - Very Low

Source: FEMA National Risk Index, 2022

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 61: Regional Extreme Heat Vulnerabilities

SECTOR	VULNERABILITY
People	-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	-Short-term interruption of business -Loss of power -Agricultural losses
Built Environment	-Damage to HVAC systems if overworked
Infrastructure	-Damages to roadways (prolonged extreme events) -Stressing electrical systems (brownouts during peak usage) -Stressing water systems
Critical Facilities	-Loss of power
Climate	-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. Flooding from excessive rainfall in Nebraska usually occurs between late spring and early fall. 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, typically more slowly developing with a moderate to long warning time, is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt or ice melt. The areas adjacent to rivers and stream banks that carry excess floodwater 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 draining to a river and its tributaries.

Flash Flooding, including from Levee or Dam Failure

Flash floods, typically rapidly developing with little to no warning time, result from convective precipitation usually due to intense thunderstorms or sudden releases due to failure of an upstream impoundment created behind a dam, landslide, or levee. Flash floods are distinguished from regular floods by a timescale of fewer than six hours. Flash floods cause the most flood-related deaths as a result of this shorter timescale.

Sheet Flooding or Urban 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 disperse 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 becoming “anchor ice”. 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. This type of flooding tends to more frequently occur on wide, shallow rivers such as the Platte or Niobrara, although other rivers can be impacted.

Location

Table 62 shows current statuses of Flood Insurance Rate Map (FIRM) panels. Only two jurisdictions in the planning area have FIRMs at the municipal level, the Village of Dunning in Blaine County and the Village of Thedford in Thomas County. There are no Digital Flood Insurance Rate Maps (DFIRMs) available for the planning area, but copies of paper maps can be viewed at the FEMA Flood Map Service Center (<https://msc.fema.gov/portal/advanceSearch>). The available map for the Village of Dunning is below. For additional jurisdictional-specific vulnerabilities and available maps, refer to *Section Seven: Community Profiles*.

Figure 34: Dunning Floodplain

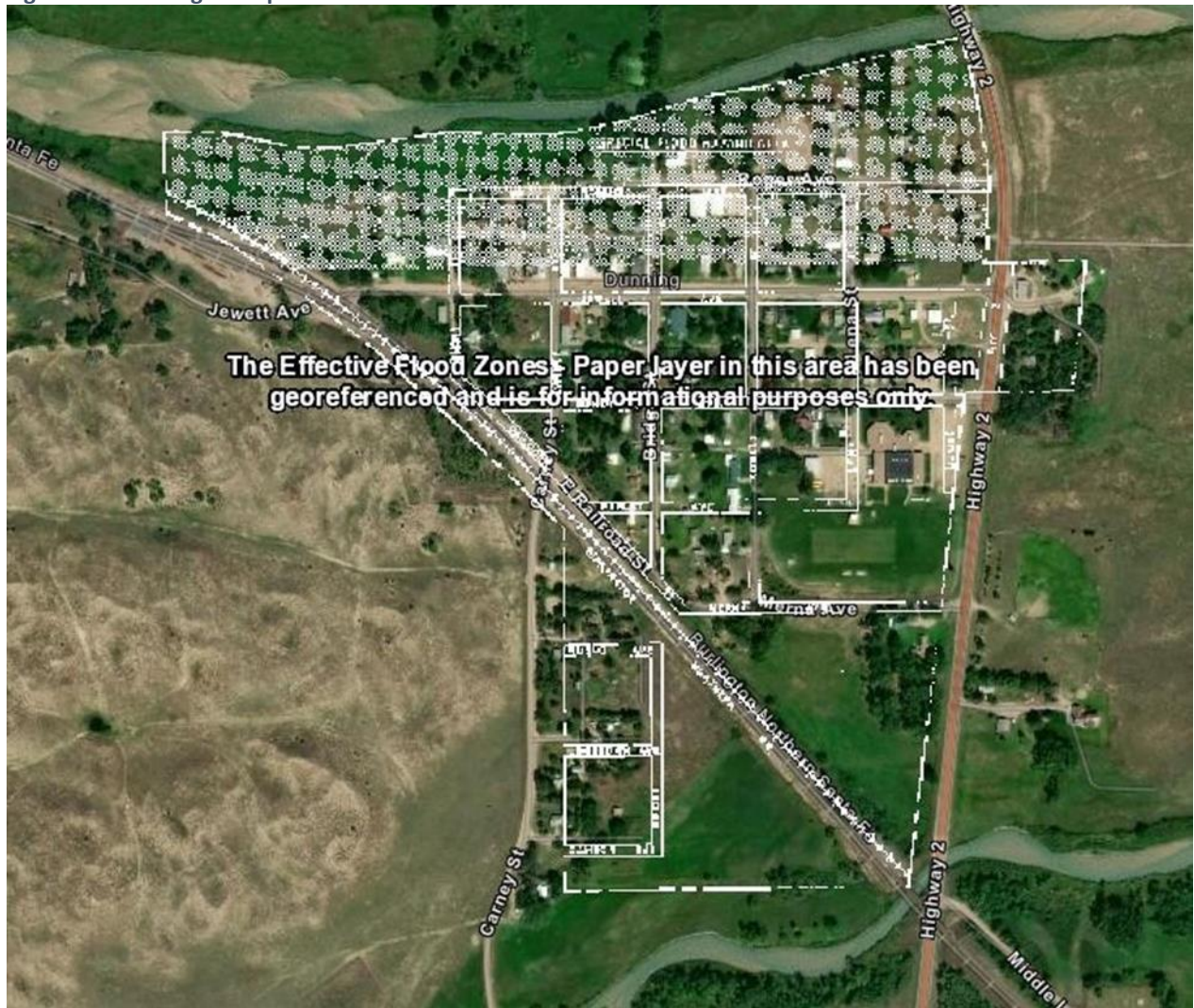


Table 62: FEMA FIRM Panel Status

JURISDICTION	PANEL NUMBER	EFFECTIVE DATE
Blaine County	-	-
Brewster	-	-
Dunning	310079999A, 31007A	07/01/1987
Grant County	-	-
Hyannis	-	-
Hooker County	-	-

JURISDICTION	PANEL NUMBER	EFFECTIVE DATE
Mullen	-	-
Logan County	-	-
Gandy	-	-
Stapleton	-	-
Thomas County	-	-
Halsey	-	-
Thedford	310326	07/11/1975

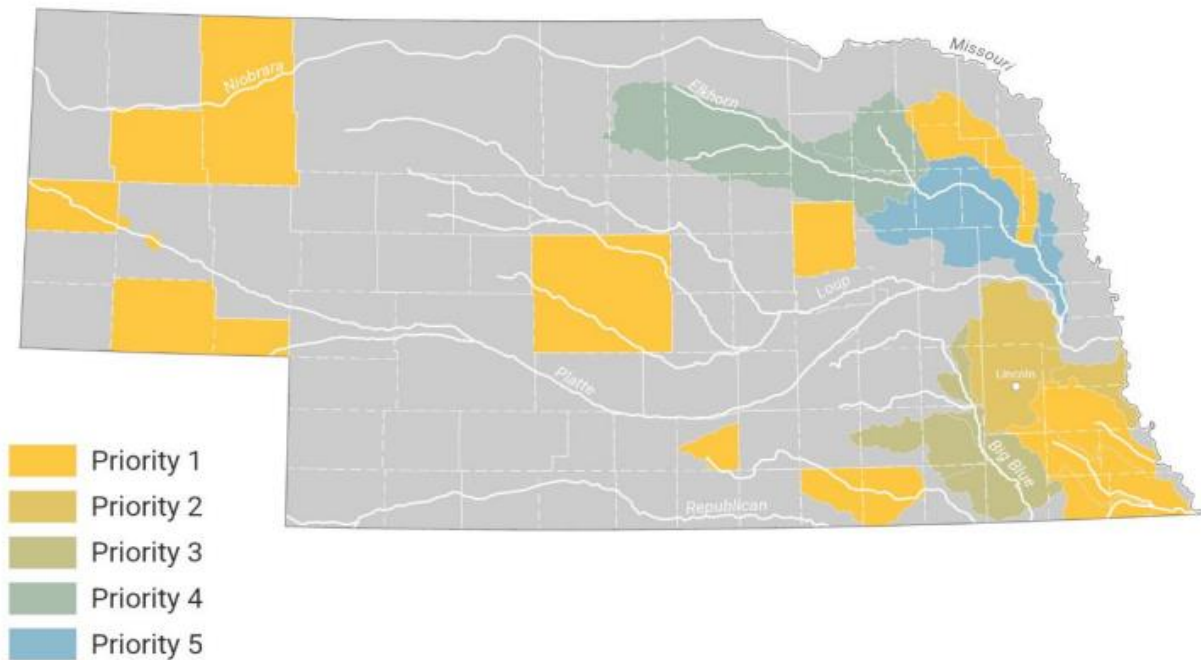
Source: FEMA⁵⁷

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, etc.) that can be used to enhance their mitigation plans and take action to better protect their citizens. As data becomes available, NeDNR hosts the Risk Map products on an interactive web map, which can be viewed here: <https://dnr.nebraska.gov/floodplain/interactive-maps>. This data can also be obtained from the FEMA Flood Map Service Center.

According to the 2022 Nebraska State Flood Hazard Mitigation Plan, there are no priority areas identified in the planning area by NeDNR (Figure 35). Other regulatory products reviewed and utilized in this planning process include Letter of Map Amendments (LOMAs), Letter of Map Revisions (LOMR), and Flood Insurance Studies (FIS) as available and applicable for each of the five counties in the planning area. Specific LOMAs as identified in the planning process are described in their appropriate community profiles in *Section Seven*.

Figure 35: Flood Risk Mapping Project Priority Areas



Source: 2022 Nebraska State Flood Hazard Mitigation Plan

⁵⁷ Federal Emergency Management Agency. Accessed December 2022. "FEMA Flood Map Service Center." <http://msc.fema.gov/portal/advanceSearch>.

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, eight flash flooding events resulted in \$535,000 in property damage, while six riverine flooding events caused \$480,000 in property damage (1996-2022). 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 \$15,286.

Figure 36: Localized Flooding in Blaine County



March 2019 Flood Event

The March 2019 flood event led to significant impacts across the state with limited impacts to the planning area. 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 (rivers and watersheds) were overwhelmed and failed. In other areas, floodwater released by ice jams breaking up destroyed roads, bridges, and levees. 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>.

Impacts reported in the NCEI for areas in the planning area noted:

- Brewster and Stapleton: Historical flooding occurred in north central Nebraska as rivers, creeks and other streams rose due to the combination of snow, rain, and rapid snow melt on top of frozen ground. The greatest flooding occurred along the Niobrara, Keya Paha, Elkhorn and Loup Rivers; Ponca, Long Pine, Victoria and Cedar creeks; and one fatality occurred from the failure of Spencer Dam that is located on the Niobrara River. In addition to the Spencer Dam failure, several privately owned dams failed. The failure of these private dams contributed to additional overland flooding and most likely exacerbated the flooding in localized areas that led to community evacuations. The combination of weather elements on ice in the rivers led to increased runoff and rapid breakup of ice. Large ice chunks on several rivers destroyed or damaged river bridges, to include state, county and private owned bridges in several counties.

Overall, the event caused 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 storm event also occurred in the midst of calving season, resulting in the loss of hundreds of calves for ranchers across the state. Roads, bridges, and critical transportation routes across the state were blocked by drifting snow, flood waters or washed out entirely, including the Highway 281 bridge that crosses the Niobrara River from Holt County into Boyd County. 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 planning area during this event and the most significant impacts from the event stemmed from blizzard conditions rather than flooding.

Average Annual Losses

The average damage per event estimate was determined based upon the 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. Flooding caused a total average of over \$36,250 in property damage and \$637 in crop losses per year for the planning area.

Table 63: Flooding Losses

HAZARD TYPE	# OF EVENTS ¹	AVERAGE # EVENTS PER YEAR	TOTAL PROPERTY LOSS ¹	AVERAGE ANNUAL PROPERTY LOSS	TOTAL CROP LOSS ²	AVERAGE ANNUAL CROP LOSS
Flash Flood	8	0.3	\$535,000	\$19,107	\$15,286	\$637
Flood	6	0.2	\$480,000	\$17,143		

Source: 1 NCEI (1996-2023), 2 USDA RMA (2000-2023)

Extent

The NWS has three categories to define the typical severity of a flood once a river reaches flood stage as indicated in Table 64. 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 64: Flooding Stages

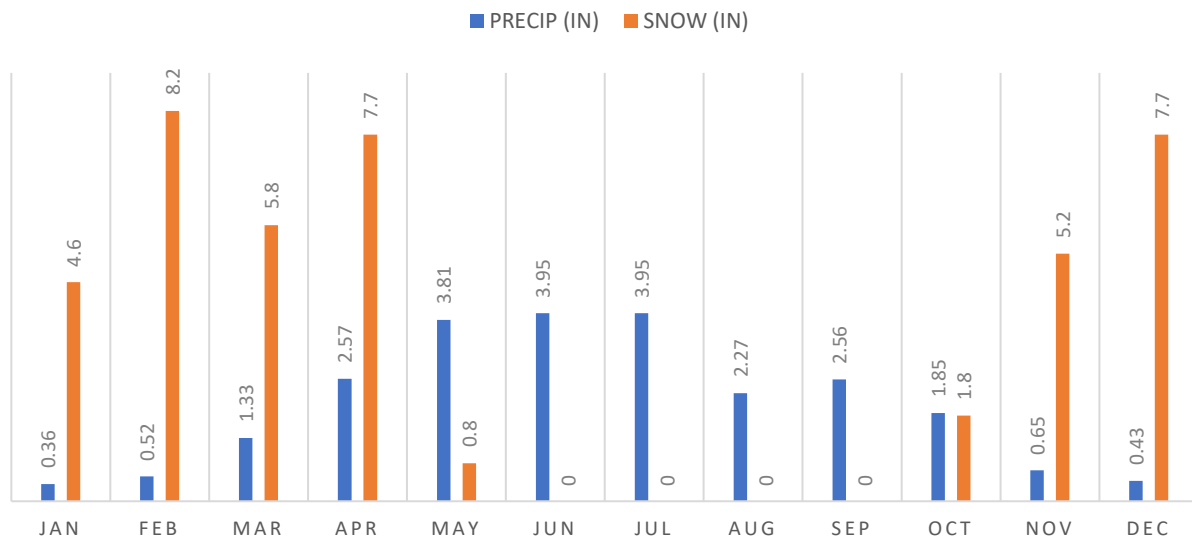
FLOOD STAGE	DESCRIPTION OF TYPICAL FLOOD IMPACTS
Minor Flooding	Minimal or no property damage, but possibly some public threat or inconvenience
Moderate Flooding	Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary
Major Flooding	Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations

Source: NOAA, 2017⁵⁸

The following figure 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 38, the most common month for flooding within the planning area is in June; however, flood events are distributed across early spring and summer months.

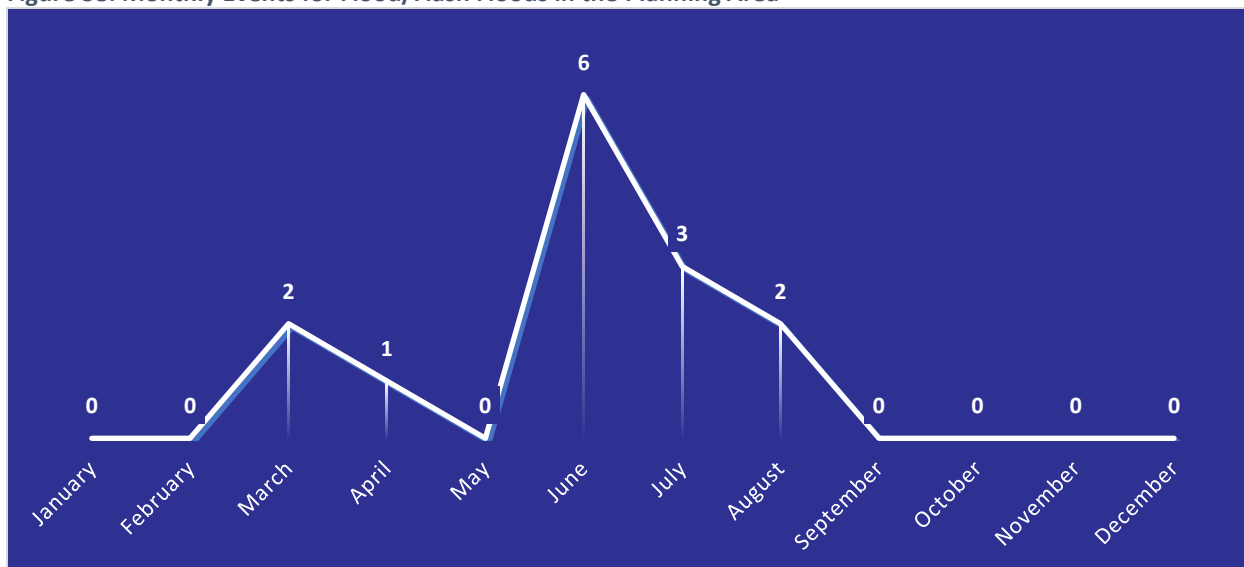
⁵⁸ National Weather Service. 2017. "Flood Safety." <http://www.floodsafety.noaa.gov/index.shtml>.

Figure 37: Average Monthly Precipitation



Source: NCEI

Figure 38: Monthly Events for Flood/Flash Floods in the Planning Area



Source: NCEI

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

keeping people away from flooding rather than keeping the flooding away from people – through historically expensive flood control projects.

The following tables summarize NFIP participation and active policies within the planning area as of August 2023. Of note, no communities in the planning area identified Flooding as a hazard of top concern or identified a need to participate in the NFIP due to minimal flood risk potential.

Table 65: NFIP Participants

JURISDICTION	PARTICIPATE IN NFIP?	ELIGIBLE-REGULAR PROGRAM	DATE CURRENT MAP	SANCTION	SUSPENSION	RESCINDED
Blaine County	No			-	-	-
Brewster	No			-	-	-
Dunning	Yes	12/20/1974	7/1/1987 (L)	-	-	-
Grant County	No			-	-	-
Hyannis	No			-	-	-
Hooker County	No			-	-	-
Mullen	Yes (E)			-	-	-
Logan County	No			-	-	-
Gandy	No			-	-	-
Stapleton	No			-	-	-
Thomas County	No			-	-	-
Halsey	No			-	-	-
Thedford	No	7/11/1975	7/11/1975	7/11/1976	-	-

Source: FEMA, NFIP Community Status Book Report⁵⁹

Note:– (L) – Original FIRM by Letter – All Zone A, C, and X; (E) – Emergency Program

According to the NFIP Community Status Book, only the Village of Dunning currently participates in the program. The local planning team noted they may leave the NFIP in the future due to the minimal flood hazard experienced in the village. According to local sources, the existing floodplain map does not accurately reflect flood risk as surveying efforts for other projects have determined incorrect elevations. Additionally, the majority of flood damages occur due to poor stormwater drainage rather than from the surrounding waterways.

The Village of Thedford has participated in the NFIP in the past but was sanctioned in 1976 and the Village of Mullen participates in the Emergency Program. Mullen has participated in the Emergency Program in the past but does not plan to join the regular program due to minimal flood risk.

