HAZARD MITIGATION REGIONAL PLANNING TEAM

Table 1: LPSNRD HMP Regional Planning Team

Name	Title	Agency
Paul Zillig	General Manager	Lower Platte South Natural Resources District
David Potter	Assistant General Manager	Lower Platte South Natural Resources District
Tracy Zayac	Stormwater/Watershed Specialist	Lower Platte South Natural Resources District
Sandy Weyers	Emergency Management Director	Cass County
James Davidsaver	Emergency Management Director	Lincoln/Lancaster County
Mark Hosking	Emergency Management Deputy Director	Lincoln/Lancaster County
Ben Higgins	Superintendent of Stormwater, Watershed Management	City of Lincoln
Mark Robertson	Emergency Management Coordinator	University of Nebraska-Lincoln
Lexy Hindt*	Deputy State Hazard Mitigation Officer	Nebraska Emergency Management Agency
Katie Ringland*	Chief Floodplain Management Section	Nebraska Department of Natural Resources
Lalit Jha*	Project Principal	JEO Consulting Group
Becky Appleford*	Project Manager	JEO Consulting Group
Brooke Welsh*	Project Coordinator	JEO Consulting Group
Ellana Haakenstad*	Junior Planner	JEO Consulting Group
Mary Baker*	Resiliency Strategist	JEO Consulting Group

**served in an advisory/consultant role*

Table 2: LPSNRD Directors and Districts

Sub-District	Sub-district Directors		Town(s)
#1	Don Jacobson	Gary Hellerich	Lincoln, Denton, Pleasant Dale, Malcolm, Garland, Raymond, Brainard, Valparaiso
#2	Sarah Wilson	Mark Spangler	Waverly, Eagle, Alvo, Greenwood, Ashland, South Bend, Louisville, Cedar Creek, Plattsmouth, Murray, Manley, Murdock, Weeping Water, Elmwood, Nehawka, Avoca, Union
#3	Mike DeKalb	Vern Barrett	Lincoln, Ceresco, Davey
#4	Gary Aldridge	Larry Ruth	Lincoln, Roca, Hickman, Sprague, Hallam
#5	Greg Osborn	Bruce Johnson	Lincoln
#6	Anthony Schutz	Deborah Eagan	Lincoln
#7	Chelsea Johnson	Luke Peterson	Lincoln
#8	Dan Steinkruger	Tom Green	Lincoln
#9	Milt Schmidt	Bob Andersen	Lincoln
#10	Ray Stevens	Karen Amen	Lincoln
At-large	David Landis		All communities in District

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LIST OF ACRONYMS

ACS – American Community Survey
BCA – Benefit Cost Analysis
CFR – Code of Federal Regulations
CIKR – Critical Infrastructure and Key Resources
CRS – Community Rating System
DHS – Department of Homeland Security
DMA 2000 – Disaster Mitigation Act of 2000
EAB – Emerald Ash Borer
EAP – Emergency Action Plan
ELAP – Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish Program
EPA – Environmental Protection Agency
EPZ – Emergency Planning Zone
ESL – English as Second Language
F&W – Fish and Wildlife
FBI – Federal Bureau of Investigations
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
HSAS – Homeland Security Advisory System
IP – Office of Infrastructure Protection
JEO – JEO Consulting Group, Inc.
LEOP – Local Emergency Operations Plan
LFD – Livestock Forage Disaster Assistance Program
LGA – Liquid Gallon
LIP – Livestock Indemnity Program
LPSNRD – Lower Platte South Natural Resources District
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
NPDP – National Performance of Dam Program
NPS – National Park Service
NRC – National Response Center
NRD – Natural Resources District
NTAS – National Terrorism Advisory System
NWS – National Weather Service
PDM – Pre-Disaster Mitigation Program
PDSI – Palmer Drought Severity Index
PHMSA – U.S. Pipeline and Hazardous Material Safety Administration
P.L. – Public Law
PSHA – Probabilistic Seismic Hazard Analysis
RMA – Risk Management Agency
SBA – Small Business Administration
SFHA – Special Flood Hazard Area
SPIA – Sperry-Piltz Ice Accumulation Index
SSA – Sector-Specific Agency
START – National Consortium for the Study of Terrorism and Responses to Terrorism
SURE – Supplemental Revenue Assistance Payments
TAP – Tree Assistance Program
TORRO – Tornado and Storm Research Organization
USACE – 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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EXECUTIVE SUMMARY

INTRODUCTION

This plan is an update to the Lower Platte South Natural Resources District (LPSNRD) Multi-Hazard Mitigation Plan (HMP) approved in 2015. The plan update was developed in compliance with the requirements of the Disaster Mitigation Act of 2000 (DMA 2000).

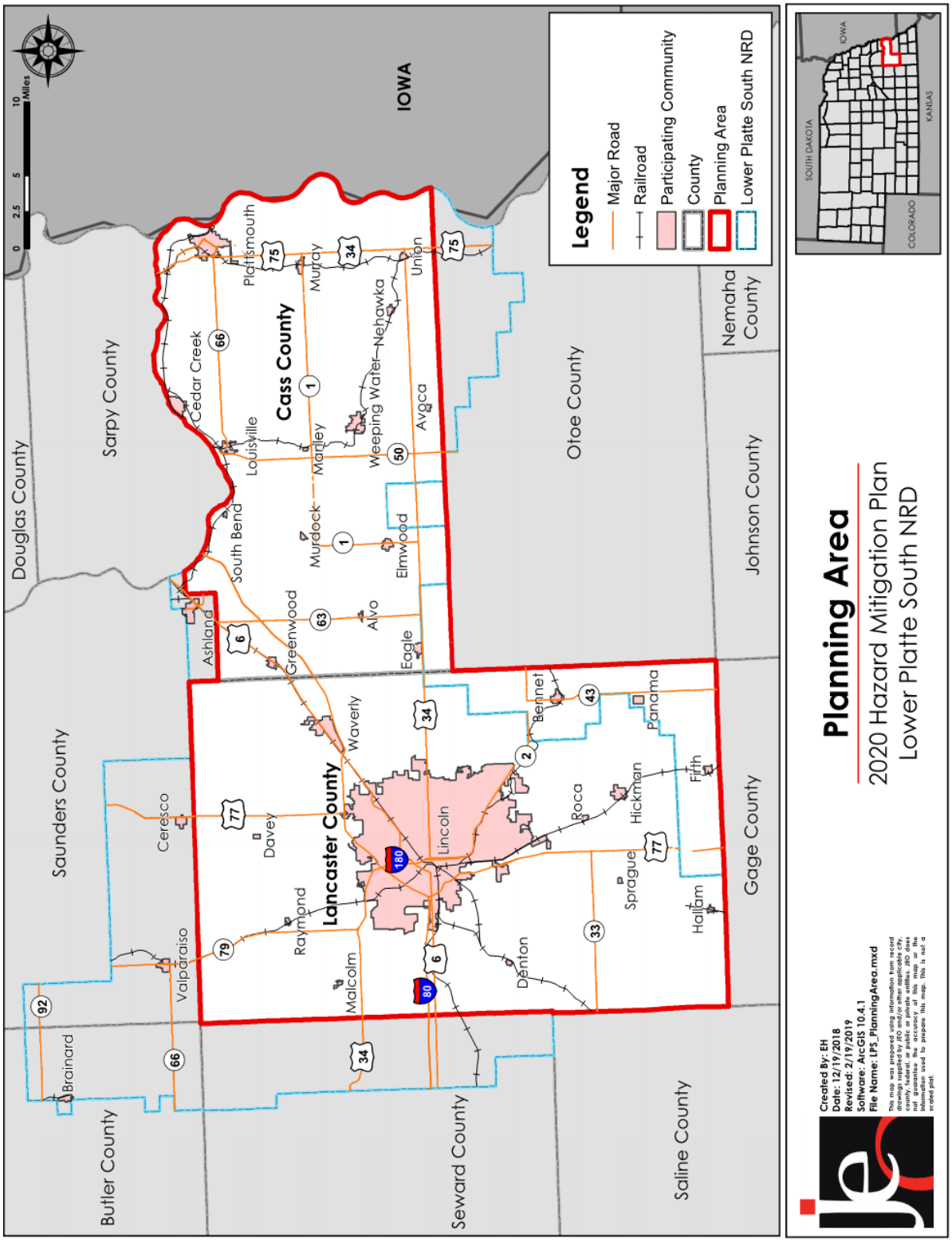
Hazard mitigation planning is a process in which hazards are identified and profiled; people and facilities at-risk are identified and assessed for threats and potential vulnerabilities; and strategies and mitigation measures are identified. Hazard mitigation planning increases the ability of communities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

Table 3: Participating Jurisdictions

Participating Jurisdictions	
Lower Platte South Natural Resources District	
Lancaster County	**Cass County**
Village of Bennet	Village of Alvo
Village of Davey	Village of Avoca
Village of Denton	Village of Cedar Creek
Village of Firth	Village of Eagle
Village of Hallam	Village of Elmwood
City of Hickman	Village of Greenwood
City of Lincoln	City of Louisville
Village of Malcolm	Village of Manley
Village of Panama	Village of Murdock
Village of Raymond	Village of Murray
Village of Roca	Village of Nehawka
Village of Sprague	City of Plattsmouth
City of Waverly	Village of South Bend
Saunders County*	Village of Union
City of Ashland	City of Weeping Water
Village of Ceresco	**Butler County***
Village of Valparaiso	Village of Brainard
Special Districts	
Cass County SID #1 (Lake WanConDa)	Cass County Rural Water District #1
Cass County SID #5	Waverly Public School District
Raymond Central Public School District	Norris Public School District
Conestoga Public School District	Weeping Water Public School District

**indicates jurisdictions not participating in this planning process*

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 2015 HMP were reviewed, and the Planning Team agreed that they are still relevant and applicable for this plan update. Jurisdictions that participated in this plan update agreed that the goals identified in 2015 would be carried forward and utilized for the 2020 plan. The goals for this plan update are as follows:

GOAL 1: PROTECT HEALTH AND SAFETY OF RESIDENTS

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

GOAL 2: REDUCE FUTURE LOSSES FROM HAZARD EVENTS

Objective 2.1: Provide protection for existing structures, future development, 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 REGARDING 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.

GOAL 4: IMPROVE EMERGENCY MANAGEMENT CAPABILITIES

Objective 4.1: Develop or improve Emergency Response Plan and procedures and abilities.

Objective 4.2: Develop or improve Evacuation Plan and procedures.

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

GOAL 5: PURSUE MULTI-OBJECTIVE OPPORTUNITIES (WHENEVER POSSIBLE)

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

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

GOAL 6: ENHANCE OVERALL RESILIENCE AND PROMOTE SUSTAINABILITY

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

SUMMARY OF CHANGES

Several changes were made to the 2015 Hazard Mitigation Plan and planning process, including: the inclusion of human-caused hazards based on the hazards addressed in the 2014 State of Nebraska Hazard Mitigation Plan; greater efforts to reach out to and include stakeholder groups; an expanded risk assessment for the entire area; and the inclusion of additional mitigation strategies. This update also works to unify the various planning mechanisms in place throughout the participating communities (i.e. comprehensive plans, local emergency operation plans (LEOP), zoning ordinances, building codes, etc.) to ensure that the goals and objectives identified in those planning mechanisms are consistent with the strategies and projects included in this plan.

PLAN IMPLEMENTATION

Various communities across the planning area have implemented hazard mitigation projects following the 2015 Hazard Mitigation Plan. A few examples of completed projects including improving drainage and stormwater patterns, buying or replacing emergency service equipment, and expanding current hazard education programs.

In order to build upon these prior successes and to continue implementing mitigation projects, despite limited resources, communities will need to continue relying upon multi-agency coordination as a means of leveraging resources. Communities across the LPSNRD have been able to work with a range of entities to complete projects; potential partners for future project implementation include, but are not limited to: Nebraska Forest Service (NFS), Nebraska Department of Transportation (NDOT), Nebraska Department of Natural Resources (NeDNR); Nebraska Emergency Management Agency (NEMA); and United States Department of Agriculture (USDA).

HAZARD PROFILES

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

Table 4: Hazard Occurrences

HAZARD	PREVIOUS OCCURRENCE EVENTS/YEARS	APPROXIMATE ANNUAL PROBABILITY	LIKELY EXTENT
AGRICULTURAL ANIMAL DISEASE	32/5	100%	~8 animals
AGRICULTURAL PLANT DISEASE	38/19	100%	Unavailable
CHEMICAL FIXED SITES	163/30	100%	~887 Gallons
CHEMICAL TRANSPORTATION	428/48	100%	~0 to 23,000 Gallons
DAM FAILURE	3/106	~3%	Varies by Structure
DROUGHT	412/1,488 months	28%	D1-D2
EARTHQUAKES	0/120	0%	>2.5 Magnitude
EXTREME HEAT	Avg 4 days per year	100%	>100°F
FLOODING	106/23	100%	Some inundation of structures and roads near streams. Some evacuations of people may be necessary (<1% of population)
GRASS/WILDFIRES	1,178/19	100%	<12 acres Some homes and structures threatened or at risk
HAIL	497/23	100%	H2-H5 Avg 1.14"; Range 0.52-5.0"
HIGH WINDS	42/23	100%	≤50 mph Avg 55mph; Range 35-57 EG
LEVEE FAILURE	3	~1%	Varies by Extent
SEVERE THUNDERSTORMS	238/23	100%	≥1" rainfall Avg 55 mph winds; Range 45-85 EG
SEVERE WINTER STORMS	150/23	100%	0.25" – 0.5" Ice 20°-40° below zero (wind chill) 4-8" snow 25-35 mph winds
TERRORISM	2/48	<1%	Unknown
TORNADOES	47/23	100%	Avg: EF0 Range EF0-EF4

EG – estimated gusts

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

Table 5: Hazard Loss History

HAZARD TYPE		Count	Property	Crop[2]
Agricultural Disease	Animal Disease[1]	32	258	N/A
	Plant Disease[2]	38	N/A	$287,111
Chemical Fixed Sites[3] *4 injuries*		163	$750,000	N/A
Chemical Transportation[4] *1 injury*		428	$2,028,294	N/A
Dam Failure[6]		3	N/A	N/A
Drought[7]		412/1,488 months	$0	$92,224,043
Earthquake[8]		0	$0	$0
Extreme Heat[7,9]		Avg 4 days per year	$0	$3,997,922
Flooding[7]	Flash Flood	53	$5,067,000	$2,362,042
	Flood	53	$102,024,000	
Grass/Wildfires[10] *2 deaths, 1 injury*		1,178	13,091 acres	$64,275
Hail[7]		497	$3,000,000	$3,658,898
High Winds[7] *1 death, 1 injury*		42	$28,000	$240,237
Levee Failure[11]		3	N/A	N/A
Severe Thunderstorms[7] *3 injuries*	Thunderstorm Wind	217	$2,049,000	$7,975,276
	Heavy Rain	8	$0	
	Lightning	13	$1,236,400	
Severe Winter Storms[7]	Blizzard	14	$0	$647,180
	Extreme Cold/Wind Chill	9	$0	
	Heavy Snow	8	$19,000,000	
	Ice Storm	6	$0	
	Winter Storm	82	$0	
	Winter Weather	31	$75,000	
Terrorism[5]		2	<$1,000,000	N/A
Tornadoes[7] *1 death, 38 injuries*		47	$101,309,000	$79,324
Total		**2,927**	**$236,566,952**	**$111,536,308**

N/A: Data not available
1 NDA (2014-2018)
2 USDA RMA (2000-2018)
3 U.S. Coast Guard NRC (1990-2019)
4 PHMSA (1971-2018)
5 START (1970-2018)
6 Stanford NPDP (1911-2019)
7 NCEI (January 1996 to December 2018)
8 USGS (1900-2019)
9 HPRCC (1902-2018)
10 NFS (2000-2018)
11 USACE (2019)

Events like agricultural disease, extreme heat, grass and wildfires, hail, severe thunderstorms, and severe winter storms will occur annually. Other hazards like drought, dam failure, earthquakes, and civil disorder will occur less often. The scope of events and how they will manifest themselves locally is not known regarding hazard occurrences. Historically, drought, grass/wildfire, flooding, severe thunderstorms, severe

winter storms, and tornadoes have resulted in the most significant damages within the planning area or are of top concern for the planning teams across the planning area. These hazards are summarized below.

DROUGHT

Drought is a regular and reoccurring phenomenon in the planning area and the state of Nebraska. Historical data shows that droughts have occurred with regularity across the planning area and recent research indicates that trend will continue and potentially intensify. The most common impacts of drought affect the agricultural sector. Over $92 million in total crop loss was reported for the planning area since 2000.

Prolonged drought events can have a profound effect on the planning area and the individual communities. Expected impacts from prolonged drought events include, but are not limited to: economic loss in the agricultural sector; loss of employment in the agricultural sector; limited water supplies (drinking and fire suppression); and decrease in recreational opportunities.

FLOODING

Flooding is one of the most significant hazards seen across the planning area, the state, and the entire country. Significant flood events have occurred in 2010, 2013, 2015, and 2019, causing millions of dollars in property damages. Both flash flooding and riverine flooding are expected to be continual hazards for the planning area due to the proximity of the Missouri River, Platte River, and Salt Creek through the City of Lincoln. Flooding events can damage municipal infrastructure, businesses, and residential homes; force residents to evacuate; damage agricultural fields; and close and/or damage roadways and major transportation corridors.

GRASS/WILDFIRE

Grass/wildfire events can occur annually and have the ability to span between only a few to millions of acres per event. Grass/wildfire events are closely tied to other hazards, including drought, flooding, or lighting in severe thunderstorms. Over 13,000 acres have burned due to grass/wildfire in the planning area since 2000. These events have threatened or destroyed homes or infrastructure. Impacts from widespread grass/wildfire events can include, but are not limited to: economic loss in agricultural sector; damage to homes, buildings, and infrastructure; destruction of crops; injuries or death to residents and first responders; obstruction of transportation routes; loss of power; and loss of recreational opportunities.

SEVERE THUNDERSTORMS

Thunderstorms differ from many other hazards in that they are generally large in magnitude, have a long duration, and travel across large areas and through multiple jurisdictions within a single region. Additionally, thunderstorms often occur in a series, with one area potentially impacted multiple times in one day. Severe thunderstorms are most likely to occur between the months of May and August with the highest number of events occurring in June. The NCEI recorded 239 severe thunderstorm events in 23 years. These events caused over $3 million in property damages. Typical impacts resulting from severe thunderstorms include but are not limited to: loss of power; obstruction of transportation routes; grass/wildfires starting from lightning strikes; localized flooding; and damages discussed in the hazard profiles for hail and high winds. Vulnerable populations related to severe thunderstorms include: residents of mobile homes (approximately three percent of housing units); citizens with decreased mobility; and those caught outside during storm events. Most residents within the planning area are familiar with severe thunderstorms and know how to appropriately prepare and respond to events.

SEVERE WINTER STORMS

Severe winter storms are an annual occurrence for the planning area. Winter storms can bring extreme cold temperatures, freezing rain and ice, and heavy or drifting snow. Blizzards are particularly dangerous and can have significant impacts throughout the planning area. Severe winter storms typically occur between November and March. The NCEI reported 150 severe winter storm events that caused over $19 million in property damages in 23 years. Impacts resulting from severe winter storms include but are not limited to: hypothermia and frost bite; closure of transportation routes; downed power lines and power outages; collapsed roofs from heavy snow loads; and closure of critical facilities. The most vulnerable

citizens within the planning area are children, the elderly, individuals and families below the poverty line, and those new to the area.

TORNADOES

Tornado events occur throughout the State of Nebraska on an annual basis. Forty-seven tornado events have been recorded in the planning area in 23 years, causing significant damages to infrastructure, residential homes, vehicles, power and service lines, and the transportation corridors. Tornadoes may disproportionally impact vulnerable populations including mobile homes, homeowners without storm shelters or basements, residents with decreased mobility, or facilities without shelters which house large numbers of people (i.e. schools, nursing homes, hospitals, etc.).

MITIGATION STRATEGIES

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

SECTION ONE
INTRODUCTION

HAZARD MITIGATION PLANNING

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

FEMA definition of Hazard Mitigation

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

Natural hazards, such as severe winter storms, tornadoes and high winds, severe thunderstorms, flooding, extreme heat, drought, agriculture diseases (plant and animal), earthquakes, and wildfires are part of the world around us. Human-caused hazards are a product of the society and can occur with significant impacts to communities. Human-caused hazards include levee failure, dam failure, chemical fixed site hazards, chemical transportation incidents, terrorism, and/or civil disorder. These hazard events can occur as a part of normal operation or as a result of human error. All jurisdictions participating in this planning process are vulnerable to a wide range of natural and human-caused hazards that threaten the safety of residents, and have the potential to damage or destroy both public and private property, cause environmental degradation, or disrupt the local economy and overall quality of life.

The Lower Platte South NRD (LPSNRD) prepared this multi-jurisdictional hazard mitigation plan in an effort to reduce impacts from natural and human-caused hazards and to better protect the people and property of the region from the effects of these hazards. This plan demonstrates a regional commitment to reducing risks from hazards and serves as a tool to help decision makers establish mitigation activities and resources. Further, this plan was developed to make LPSNRD and participating jurisdictions eligible for federal pre-disaster funding programs and to accomplish the following objectives:

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

DISASTER MITIGATION ACT OF 2000

The U.S. Congress passed the Disaster Mitigation Act 2000 to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act.[1] Section 322 of the DMA 2000 requires that state and local governments develop, adopt, and routinely update a hazard mitigation plan to remain eligible for pre- and post-disaster mitigation funding.[2] These funds include the Hazard Mitigation Grant Program (HMGP)[3], Pre-Disaster

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

[2] Federal Emergency Management Agency. June 2007. "Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and Related Authorities." Federal Emergency Management Agency 592: 22. Sec. 322. Mitigation Planning (42 U.S.C. 5165). https://www.fema.gov/pdf/about/stafford_act.pdf.

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

Mitigation Program (PDM)[4], and the Flood Mitigation Assistance Program (FMA)[5]. The Federal Emergency Management Agency (FEMA) administers these programs under the Department of Homeland Security (DHS).[6]

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

HAZARD MITIGATION ASSISTANCE

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

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

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

- **HMGP:** To qualify for post-disaster mitigation funds, local jurisdictions must have adopted a mitigation plan that is approved by FEMA. HMGP provides funds to states, territories, Indian tribal governments, local governments, and eligible private non-profits following a presidential disaster declaration. The DMA 2000 authorizes up to seven percent of HMGP funds available to a state after a disaster to be used for the development of state, tribal, and local mitigation plans.
- **FMA:** To qualify to receive grant funds to implement projects such as acquisition or elevation of flood-prone homes, local jurisdictions must prepare a mitigation plan. Furthermore, local jurisdictions must be participating communities in the National Flood Insurance Program (NFIP). The goal of FMA is to reduce or eliminate claims under the NFIP.
- **PDM:** To qualify for pre-disaster mitigation funds, local jurisdictions must adopt a mitigation plan that is approved by FEMA. PDM assists states, territories, Indian tribal governments, and local governments in implementing a sustained pre-disaster hazard mitigation program.

PLAN FINANCING AND PREPARATION

Regarding plan financing and preparation, in general, the LPSNRD 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.

[4] Federal Emergency Management Agency. "Pre-Disaster Mitigation Grant Program." Last modified July 11, 2017. https://www.fema.gov/pre-disaster-mitigation-grant-program.
[5] Federal Emergency Management Agency. "Flood Mitigation Assistance Grant Program." Last modified July 11, 2017. https://www.fema.gov/flood-mitigation-assistance-grant-program.
[6] Federal Emergency Management Agency. "Hazard Mitigation Assistance." Last modified March 29, 2017. https://www.fema.gov/hazard-mitigation-assistance.
[7] Federal Emergency Management Agency: Federal Register. 2002. "Section 104 of Disaster Mitigation Act 2000: 44 CFR Parts 201 and 206: Hazard Mitigation Planning and Hazard Mitigation Grant Programs; Interim Final Rule." https://www.fema.gov/pdf/help/fr02-4321.pdf.
[8] Federal Emergency Management Agency: Federal Register. 2002 "44 CFR Parts 201 and 206: Hazard Mitigation Planning and Hazard Mitigation Grant Programs; Interim Final Rule." https://www.fema.gov/pdf/help/fr02-4321.pdf.

SECTION TWO
PLANNING PROCESS

INTRODUCTION

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

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

(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;

(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and

(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

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

MULTI-JURISDICTIONAL APPROACH

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

- It provides a comprehensive approach to the mitigation of hazards that affect multiple jurisdictions;
- It allows economies of scale by leveraging individual capabilities and sharing cost and resources;
- It avoids duplication of efforts; 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 resource districts. The LPSNRD utilized the multi-jurisdiction planning process recommended by FEMA (Local Mitigation Plan Review Guide[10], Local Mitigation Planning Handbook[11], and Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards[12]) to develop this plan.

[10] 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.

[11] 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.

[12] Federal Emergency Management Agency. 2013. "Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards." https://www.fema.gov/media-library-data/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf.

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.

Organization of Resources

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

Assessment of Risk

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

Mitigation Plan Development

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

Plan Implementation and Progress Monitoring

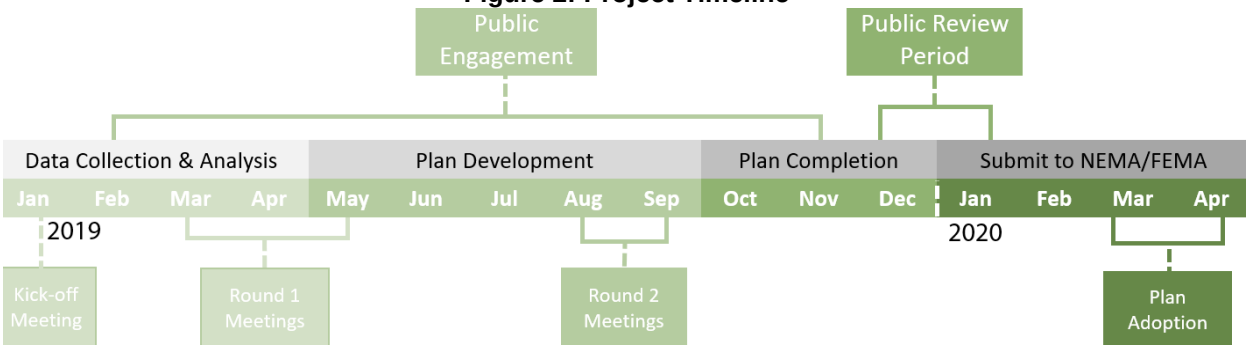
- Bring the plan to life by implementing specific mitigation projects and changing day-to-day operations. It is critical that the plan remains relevant to succeed. Thus, it is important to conduct periodic evaluations and revisions, as needed.

ORGANIZATION OF RESOURCES

PLAN UPDATE PROCESS

The LPSNRD secured funding for their multi-jurisdictional hazard mitigation plan (HMP) in July 2018. JEO Consulting Group, INC. (JEO) was contracted in November 2018 to guide and facilitate the planning process and assemble the multi-jurisdictional hazard mitigation plan. For the planning area, David Potter (Assistant General Manager with LPSNRD) led the development of the plan and served as the primary point-of-contact throughout the project. A clear timeline of this plan update process is provided in Figure 2.

Figure 2: Project Timeline



PLANNING TEAM

At the beginning of the planning process the LPSNRD and JEO staff identified key contacts who would be the regional Hazard Mitigation Planning Team. This Planning Team, comprised of local participants and the consultant, was established to guide the planning process, review the existing plan, and serve as a liaison

to plan participants throughout the planning area. A list of Planning Team members can be found in Table 4. Additional technical support was provided to the Planning Team by staff from NEMA and the NeDNR.

Table 6: Hazard Mitigation Planning Team

Name	Title	Jurisdiction
Paul Zillig	General Manager	Lower Platte South NRD
David Potter	Assistant General Manager	Lower Platte South NRD
Tracy Zayac	Stormwater/Watershed Specialist	Lower Platte South NRD
Sandy Weyers	Emergency Manager	Cass County
James Davidsaver	Emergency Manager	Lincoln/Lancaster County
Mark Hosking	Deputy Director	Lincoln/Lancaster County
Ben Higgins	Superintendent of Stormwater	City of Lincoln
Mark Robertson	Emergency Management Coordinator	University of Nebraska-Lincoln
***Lexy Hindt**	Deputy State Hazard Mitigation Officer	NEMA
***Katie Ringland**	Chief Floodplain Management Section	NeDNR
***Lalit Jha**	Project Principal	JEO Consulting Group
***Becky Appleford**	Project Manager	JEO Consulting Group
***Mary Baker**	Resiliency Strategist	JEO Consulting Group
***Brooke Welsh**	Project Coordinator	JEO Consulting Group
***Ellana Haakenstad**	Junior Planner	JEO Consulting Group

**Served as a consultant or advisory role*

A kick-off meeting was held on January 24, 2019 to discuss an overview of the planning process between JEO staff and the Regional Planning Team. Discussion at this meeting included participation requirements for communities, required changes to the HMP process from the previous planning effort, planning team establishment, identifying all potential plan participants or key stakeholders, goals and objectives, and a general schedule for the plan update. This meeting also assisted in clarifying the role and responsibilities of the Planning Team and strategies for public engagement throughout the planning process. Table 7 shows Kick-off Meeting attendees.

Table 7: Kick-off Meeting Attendees

Name	Title	Jurisdiction
Paul Zillig	General Manager	Lower Platte South NRD
David Potter	Assistant General Manager	Lower Platte South NRD
James Davidsaver	Emergency Manager	Lincoln/Lancaster County
Mark Hosking	Deputy Director	Lincoln/Lancaster County
Ben Higgins	Superintendent of Stormwater	City of Lincoln
Brian Dixon	Floodplain Management and Mitigation Coordinator	NeDNR
Mark Robertson	Emergency Management Coordinator	University of Nebraska-Lincoln
*Becky Appleford	Project Manager	JEO Consulting Group
*Mary Baker	Resiliency Strategist	JEO Consulting Group
*Dan Feuerbach	Planner	JEO Consulting Group
*Phil Luebbert	Senior Planner	JEO Consulting Group

Table 8 shows the data and locatiosn of meetings held for the Kick-Off Meeting.

Table 8: Meeting Locations and Times

Location and Time	Agenda Items
Lower Platte South NRD 39252 Hwy 2 Lincoln, NE January 24, 2019 12:00pm	-Consultant and Planning Team responsibilities -Overview of plan update process and changes from 2015 HMP -Planning team establishment -Public Engagement and potential participants

NEIGHBORING JURISDICTIONS

Neighboring jurisdictions were notified and invited to participate in the planning process. The following table indicates which neighboring communities or entities were notified of the planning process. Invitation and informational letters were sent to county clerks, county and regional emergency managers, and NRDs. There was no other participation from jurisdictions outside of the planning area.

Table 9: Notified Neighboring Jurisdictions

Notified Nebraska Jurisdictions	
Colfax County	Papio-Missouri River Natural Resources District
Fremont County	Platte County
Gage County	Polk County
Johnson County	Saline County
Lower Big Blue Natural Resources District	Sarpy County
Lower Platte North Natural Resources District	Saunders County
Mills County	Upper Big Blue Natural Resources District
Nemaha Natural Resources District	York County

PARTICIPANT INVOLVEMENT

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

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

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

Table 10: Outreach Activity Summary

Action	Intent
Project Website	Informed the public and local/planning team members of past, current, and future activities (https://jeo.com/lpsnrdhmp)
Project Announcement	Project announcement posted on the project websites
Round 1 Meeting Letters or Postcards (30-day notification)	Sent to participants, stakeholders, and neighboring jurisdictions to discuss the agenda/dates/times/ locations of the first round of public meetings
Round 2 Meeting Letters or Postcards (30-day notification)	Sent to participants to discuss the agenda/dates/times/locations of the second round of public meetings
Press Release	Shared with jurisdictions and media to announce the plan and describe the purpose of the plan

Notification Emails	Emailed all participants to remind them about upcoming meetings
Follow-up Emails and Phone Calls	Correspondence was provided to remind and assist participating jurisdictions with the collection and submission of required local data
Project Flyer	Flyers were posted about the LPSNRD HMP and how to get involved. Flyers were distributed at meetings to post in communities and online.
Word-of-Mouth	Staff discussed the plan with jurisdictions throughout the planning process

ASSESSMENT OF RISK

ROUND 1 MEETINGS: HAZARD IDENTIFICATION

At the Round 1 meetings, jurisdictional representatives (i.e. the local planning teams) reviewed the hazards consistent with the 2014 Nebraska State Hazard Mitigation Plan to conduct further risk and vulnerability assessment based on these hazards' previous occurrence and the communities' exposure to the various hazards. (For a complete list of hazards reviewed, see *Section Four: Risk Assessment.)*.

Table 11 shows the date and location of meetings held for the Round 1 meeting phase of the project.

Table 11: Round 1 Meeting Dates and Locations

Agenda Items	
General overview of the HMP planning process, discuss participation requirements, begin the process of risk assessment and impact reporting, update critical facilities, capabilities assessment, and status update on current mitigation projects	
Location and Time	**Date**
LPSNRD Office, Lincoln NE: 7:00PM	Thursday, March 14, 2019
Cass County Extension Office, Weeping Water NE: 7:00PM	Tuesday, March 26, 2019

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

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

Table 12: Round 1 Meeting Attendees

Name	Title	Jurisdiction
Lancaster County – Thursday, March 14, 2019		
Daniel Steinkruger	Director	LPSNRD Board
David Hobelman	Board Chairman	Village of Firth
David Potter	Assistant General Manager	LPSNRD
Gary Aldridge	Director	LPSNRD Board
Jessica Quady	City Administrator	City of Ashland
Jim Davidsaver	Emergency Manager	Lancaster County
Larry Legg	Design Engineer	Lancaster County
Mark Fredrickson	Trustee	Village of Davey
Mark Hosking	Deputy Emergency Manager	Lancaster County
Paul Zillig	General Manager	LPSNRD
Robert Andersen	Director	LPSNRD Board
Robin Hoffman	Business Manager	Waverly Public Schools
Sarah Wilson	Board Member	LPSNRD Board

Becky Appleford	Project Manager	JEO Consulting Group
Mary Baker	Resiliency Strategist	JEO Consulting Group
Jeff Henson	Project Manager	JEO Consulting Group
Lalit Jha	Engineer	JEO Consulting Group
Dan Feuerbach	Planner	JEO Consulting Group
Karl Dietrich	Junior Planner	JEO Consulting Group
Cass County – Tuesday, March 26, 2019		
Alan Barnes	Firefighter	Village of Manley
Alan Millen	Emergency Management Coordinator	Village of Murray
Chad Korte	Paramedic	Cass County
Chuck Paukert	Flood Plain Manager	Village of Cedar Creek
Don Murray	Board of Trustees	Village of Bennet
Gary Brucchert		Cass Couny SID #1
Gary Hellwig	General Manager	Cass County RWD #1
Heidi Hoglund	Zoning Flood Plain Administrator	Village of Hickman
Jake Wilson	Village Board Member	Village of Murdock
James Noerlinger	Caretaker	Cass County SID #1
Jim Grotrian		Cass County SID #5
Jo Nutter	City Council	Village of Weeping Water
John Surman	Village Board Member	Village of Eagle
Josh Buck	Planning	Village of Bennet
Larry Schuefert	Fire Chief	Village of Manley
Patricia Rule	Village Clerk	Village of Bennet
Roseann Bodesh-DeGraff	Emergency Management Administration Officer	Cass County
Becky Appleford	Project Manager	JEO Consulting Group
Dan Feuerbach	Planner	JEO Consulting Group
Mary Baker	Resiliency Strategist	JEO Consulting Group
Ellana Haakenstad	Junior Planner	JEO Consulting Group

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

Name	Title	Jurisdiction
City of Plattsmouth – Friday, March 8, 2019		
Erv Portis	City Administrator	City of Plattsmouth
Becky Appleford	Project Manager	JEO Consulting Group
Dan Feuerbach	Planner	JEO Consulting Group
City of Lincoln – Wednesday, March 27, 2019		
Ben Higgins	Superintendent of Stormwater	City of Lincoln
Chin Lim	Sanitary Engineer	City of Lincoln
Dave Beyersdorf	Superintendent of Water Distribution	City of Lincoln
Jim Davidsaver	Emergency Management Director	Lancaster County
JJ Yost	Parks & Recreation Facilities Manager	City of Lincoln
Mark Hosking	Emergency Manager	Lancaster County
Pam Dingman	County Engineer	Lancaster County
Pat Borer	Assistant Fire Chief	City of Lincoln
Rachel Jones	Planner	Lancaster County
Randy Hoskins	City Engineer	City of Lincoln
Robert Farber	Police Captain	City of Lincoln
Terry Kathe	Building and safety Manager	City of Lincoln

Tim Byrne	Transportation and Utilities Maintenance Operations Manager	City of Lincoln
Becky Appleford	Project Manager	JEO Consulting Group
Dan Feuerbach	Planner	JEO Consulting Group
Jeff Henson	Project Manager	JEO Consulting Group
Lalit Jah	Project Principal	JEO Consulting Group
Mary Baker	Resiliency Strategist	JEO Consulting Group
City of Louisville – Friday, July 12, 2019		
Dee Arias	Village Clerk	City of Louisville
Roger Burns	Mayor	City of Louisville
Brooke Welsh	Project Coordinator	JEO Consulting Group
Village of Murdock – Thursday, April17, 2019		
Jackie Barnes	Village Clerk	Village of Murdock
Jake Wilson	Village Board Member	Village of Murdock
TJ Olson	Village Board Member	Village of Murdock
Matt Frite	Village Board Member	Village of Murdock
John Story	Village Board Member	Village of Murdock
Kristi McHugh	Village Board Member	Village of Murdock
Dan Feuerbach	Planner	JEO Consulting Group
Lancaster County – Monday, April 29, 2019		
David Potter	Assistant General Manager	Lower Platte South NRD
Jim Davidsaver	Director	Lincoln/Lancaster County Emergency Management
Mark Hosking	Deputy Director	Lincoln/Lancaster County Emergency Management
Ron Bohaty	Road Maintenance Superintendent	Lancaster County
Larry Legg	Road Design Manager	Lancaster County
Pam Dingman	County Engineer	Lancaster County
Becky Appleford	Project Manager	JEO Consulting Group
Dan Feuerbach	Planner	JEO Consulting Group
Mary Baker	Resiliency Strategist	JEO Consulting Group
Steve Ahrens	Senior Bridge/Structural Engineer	JEO Consulting Group
Village of Hallam – Wednesday, July 31, 2019		
Victoria Polak	Village Clerk	Village of Hallam
Becky Appleford	Project Manager	JEO Consulting Group
Village of Roca – Tuesday, July 30, 2019		
Diana Van Duen	Village Clerk	Village of Roca
Brooke Welsh	Project Coordinator	JEO Consulting Group
City of Waverly – Thursday, May 9, 2019		
Stephanie Fisher	City Administrator	City of Waverly
Dan Feuerbach	Planner	JEO Consulting Group
Village of Brainard – Monday, August 5, 2019		
Carla Sander	Village Clerk	Village of Brainard
John Bruner	Board Chairman	Village of Brainard
Ellana Haakenstad	Planner	JEO Consulting Group
Brooke Welsh	Project Coordinator	JEO Consulting Group
City of Ashland – Thursday, May 9, 2019		
Jessica Quady	City Administrator	City of Ashland
Richard Grauerholz	Mayor	City of Ashland
Dan Feuerbach	Planner	JEO Consulting Group

Village of Ceresco – Thursday, June 6, 2019		
Davy Wilson	Village Board Member	Village of Ceresco
Joan Lindgren	Village Clerk	Village of Ceresco
Chilton Leedom	Police Officer	Village of Ceresco
Adam Rupe	Planner	JEO Consulting Group
Village of Valparaiso – Friday, August 16, 2019		
Greg Bouc	Utility Superintendent	Village of Valparaiso
Brooke Welsh	Project Coordinator	JEO Consulting Group
Lower Platte South NRD – Friday, June 7, 2019		
Paul Zillig	General Manager	Lower Platte South NRD
David Potter	Assistant General Manager	Lower Platte South NRD
Becky Appleford	Project Coordinator	JEO Consulting Group
Mary Baker	Resiliency Strategist	JEO Consulting Group

Mitigation Plan Development

Round 2 Meetings: Mitigation Strategies

The identification and prioritization of mitigation measures is an essential component in developing effective hazard mitigation plans. At the Round 2 meetings, participating jurisdictions identified new mitigation actions in addition to the mitigation actions continued from the 2015 HMP to address additional hazards of concern. Participating jurisdictions were also asked to review the information collected from the Round 1 meeting related to their community through this planning process. Local planning teams were asked to ensure all information included was up-to-date and accurate. Information/data reviewed include, but was not limited to: local hazard prioritization results; identified critical facilities and their location within the community; concentrations of populations identified as 'highly vulnerable'; future development areas; future mitigation projects (refer to *Appendices A* and *B);* and expected growth trends (refer to *Appendix B*).