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). Currently no jurisdictions in the planning area participate in the CRS program.⁶⁰

⁵⁹ Federal Emergency Management Agency. 2023. "The National Flood Insurance Program Community Status Book." <https://www.fema.gov/cis/NE.html>.

⁶⁰ Federal Emergency Management Agency. May 2017. "National Flood Insurance Program Community Rating System: Coordinator’s Manual FIA-15/2017." Accessed October 2020. https://www.fema.gov/media-library-data/1493905477815-d794671adeed5beab6a6304d8ba0b207/633300_2017_CRS_Coordinators_Manual_508.pdf.

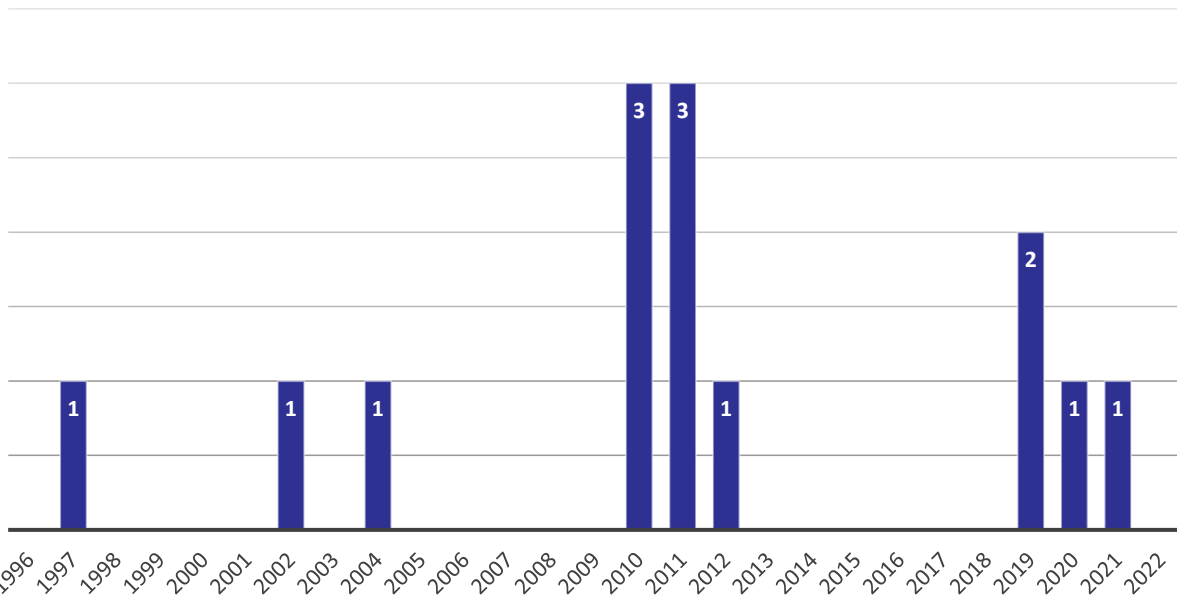
NFIP Repetitive Loss Structures

NeDNR and FEMA Region VII were contacted to determine if any existing buildings, infrastructure, or critical facilities are classified as NFIP Repetitive Loss Structures. As of August 2023, there were no repetitive loss properties located in the planning area.

Historical Probability and Future Likelihood

The NCEI reports six flooding and eight flash flooding events from January 1996 to February 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 (Possible).

Figure 39: Flood Events by Year



Source: NCEI, 2023

Table 66: Historical Probability & Future Likelihood – Flooding

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
32%	Increase in Frequency and Intensity	Increase in Frequency. Increase Exposure	Possible

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.⁶¹ 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 67 shows that the annual total precipitation is expected to increase in both low emissions and high 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.⁶²

Table 67: Average Annual Total Precipitation

County	Emission Scenario	Historical (1976-2005)	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
BLAINE	Lower Emissions	21.8	22.0	22.0	22.1
	Higher Emissions	21.8	21.9	22.1	22.2
GRANT	Lower Emissions	19.1	19.4	19.4	19.7
	Higher Emissions	19.1	19.4	19.6	19.8
HOOKER	Lower Emissions	20.5	20.7	20.7	20.9
	Higher Emissions	20.5	20.7	20.9	21.1
LOGAN	Lower Emissions	21.1	21.4	21.5	21.6
	Higher Emissions	21.1	21.4	21.6	21.8
THOMAS	Lower Emissions	21.2	21.4	21.4	21.5
	Higher Emissions	21.2	21.3	21.4	21.5

Source: NOAA⁶³

Community Top Hazard Status

No jurisdictions identified Flooding as a top hazard of concern.

Regional Vulnerabilities

An updated national study examining social vulnerability as it relates to flood events found that low-income and minority populations are disproportionately vulnerable to flood events.⁶⁴ 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 and renters are more likely to live in areas vulnerable to the threat of flooding yet lack the resources necessary to purchase flood insurance. And finally 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, children, those outdoors during rain events, and those in low-lying areas. Elderly residents may suffer from a

⁶¹ 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.

⁶² 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).

⁶³ NOAA. August 2022. “Climate Mapping for Resilience and Adaptation”. <https://livingatlas.arcgis.com/assessment-tool/explore/details>.

⁶⁴ Tate, E., Rahman, M.A., Emrich, C.T. et al. Flood exposure and social vulnerability in the United States. *Nat Hazards* (2021). <https://doi.org/10.1007/s11069-020-04470-2>

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 NeDNR’s National Flood Insurance Coordinator 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 tables provide information related to regional vulnerabilities and FEMA’s National Risk Index values for Riverine Flooding. For jurisdictional specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 68: National Risk Index Riverine Flooding Vulnerabilities

RISK INDEX FACTOR	BLAINE	GRANT	HOOKEE	LOGAN	THOMAS
Risk Index	Very Low	Very Low	Very Low	Very Low	Very Low
Expected Annual Loss	Very Low	Very Low	Very Low	Very Low	Very Low

Source: FEMA National Risk Index, 2022

Table 69: 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 railroads 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

HAZARDOUS MATERIALS RELEASE

The following description for hazardous materials is provided by the Federal Emergency Management Agency (FEMA):

Chemicals are found everywhere. They purify drinking water, are used in agriculture and industrial production, fuel our vehicles and machines, 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. The community is at risk if a chemical is used unsafely or released in harmful amounts.

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.

Table 70 demonstrates the nine classes of hazardous material according to the 2016 Emergency Response Guidebook.

Table 70: 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 Division 1.3 – Explosives predominantly a fire hazard Division 1.4 – Explosives with no significant blast hazard Division 1.5 – Very insensitive explosives with a mass explosion hazard Division 1.6 – Extremely insensitive articles
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 Division 4.2 – Spontaneously combustible materials Division 4.3 – Water-reactive substances/Dangerous when wet materials
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	

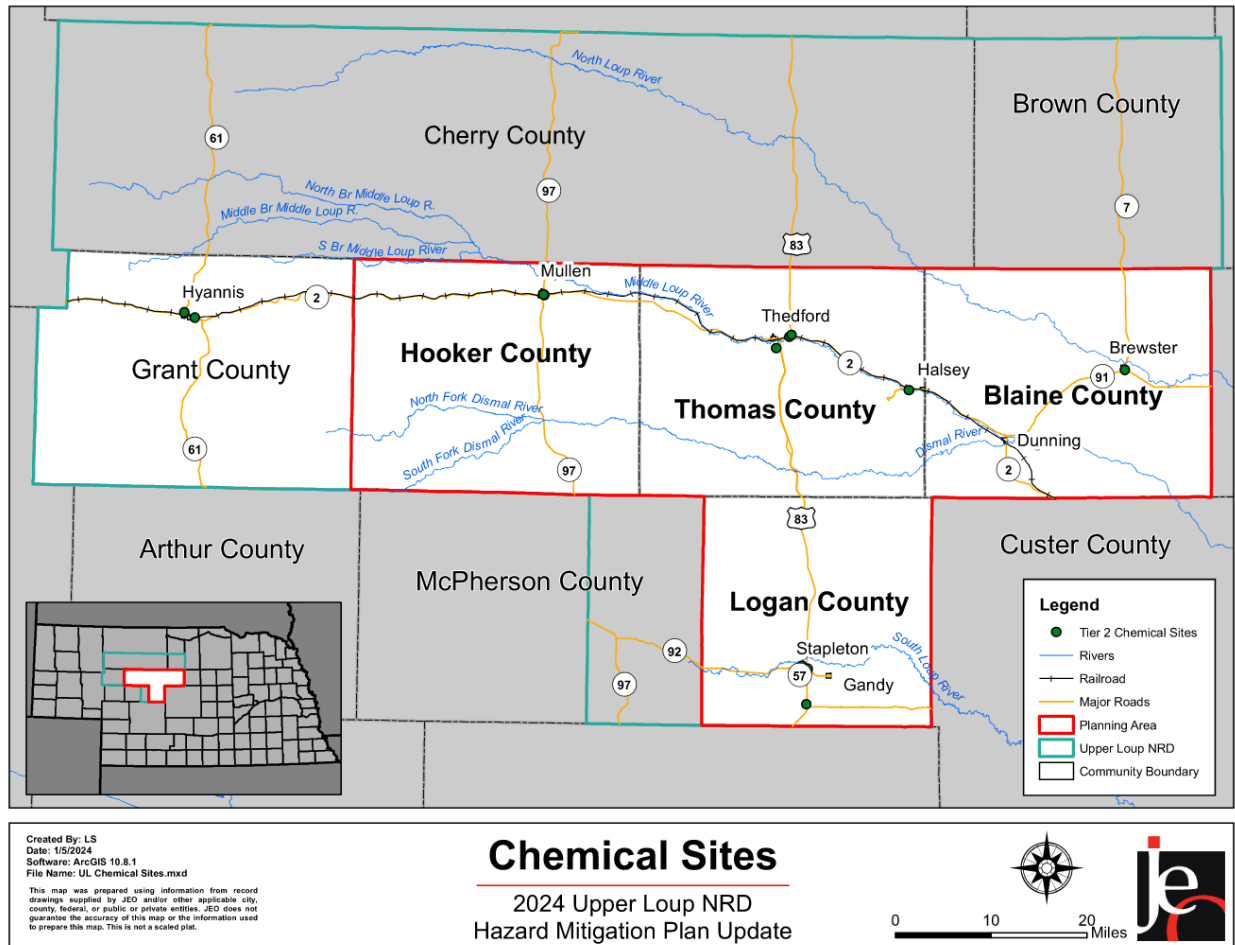
Source: *Emergency Response Guidebook, 2016*⁶⁵

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. Of those, 13 locations are located in the planning area. These locations are shown in the following figure. A listing of hazardous material storage sites can be found in *Section Seven: Community Profiles* for each jurisdiction.

⁶⁵ 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>.

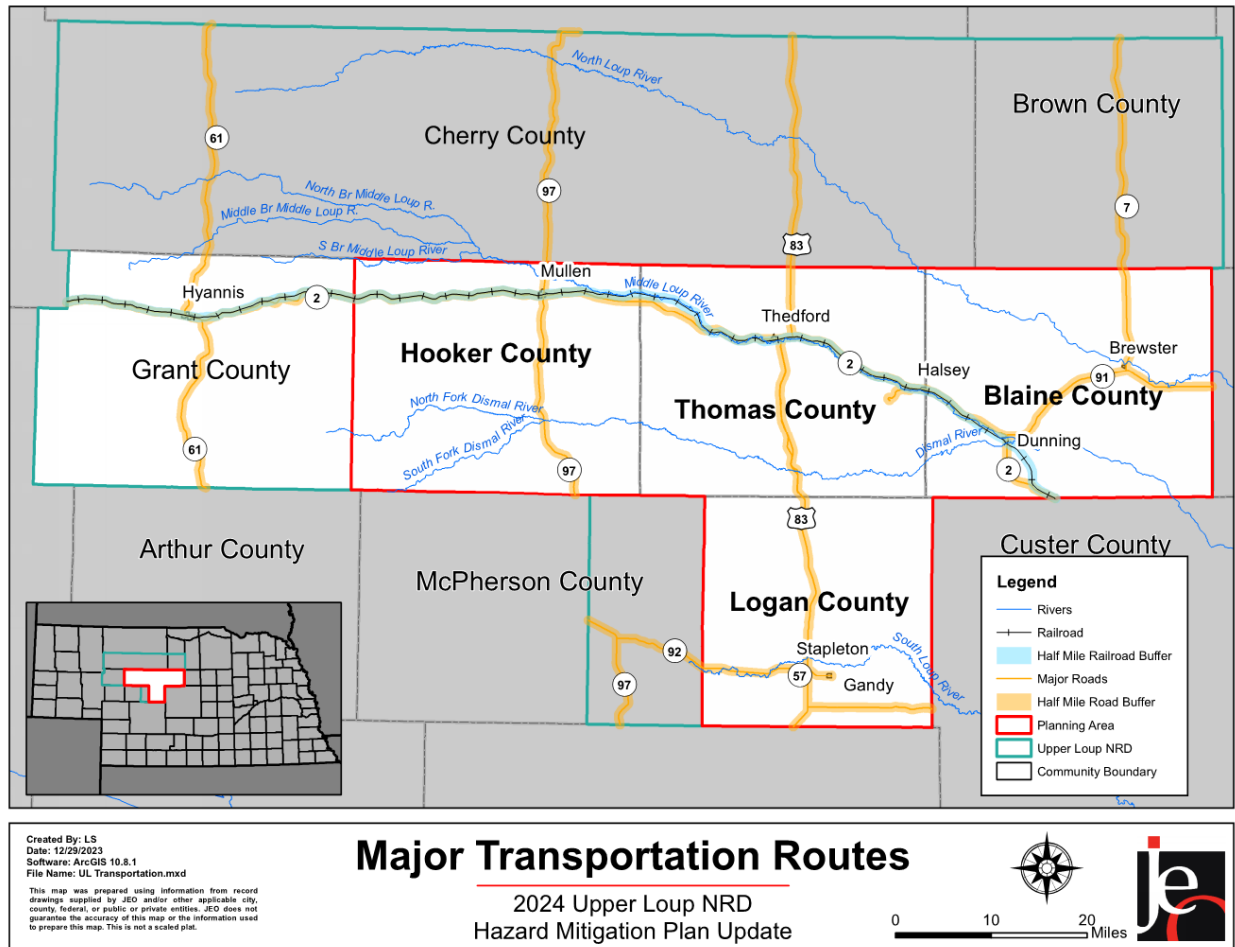
Figure 40: Fixed Chemical Sites in the Planning Area



Hazardous material releases during transportation primarily occur on major transportation routes as identified in Figure 41. 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. Transportation corridors in the planning area are primarily US Routes and County Highways throughout each county. No interstates are located in the planning area. According to PHMSA, there are no gas transmission and hazardous liquid pipelines located in the planning area.⁶⁶

⁶⁶ Pipeline and Hazardous Materials Safety Administration. 2020. "National Pipeline Mapping System." <https://www.npms.phmsa.dot.gov/>.

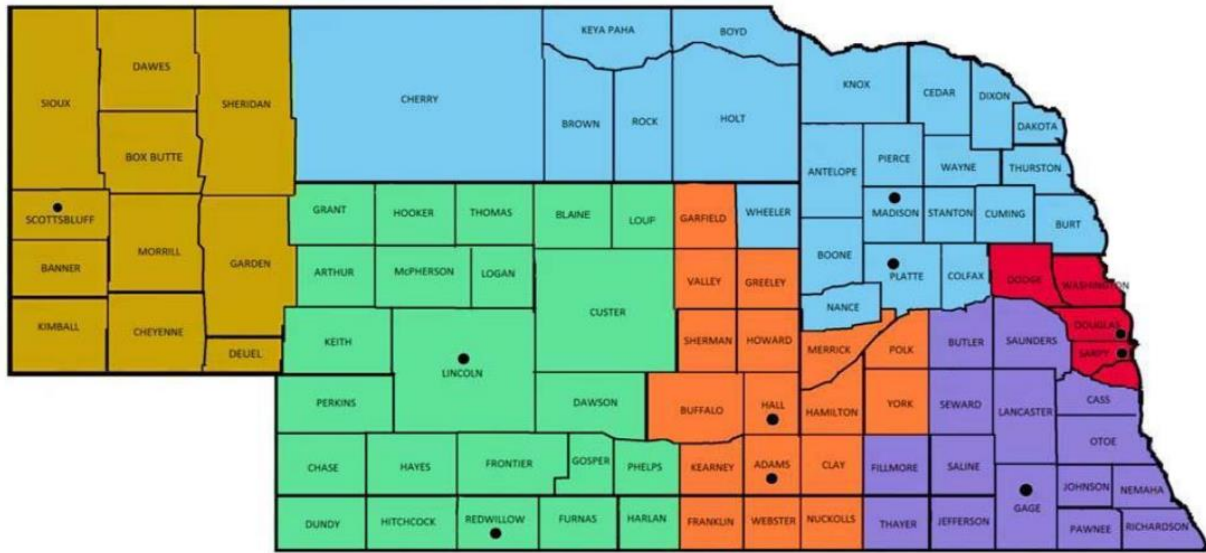
Figure 41: Major Transportation Routes with Half Mile Buffer



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 is one SERT district which covers the entire planning area with the nearest team located in North Platte in Lincoln County.⁶⁷

⁶⁷ 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>.

Figure 42: Nebraska SERTs Map



Historical Occurrences

Fixed Site Spills

According to the U.S. Coast Guard’s National Response Center database (NRC), there have been no fixed site chemical spills from 1990 – 2022 in the planning area.

Transportation Spills

According to the Pipeline and Hazardous Materials Safety Administration (PHMSA), eight hazardous materials releases occurred during transportation in the planning area between 1971 and April 2022. During these events, there were one injury, no fatalities, and \$80,826 in damages. The following table provides a list of the hazardous materials releases during transportation in the planning area.

Table 71: Historical Chemical Transportation Spills, 1990-2022

DATE	LOCATION OF RELEASE	FAILURE DESCRIPTION	MATERIAL INVOLVED	METHOD OF TRANSPORT	QUANTITY SPILLED	TOTAL DAMAGES	INJURIES
4/2/1990	Theftford	Rollover Accident; Vehicular Crash or Accident Damage	Gasoline	Highway	8,800	\$53,824	1
6/18/1996	Mullen	Unknown	Gasoline	Highway	100	\$2,150	0
1/16/2001	Hyannis	Loose Closure Component or Device; Derailment	Fuel	Rail	50	\$4,550	0
5/18/2001	Grant County	Loose Closure Component or Device	Flammable Liquids	Highway	0	\$0	0

DATE	LOCATION OF RELEASE	FAILURE DESCRIPTION	MATERIAL INVOLVED	METHOD OF TRANSPORT	QUANTITY SPILLED	TOTAL DAMAGES	INJURIES
4/12/2006	Thedford	Loose Closure Component or Device	Ammonium Fertilizer	Rail	0.5	\$3,202	0
9/17/2006	Dunning	Vehicular Crash or Accident Damage	Phosphoric Acid	Highway	9	\$12,425	0
1/7/2015	Hyannis	Valve Open	Argon	Rail	0	\$0	0
11/2/2015	Hooker County	Improper Preparation for Transportation	Fuel	Rail	46	\$4,675	0

Source: PHMSA, 1971-2022

Average Annual Damages

There have been no chemical fixed site spills in the planning area reported from the NRC and eight transportation spills as reported by PHMSA. Neither the NRC nor PHMSA track crop losses from chemical spills. These events reported a total of \$80,826 in property damage. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 72: Chemical Fixed Site Average Annual Losses

HAZARD TYPE	NUMBER OF EVENTS	EVENTS PER YEAR	INJURIES	TOTAL EVACUATED	TOTAL DAMAGES	AVERAGE ANNUAL LOSS
Chemical Spills	0	0	0	0	0	\$0
Transportation Spills	8	0.2	1	0	\$80,826	\$1,554

Source: National Response Center, 1990-2022; PHMSA, 1971-2022

Extent

The extent of chemical spills at fixed sites varies and depends on the type of chemical that is released with a majority of events localized to the facility. The probable extent of chemical spills during transportation is difficult to anticipate and depends on the type and quantity of chemical released. As no fixed chemical spill events occurred in the planning area, it is not possible to determine extent for fixed spills.

Transportation spills ranged from no material released to 8,800 liquid gallons of material with an average quantity spilled of 1,125 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 extend scale for this hazard applies the same to all communities in the planning area which have a fixed chemical site or major transportation corridor used for hazardous material transport. The communities of Stapleton and Thedford contain the most fixed chemical sites in the planning area which may increase overall vulnerability of spill events occurring more frequently.

Historical Probability and Future Likelihood

Given the historic record of occurrence for fixed chemical spill events (no spills reported in 33 years), for the purposes of this plan, the probability of a fixed chemical spill is stated at approximately 1% annually (Unlikely). Given the historic record of occurrence for chemical transportation spill events (5 out of 53 years with a reported event), for the purposes of this plan, the annual probability of chemical transportation occurrence is 9% (Possible).

Table 73: Historical Probability & Future Likelihood – Hazardous Materials

Hazard	Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
Fixed Spills	1%	Neither Increase nor Decrease in Frequency	Increase in Frequency and Exposure	Unlikely
Transportation Spills	9%	Neither Increase nor Decrease in Frequency	Increase in Frequency and Exposure	Possible

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,⁶⁸ 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:

- Blaine County
- Thomas County
- Village of Thedford
- Sandhills Public Schools

Regional Vulnerabilities

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

Table 74: Regional Hazardous Materials Vulnerabilities

SECTOR	VULNERABILITY
People	-Those in close proximity could have minor to moderate health impacts -Possible evacuations -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
Economic	-A chemical plant shutdown in smaller communities would have significant impacts to the local economy

⁶⁸ NOAA. August 2022. "Climate Mapping for Resilience and Adaptation". <https://livingatlas.arcgis.com/assessment-tool/explore/details>.

SECTION FOUR: RISK ASSESSMENT

SECTOR	VULNERABILITY
	-Evacuations and closed transportation routes could impact businesses near spill
Built Environment	-Risk of fire or explosion
Infrastructure	-Transportation routes can be closed during evacuations or cleanup
Critical Facilities	-Risk of fire, explosion, or other damages -Risk of evacuation
Climate	-More extreme weather events and flood events put sites at risk of flooding at greater risk

SEVERE THUNDERSTORMS

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

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

Economically, thunderstorms are generally beneficial in that they provide moisture necessary to support Nebraska’s largest industry, agriculture. Most thunderstorms do not cause damage, but when they escalate to severe storms, the potential for damages increases. Damages can include crop losses from wind 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 43 displays the average number of days with thunderstorms across the country each year. The planning area experiences an average of 36 to 45 thunderstorms over the course of one year.

Location

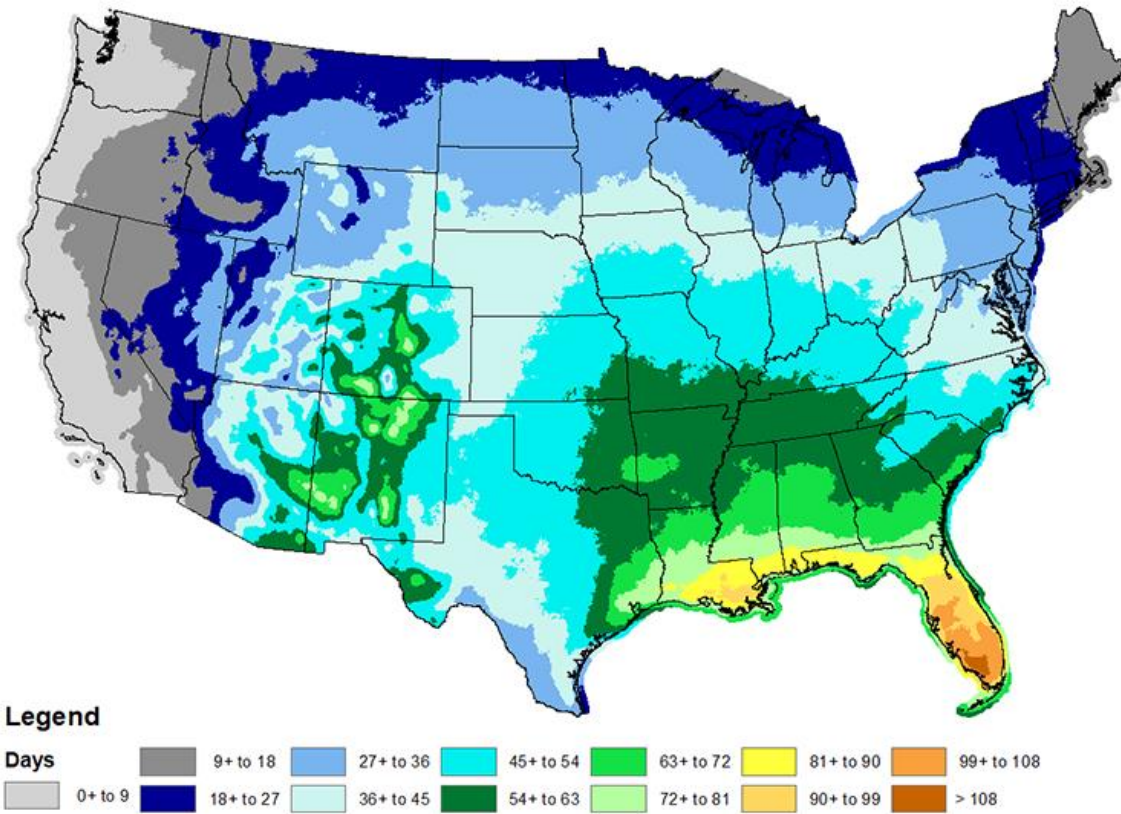
The entire five-county planning area is at risk to thunderstorms and associated damages from heavy rain, lightning, hail, and thunderstorm level winds.

Historical Occurrences

Severe thunderstorms in the planning area usually occur in the afternoon and evening during the summer months.

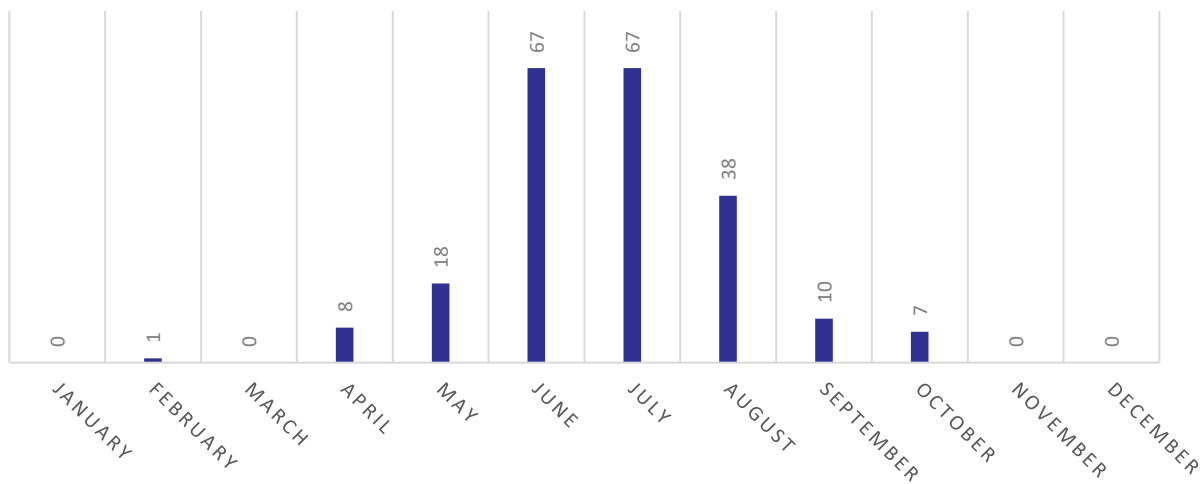
Figure 43: Average Annual Thunderstorms

Annual Mean Thunderstorm Days (1993-2018)



Source: NWS, 2019⁶⁹

Figure 44: Thunderstorm Wind Events by Month



Source: NCEI, 1996-2023

⁶⁹ National Weather Service. 2019. "Global Weather: Introduction to Thunderstorms." https://www.weather.gov/jetstream/tstorms_intro.

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

The NCEI reports a total of 1,072 total severe thunderstorm events. Of those there were:

- Hail 851 events
- Heavy Rain 3 events
- Lightning 2 events
- Thunderstorm Wind 216 events

In total these events were responsible for \$2,361,000 in property damage. The USDA RMA data does not specify severe thunderstorms as a cause of loss, however heavy rains and hail which may be associated with severe thunderstorms caused \$4,183,741 in crop damages. However, Hooker and Grant County do not have RMA data available so crop damages are likely higher than reported here.

Average Annual Losses

The average damage per event estimate was determined based upon recorded damages from NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe thunderstorms cause an average of \$84,321 per year in property damage.

Table 75: Severe Thunderstorm Losses

HAZARD TYPE	# OF EVENTS ¹	AVERAGE # EVENTS PER YEAR	TOTAL PROPERTY LOSS ¹	AVERAGE ANNUAL PROPERTY LOSS	TOTAL CROP LOSS ²	AVERAGE ANNUAL CROP LOSS
Hail	851	30.4	\$1,822,000	\$65,071		
Heavy Rain	216	7.7	\$536,000	\$19,143		
Lightning	3	0.1	\$0	\$0	\$4,183,741	\$174,323
Thunderstorm Winds	2	0.1	\$3,000	\$107		
Totals	1,072	38.3	\$2,361,000	\$84,321	\$4,183,741	\$174,323

Source: 1 NCEI (1996-2023), 2 USDA RMA (2000-2023)

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. Thunderstorm wind events in the planning area ranged from 50mph to 75mph with an average wind speed of 58mph.

The NCEI reported 851 individual hail events across the planning area. As the NCEI reports events per county, this value overestimates the total amount of thunderstorm events. 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 76 outlines the TORRO Hail Scale. The average hailstone size was 1.19 inches. Events of this magnitude correlate to an H4 Severe classification. It is reasonable to expect hail events between H0 and H4 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

SECTION FOUR: RISK ASSESSMENT

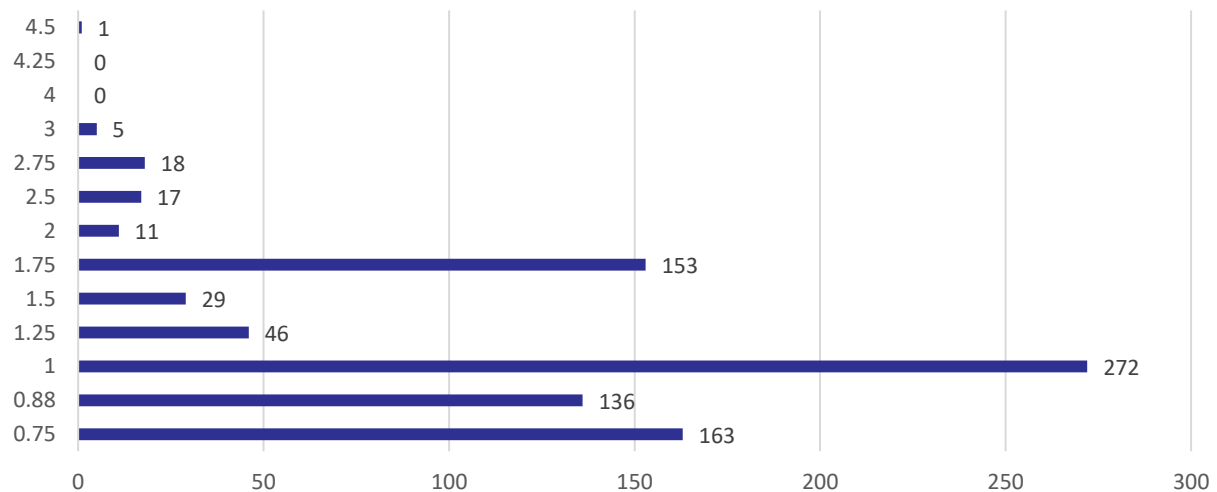
annually. The planning area has endured one H10 hail event (>4.0 inches) during the period of record. Figure 45 shows hail events based on the size of the hail.

Table 76: TORRO Hail Ranking

Class	Type of Material	Divisions
H0: Hard Hail	5 mm; 0.2 in (pea size)	No damage
H1: Potentially Damaging	5-15 mm; 0.2-0.6in (marble)	Slight general damage to plants and crops
H2: Significant	10-20 mm; 0.4-0.8 in (grape)	Significant damage to fruit, crops, and vegetation
H3: Severe	20-30 mm; 0.8-1.2 in (walnut)	Severe damage to fruit and crops, damage to glass and plastic structures
H4: Severe	30-40mm; 1.2-1.6 in (squash ball)	Widespread damage to glass, vehicle bodywork damaged
H5: Destructive	40-50 mm; 1.6-2.0 in (golf ball)	Wholesale destruction of glass, damage to tiled roofs; significant risk of injury
H6: Destructive	50-60 mm; 2.0-2.4 in (chicken egg)	Grounded aircrafts damaged, brick walls pitted; significant risk of injury
H7: Destructive	60-75 mm; 2.4-3.0 in (tennis ball)	Severe roof damage; risk of serious injuries
H8: Destructive	75-90 mm; 3.0-3.5 in (large orange)	Severe damage to structures, vehicles, airplanes, risk of serious injuries
H9: Super Hail	90-100 mm; 3.5-4.0 in (grapefruit)	Extensive structural damage, risk of severe or even fatal injuries to persons outdoors
H10: Super Hail	>100 mm; >4 in (melon)	Extensive structural damage; risk of severe or even fatal injuries to persons outdoors.

Source: TORRO, 2017⁷⁰

Figure 45: Hail Events by Magnitude



Source: NCEI, 1996-2023

⁷⁰ Tornado and Storm Research Organization. 2017. "Hail Scale." <http://www.torro.org.uk/hscale.php>.

Communities and jurisdictions across the planning area are likely to experience similar extent impacts from severe thunderstorms. However, communities or areas with poor stormwater management systems may be at higher risk during heavy rain events.

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 1,072 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 77: 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.”⁷¹ 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.”⁷² There is also some suggestion in the models that the atmosphere will become more favorable to severe thunderstorm development and increased intensity.

Community Top Hazard Status

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

- Upper Loup NRD
- Village of Brewster
- Village of Dunning
- Village of Hyannis
- Hooker County
- Village of Mullen

⁷¹ University of Nebraska-Lincoln. 2014. “Understanding and Assessing Climate Change: Implications for Nebraska”.
<http://snr.unl.edu/download/research/projects/climateimpacts/2014ClimateChange.pdf>.

⁷² 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/>.

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- Logan County
- Village of Gandy
- Village of Stapleton
- Village of Halsey
- Village of Thedford
- Mullen Public Schools
- Sandhills Public Schools
- Thedford Public Schools

Regional Vulnerabilities

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

Table 78: National Risk Index Severe Thunderstorms Vulnerabilities

HAZARD TYPE	RISK INDEX FACTOR	HAIL	LIGHTNING
Blaine	Risk Index	Very Low	Very Low
	Expected Annual Loss	Very Low	Very Low
Grant	Risk Index	Very Low	Very Low
	Expected Annual Loss	Very Low	Very Low
Hooker	Risk Index	Very Low	Very Low
	Expected Annual Loss	Very Low	Very Low
Logan	Risk Index	Very Low	Very Low
	Expected Annual Loss	Very Low	Very Low
Thomas	Risk Index	Very Low	Very Low
	Expected Annual Loss	Very Low	Very Low

Source: FEMA National Risk Index, 2022

Table 79: Regional Severe Thunderstorm Vulnerabilities

SECTOR	VULNERABILITY
People	-Elderly citizens with decreased mobility may have trouble evacuating or seeking shelter -Mobile home residents are at risk of injury and damage to their property if the mobile home is not properly anchored -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 damage
Infrastructure	-High winds and lightning can cause power outages and down power lines -Roads may wash out from heavy rains and become blocked from downed tree limbs
Critical Facilities	-Power outages are possible -Critical facilities may sustain damage from hail, lightning, and wind
Climate	-Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of severe storm events

SECTOR	VULNERABILITY
Other	-High winds, hail, 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. Extreme cold, freezing rain, and blizzards also occur alongside many severe winter storms.

Extreme Cold

Along with snow and ice storm events, extreme cold is dangerous to the well-being of people and animals. What constitutes extreme cold varies from region to region but is generally accepted as temperatures that are significantly lower than the average low temperature. For the planning area, the coldest months of the year are January, February, and December. The average low temperature for these months are all below freezing (average low for the three months in the planning area is 12.4°F). The average high temperatures for the months of January, February, and December are near 34.2°F in the planning area.⁷³

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 and 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 five-county planning area is at risk to severe winter storms and associated damages from blizzards, heavy snow, extreme cold, 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 296 severe winter storm events for the planning area from January 1996 to February 2023. These recorded events caused a total of \$596,000 in property damage and \$57,083 in crop damages. The most damaging event was a heavy snow event which impacted Hooker

⁷³ High Plains Regional Climate Center. 2020. "Monthly Climate Normals 1981-2010." <http://climod.unl.edu/>.

County in October 1997, which caused \$200,000 in property damages. One storm in 1998 led to one injury and two fatalities.

Average Annual Losses

The average damages 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 \$21,286 per year in property damage to the planning area.

Table 80: Severe Winter Storms Losses

HAZARD TYPE	# OF EVENTS ¹	AVERAGE # EVENTS PER YEAR	TOTAL PROPERTY LOSS ¹	AVERAGE ANNUAL PROPERTY LOSS	TOTAL CROP LOSS ²	AVERAGE ANNUAL CROP LOSS
Blizzard	49	1.8	\$255,000	\$9,107	\$57,083	\$2,378
Heavy Snow	22	0.8	\$10,000	\$357		
Ice Storm	2	0.1	\$16,000	\$571		
Winter Storms	223	8.0	\$315,000	\$11,250		
Winter Weather	0	0.0	\$0	\$0		
Totals	296	10.6	\$596,000	\$21,286	\$57,083	\$2,378

Source: 1 NCEI (1996-2023), 2 USDA RMA (2000-2023)

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

- Winter Storm, 10/24/1997 (\$200,000 in property damages)**- A major winter storm moved across southwest and northcentral Nebraska dumping from 4 to 12 inches of snow. Sustained winds at 40 mph with gusts to near 60 mph created blowing and drifting snow. The storm began as rain and then changed over to snow as temperatures fell. Ice and snow collected on power lines and trees causing considerable damage to tree limbs and scattered power outages. Interstate 80 was closed to traffic along with other roads in the area due to blowing and drifting snow and icy conditions. However, there were still numerous traffic accidents due to slick roads and poor visibilities. Many school and community activities were cancelled or postponed.
- Winter Storm, 2/25/1998 (\$82,000 in property damages)** - An intense winter storm dumped up to eight inches of snow in the Northeast Nebraska Panhandle. Snow and blowing snow made travel almost impossible so that roads were closed and school was canceled. High winds in excess of 60 mph blew a metal utility building into cars in a nearby parking lot in Broken Bow. The winds flipped a metal building into a motel in Valentine. The destructive winds also lifted and tore off roof shingles, damaged a garage door and tore siding off of a country school south of North Platte.
- Ice Storm, 2/25/1998 (\$16,000 in property damages; 2 fatalities; 1 injury)** - Light freezing drizzle on highway surfaces caused hazardous driving conditions during the morning. A few accidents occurred in which motorists hit patches of ice, lost control and rolled over. One of the accidents happened four miles north of Stapleton in which the driver and passenger were killed.