There was also a brief discussion about the planning process, when the plan would be available for public review and comment, annual review of the plan, and the approval and grant opportunities available once the plan was approved. Table 14 shows the date and location of meetings held for the Mitigation Strategies phase of this project. Meeting attendees are identified in Table 15.

Table 14: Round 2 Meeting Dates and Locations

Agenda Items	
Identify new mitigation actions, review of local data and community profile, discuss review process, complete plan integration tool.	
Location and Time	**Date**
LPSNRD Office, Lincoln, NE: 6:30PM	Wednesday, August 28, 2019
Weeping Water Community Center, Weeping Water, NE: 6:30 PM	Thursday, September 5, 2019

Table 15: Round 2 Meeting Attendees

Name	Title	Jurisdiction
Lancaster County – Wednesday, August 28, 2019		
Aaron Hummel	Emergency Services Coordinator	City of Waverly
Anthony Meints	Assistant Facilities Supervisor	Lincoln Public Schools
Bill Edwards	Board Chair	Village of Denton
Charlotte TeBrink	Clerk	Village of Denton
David Hobelman	Board Chair	Village of Firth
David Potter	Assistant General Manager	Lower Platte South NRD
Gary Aldridge	Subdistrict 4 Director	Lower Platte South NRD
Gary Bruechert	Chairman	Cass County SID #1 (Lake WanConDa)
James Davidsaver	Emergency Manager	Lancaster County
Jill Hoefler	Clerk	Village of Firth

Name	Title	Jurisdiction
John Schwartz	Superintendent	Norris School District
Madeline Schreier	Emergency Management Intern	Lancaster County
Mark Hosking	Deputy EMA	Lancaster County
Pam Pickard	Clerk/Treasurer	Village of Panama
Pamela Huck	Clerk	Village of Davey
Robin Hoffman	Business Manager	Waverly School District
Toni Rupe	Sewer Commissioner	Village of Ceresco
Tracy Zayac	Stormwater/Watershed Specialist	Lower Platte South NRD
Becky Appleford	Project Manager	JEO Consulting Group
Brooke Welsh	Project Coordinator	JEO Consulting Group
Jeff Henson	Project Manager	JEO Consulting Group
Mary Baker	Resiliency Strategist	JEO Consulting Group
Lalit Jha	Project Principal	JEO Consulting Group
Cass County – Thursday, September 5, 2019		
Alan Miller	Emergency Management Coordinator	Village of Murray
Chuck Paukert	Floodplain Manager	Village of Cedar Creek
David Potter	Assistant General Manager	Lower Platte South NRD
Deb Cunningham	Village Clerk	Village of South Bend
Don Murray	Board Member	Village of Bennet
Gary Hellwig	General Manager	Cass Co. RWD#1
Heidi Hoglund	Planner	City of Hickman
Jacob Wilson	Board Member	Village of Murdock
Jeff Buffington	Maintenance Supervisor	City of Weeping Water
Jim Grotrian	Board Member	Cass Co. SID #5
Linda Fleming	City Clerk	City of Weeping Water
Marilyn Kirchhoff	Village Clerk	Village of Avoca
Mickey Dalton	Board Member	Village of Manley
Miki Bruns	Chairperson	Village of Elmwood
Roseann Dobesh-DeGraff	Admin Officer	Cass County Emergency Management
Sandy Weyers	Director	Cass County Emergency Management
Becky Appleford	Project Manager	JEO Consulting Group
Brooke Welsh	Project Coordinator	JEO Consulting Group
Mary Baker	Resiliency Strategist	JEO Consulting Group

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

Name	Title	Jurisdiction
Cass County – September 23, 2019		
Sandy Weyers	Director	Cass County Emergency Management
Roseann Dobesh-DeGraff	Admin Officer	Cass County Emergency Management
Chad Korte	Chief Deputy Director	Cass County Emergency Management
Becky Appleford	Project Manager	JEO Consulting Group
Brooke Welsh	Project Coordinator	JEO Consulting Group
Lower Platte South NRD – October 3, 2019		
David Potter	Assistant General Manager	Lower Platte South NRD
Tracy Zayak	Stormwater/Watershed Specialist	Lower Platte South NRD
Mary Baker	Resiliency Strategist	JEO Consulting Group

Name	Title	Jurisdiction
Becky Appleford	Project Manager	JEO Consulting Group
Brooke Welsh	Project Coordinator	JEO Consulting Group
Village of Malcolm –September 17, 2019		
Nadine Link	Village Clerk	Village of Malcolm
Brooke Welsh	Project Coordinator	JEO Consulting Group
Raymond Central Public Schools –September 13, 2019		
Phil Carlson	Utilities and Maintenance	Raymond Central Public Schools
Jared Shanahan	Utilities and Maintenance	Raymond Central Public Schools
Brooke Welsh	Project Coordinator	JEO Consulting Group
Norris Public Schools –September 19, 2019		
John Schwartz	Superintendent	Norris Public Schools
Brian Maschmann	Admin-Assistant Superintendent	Norris Public Schools
Brooke Welsh	Project Coordinator	JEO Consulting Group
Conestoga Public Schools –September 19, 2019		
Beth Johnson	Superintendent	Conestoga Public Schools
Brooke Welsh	Project Coordinator	JEO Consulting Group
Weeping Water Public Schools –September 11, 2019		
Kevin Reiman	Superintendent	Weeping Water Public Schools
Brooke Welsh	Project Coordinator	JEO Consulting Group
City of Plattsmouth – November 6, 2019		
Erv Portis	City Administrator	City of Plattsmouth
Brooke Welsh	Project Coordinator	JEO Consulting Group
Becky Appleford	Project Manager	JEO Consulting Group
City of Lincoln – Wednesday, October 23, 2019		
Ben Higgins	Superintendent of Stormwater	City of Lincoln
Chin Lim	Sanitary Engineer	City of Lincoln
David Potter	Assistant General Manager	Lower Platte South NRD
Jim Davidsaver	Emergency Management Director	Lancaster County
Mark Hosking	Emergency Manager	Lancaster County
Pat Borer	Assistant Fire Chief	City of Lincoln
Rachel Jones	Planner	Lancaster County
Terry Kathe	Building and Safety Manager	City of Lincoln
Tim Byrne	Transportation and Utilities Maintenance Operations Manager	City of Lincoln
Tracy Zayac	Stormwater/Watershed Specialist	Lower Platte South NRD
Becky Appleford	Project Manager	JEO Consulting Group
Brooke Welsh	Project Coordinator	JEO Consulting Group
Mary Baker	Resiliency Strategist	JEO Consulting Group
City of Louisville – Thursday, October 24, 2019		
Dee Arias	Village Clerk	City of Louisville
Roger Burns	Mayor	City of Louisville
Brooke Welsh	Project Coordinator	JEO Consulting Group
City of Ashland – Wednesday, November 6, 2019		
Jessica Quady	City Administrator	City of Ashland
Becky Appleford	Project Manager	JEO Consulting Group
Brooke Welsh	Project Coordinator	JEO Consulting Group

Name	Title	Jurisdiction
Village of Manley – Wednesday, November 6, 2019		
Denise Swenson	Village Board Chair	Village of Manley
Roseann Dobesh-DeGraff	Admin Officer	Cass County Emergency Management
Brooke Welsh	Project Coordinator	JEO Consulting Group
Village of Raymond – Wednesday, November 13, 2019		
Shane Cuttlers	Deputy Emergency Manager	Village of Raymond
Brooke Welsh	Project Coordinator	JEO Consulting Group
Village of Nehawka – Wednesday, November 13, 2019		
Allen Gansemer	Board Chair	Village of Nehawka
Jen Gansemer	Clerk	Village of Nehawka
Robert Sorenson	Board Member	Village of Nehawka
John Henderson	Board Member	Village of Nehawka
Thomas Prickett	Village Attorney	Village of Nehawka
Brooke Welsh	Project Coordinator	JEO Consulting Group
City of Waverly – Tuesday, August 6, 2019		
Stephanie Fisher	City Administrator	City of Waverly
Chad Lyon	Floodplain Administrator	City of Waverly
Aaron Hummel	Emergency Services Coordinator	City of Waverly
Brooke Welsh	Project Coordinator	JEO Consulting Group
Village of Sprague – Tuesday, October 8, 2019		
Mark Hosking	Deputy EM	Lincoln/Lancaster County Emergency Management
Ken Chelton	Board Member	Village of Sprague
Staci Hayden	Clerk	Village of Sprague
Luke Foote	Chairman	Village of Sprague
Brooke Welsh	Project Coordinator	JEO Consulting Group
Lancaster County – Friday, November 15, 2019		
David Potter	Assistant General Manager	Lower Platte South NRD
Jim Davidsaver	Emergency Management Director	Lincoln/Lancaster County Emergency Management
Larry Legg	Design Engineer	Lancaster County
Mark Hosking	Deputy EM	Lincoln/Lancaster County Emergency Management
Pam Dingman	County Engineer	Lancaster County
Ron Bohaty	Roads Superintendent	Lancaster County
Madi Schreier	Intern	Lancaster County
Brooke Welsh	Project Coordinator	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group
Lower Platte South – Thursday, October 3, 2019		
David Potter	Assistant General Manager	Lower Platte South NRD
Tracy Zayac	Stormwater/Watershed Specialist	Lower Platte South NRD
Becky Appleford	Project Coordinator	JEO Consulting Group
Mary Baker	Resiliency Strategist	JEO Consulting Group
Brooke Welsh	Project Coordinator	JEO Consulting Group

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: Community Profiles.*

Table 17: General Plans, Documents, and Information

Documents	
Disaster Mitigation Act of 2000 DMA https://www.fema.gov/media-library/assets/documents/4596?id=1935	Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (2013) https://www.fema.gov/media-library/assets/documents/30627
Final Rule (2007) https://www.fema.gov/media-library/assets/documents/23672	National Flood Insurance Program Community Status Book (2018) https://www.fema.gov/national-flood-insurance-program-community-status-book
Hazard Mitigation Assistance Unified Guidance (2013) https://www.fema.gov/media-library/assets/documents/33634	National Response Framework (2019) https://www.fema.gov/media-library/assets/documents/117791
Hazard Mitigation Assistance Guidance and Addendum (2015) https://www.fema.gov/media-library/assets/documents/103279	Robert T. Stafford Disaster Relief and Emergency Assistance Act (2016) https://www.fema.gov/media-library/assets/documents/15271
Local Mitigation Plan Review Guide (2011) https://www.fema.gov/media-library/assets/documents/23194	The Census of Agriculture (2012) https://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Nebraska/
Local Mitigation Planning Handbook (2013) https://www.fema.gov/media-library/assets/documents/31598	What is a Benefit: Guidance on Benefit-Cost Analysis on Hazard Mitigation Projects http://www.fema.gov/benefit-cost-analysis
Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (2013) https://www.fema.gov/media-library/assets/documents/30627	
Plans and Studies	
Lower Platte South NRD Hazard Mitigation Plan (2015) https://jeo.com/sites/default/files/inline-files/LPSNRD-HMP-Final-10.8.15%28reduced%29.pdf	National Climate Assessment (2014) https://nca2014.globalchange.gov/
Flood Insurance Studies http://www.fema.gov/floodplain-management/flood-insurance-study	Nebraska Drought Mitigation and Response Plan (2000) http://carc.nebraska.gov/docs/NebraskaDrought.pdf
Fourth National Climate Assessment (2018) https://nca2018.globalchange.gov/	State of Nebraska Hazard Mitigation Plan (2014) https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmitplan.pdf
Data Sources/Technical Resources	
Arbor Day Foundation – Tree City Designation https://www.arborday.org/programs/treecityusa/directory.cfm	Nebraska Department of Natural Resource – Geographic Information Systems (GIS) https://dnr.nebraska.gov/data
Environmental Protection Agency - Chemical Storage Sites https://myrtk.epa.gov/info/search.jsp	Nebraska Department of Natural Resources http://www.dnr.ne.gov
Federal Emergency Management Agency http://www.fema.gov	Nebraska Department of Natural Resources – Dam Inventory

	http://prodmaps2.ne.gov/html5DNR/?viewer=daminventory
FEMA Flood Map Service Center https://msc.fema.gov/portal/advanceSearch	Nebraska Department of Revenue – Property Assessment Division www.revenue.ne.gov/PAD
High Plains Regional Climate Center http://climod.unl.edu/	Nebraska Department of Transportation http://dot.nebraska.gov/
National Agricultural Statistics Service http://www.nass.usda.gov/	Nebraska Emergency Management Agency http://www.nema.ne.gov
National Centers for Environmental Information https://www.ncei.noaa.gov/	Nebraska Forest Service – Wildland Fire Protection Program http://nfs.unl.edu/fire
National Consortium for the Study of Terrorism and Responses to Terrorism (START) http://www.start.umd.edu/gtd/	Nebraska Forest Service (NFS) http://www.nfs.unl.edu/
National Drought Mitigation Center – Drought Impact Reporter http://droughtreporter.unl.edu/map/	Nebraska Public Power District Service http://econdev.nppd.com/
National Drought Mitigation Center – Drought Monitor http://droughtmonitor.unl.edu/	Nebraska State Historical Society http://www.nebraskahistory.org/histpres/index.shtml
National Environmental Satellite, Data, and Information Service http://www.nesdis.noaa.gov/	Stanford University - National Performance of Dams Program https://npdp.stanford.edu/
National Fire Protection Association https://www.nfpa.org/	Storm Prediction Center Statistics http://www.spc.noaa.gov
National Flood Insurance Program https://www.fema.gov/national-flood-insurance-program	United States Army Corps of Engineers – National Levee Database http://nld.usace.army.mil/egis/f?p=471:1:0::NO
National Flood Insurance Program https://dnr.nebraska.gov/floodplain/flood-insurance	United States Census Bureau http://www.census.gov
National Historic Registry http://www.nps.gov/nr	United States Census Bureau https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml
National Oceanic Atmospheric Administration (NOAA) http://www.noaa.gov/	United States Department of Agriculture http://www.usda.gov
National Weather Service http://www.weather.gov/	United States Department of Agriculture – Risk Management Agency http://www.rma.usda.gov
Natural Resources Conservation Service www.ne.nrcs.usda.gov	United States Department of Agriculture – Web Soil Survey https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
Nebraska Association of Resources Districts http://www.nrdnet.org	United States Department of Commerce http://www.commerce.gov/
Nebraska Climate Assessment Response Committee http://carc.agr.ne.gov	United States Department of Transportation – Pipeline and Hazardous Materials Safety Administration https://www.phmsa.dot.gov/
Nebraska Department of Education http://nep.education.ne.gov/	United States Geological Survey http://www.usgs.gov/
Nebraska Department of Education http://educdirsrc.education.ne.gov/	United States National Response Center http://www.nrc.uscg.mil/
Nebraska Department of Environment and Energy	United States Small Business Administration

http://www.deq.state.ne.us/	http://www.sba.gov
Nebraska Department of Health and Human Services http://dhhs.ne.gov/Pages/default.aspx	UNL – College of Agricultural Sciences and Natural Resources – Schools of Natural Resources http://casnr.unl.edu

Public Review

Once the draft of the HMP was completed, a public review period was opened to allow for participants and community members at large to review the plan and provide comments and changes. The public review period was open from December 20, 2019 through January 21, 2019. Participating jurisdictions were emailed and mailed a letter notifying them of this public review period. The HMP was also made available on the project website (https://jeo.com/lpsnrdhmp) to download the document, and a notification was posted to the LPSNRD website. Received comments and suggested changes were incorporated into the plan.

Plan Adoption

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

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

Once adopted, participants are responsible for implementing and updating the plan every five years. Those who participated directly in the planning process would be logical champions for updating the plan. In addition, the plan will need to be reviewed and updated annually or when a hazard event occurs that significantly affects the area or individual participants.

Plan Implementation and Progress Monitoring

Hazard mitigation plans need to be living documents. To ensure this, the plan must be monitored, evaluated, and updated on a five-year or less cycle. This includes incorporating the mitigation plan into county and local comprehensive or capital improvement plans as they stand or are developed. *Section Six* describes the system that jurisdictions participating in the LPSNRD HMP have established to monitor the plan; provides a description of how, when, and by whom the HMP process and mitigation actions will be evaluated; presents the criteria used to evaluate the plan; and explains how the plan will be maintained and updated.

SECTION THREE
PLANNING AREA PROFILE

INTRODUCTION

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

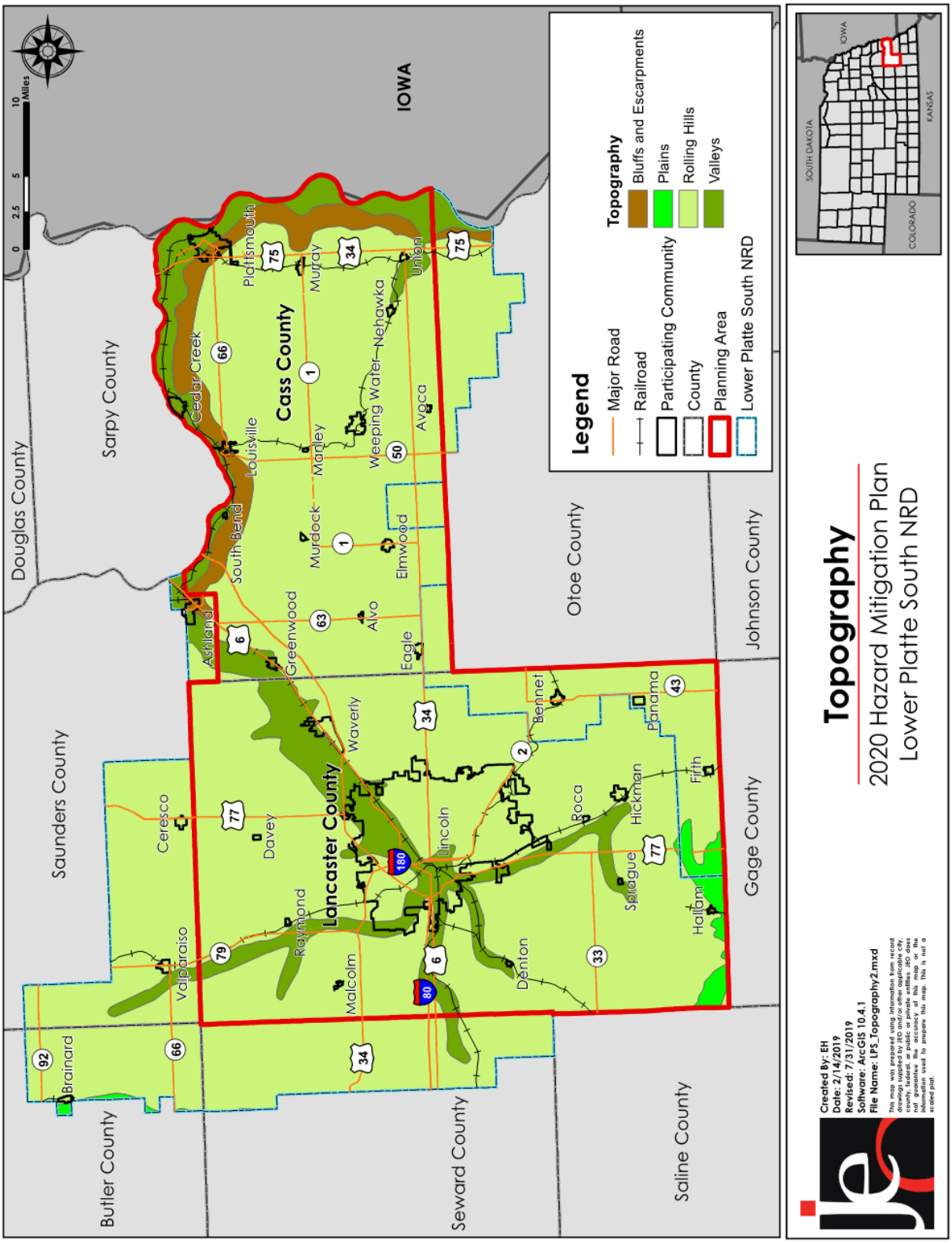
The LPSNRD is located is eastern Nebraska and covers 1,670 square miles and includes all or part of six counties including: Lancaster, Cass, Otoe, Saunders, Butler, and Seward Counties. The majority of the over one million acres of land in the NRD lies within Rolling Hill regions, with some small areas in the including Valleys, Bluffs and Escarpments, and Plains topography (Figure 3). Rolling hills are hilly lands with moderate to steep slopes and rounded ridge crests; valleys are flat-lying land along major streams and include stream-deposited silt, clay, sand, and gravel materials; bluffs and escarpments are rugged areas with very steep and irregular slopes; and plains are flat-lying land that lies above the valley.

The main rivers in the planning area are the Missouri River which runs along the eastern border of LPSNRD and Cass County, and the Platte River which runs along the northern border of the NRD. Several important tributaries are also located within the planning area including, but not limited to: Salt Creek, Haines Branch Creek, Olive Brach Creek, Hickman Branch, Stevens Creek, Weeping Water Creek, Oak Creek, Rock Creek, and Wahoo Creek. Major waterbodies within the planning area include Branched Oak Lake, Pawnee Lake, Twin Lakes, Conestoga Lake, Yankee Hill Lake, Bluestem Lake, Olive Creek Lake, Stagecoach Lake, Wagon Train Lake, and Beaver Lake.[13]

The planning area includes one of the most heavily populated areas in the state, the City of Lincoln, with most of the remaining area comprised of developed communities, pasture/grassland, cropland, rivers and water bodies.

[13] Lower Platte South Natural Resources District. Public Lakes and Wildlife Management Areas. Accessed March 2019. https://lpsnrd.maps.arcgis.com/apps/MapJournal/index.html?appid=a07535d5d2f64bffbef4ca2ec6c8cd0e.

Figure 3: Planning Area Topography



DEMOGRAPHICS AND AT-RISK POPULATIONS

The planning area includes all of Lancaster and Cass Counties, and portions of Otoe, Seward, Butler, and Saunders Counties. While neither the NRD or U.S. Census Bureau collects specific demographic information for the NRD, it serves an estimated population of 336,312.[14] This population includes a range of demographics and persons at risk to natural and man-made disasters.

Table 18: Estimated Population for Planning Area

Age	Planning Area	State of Nebraska
<5	6.6%	6.9%
5-18	20.2%	20.7%
19-64	60.3%	57.6%
>64	12.9%	14.8%
Median	40.4	36.3

Source: U.S. Census Bureau
**Numbers include estimates from Lancaster and Cass Counties and the communities of Ashland, Brainard, Ceresco, and Valparaiso*

AT-RISK POPULATIONS

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."[15]

Dependent children under 19 years old are one of the most vulnerable populations to disasters.[16] 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 total 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 4 is a map of the school district boundaries. This list is comprehensive and does not represent only the school districts participating in this plan.

Table 19: School Inventory

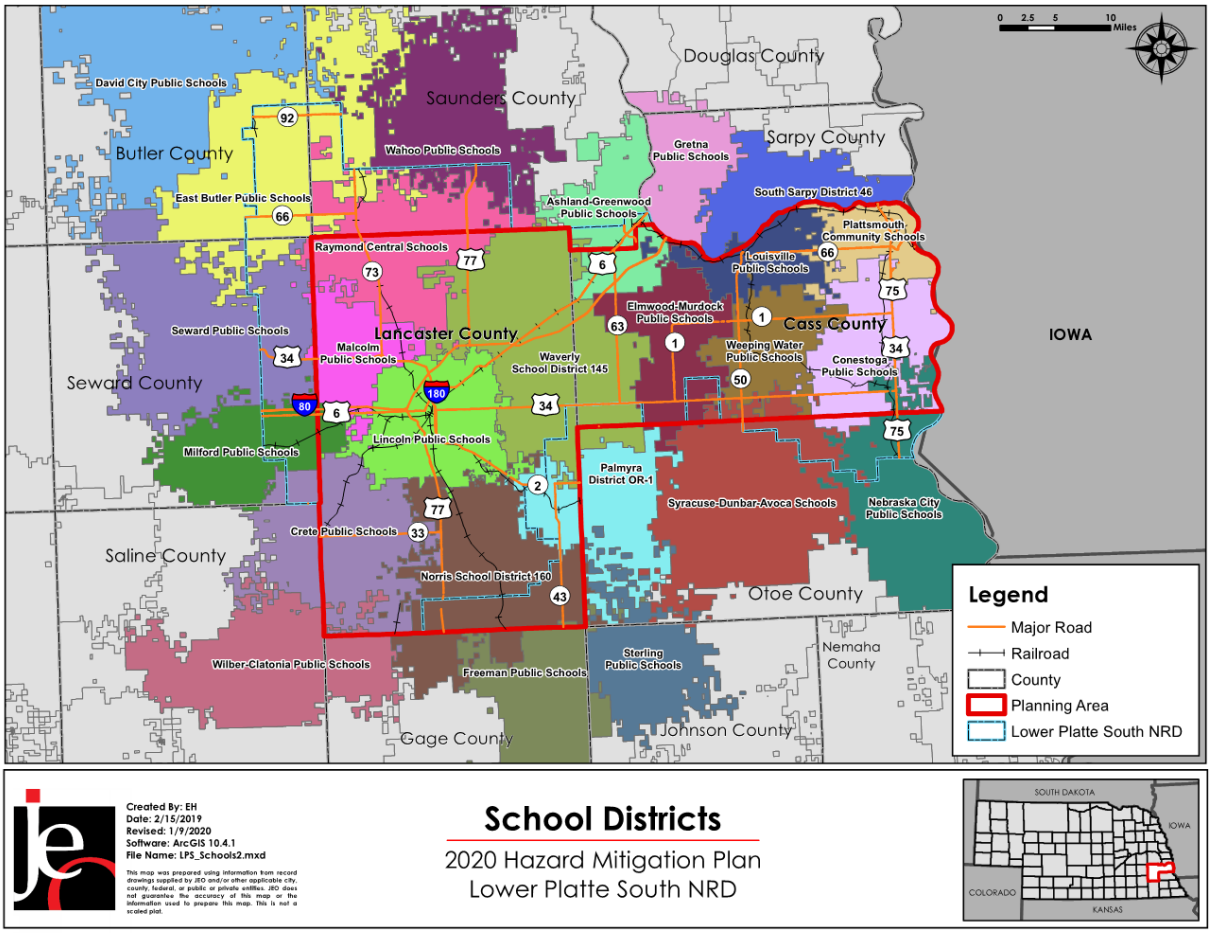
School District	Total Enrollment (2017-2018)
Conestoga Public Schools	705
Crete Public Schools	2,045
East Butler Public Schools	306
Elmwood-Murdock Public Schools	461
Lincoln Public Schools	41,737
Louisville Public Schools	664

[14] Lower Platte South Natural Resources District. 2019. Lower Platte South About. https://www.lpsnrd.org/about.
[15] United States Department of Homeland Security. June 2016. "National Response Framework Forth Edition." https://www.fema.gov/media-library-data/1572366339630-0e9278a0ede9ee129025182b4d0f818e/National_Response_Framework_4th_20191028.pdf.
[16] Flanagan, Gregory, Hallisey, Heitgerd, & Lewis. 2011. "A Social Vulnerability Index for Disaster Management." Journal of Homeland Security and Emergency Management, 8(11): Article 3.

Malcolm Public Schools	556
Norris Public Schools	2,358
Plattsmouth Community Schools	1,695
Raymond Central Public Schools	688
Waverly Public School District	2,061
Weeping Water Public Schools	315

Source: Nebraska Department of Education[17]

Figure 4: 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.[18] 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.

[17] Nebraska Department of Education. 2019. "Nebraska Education Profile: District and School Data." Accessed March 2019. http://nep.education.ne.gov/.
[18] Center for Injury Research and Policy. January 2011. "Snow Shoveling Safety." Accessed July 2017. http://www.nationwidechildrens.org/cirp-snow-shoveling.

While the previously identified populations do live throughout the planning area, there is the potential that they will be located in higher concentrations at care facilities. Table 20 identifies the number and capacity of care facilities throughout the planning area.

Table 20: Inventory of Care Facilities

Jurisdiction	Hospitals	Hospital Beds	Health Clinics	Adult Care Homes	Adult Care Beds	Assisted Living Homes	Assisted Living Beds
Cass County	0	0	1	3	244	4	197
Lancaster County	9	1,352	17	16	1,609	42	2,466
*Ashland	0	0	1	1	97	1	129

Source: Nebraska Department of Health and Human Services[19,20,21,22]
**Ashland is located in Saunders County, however the community is participating in this plan update*

In addition to residents being classified as at-risk by age, there are other specific groups within the planning area that experience vulnerabilities related to their ability to communicate or their economic status. Table 21 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 21: ESL and Poverty At-Risk Populations

County	Percent That Speaks English as Second Language	Families Below Poverty Level
Cass County	1.9%	6.3%
Lancaster County	11.5%	14.0%

Source: U.S. Census Bureau[23,24]

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

[19] Department of Health and Human Services. November 2018. "Assisted Living Facilities." http://dhhs.ne.gov/publichealth/Documents/ALF%20Roster.pdf.
[20] Department of Health and Human Services. November 2018. "Hospitals." http://dhhs.ne.gov/publichealth/Documents/Hospital%20Roster.pdf.
[21] Department of Health and Human Services. November 2018. "Long Term Care Facilities." http://dhhs.ne.gov/publichealth/Documents/LTCRoster.pdf.
[22] Department of Health and Human Services. November 2018. "Rural Health Clinic." http://dhhs.ne.gov/publichealth/Documents/RHC_Roster.pdf.
[23] U.S. Census Bureau. 2018. "Language Spoken at Home: 2016 American Community Survey (ACS) 5-year estimates." https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.
[24] U.S. Census Bureau. 2018. "Selected Economic Characteristics: 2016 ACS 5-year estimate." https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.

While the planning area is primarily White, not Hispanic, diversity has increased since 2010. However, these small changes in racial inequity will likely not significantly affect the community's vulnerability to hazards (Table 22).

Table 22: Racial Composition Trends

	2010		2017		
RACE	NUMBER	% OF TOTAL	NUMBER	% OF TOTAL	% CHANGE
WHITE, NOT HISPANIC	278,280	90.0%	293,991	87.4%	-2.60%
BLACK	9,341	3.0%	12,511	3.7%	0.70%
AMERICAN INDIAN AND ALASKAN NATIVE	1,803	0.6%	1,770	0.5%	-0.10%
ASIAN	9,888	3.2%	13,102	3.9%	0.70%
NATIVE HAWAIIAN AND OTHER PACIFIC ISLANDER	220	0.1%	273	0.1%	0.00%
OTHER RACES	3,208	1.0%	4,800	1.4%	0.40%
TWO OR MORE RACES	6,447	2.1%	9,865	2.9%	0.80%
TOTAL POPULATION	309,187	-	336,312	-	8.07%

Source: U.S. Census Bureau[25,26]
**Numbers include estimates from Cass and Lancaster Counties*

BUILT ENVIRONMENT AND STRUCTURAL INVENTORY

The US Census provides information related to housing units and potential areas of vulnerability. The selected characteristics examined in Table 23 include: lacking complete plumbing facilities; lacking complete kitchen facilities; no telephone service available; housing units that are mobile homes; and housing units with no vehicles.

Table 23: Selected Housing Characteristics

	Cass	Lancaster	Total
Occupied housing units	**9,894 (86.9%)**	**120,962 (95.0%)**	**130,856**
Lacking complete plumbing facilities	0.4%	0.3%	**378**
Lacking complete kitchen facilities	1.2%	0.8%	**1,108**
No telephone service available	2.8%	2.4%	**3,238**
Housing unit with no vehicles available	3.3%	6.1%	**7,676**
Mobile Homes	3.6%	1.9%	**2,831**

Source: U.S. Census Bureau, 2018[27]
**Indicated percentages are determined based on total housing units*

Less than three percent of housing units lack access to landline telephone service. This does not necessarily indicate that there is not a phone in the housing unit, as cellular telephones are increasingly a primary form of telephone service. However, this lack of access to landline telephone service does represent a population at increased risk to disaster impacts. Reverse 911 systems are designed to contact households via landline services and as a result, some homes in hazard prone areas may not receive notification of potential impacts in time to take protective actions. Emergency managers should continue to promote the registration of cell phone numbers with emergency alert systems.

Approximately two percent of housing units in the planning area are mobile homes. Cass County has more mobile homes than Lancaster County, however they make up less than four percent of total housing type. Mobile homes have a higher risk of sustaining damages during high wind events, tornadoes, severe

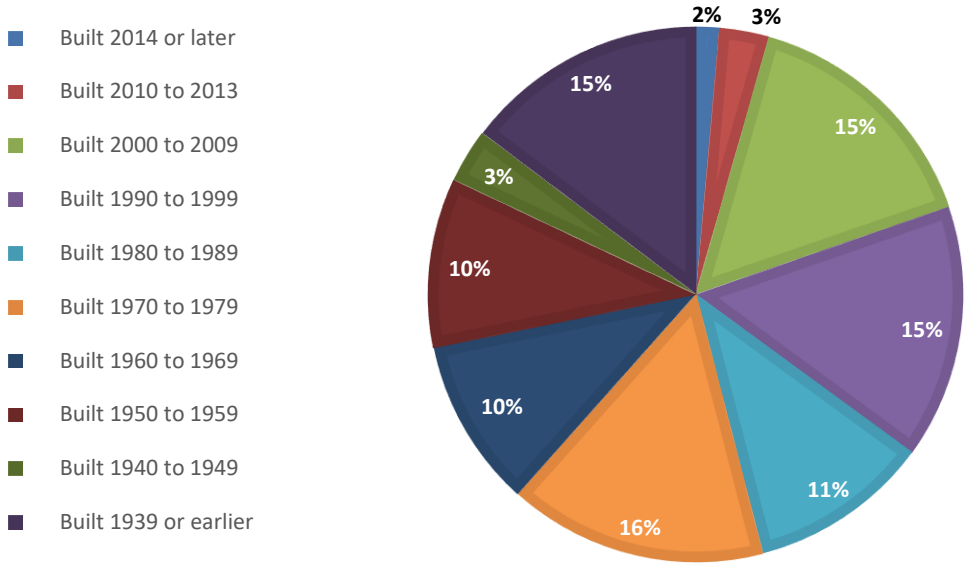
[25] U.S. Census Bureau. 2018. "Race: 2010 ACS 5-year estimate." https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.
[26] U.S. Census Bureau. 2018. "Race: 2016 ACS 5-year estimate." https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.
[27] U.S. Census Bureau. 2018. "Selected Housing Characteristics: 2016 ACS 5-year estimate." https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.

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.

Cass County has a higher percentage of unoccupied housing units. Unoccupied homes may not be maintained as well as occupied housing, thus adding to their vulnerability. Furthermore, approximately six percent of all housing units in the planning area do not have a vehicle available. Households without vehicles may have difficulty evacuating during a hazardous event and a reduced ability to access resources in time of need.

Housing age throughout the planning area is spread relatively evenly between prior to 1939 through 2009, with only a small percentage of homes built after 2010 (Figure 5). 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 5: Housing Age in Planning Area



State and Federally Owned Properties

The following table provides an inventory of state and federally-owned properties within the planning area by county. Note that this list includes counties not participating in this plan update but have properties which fall within the Lower Platte South NRD's jurisdictional boundaries. Only properties located within the NRD boundaries are included here.

Table 24: State and Federally-Owned Facilities

Facility	Nearest Community
Cass County	
Civil Bend (USACE)	Union
Eugene T. Mahoney State Park	Ashland
Louisville State Recreation Area	Louisville
Platte River State Park	South Bend
Rakes Creek Wildlife Management Area	Murray
Randall W. Schilling Wildlife Management Area	Plattsmouth
Van Horn's Bend (USACE)	Union
William Gillmour Wildlife Management Area	Plattsmouth
Lancaster County	

Facility	Nearest Community
Administrative Services Department of Nebraska	Lincoln
Aeronautics Dept Of Nebraska	Lincoln
Assistive Technology Partnership & Nebraska Child Fund	Lincoln
Athletic Commission State	Lincoln
Banking & Finance Department of Nebraska	Lincoln
Barber Examiners Board of Nebraska, Energy Office	Lincoln
Bluestem State Recreation Area & Wildlife Management Area	Martell
Branched Oak State Recreation Area & Wildlife Management Area	Raymond
Conestoga Lake State Recreation Area & Wildlife Management Area	Denton
Cotton Tail Wildlife Management Area	Sprague
Deaf & Hard Hearing Commission	Lincoln
Economic Development Department, Revenue Department of NE, Tourism Commission, Employee Relations, Material Division, Risk Management, Task Force for Building Renewal, Agriculture Department of NE, Crime Commission, Education Department of NE, Equal Opportunity Commission, Ethanol Board, Health & Human Services Department of NE, Law Enforcement & Criminal Justice, Nebraska Department of Motor Vehicles, & NE Department of Natural Resources	Lincoln
Engineers & Architects Board Of NE, Geologists Board of NE, & Landscape Architects State Board of NE	Lincoln
Environmental Trust	Lincoln
Farm Service Agency	Lincoln
Federal Aviation Administration	Lincoln
Federal Bureau of Investigation, National Agricultural Statistics Service, Natural Resources Conservation Service, National Soil Survey Center, Office of Inspector General, Rural Development, US Court, National Park Service, US Department of Labor, Social Security Administration, Federal Highway Administration, Federal Motor Carrier Safety Administration	Lincoln
Fire Marshal	Lincoln
Game and Parks	Lincoln
Hedgefield Wildlife Management Area	Panama
Helmuth Public Access Area	Raymond
Insurance Dept Of Nebraska	Lincoln
Jack Sinn Memorial Wildlife Management Area	Ceresco
Killdeer Wildlife Management Area	Martell
Labor Department of Administrative Offices	Lincoln
Lincoln USDA Service Center	Lincoln
Little Salt Creek West Wildlife Management Area	Raymond
Little Salt Fork Marsh Preserve Wildlife Management Area	Raymond
Merganser Wildlife Management Area	Martell
National Agroforestry Center	Lincoln
National Guard Headquarters	Lincoln
National Soil Mechanics Center	Lincoln
Nebraska Forest Service	Lincoln
Nebraska Public Service Commission, Abstracters Boards of Examiners, & Department of Environmental Quality	Lincoln
Nebraska State Penitentiary	Lincoln
Olive Creek State Recreation Area & Wildlife Management Area	Hallam
Pawnee Lake State Recreation Area & Wildlife Management Area	Malcolm
State Personnel Division	Lincoln
Roads Department State Headquarters	Lincoln
Stagecoach Lake State Recreation Area & Wildlife Management Area	Hallam
State Patrol	Lincoln

Facility	Nearest Community
Surplus Property	Lincoln
Tanglewood Wildlife Management Area	Hallam
Teal Wildlife Management Area	Hallam
USDA Agricultural Research Service	Lincoln
USGS Water Resources Division	Lincoln
VA Nebraska-Western Iowa Health Care	Lincoln
Wagon Train State Recreation Area & Wildlife Management Area	Hickman
Wild Plum Wildlife Management Area	Crete
Wildwood Wildlife Management Area	Valparaiso
Yankee Hill Wildlife Management Area	Lincoln
Butler County	
Timber Point Watershed Management Area	Brainard
Otoe County	
Wilson Creek Wildlife Management Area	Otoe
Saunders County	
Catfish Run Wildlife Management Area	Ashland
Jack Sinn Memorial Wildlife Management Area	Ceresco
Larkspur Watershed Management Area	Valparaiso
Red Cedar Watershed Management Area	Brainard
Seward County	
Branched Oak Wildlife Management Area	Raymond
Twin Lakes Wildlife Management Area	Pleasant Dale
Meadowlark Wildlife Management Area	Valparaiso

Source: Nebraska Game and Parks[28]

HISTORICAL SITES

According to the National Register of Historic Places for Nebraska by the National Park Service (NPS), there are 140 historic sites located in the planning area.