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 46: SPIA Index

The Sperry-Piltz Ice Accumulation Index, or “SPIA Index”

Copyright, February, 2009

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.)

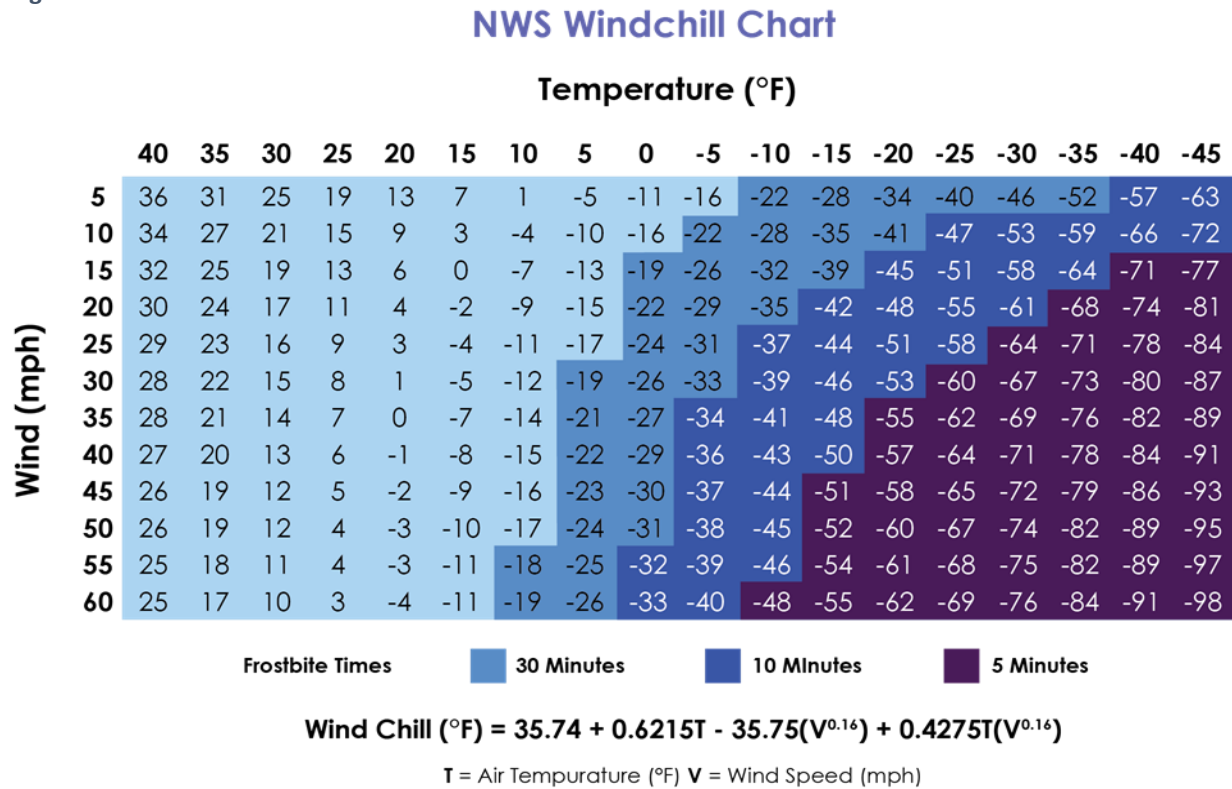
Source: SPIA-Index⁷⁴

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

⁷⁴ SPIA-Index. 2009. “Sperry-Piltz Ice Accumulation Index.” <https://www.spia-index.com/>.

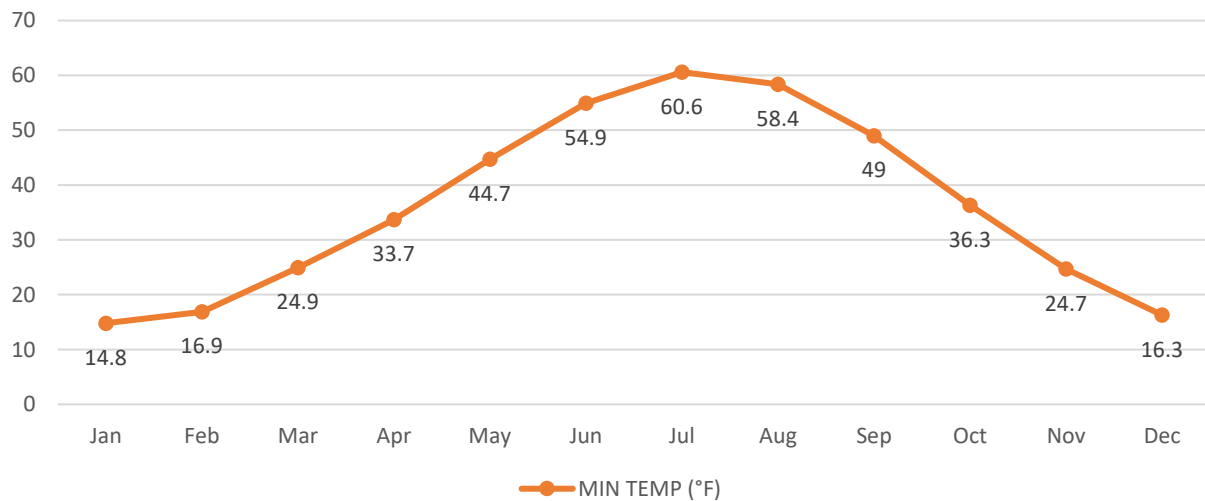
the effects of hypothermia or frost bite as it gets lower. The following figure shows the Wind Chill Index used by the NWS.

Figure 47: Wind Chill Index Chart



Source: NWS

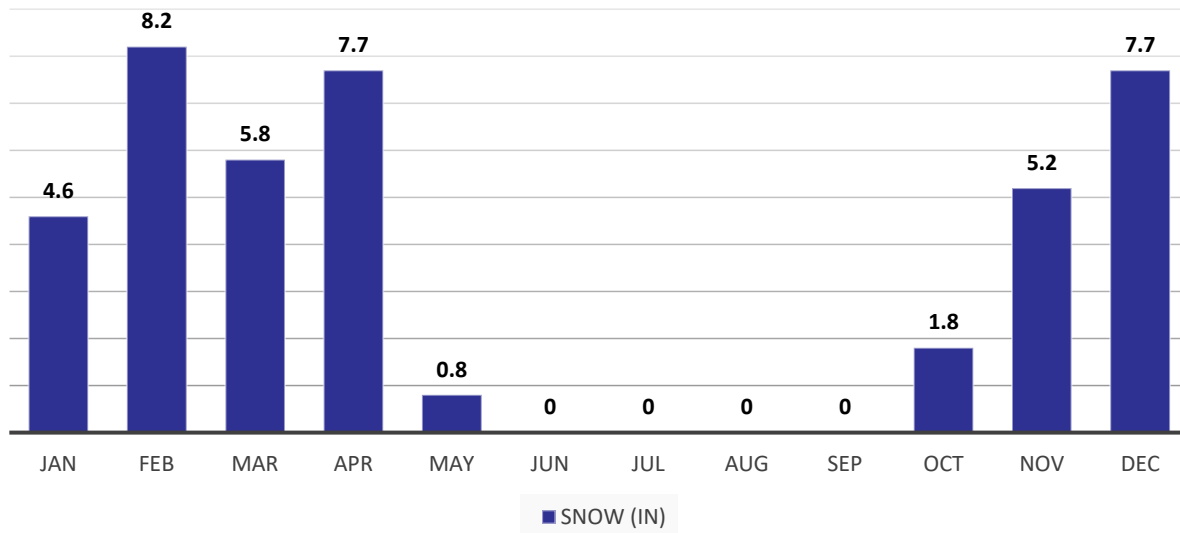
Figure 48: Monthly Climate Normals Min Temperature (1981-2010)



Source: NCEI

Average monthly snowfall for the planning area is shown in Figure 49, which shows the snowiest months are December, February, and April. A common snow event (likely to occur annually) will result in accumulation totals between one to five inches. Often these snow events are accompanied by high winds. It is reasonable to expect wind speeds of 25 to 35 mph with gusts reaching 50 mph or higher. Strong winds and low temperatures can combine to produce extreme wind chills of 20°F to 40°F below zero.

Figure 49: Monthly Normal Snowfall in Inches (1981-2010)



Source: High Plains Regional Climate Center

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.

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 296 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 81: 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 five-county 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.”⁷⁵ 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.⁷⁶ 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 82: Number of Freezing Days

	Warming Scenarios			
	1° C	1.5° C	2° C	3° C
NUMBER OF FREEZING DAYS	8-30 Days per Year Avg. 17	31-90 Days per Year Avg. 31	31-90 Days per Year Avg. 36	31-90 Days per Year Avg. 51

Source: *Probable Futures*⁷⁷

Community Top Hazard Status

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

- Upper Loup NRD
- Village of Dunning
- Village of Hyannis
- Hooker County
- Village of Mullen
- Logan County
- Village of Gandy
- Thomas County
- Village of Halsey
- Village of Thedford
- Mullen Public Schools
- Sandhills Public Schools
- Thedford Public Schools

Regional Vulnerabilities

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

Table 83: National Risk Index Severe Winter Storms Vulnerabilities

HAZARD TYPE	RISK INDEX FACTOR	ICE STORM	WINTER WEATHER
Blaine	Risk Index	Very Low	Very Low
	Expected Annual Loss	Very Low	Very Low
Grant	Risk Index	Very Low	Very Low

⁷⁵ University of Nebraska-Lincoln. 2014. “Understanding and Assessing Climate Change: Implications for Nebraska”.
<http://snr.unl.edu/download/research/projects/climateimpacts/2014ClimateChange.pdf>.

⁷⁶ 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/>.

⁷⁷ Probable Futures. “Maps of Temperature”. Accessed December 2022. <https://probablefutures.org/>.

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HAZARD TYPE	RISK INDEX FACTOR	ICE STORM	WINTER WEATHER
Hooker	Expected Annual Loss	Very Low	Very Low
	Risk Index	Very Low	Very Low
Logan	Expected Annual Loss	Very Low	Very Low
	Risk Index	Very Low	Very Low
Thomas	Expected Annual Loss	Very Low	Very Low
	Risk Index	Very Low	Very Low
	Expected Annual Loss	Very Low	Very Low

Source: FEMA National Risk Index, 2022

Table 84: Regional Severe Winter Storm Vulnerabilities

SECTOR	VULNERABILITY
People	-Elderly citizens are at higher risk to injury or death, especially during extreme cold and heavy snow accumulations -Citizens without adequate heat and shelter at higher risk of injury or death
Economic	-Closed roads and power outages can cripple a region for days, leading to significant revenue loss and loss of income for workers
Built Environment	-Heavy snow loads can cause roofs to collapse -Significant tree damage possible, downing power lines and blocking roads
Infrastructure	-Heavy snow and ice accumulation can lead to downed power lines and prolonged power outages -Transportation may be difficult or impossible during blizzards, heavy snow, and ice events
Critical Facilities	-Emergency response and recovery operations, communications, water treatment plants, and others 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 & CIVIL DISOBEDIENCE

Civil disorder and terrorism are broad terms typically used by law enforcement to describe a group of people/ protesting major socio-political problems. 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 a political or social objectives” (28 C.F.R. Section 0.85).

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

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

Though peaceful public demonstrations are allowed under US Federal law, any domestic situations such as a strike or riot involving three or more people could be considered civil disorder if the demonstration has devolved into having a potential for causing injuries, casualties, or property damage. U.S. Code on civil disorder considers the following actions to be civil disorder:

1. Whoever teaches or demonstrates to any other person the use, application, or making of any firearm or explosive or incendiary device, or technique capable of causing injury or death to persons, knowing or having reason to know or intending that the same will be unlawfully employed for use in, or in furtherance of, a civil disorder which may in any way or degree obstruct, delay, or adversely affect commerce or the movement of any article or commodity in commerce or the conduct or performance of any federally protected function; or
2. Whoever transports or manufactures for transportation in commerce any firearm, or explosive or incendiary device, knowing or having reason to know or intending that the same will be used unlawfully in furtherance of a civil disorder; or
3. Whoever commits or attempts to commit any act to obstruct, impede, or interfere with any fireman or law enforcement officer lawfully engaged in the lawful performance of his official duties incident to and during the commission of a civil disorder which in any way or degree obstructs, delays, or adversely affects commerce or the movement of any article or commodity in commerce or the conduct or performance of any federally protected function

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

Location

Civil disorder or terrorist activities could occur throughout the entire planning area. In rural areas, concerns are primarily related to agro-terrorism and tampering with water supplies. In urban areas, concerns are related to political unrest, activist groups, and others that may be targeting businesses, police, and federal buildings. Urban areas are more likely to see protesters, while rural areas may experience environmental justice protesters.

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 no terrorist incidents since 1970 within the planning area. The Planning Team did not report any accounts of water supplies being tampered with to date.

Average Annual Losses

According to the START Global Terrorism Database (1970-2018) and the SPEED database of civil disorder events (1946-2018), there have been no civil disorder events that have occurred in the planning area. As there were no terrorist events within the planning area, there were no average annual damages.

Extent

Incidents of civil disorder can vary greatly in scale and magnitude, depending on the location of the attack, number of protesters, and reasoning for unrest.

Historical Probability and Future Likelihood

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

Table 85: 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.

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

No jurisdictions identified Terrorism and Civil Disobedience as a top hazard of concern.

Regional Vulnerabilities

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

Table 86: Regional Terrorism and Civil Disobedience Vulnerabilities

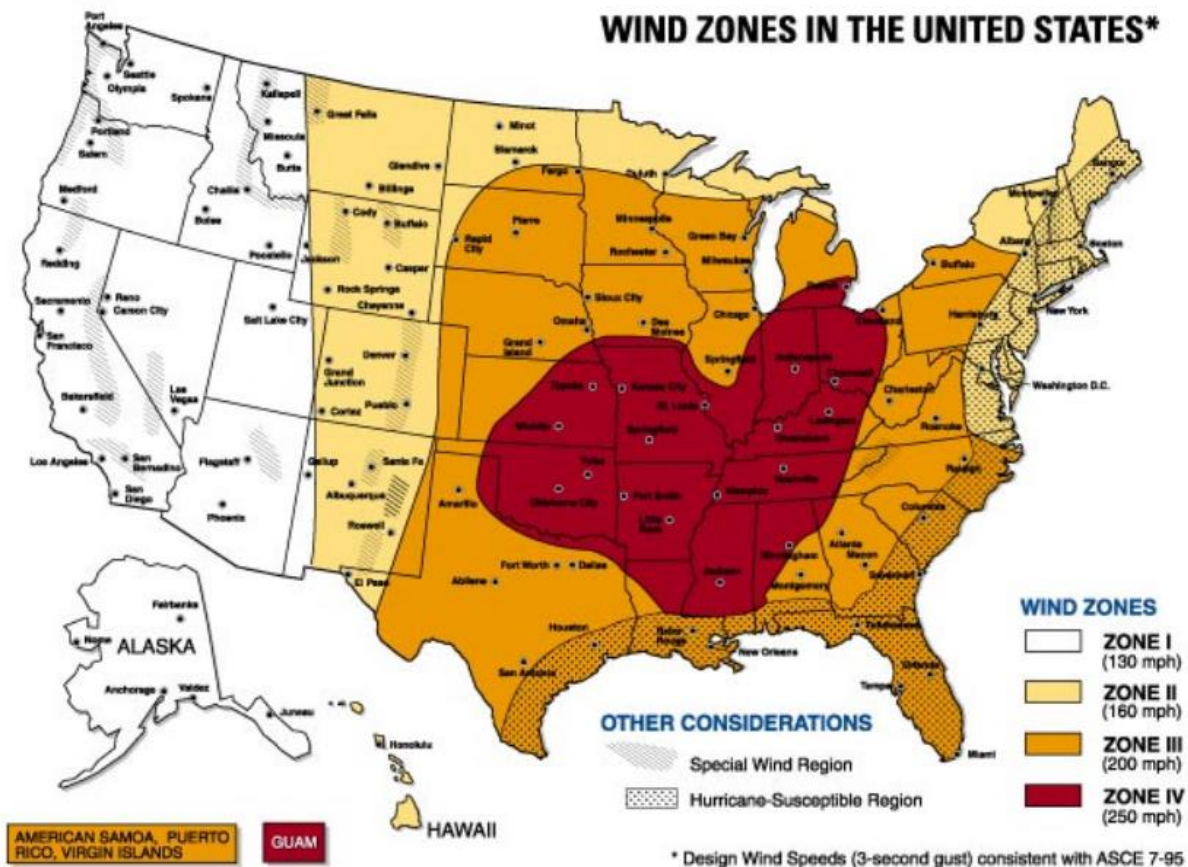
SECTOR	VULNERABILITY
People	-Police officers and first responders at risk of injury or death -Protestors and civilians at risk of injury or death
Economic	-Damaged businesses can cause loss of revenue and loss of income for workers -Agricultural attacks could cause significant economic losses for the region -Severe civil disorder events are often accompanied by looting -Risk of violence in an area can reduce income flowing into and out of that area
Built Environment	-Targeted buildings may sustain heavy damage -Public property may be at risk of damage
Infrastructure	-Water supply, power plants, utilities may be damaged -Public property including signs, community art, or public park facilities may be at risk to damage
Critical Facilities	-Police stations and government offices are at a higher risk
Climate	-Ideologies on climate change may contribute to overall unrest and acts of disobedience

TORNADOES AND HIGH WINDS

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

The National Weather Service (NWS) defines high winds as sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration.⁷⁸ 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 50: Wind Zones in the U.S.



Source: FEMA

⁷⁸ National Weather Service. 2017. "Glossary." <http://w1.weather.gov/glossary/index.php?letter=h>.