Table 25: Historical Sites

Site Name	Date Listed	Nearest Community	County	In Floodplain?
Agricultural Hall	12/10/2010	Lincoln	Lancaster County	No
Albert Watkins House	4/3/1989	Lincoln	Lancaster County	No
Antelope Grocery	3/17/1988	Lincoln	Lancaster County	No
Arthur C Ziemer House	11/23/1977	Lincoln	Lancaster County	No
Ashland Archeological District	11/29/2000	Ashland	Saunders County	No
Ashland Archeological Site	2/10/1975	Ashland	Cass County	No
Ashland Bridge	6/29/1992	Ashland	Saunders County	No
Ashland Public Library	1/27/1983	Ashland	Saunders County	No
Barnes Oil Company	12/5/2002	Ashland	Saunders County	No
Barr Terrace	10/1/1979	Lincoln	Lancaster County	No
Beal Slough Bridge	6/29/1992	Lincoln	Lancaster County	No
Beatrice Creamery Company Lincoln Plant	3/12/2012	Lincoln	Lancaster County	Yes
Boulevards Historic District	12/10/2008	Lincoln	Lancaster County	No
Bridge	6/29/1992	Louisville	Cass County	No
Brownbilt Residential Historic District	8/29/2012	Lincoln	Lancaster County	No
Burckhardt House	6/25/1999	Lincoln	Lancaster County	No
Burr Block	5/18/1979	Lincoln	Lancaster County	No

28 Nebraska Game and Parks. 2019. "Public Access ATLAS." [Web Map]. https://www.google.com/search?q=public+atlas+access&rlz=1C1GCEA_enUS812US812&oq=public+atlas+access&aqs=chrome..69i57j69i60j0l4.3399j0j7&sourceid=chrome&ie=UTF-8.

Site Name	Date Listed	Nearest Community	County	In Floodplain?
Capt John O'Rourke House	3/2/2006	Plattsmouth	Cass County	No
Cass County Courthouse	1/10/1990	Plattsmouth	Cass County	No
Charles Hurlbut House	9/17/1999	Lincoln	Lancaster County	No
Chicago, Burlington & Quincy Steam Locomotive No. 710	6/20/1997	Lincoln	Lancaster County	Yes
Christian Kupke Farmstead	12/19/2012	Murdock	Cass County	No
Christian Record Building	12/1/1986	Lincoln	Lancaster County	No
City Hall	10/15/1969	Lincoln	Lancaster County	No
College View Public Library	6/28/1984	Lincoln	Lancaster County	No
Davis Theodore Site	5/19/1972	Weeping Water	Cass County	No
Eddy-Taylor House	7/21/1983	Lincoln	Lancaster County	No
Edgar A. Burnett House	7/12/2006	Lincoln	Lancaster County	No
Ehlers Round Barn	6/30/1995	Roca	Lancaster County	No
Fairview	10/15/1966	Lincoln	Lancaster County	No
Federal Trust Building	4/25/2002	Lincoln	Lancaster County	No
First National Bank Building	3/5/1998	Lincoln	Lancaster County	No
First State Bank of Bethany	7/24/1986	Lincoln	Lancaster County	No
Frank and Emma Gillen House	3/5/1998	Lincoln	Lancaster County	No
Frank and Nelle Cochrane Woods House	6/30/1995	Lincoln	Lancaster County	No
Frank M. Spalding House	3/25/1999	Lincoln	Lancaster County	No
Gibson House	3/20/1986	Weeping Water	Cass County	No
Gilmore, Walker, Site (22CC28)	10/15/1966	Murray	Cass County	No
Glenn and Addie Perry Farmhouse	11/8/2006	Plattsmouth	Cass County	No
Goffriend Gustav Pitz Barn	8/27/2012	Plattsmouth	Cass County	No
Gold and Company Store Building	10/19/1982	Lincoln	Lancaster County	No
Government Square	4/15/2004	Lincoln	Lancaster County	No
Greek Row Historic District	6/25/1997	Lincoln	Lancaster County	No
Guy A. Brown House	3/5/1998	Lincoln	Lancaster County	No
Harris House	9/2/1982	Lincoln	Lancaster County	No
Hayward School	8/23/1985	Lincoln	Lancaster County	Yes
Helmer-Winnett-White Flats	10/1/1979	Lincoln	Lancaster County	No
Herter Farmstead	7/24/2000	Walton	Lancaster County	No
Herter Farmstead (Boundary Increase)	7/28/2004	Walton	Lancaster County	No
Hotel Capital	12/5/1983	Lincoln	Lancaster County	No
Hurlbut, Aeneas--Yates, Charles, House	9/17/1999	Lincoln	Lancaster County	No
Israel Beetison House	4/18/1977	Ashland	Saunders County	No
James A. Beattie House	12/4/1990	Lincoln	Lancaster County	No
James and Margaret Greer Farmstead	3/21/2011	Alvo	Cass County	No
James D. Calhoun House	4/26/2002	Lincoln	Lancaster County	No
Jasper Newton Bell House	6/21/1984	Lincoln	Lancaster County	No
John and Christina Yost House	4/26/2002	Lincoln	Lancaster County	No
John M. Thayer House	12/5/2002	Lincoln	Lancaster County	No
Kehlbeck Farmstead	9/26/1985	Avoca	Cass County	No

Site Name	Date Listed	Nearest Community	County	In Floodplain?
Lancaster Block	4/12/1989	Lincoln	Lancaster County	No
Lewis-Syford House	2/18/1971	Lincoln	Lancaster County	No
Lincoln Army Air Field Regimental Chapel	6/17/1993	Lincoln	Lancaster County	No
Lincoln Haymarket Historic District	7/8/2014	Lincoln	Lancaster County	No
Lincoln Liberty Life Insurance Building	1/19/1988	Lincoln	Lancaster County	No
Lincoln Veterans Administration Hospital Historic District	9/10/2012	Lincoln	Lancaster County	No
Lincoln YWCA Building	6/21/1984	Lincoln	Lancaster County	No
Lyman Terrace	10/1/1979	Lincoln	Lancaster County	No
Manley School	12/30/2004	Manley	Cass County	No
Masonic Temple	8/5/2005	Lincoln	Lancaster County	No
McLaughlin-Waugh-Dovey House	10/14/1980	Plattsmouth	Cass County	No
McWilliams House	6/25/1999	Lincoln	Lancaster County	No
Mount Emerald and Capitol Additions Historic Residential District	6/5/1980	Lincoln	Lancaster County	No
Municipal Lighting and Waterworks Plant	7/24/1986	Lincoln	Lancaster County	No
Murphy, William L. and Sydney V., House	11/4/1994	Lincoln	Lancaster County	No
Naomi Institute	3/24/1977	Murray	Cass County	No
National Bank of Ashland	1/27/1983	Ashland	Saunders County	No
Nebraska City to Fort Kearny Cutoff Ruts at Spring Creek Prairie	7/11/2002	Lincoln	Lancaster County	No
Nebraska Governor's Mansion	3/12/2008	Lincoln	Lancaster County	No
Nebraska State Capitol	10/16/1970	Lincoln	Lancaster County	No
Nebraska State Historical Society Building	8/21/2003	Lincoln	Lancaster County	No
Nebraska Telephone Company Building	11/16/1978	Lincoln	Lancaster County	No
Nehawka Flint Quarries	1/26/1970	Nehawka	Cass County	No
Nehawka Public Library	12/5/2002	Nehawka	Cass County	No
Nimrod Ross House	6/25/1999	Lincoln	Lancaster County	No
Nine-Mile Prairie	7/30/1986	Lincoln	Lancaster County	No
Old Main, Nebraska Wesleyan University	5/21/1975	Lincoln	Lancaster County	No
Old University Library	8/6/1975	Lincoln	Lancaster County	No
Olive Branch Bridge	6/29/1992	Sprague	Lancaster County	No
Palisade and Regent Apartments	3/5/1998	Lincoln	Lancaster County	No
Park Hill	9/3/2010	Lincoln	Lancaster County	No
Park Manor Residential Historic District	9/4/2013	Lincoln	Lancaster County	No
Paul Fitzgerald House	3/2/2006	Louisville	Cass County	No
Paul Gering House	7/12/2006	Plattsmouth	Cass County	No
Perry, Glenn and Addie, Farmhouse	11/8/2006	Plattsmouth	Cass County	No

Site Name	Date Listed	Nearest Community	County	In Floodplain?
Peter Peterson Farmstead	2/11/1980	Waverly	Lancaster County	No
Phi Delta Theta Fraternity House	5/28/1986	Lincoln	Lancaster County	No
Phi Kappa Tau Fraternity House	11/25/2005	Lincoln	Lancaster County	No
Pioneers Park	6/17/1993	Lincoln	Lancaster County	No
Plattsmouth Bridge	4/15/1993	Plattsmouth	Cass County	No
Plattsmouth Main Street Historic District	9/26/1985	Plattsmouth	Cass County	No
President and Ambassador Apartments	12/10/1993	Lincoln	Lancaster County	No
Quinn Chapel African Methodist Episcopal Church and Parsonage	6/25/1999	Lincoln	Lancaster County	No
R.O. Philips House	11/29/1979	Lincoln	Lancaster County	No
R.O. Stake House	4/27/2005	Lincoln	Lancaster County	No
Retzlaff Farmstead	5/31/1979	Walton	Lancaster County	No
Rock Island Depot	9/3/1971	Lincoln	Lancaster County	No
Rose Kirkwood Brothel	8/28/2012	Lincoln	Lancaster County	No
Royer-Williams House	6/14/1982	Lincoln	Lancaster County	No
Ryons-Alexander House	7/8/1982	Lincoln	Lancaster County	No
Schrader Archeological Site	1/21/1974	Roca	Lancaster County	No
Scottish Rite Temple	12/1/1986	Lincoln	Lancaster County	No
Sheldon Memorial Art Gallery	9/3/2013	Lincoln	Lancaster County	No
Snoke Farmstead	3/5/1998	Eagle	Cass County	No
South Bottoms Historic District	7/17/1986	Lincoln	Lancaster County	No
St. Charles Apartments	9/12/1985	Lincoln	Lancaster County	No
St. Stephen's Episcopal Church	1/25/1979	Ashland	Saunders County	No
State Arsenal	9/17/1981	Lincoln	Lancaster County	No
Stuart Building	12/23/2003	Lincoln	Lancaster County	No
Temple of Congregation B'nai Jeshurun	6/25/1982	Lincoln	Lancaster County	No
Terminal Building	12/29/1986	Lincoln	Lancaster County	No
The Elms	3/24/1977	Elmwood	Cass County	No
Theodore A. Kiesselbach House	7/1/1994	Lincoln	Lancaster County	No
Thomas P Kennard House	4/16/1969	Lincoln	Lancaster County	No
Tifereth Israel Synagogue	5/9/1985	Lincoln	Lancaster County	No
Union Jail	7/12/2006	Union	Cass County	No
University Place Historic Residential District	2/7/2003	Lincoln	Lancaster County	No
Upper Oak Creek Descent Ruts of the Woodbury Cutoff, Ox Bow Trail of the California Road	11/27/1992	Brainard	Butler County	No
Veith Building	9/18/1980	Lincoln	Lancaster County	No
W.F. Hitchcock House	12/5/2002	Lincoln	Lancaster County	No
Walker Gilmore Site	10/15/1966	Murray	Cass County	No
Weeping Water Historic District	12/8/1972	Weeping Water	Cass County	No
Whitehall	10/29/1982	Lincoln	Lancaster County	No
William H. Charlton House	1/25/1997	Roca	Lancaster County	No

Site Name	Date Listed	Nearest Community	County	In Floodplain?
William H. Ferguson House	11/29/1972	Lincoln	Lancaster County	No
William H. Tyler House	4/6/1978	Lincoln	Lancaster County	No
Woods Brothers Building	9/18/1980	Lincoln	Lancaster County	No
Woodshire Residential Historic District	3/29/2011	Lincoln	Lancaster County	No
Wyuka Cemetery	7/19/1982	Lincoln	Lancaster County	No
Yost, John H. and Christina, House	4/26/2002	Lincoln	Lancaster County	No
Young Cemetery Cabin	12/30/2004	Plattsmouth	Cass County	No

Source: National Park Service[29]

29 National Park Service. June 2019. "National Register of Historic Places NPGallery Database." https://npgallery.nps.gov/nrhp.

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SECTION FOUR
RISK ASSESSMENT

INTRODUCTION

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

Table 26: Term Definitions

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

METHODOLOGY

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

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.

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

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

AVERAGE ANNUAL DAMAGES AND FREQUENCY

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

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

- **Total Damages in Dollars:** This is the total dollar amount of all property damages and crop damages as recorded in federal, state, and local data sources. The limitation to these data sources is that dollar figures usually are estimates and often do not include all damages from every event, but only officially recorded damages from reported events.
- **Total Years of Record:** This is the span of years there is data available for recorded events. During this planning process, vetted and cleaned up National Centers for Environmental Information (NCEI) data is available for January 1996 to November 2018. Although some data is available back to 1950, this plan update only utilizes the more current and more accurate data available. Wildfire data is available from the Nebraska Forest Service from 2000 to 2018.
- **Number of Hazard Events:** This shows how often an event occurs. The frequency of a hazard event will affect how a community responds. A thunderstorm may not cause much damage each time, but multiple storms can have an incremental effect on housing and utilities. In contrast, a rare tornado can have a widespread effect on a city.

An example of the Event Damage Estimate is found below:

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

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

Each hazard will be included, while those which have caused significant damages or occurred in significant numbers are discussed in detail. It should be noted NCEI data is not all inclusive and it provides very limited information on crop losses. To provide a better picture of the crop losses associated with the hazards within the planning area, crop loss information provided by the Risk Management Agency (RMA) of the USDA was also utilized for this update of the plan for counties with available data. The collected data was from 2000 to 2018. Data for all the hazards are not always available, so only those with an available dataset are included in the loss estimation.

HAZARD IDENTIFICATION

The identification of relevant hazards for the planning area began with a review of the 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 27: Hazards Addressed in the Plan

Hazards Addressed in the Plan		
Agricultural Disease (Animal and Plant)	Extreme Heat	Severe Thunderstorms
Chemical Fixed Sites	Flooding	Severe Winter Storms
Chemical Transportation	Grass/Wildfires	Terrorism
Dam Failure	Hail	Tornadoes
Drought	High Winds	
Earthquakes	Levee Failure	

HAZARD ELIMINATION

Given the location and history of the planning area, several hazards from the 2015 Lower Platte South NRD HMP as well as the State HMP were eliminated from further review. These hazards are listed below with a brief explanation of why the hazards were eliminated.

ELIMINATED HAZARDS FROM 2015 LOWER PLATTE SOUTH NRD HAZARD MITIGATION PLAN:

- **Landslides -** While there is data available related to landslides across the state, only one event which caused no damage occurred in Cass County and no events have occurred in Lancaster County. The following table outlines the number of recorded landslide events that have occurred in the planning area. This is consistent with the 2014 Nebraska State HMP.

Table 28: Known Landslides in the Planning Area by County

County	Number of Landslides	Total Estimated Damages
Cass	1	$0
Lancaster	0	$0

Source: Nebraska Hazard Mitigation Plan, 2014[30]; University of Nebraska-Lincoln, 2018[31]

- **Radiological Fixed Facilities* -** Both state and local agencies have developed appropriate and extensive plans and protocols relative to the two nuclear facilities located in the state. The existing plans and protocols are reviewed, updated, and exercised on a regular basis. Due to the extensive planning and regulations related to this threat it will not be further profiled in this plan. This approach is consistent with the 2014 Nebraska State Hazard Mitigation Plan.

- **Radiological Transportation* -** There have been no incidents reported in the planning area or the state that have required assistance beyond what is considered regular roadside services. Further, the transportation of radiological materials is heavily regulated and monitored. There are other plans across the state that have thoroughly addressed this threat, therefore it will not be further profiled for this plan. This approach is consistent with the 2014 Nebraska HMP.

- **Transportation* –** The 2014 Nebraska HMP identifies Transportation as high risk for Region 2 (which includes the entire planning area). However, descriptions of major transportation routes, airports, rail lines, uses, and significant accident events are described throughout the plan and in hazard profiles as appropriate. Due to this, this hazard is not fully profiled in this plan.

[30] Nebraska Emergency Management Agency. 2014. "State of Nebraska Hazard Mitigation Plan."
[31] University of Nebraska-Lincoln. 2018. "Database of Nebraska Landslides." http://snr.unl.edu/data/geologysoils/landslides/landslidedatabase.aspx.

- **Urban Fire* -** Fire departments across the planning area have mutual aid agreements in place to address this threat, and typically this hazard is addressed through existing plans and resources. As such, urban fire will not be fully profiled for this plan. Discussion relative to fire will be focused on wildfire and the potential impacts they could have on the built environment. This approach is consistent with the 2014 Nebraska State Hazard Mitigation Plan.

Note: Eliminated hazards marked with an Asterix (*) were also listed in the 2014 State of Nebraska HMP and were eliminated for further review.

ELIMINATED HAZARDS FROM 2014 STATE OF NEBRASKA HAZARD MITIGATION PLAN

- **Power Failure –** Descriptions of power failure vulnerabilities and occurrences are included, as appropriate, in hazard profiles. Additionally, local power utilities across the state have extensive regulation and recovery plans related to power failure. Therefore, power failure will not be fully profiled for this plan as a hazard.

- **Public Health Emergency –** The 2014 Nebraska HMP identifies Public Health Emergencies as low risk for Region 2 (which includes the entire planning area) with a composite ranking score of 25.52. The local Planning Team did not identify this hazard to be included. As such, this hazard will not be fully profiled in this plan.

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 29: Regional Risk Assessment

HAZARD	PREVIOUS OCCURRENCE EVENTS/YEARS	APPROXIMATE ANNUAL PROBABILITY	LIKELY EXTENT
AGRICULTURAL ANIMAL DISEASE	32/5	100%	~8 animals
AGRICULTURAL PLANT DISEASE	38/19	100%	Unavailable
CHEMICAL FIXED SITES	163/30	100%	~887 Gallons
CHEMICAL TRANSPORTATION	428/48	100%	~0 to 23,000 Gallons
TERRORISM	2/48	<1%	Unknown
DAM FAILURE	3/106	~3%	Varies by Structure
DROUGHT	412/1,488 months	28%	D1-D2
EARTHQUAKES	0/120	0%	>2.5 Magnitude
EXTREME HEAT	Avg 4 days per year	100%	>100°F
FLOODING	106/23	100%	Some inundation of structures and roads near streams. Some evacuations of people may be necessary (<1% of population)
GRASS/WILDFIRES	1,178/19	100%	<12 acres Some homes and structures threatened or at risk
HAIL	497/23	100%	H2-H5 Avg 1.14"; Range 0.52-5.0"
HIGH WINDS	42/23	100%	≤50 mph Avg 55mph; Range 35-57 EG
LEVEE FAILURE	3	~1%	Varies by Extent
SEVERE THUNDERSTORMS	238/23	100%	≥1" rainfall Avg 55 mph winds; Range 45-85 EG
SEVERE WINTER STORMS	150/23	100%	0.25" – 0.5" Ice 20°-40° below zero (wind chill) 4-8" snow 25-35 mph winds
TORNADOES	47/23	100%	Avg: EF0 Range EF0-EF4

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

Table 30: Loss Estimation for the Planning Area

HAZARD TYPE		Count	Property	Crop[2]
Agricultural Disease	Animal Disease[1]	32	258	N/A
	Plant Disease[2]	38	N/A	$287,111
Chemical Fixed Sites[3] *4 injuries*		163	$750,000	N/A
Chemical Transportation[4] *1 injury*		428	$2,028,294	N/A
Terrorism[5]		2	<$1,000,000	N/A
Dam Failure[6]		3	N/A	N/A
Drought[7]		412/1,488 months	$0	$92,224,043
Earthquake[8]		0	$0	$0
Extreme Heat[7,9]		Avg 4 days per year	$0	$3,997,922
Flooding[7]	Flash Flood	53	$5,067,000	$2,362,042
	Flood	53	$102,024,000	
Grass/Wildfires[10] *2 deaths, 1 injury*		1,178	13,091 acres	$64,275
Hail[7]		497	$3,000,000	$3,658,898
High Winds[7] *1 death, 1 injury*		42	$28,000	$240,237
Levee Failure		3	N/A	N/A
Severe Thunderstorms[7] *3 injuries*	Thunderstorm Wind	217	$2,049,000	$7,975,276
	Heavy Rain	8	$0	
	Lightning	13	$1,236,400	
Severe Winter Storms[7]	Blizzard	14	$0	$647,180
	Extreme Cold/Wind Chill	9	$0	
	Heavy Snow	8	$19,000,000	
	Ice Storm	6	$0	
	Winter Storm	82	$0	
	Winter Weather	31	$75,000	
Tornadoes[7] *1 death, 38 injuries*		47	$101,309,000	$79,324
Total		**2,927**	**$236,566,952**	**$111,536,308**

N/A: Data not available
1 NDA (2014-2018)
2 USDA RMA (2000-2018)
3 U.S. Coast Guard NRC (1990-2019)
4 PHMSA (1971-2018)
5 START (1970-2018)
6 Stanford NPDP (1911-2019)
7 NCEI (January 1996 to December 2018)
8 USGS (1900-2019)
9 HPRCC (1902-2018)
10 NFS (2000-2018)

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 31: SBA Declarations

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

Source: Small Business Administration, 2005-2018[32]

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

PRESIDENTIAL DISASTER DECLARATIONS

The presidential disaster declarations involving the planning area from 1953 to April 2019 are summarized in the following table. Declarations prior to 1962 are not designated by county on the FEMA website and are not included below.

Table 32: Presidential Disaster Declarations

Disaster Declaration Number	Declaration Date	Title	Affected Counties	Total Public Assistance
228	7/18/1967	SEVERE STORMS & FLOODING	Cass, Lancaster	-
406	10/20/1973	SEVERE STORMS & FLOODING	Cass, Lancaster	-
552	3/24/1978	STORMS, ICE JAMS, SNOWMELT & FLOODING	Cass	-
716	7/3/1984	TORNADOES & FLOODING	Cass	-
998	7/19/1993	SEVERE STORMS AND FLOODING	Cass, Lancaster	-
1190	11/1/1997	SEVERE SNOW STORMS, RAIN, AND STRONG WINDS	Cass, Lancaster	-
1517	5/25/2004	SEVERE STORMS, TORNADOES AND FLOODING	Cass, Lancaster	$13,351,657.77
1706	6/6/2007	SEVERE STORMS, FLOODING, AND TORNADOES	Cass	$6,109,252.52
1770	6/20/2008	SEVERE STORMS, TORNADOES, AND FLOODING	Cass, Lancaster	$36,258,650.19
1878	2/25/2010	SEVERE WINTER STORMS AND SNOWSTORM	Cass, Lancaster	$6,577,021.37
1902	4/21/2010	SEVERE STORMS, ICE JAMS, AND FLOODING	Cass, Lancaster	$3,112,391.72
1924	7/15/2010	SEVERE STORMS AND FLOODING	Cass	$49,926,354.50
1945	10/21/2010	SEVERE STORMS, FLOODING, TORNADO, AND STRAIGHT-LIN	Cass	$2,138,551.99
3245	9/13/2005	HURRICANE KATRINA EVACUEES	Cass, Lancaster	$393,813.27
3323	6/18/2011	FLOODING	Cass	-
4013	8/12/2011	FLOODING	Cass	$62,808,331.04
4185	7/28/2014	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	Cass	$3,837,595.30
4225	6/25/2015	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	Cass, Lancaster	$14,309,444.52
4325	8/1/2017	SEVERE STORMS, TORNADOES, AND STRAIGHT-LINE WINDS	Cass	$15,078,067.97
4420	3/21/2019	SEVERE WINTER STORM, STRAIGHT-LINE WINDS, AND FLOODING	Cass, Lancaster	$1,858,661.84

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

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

CLIMATE ADAPTATION

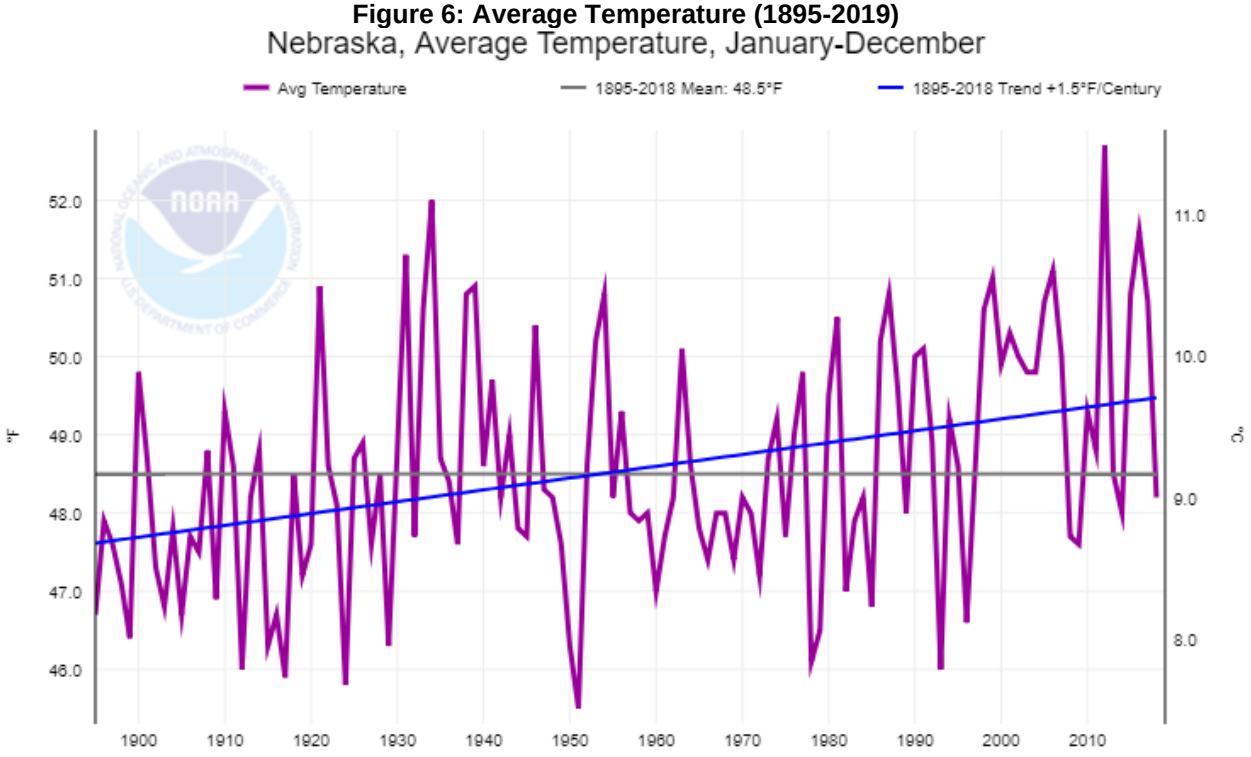
Long term climate trends have increased and will continue to increase the vulnerability to hazards across the planning area. Since 1895, Nebraska's overall average temperature has increased by almost 2°F (Figure 6). This trend will likely contribute to an increase in the frequency and intensity of hazardous events, which will cause significant economic, social, and environmental impacts on Nebraskans.

As seen in Figure 7 and Figure 8, the United States is experiencing an increase in the number of billion-dollar natural disasters. Regardless of whether this trend is due to a change in weather patterns or due to increased development, the trend exists.

According to a recent University of Nebraska report (*Understanding and Assessing Climate Change: Implications for Nebraska,* 2014),[34] Nebraskans can expect the following from the future climate:

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

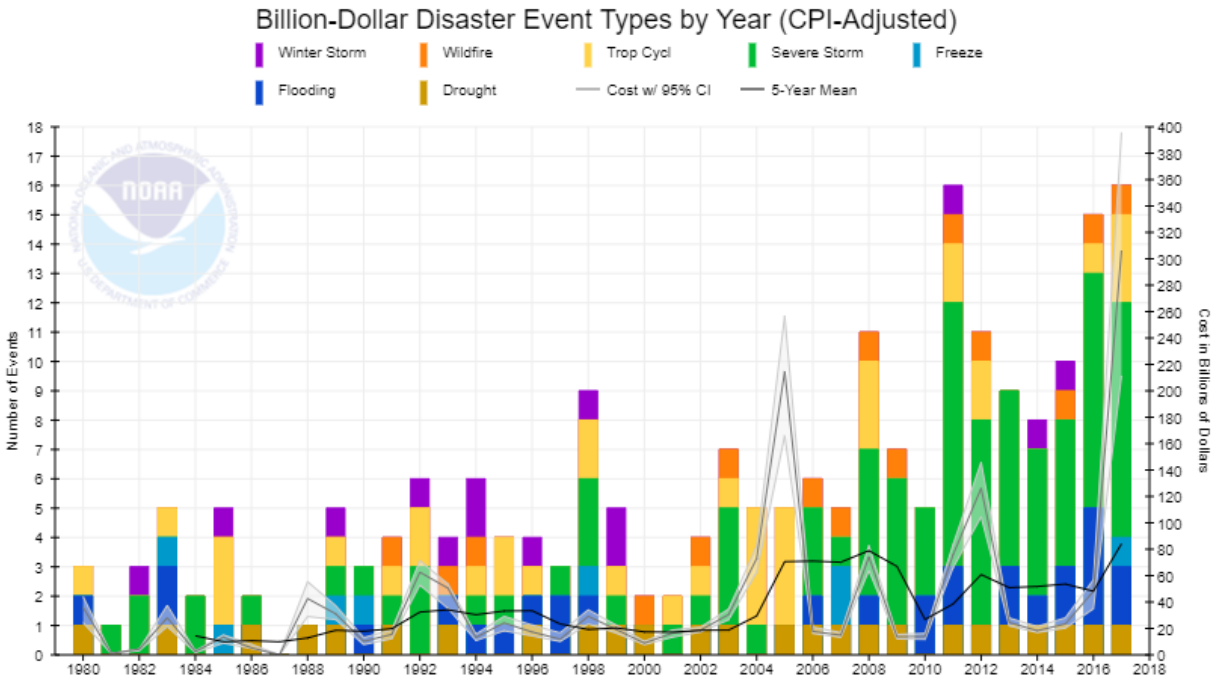
Figure 6: Average Temperature (1895-2019)



Source: NOAA/NCEI, 2019

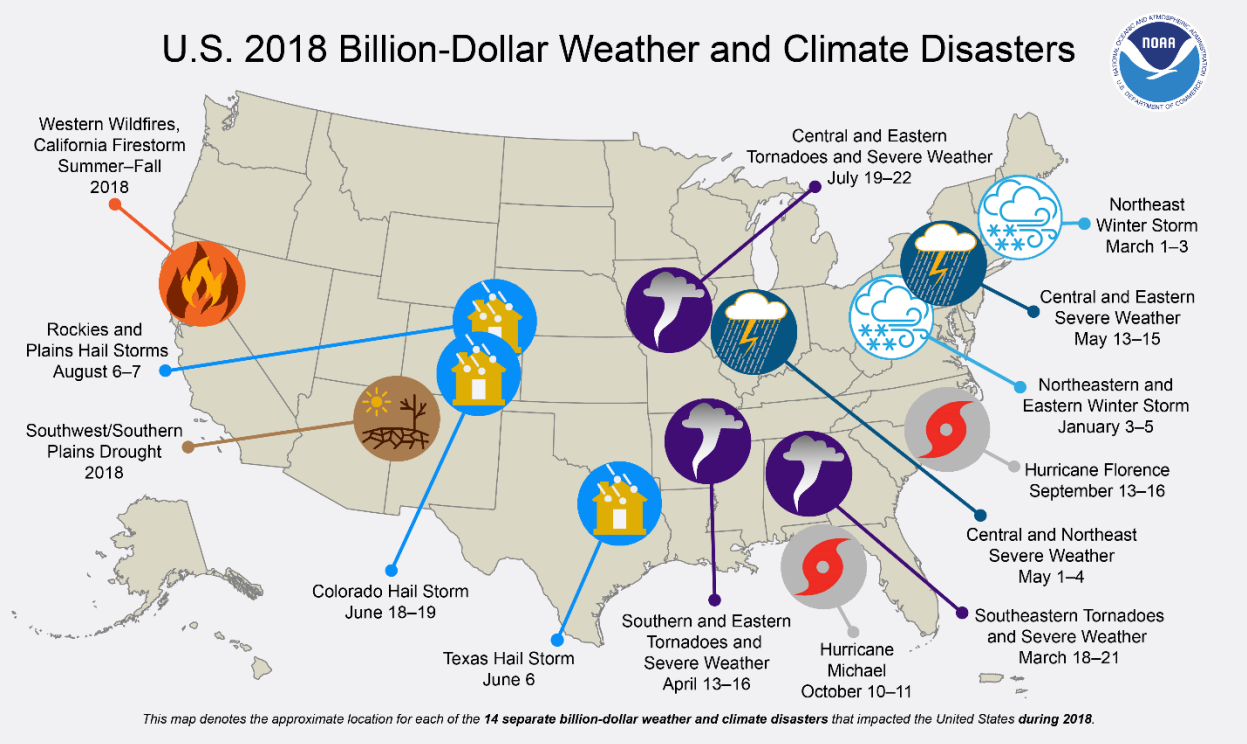
[34] Rowe, C.M., Bathke, D.J., Wilhite, D.A., & Oglesby, R.J. 2014. "Understanding and Assessing Climate Change: Implications for Nebraska."

Figure 7: Billion Dollar Disasters



Source: NOAA, 2018

Figure 8: Billion Dollar Weather and Climate Disasters

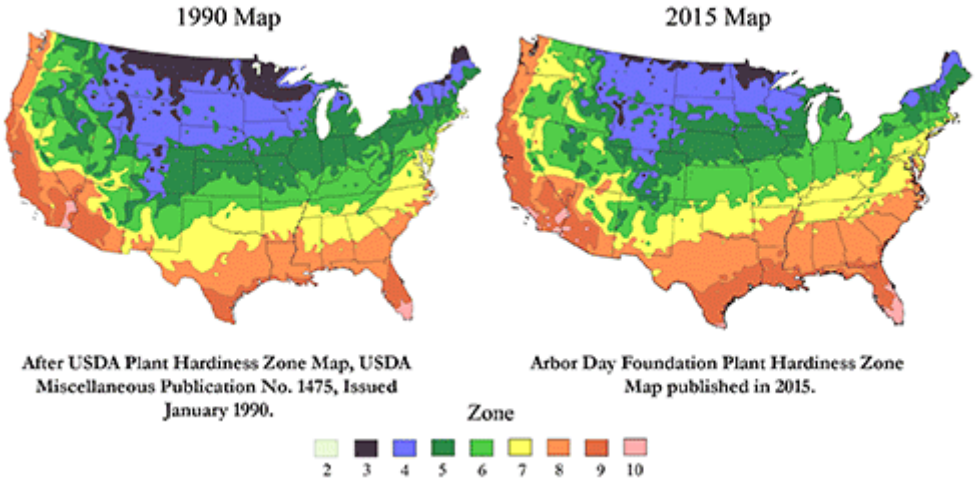


Source: NOAA, 2019

These trends will have a direct impact on water and energy demands. As the number of 100°F days increase, along with warming nights, the stress placed on the energy grid will likely increase and possibly lead to more power outages. Critical facilities and vulnerable populations that are not prepared to handle

periods of power outages, particularly during heat waves, will be at risk. Furthermore, the agricultural sector will experience an increase in droughts, an increase in grass and wildfires, changes in the growth cycle as winters warm, and changes in the timing and magnitude of rainfall. These added stressors on agriculture could have devastating economic effects if new agricultural and livestock management practices are not adopted.

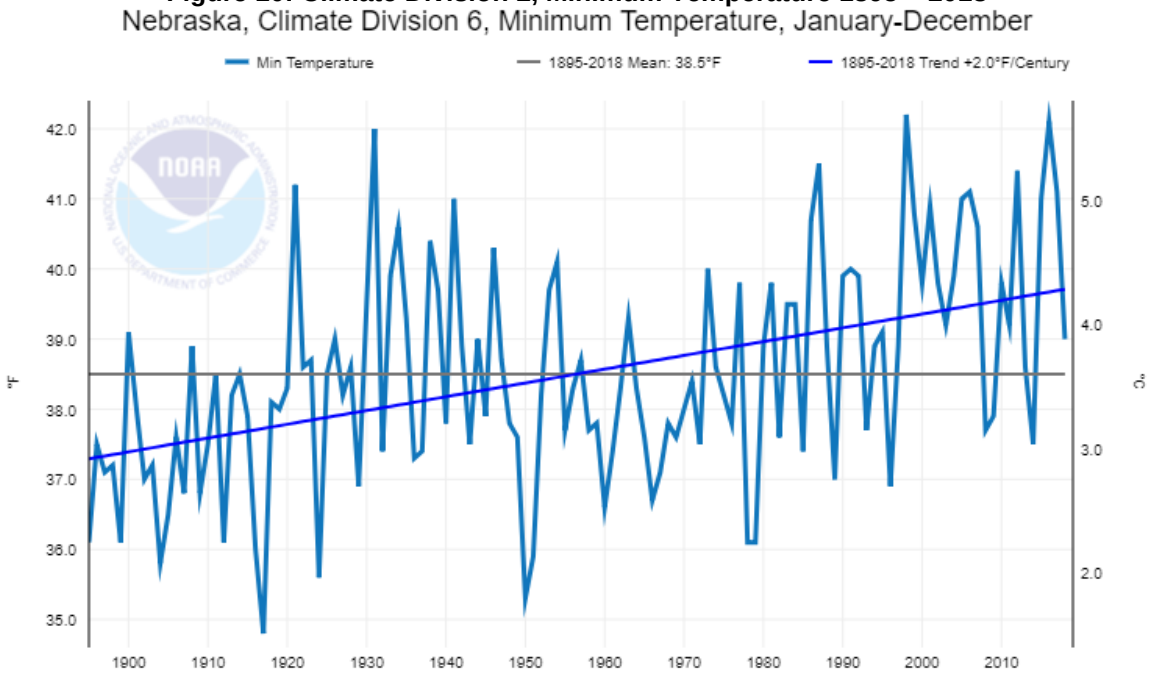
Figure 9: Plant Hardiness Zone Change



Source: Arbor Day Foundation, 2018[35]

Figure 10 shows a trend of increasing minimum temperatures in Climate Division 6, which includes the planning area. High nighttime temperatures can reduce grain yields, increase stress on animals, and lead to an increase in heat-related deaths.

Figure 10: Climate Division 2, Minimum Temperature 1895 – 2018



Source: NOAA, 2019

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

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

HAZARD PROFILES

Based on research and experiences of the participating jurisdictions, the hazards profiled were determined to either have a historical record of occurrence or the potential for occurrence in the future. As the planning area is generally uniform in climate, topography, building characteristics, and development trends, overall hazards and vulnerability do not vary greatly across the planning area. The following profiles will broadly examine the identified hazards across the region. Hazards of local concern or events which have deviated from the norm are discussed in greater detail in its respective community profile (see *Section* Seven of this plan).

AGRICULTURAL ANIMAL AND PLANT DISEASE

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

The economy of the state of Nebraska is heavily vested in both livestock and crop sales. According to the Nebraska Department of Agriculture (NDA) in 2012, the market value for Nebraska 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 $327 million.[36]

Table 33 shows the population of livestock within the planning area. This count does not include wild populations that are also at risk from animal diseases.

Table 33: Livestock Inventory

County	Market Value of 2012 Livestock Sales	Cattle and Calves	Hogs and Pigs	Poultry Egg Layers	Sheep and Lambs
Cass	$9,166,000	9,824	2,669	1,545	565
Lancaster	$31,057,000	21,732	13,772	9,130	884
Total	**$40,223,000**	**31,556**	**16,441**	**10,675**	**1,449**

Source: U.S. Census of Agriculture, 2012

According to the NDA, the primary crops grown throughout the state include alfalfa, corn, sorghum, soybeans, and wheat. The planning area is a mixture of pasture/grassland and cropland (primarily corn and soybeans). The following tables provide the value and acres of land in farms for the planning area.

Table 34: Land and Value of Farms in the Planning Area

County	Number of Farms	Land in Farms (acres)	Market Value of 2012 Crop Sales
Cass	731	344,869	$140,172,000
Lancaster	1,836	489,023	$146,709,000
Total	**2,567**	**833,892**	**$286,881,000**

Source: U.S. Census of Agriculture, 2012

[36] US Department of Agriculture, National Agricultural Statistics Server. 2012. "2012 Census of Agriculture – County Data."

Table 35: Crop Values

County	Corn		Soybeans		Wheat	
	Acres Planted	Value (2012)	Acres Planted	Value (2012)	Acres Planted	Value (2012)
Cass	136,941	$80,576,000	140,042	$54,112,000	1,122	$404,000
Lancaster	171,019	$83,215,000	166,654	$54,372,000	4,533	$1,695,000
Total	**307,960**	**$163,791,000**	**306,696**	**$108,484,000**	**5,655**	**$2,099,000**

Source: U.S. Census of Agriculture, 2012

LOCATION

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

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

HISTORICAL OCCURRENCES

ANIMAL DISEASE

The NDA provides reports on diseases occurring in the planning area. There were 32 instances of animal diseases reported between January 2014 and December 2018 by the NDA (Table 36). These outbreaks affected a total of 258 animals.

Table 36: Livestock Diseases Reported in the Planning Area

Disease	County	Year	Population Impacted
Anaplasmosis	Lancaster	2016; 2017; 2018	4; 126; 4
Bovine Viral Diarrhea	Cass	2014	1
	Lancaster	2014; 2016; 2017; 2018	2; 6; 2; 4
Enzootic Bovine Leukosis	Lancaster	2014; 2016; 2017; 2018	1; 5; 5; 1
Infectious Bovine Rhinotracheitis/Infectious Pustula	Lancaster	2014	2
Leptospirosis	Lancaster	2017	2
Mycoplasmosis	Lancaster	2017	2
Paratuberculosis	Cass	2017	1
	Lancaster	2014; 2015; 2016; 2018	1; 65; 1; 3
Porcine Circovirus	Cass	2016; 2018	1; 2
Porcine Epidemic Diarrhea	Lancaster	2014; 2016; 2017; 2018	3; 3; 2; 1
Porcine Reproductive and Respiratory Syndrome	Cass	2018	2
	Lancaster	2013; 2016	3; 1
Salmonellosis	Cass	2014	1
Transmissible Gastroenteritis	Lancaster	2018	1
Trichomoniasis	Cass	2016	1

Source: Nebraska Department of Agriculture, Jan 2014 - Dec 2018[37]

[37] Nebraska Department of Agriculture. 2018. "Livestock Disease Reporting." http://www.nda.nebraska.gov/animal/reporting/index.html.

PLANT DISEASE

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

Table 37: Common Crop Diseases in Nebraska by Crop Types

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

EMERALD ASH BORER

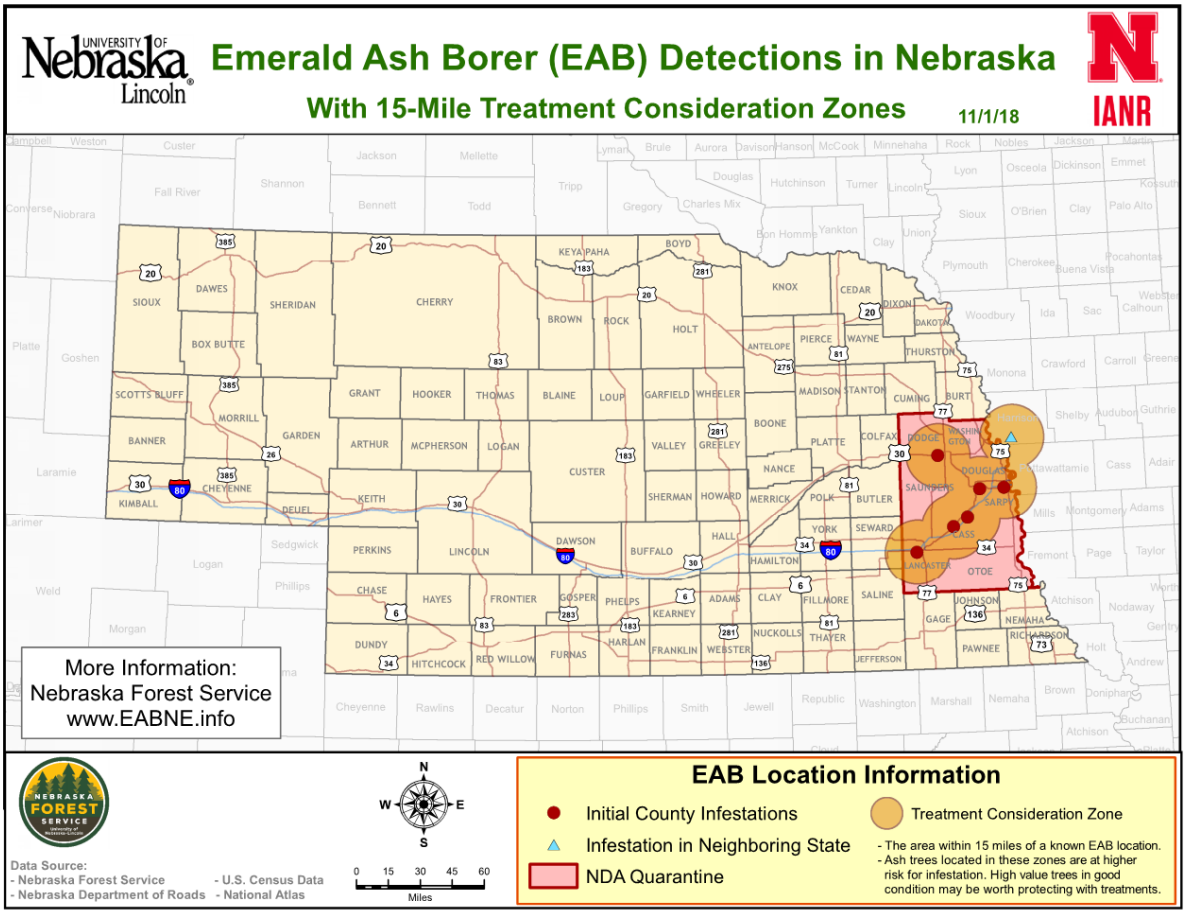
The spread and presence of the Emerald Ash Borer (EAB) has become a rising concern for many Nebraskan communities in recent years. The beetle spreads through transport of infected ash trees, lumber, and firewood. All species of North American ash trees are vulnerable to infestation. Confirmed cases of EAB have been found in three Canadian provinces and 35 US states, primarily in the eastern, southern, and midwestern regions. The two most recent infestation confirmations came from South Dakota and Vermont in early 2018; however, EAB can be found in Iowa, Missouri, Kansas, South Dakota, and Colorado. Nebraska's confirmed cases occurred on private land in Omaha and Greenwood in 2016 and Lancaster County in 2018.[38] Figure 11 shows the locations of Nebraska's confirmed EAB cases as of 2018. Additional confirmed cases have likely occurred throughout 2019 and many communities across the state are prioritizing the removal of ash trees to help curb potential infestations and tree mortality.

[38] Emerald Ash Borer Information Network. April 2018. "Emerald Ash Borer." http://www.emeraldashborer.info/.

While adult beetles cause little damage, larvae damage trees by feeding on the inner bark of mature and growing trees, causing tunnels. Effects of EAB infestation include: extensive damage to trees by birds, canopy dieback, bark splitting, and water sprout growth at the tree base, and eventual tree mortality. EAB has impacted millions of trees across North America, killing young trees one to two years after infestation and mature trees three to four years after infestation.[39] Estimated economic impacts to Nebraska's 44 million ash trees exceeds $961 million.[40] Dead or dying trees affected by EAB are also more likely to cause damage during high winds, severe thunderstorms, or severe winter storms from weakened or hazardous limbs and can contribute a significant fuel load to grass/wildfire events.

Because of the Nebraska infestations, a quarantine has been established in Cass, Dodge, Douglas, Otoe, Sarpy, Saunders, Washington, and Lancaster Counties that restricts the movement of Ash trees and lumber to further mitigate the spread of EAB. The Nebraska Department of Agriculture regulates and monitors the sale and distribution of firewood in the state to restrict the flow of firewood from outside the state.

Figure 11: EAB Confirmation in Nebraska



Source: NDA, 2019[41]

AVERAGE ANNUAL LOSSES

According to the USDA RMA (2000-2018) there were 38 plant disease events planning area. The RMA does not track losses for livestock, but annual crop losses from plan disease can be estimated. The USDA RMA also does not include losses associated with Ash tree mortality from EAB.

[39] Arbor Day Foundation. 2015. "Emerald Ash Borer." https://www.arborday.org/trees/health/pests/emerald-ash-borer.cfm.
[40] "Nebraska Emerald Ash Borer Response Plan." May 2015. https://nfs.unl.edu/NebraskaEABResponsePlan.pdf.
[41] Nebraska Department of Agriculture. 2019. "Emerald Ash Borer." https://nda.nebraska.gov/plant/entomology/eab/index.html.

Table 38: Agricultural Plan Disease Losses

Hazard Type	Number of Events	Events per Year	Total Crop Loss	Average Annual Crop Loss
Plant Disease	38	2	$287,111	$15,111

Source: RMA, 2000-2018

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. Any severe plant or animal disease outbreak which may impact this sector would negatively impact the entire planning area.

PROBABILITY

Given the historic record of occurrence for agricultural disease events (32 animal disease outbreaks reported in five years, 38 plant disease outbreaks in 19 years) and the role of agriculture in the planning area, for the purposes of this plan, the annual probability of agricultural disease occurrence is 100 percent.

REGIONAL VULNERABILITIES

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

Table 39: 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	-Economic power tied to the agricultural industry -Large scale or prolonged events may impact tax revenues and local capabilities -Land value may largely drive population changes within the planning area
BUILT ENVIRONMENT	None
INFRASTRUCTURE	-Transportation routes can be closed during quarantine
CRITICAL FACILITIES	None
CLIMATE	-Changes in seasonal normals can promote spread of invasive species and agricultural disease

CHEMICAL FIXED SITES

The following description for hazardous materials is provided by FEMA:

> Chemicals are found everywhere. They purify drinking water, increase crop production and simplify household chores. But chemicals also can be hazardous to humans or the environment if used or released improperly. Hazards can occur during production, storage, transportation, use or disposal. You and your community are at risk if a chemical is used unsafely or released in harmful amounts into the environment where you live, work or play.[42]

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 in an estimated 4.5 million facilities in the United States—from major industrial plants to local dry-cleaning establishments or gardening supply stores.

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

The Environmental Protection Agency (EPA) requires the submission of the types and locations of hazardous chemicals being stored at any facility within the state over the previous calendar year. This is completed by submitting a Tier II form to the EPA as a requirement of the Emergency Planning and Community Right-to-Know Act of 1986.[43]

Fixed-sites are those that involve chemical manufacturing sites and stationary storage facilities. Table 35 demonstrates the nine classes of hazardous material according to the 2016 Emergency Response Guidebook.

[42] Federal Emergency Management Agency. 2017. "Hazardous Materials Incidents." https://www.ready.gov/hazardous-materials-incidents.
[43] Emergency Planning and Community Right-to-Know Act of 1986, Pub. L. No. 116 § 10904. 1986.

Table 40: Hazardous Material Classes

CLASS	TYPE OF MATERIAL	DIVISIONS
1	Explosives	Division 1.1 – Explosives with a mass explosion hazard Division 1.2 – Explosives with a projection hazard but not a mass explosion hazard Division 1.3 – Explosives which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard Division 1.4 – Explosives which present no significant blast hazard Division 1.5 – Very insensitive explosives with a mass explosion hazard Division 1.6 – Extremely insensitive articles which do not have a mass explosion hazard
2	Gases	Division 2.1 – Flammable gases Division 2.2 – Non-flammable, non-toxic gases Division 2.3 – Toxic gases
3	Flammable liquids (and Combustible liquids)	
4	Flammable solids; Spontaneously combustible materials	Division 4.1 – Flammable solids, self-reactive substances and solid desensitized explosives Division 4.2 – Substances liable to spontaneous combustion Division 4.3 – Substances which in contact with water emit flammable gases
5	Oxidizing substances and Organic peroxides	Division 5.1 – Oxidizing substances Division 5.2 – Organic peroxides
6	Toxic substances and infections 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	

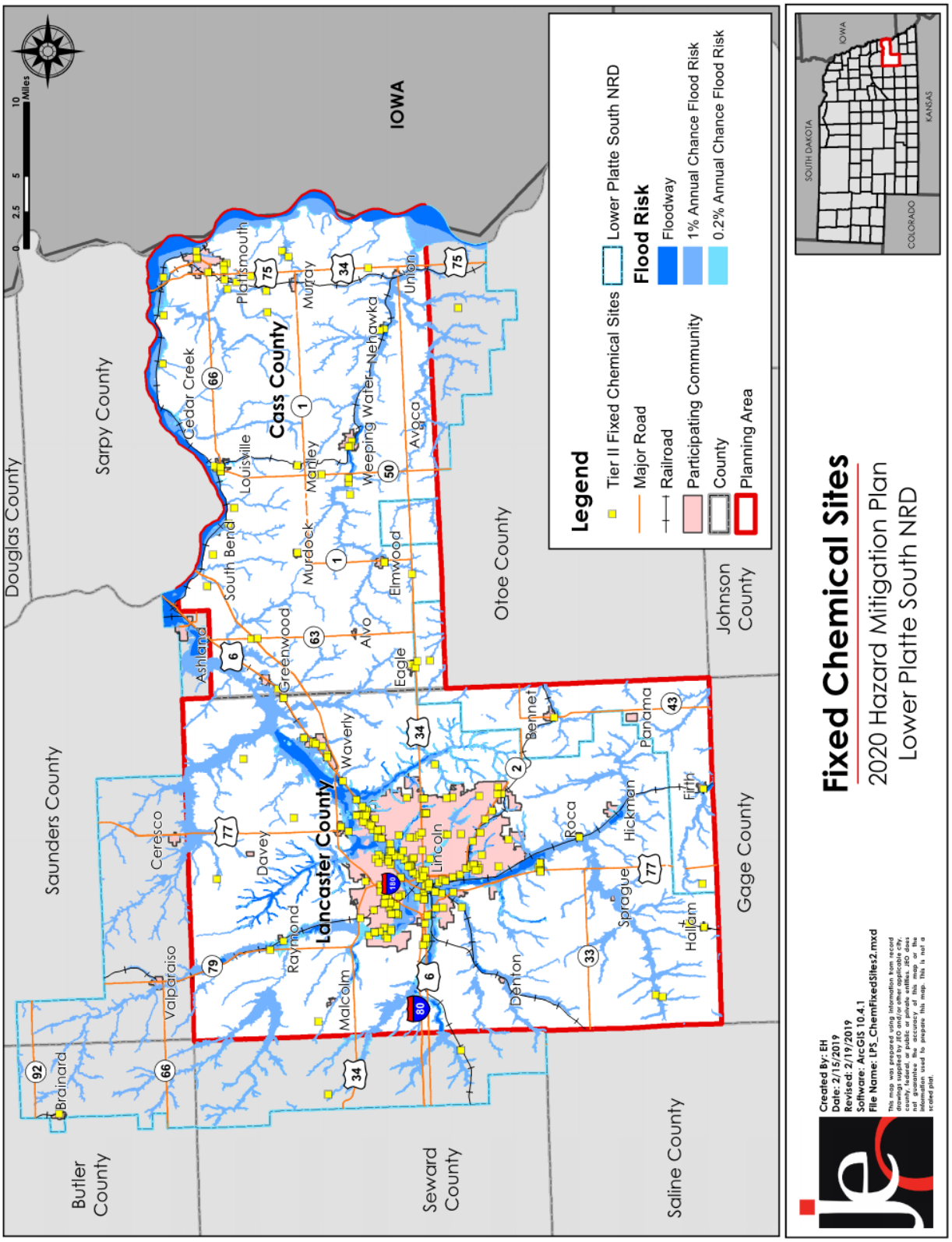
Source: Emergency Response Guidebook, 2016[44]

LOCATION

There are 318 locations across the planning area that house hazardous materials, according to the Tier II reports submitted to the Nebraska Department of Environment and Energy (NDEE) in 2017. A listing of chemical storage sites can be found in *Section Seven: Community Profiles* for each jurisdiction.

[44] 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 12: Fixed Chemical Sites in the Planning Area



Extent

The extent of chemical spills at fixed sites varies and depends on the type of chemical that is released. According to the U.S. Coast Guard's National Response Center (NRC) database, there have been 163 fixed site releases in the planning area and the total amount spilled ranged from 0 gallons or pounds to 100,000 gallons of pollutant. On average, approximately 887 gallons of pollutant are spilled per occurrence. Of the 163 chemical spills, one spill led to the evacuation of 300 individuals in 2000, two spills led to one injury each in 1999 and 2005, and one spill in 1995 injured two individuals. Based on historic records, it is likely that any spill involving hazardous materials will not affect an area larger than a quarter mile from the spill location.

Historical Occurrences

According to the NRC database, there have been 163 fixed site chemical spills between January 1990 – February 2019 in the planning area. The following table lists only those events with the largest quantity of material released, incidents with injuries or evacuations involved, and largest property damages.

Table 41: Chemical Fixed Site Incidents

Year of Event	Location of Release	Quantity Spilled	Material Involved	Number of Injuries	Number Evacuated	Property Damage
1992	Lincoln	0	Anhydrous Ammonia	0	3	$0
1994	Greenwood	50 gals	Anhydrous Ammonia	0	1	$0
1995	Lincoln	3,000 lbs	Anhydrous Ammonia	2	50	$0
1996	Lincoln	10,000 gals	Oil	0	0	$0
1998	Lincoln	100,000 gals	Oil	0	0	$0
1999	Murdock	Unknown	Anhydrous Ammonia	1	0	$0
2000	Lincoln	Unknown	Foam, Mineral Spirits	0	300	Unknown
2003	Lincoln	55 gals and 12 lbs	Pesticides and Water-Soluble Powder	0	0	$750,000
2005	Lincoln	3 gals	Gasoline	1	0	$0
2015	Lincoln	Unknown	Anhydrous Ammonia	0	150	$0

Source: National Response Center, 1990-Feb 2019

Average Annual Damages

The following table estimates average annual damages from chemical fixed site spills.

Table 42: Chemical Fixed Site Losses

Hazard Type	Number of Events	Events per Year	Total Injuries	Total Evacuated	Total Damages	Average Annual Damages
Chemical Spills	163	5.4	4	504	$750,000	$25,000

Source: NRC, 1990-Feb 2019

PROBABILITY

Chemical releases at fixed site storage areas are likely in the future. Given the historic record of occurrence (163 chemical fixed site spills reported in 30 years), the probability of occurrence for chemical fixed site spills is 100 percent annually.

REGIONAL VULNERABILITIES

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

Table 43: Regional Chemical Fixed Site Vulnerabilities

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

CHEMICAL TRANSPORTATION

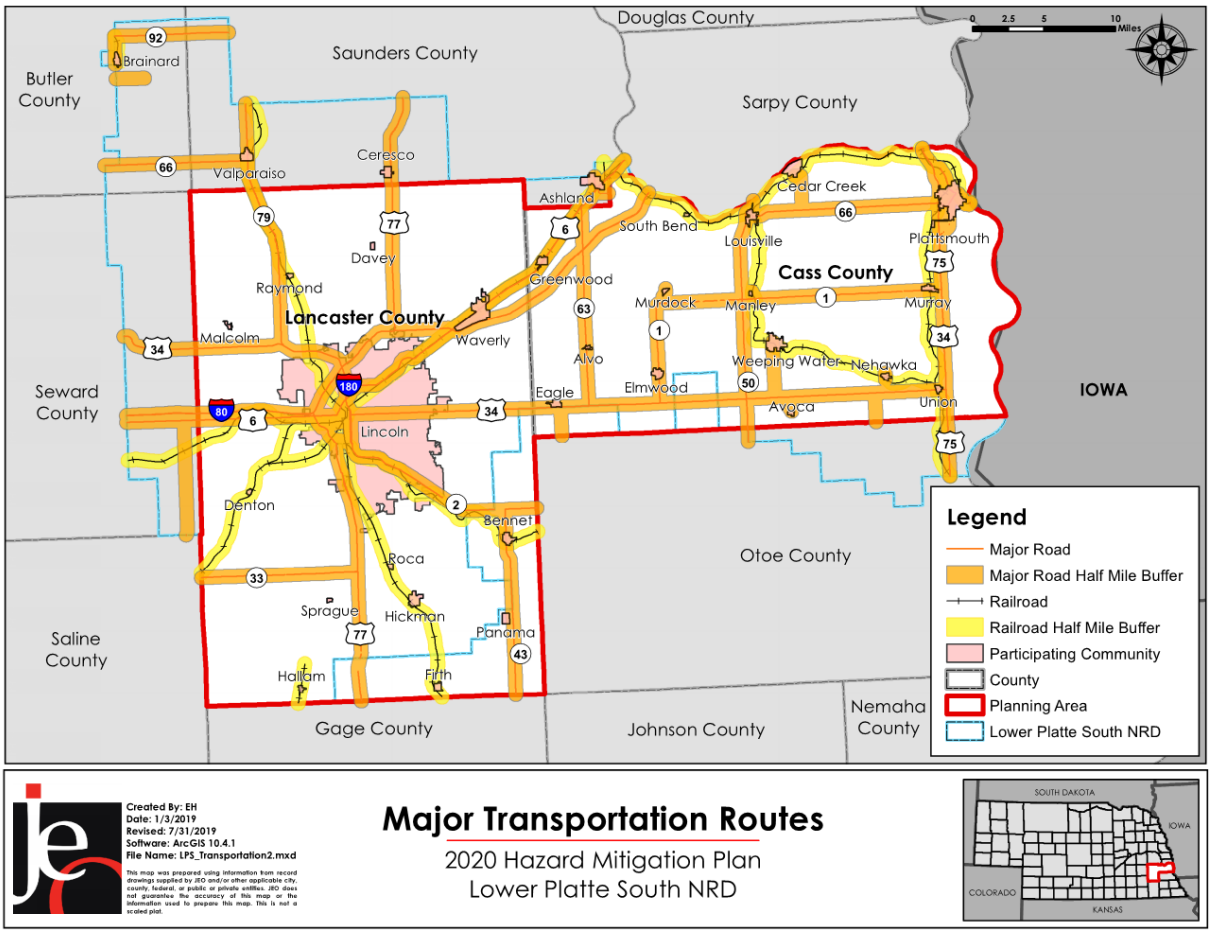
The transportation of hazardous materials is defined by the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) as "…a substance that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce…"[45] According to PHMSA, hazardous materials traffic in the U.S. now exceeds 1,000,000 shipments per day.[46]

Nationally, the U.S. has had 116 fatalities associated with the transport of hazardous materials between 2007 through 2017.[47] 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 rupture tanker. The resulting poisonous fog killed nine people and injured 53.

LOCATION

Chemical releases can occur during transportation, primarily on major transportation routes as identified in Figure 13. A large number of spills also typically occur during the loading and unloading of chemicals. According to PHMSA there are several gas transmission and hazardous liquid pipelines located in the planning area.[48]

Figure 13: Major Transportation Routes with Half Mile Buffer



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

EXTENT

The probable extent of chemical spills during transportation is difficult to anticipate and depends on the type and quantity of chemical released. Releases that have occurred during transportation in the planning area ranged from zero to 23,000 liquid gallons (LGA). One event led to injuries to a driver.

HISTORICAL OCCURRENCES

PHMSA reports that 428 chemical spills have occurred during transportation in the planning area between 1971 and 2018. During these events, there were no fatalities, one injury, and $2,028,294 in damages.

The following table provides a list of the most significant historical chemical spills during transportation in the planning area.

Table 44: Historical Chemical Spills 1980-2018

Date of Event	Location of Release	Failure Description	Material Involved	Method of Transportation	Amount in Gallons	Total Damage	Injuries (Yes/No)
1979	Lincoln	Corrosion – Exterior	Phosphoric Acid Solution	Rail	31,500	$0	No
1994	Lincoln	Derailment; Rollover Accident	Denatured Alcohol	Rail	23,000	$101,050	No
1998	South Bend	Derailment	Elevated Temperature Liquid N.O.S. at or above 100 C and below its flash point	Rail	18,000	$23,000	No
2004	Waverly	Equipment Malfunction	Environmentally Hazardous Substances Solid N.O.S.	Highway	15,650	$3,531	No
2004	Lincoln	Derailment; Vehicular Crash or Accident Damage	Flammable Liquids Toxic N.O.S.	Rail	10,200	$500,000	No
2011	Lincoln	Vehicular Crash or Accident Damage	Corrosive Liquids N.O.S.	Highway	250	$231,000	No
1996	Ashland	Fire Temperature or Heat	Sodium Hydroxide Solid	Highway	2	$173,000	No
1996	Ashland	Fire Temperature or Heat	Potassium Hydroxide Solution	Highway	1	$173,000	No
1996	Ashland	Fire Temperature or Heat	Hydrochloric Acid Solution	Highway	<1	$173,000	No
1996	Ashland	Fire Temperature or Heat	Corrosive Liquids N.O.S.	Highway	<1	$173,000	No
1998	Lincoln	Equipment Malfunction	Caustic Alkali Liquids N.O.S.	Highway	2	$0	Yes - 1

Source: PHMSA, April 1971– December 2018[49]

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

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon PHMSA's Incidents Reports since 1971 and the number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. This hazard causes, on average, over $50,000 per year in property damages.

Table 45: Chemical Transportation Losses

Hazard Type	Number of Events	Events Per Year	Total Property Loss	Average Annual Property Loss
Chemical Transportation Spills	428	8.9	$2,028,294	$52,008

Source: PHMSA April 1971 – December 2018

PROBABILITY

The historical record indicates that chemical releases during transport are likely to occur annually in the planning area, with 428 events over a 48-year period.

REGIONAL VULNERABILITIES

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

Table 46: Regional Chemical Transportation Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Those in close proximity to transportation corridors -Possible evacuation -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
ECONOMIC	-Evacuations and closed transportation routes could impact businesses near spill
BUILT ENVIRONMENT	-Risk of fire or explosion
INFRASTRUCTURE	-Transportation routes can be closed
CRITICAL FACILITIES	-Critical facilities near major transportation corridors are at risk
CLIMATE	-None

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."[50]

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 47: Dam Size Classification

SIZE	EFFECTIVE HEIGHT (FEET) X EFFECTIVE STORAGE (ACRE-FEET)	EFFECTIVE HEIGHT
SMALL	≤ 3,000 acre-feet	and ≤ 35 feet
INTERMEDIATE	> 3,000 acre-feet to < 30,000 acre-feet	or > 35 feet
LARGE	≥ 30,000 acre-feet	Regardless of Height

Source: NeDNR, 2013[51]

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

[50] 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.

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

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

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

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

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

- **Low Hazard Potential** - failure of the dam expected to result in no probable loss of human life and in low economic loss. Failure may damage storage buildings, agricultural land, and county roads.

- **Significant Hazard Potential** - failure of the dam expected to result in no probable loss of human life but could result in major economic loss, environmental damage, or disruption of lifeline facilities. Failure may result in shallow flooding of homes and commercial buildings or damage to main highways, minor railroads, or important public utilities.

- **High Hazard Potential** - failure of the dam expected to result in loss of human life is probable. Failure may cause serious damage to homes, industrial or commercial buildings, four-lane highways, or major railroads. Failure may cause shallow flooding of hospitals, nursing homes, or schools.

In total, there are 207 dams located within the two-county planning area, and an additional 49 dams in the surrounding area within the LPSNRD boundaries. Figure 14 maps the location of these dams.

Table 48: Dam Classification in the Planning Area and LPSNRD Boundary

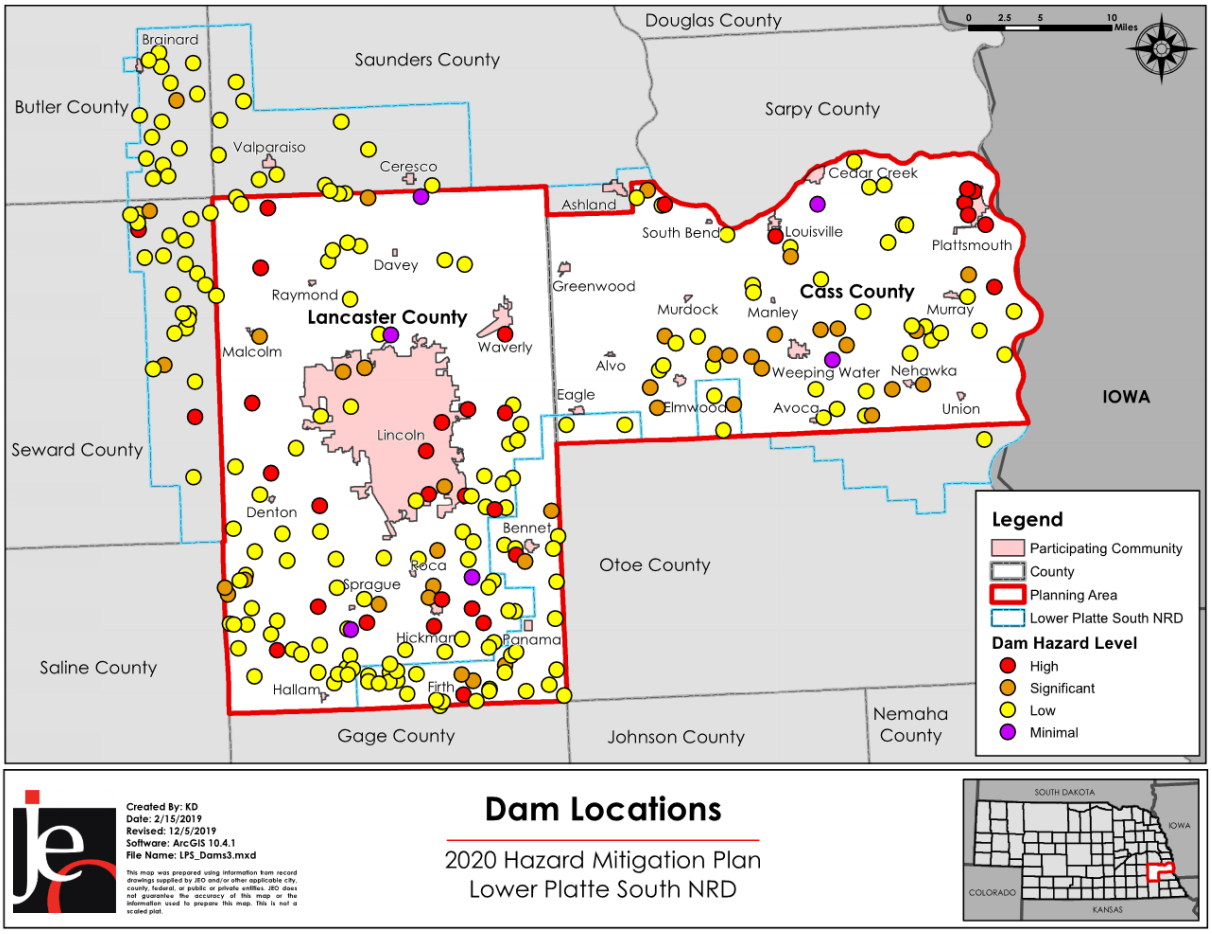
County	Minimal Hazard	Low Hazard	Significant Hazard	High Hazard
Cass	1	35	21	8
Lancaster	3	100	16	23
Planning Area Total	**4**	**135**	**37**	**31**
Neighboring County Dams within LPSNRD Boundary				
Butler*	0	14	1	0
Otoe*	0	1	0	0
Saunders*	0	11	0	0
Seward*	0	17	3	2
Total	**4**	**178**	**41**	**33**

**Note: Only portions of Butler, Otoe, Saunders, and Seward Counties are located within the LPSNRD. Dams in these counties located outside of the LPSNRD boundaries are not included here.*
Source: NeDNR, 2018[52]

[52] Nebraska Department of Natural Resources. 2019. "Nebraska Dam Inventory." https://dnr.nebraska.gov/dam-safety/nebraska-dam-inventory.

Dams classified with high hazard potential require the creation of an Emergency Action Plan (EAP). The EAP defines responsibilities and provides procedures designed to identify unusual and unlikely conditions which may endanger the structural integrity of the dam within sufficient time to take mitigating actions and to notify the appropriate emergency management officials of possible, impending, or actual failure of the dam. The EAP may also be used to provide notification when flood releases will create major flooding. An emergency situation can occur at any time; however, emergencies are more likely to happen when extreme conditions are present. There are 33 high hazard dams located within the planning area.

Figure 14: Dam Locations



There are ten dams in the planning area or surrounding areas that are included in the 2014 Nebraska State HMP's list of "Top 30 Ranked High Hazard Dams Based on Population at Risk." Those dams are listed in the following table.

Table 49: Planning Area Dams in Top 30 Ranked High Hazard Dams Based on Population at Risk

Dam	County (City)	Stream	Level of Risk	Population at Risk
Branched Oak/Site 18	Lancaster (Raymond)	Oak Creek	High	22,331
Holmes Lake/Site 17	Lancaster (Lincoln)	Antelope Creek	High	16,703
Pawnee/Site 14	Lancaster (Emerald)	N BR Middle Creek	High	16,450

Dam	County (City)	Stream	Level of Risk	Population at Risk
Conestoga/Site 12	Lancaster (Lincoln)	Holmes Creek	High	14,382
Bluestem/Site 4	Lancaster (Sprague)	Olive BR Salt Creek	High	12,995
Wagon Train/Site 8	Lancaster (Hickman)	Hickman BR Salt Creek	High	10,476
Twin Lake/Site 13	Seward (Lincoln)	S BR Middle Creek	High	10,126
State Coach/Site 9	Lancaster (Hickman)	Hickman BR Salt Creek	High	8,217
Olive Creek/Site 2	Lancaster (Sprague)	Olive Creek	High	8,142
Yankee Hill/Site 10	Lancaster (Lincoln)	Cardwell BR Salt Creek	High	6,090

Source: NEMA, 2014[53]

Upstream Dams Outside the Planning Area

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

Table 50: Upstream Missouri River Dams

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

During significant flood events heightened releases from upstream dams may contribute to flooding impacts in the planning area. Of the dams listed above, only four are designed for significant flood control: Fort Peck, Garrison, Oahe, and Fort Randall. Notably during the 2011 and 2019 flood events, heightened dam release rates, including from Gavins Point, contributed to flooding impacts. The March 2019 flood event saw significant rainfall and snowmelt upstream of the dams which filled the dam reservoirs to capacity and necessitated release. Unfortunately, additional precipitation was also entering Missouri River from heavy flows on the Platte River. The combination of heightened flows on the Missouri, including the released water from the dams, and the flood waters from the Platte River likely exacerbated flood conditions along the Missouri River bordering Cass County and primarily in the City of Plattsmouth.

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

Table 51: Upstream Platte River Dam

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

[53] Nebraska Emergency Management. 2014. "State of Nebraska Hazard Mitigation Plan". Accessed April 2019. https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmitplan.pdf

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

LOCATION

Communities or areas downstream of a dam, especially high hazard dams, are at greatest risk of dam failure. There are 31 high hazard dams in the two-county planning area. However, 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 map specific to a dam.

EXTENT

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

HISTORICAL OCCURRENCES

According to the Stanford University National Performance of Dams Program, there have been three dam failure events within the planning area.[54] The following table lists information about these failure events. No events resulted in reported damages, injuries, or fatalities.

Table 52: Dam Failure Events

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

Source: Stanford University, 2019

During the March 2019 flood event, Spencer Dam (Boyd/Holt Counties) failed due to significant ice and debris buildup. The water released from the dam traveled downstream into the Niobrara and Missouri rivers, overwhelming the systems and contributing to widespread inundation and flooding across eastern Nebraska. While this dam was not located in the planning area, its failure likely significantly impacted subsequent flooding for communities along the Missouri River in Cass County. Additional dam and flood related impacts are discussed in greater detail in applicable *Community Profiles.*

AVERAGE ANNUAL DAMAGES

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

PROBABILITY

According to the 2014 Nebraska State Hazard Mitigation Plan, the probability of a high hazard dam failing is “very low” due to the high design standards for this class of dam. There is a higher possibility of a significant or low hazard dam failing as those dams are not designed to the same standard. For the purpose of this plan, the probability of dam failure will be stated as three percent annually as three dams have failed in the planning area over the past 106 years.

[54] Stanford University. 1911-2019. “National Performance of Dams Program Dam Incident Database.” Accessed March 2019. http://npdp.stanford.edu/dam_incidents.

REGIONAL VULNERABILITIES

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

Table 53: Regional Dam Failure Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Those living downstream of high hazard dams -Evacuation likely with high hazard dams -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
ECONOMIC	-Businesses located in the inundation areas would be impacted and closed for an extended period of time -Employees working in the inundation area may be out of work for an extended period of time
BUILT ENVIRONMENT	-Damage to homes and buildings
INFRASTRUCTURE	-Transportation routes could be closed for extended period of time
CRITICAL FACILITIES	-Critical facilities in inundation areas are vulnerable to damages
CLIMATE	-Increased annual precipitation contributes to sustained stress on systems -Changes in water availability and supply can constrain energy production and reservoir stores

DROUGHT

Drought is generally defined as a natural hazard that results from a substantial period of below normal precipitation. Although many erroneously consider it a rare and random event, drought is a normal, recurrent feature of climate. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another. A drought often coexists with periods of extreme heat, which together can cause significant social stress, economic losses, and environmental degradation.

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

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

- **Meteorological Drought** – is defined based on the degree of dryness and the duration of the dry period. Meteorological drought is often the first type of drought to be identified and should be defined regionally as precipitation rates and frequencies (norms) vary.

- **Agricultural Drought** – occurs when there is deficient moisture that hinders planting germination, leading to low plant population per hectare and a reduction of final yield. Agricultural drought is closely linked with meteorological and hydrological drought; as agricultural water supplies are contingent upon the two sectors.

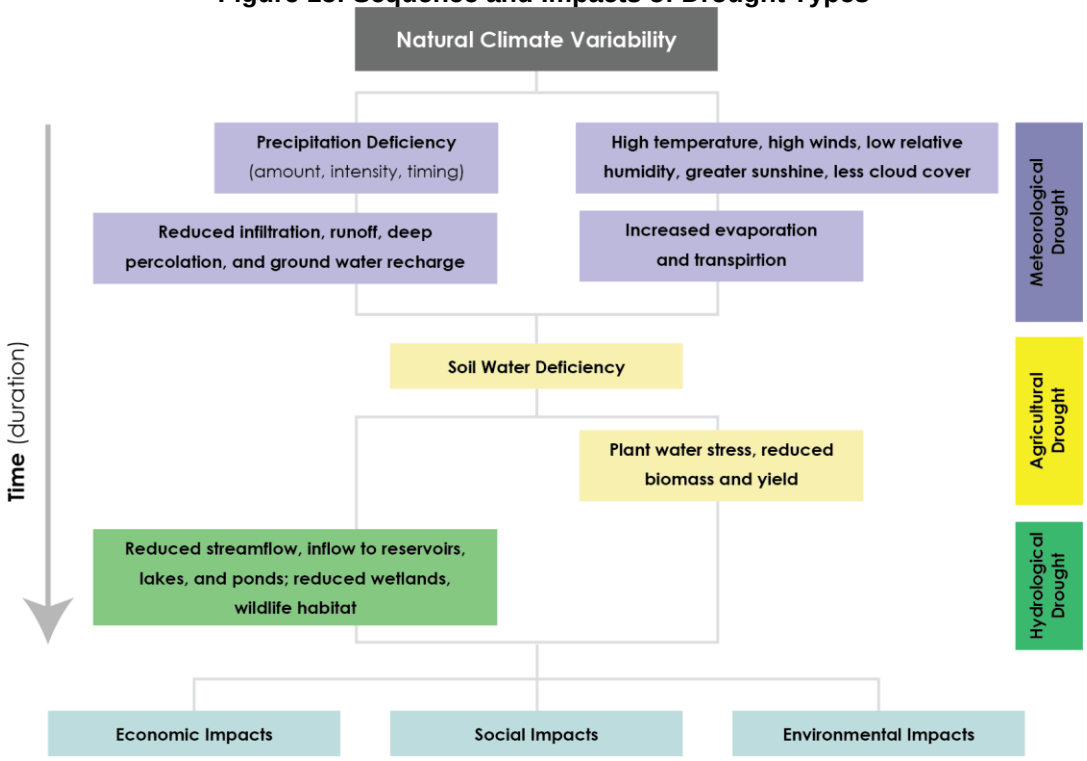
- **Hydrologic Drought** – occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives average precipitation. This is due to the reserves diminishing from increased water usage, usually from agricultural use or high levels of evapotranspiration, resulting from prolonged high temperatures. Hydrological drought often is identified later than meteorological and agricultural drought. Impacts from hydrological drought may manifest themselves in decreased hydropower production and loss of water based recreation.