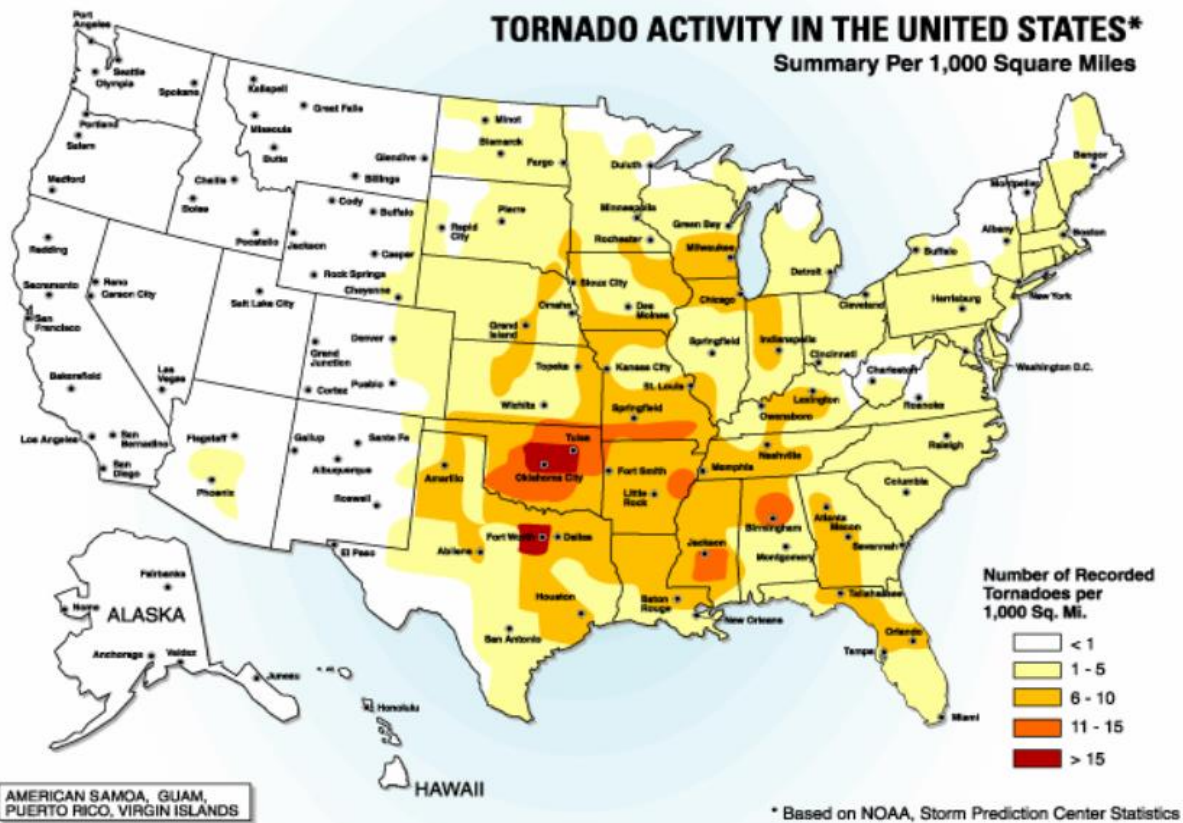
High winds are a critical component of tornado formation. A tornado is typically associated with a supercell thunderstorm. For a rotation to be classified as a tornado, three characteristics must be met:

- 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,
- 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 2010.⁷⁹

Figure 51: Tornado Activity in the United States



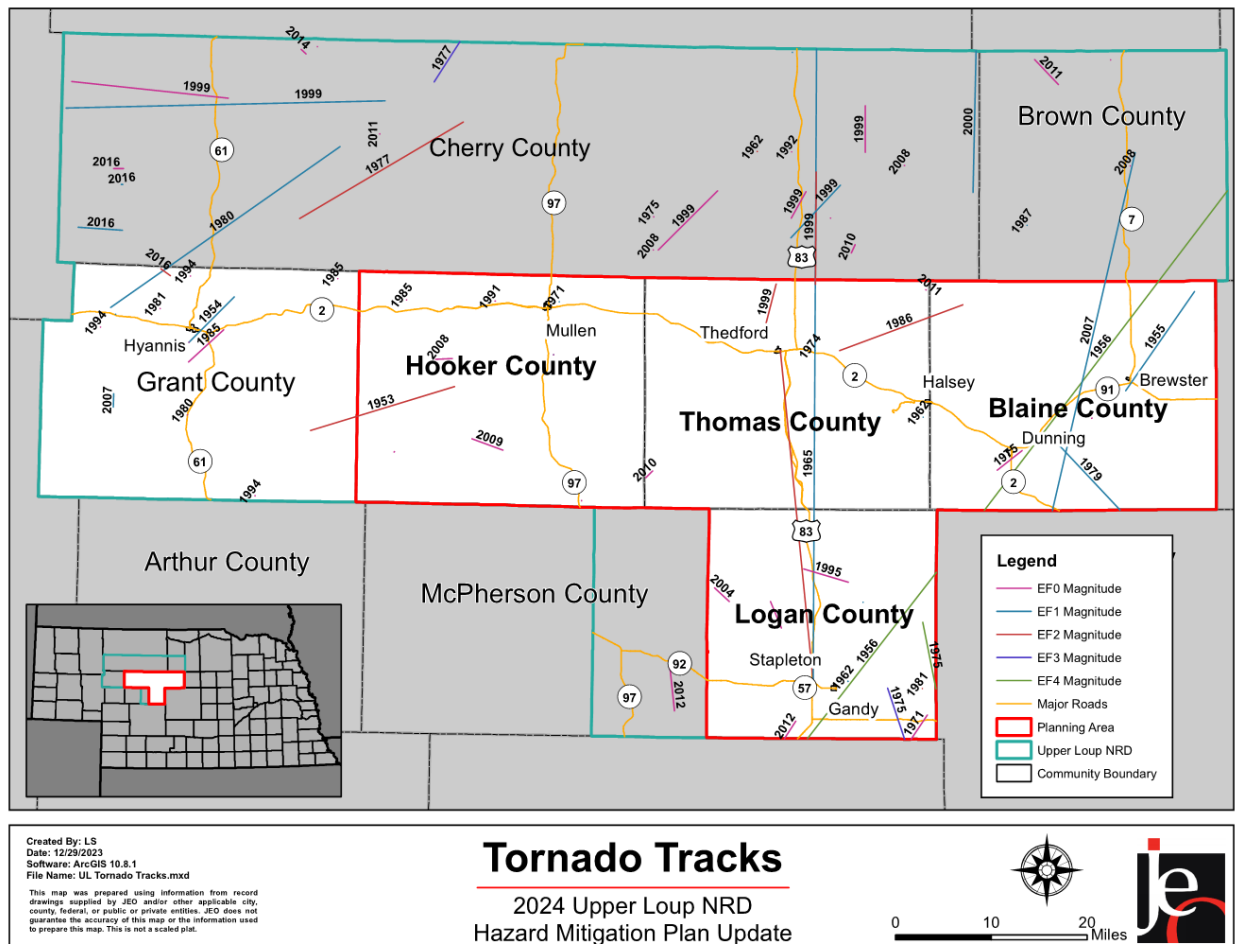
Source: FEMA

⁷⁹ National Centers for Environmental Information. 2013. “U.S. Tornado Climatology.” <https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornadoclimatology>.

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 the surrounding agricultural areas. The following map shows the historical track locations across the region according to the Midwestern Regional Climate Center. Few significant tornado events have directly impacted communities located in the planning area, but touchdowns and tornado events can occur anywhere within the three-county planning area. Note that this map shows tornado tracks both within or that cross into the boundaries of the Upper Loup NRD, including southern Cherry and Brown Counties and eastern McPherson County.

Figure 52: Tornado Tracks in the Planning Area

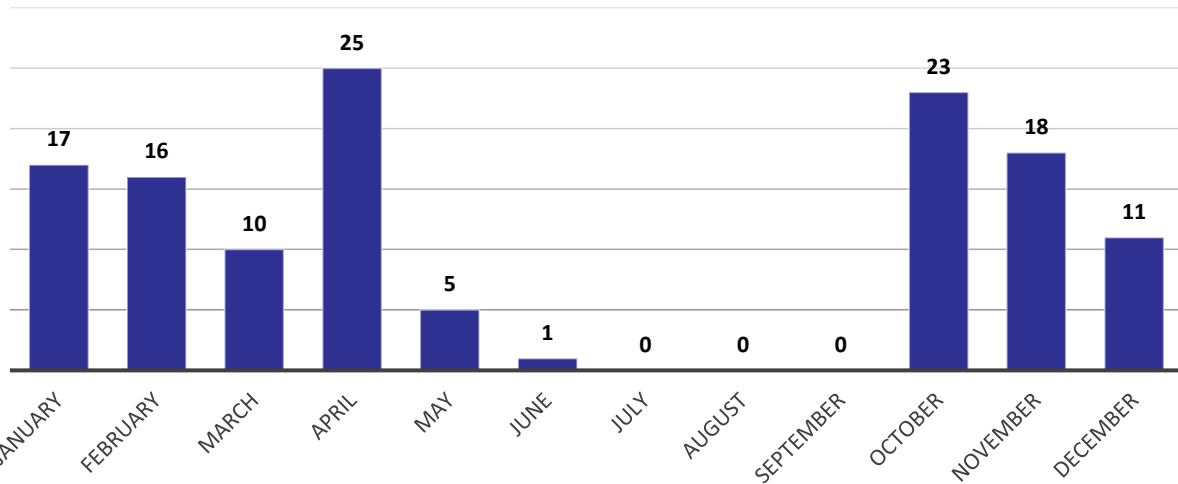


Historical Occurrences

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 126 high wind events that occurred between 1996 and 2023 and 26 tornadic events ranging from a magnitude of E/EF0 to E/EF2 between 1981 and 2023. These events were responsible for \$111,500 in property damages and \$259,921 in crop damages. No injuries or deaths were reported. The most damaging tornado occurred in Thomas County in 1999, causing \$50,000 in damages.

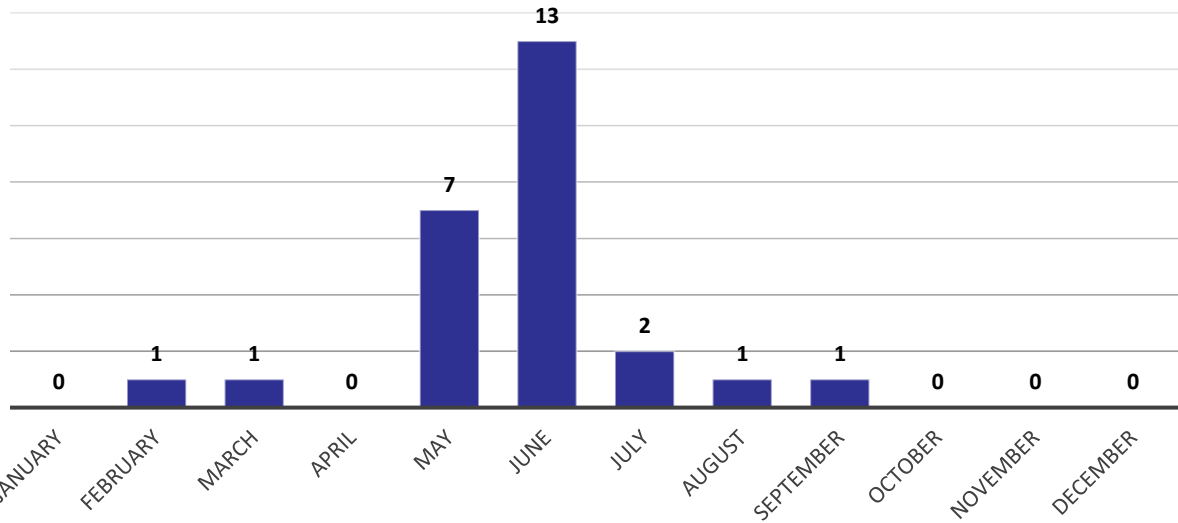
As seen in the following figures, the majority of high wind events occur in the spring and winter months, while most tornado events occur in the summer. Significant hazard events with direct impacts to communities are discussed in more detail in the applicable *Community Profiles*.

Figure 53: High Wind Events by Month



Source: NCEI, 1996-2032

Figure 54: Tornadoes by Month in the Planning Area



Source: NCEI, 1981-2023

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

- F2 Tornado 6/4/1999 - \$500,000 in property damages.** *The tornado, observed by numerous storm chasers, including the VORTEX team, and the general public, touched down in Thomas County 3 miles north northwest of Thedford and was on the ground for 15 miles before lifting in southeast Cherry County 6 miles east southeast of Brownlee. The path was over rangeland destroying 9 windmills,*

several miles of fences and numerous trees. This was the most significant of 6 tornadoes produced by the same supercell thunderstorm.

- **EF1 Tornado 5/5/2007 –\$20,000 in property damages.** The tornado moved into Blaine County from Custer County approximately 7 miles southeast of Dunning and continued to move northward across the county and then crossed into Brown County approximately 11 miles northwest of Brewster. Along the path, the tornado snapped trees, broke power poles, destroyed fences, lifted and turned a vehicle driving along Highway 2, and destroyed windmills. The average path width of the tornado was 220 yards. The total path length of the tornado was approximately 55 miles.

Average Annual Losses

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. It is estimated that high wind events can cause an average of \$3,982 per year in property damage and \$10,830 per year in crop damages. Damages from tornadoes vary greatly depending on the severity or magnitude of each event.

Table 87: High Winds and Tornado Losses

Hazard Type	# of Events ¹	Average # events per year	Total Property Loss ¹	Average Annual Property Loss	Total Crop Loss ²	Average Annual Crop Loss
High Winds	126	4.5	\$7,000	\$250	\$259,921	\$10,830
Tornadoes	26	0.9	\$104,500	\$3,732	\$0	\$0
Total	152	5.4	\$174,500	\$3,982	\$259,921	\$10,830

Source: 1 NCEI (high winds 1996-2023), 2 USDA RMA (2000-2023)

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 88: 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 overturned

Beaufort Wind Force Ranking	Range of Wind	Conditions
11	64-72 mph	Widespread damages; very rarely experienced
12 - 17	72 - > 200 mph	Hurricane; devastation

Source: Storm Prediction Center, 2017⁸⁰

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.⁸¹

Table 89: Enhanced Fujita Scale

Storm Category	3 Second Gust (mph)	Damage Level	Damage Description
EF0	65-85	Gale	Some damages to chimneys; breaks 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

⁸⁰ Storm Prediction Center: National Oceanic and Atmospheric Administration. 1805. "Beaufort Wind Scale." <http://www.spc.noaa.gov/faq/tornado/beaufort.html>.

⁸¹ 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."

Storm Category	3 Second Gust (mph)	Damage Level	Damage Description
			heaters, storage tanks, automobiles, etc. will create serious secondary damage on structures.

Source: NOAA; FEMA

Table 90: 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
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

Source: NOAA; FEMA

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 65 mph, with an average speed of 47.8 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 26 reported tornado events, 22 were EF/F0, two were EF/F1, one was EF/F2, 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, such as throughout the planning area, 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.

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 (22 out of

28 years with reported events), for the purposes of this plan, the annual probability of wind event occurrence is 79 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 (17 out of 28 years with reported events), for the purposes of this plan, the annual probability of tornado occurrence is 61 percent (Likely).

Table 91: Historical Probability & Future Likelihood – Tornadoes and High Winds

Hazard	Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
High Winds	79%	Uncertain	Neither Increase nor Decrease in Frequency. Increase in Exposure	Likely
Tornadoes	61%	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.”⁸²

Community Top Hazard Status

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

- Upper Loup NRD
- Blaine County
- Village of Brewster
- Hooker County
- Village of Mullen
- Village of Stapleton
- Thomas County
- Mullen Public Schools
- Sandhills Public Schools
- Thedford Public Schools

⁸² University of Nebraska-Lincoln. 2014. “Understanding and Assessing Climate Change: Implications for Nebraska”. <http://snr.unl.edu/download/research/projects/climateimpacts/2014ClimateChange.pdf>.

Regional Vulnerabilities

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

Table 92: National Risk Index Tornadoes and High Winds Vulnerabilities

HAZARD TYPE	RISK INDEX FACTOR	STRONG WIND	TORNADES
Blaine	Risk Index	Very Low	Very Low
	Expected Annual Loss	Very Low	Very Low
Grant	Risk Index	Very Low	Very Low
	Expected Annual Loss	Very Low	Very Low
Hooker	Risk Index	Very Low	Very Low
	Expected Annual Loss	Very Low	Very Low
Logan	Risk Index	Very Low	Very Low
	Expected Annual Loss	Very Low	Very Low
Thomas	Risk Index	Very Low	Very Low
	Expected Annual Loss	Very Low	Very Low

Source: FEMA National Risk Index, 2022

Table 93: Regional Tornadoes and High Winds Vulnerabilities

Sector	Vulnerability
People	<ul style="list-style-type: none"> -Vulnerable populations include those living in mobile homes (especially if improperly anchored), nursing homes, schools, or in substandard housing -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

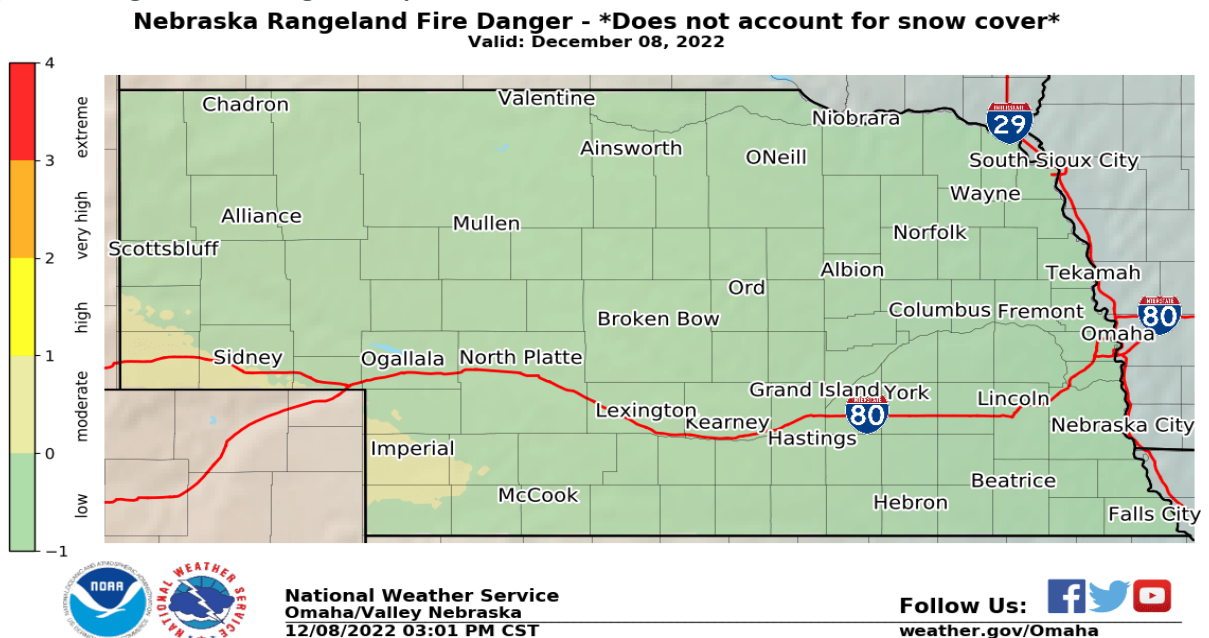
WILDFIRES

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.

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 55).