- **Socioeconomic Drought** – occurs when the demand for an economic good exceeds supply due to a weather-related shortfall in water supply. The supply of many economic goods includes, but are not limited to, water, forage, food grains, fish, and hydroelectric power.[55]

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

[55] National Drought Mitigation Center. 2017. "Drought Basics." http://drought.unl.edu/DroughtBasics.aspx.

Figure 15: Sequence and Impacts of Drought Types



Source: National Drought Mitigation Center, University of Nebraska-Lincoln, 2017[56]

HISTORICAL OCCURRENCES

The Palmer Drought Severity Index (PDSI) is utilized by climatologists to standardize global long-term drought analysis. The data for the planning area was collected for Climate Division 6, which includes the planning area. This particular station's period of record started in 1895. Figure 16 shows the data from this time period. The negative Y axis represents a drought, for which '-2' indicates a moderate drought, '-3' a severe drought, and '-4' an extreme drought. Table 54 shows the details of the Palmer classifications.

Table 54: Palmer Drought Severity Index Classification

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

Source: Climate Prediction Center[57]

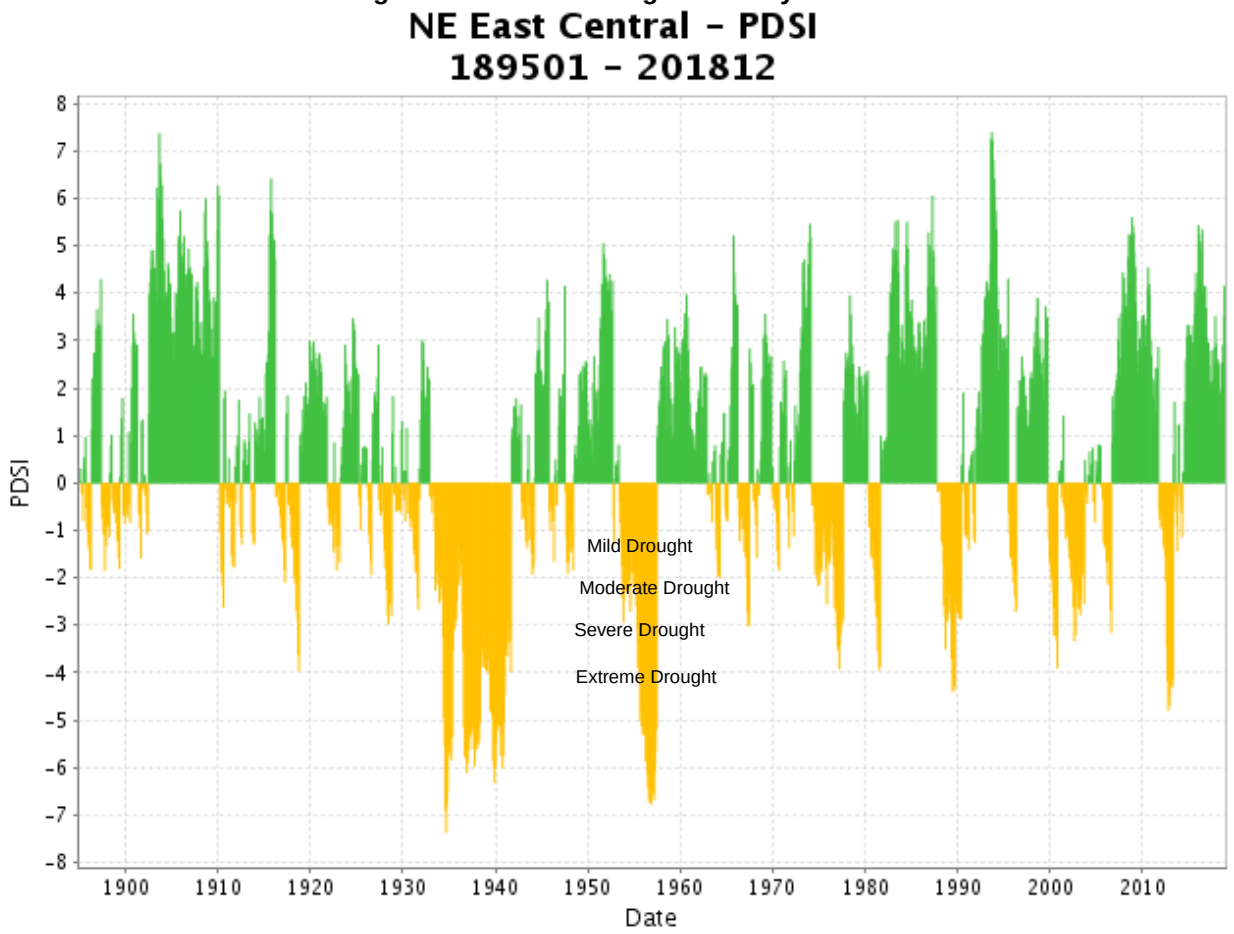
[56] National Drought Mitigation Center. 2017. "Types of Drought." http://drought.unl.edu/DroughtBasics/TypesofDrought.aspx.
[57] National Weather Service. 2017. "Climate Prediction Center." http://www.cpc.noaa.gov/.

Table 55: Historic Droughts

DROUGHT MAGNITUDE	MONTHS IN DROUGHT	PERCENT CHANCE
-1 MAGNITUDE (MILD)	171/1,488	11.5%
-2 MAGNITUDE (MODERATE)	103/1,488	6.9%
-3 MAGNITUDE (SEVERE)	48/1,488	3.2%
-4 MAGNITUDE OR GREATER (EXTREME)	90/1,488	6.0%

Source: NCEI, Jan 1895-Dec 2018[58]

Figure 16: Palmer Drought Severity Index



Source: NCEI, Jan. 1895-Dec 2018

LOCATION

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

EXTENT

Using the data from Table 55 it is reasonable to expect extreme drought to occur in 6.0 percent of months for the planning area (90 extreme drought months in 1,488 months). Severe drought occurred in 48 months of the 1,488 months of record (3.2 percent of months). Moderate drought occurred in 103 months of the 1,488 months of record (6.9 percent of months), and mild drought occurred in 171 of the 1,488 months of record (11.5 percent of months). Non-drought conditions (incipient dry spell, near normal, or incipient wet spell conditions) occurred in 358 months, or 24.1% percent of months. These statistics show that the drought conditions of the planning area are highly variable.

[58] National Centers for Environmental Information. 1895-2018. Accessed December 6, 2018. https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp.

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.

Table 56: Loss Estimate for Drought

Hazard Type	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Drought	$0	$0	$92,224,043	$4,853,897

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

The extreme drought in 2012 significantly affected the agricultural sector of the state. Although the full impacts are yet to be studied, the USDA reported a total of $139,957,809 in drought relief to Nebraska from 2008 to 2011 for all five disaster programs: Supplemental Revenue Assistance Payments (SURE); Livestock Forage Disaster Assistance Program (LFD); Emergency Assistance for Livestock, Honeybees, and Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish Program (ELAP); Livestock Indemnity Program (LIP); and Tree Assistance Program (TAP). According to the PDSI for the planning area, 2012's average severity index was ranked at a -2.79, with extremes in September and November of -4.81 and -4.70 respectively.

PROBABILITY

The following table summarizes the magnitude of drought and monthly probability of occurrence.

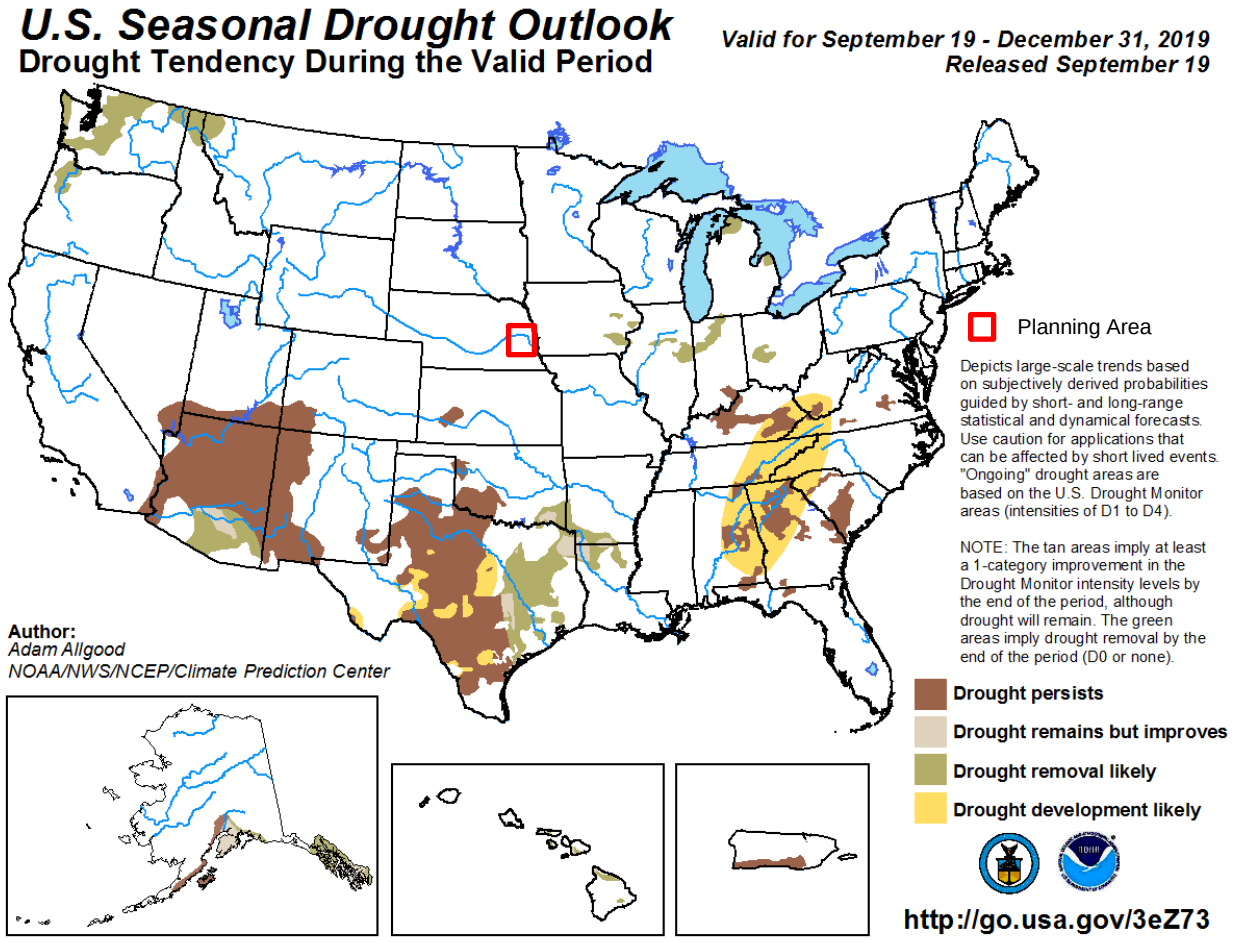
Table 57: Period of Record in Drought

PDSI Value	Magnitude	Drought Occurrences by Month	Monthly Probability
4 or more to -0.99	No Drought	1,076/1,488	72.4%
-1.0 to -1.99	Mild Drought	171/1,488	11.5%
-2.0 to -2.99	Moderate Drought	103/1,488	6.9%
-3.0 to -3.99	Severe Drought	48/1,488	3.2%
-4.0 or less	Extreme Drought	90/1,488	6.0%

Source: NCEI, Jan 1895-Dec 2018

The U.S. Seasonal Drought Outlook (Figure 17) provides a short-term drought forecast that can be utilized by local officials and residents to examine the likelihood of drought developing or continuing depending on the current situation. The following figure provides the drought outlook for September 19, 2019 through December 31, 2019. According to the U.S. Seasonal Drought Outlook, drought will decrease across the southwest, but the planning area should experience seasonal norms relative to precipitation and temperatures.

Figure 17: U.S. Seasonal Drought Outlook



Source: NCEI, 2019

REGIONAL VULNERABILITIES

The Drought Impact Reporter is a database of drought impacts throughout the United States with data going back to 2000. The Drought Impact Reporter has recorded a total of 18 drought-related impacts throughout the region. This is not a comprehensive list of droughts which may have impacted the planning area. These impacts are summarized in the following table.

Table 58: Drought Impacts in Planning Area

Category	Date	Affected Counties	Title
Water Supply & Quality	3/6/2008	Lancaster County	Water Supply & Quality impact from Media submitted on 3/6/2008
Agriculture, Business & Industry	1/1/2012	Lancaster County	Dearth of mature Christmas trees on Nebraska tree farms
Plants & Wildlife	5/1/2012	Cass County	Grass planted on new levees along the Missouri River in eastern Nebraska was slow to grow
Plants & Wildlife, Tourism & Recreation, Water Supply & Quality	6/11/2012	Cass County	Lower Platte River in Nebraska experiencing record low flows

Category	Date	Affected Counties	Title
Fire, Relief, Response & Restrictions	6/28/2012	Cass County, Lancaster County	Nebraskans urged to leave the fireworks to the professionals
Plants & Wildlife	7/1/2012	Lancaster County	Raspberry bushes succumb to drought in Lincoln, Nebraska
Fire, Relief, Response & Restrictions	7/4/2012	Lancaster County	Fireworks ban for Nebraska state parks
Society & Public Health, Tourism & Recreation	8/21/2012	Cass County, Lancaster County	Hot, dry conditions damage hiker/biker trails in Butler, Cass, Gage, and Lancaster counties in Nebraska
Agriculture, Relief, Response & Restrictions	1/9/2013	Cass County, Lancaster County	Drought-related USDA disaster declarations in 2013
Relief, Response & Restrictions, Water Supply & Quality	2/12/2013	Lancaster County	New horizontal well to enhance water supply for Lincoln, Nebraska
Society & Public Health	9/25/2013	Cass County	Drought alleviated some of the flooding that would have otherwise occurred along the Platte River in southern Nebraska
Fire, Water Supply & Quality	1/29/2018	Lancaster County	Dry soils and fire danger in Lancaster County, Nebraska
Fire	3/3/2018	Lancaster County	Lack of rain created fire danger in Lancaster County, Nebraska
Relief, Response & Restrictions, Water Supply & Quality	3/28/2018	Lancaster County	Additional water source for Lincoln, Nebraska
Agriculture, Plants & Wildlife	5/13/2018	Lancaster County	Lawn, plants showing stress in Lancaster County, Nebraska
Plants & Wildlife	6/4/2018	Lancaster County	Even with some rain, some trees are still yellowing and dropping leaves in Lancaster County, Nebraska
Plants & Wildlife	6/17/2018	Lancaster County	Irrigated lawns turning brown, tree leaves cupping in Lancaster County, Nebraska
Plants & Wildlife	8/13/2018	Lancaster County	Despite some rain, cracks are widening and lawns are going dormant in Lancaster County, Nebraska

Source: NDMC, 2000-2019[59]

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

[59] National Drought Mitigation Center. 2018. "U.S. Drought Impact Reporter." http://droughtreporter.unl.edu/map/.

Table 59:Regional Drought Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Insufficient water supply -Loss of jobs in agricultural sector -Residents in poverty if food prices increase
ECONOMIC	-Closure of water intensive businesses (carwashes, pools, etc.) -Loss of tourism dollars -Decrease of land prices→ jeopardizes educational funds
BUILT ENVIRONMENT	-Cracking of foundations (residential and commercial structures) -Damages to landscapes
INFRASTRUCTURE	-Damages to waterlines below ground -Damages to roadways (prolonged extreme events) -Stressing of electrical systems (brownouts during peak usage)
CRITICAL FACILITIES	-None
CLIMATE	-Changes in annual precipitation can be detrimental to agriculture and energy production sectors -Changes in annual normal temperatures and weather patterns can exacerbate drought conditions

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 60: Richter Scale

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

Source: FEMA, 2016[60]

Table 61: Modified Mercalli Intensity Scale

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

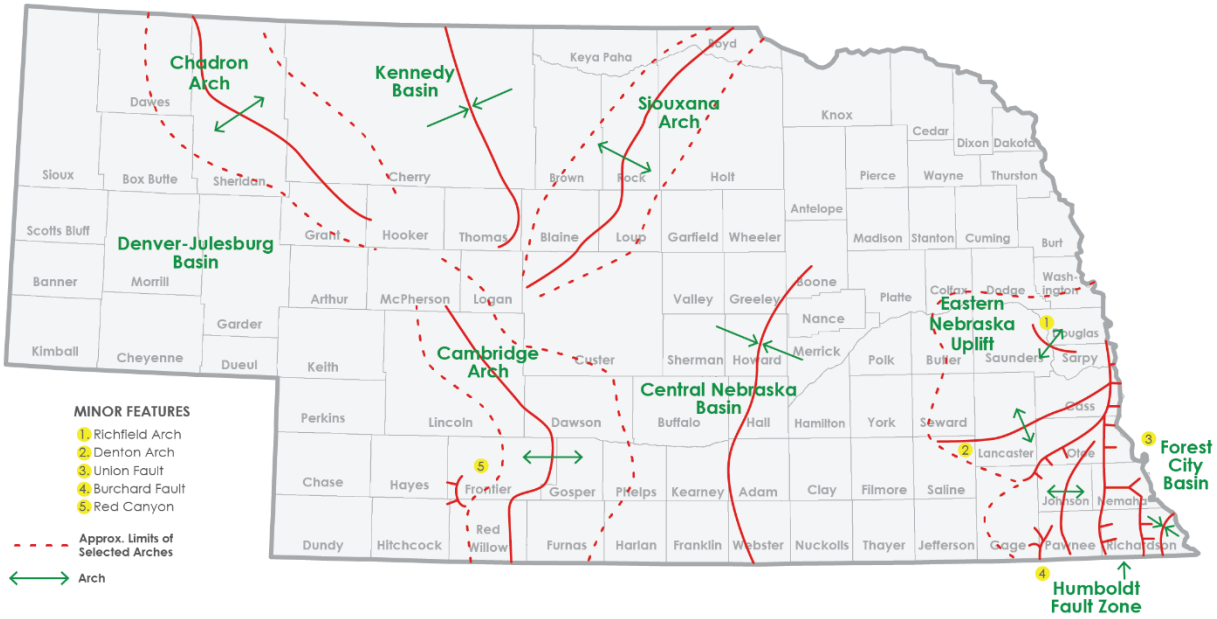
Source: FEMA, 2016

[60] Federal Emergency Management Agency. 2016. "Earthquake." https://www.fema.gov/earthquake.

LOCATION

The most likely locations in the planning area to experience an earthquake are near a fault line (Figure 18). The Denton Arch, Richfield Arch, and Union Fault lines could all affect the planning area.

Figure 18: Fault Lines in Nebraska



Source: Nebraska Department of Natural Resources

EXTENT

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

HISTORICAL OCCURRENCES

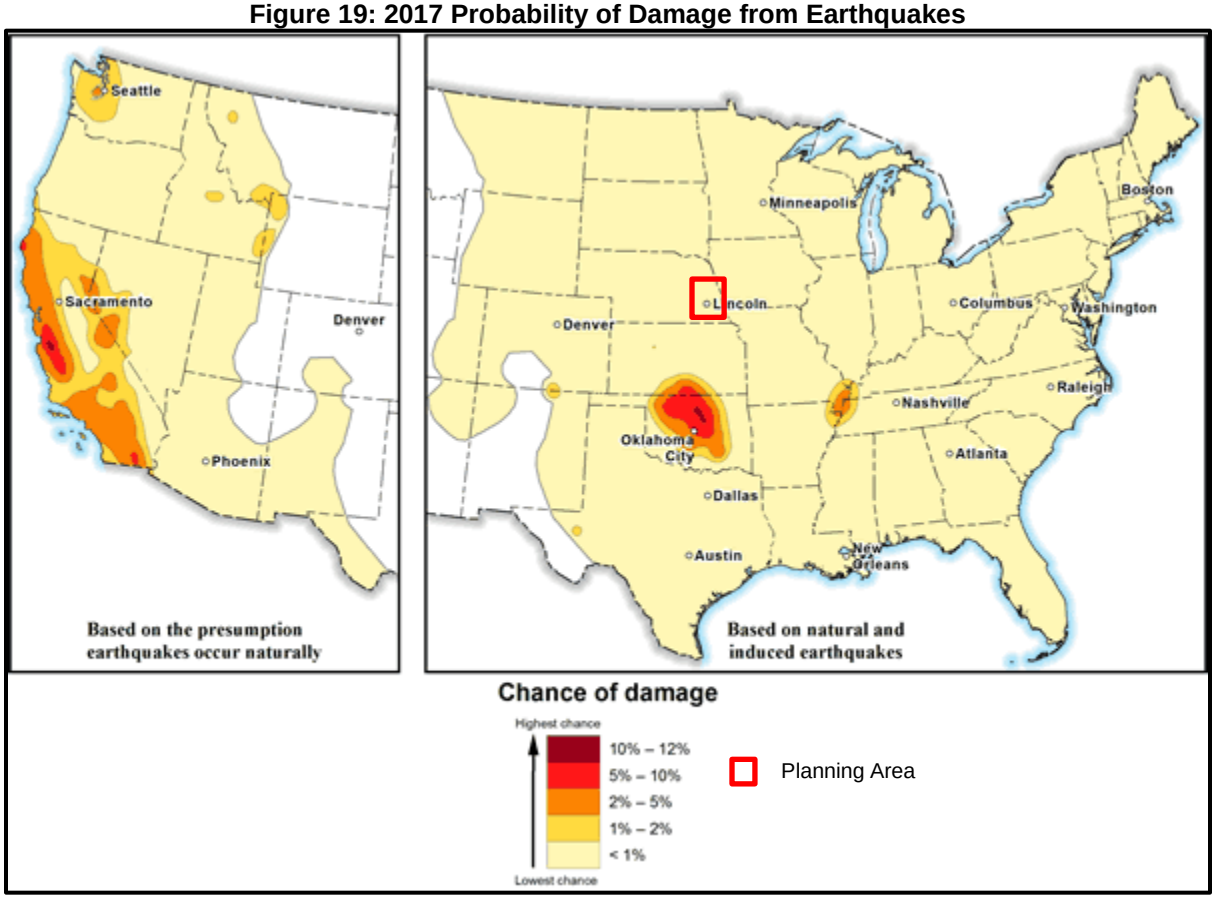
According to the United States Geological Survey (USGS), there have been no earthquakes within the planning area since 1900.[61]

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. Figure 19 shows the probability of damage from earthquakes, according to the USGS. The figure shows that the planning area has a less than one percent chance of damages from earthquakes.

[61] United States Geological Survey. 2018. "Information by Region – Nebraska." https://earthquake.usgs.gov/earthquakes/byregion/nebraska.php.

Figure 19: 2017 Probability of Damage from Earthquakes



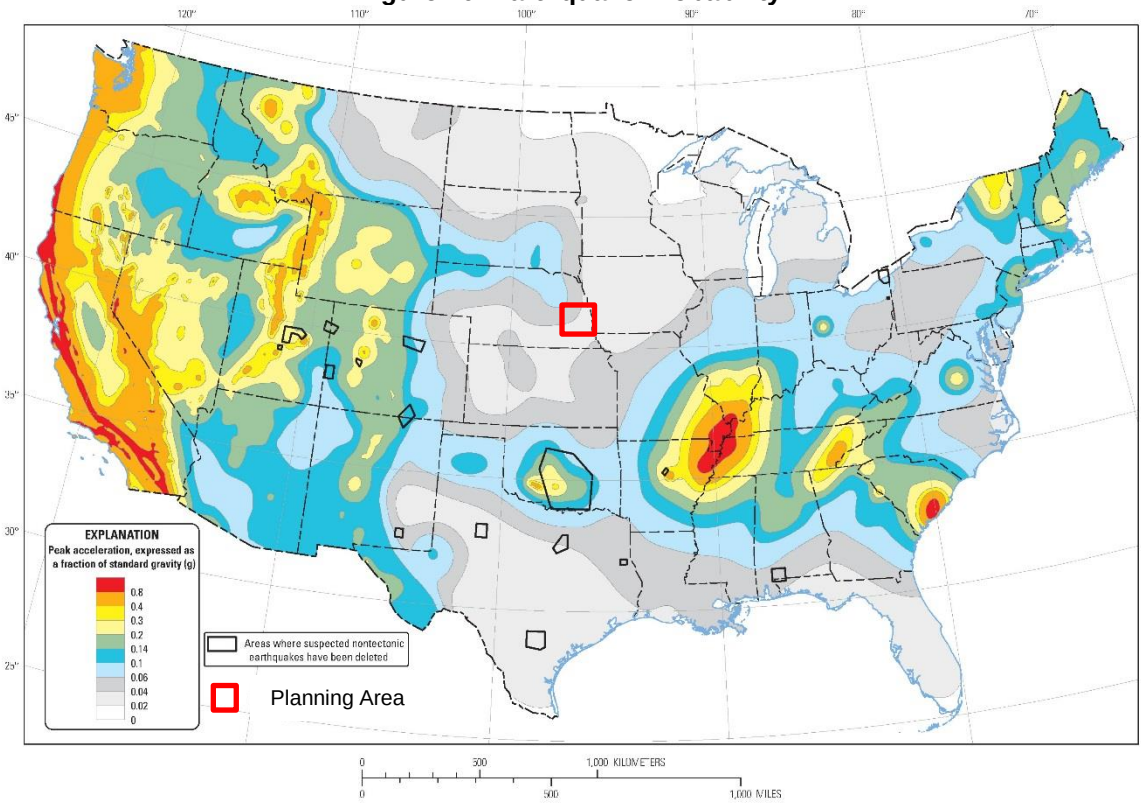
Source: USGS, 2017[62]

PROBABILITY

The following figure summarizes the probability of a 5.0 or greater earthquake occurring in the planning area within 50 years. However, with no earthquakes occurring in the planning area in 120 years, for the purposes of this plan, there is less than one percent chance of an earthquake occurring each year.

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

Figure 20: Earthquake Probability



Source: USGS 2009 PSHA Model
**Map shows the two-percent probability of exceedance in 50 years of peak ground acceleration*

REGIONAL VULNERABILITIES

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

Table 62: Regional Earthquake Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Risk of injury or death from falling objects and structures
ECONOMIC	-Short term interruption of business
BUILT ENVIRONMENT	-Damage to buildings, homes, or other structures from foundation cracking, falling objects, shattered windows, etc.
INFRASTRUCTURE	-Damage to subterranean infrastructure (i.e. waterlines, gas lines, etc.) -Damage to roadways
CRITICAL FACILITIES	-Same as all other structures
CLIMATE	-None

EXTREME HEAT

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

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

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

For the planning area, the months with the highest temperatures are June, July, and August. The National Weather Service (NWS) is responsible for issuing excessive heat outlooks, excessive heat watches, and excessive heat warnings.

- **Excessive heat outlooks** are issued when the potential exists for an excessive heat event in the next 3 to 7 days. Excessive heat outlooks can be utilized by public utility staffs, emergency managers, and public health officials to plan for extreme heat events.
- **Excessive heat watches** are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours.
- **Excessive heat warnings** are issued when an excessive heat event is expected in the next 36 hours. Excessive heat warnings are issued when an extreme heat event is occurring, is imminent, or has a very high probability of occurring.

LOCATION

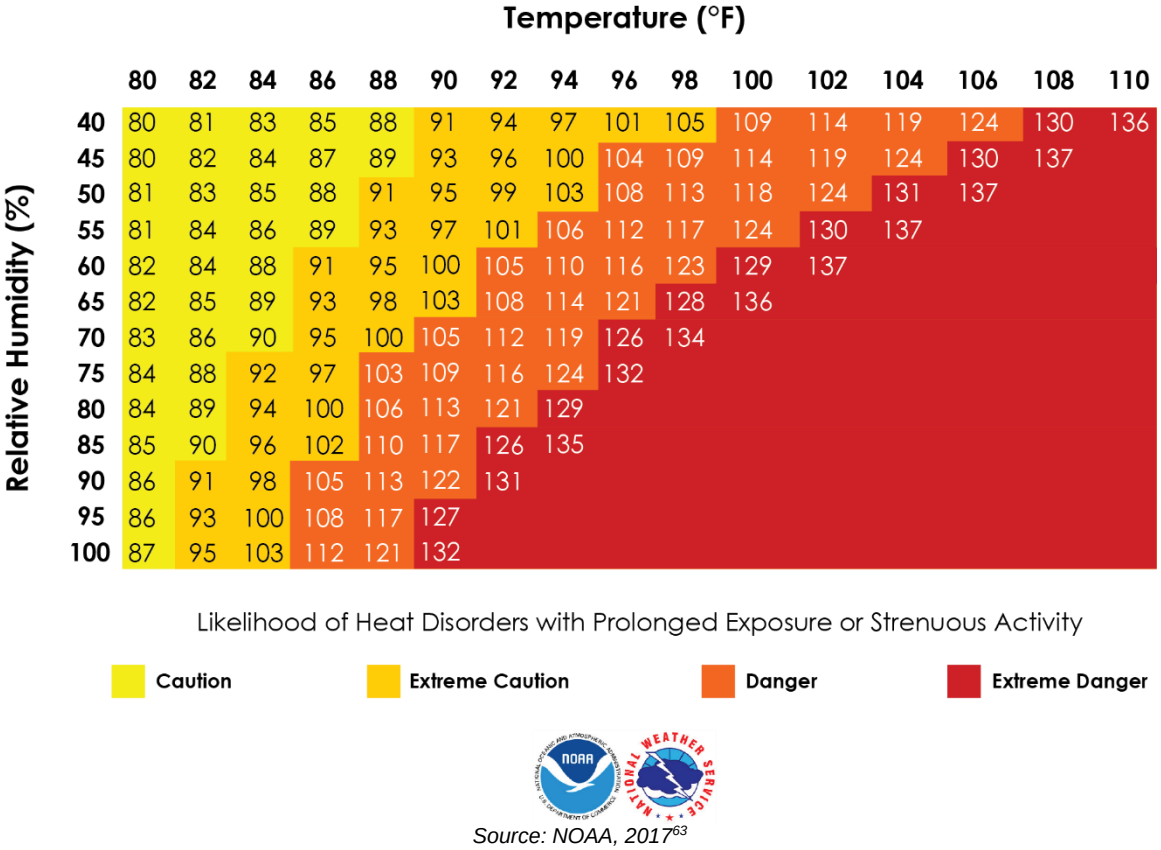
This hazard may occur throughout the planning area.

EXTENT

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

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

Figure 21: NOAA Heat Index



Source: NOAA, 2017[63]

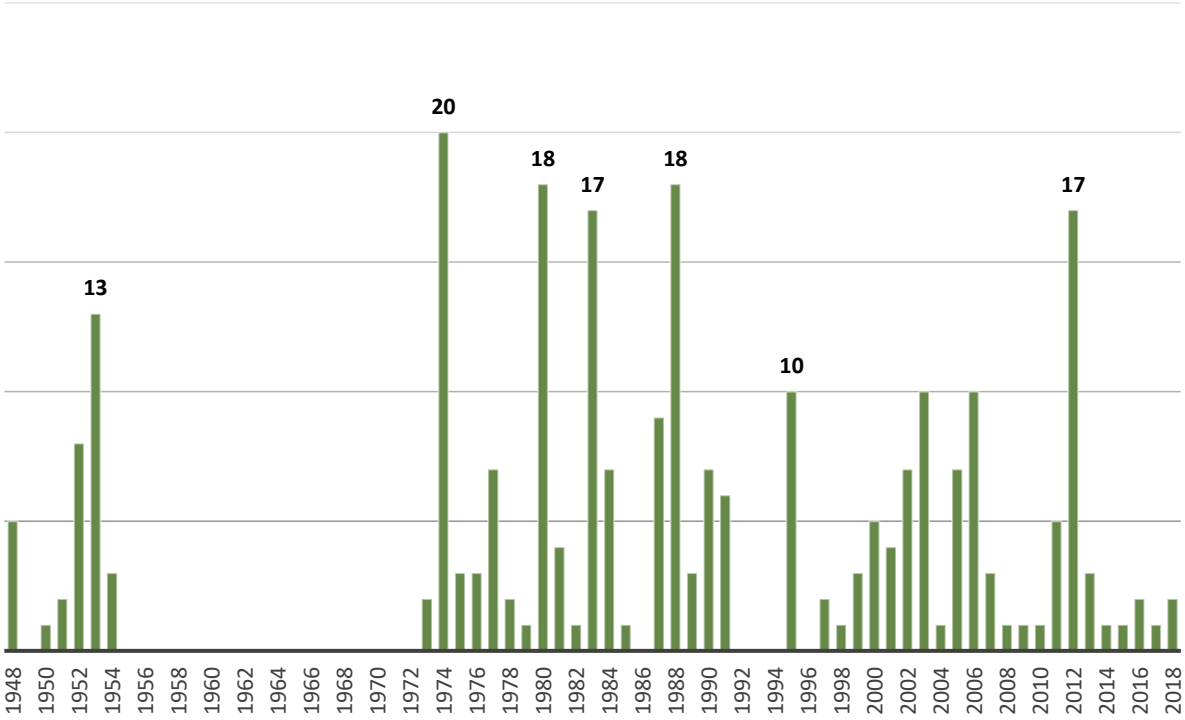
The figure above is designed for shady and light wind conditions. Exposure to full sunshine or strong winds can increase hazardous conditions and raise heat index values by up to 15°F. For the purposes of this plan, extreme heat is being defined as temperatures of 100°F or greater.

Historical Occurrences

According to the High Plains Regional Climate Center (HPRCC), on average, the planning area experiences four days above 100°F per year. The planning area experienced the most days on record above 100°F in 1974 with 20 days. More recently, in 2006 and 2012 there were 10 and 17 days above 100°F respectively. Conversely, 2010 was the most recent "coolest" year on record, with one day above 100°F.

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

Figure 22: Number of Days Above 100°F



Source: HPRCC, 1902-2018

AVERAGE ANNUAL LOSSES

The direct and indirect effects of extreme heat are difficult to quantify. Potential losses such as power outages could affect businesses, homes, and critical facilities. High demand and intense use of air conditioning can overload the electrical systems and cause damages to infrastructure.

The NCEI database did not report any property damage due to extreme heat events.

Table 63: Extreme Heat Loss Estimation

Hazard Type	Average Number of Days Above 100°F[1]	Property Damages[2]	Average Annual Property Damage[2]	Total Crop Loss[3]	Annual Crop Loss[3]
Extreme Heat	4	$0	$0	$3,997,922	$210,417

Source: 1 indicates the data is from HPRCC (1902-2018); 2 NCEI (1996-2018); 3 USDA RMA (2000-2018)

ESTIMATED LOSS OF ELECTRICITY

According to the FEMA Benefit Cost Analysis (BCA) Reference Guide, if an extreme heat event occurred within the planning area, the following table assumes the event could potentially cause a loss of electricity for 10 percent of the population at a cost of $126 per person per day.[64] In rural areas, the percent of the population affected and duration may increase during extreme events. The assumed damages do not take into account physical damages to utility equipment and infrastructure.

[64] Federal Emergency Management Agency. June 2009. "BCA Reference Guide."

Table 64: Loss of Electricity - Assumed Damage by Jurisdiction

Jurisdiction	2017 Population	Population Affected (Assumed)	Electric Loss of Use Assumed Damage Per Day
Cass	25,513	2,551	$321,426
Lancaster	306,357	30,636	$3,860,136

PROBABILITY

Extreme heat is a regular part of the climate for the planning area; there is a 100 percent probability that temperatures greater than 100°F will occur annually. The Union for Concerned Scientists released a report in July 2019 titled *Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days*[65] 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 65: Extreme Heat Predictions for Days over 100F

Jurisdiction	Historical Average 1971-2000 (days per year)	Midcentury prediction 2036-2065 (days per year)	late century 2070-2099 (days per year)
Cass	7	39	65
Lancaster	7	39	66

Source: Union of Concerned Scientists, 1971-2019[66]

REGIONAL VULNERABILITIES

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

Table 66: Regional Extreme Heat Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Heat exhaustion -Heat Stroke -Vulnerable populations include: -People working outdoors -People without air conditioning -Young children outdoors or without air conditioning -Elderly outdoors or without air conditioning
ECONOMIC	-Short-term interruption of business -Loss of power -Agricultural losses
BUILT ENVIRONMENT	-Damage to air conditioning units if overworked
INFRASTRUCTURE	-Overload of electrical systems -Damages to roadways
CRITICAL FACILITIES	-Loss of power
CLIMATE	-Increases in extreme heat conditions are likely, adding stress on livestock, crops, people, and infrastructure

[65] 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.

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

FLOODING

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

RIVERINE FLOODING

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

FLASH FLOODING

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

SHEET FLOODING

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

ICE JAM FLOODING

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

LOCATION

Table 67 shows current statuses of Flood Insurance Rate Map (FIRM) panels. Most of the jurisdictions throughout the planning area also have FIRMs at the municipal level. Figure 23 shows the preliminary firm data for the planning area. For jurisdictional-specific maps as well as an inventory of structures in the floodplain, please refer to *Section Seven: Participant Sections.*

Table 67: FEMA FIRM Panel Status

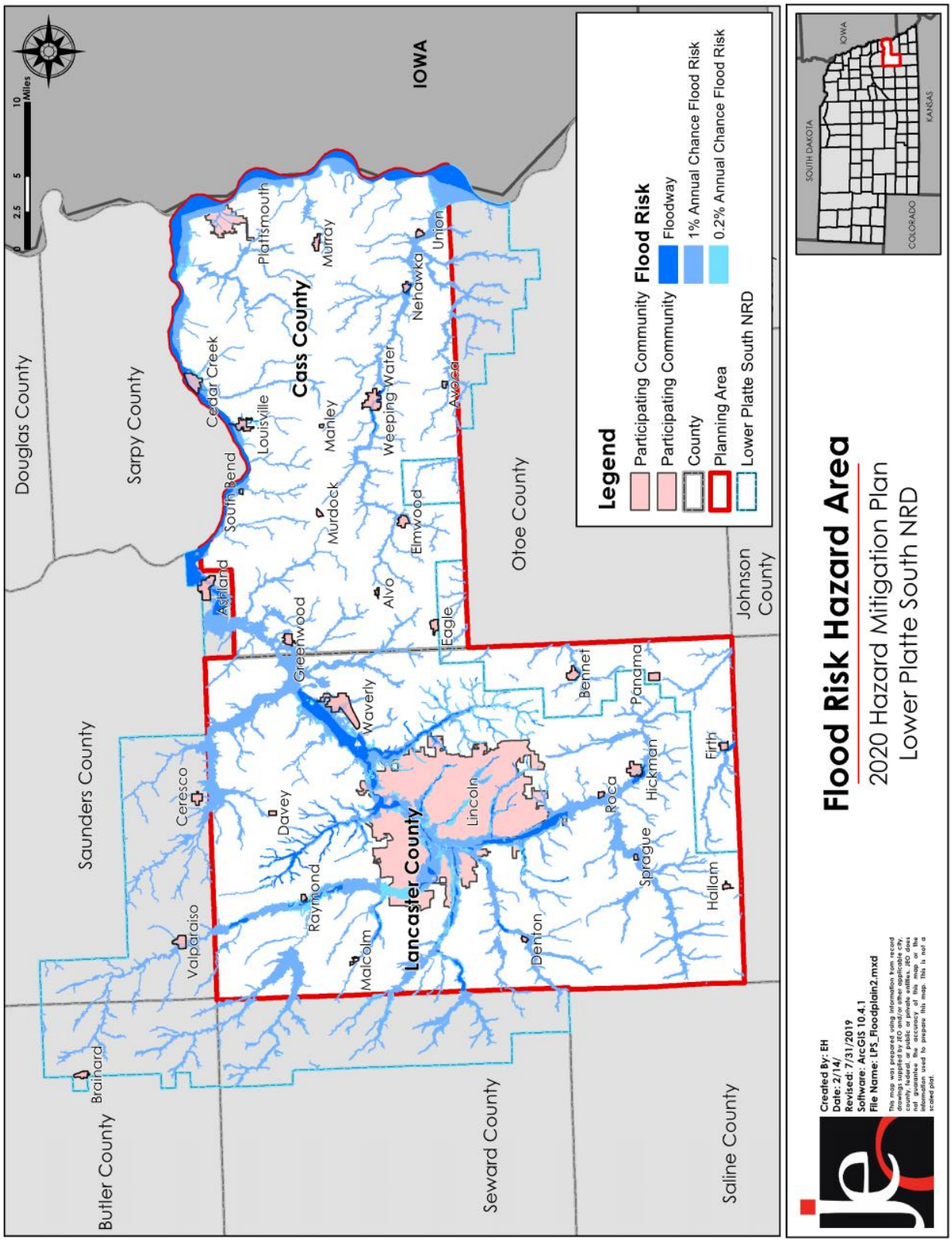
Jurisdiction	Panel Number	Effective Date
Butler County	31023CIN0A	08/16/2011
Brainard	31023CIN0A, 31023C0260C, 31023C0270C, 31023C0290C	08/16/2011
Cass County	31025CIN0A	11/26/2010
Alvo	31025CIN0A, 31025C0175D, 31025C0200D, 31025C0325D, 31025C0350D	11/26/2010
Avoca	31025CIND0A, 31025C0360D, 31025C0375D, 31025C0380D, 31025C0390D	11/26/2010
Cedar Creek	31025CIND0A, 31025C0070D, 31025C0090D	11/26/2010
Eagle	31025CIND0A, 31025C0325D	11/26/2010
Elmwood	31025CIND0A, 31025C0350D	11/26/2010
Greenwood	31025CIND0A, 31025C0155D, 31025C0160D	11/26/2010
Louisville	31025CIND0A, 31025C0070D, 31025C0205D, 31025C0210D	11/26/2010
Manley	31025CIND0A, 31025C0220D	11/26/2010
Murdock	31025CIND0A, 31025C0200D	11/26/2010
Murray	31025CIND0A, 31025C0275D	11/26/2010
Nehawka	31025CIND0A, 31025C0385D, 31025C0405D, 31025C0415D	11/26/2010
Plattsmouth	31025CIND0A, 31025C0115D, 31025C0120D, 31025C0140D, 31025C0255D, 31025C0260D, 31025C0300D	11/26/2010
South Bend	31025CIND0A, 31025C0050D, 31025C0065D	11/26/2010
Union	31025CIND0A, 31025C0410D, 31025C0420D	11/26/2010
Weeping Water	31025CIND0A, 31025C0220D, 31025C0250D, 31025C0360D, 31025C0380D	11/26/2010
Lancaster County	31109CIND0B	04/16/2013
Bennet	31109CIND0B, 3109C0459G, 31109C0467G, 31109C0478G, 31109C0486G	04/16/2013
Davey	31109CIND0B, 31109C0070G, 31109C0177G, 31109C0183G, 31109C0184G, 31109C0185G	04/16/2013
Denton	31109CIND0B, 31109C0290G, 31109C0405G	04/16/2013
Firth	31109CIND0B, 31109C0575G, 31109C0586G, 31109C0588G, 31109C0600G	04/16/2013
Hallam	31109CIND0B, 31109C0550G	04/16/2013
Hickman	31109CIND0B, 31109C0444G, 31109C0445G, 31109C0463G, 31109C0557G, 31109C0575G, 31109C0576G	04/16/2013
Lincoln	31109CIND0B, 31109C0165G 31109C0170G, 31109C0183G, 31109C0184G, 31109C0186G, 31109C0187G, 31109C0188G, 31109C0189G, 31109C0191G, 31109C0192G, 31109C0193G, 31109C0194G, 31109C0205G, 31109C0215G, 31109C0216F, 31109C0218G, 31109C0280G, 31109C0285F, 31109C0290G, 31109C0295G, 31109C0305F, 31109C0310F, 31109C0315F, 31109C0316F, 31109C0317F, 31109C0318F, 31109C0319F, 31109C0326F, 31109C0327G, 31109C0328F, 31109C0329F, 31109C0331G, 31109C0332G, 31109C0333F, 31109C0334F, 31109C0336F, 31109C0337F, 31109C0338F, 31109C0339F, 31109C0341F, 31109C0342F, 31109C0343F, 31109C0344F, 31109C0407G, 31109C0409G, 31109C0410G, 31109C0420G, 31109C0430G, 31109C0431F, 31109C0432F, 31109C0435G, 31109C0440G, 31109C0445G, 31109C0451F, 31109C0452F, 31109C0453G, 31109C0454G, 31109C0456F, 31109C0457F, 31109C0458G, 31109C0459G, 31109C0465G	4/16/2013, 2/18/2011
Malcolm	31109CIND0B, 31109C0145G, 31109C0165G	04/16/2013
Panama	31109CIND0B, 31109C0600G, 31109C0625G	04/16/2013

Jurisdiction	Panel Number	Effective Date
Raymond	31109CIND0B, 31109C0156, 31109C0157G, 31109C0158G, 31109C0159G	04/16/2013
Roca	31109CIND0B, 31109C0444G, 31109C0445G	04/16/2013
Sprague	31109CIND0B, 31109C0420G, 31109C0440G, 31109C0535G, 31109C0555G	04/16/2013
Waverly	31109CIND0B, 31109C0210G. 31109C0215G, 31109C0216F, 31109C0217G, 31109C0218G, 31109C0219G, 31109C0240G	04/19/2013, 02/18/2011
Otoe County	31131CIND0B	02/18/2011
Saunders County	31155CIND0B	08/03/2016
Ashland	31155CIND0B, 31155C0535D, 31155C0545D, 31155C0555D, 31155C0565D	08/03/2016, 04/05/2010
Ceresco	31109CIND0B, 31155CIND0B, 31109C0070G, 31109C0090G, 3155C0500D, 31155C0525D	04/16/2013, 08/03/2016, 04/05/2010
Valparaiso	31155CIND08, 31155C0475D	08/03/2016, 04/05/2010
Seward County	310474IND0	03/16/1992

Source: FEMA, 2019[67]

[67] Federal Emergency Management Agency. 2019. "FEMA Flood Map Service Center." http://msc.fema.gov/portal/advanceSearch.

Figure 23: 1% Annual Flood Risk Hazard Area



EXTENT

The NWS has three categories to define the severity of a flood once a river reaches flood stage as indicated in Table 68.

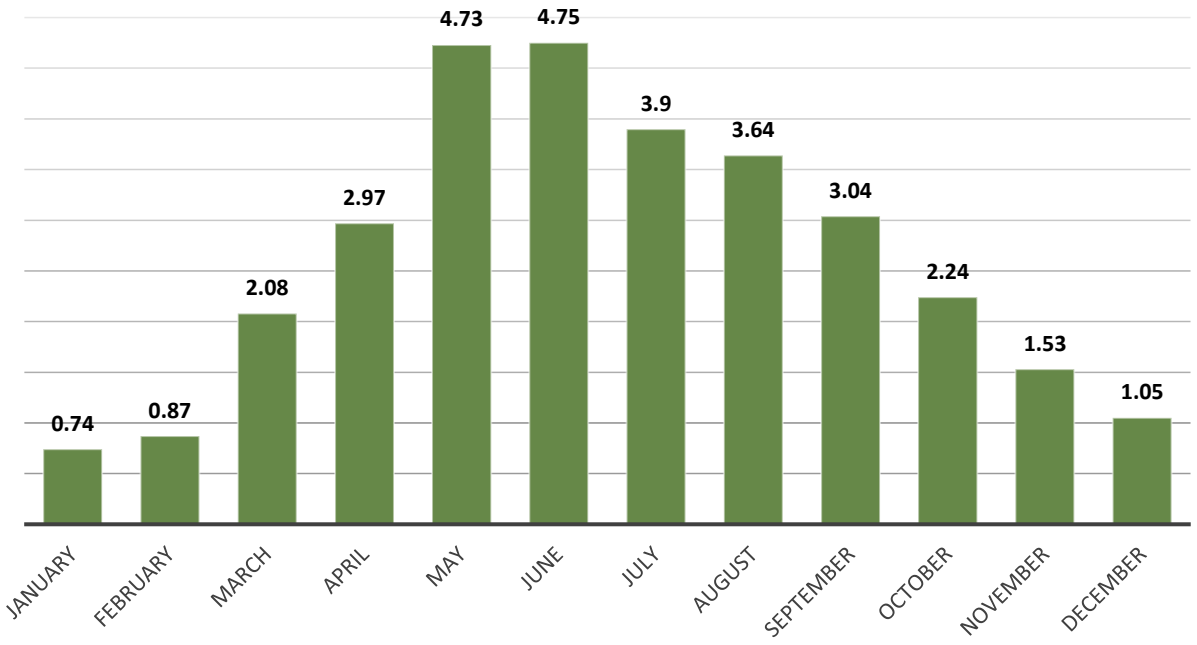
Table 68: Flooding Stages

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

Source: NOAA, 2017[68]

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. As indicated in Figure 25, the most common month for flooding within the planning area is in June.

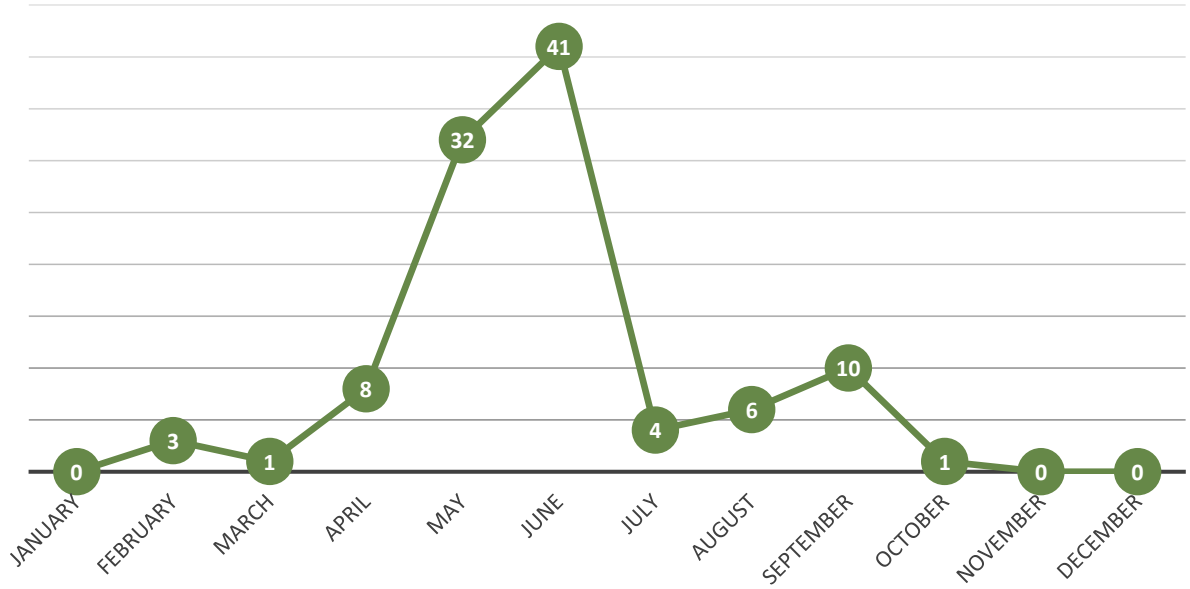
Figure 24: LPSNRD Average Monthly Precipitation



Source: NCEI, 2019

[68] National Weather Service. 2017. "Flood Safety." http://www.floodsafety.noaa.gov/index.shtml.

Figure 25: Monthly Events for Floods/Flash Flood in the LPSNRD



Source: NCEI, 1996-2018

NATIONAL FLOOD INSURANCE PROGRAM (NFIP)

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

In return for availability of federally-backed flood insurance, jurisdictions participating in the NFIP must agree to adopt and enforce floodplain management standards to regulate development in special flood hazard areas (SFHA) as defined by FEMA's flood maps.

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

Table 69: NFIP Participants

Jurisdiction	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded	Participation in NFIP
Butler County	08/16/11	08/16/11	No	No	No	Yes
Brainard	-	-	-	-	-	No
Cass County	09/02/82	11/26/10	No	No	No	Yes
Alvo	-	-	-	-	-	No
Avoca	08/03/79	11/26/10	No	No	No	Yes
Cedar Creek	09/15/78	11/26/10	No	No	No	Yes
Eagle	08/26/77	11/26/10	No	No	No	Yes
Elmwood	-	-	-	-	-	No
Greenwood	06/03/80	11/26/10	No	No	No	Yes
Louisville	03/04/80	11/26/10	No	No	No	Yes
Manley	-	-	-	-	-	No

Jurisdiction	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded	Participation in NFIP
Murdock	-	-	-	-	-	No
Murray	01/05/78	11/26/10	No	No	No	Yes
Nehawka	02/15/78	11/26/10	No	No	No	Yes
Plattsmouth	03/01/78	11/26/10	No	No	No	Yes
South Bend	07/20/84	11/26/10	No	No	No	Yes
Union	04/03/78	11/26/10	No	No	No	Yes
Weeping Water	12/01/77	11/26/10	No	No	No	Yes
Lancaster County	02/03/82	04/16/13	No	No	No	Yes
Bennet	03/02/81	04/16/13	No	No	No	Yes
Davey	-	-	-	-	-	No
Denton	09/21/01	04/16/13	No	No	No	Yes
Firth	04/15/81	04/16/13	No	No	No	Yes
Hallam	-	-	-	-	-	No
Hickman	02/03/82	04/16/13	No	No	No	Yes
Lincoln	04/23/71	04/16/13	No	No	No	Yes
Malcolm	03/30/09	04/16/13(M)	No	No	No	Yes
Panama	-	-	-	-	-	No
Raymond	04/18/85	04/16/13	No	No	No	Yes
Roca	01/28/14	04/16/13(M)***	No	No	No	Yes
Sprague	09/21/01	04/16/13(M)*	No	No	No	Yes
Waverly	04/15/82	04/16/13	No	No	No	Yes
Saunders County	12/01/78	08/03/16	No	No	No	Yes
Ashland	11/03/82	04/05/10	No	No	No	Yes
Ceresco	07/03/86	04/16/13	No	No	No	Yes
Valparaiso	06/03/86	04/05/10(M)*	No	No	No	Yes

Source: Federal Emergency Management Agency, National Flood Insurance Program, 2019
**(M) indicates No Elevation Determined – All Zone A, C, and X.*

Table 70: NFIP Policies in Force and Total Payments

Jurisdiction	Policies In-force	Total Coverage	Total Premiums	Closed Losses*	Total Payments
Butler County	28	$2,068,700	$25,716	-	-
Brainard	-	-	-	-	-
Cass County	300	$75,088,600	$203,726	228	$2,421,258
Alvo	-	-	-	-	-
Avoca	-	-	-	1	$80,678
Cedar Creek	102	$20,446,000	$122,197	25	$259,864
Eagle	-	-	-	1	$1,577
Elmwood	-	-	-	-	-

Jurisdiction	Policies In-force	Total Coverage	Total Premiums	Closed Losses*	Total Payments
Greenwood	-	-	-	-	-
Louisville	28	$4,015,500	$33,042	23	$160,038
Manley	-	-	-	-	-
Murdock	-	-	-	-	-
Murray	1	$50,000	$881	-	-
Nehawka	7	$1,116,500	$9,581	26	$207,859
Plattsmouth	48	$9,606,600	$65,378	7	$167,980
South Bend	16	$2,099,800	$9,876	-	-
Union	2	$97,000	$1,173	9	$49,013
Weeping Water	10	$1,710,900	$12,181	13	$158,710
Lancaster County	17	$3181600	$22,655	7	$61,670
Bennet	1	$70,000	$263	0	$0
Davey	-	-	-	-	-
Denton	-	-	-	-	-
Firth	2	$476,200	$1,232	-	-
Hallam	-	-	-	-	-
Hickman	19	$2,163,300	$20,081	6	$38,070
Lincoln	1262	$278,597,100	$1,533,584	128	$2,564,220
Malcolm	1	$350,000	$415	-	-
Panama	-	-	-	-	-
Raymond	-	-	-	1	$11,086
Roca	4	$614,100	$1,698	3	$19,574
Sprague	-	-	-	-	-
Waverly	73	$23,253,400	$98,445	4	$98,081
Saunders County	332	$83,928,500	$197,658	156	$1,968,007
Ashland	1	$350,000	$415	55	$496,128
Ceresco	1	$150,000	$628	0	$0
Valparaiso	2	$318,900	$3,841	-	-

Source: Federal Emergency Management Agency, National Flood Insurance Program, NFIP Community Status Book, 2019[69]
**Closed Losses are those flood insurance claims that resulted in payment*

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).[70] Currently Lincoln

[69] Federal Emergency Management Agency: National Flood Insurance Program. December 2019. Policy & Claim Statistics for Flood Insurance." Accessed December 2019. https://www.fema.gov/policy-claim-statistics-flood-insurance.
[70] Federal Emergency Management Agency. May 2017. "National Flood Insurance Program Community Rating System: Coordinator's Manual FIA-15/2017." Accessed August 2017. https://www.fema.gov/media-library/assets/documents/8768.

is the only jurisdiction in the planning area that participates in the CRS program. Lincoln is currently a Class 5 jurisdiction within the CRS program.

NFIP Repetitive Loss Structures

NeDNR and FEMA Region VII were contacted to determine if any existing buildings, infrastructure, or critical facilities are classified as NFIP Repetitive Loss Structures. There are 12 repetitive loss properties and eight severe repetitive loss properties located in the planning area.

Table 71: Repetitive Loss and Severe Repetitive Loss Properties

Jurisdiction	# of Repetitive Loss Properties	Repetitive Loss Type	# of Severe Repetitive Loss Properties	Severe Repetitive Loss Type
City of Ashland*	0	-	2	1 Single Family; 1 Other non-residence
Cass County*	5	5 Single Family	5	4 Single Family; 1 Other non-residence
City of Lincoln^	7	4 Single Family; 3 Businesses	0	-
City of Plattsmouth*	0	-	1	1 Single Family

*Source: *indicates data is from NeDNR, 2019; ^indicates data is from FEMA Region VII, Jan 2020*

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, 53 flash flooding events resulted in $5,067,000 in property damage, while 53 riverine flooding events caused $102,024,000 in property damage. USDA RMA data does not distinguish the difference between riverine flooding damages and flash flooding damages. The total crop loss according to the RMA is $2,362,042.

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

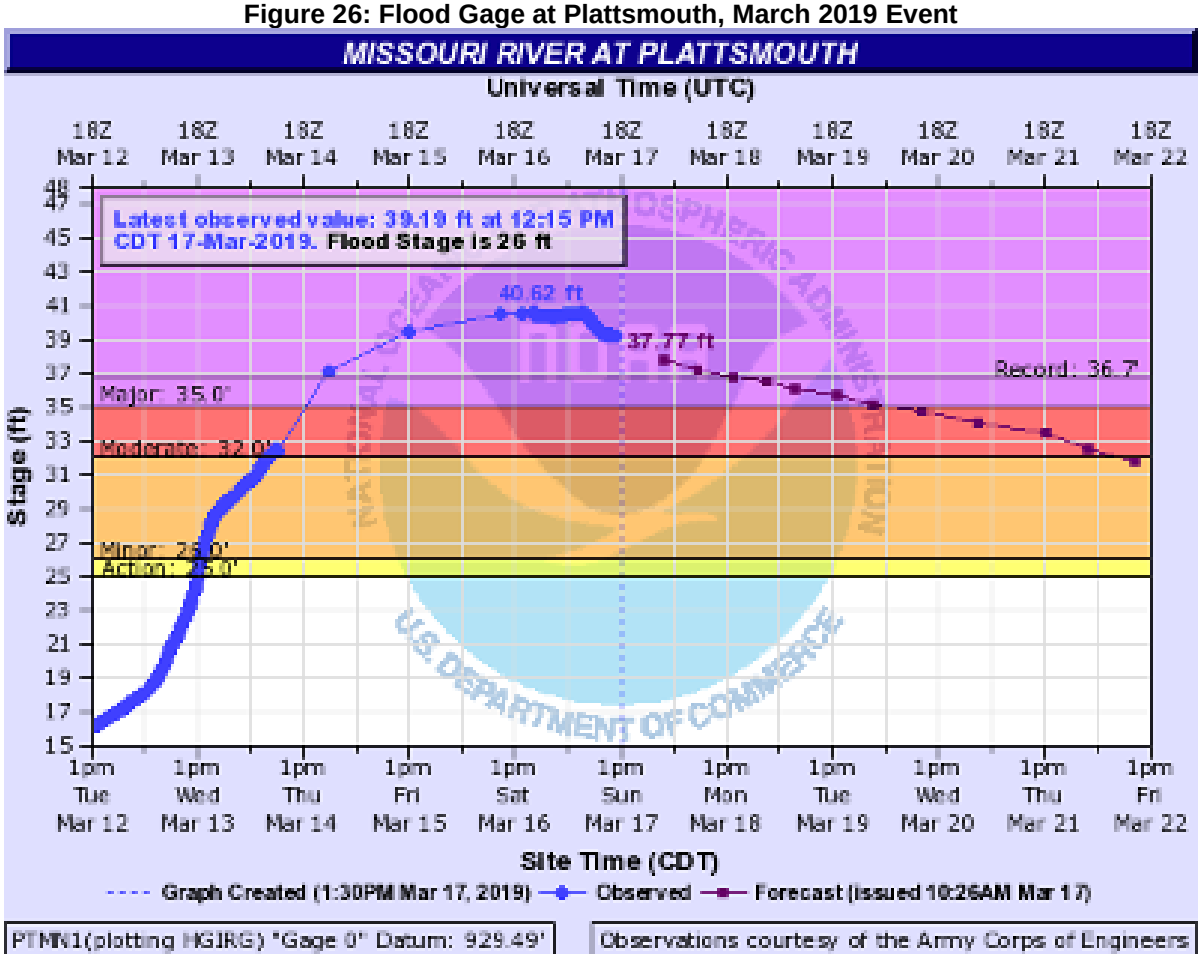
- June 21, 2010: In the Village of Avoca the creek flooded, and water was standing on the streets. The flooding caused damage to the Village Wastewater Plant, bridges, parks, and some residential buildings.
- September 2010: In the City of Weeping Water the campgrounds and its amenities and park facilities flooded.
- June-July 2011: Flooding along the Missouri and Platte Rivers caused property damage to residents on lots in Buccaneer Bay along the Platte River and Four Mile Creek. No damage was caused to the water and wastewater infrastructure, though a number of preventative steps were required, such as plugs in manhole covers.
- June 4, 2013: In the City of Hickman large flooding filled basements and impacted the first floor of structures in the floodplain. It also largely impacted the City of Hickman Main Park.
- Mary 29, 2013: In the Village of Ceresco, a flooding event occurred that flooded the bridges and highways and disturbed traffic for several hours.
- May 6, 2015: Record rainfall of 5 to 10 inches fell across Lancaster County, and the Salt Creek basin on the evening of the 6th into the early morning of the 7th. This led to significant flooding along the creek, from near Roca north through the Lincoln metro area. The flooding resulted in numerous road closures, water rescues, and some mandatory evacuations. The flooding was largely contained within the levee system within Lincoln, but many parks and low-lying areas were flooded.

MARCH 2019 FLOOD EVENT

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

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

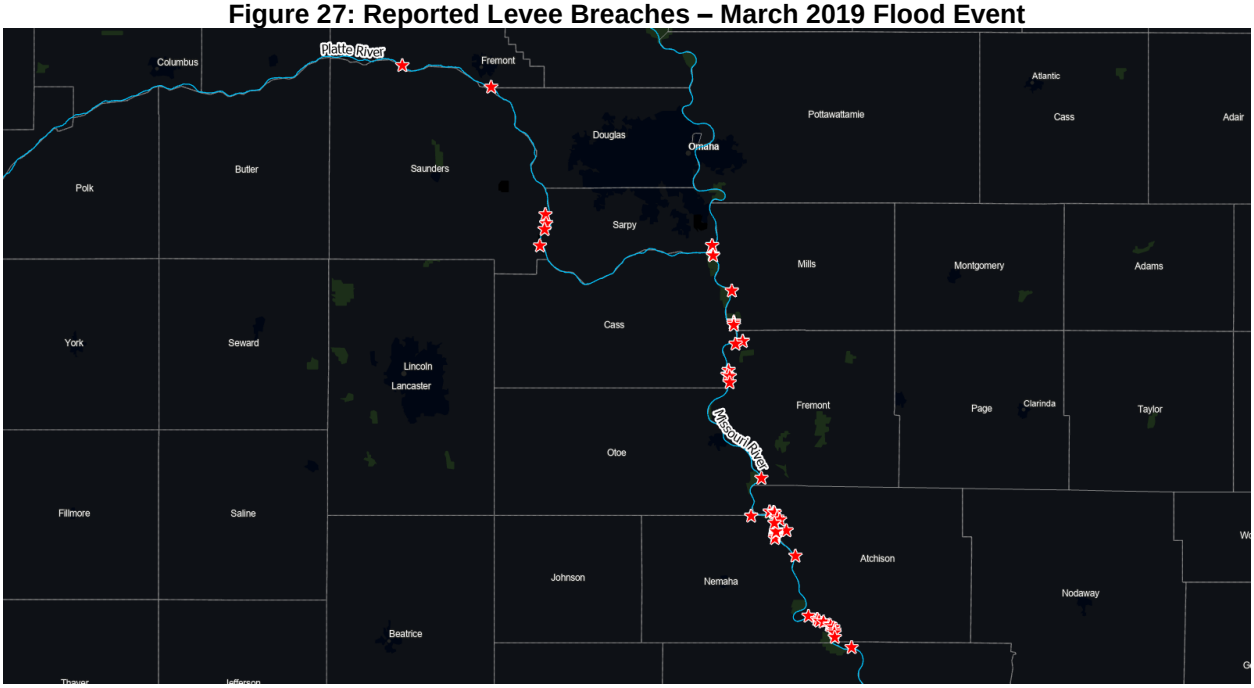
Figure 26: Flood Gage at Plattsmouth, March 2019 Event



Impacts from this event included significant damage to homes, commercial buildings, agriculture, bridges, and roads. Agriculturally, hundreds of acres of pastureland and fields were destroyed by several inches to feet of sand and silt left behind by receding flood waters. The flooding event also occurred in the midst of calving season, resulting in the loss of hundreds of calves for ranchers across the state. Roads and critical transportation routes across the state were blocked by flood waters or washed out entirely. At least three fatalities occurred during the flood event while the Nebraska National Guard performed dozens of rescues in inundated areas. No fatalities were reported within the LPSNRD and two-county planning area during this event.

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

Figure 27: Reported Levee Breaches – March 2019 Flood Event



Source: USACE

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

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

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

Average Annual Damages

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and the number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Flooding caused an average of $4,656,130 in property damages and $124,318 in crop losses per year for the planning area.

Table 72: Flood Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Flood Events	106	4.6	$107,091,000	$4,656,130	$2,362,042	$124,318

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

PROBABILITY

The NCEI reports 53 flooding and 53 flash flooding events from January 1996 to December 2018. Based on the historic record and reported incidents by participating communities, there is a 100 percent probability that flooding will occur annually in the planning area.

REGIONAL VULNERABILITIES

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

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

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

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

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

Table 73:Regional Flooding Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Low income and minority populations may lack the resources needed for evacuation, response, or to mitigate the potential for flooding -Elderly or residents with decreased mobility may have trouble evacuating -Residents in low-lying areas, especially campgrounds, are vulnerable during flash flood events -Residents living in the floodplain may need to evacuate for extended periods
ECONOMIC	-Business closures or damages may have significant impacts -Agricultural losses from flooded fields or cattle loss -Closed roads and railways would impact commercial transportation of goods
BUILT ENVIRONMENT	-Building may be damaged
INFRASTRUCTURE	-Damages to roadways and railways
CRITICAL FACILITIES	-Wastewater facilities are at risk, particularly those in the floodplain -Critical facilities, especially those in the floodplain, are at risk to damage (critical facilities are noted within individual community profiles)
CLIMATE	-Changes in seasonal and annual precipitation normals will likely increase frequency and magnitude of flood events

GRASS/WILDFIRE

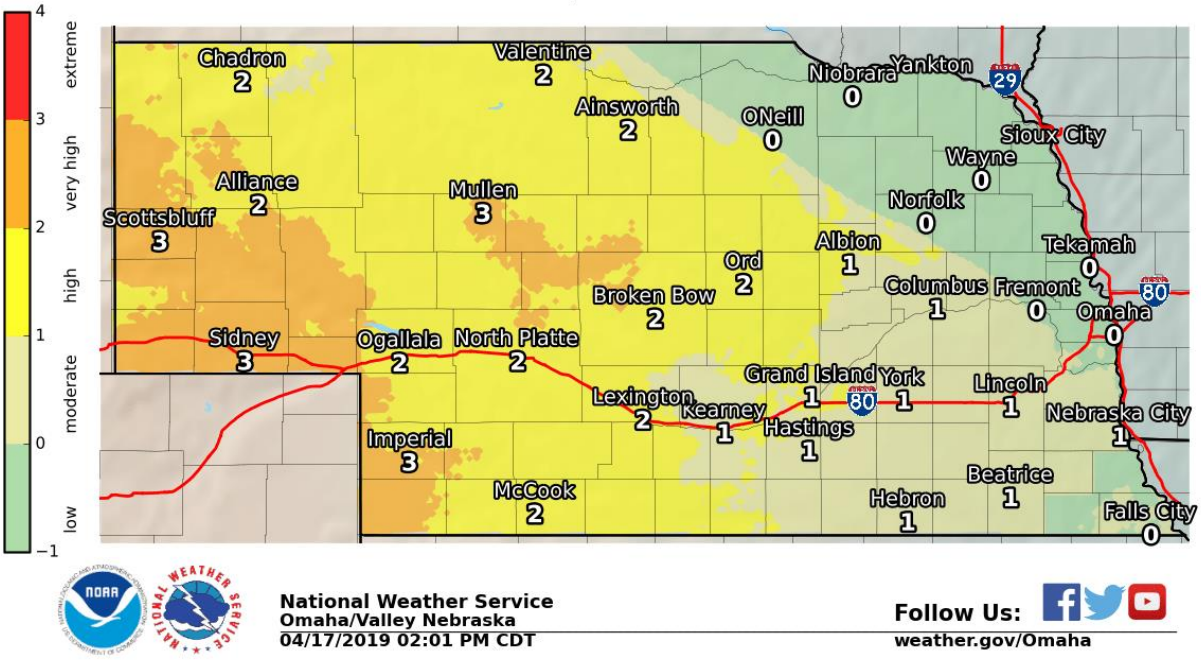
Wildfires, also known as brushfires, forest fires, or wildland fires, are any uncontrolled fire that occurs in the countryside or wildland. Wildland areas may include, but are not limited to: grasslands; forests; woodlands; agricultural fields; pastures; and other vegetated areas. Wildfires differ from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

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

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

Wildfires are characterized in terms of their physical properties including topography, weather, and fuels. Wildfire behavior is often complex and variably dependent on factors such as fuel type, moisture content in the fuel, humidity, wind speed, topography, geographic location, ambient temperature, the effect of weather on the fire, and the cause of ignition. Fuel is the only physical property humans can control and is the target of most mitigation efforts. The NWS monitors the risk factors including high temperature, high wind speed, fuel moisture (greenness of vegetation), low humidity, and cloud cover in the state on a daily basis (Figure 28).

Figure 28: Rangeland Fire Danger



Source: NWS, 2019[71]

[71] National Weather Service. January 2019. "Nebraska Fire Danger Map." https://www.weather.gov/oax/fire. Accessed April 2019.

LOCATION

As the number of reported wildfires by the county indicates, Lancaster County has both reported the greatest number of fires and had the greatest amount of acres burned.

Table 74: Reported Wildfires by County

County	Reported Wildfires	Acres Burned
Cass County	308	1,671
Lancaster County	870	11,420
Total	**1,178**	**13,091**

Source: Nebraska Forest Service, Jan 2000- Jan 2018[72]

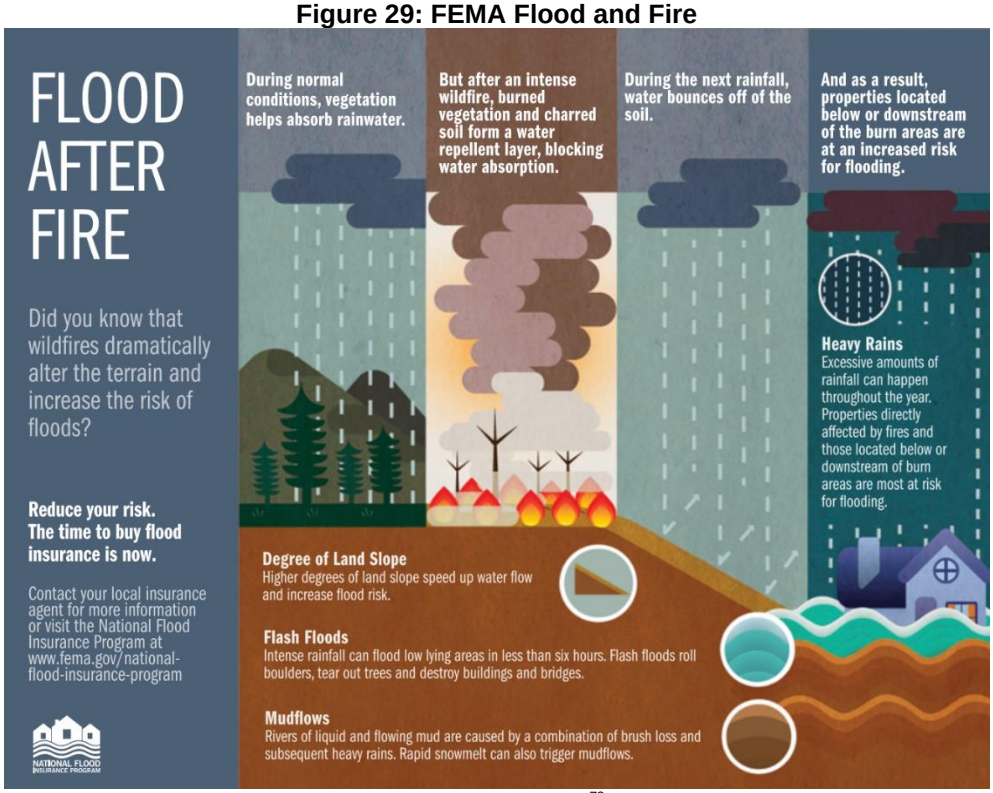
EXTENT

Figure 31 illustrates the number of wildfires by cause in the planning area from January 2000 to January 2018, which burned 13,091 acres in total. Overall, 1,178 wildfires were reported in the planning area. Of these, 17 fires burned 100 acres or more, with the largest wildfire burning 2,000 acres in Lancaster County in March of 2014.

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

Figure 30 shows the USGS' Mean Fire Return Interval. This model considers a variety of factors, including landscape, fire dynamics, fire spread, fire effects, and spatial context. These values show how often fires occur in each area under natural conditions.

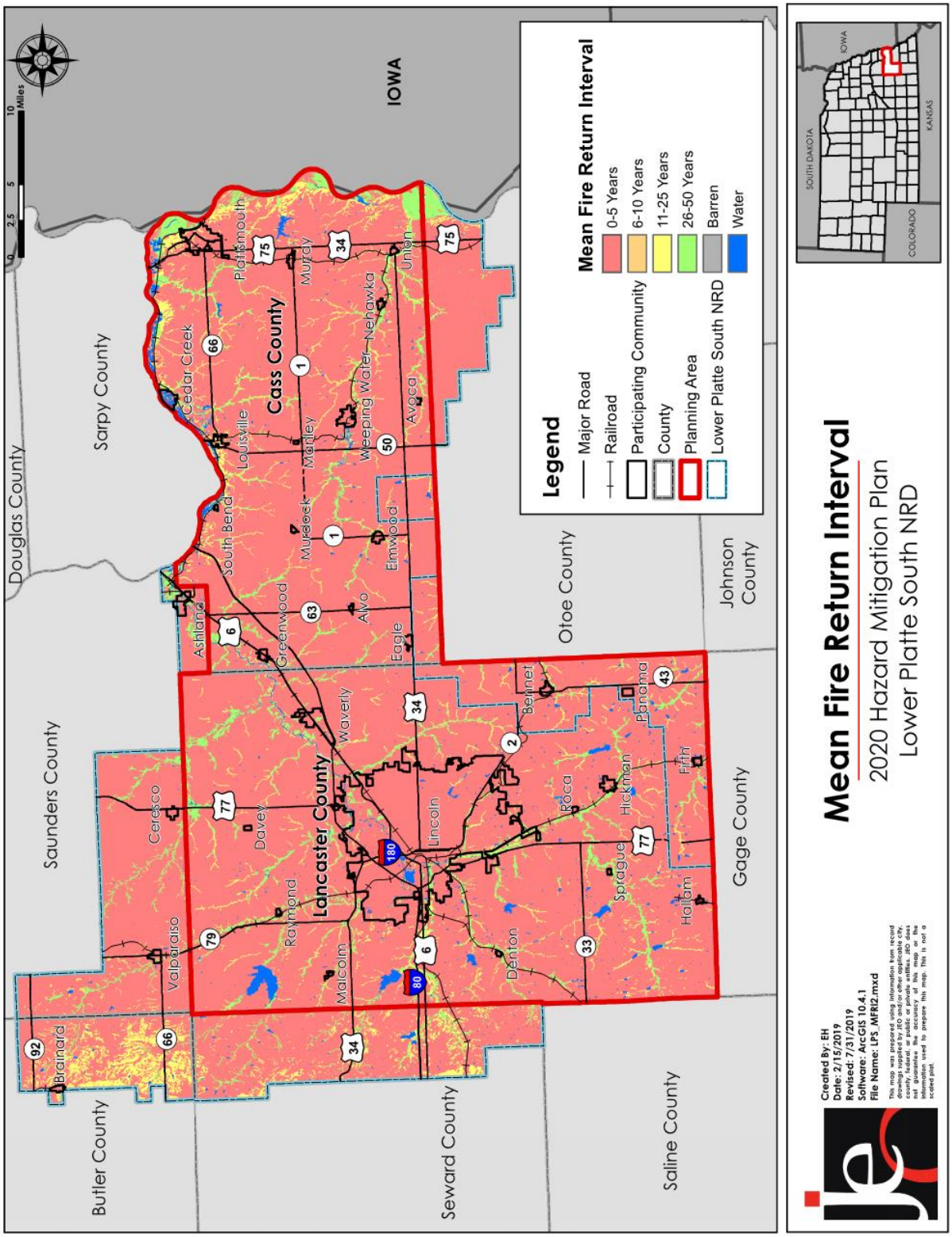
Figure 29: FEMA Flood and Fire



Source: FEMA, 2018[73]

[72] Nebraska Forest Service. 2000-2014. "Fire Incident Type Summary." Data Files 2000-2018.
[73] Federal Emergency Management Agency. 2018. "Flood After Fire." https://www.fema.gov/flood-after-fire.