Figure 55: Rangeland Fire Danger Example

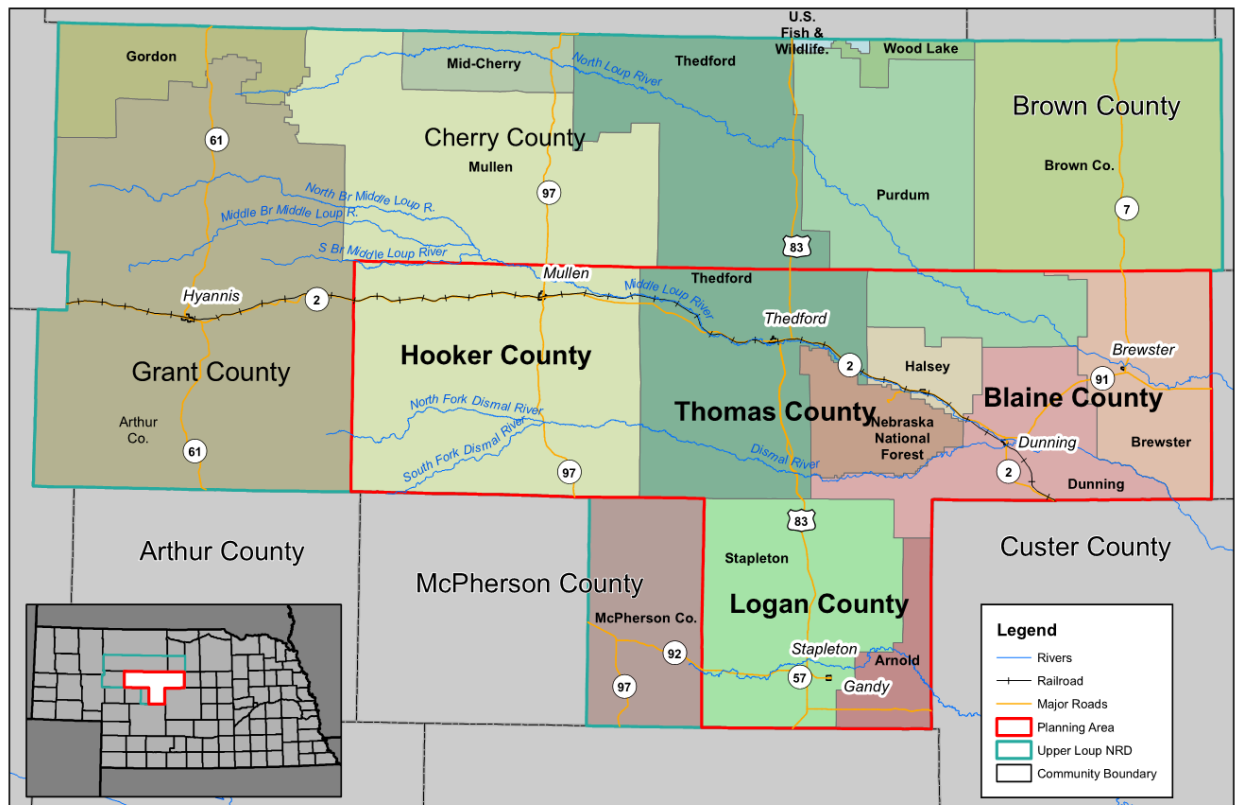


Fire Protection

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

- Brewster Rural Fire District
- Dunning Volunteer Fire Department
- Halsey Rural Fire District
- Mullen Volunteer Fire Department
- Purdum Rural Fire Department
- Sandhills Fire Protection District (Hyannis)
- Stapleton Volunteer Fire Department
- Thedford Volunteer Fire Department

Figure 56: Fire Districts in the Planning Area



Created By: LS
 Date: 1/5/2024
 Software: ArcGIS 10.8.1
 File Name: UL Fire Districts.mxd

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 plan.

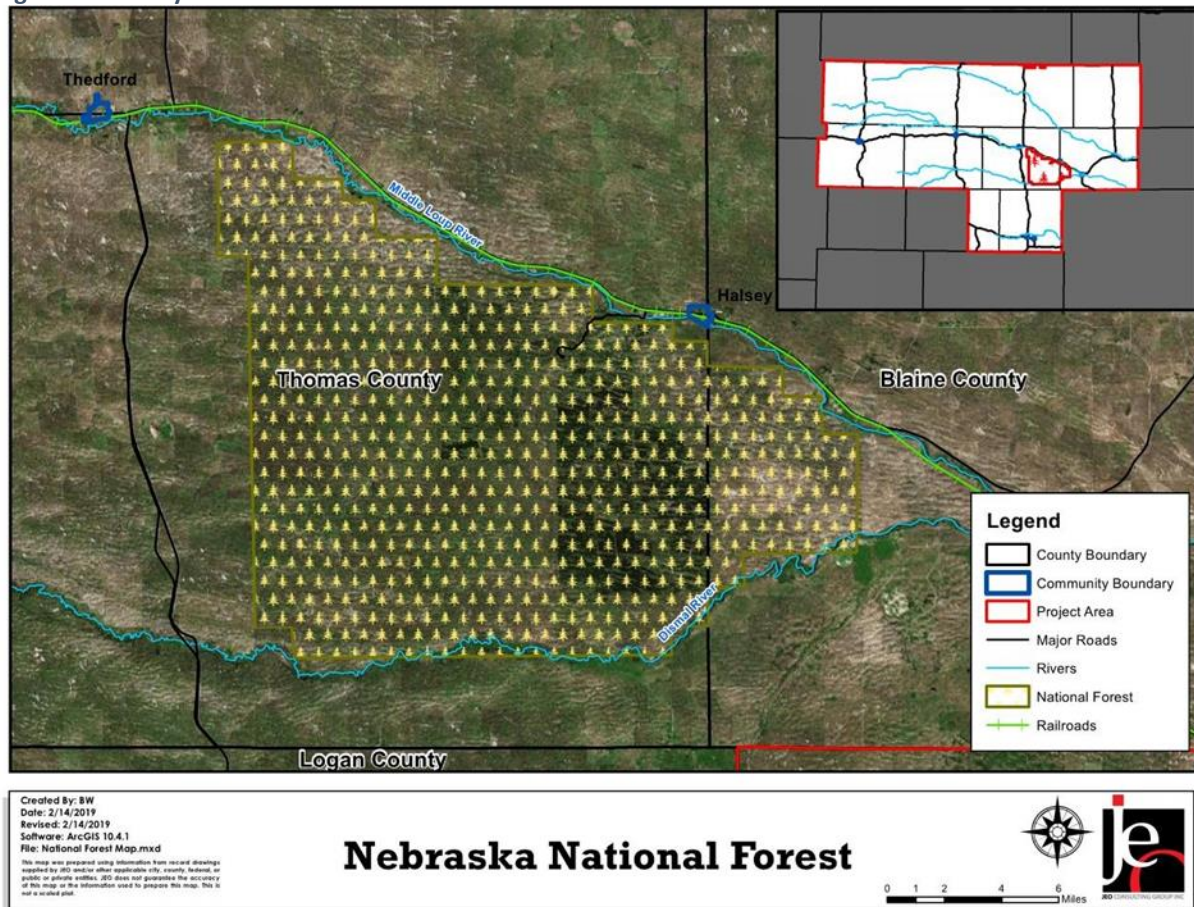
Fire Districts

2024 Upper Loup NRD
 Hazard Mitigation Plan Update

Location

Wildfire events can occur throughout the planning area. Additionally, the Halsey Nebraska National Forest is located in Thomas and Blaine Counties and covers 141,864 acres. The forest is at higher risk to wildfire due to high fuel loads. Wildfires that begin in the forest may spread into surrounding range land areas. The Nebraska Forestry Service conducts fuel load management programs in the forest areas.

Figure 57: Halsey National Forest



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)
- 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 94: Wildfire Vulnerabilities by County

COUNTY	RISK TO HOMES	WILDFIRE LIKELIHOOD	EXPOSURE RISK	VULNERABLE POPULATIONS	OVERALL RISK
Blaine	High	High	Very High	Very High	High
Grant	Very High	Very High	Very High	Very High	Very High
Hooker	High	High	High	Very High	High
Logan	Medium	Medium	High	Very High	Medium
Thomas	High	High	Very High	Very High	High

Source: *Wildfire Risk to Communities, 2023*⁸³

Table 95: Wildfire Vulnerable Populations by County

COUNTY	FAMILIES IN POVERTY	PEOPLE WITH DISABILITIES	PEOPLE OVER 65	DIFFICULTY WITH ENGLISH	HOUSEHOLDS WITH NO VEHICLE	MOBILE HOMES
Blaine	2 (1.4%)	81 (17.3%)	147 (31.5%)	2 (0.4%)	1 (0.4%)	21 (8.9%)
Grant	18 (10.1%)	82 (11.9%)	158 (22.9%)	0 (0%)	3 (1%)	40 (13.5%)
Hooker	12 (7.1%)	112 (15.6%)	188 (25.4%)	0 (0%)	21 (6.6%)	36 (11.4%)
Logan	18 (8.2%)	85 (9.5%)	172 (19.2%)	15 (1.8%)	0 (0%)	28 (8.8%)
Thomas	10 (5.9%)	81 (13.8%)	149 (25.4%)	0 (0%)	3 (1.1%)	9 (3.3%)

Source: *Wildfire Risk to Communities, 2023*

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 September 2023. Unofficial reports from the Bovee Fire in October 2022 were also included. As the number of reported wildfires by county indicates, wildfire events can occur in any county within the planning area.

For the planning area, there were 372 wildfires reported from 2000 to 2023, according to the NFS. The reported events burned 95,672 acres. While the RMA lists no damages from fire in the planning area, the NFS reported \$139,583 in crop loss and \$315,506 in property damages. Reported wildfires are most likely to be started by lightning (40.9%). Equipment (21.5%) and miscellaneous causes (18.5%) are the second and third leading causes of fires in the planning area. Wildfire events have ranged from less than one acre to 19,000 acres, with an average event burning 259 acres. Thomas County has reported the greatest number of fires and has had the greatest number of acres burned.

Table 96: Reported Wildfires by County

County	Reported Wildfires	Acres Burned
Blaine County	60	4,096
Grant County	96	19,263
Hooker County	74	19,012

⁸³ United States Department of Agriculture, United States Forest Service. Accessed January 2024. "Wildfire Risk to Communities." <https://wildfirerisk.org/>.

County	Reported Wildfires	Acres Burned
Logan County	38	12,451
Thomas County	106	40,850
Total	372	95,672

Source: Nebraska Forest Service, 2000-2023

Nebraska Thedford Fire

A presidentially declared disaster was issued on April 22, 2011 for what became known as the Nebraska Thedford Fire. Mid 60's temperatures, low relative humidity, and 30 to 50 mph winds contributed to a quickly growing wildfire which began mid-afternoon on private property. Fire-fighting response included over 28 fire departments throughout the north central region and airplane response. Two fire fighters from the Valentine Volunteer Fire Department in northern Cherry County were injured in the fire. Over the span of three hours, the wildfire burned over 11,000 acres in Thomas County.

Bovee Fire

A major fire occurred near Halsey in October 2022 – the Bovee Fire. An overturned vehicle and extreme drought conditions led to perfect conditions for wildfire to spread. This event impacted approximately 19,000 acres in Thomas County. Of those acres over 5,000 were United States Forest Land, approximately 580 acres were state owned, and approximately 13,000 acres were privately owned. The fire impacted the local 4-H camp and fire tower and led to one fatality (a local assistant fire chief who suffered a heart attack while responding). The Eppley Lodge, cabins, and fire tower were completely lost and staff housing at the camp was deemed unsafe for occupancy. During the fire, local campgrounds and the residents of Halsey were issued evacuation orders by local fire personnel.

A Facebook post made by the Nebraska National Forest Service on October 3, 2022 stated the following regarding the Bovee Fire event as it was taking place:

“HALSEY, NE – Federal, state, and local firefighters are aggressively attacking the 15,000-acre Bovee Fire, which ignited yesterday afternoon in the Nebraska National Forest about three miles south of the Bessey Ranger District office.

The Bovee Fire was reported at 1:39 p.m. on October 2, and quickly spread up to 15 miles north, pushed through dry fuels by gusty south winds. Aggressive structure protection efforts by Forest Service and local firefighters successfully defended the historic Bessey Nursery and CCC Campground. Unfortunately, the lodge and camper cabins of the Nebraska 4H Camp were destroyed, along with the Scott Lookout Tower. The fire's cause is under investigation.

“We had a good night last night and made a lot of progress on the east and north,” said Incident Commander Brian Daunt. “Today's focus is going to be holding those lines, and constructing line to the west of the fire.”

More than 100 firefighters are on scene, including two Type I Interagency Hotshot Crews, 10 engines, a dozer, and a fire suppression module. Air tankers were used yesterday to drop retardant and slow the fire's spread, and will be available today if needed. Colorado's Multimission Aircraft is scheduled to fly the fire this afternoon to provide detailed infrared mapping of the fire perimeter.

Weather conditions today are expected to be much more favorable for firefighters, with highs in the 70s and lighter winds.

SECTION FOUR: RISK ASSESSMENT

The Rocky Mountain Complex Incident Management Team, led by Incident Commander Dan Dallas, has been activated to take command of the Bovee Fire, and is mobilizing en route to the incident.

Nebraska Highway 2 has been reopened between Thedford and Halsey. To protect public and firefighter safety, the Nebraska National Forest has closed the entire Bessey Ranger District to the public during the Bovee Fire. Closure details will be posted on the Nebraska National Forests and Grasslands website at <https://www.fs.usda.gov/alerts/nebraska/alerts-notice>.

Figure 58: Location of Bovee Fire

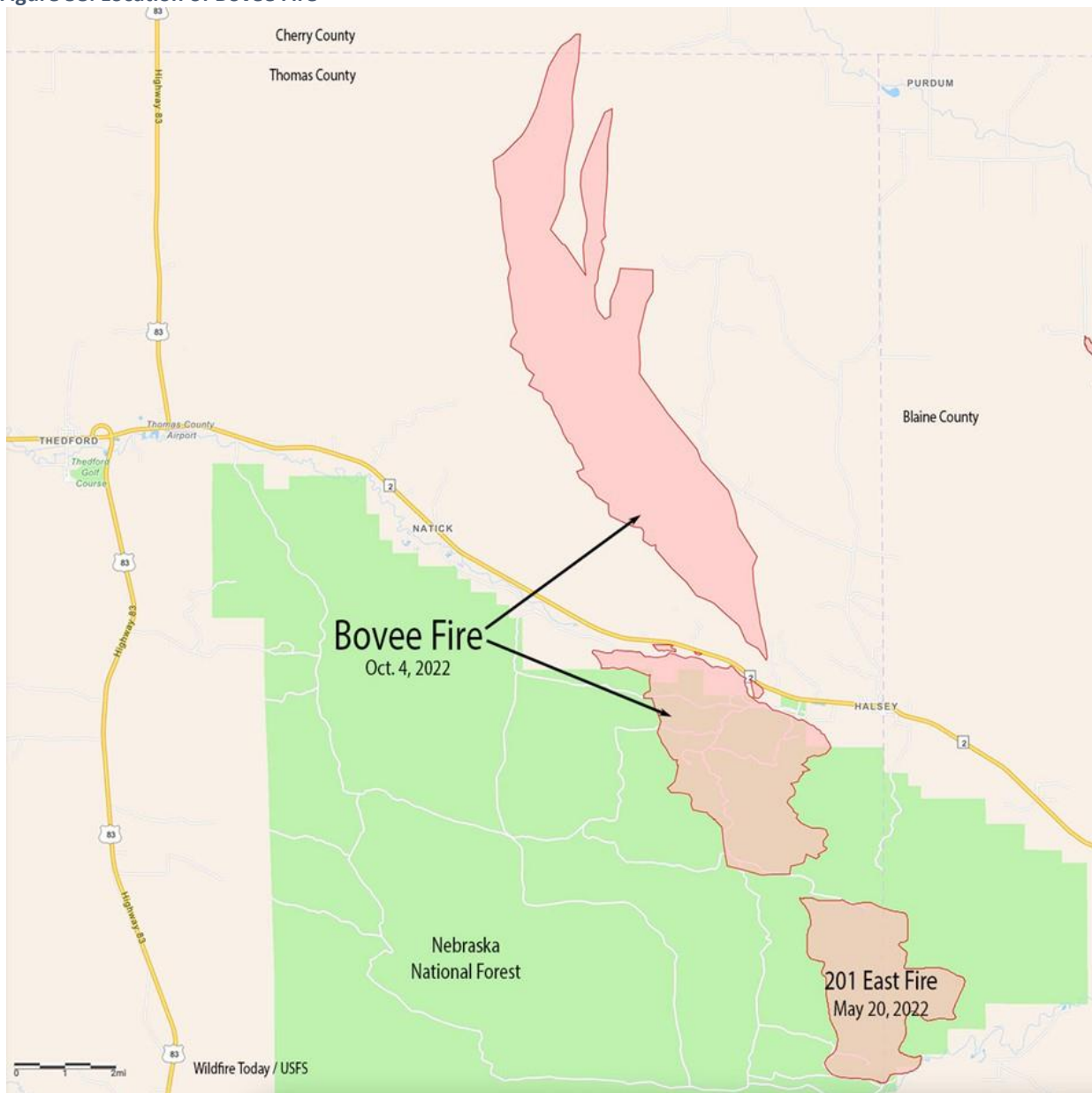
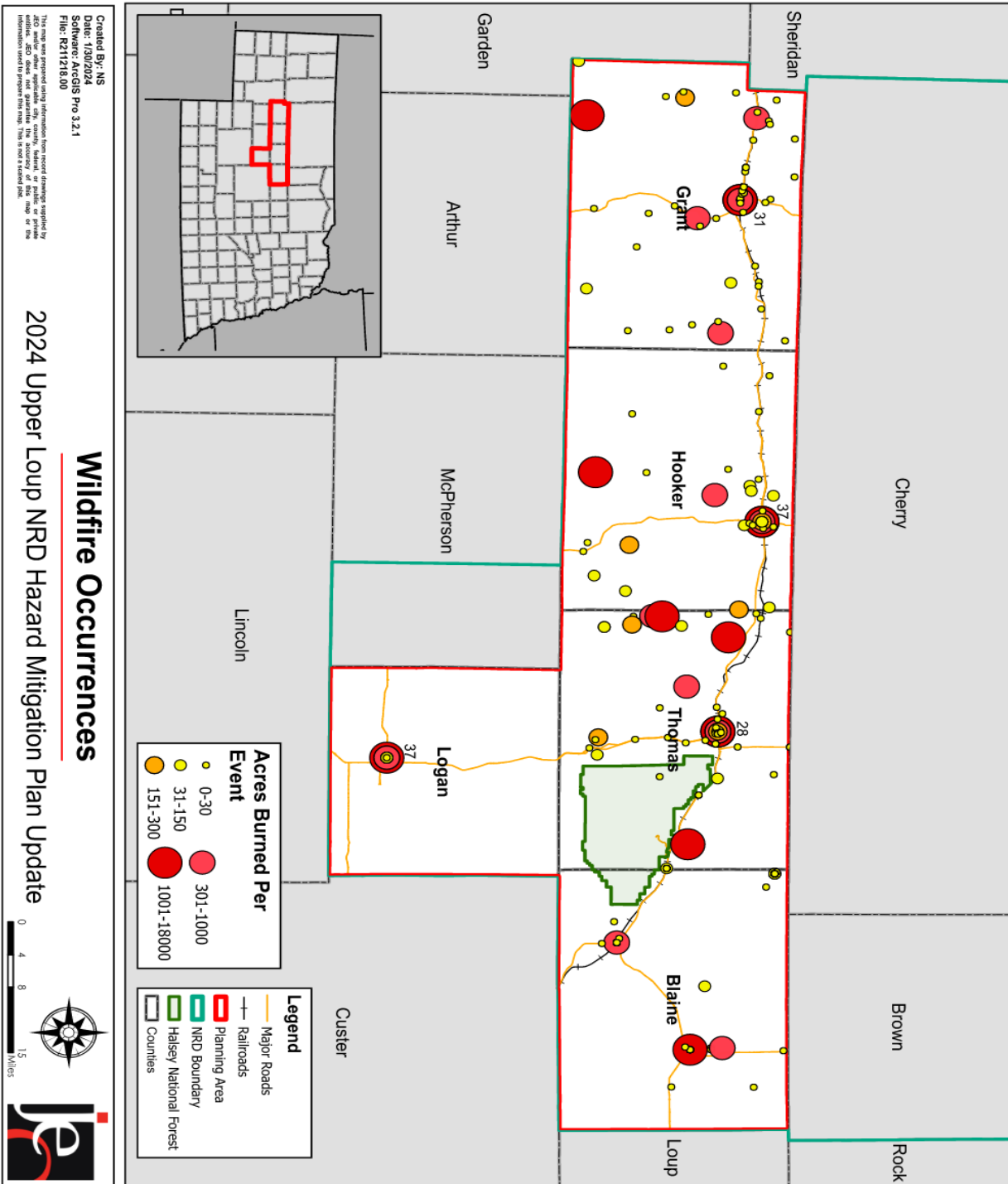
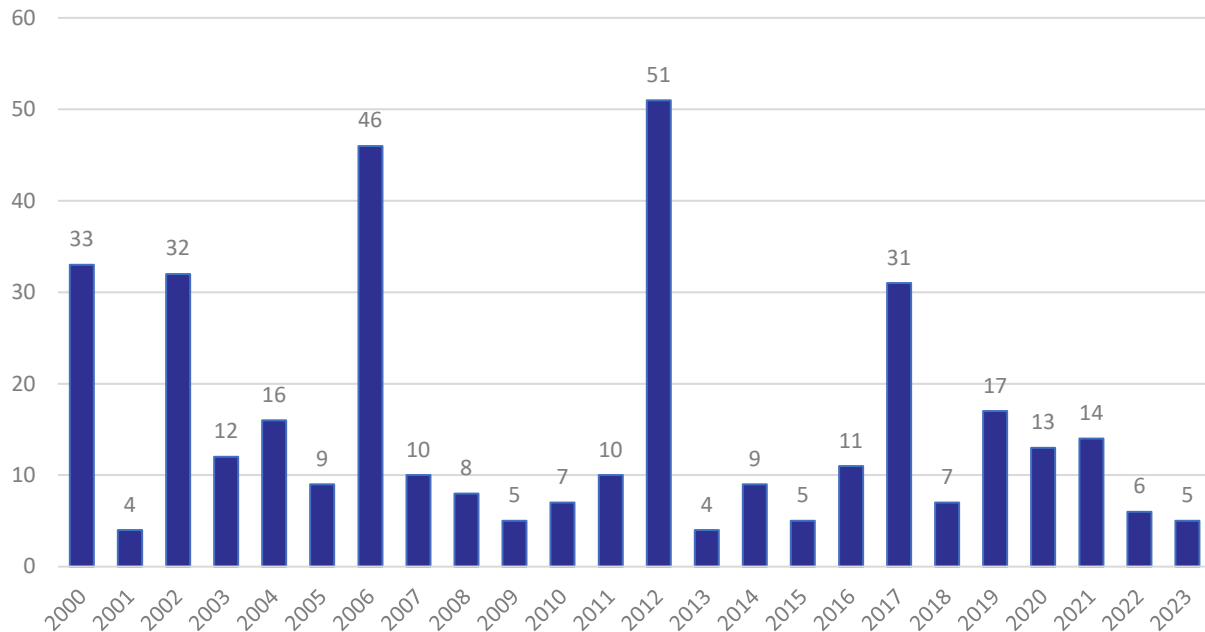