Figure 30: Mean Fire Return Interval



Source: USGS LANDFIRE Database[74]

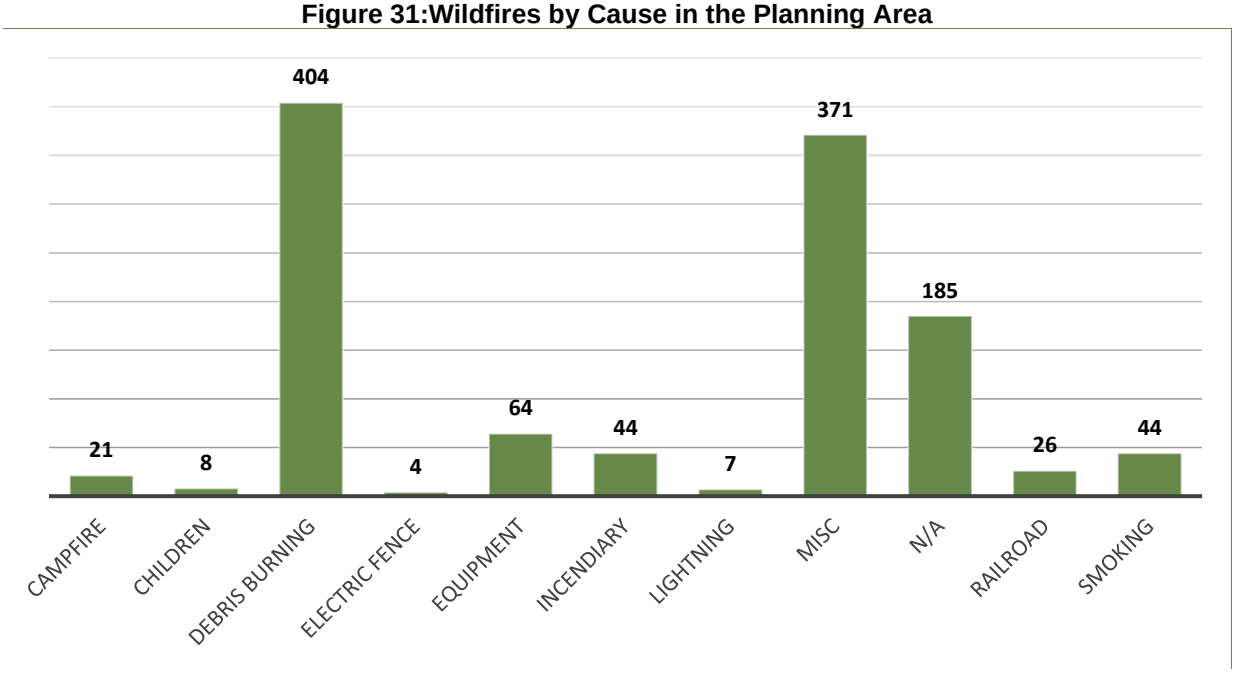
[74] United States Geological Survey. 2010. "Landfire Data Distribution Site." https://landfire.cr.usgs.gov/viewer/viewer.html.

HISTORICAL OCCURRENCES

For the planning area, 20 different fire departments reported a total of 1,178 wildfires, according to the National Forest Service (NFS), from January 2000 to January 2018. Most fires occurred in 2005 (Figure 32). The reported events burned 13,091 acres. While the RMA lists no damages from fire in the planning area, the NFS reported $64,275 in crop loss.

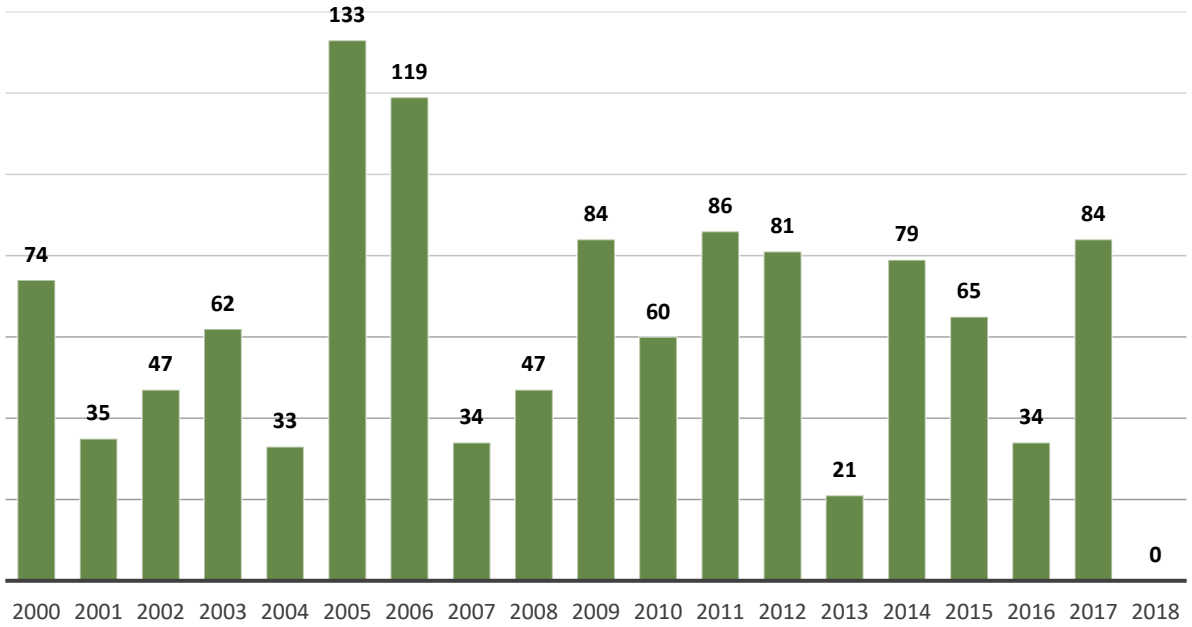
The majority of wildfires in the planning area were caused by debris burning (Figure 31). Wildfires in the planning area have ranged from zero to 2,000 acres, with an average event burning 11 acres.

Figure 31:Wildfires by Cause in the Planning Area



Source: Nebraska Forest Service, Jan 2000- Jan 2018

Figure 32: Number of Wildfires by Year in the Planning Area



Source: Nebraska Forest Service, Jan 2000- Jan 2018

Average Annual Damages

The average damage per event estimate was determined based upon records from the Nebraska Forest Service Wildfires Database from January 2000 to January 2018 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. During the 19-year period, 1,178 wildfires burned 13,091 acres and caused $64,275 in crop damage in the planning area.

Table 75: Wildfire Loss Estimation

Hazard Type	Number of Events	Events Per Year	Average Acres Per Fire	Total Property Loss	Total Crop Loss	Average Annual Crop Loss
Grass/Wildfires	1,178	62	11	13,091 acres	$64,275	$3,383

Source: Nebraska Forest Service, Jan 2000- Jan 2018

Table 76: Wildfire Threats

Hazard Type	Injuries	Fatalities	Homes Threatened or Destroyed	Other Structures Threatened or Destroyed
Grass/Wildfires	1	2	32	35

Source: Nebraska Forest Service, Jan 2000- Jan 2018

Probability

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

Regional Vulnerabilities

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

Table 77: Regional Wildfire Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Risk of injury or death for residents and firefighting personnel -Displacement of people and loss of homes -Lack of transportation poses risk to low income individuals, families, and elderly -Transportation routes may be blocked by fire, preventing evacuation efforts
ECONOMIC	-Damages to buildings and property can cause significant losses to business owners -Loss of businesses
BUILT ENVIRONMENT	-Property damages
INFRASTRUCTURE	-Damage to power lines and utility structures
CRITICAL FACILITIES	-Risk of damages
CLIMATE	-Changes in seasonal temperature and precipitation normals can increase frequency and severity of wildfire events -Changes in climate can help spread of invasive species, changing potential fuel load in wildland areas
OTHER	-Increase chance of landslides and erosion -May lead to poor water quality -Post fire, flash flooding events may be exacerbated

HAIL

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

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

LOCATION

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

EXTENT

The Tornado and Storm Research Organization (TORRO) scale is used to classify hailstones and provides some detail related to the potential impacts from hail. Table 78 outlines the TORRO Hail Scale.

Table 78: TORRO Hail Scale

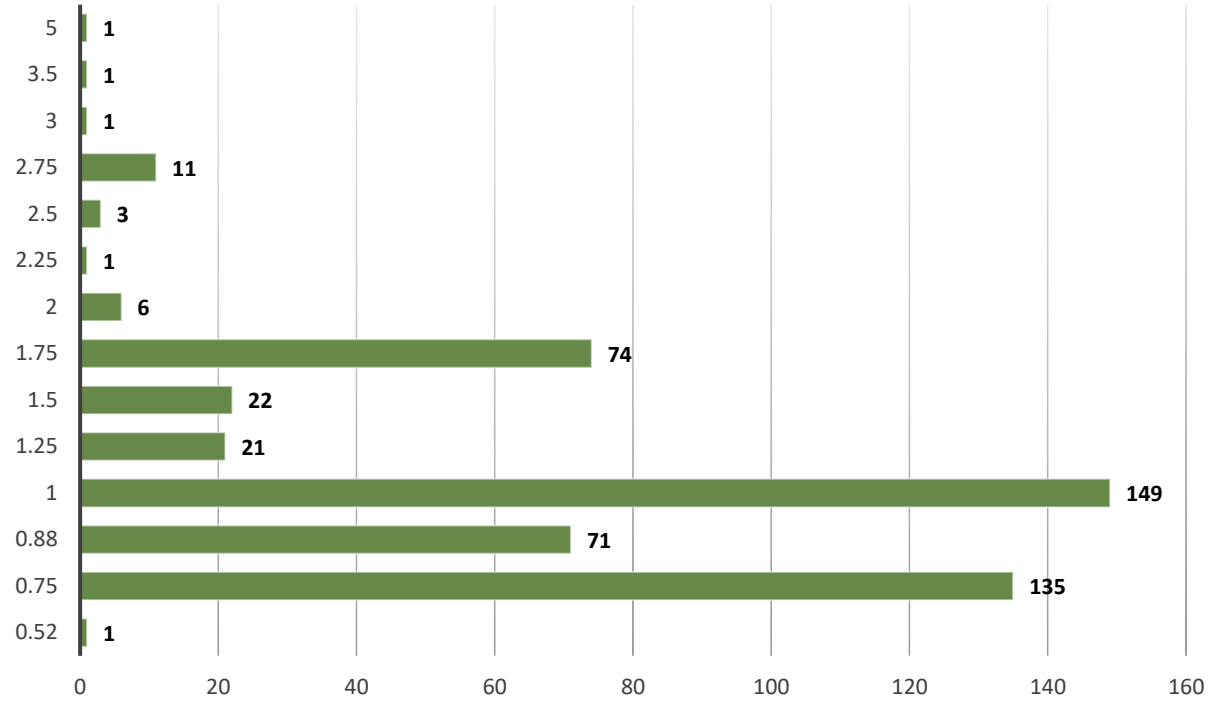
CLASS	TYPE OF MATERIAL	DIVISIONS
H0: Hard Hail	5 mm; (Pea size); 0.2 in	No damage
H1: Potentially Damaging	5 -15 mm (Marble); 0.2 – 0.6 in	Slight general damage to plants and crops
H2: Significant	10 -20 mm (Grape); 0.4 – 0.8 in.	Significant damage to fruit, crops, and vegetation
H3: Severe	20 -30 mm (Walnut); 0.8 – 1.2 in	Severe damage to fruit and crops, damage to glass and plastic structures
H4: Severe	30 -40 mm (Squash Ball); 1.2 – 1.6 in	Widespread damage to glass, vehicle bodywork damaged
H5: Destructive	40 – 50 mm (Golf ball); 1.6 – 2.0 in.	Wholesale destruction of glass, damage to tiled roofs; significant risk or injury
H6: Destructive	50 – 60 mm (chicken egg); 2.0 – 2.4 in	Grounded aircrafts damaged, brick walls pitted; significant risk of injury
H7: Destructive	60 – 75 mm (Tennis ball); 2.4 – 3.0 in	Severe roof damage; risk of serious injuries
H8: Destructive	75 – 90 mm (Large orange); 3.0 – 3.5 in.	Severe damage to structures, vehicles, airplanes; risk of serious injuries
H9: Super Hail	90 – 100 mm (Grapefruit); 3.5 – 4.0 in	Extensive structural damage; risk of severe or even fatal injuries to persons outdoors
H10: Super Hail	>100 mm (Melon); > 4.0 in	Extensive structural damage; risk or severe or even fatal injuries to persons outdoors

Source: TORRO, 2017[75]

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

Of the 497 hail events reported across the planning area, the average hailstone size was 1.14 inches. Events of this magnitude correlate to an H3 classification. It is reasonable to expect H3 classified events to occur several times in a year throughout the planning area. In addition, it is reasonable, based on the number of occurrences, to expect larger hailstones to occur in the planning area annually. The planning area has endured one H10 hail events (>4.0 inches) during the period of record. Figure 33 shows hail events based on the size of the hail.

Figure 33: Hail Events by Magnitude



Source: NCEI, 1996-2018

HISTORICAL OCCURRENCES

The NCEI reports events as they occur in each community. A single hail event can affect multiple communities and counties at a time; the NCEI reports these large scale, multi-county events as separate events. The result is a single hail event covering a large portion of the planning area could be reported by the NCEI as several events. The NCEI reports a total of 497 hail events in the planning area between January 1996 and December 2018. These events were responsible for $3,000,000 in property damages and $3,658,898 in crop damages. These events resulted in no injuries or fatalities.

Specific hail events from NCEI reported by each community are listed in *Section Seven: Community Profiles*.

AVERAGE ANNUAL DAMAGES

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

Table 79: Hail Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Hail Events	497	21.6	$3,000,000	$130,435	$3,658,898	$192,574

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

PROBABILITY

Based on historic records and reported events, hail events are likely to occur several times annually within the planning area. The NCEI reported 497 hail events between 1996 and 2018, or approximately 22 hail occurrences per year.

REGIONAL VULNERABILITIES

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

Table 80: Regional Hail Vulnerabilities

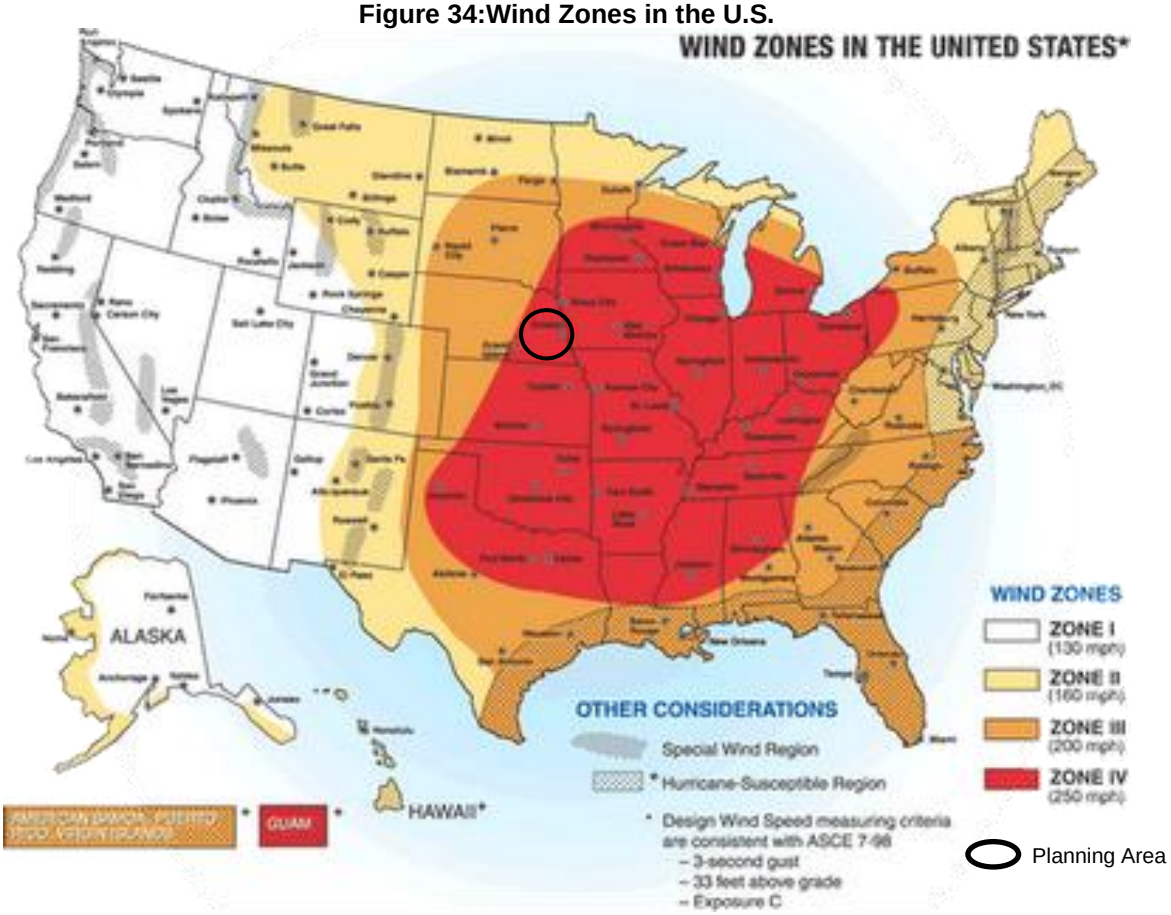
SECTOR	VULNERABILITY
PEOPLE	-Injuries can occur from: not seeking shelter, standing near windows, and shattered windshields in vehicles
ECONOMIC	-Damages to buildings and property can cause significant losses to business owners
BUILT ENVIRONMENT	-Roofs, siding, windows, gutters, HVAC systems, etc. can incur damages
INFRASTRUCTURE	-Power lines and utilities can be damaged
CRITICAL FACILITIES	-Property damages and power outages
CLIMATE	-Increased likelihood of more frequent and severe storm events, including hail
OTHER	-High winds, lightning, heavy rain, and possibly tornadoes can occur with this hazard

HIGH WINDS

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

The National Weather Service (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.[76] The NWS issues High Wind Advisories when there are sustained winds of 25 to 39 miles per hour and/or gusts to 57 mph. Figure 34 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/IV which has maximum winds of 250 mph equivalent to an EF5 tornado.

Figure 34:Wind Zones in the U.S.



Source: FEMA, 2016

LOCATION

High winds commonly occur throughout the planning area.

EXTENT

The Beaufort Wind Scale can be used to classify wind strength. Table 81 outlines the scale, provides wind speed ranking, range of wind speeds per ranking, and a brief description of conditions for each ranking.

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

Table 81: Beaufort Wind Ranking

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

Source: Storm Prediction Center, 2017[77]

Using the NCEI reported events, the most common high wind event is a level 10. The reported high wind events had an average of 55 mph winds. It is likely that this level of event will occur annually.

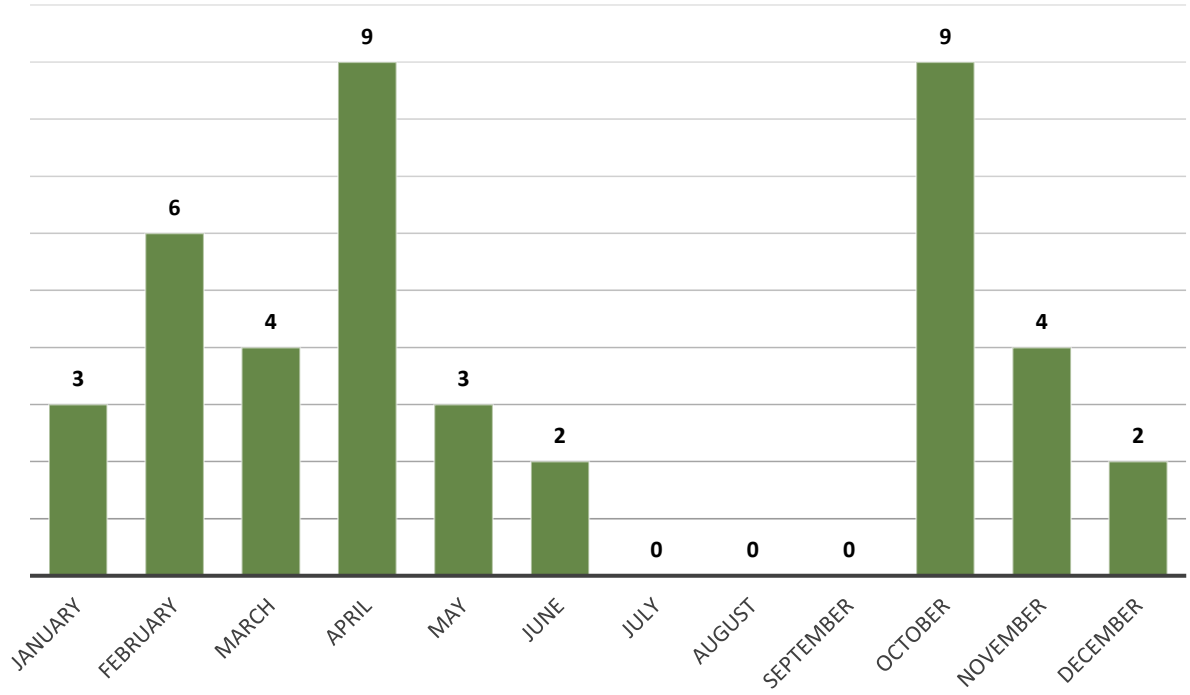
HISTORICAL OCCURRENCES

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 42 high wind events that occurred between January 1996 and December 2018. As seen in Figure 35, most high wind events occur in the spring and winter months. High wind events led to one injury and one fatality. The events identified by the NCEI are listed in *Section Seven: Community Profiles* for each county.

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

Figure 35: High Wind Events by Month



Source: NCEI, 1996-2018

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. It is estimated that high wind events can cause an average of $1,217 per year in property damage, and an average of $12,644 per year in crop damage for the planning area.

Table 82: High Wind Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
High Winds	42	1.8	$28,000	$1,217	$240,237	$12,644

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

PROBABILITY

Based on historical records and reported events, it is likely that high winds will occur within the planning area annually. For the 23 years examined, there were 42 reported high wind events reported.

REGIONAL VULNERABILITIES

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

Table 83: Regional High Wind Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Vulnerable populations include those living in mobile homes, especially if they are not anchored properly -People outdoors during events
ECONOMIC	-Agricultural losses to both crops and livestock -Damages to businesses and prolonged power outages can cause significant impacts to the local economy
BUILT ENVIRONMENT	-All building stock are at risk to damages from high winds
INFRASTRUCTURE	-Downed power lines and power outages -Downed trees blocking road access
CRITICAL FACILITIES	-All critical facilities are at risk to damages from high winds
CLIMATE	-Increased likelihood of frequency and magnitude of events

LEVEE FAILURE

According to FEMA:

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

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

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

LOCATION

There are 11 federal levees and five non-federal levees located within the two-county and LPSNRD planning area as reported in USACE's National Levee Database. The Clear Creek Levee System, located just north of Ashland, is outside of the two-county planning area; however, a small portion of the Levee System falls within the LPSNRD boundary, and it provides flood risk reduction for the City of Lincoln wellfield and the Nebraska Army National Guard Camp. See Figure 37, Table 84, and Table 85 for information on levee protected areas.

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

HISTORICAL OCCURRENCES

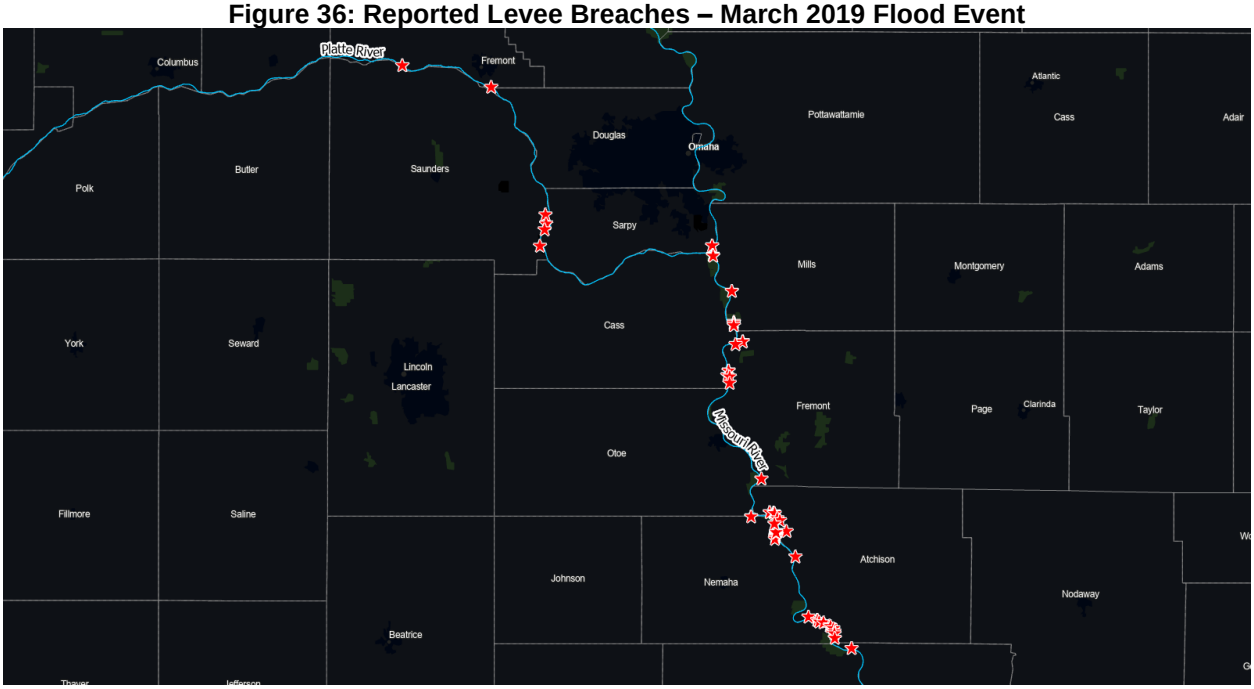
As there is no formal database of historical levee failures, the following sources were consulted: members of the Planning Team, local newspapers and media outlets, and the USACE. After the March 2019 flood event, USACE reported 41 breaches and numerous damages to federal and non-federal levees across the State of Nebraska. The failure of these structures significantly impacted subsequent flooding in neighboring communities. For a complete event narrative, refer to the Flooding hazard profile. As reported by USACE and the Planning Team, the Clear Creek Levee System was breached, but as noted above, does not fall within the two-county planning area. Three additional levee systems were damaged. Descriptions of these levees from USACE are found below:[78]

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

[78] U.S. Army Corps of Engineers. 2019. "Omaha District System Restoration Team: Levee System Status as of October 3, 2019." https://www.nwo.usace.army.mil/Omaha-District-System-Restoration-Team/.

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

Figure 36: Reported Levee Breaches – March 2019 Flood Event



Source: USACE

Table 84: LPSNRD USACE Levees

Name	Sponsor	Location	River	Length (miles)	Type of Protection	Protected Area (sq miles)	Risk Level
Salt Creek LB & Haines RB	LPSNRD	Lincoln, Lancaster County	Salt Cr, Haines Cr	1.25	Urban	0.19	Low
Salt Creek RB	LPSNRD	Lincoln, Lancaster County	Salt Creek	4.71	Urban	1.33	Moderate
Salt Creek LB & Haines LB & Middle Cr RB	LPSNRD	Lincoln, Lancaster County	Salt Cr, Haines CR	2.49	Urban	0.47	Low
Salt Creek LB & Middle Creek LB	LPSNRD	Lincoln, Lancaster County	Salt Cr, Middle Cr	1.5	Urban	0.47	Moderate
Salt Creek LB & Oak Creek LB	LPSNRD	Lincoln, Lancaster County	Salt Cr, Oak Cr	1.72	Urban	0.45	Low
Salt Creek RB to Dead Man's Run	LPSNRD	Lincoln, Lancaster County	Salt Creek	1.62	Urban	0.44	Low
Salt Creek RB & Dead Man's Run RB	LPSNRD	Lincoln, Lancaster County	Salt Creek	1.6	Urban	0.38	Low
YMCA Camp Kitaki – Platte River RB (NF)	YMCA Camp Kitaki	South Bend, Cass County	Platte River	0.22	Structural	0.047	Low
Cedar Creek (Omaha F&W) – Platte RB	Omaha Fish & Wildlife Club and LPSNRD (co-sponsors)	Cedar Creek, Cass County	Platte River	1.56	Residential	0.38	Not Screened
Lake Waconda – Missouri River RB	Cass County SID #1	Cass County	Missouri River and Lake Waconda	2.53	Residential	0.6	Moderate
Clear Creek – Platte River RB*	LPNNRD and LPSNRD (co-sponsors)	Wann, Saunders County	Platte River	12.25	Urban	28.04	Not Screened

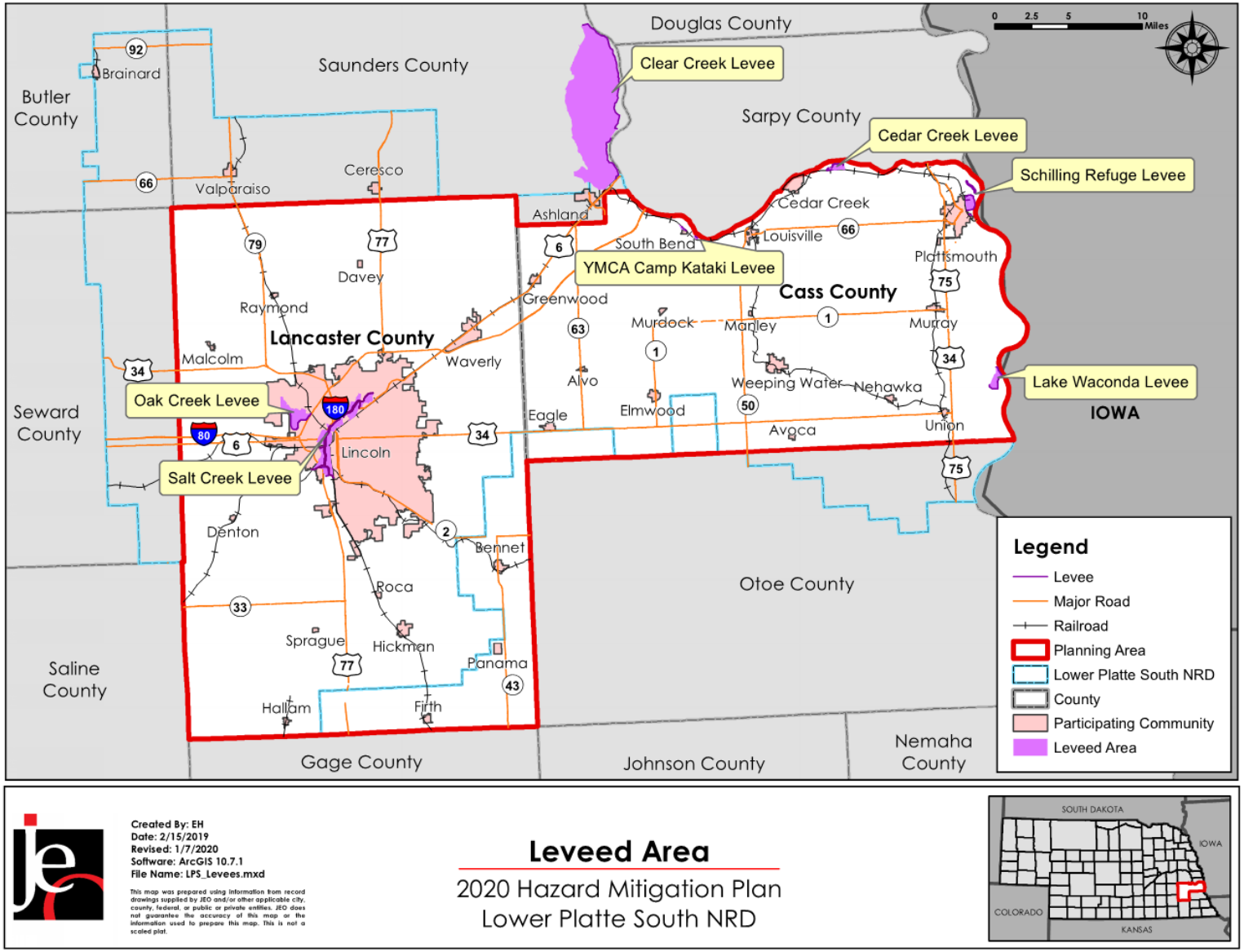
Source: USACE Levee Database
**Note: The Clear Creek Levee System is outside of the two-county planning area. However, a small portion of the levee falls within the LPSNRD area.*

Table 85: LPSNRD Non-USACE Levees

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

Source: USACE Levee Database

Figure 37: Leveed Area in the Planning Area



Potential Losses

To determine potential losses from levee failure, a parcel inventory from the levee breach area was utilized. Based on the nature of the assessor's parcel data, it is not possible to do a true structural inventory with structure-specific impacts. Instead, inundated parcels were used as a proxy for structural data. The following tables show the number of parcels included in the leveed areas within the planning area. A total of 1,961 parcels are within the leveed areas, which are valued at over $340 million.

Table 86: Potential Losses in Levee Breach Area

Number of Parcels in Leveed Area	Value of All Parcels in Leveed Area	Mean Value of Parcels in Leveed Area
1,961	$340,499,539	$173,636

Source: County Assessors

Extent

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

Table 87: USACE Levee Rating Categories

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

Source: USACE

Probability

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

Regional Vulnerabilities

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

Table 88: Regional Levee Failure Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Those living in federal levee protected areas -Residents with low mobility or with no access to a vehicle are more vulnerable during a levee failure
ECONOMIC	-Businesses and industries protected by levees are at risk during failures
BUILT ENVIRONMENT	-All buildings within levee protected areas are at risk to damages
INFRASTRUCTURE	-Major transportation corridors and bridges at risk during levee failures
CRITICAL FACILITIES	-Critical facilities in levee protected areas are at risk
CLIMATE	-Changes in seasonal precipitation and temperature normals can increase strain on infrastructure

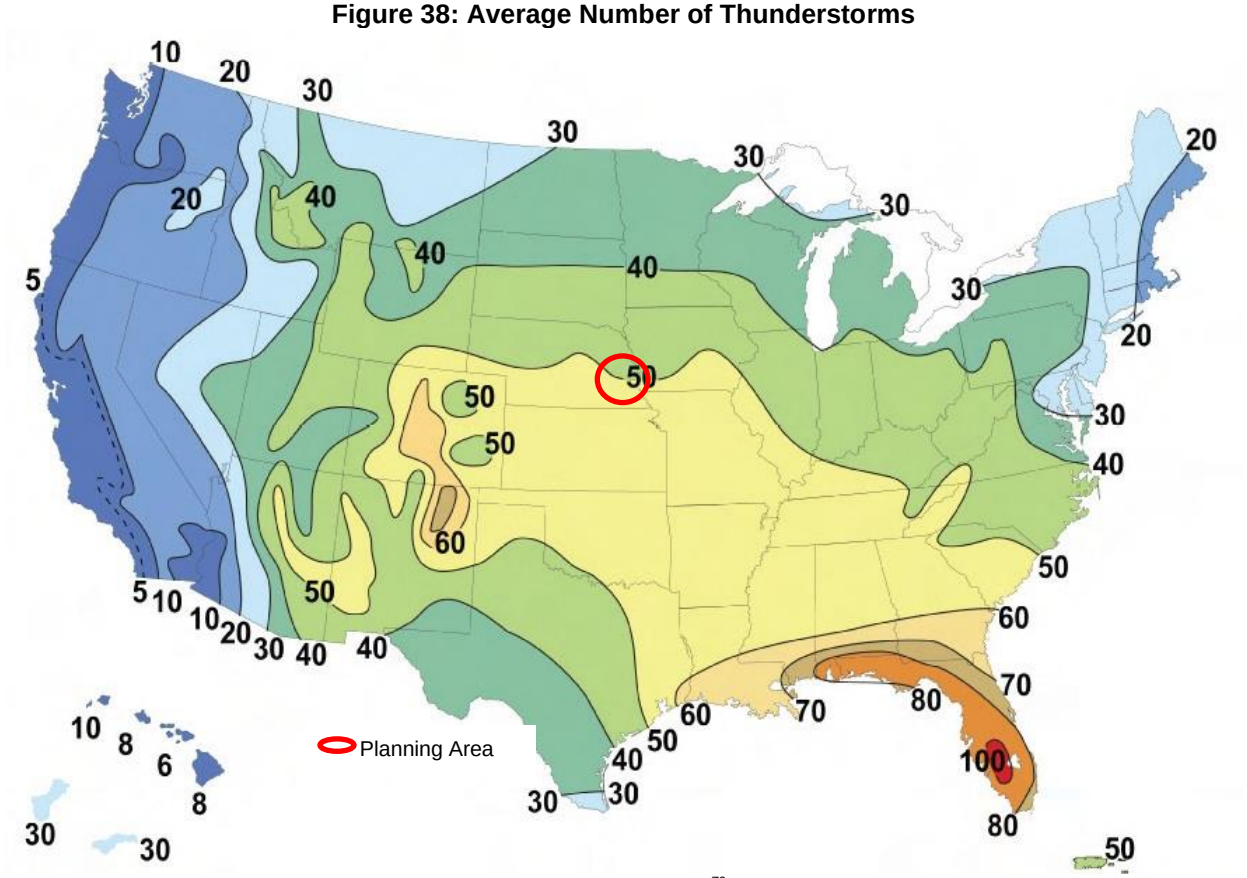
SEVERE THUNDERSTORMS

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

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

Economically, thunderstorms are generally beneficial in that they provide moisture necessary to support Nebraska's largest industry, agriculture. The majority of thunderstorms do not cause damage, but when they escalate to severe storms, the potential for damages increases. Damages can include: crop losses from wind and hail; property losses due to building and automobile damages from hail; high wind; flash flooding; and death or injury to humans and animals from lightning, drowning, or getting struck by falling or flying debris. Figure 38 displays the average number of days with thunderstorms across the country each year. The planning area experiences an average of 40 to 50 thunderstorms over the course of one year.

Figure 38: Average Number of Thunderstorms



Source: NWS, 2017[79]

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

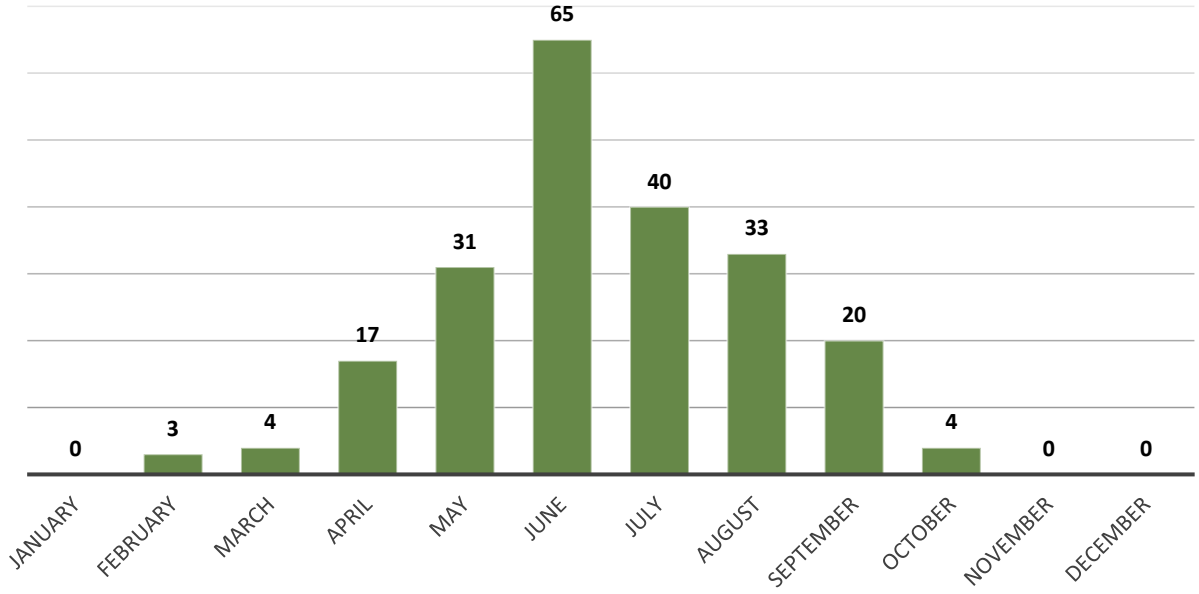
LOCATION
The entire planning area is at risk of severe thunderstorms.

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.

HISTORICAL OCCURRENCES
Severe thunderstorms in the planning area usually occur in the afternoon and evening during the summer months (Figure 39).