Figure 59: Wildfire Occurrence in the Planning Area



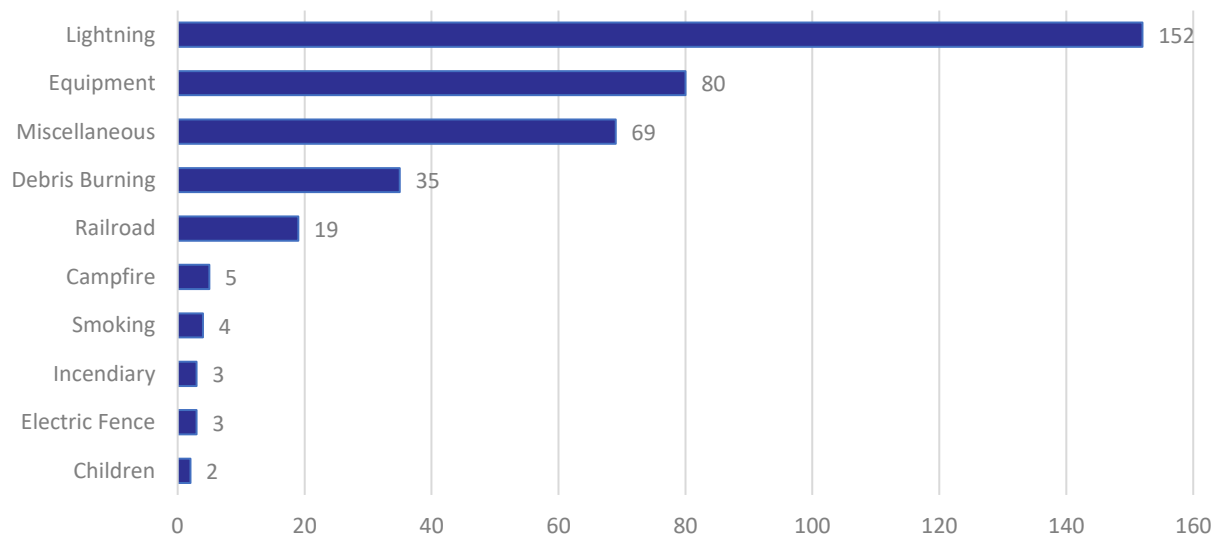
Note that numerous fires are reported as occurring in the same location (i.e. on top of communities), however, these locations are likely placeholders of the nearest location, rather than the actual location for the fire event. More specific fire location data was not available during this analysis.

Figure 60: Wildfire Events by Year



Source: Nebraska Forest Service, 2000-2023

Figure 61: Wildfires by Cause in Planning Area



Source: Nebraska Forest Service, 2000-2023

Average Annual Losses

The average damage per event estimate was determined based upon records provided to the Nebraska Forest Service from January 2000 to September 2023 and the number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. During this 24-year period, 372 wildfires burned 95,672 acres and caused \$139,583 in crop loss and \$315,506 in property damages. Damages caused by wildfires extend beyond the loss of building stock, recreation areas, timber, forage, wildlife habitat, and scenic views. Secondary effects of wildfires, including erosion, landslides, introduction of invasive species, and changes in water quality, all increase due to the exposure

of bare ground and loss of vegetative cover following a wildfire, and can often be more disastrous than the fire itself in long-term recovery efforts.

Table 97: Wildfire Loss Estimation

HAZARD TYPE	NUMBER OF EVENTS	EVENTS PER YEAR	AVERAGE ACRES PER FIRE	TOTAL PROPERTY LOSS	AVERAGE PROPERTY LOSS	TOTAL CROP LOSS	AVERAGE ANNUAL CROP LOSS
Wildfire	372	15	259	\$315,506	\$13,146	\$139,583	\$5,816

Source: Nebraska Forest Service, 2000-2023

Table 98: Wildfire Event Impacts and Threats

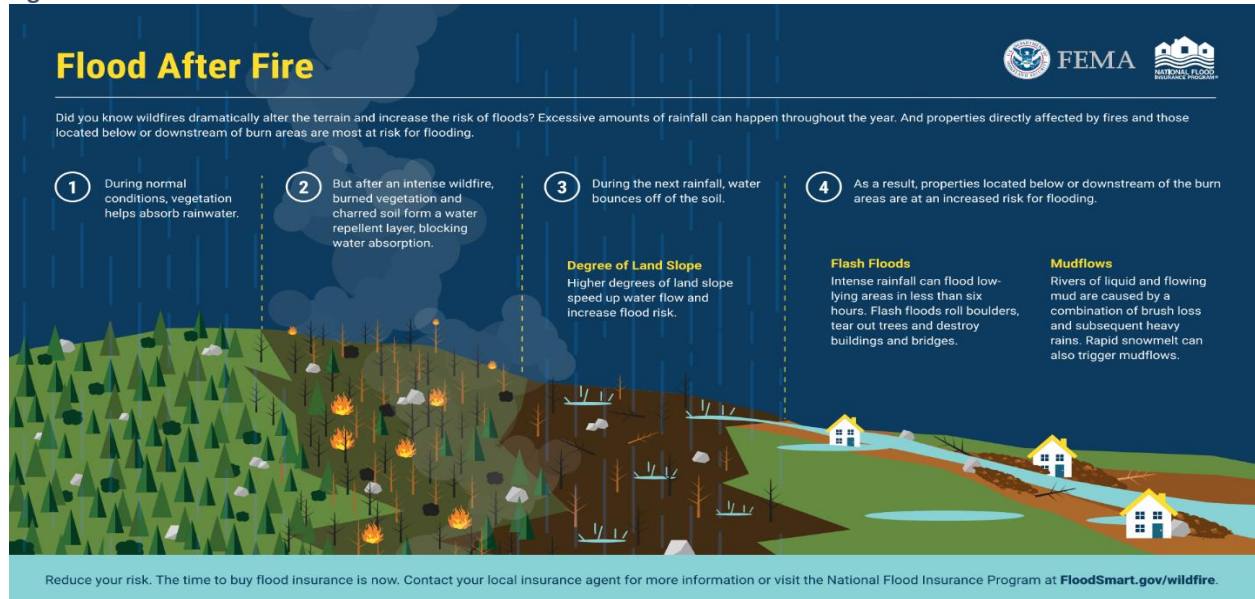
HAZARD TYPE	INJURIES	FATALITIES	HOMES THREATENED OR DESTROYED	OTHER STRUCTURES THREATENED OR DESTROYED
Wildfire	0	1	23	19

Extent

Overall, 372 wildfires were reported in the planning area and burned 95,672 acres in total. Of these, 70 fires burned more than 100 acres, with the largest wildfire (the Bovee Fire) burning approximately 19,000 acres in Thomas and Blaine Counties. The average area burned per wildfire was 259 acres indicating wildfire events pose a significant and concerning risk to the planning area which may require extensive resources for an area with reduced capacity.

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 (Figure 62). 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 62: FEMA Flood After Fire



Source: FEMA, 2020⁸⁴

⁸⁴ FEMA and NFIP. 2020. "Flood After Fire." Accessed September 2020. https://www.fema.gov/media-library-data/1573670012259-3908ab0344ff8bf5d537ee0c6fb531d/101844-019_FEMA_FAF_Infographic-ENG-web_v8_508.pdf.

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. Grant and Hooker County are within the Western Sandhills CWPP while Thomas, Blaine, and Logan County are within the Central Sandhills CWPP.⁸⁵

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 Western Sandhills CWPP noted the following areas of concern:

- Grant County - According to the FAP, the area immediately surrounding Hyannis is the most at-risk from wildfire. The Grant County fire chief identified reliable water supply as the primary concern for the district. All of Grant County's population centers and dispersed farms and ranches lie within the boundaries of the WUI. Hyannis has a municipal water system. Smaller population centers and ranches are on private wells. Part of the South Branch of the Middle Loup River follows the east part of the north county line. There are numerous shallow Sandhills lakes, as well as ponds and stock tanks located throughout the county. Windmills can provide water when they are operational. There are no irrigation canals in the county.
- Hooker County - The entire county lies in the Sandhills prairie vegetation zone. Eastern redcedar forest and savanna are found along the Middle Loup and Dismal Rivers, where there are also riparian deciduous woodlands. In some parts of the county eastern redcedar has encroached into grasslands and riparian woodlands to become a distinct and highly flammable vegetation type. A few irrigated agriculture crop fields are scattered across the county. The Mullen Fire Department identified the Dismal River and Middle Loup River valleys as being of particular concern. These valleys are rugged, steep, and in some areas heavily timbered, with very little or no access. The Sandhills Golf Club clubhouse and cabins sit on the north fork of the Dismal River with only golf cart paths for access. It is heavily timbered around the cabins and clubhouse. The Dismal River Golf Club is in a remote area with a large fuel load surrounding the premises and clubhouse. The major issues are multiple structures, difficult access, rough terrain, one way in and out, heavy fuels, and lack of water within an effective distance. The Village of Mullen has high home density and infrastructure at risk. These and other high-risk areas are mapped in Appendix A. All of Hooker County's population centers, dispersed ranches, and wooded areas along the rivers and streams lie within the boundaries of the WUI. The Mullen Fire Department noted that their greatest concerns are structure protection from wildland fires and loss of grass for grazing causing economic impacts.

The Central Sandhills CWPP noted the following areas of concern:

- Blaine County - The area most at-risk from wildfire is the Bessey Ranger District of the Nebraska National Forest, which straddles the Blaine/Thomas County line. This area contains about 25,000 acres of planted pines and eastern redcedars, constituting a high fire hazard. The Halsey fire chief considers the village itself as a concern, as the fire department is not equipped for fighting

⁸⁵ Nebraska Forest Service. 2022. "Community Wildfire Protection Plans." <https://nfs.unl.edu/publications/community-wildfire-protection-plans>.

structure fires. Some homes on the north side of town have heavy fuels close to them. He also has concerns that the river bridges in his district in both Blaine and Thomas Counties are not rated to handle tankers. Maps of these areas are included in Appendix A. Other locations of special concern include population centers adjacent to grasslands, and the west side and southeast corner of the county, where eastern redcedar has encroached into grasslands, creating high fire hazard. All of Blaine County's population centers, dispersed ranches, and wooded areas along the rivers and streams lie within the boundaries of the WUI.

- Logan County - Vegetation zones include Sandhills prairie in the northern three quarters of the county and mixed grass prairie with agricultural fields in the south part of the county. The area most at-risk from wildfire is located in the southeast corner of the county, in the Arnold Fire District, where there is rough terrain and few roads. In this area eastern redcedar has encroached into grasslands, creating high fire hazard. The area has a history of large wildfires. In 2011, a wildfire burned over 20,000 acres and was stopped just south of Stapleton. It caused over \$4 million in damage, including several homes destroyed. All of Logan County's population centers and dispersed farms and ranches lie within the boundaries of the WUI.
- Thomas County - The area most at-risk from wildfire is the Bessey Ranger District of the Nebraska National Forest, located near Halsey. This area contains about 25,000 acres of planted pines and eastern redcedars, constituting a high fire hazard. There are also scattered areas throughout Thomas County where eastern redcedar has encroached into grasslands, increasing fire risk. The Thedford Fire Department considers the Dismal River Valley to be a concern due to rough terrain and limited road access. The Halsey fire chief considers the village itself as a concern, as the fire department is not equipped for fighting structure fires. Some homes on the north side of town have heavy fuels close to them. He also has concerns that the river bridges in his district both in Thomas and Blaine Counties are not rated to handle tankers.

Figure 63: Western Sandhills CWPP Priority Landscapes

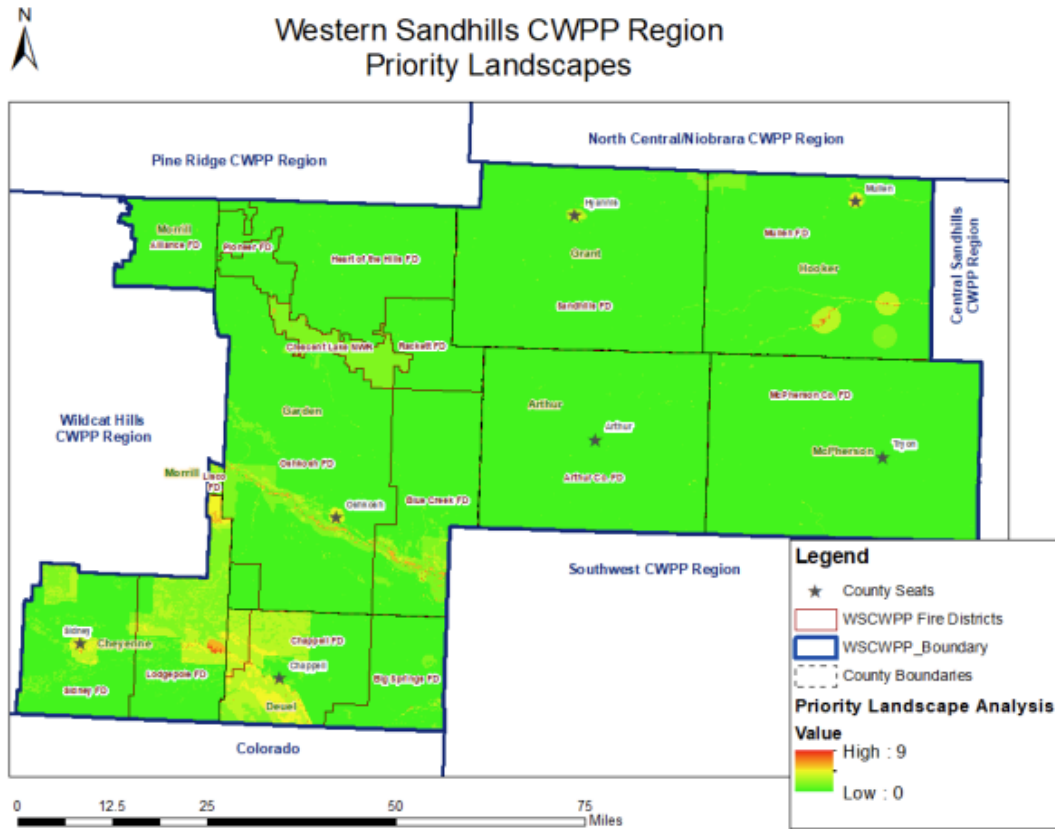


Figure 64: Western Sandhills CWPP Areas of Concern

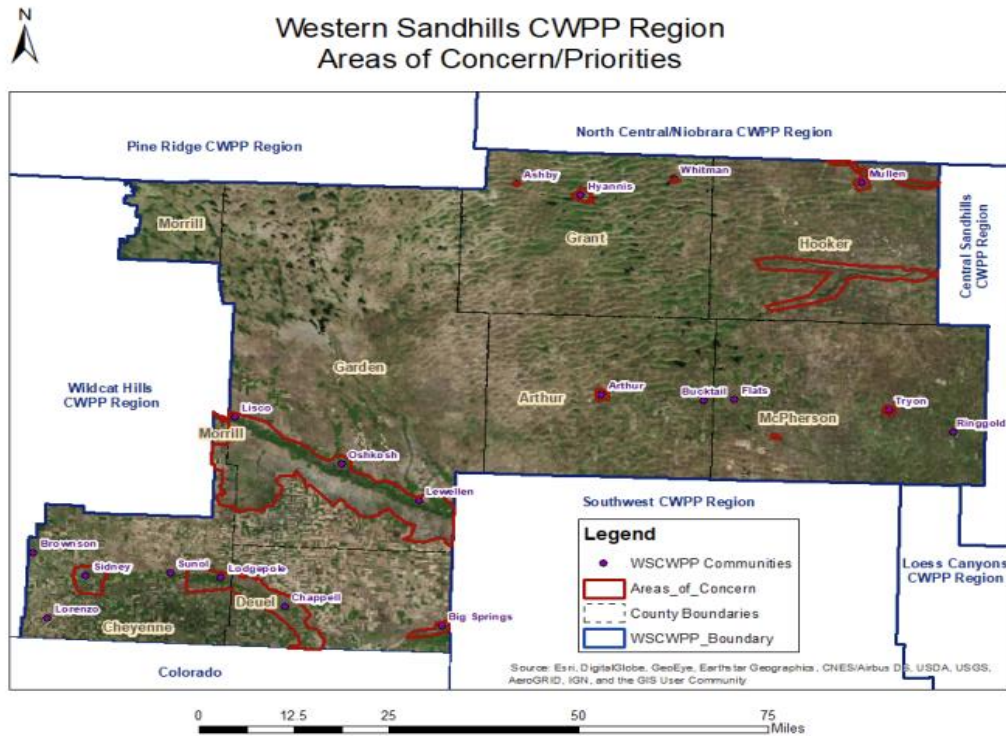


Figure 65: Central Sandhills CWPP Priority Landscapes

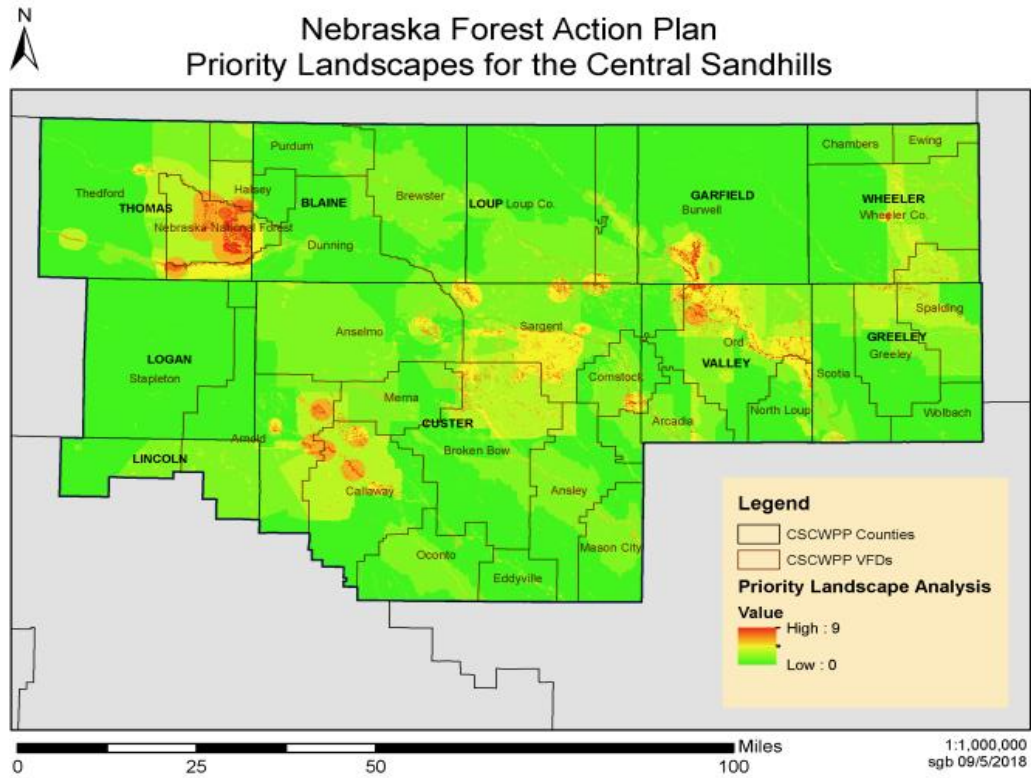
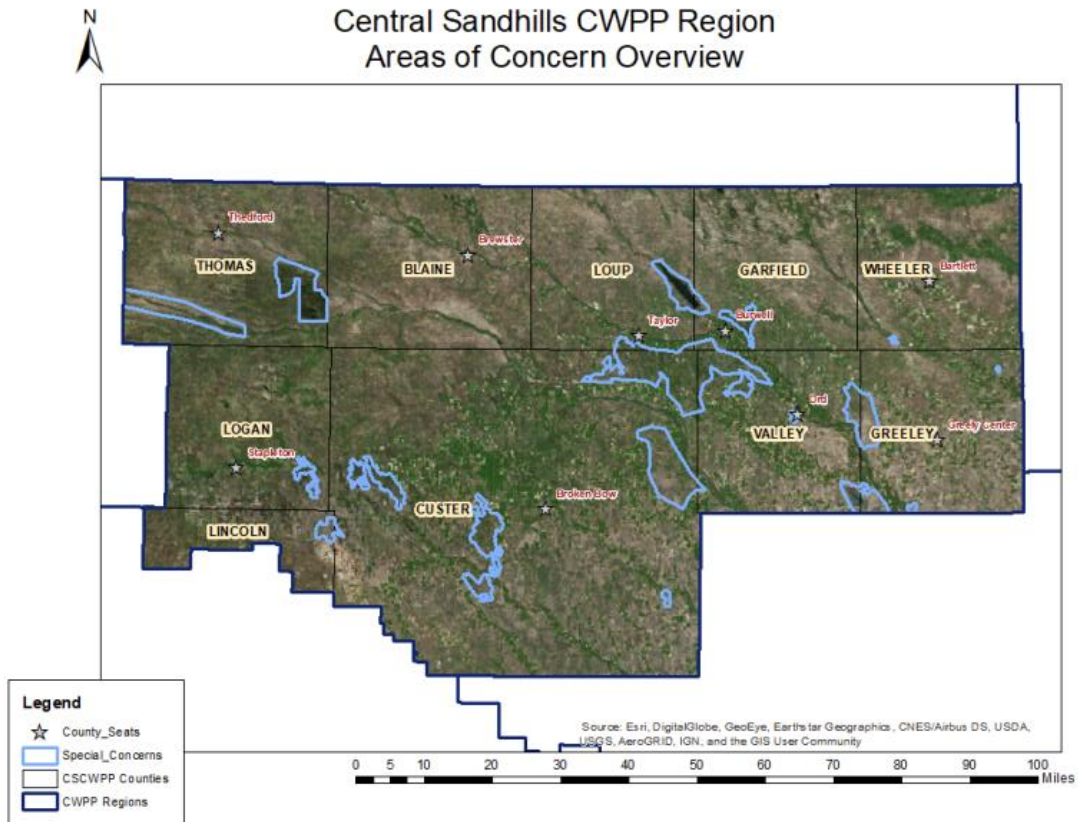


Figure 66: Central Sandhills CWPP Areas of Concern



The likely extent scale from this hazard is likely greatest for those communities located in or near areas of concern or priority landscapes, specifically around the Halsey Nebraska National Forest.

Historical Probability and Future Likelihood

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 99: Historical Probability & Future Likelihood – Wildfire Disease

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.⁸⁶

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.⁸⁷ 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, three 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 Severe Thunderstorms as a top hazard of concern:

- Blaine County
- Village of Hyannis

⁸⁶ 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/>.

⁸⁷ 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.)

- Hooker County
- Logan County
- Thomas County
- Village of Halsey
- Sandhills Public Schools
- Thedford 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 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 remote areas, aging or inadequate equipment, and extremely limited staff capacity as volunteer rosters continue to decline. For this reason, the overall risk for counties in the Upper Loup NRD area are likely somewhere between the risk indices as described by FEMA’s NRI and USDA’s Wildfire Risk to Communities.

Table 100: Risk Index Wildfire Vulnerabilities

SOURCE	RISK FACTOR	BLAINE	GRANT	HOOKER	LOGAN	THOMAS
FEMA National Risk Index	Risk Index	Very Low	Relatively Low	Very Low	Very Low	Very Low
	Expected Annual Loss	Very Low	Relatively Low	Very Low	Very Low	Very Low
USDA Forest Service Wildfire Risk to Communities	Overall Risk	High	Very High	High	Medium	High

Source: FEMA National Risk Index, 2023

Table 101: Regional Wildfire Vulnerabilities

SECTOR	VULNERABILITY
People	<ul style="list-style-type: none"> -Risk of injury or death for residents and firefighting personnel -Displacement of people and loss of homes -Lack of transportation poses risk to low-income individuals, families, and elderly -Transportation routes may be blocked by fire, preventing evacuation efforts

SECTOR	VULNERABILITY
Economic	<ul style="list-style-type: none"> -Damages to buildings and property can cause significant losses to business owners -Loss of businesses
Built Environment	<ul style="list-style-type: none"> -Property damages
Infrastructure	<ul style="list-style-type: none"> -Damage to power lines and utility structures
Critical Facilities	<ul style="list-style-type: none"> -Risk of damages
Climate	<ul style="list-style-type: none"> -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	<ul style="list-style-type: none"> -Increase chance of landslides, erosion, and land subsidence -May lead to poor water quality -Post fire, flash flooding events may be exacerbated

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 2019 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. For the purposes of this plan, all jurisdictions used the same Goals and Objectives.

Goals and Objectives

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 RESIDENTS

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

GOAL 2: REDUCE FUTURE LOSSES FROM HAZARD EVENTS

- Objective 2.1: Provide protection for existing structures, future development, critical facilities, services, utilities, and trees to the greatest extent possible.
- Objective 2.2: Develop hazard specific plans, conduct studies or assessments, and retrofit jurisdiction to mitigate for hazards and minimize their impact.
- Objective 2.3: Minimize and control the impact of hazard events through enacting or updating ordinances, permits, laws, or regulations.

GOAL 3: INCREASE PUBLIC AWARENESS AND EDUCATION ON THE VULNERABILITY TO HAZARDS

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 3.1: Develop and provide information to residents and businesses about the types of hazards they are exposed to, what the effects may be, where they occur, and what they can do to be better prepared.
- Objective 3.2: Enhance education and communication to increase resident preparedness before, during, and after hazard events.

GOAL 4: IMPROVE EMERGENCY MANAGEMENT CAPABILITIES

- Objective 4.1: Develop or improve Emergency Response Plans, Evacuation Plans, and other procedures and abilities; increase the capability to respond.
- Objective 4.2: Improve warning systems and ability to communicate to residents and businesses during and following a disaster or emergency.
- Objective 4.3: Evaluate and improve interlocal emergency response communication among communities and agencies.
- Objective 4.4: Evaluate and improve interoperability communication among emergency response personnel.

GOAL 5: ENHANCE OVERALL RESILIENCE AND PROMOTE SUSTAINABILITY

- Objective 5.1: Incorporate hazard mitigation and adaptation into updating other local planning endeavors (e.g., comprehensive plans, zoning ordinance, subdivision regulation, etc.)

GOAL 6: PURSUE MULTI-OBJECTIVE OPPORTUNITIES (WHENEVER POSSIBLE)

- Objective 6.1: When possible, use existing resources, agencies, and programs to implement the projects.
- Objective 6.2: When possible implement projects that achieve several goals

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. Participants were informed of the STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, Environmental) feasibility review process during their one-on-one meetings and actions were evaluated one by one by this method. 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.

Mitigation Action Descriptions

Mitigation actions identified by participants of the Upper Loup HMP are found in the Mitigation Alternative Project Matrix below. Additional information about selected actions can be found in *Section Seven*. Each action includes the following information:

- Mitigation Action – general title of the action item
- Description – brief summary of what the action item(s) will accomplish
- Hazard(s) Addressed – which hazard(s) 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 local funding mechanisms or sources to fund the action
- Timeline – a general timeline as established by planning participants for project implementation
- 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 or limiting factors
- 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 continuing or new mitigation alternatives for each participating jurisdiction can be found in *Section Seven: Community Profiles*.

Mitigation Action Matrix

Throughout this planning process, each jurisdiction was asked to review mitigation projects from the previous FEMA-approved Upper Loup NRD HMP and identify new potential mitigation alternatives to further reduce the effects of hazards. Selected projects varied amongst jurisdictions depending upon the significance of each hazard present and local priorities. The following tables are a compilation of new and continuing mitigation alternatives identified by participating jurisdictions. Completed and removed mitigation alternatives can be found in the respective community profile.

Table 102: Mitigation Actions Selected per Jurisdiction

MITIGATION ACTION	GOAL	UPPER LOUP NRD	BLAINE COUNTY	BREWSTER	DUNNING	HYANNIS	HOOKER COUNTY	MULLEN	LOGAN COUNTY	GANDY	STAPLETON	THOMAS COUNTY	HALSEY	THEDFORD	MULLEN SCHOOLS	SANDHILLS SCHOOL	THEDFORD SCHOOLS
			BLAINE	GRANT	HOOKER	LOGAN	THOMAS										
Alert/Warning Siren	1,4,6		X		X		X		X	X	X	X	X				
Backup Generators	1,5,6		X		X	X	X	X	X		X	X	X	X	X	X	X
Bus Barn	2																X
Civil Service Improvements	4		X						X								
Collaborate with Fire Department	3, 4, 6																X
Communications Plan	3, 4, 5															X	
Community Center Improvements	1, 2			X													
Complete/Update Wildfire Protection Plan	3, 5															X	
Construct Breezeway	1														X		
Defensible Space and Fuel Loads	1, 2, 4		X				X					X	X				
Drainage Improvements	2, 5, 6				X			X			X			X			
Drought Dashboard	3, 5	X															

MITIGATION ACTION	GOAL	UPPER LOUP NRD	BLAINE COUNTY	BREWSTER	DUNNING	HYANNIS	HOOKER COUNTY	MULLEN	LOGAN COUNTY	GANDY	STAPLETON	THOMAS COUNTY	HALSEY	THEDFORD	MULLEN SCHOOLS	SANDHILLS SCHOOL	THEDFORD SCHOOLS
			BLAINE			GRANT	HOOKER		LOGAN			THOMAS					
Electrical System Looped Distribution/Redundancies	2, 5, 6							X									
Emergency Communication	4		X														
Emergency Exercise: Hazardous Spill	4															X	
Emergency Fuel Supply Plan	2, 4, 5, 6		X														
Fan & Air Conditioning Program	1	X															
Hazardous Tree Removal Program	2				X								X				
Hydrant Improvements	1, 2, 4													X			
Improve and Revise Snow/Ice Removal Program	1, 4, 6							X				X					X
Infrastructure Hardening	1, 4													X			
Lightning Rods	1	X														X	
Public Awareness and Education	1, 3, 4, 6	X		X	X			X	X	X	X	X	X		X	X	X
Promote First Aid	1														X		
Railroad Crossing Guard	1							X									
Review Fire Code Ordinances	5, 6											X					
Storm Shelters/Safe Rooms	1, 2, 6	X					X	X			X	X					X

SECTION FIVE: MITIGATION STRATEGY

MITIGATION ACTION	GOAL	UPPER LOUP NRD	BLAINE COUNTY	BREWSTER	DUNNING	HYANNIS	HOOKER COUNTY	MULLEN	LOGAN COUNTY	GANDY	STAPLETON	THOMAS COUNTY	HALSEY	THEDFORD	MULLEN SCHOOLS	SANDHILLS SCHOOL	THEDFORD SCHOOLS
			BLAINE			GRANT	HOOKER		LOGAN			THOMAS					
Trails Mowing	2												X				
Update Comprehensive Plan	1, 3, 4, 6						X										
Warning Systems - Radio Signals	1, 3, 4, 6					X											
Water Storage and Contingency Plan	2, 4	X					X					X					
Water System Improvements	2		X			X		X									
Well Improvements	2							X									
Windbreaks and Snow Fences	2, 5, 6	X					X										

SECTION SIX IMPLEMENTATION AND MAINTENANCE

Participants of the Upper Loup NRD HMP will be responsible for monitoring, evaluating, implementing, 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, local planning teams, and/or lead agencies identified in the mitigation action, the participant's governing body will be responsible for implementation of the recommended projects. The lead agency (or appropriate department/staff) identified on each mitigation action will report on the status of projects and include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies could be revised.

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.

Integrating Other Capabilities

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

Nebraska Emergency Management Agency

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

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

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

NEMA's role during a response is to assist communities in responding to hazard events *when the need for assistance exceeds the local capabilities and resources*. This includes facilitating and tracking grants,

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

Nebraska Department of Natural Resources

The NeDNR is committed to providing Nebraska's citizens and leaders with the data and analyses they need to make appropriate natural resource decisions for the benefit of all Nebraskans both now and in the future. This state agency is responsible in the area of surface water, groundwater, floodplain management, dam safety, natural resource planning, integrated water management, storage of natural resources and related data, and administration of state funds. In 2022 NeDNR completed the State of Nebraska Flood Hazard Mitigation Plan (https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/floodplain/resources/2022_SFHMP_Draft_Published04112022.pdf). Information in the plan can help communities and counties with mitigation ideas and resources, flood history and risk levels, NFIP information, and funding and service providers.

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

Nebraska Forest Service

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

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

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*⁸⁸ guidance, FEMA’s *2015 Plan Integration*⁸⁹ guide, as well as the *Comprehensive Economic Development Strategy and Hazard Mitigation Plan Alignment Guide*⁹⁰ 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.

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 Upper Loup 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?

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

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

⁸⁸ 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.

⁸⁹ 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.

⁹⁰ 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.

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.

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. Strategies identified by local participants to continue engaging the public in the plan update process included:

- Public spaces around the jurisdiction
- Village Halls
- Websites or social media sites
- Board meetings
- Local radio stations
- Local newspapers
- Letters/mailings from project sponsors

SECTION SEVEN COMMUNITY PROFILES

Purpose of Community Profiles

Community Profiles contain information specific to jurisdictions which have participated in the Upper Loup NRD 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 one-on-one meetings and used to establish the plan. Community Profiles may include the following elements:

- Local Planning Team
 - Governance
 - Plan Maintenance
- Location and Geography
- Demographic Vulnerabilities
- Future Development Trends
- Community Lifelines
- Local Capabilities and Social Vulnerabilities
- Plans and Studies Integration
- Hazard Prioritization and Mitigation Strategy

In addition, maps specific only to each jurisdiction are included such as critical facilities and future land use or zoning maps (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, 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. The discussion of certain hazards selected for each Community Profile was prioritized by the local planning team based on the identification of hazards of greatest concern, hazard history, and the jurisdiction's capabilities. The hazards not examined in depth can be referred to in *Section Four: Risk Assessment*.

Community and county profiles are located in their respective county profile appendix. Special districts such as fire departments, school districts, and health departments are located in the *Special District Appendix*.

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SECTION EIGHT FUNDING GUIDEBOOK

Overview

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
- 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 adaptation, 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
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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.
Additional Information	This year, each state and territory will receive a funding allocation as determined by the statutory formula: <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>

Watershed Rehabilitation Program	
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 EJPCS 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 \$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/Publica.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/Publica.nsf/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.