Figure 39: Thunderstorm Wind Events by Month



Source: NCEI, 1996-2018

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 217 thunderstorm wind, eight heavy rain, and 13 lightning events in the planning area from January 1996 to December 2018. Severe thunderstorm events were responsible for $3,285,400 in property damages. The USDA RMA data does not specify severe thunderstorms as a cause of loss, however heavy rains which may be associated with severe thunderstorms caused $7,975,276 in crop damages. There were three injuries and no deaths reported in association with these storms.

AVERAGE ANNUAL DAMAGES
The average damage per event estimate was determined based upon recorded damages from NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe thunderstorms and lightning cause an average of $142,843 per year in property damages and $419,751 in crop damages.

Table 89: Severe Thunderstorms Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss	Total Crop Loss[2]	Average Annual Crop Loss
Thunderstorm Wind	217	9.4	$2,049,000	$89,087	N/A	N/A
Heavy Rain	8	0.3	$0	$0	$7,975,276	$419,751
Lightning	13	0.6	$1,236,400	$53,757	N/A	N/A
Total	**238**	**10.3**	**$3,285,400**	**$142,843**	**$7,975,276**	**$419,751**

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

PROBABILITY

Based on historical records and reported events, severe thunderstorms are likely to occur on an annual basis. The NCEI reported 238 severe thunderstorm events between 1996 and 2018; resulting in 100 percent chance annually for thunderstorms.

REGIONAL VULNERABILITIES

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

Table 90: Regional Thunderstorm Vulnerabilities

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

SEVERE WINTER STORMS

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

EXTREME COLD

Along with snow and ice storm events, extreme cold is dangerous to the well-being of people and animals. What constitutes extreme cold varies from region to region, but is generally accepted as temperatures that are significantly lower than the average low temperature. For the planning area, the coldest months of the year are January, February, and December. The average low temperature for these months are all below freezing (average low for the three months is 16.1°F). The average high temperatures for the months of January, February, and December are near 37°F.[80]

FREEZING RAIN

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

BLIZZARDS

Blizzards are particularly dangerous due to drifting snow and the potential for rapidly occurring whiteout conditions, which greatly inhibits vehicular traffic. Heavy snow is usually the most defining element of a winter storm. Large snow events can cripple an entire jurisdiction for several days by hindering transportation, knocking down tree limbs and utility lines, structurally damaging buildings, and injuring or killing crops and livestock.

LOCATION

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

EXTENT

The Sperry-Piltz Ice Accumulation Index (SPIA) was developed by the NWS to predict the accumulation of ice and resulting damages. The SPIA assesses total precipitation, wind, and temperatures to predict the intensity of ice storms. Figure 40 shows the SPIA index.

[80] High Plains Regional Climate Center. 2017. “Monthly Climate Normals 1981-2010.” http://climod.unl.edu/.

Figure 40: SPIA Index

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

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

Source: SPIA-Index, 2017[81]

The Wind Chill Index was developed by the NWS to determine the decrease in air temperature felt by the body on exposed skin due to wind. The wind chill is always lower than the air temperature and can quicken the effects of hypothermia or frost bite as it gets lower. Figure 41 shows the Wind Chill Index used by the NWS.

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

Figure 41: Wind Chill Index Chart

Temperature (°F)

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

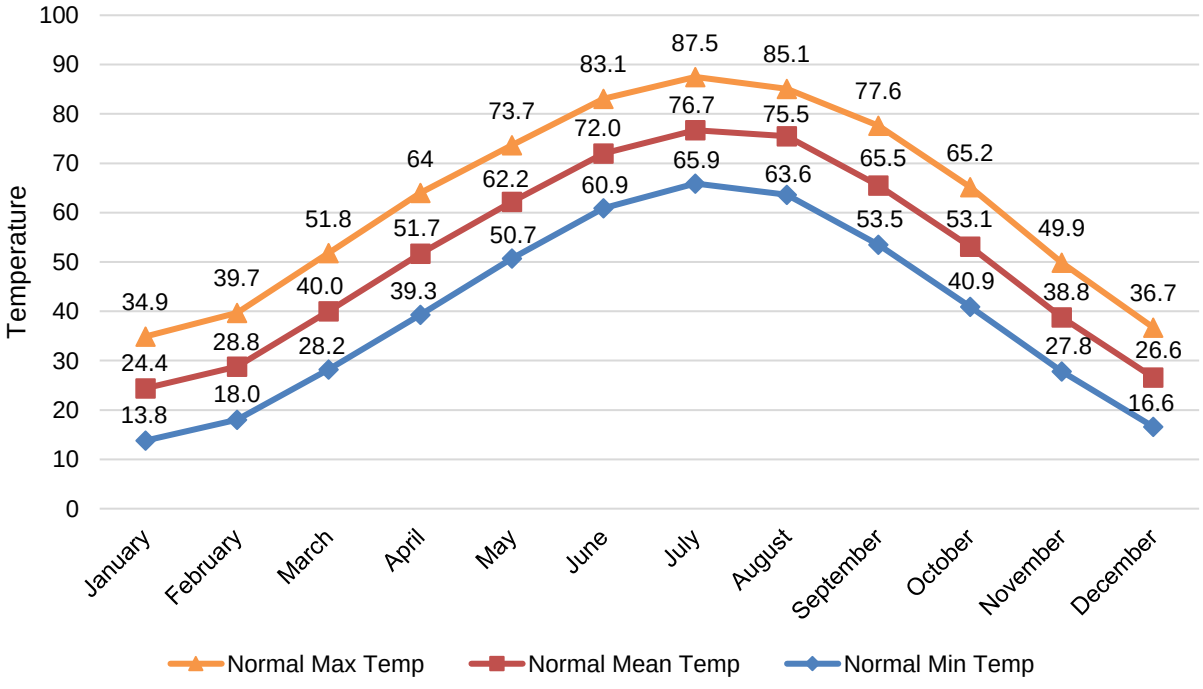
Frostbite Times: 30 Minutes | 10 Minutes | 5 Minutes

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

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

Source: NWS, 2017[82]

Figure 42: Monthly Climate Normals Temperature (1981-2010)



Source: NCEI, 2018

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

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 150 severe winter storm events for the planning area from January 1996 to December 2018. These recorded events caused a total of $19,075,000 in property damages and $$647,180 in crop damages.

According to the NCEI, nine heavy snow events were reported between January 1996 to December 2018 causing $19,000,000 in property damage. The most damaging event occurred in Lancaster County on December 25th, 1997. Six to 14 inches of heavy wet snow fell in the area causing power outages, tree damage, and $16,000,000 in property damage.

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

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and includes aggregated calculations for each of the six types of winter weather as provided in the database. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe winter storms have caused an average of $829,348 per year in property damage for the planning area.

Table 91: Severe Winter Storm Loss Estimate

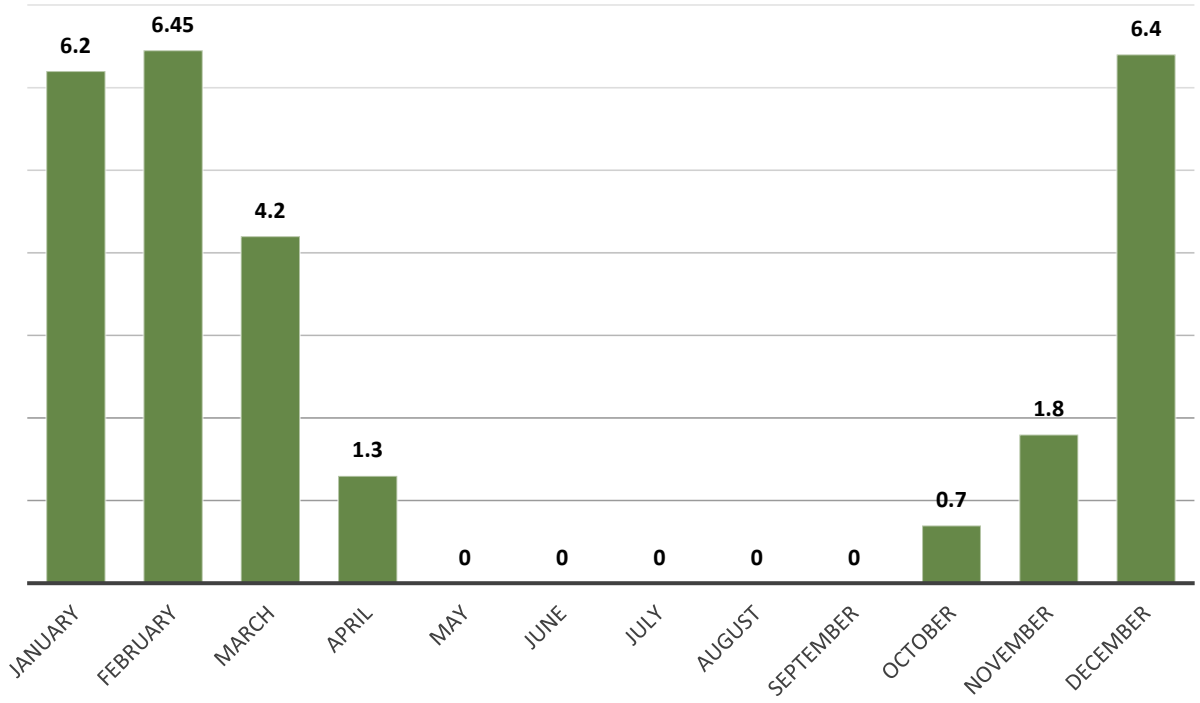
Hazard Type	Number of Events[1]	Average Events Per Year[1]	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Blizzard	14	0.6	$0	$0	$647,180	$34,062
Heavy Snow	9	0.4	$19,000,000	$826,087		
Ice Storm	6	0.3	$0	$0		
Winter Storm	82	3.6	$0	$0		
Winter Weather	31	1.3	$75,000	$3,261		
Extreme Cold/Wind Chill	8	0.3	$0	$0		
Severe Winter Storms	**150**	**6.5**	**$19,075,000**	**$829,348**	**$647,180**	**$34,062**

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

PROBABILITY

Average monthly snowfall for the planning area is shown in Figure 43, which shows the snowiest months are between December and March. A common snow event (likely to occur annually) will result in accumulation totals between one and six inches. Often these snow events are accompanied by high winds. It is reasonable to expect wind speeds of 25 to 35 mph with gusts reaching 50 mph or higher. Strong winds and low temperatures can combine to produce extreme wind chills of 20°F to 40°F below zero.

Figure 43: Monthly Normal (1981-2010) Snowfall in Inches



Source: High Plains Regional Climate Center, 2019

REGIONAL VULNERABILITIES

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

Table 92: Regional Severe Winter Storm Vulnerabilities

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

TERRORISM

According to the Federal Bureau of Investigation (FBI), there is no single, universally accepted definition of terrorism. Terrorism is defined in the Code of Federal Regulations as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives" (28 C.F.R. Section 0.85).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The Department of Homeland Security and its affiliated agencies are responsible for disseminating any information regarding terrorist activities in the country. The system in place is the National Terrorism Advisory System (NTAS). In 2011, NTAS replaced the Homeland Security Advisory System (HSAS) which was the color-coded system put in place after the September 11th attacks by Presidential Directive 5 and 8 in March of 2002.

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

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

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

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

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

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

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

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

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

HISTORICAL OCCURRENCES
Previous accounts of terrorism in the planning area were gathered from the Global Terrorism Database, maintained by the University of Maryland and the National Consortium for the Study of Terrorism and Responses to Terrorism (START). This database contains information for over 140,000 terrorist attacks. According to this database, there have been two terrorist incidents in the planning area between 1970 - 2018.[83]

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

Table 93: Civil Disorder Occurrences

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

Source: Global Terrorism Database, 1970 - 2018

Average Annual Damages

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

Probability

Given two incidences over the course of 48 years, the annual probability for terrorism in the planning area has a less than four percent chance of occurring during any given year. This does not indicate that a terrorist event will never occur within the planning area, only that the likelihood of such an event is incredibly low.

Regional Vulnerabilities

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

Table 94: Regional Terrorism Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Police officers and first responders at risk of injury or death
ECONOMIC	-Damaged business can cause loss of revenue and loss of income for workers -Agricultural attacks could cause significant economic losses for the region
BUILT ENVIRONMENT	-Targeted buildings may sustain heavy damage
INFRASTRUCTURE	-Water supply, power plants, utilities all at risk of damage
CRITICAL FACILITIES	-Police stations and governmental offices are at higher risk
CLIMATE	-Activism pertaining to climate can place first responders and residents at risk

TORNADOES

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

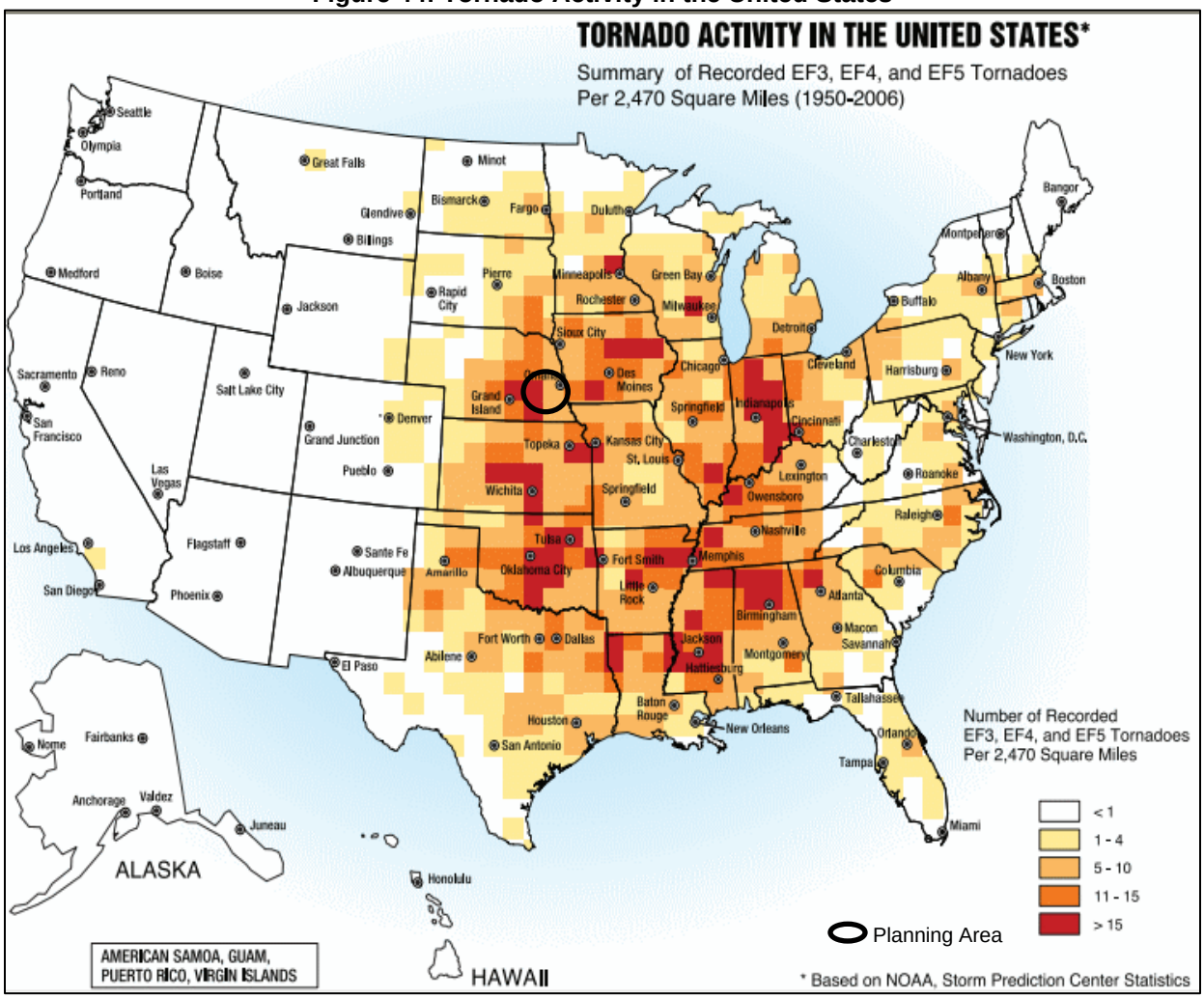
- There must be a microscale rotating area of wind, ranging in size from a few feet to a few miles wide;
- The rotating wind, or vortex, must be attached to a convective cloud base and must be in contact with the ground; and,
- The spinning vortex of air must have caused enough damage to be classified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

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

Nebraska is ranked fifth in the nation for tornado frequency with an annual average of 57 tornadoes between 1991 to 2010.[84] The following figure shows the tornado activity in the United States as a summary of recorded EF3, EF4, and EF5 tornadoes per 2,470 square miles from 1950-2006.

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

Figure 44: Tornado Activity in the United States



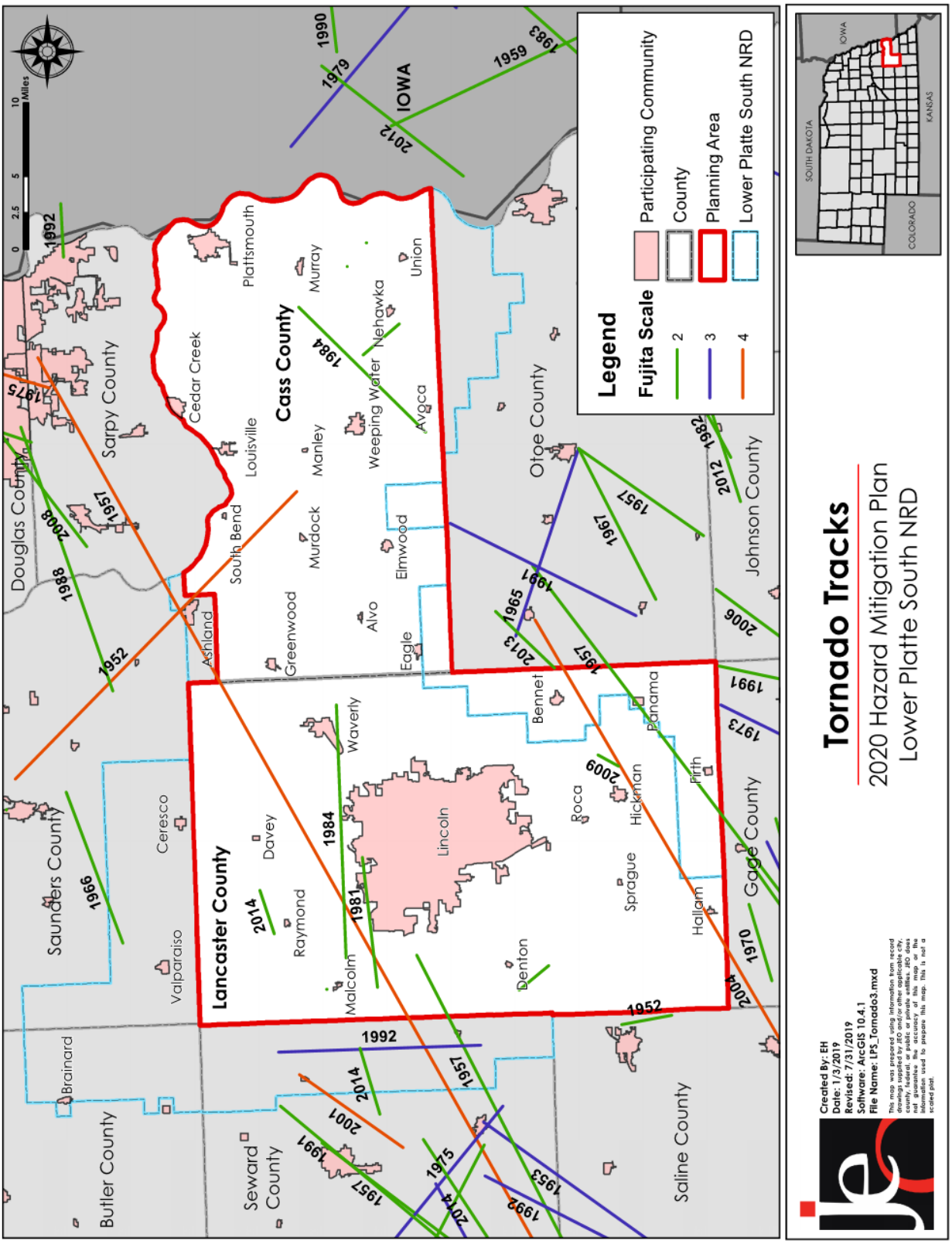
Source: FEMA, 2008[85]

LOCATION

Tornadoes can occur anywhere in the planning area. The impacts would likely be greater in more densely populated areas. The following map shows the historical track locations across the region from 1950 to 2017 according to the Midwestern Regional Climate Center. Note that this map shows tornado tracks both within or that cross into the boundaries of the Lower Platte South NRD.

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

Figure 45: Historic Tornado Tracks



EXTENT

After a tornado passes through an area, an official rating category is determined, which provides a common benchmark that allows comparisons to be made between different tornadoes. The magnitude of tornadoes is measured by the Enhanced Fujita Scale. 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. The Enhanced Fujita Scale replaced the Fujita Scale in 2007. 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. Table 95 and Table 96 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.[86]

Table 95: Enhanced Fujita Scale

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

Source: NOAA; FEMA

[86] Kuligowski, E.D., Lombardo, F.T., Phan, L.T., Levitan, M.L., & Jorgensen, D.P. March 2014. "Final Report National Institute of Standards and Technology (NIST) Technical Investigation of the May 22, 2011, Tornado in Joplin, Missouri."

Table 96: Enhanced Fujita Scale Damage Indicator

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

Source: NOAA; FEMA

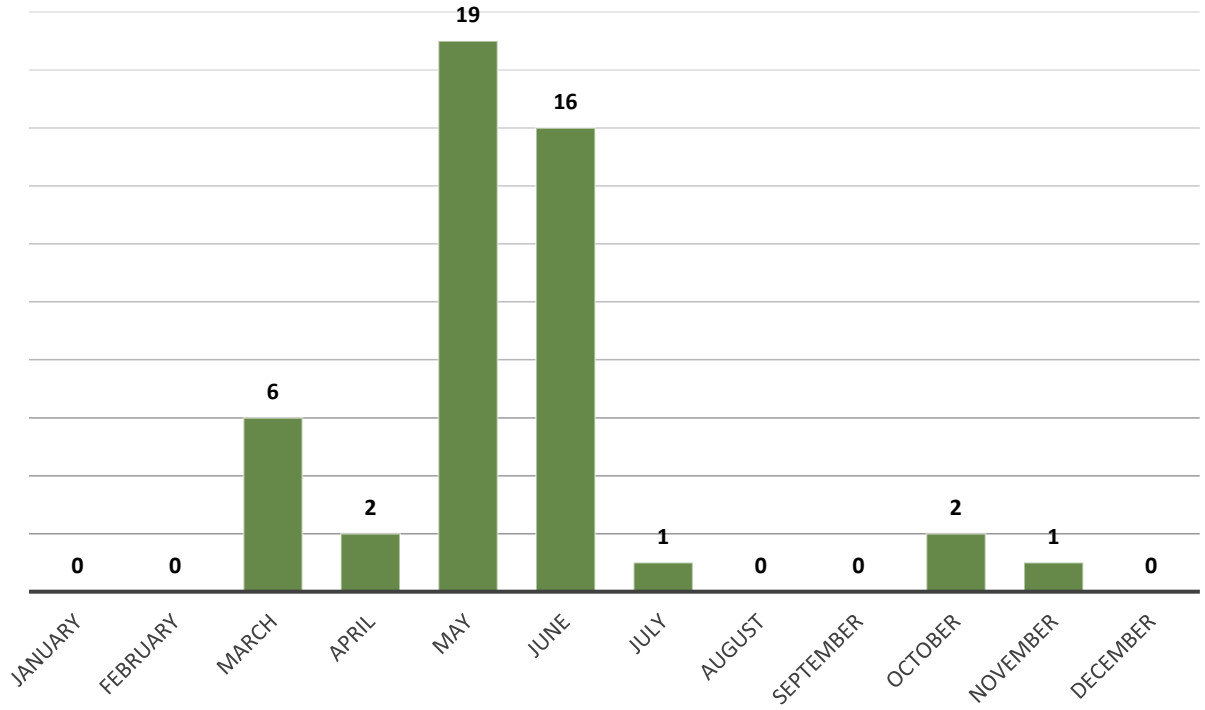
Based on the historic record, it is most likely that tornadoes that occur within the planning area will be of EF0 strength. Of the 47 reported events, 25 were EF0, 17 were EF1, four were EF2, and one was EF4.

Historical Occurrences

NCEI cites 47 tornadic events ranging from a magnitude of EF0 to EF4 between 1996 and 2018. These events were responsible for $101,309,000 in property damages. One death and 38 injuries were reported for these events. The most damaging tornadoes occurred in Lancaster County: an EF4 with $100,000,000 in damages, one death, and 30 injuries in 2004, and an EF1 with $1,000,000 in damages in 2009.

The jurisdiction-specific events from NCEI and reported by each community are listed in *Section Seven: Community Profiles*. The following figure shows that the month of May is the busiest month of the year with the highest number of tornadoes in the planning area.

Figure 46: Tornadoes by Month in the Planning Area



Source: NCEI, 1996-2018

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Tornadoes cause an average of $4,404,739 per year in property damage. The RMA reported $79,324 in crop damages due to tornadic events.

Table 97: Tornado Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Tornadoes	47	2	$101,309,000	$4,404,739	$79,324	$4,175

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

PROBABILITY

Given the 47 events over the course of 23 years, there is roughly a 100 percent probability that a tornadic event will occur in the planning area in any given year.

REGIONAL VULNERABILITIES

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

Table 98: Regional Tornado Vulnerabilities

SECTOR	VULNERABILITY
PEOPLE	-Citizens living in mobile homes are at risk to death or injury -Citizens without access to shelter below ground or in safe room -Elderly with decreased mobility or poor hearing may be higher risk -Vulnerable populations including nursing homes and children at schools -Lack of multiple ways of receiving weather warnings, especially at night
ECONOMIC	-Significant economic losses possible, especially with EF3 tornadoes or greater
BUILT ENVIRONMENT	-All building stock are at risk of significant damages
INFRASTRUCTURE	-All above ground infrastructure at risk to damages -Impassable roads due to debris blocking roadways
CRITICAL FACILITIES	-All critical facilities at risk to significant damages and power outages
CLIMATE	-Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of severe storm events

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SECTION FIVE
MITIGATION STRATEGY

INTRODUCTION

The primary focus of the mitigation strategy is to establish goals and objectives and identify action items to reduce the effects of hazards on existing infrastructure and property in a cost effective and technically feasible manner. The establishment of goals and objectives took place during the kick-off meeting with the regional planning team.

Meeting participants reviewed the goals from the 2015 HMP and discussed recommended additions and modifications. The intent of each goal and set of objectives is to develop strategies to account for risks associated with hazards and identify ways to reduce or eliminate those risks. Each goal and set of objectives is followed by 'mitigation alternatives,' or actions.

A preliminary list of goals and objectives was provided to the Planning Team and the Team voted to maintain the same list of goals from the 2015 HMP.

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

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

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

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

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

SUMMARY OF CHANGES

The development of the mitigation strategy for this plan update includes the addition of several mitigation actions, revisions to the mitigation alternative selection process, and the incorporation of mitigation actions for the additional hazards addressed in the update.

GOALS

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

- **GOAL 1: PROTECT HEALTH AND SAFETY OF RESIDENTS**
- **GOAL 2: REDUCE FUTURE LOSSES FROM HAZARD EVENTS**
- **GOAL 3: INCREASE PUBLIC AWARENESS AND EDUCATION ON THE VULNERABILITY TO HAZARDS**
- **GOAL 4: IMPROVE EMERGENCY MANAGEMENT CAPABILITIES**
- **GOAL 5: PURSUE MULTI-OBJECTIVE OPPORTUNITIES (WHENEVER POSSIBLE)**
- **GOAL 6: ENHANCE OVERALL RESILIENCE AND PROMOTE SUSTAINABILITY**

MITIGATION ALTERNATIVES (ACTION ITEMS)

After establishing the goals, mitigation alternatives were prioritized. The alternatives considered included: the mitigation actions identified per community/jurisdiction in the previous plan; additional mitigation actions discussed during the planning process; and recommendations from JEO for additional mitigation actions based on identified needs. JEO provided each participant a preliminary list of mitigation alternatives to be used as a starting point which was tailored to the hazards of top concern identified by jurisdictions. This prioritized list of alternatives helped participants determine which actions will best assist their respective

jurisdiction in alleviating damages in the event of a disaster. The listed priority does not indicate which actions will be implemented first, but will serve as a guide in determining the order in which each action should be implemented.

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

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

It is important to note that not all of the mitigation actions identified by a community may ultimately be implemented due to limited capabilities, prohibitive costs, low benefit/cost ratio, or other concerns. These factors may not be identified during the 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.

PARTICIPANT MITIGATION ALTERNATIVES

Mitigation alternatives identified by participants of the Lower Platte South NRD HMP are found in the Mitigation Alternative Project Matrix below. Additional information about selected actions can be found in *Section Seven: Community Profiles.* Each action includes the following information in the respective community profile:

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

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

MITIGATION ALTERNATIVE PROJECT MATRIX

During public meetings, each jurisdiction was asked to review mitigation projects from the 2015 HMP and identify new potential mitigation alternatives to further reduce the effects of hazards. Selected projects varied from community to community depending upon the significance of each hazard present. The

following tables are a compilation of new and on-going mitigation alternatives identified by participating jurisdictions. Completed and removed mitigation alternatives can be found in the respective community profile.

Table 99: Mitigation Alternatives Selected by Each Jurisdiction

Mitigation Alternatives	Goal	Lower Platte South NRD	Cass County	Village of Alvo	Village of Avoca	Village of Cedar Creek	Village of Eagle	Village of Elmwood	Village of Greenwood	City of Louisville	Village of Manley	Village of Murdock	Village of Murray	Village of Nehawka	City of Plattsmouth	Village of South Bend	Village of Union	City of Weeping Water
		LPSNRD	**Cass County**															
3-D Dam Failure Modeling	2.2																	
Acquire Identification Resources	3.1							X										
Alert Sirens	4.3																X	
Alternate Water Sources	2.1									X								
Anchor Fertilizer, Fuel, and Propane Tanks	2.2					X												
Automated Telephone Dialer	4.3																	
Backup Generators	2.1	X					X	X			X		X		X	X	X	
Backup Municipal Records	4.3			X		X	X											
Bank Stabilization	2.1																	
Bury Main Power Lines	2.1								X									
Business Continuity Plan	2.2																	
Capability to Connect to Portable Generators to Operate City Vehicle Fuel Sites	4.1																	
Chemical Incident Sheltering	1.1							X										
City Wide Master Plan	2.2																	
Civil Service Improvements	2.1			X		X	X											

Mitigation Alternatives	Goal	Lower Platte South NRD	Cass County	Village of Alvo	Village of Avoca	Village of Cedar Creek	Village of Eagle	Village of Elmwood	Village of Greenwood	City of Louisville	Village of Manley	Village of Murdock	Village of Murray	Village of Nehawka	City of Plattsmouth	Village of South Bend	Village of Union	City of Weeping Water
		LPSNRD	**Cass County**															
Complete Citywide Flood Project Master Plan	6.1					X												
Comprehensive City Disaster/Emergency Response Plan	4.1			X			X	X										
Conservation Plan	2.2																	
Continue & Expand Water Conservation Awareness Program	3.1	X																
Continuity Planning	2.2		X	X			X		X				X					X
Dam Failure Exercise	4.1																	
Designate Snow Routes	6.1											X						
Develop Dam Failure Emergency Action and Evacuation Plans	4.2																	
Develop Levee Failure Evacuation Plans	4.2																	
Drought Education	3.1																	
Drought Response Plan and Drought Contingency Plan	4.1	X																
Educate Local Businesses about Continuity Planning	3.1																	
Educate Public and Businesses on Flood Mitigation Projects	3.1																	

Mitigation Alternatives	Goal	Lower Platte South NRD	Cass County	Village of Alvo	Village of Avoca	Village of Cedar Creek	Village of Eagle	Village of Elmwood	Village of Greenwood	City of Louisville	Village of Manley	Village of Murdock	Village of Murray	Village of Nehawka	City of Plattsmouth	Village of South Bend	Village of Union	City of Weeping Water
		LPSNRD	**Cass County**															
Education Program for Chemical Releases	3.1																	
Electric Pump	2.1																	
Elevate Infrastructure	2.1																	
Emergency Action Plans	4.1	**X**																
Emergency Exercise: Hazardous Spill	2.2																	
Emergency Fuel Supply Plan	4.1			**X**									**X**					
Emergency Operations Center	4.1			**X**			**X**											
Emergency Preparedness Plan	2.2																	
Evacuation Planning	4.2												**X**					
Facility Monitoring	2.1						**X**											
Facility Security	2.1																	
Feasibility Study	2.2	**X**																
First Aid Training	3.1					**X**												
Flood Impact and Flood Risk Assessment	2.2																	
Flood Reduction within Deadman's Run Watershed	2.1																	
Floodplain Management	2.3						**X**											
Floodproof Facilities	2.1																	

Mitigation Alternatives	Goal	Lower Platte South NRD	Cass County	Village of Alvo	Village of Avoca	Village of Cedar Creek	Village of Eagle	Village of Elmwood	Village of Greenwood	City of Louisville	Village of Manley	Village of Murdock	Village of Murray	Village of Nehawka	City of Plattsmouth	Village of South Bend	Village of Union	City of Weeping Water
		LPSNRD	**Cass County**															
Green Mitigation	3.1	X																
Hail Insurance	2.3						X											
Hail Resistant Roofing	2.1																	
Hazard Education	3.1	X									X							
Hazard Risk Reduction	5.1	X																
Hazardous Tree Inventory	2.1																	
Hazardous Tree Removal	2.1	X						X			X	X		X				
High Risk Properties	2.2																	
Improve Construction Standards and Building Survivability	2.3								X									
Improve Drainage at Forest Lake Blvd	2.1																	
Improve Emergency Communication	4.3					X												
Improve Emergency Response Resources	4.1																	
Improve Snow Removal Resources	4.1																	
Improve Water Supply	2.1																	
Improve/Provide Facilities for Vulnerable Populations	1.1			X														
Incorporate Hazards in Planning Mechanisms	6.1	X																

Mitigation Alternatives	Goal	Lower Platte South NRD	Cass County	Village of Alvo	Village of Avoca	Village of Cedar Creek	Village of Eagle	Village of Elmwood	Village of Greenwood	City of Louisville	Village of Manley	Village of Murdock	Village of Murray	Village of Nehawka	City of Plattsmouth	Village of South Bend	Village of Union	City of Weeping Water
		LPSNRD	**Cass County**															
Infrastructure Assessment Study	2.2					**X**												
Infrastructure Hardening	2.1	**X**					**X**											
Infrastructure Protection	2.1																	
Install Weather Station	4.1																	
Integrated Water Management Plan	2.2	**X**																
Intergovernmental Support	5.1			**X**														
Investigate New Sources of Water	2.1		**X**															
Join the CRS	2.3																	
Lagoon Expansion and Elevation	2.1																	
Levee/Floodwall Construction and/or Improvements	2.1					**X**												
Lightning Rods	2.1																	
New Bridge Construction	2.1																	
New Fire Hall	2.1																	
New Overpass Construction	2.1																	
New Sewer Plant	2.1																	
Participate in the Community Rating System	2.3		**X**			**X**				**X**								**X**

Mitigation Alternatives	Goal	Lower Platte South NRD	Cass County	Village of Alvo	Village of Avoca	Village of Cedar Creek	Village of Eagle	Village of Elmwood	Village of Greenwood	City of Louisville	Village of Manley	Village of Murdock	Village of Murray	Village of Nehawka	City of Plattsmouth	Village of South Bend	Village of Union	City of Weeping Water
		LPSNRD	**Cass County**															
Power and Service Lines	2.1					X												
Prepare Sample Water Conservation Ordinances	2.3		X															
Preserve Floodplain	2.1	X																
Preserve Natural and Beneficial Functions	2.1		X												X			X
Promote Use of Higher Codes and Standards	2.3		X									X						X
Property Acquisitions	2.1														X			
Public Education	3.1		X							X			X					
Redundancy Power for Water System	4.1																	
Relocate Water Treatment Plant	2.1														X			
Rural Drainage Study	2.2																	
Safety Action Plan	4.1																	
Sanitary System Improvements	2.1													X				
Shelter-in-Place Training	3.1														X			
Short Term Residency Shelters and Identification	3.1			X							X							
Snow Fences	2.1										X							
Source Water Contingency Plan	2.2																	
Staff Safety Training	3.1																	

Mitigation Alternatives	Goal	Lower Platte South NRD	Cass County	Village of Alvo	Village of Avoca	Village of Cedar Creek	Village of Eagle	Village of Elmwood	Village of Greenwood	City of Louisville	Village of Manley	Village of Murdock	Village of Murray	Village of Nehawka	City of Plattsmouth	Village of South Bend	Village of Union	City of Weeping Water
		LPSNRD	**Cass County**															
Storm Shelter Identification	4.1						X											
Storm Shelters	1.1	X	X		X				X	X			X					
Stormwater Management	2.1								X									
Stormwater System and Drainage Improvements	2.1		X				X			X	X	X						X
Stream Stabilization	2.1				X													
Surge Protectors	2.1						X											
Transportation Route	1.1					X												
Tree City USA	2.3					X										X		
Tree Education	3.1																	
Tree Planting	2.3							X										
Update Comprehensive Plan	6.1					X												
Upgrade Security Software	2.1																	
Urban Drainage Study	2.2														X			
Utilize Low-Impact Development and Green Infrastructure	2.3	X	X															X
Vehicular Barriers	2.1		X						X				X					
Vulnerable Population Assistance Database	4.3						X											X
Water Conservation Awareness	3.1		X						X									

Mitigation Alternatives	Goal	Lower Platte South NRD	Cass County	Village of Alvo	Village of Avoca	Village of Cedar Creek	Village of Eagle	Village of Elmwood	Village of Greenwood	City of Louisville	Village of Manley	Village of Murdock	Village of Murray	Village of Nehawka	City of Plattsmouth	Village of South Bend	Village of Union	City of Weeping Water
		LPSNRD	**Cass County**															
Water Distribution Line/Primary Water Source Line	2.1														**X**			
Water Level Control Structure	2.1																	
Weather Radios	4.3						**X**	**X**				**X**						
Well Improvements	2.1											**X**						
West and East Levees	2.1																	
Windbreaks	2.1										**X**							

Mitigation Alternatives	Goal	Lancaster County	Village of Bennet	Village of Davey	Village of Denton	Village of Firth	Village of Hallam	City of Hickman	City of Lincoln	Village of Malcolm	Village of Panama	Village of Raymond	Village of Roca	Village of Sprague	City of Waverly	Village of Brainard	City of Ashland	Village of Ceresco	Village of Valparaiso	Cass County SID #1	Cass County SID #5	Cass County RWD #1
		Lancaster County														**Special Districts**						
3-D Dam Failure Modeling	2.2							X														
Acquire Identification Resources	3.1																					
Alert Sirens	4.3	X							X							X	X			X		
Alternate Water Sources	2.1																					
Anchor Fertilizer, Fuel, and Propane Tanks	2.2																					
Automated Telephone Dialer	4.3										X											
Backup Generators	2.1	X		X	X			X	X		X		X	X	X	X	X	X				
Backup Municipal Records	4.3																	X				
Bank Stabilization	2.1							X	X													
Bury Main Power Lines	2.1			X	X							X				X						
Business Continuity Plan	2.2								X													
Capability to Connect to Portable Generators to Operate City Vehicle Fuel Sites	4.1								X													
Chemical Incident Sheltering	1.1																					
City Wide Master Plan	2.2																X					

Mitigation Alternatives	Goal	Lancaster County	Village of Bennet	Village of Davey	Village of Denton	Village of Firth	Village of Hallam	City of Hickman	City of Lincoln	Village of Malcolm	Village of Panama	Village of Raymond	Village of Roca	Village of Sprague	City of Waverly	Village of Brainard	City of Ashland	Village of Ceresco	Village of Valparaiso	Cass County SID #1	Cass County SID #5	Cass County RWD #1
		Lancaster County														**Special Districts**						
Civil Service Improvements	2.1																					
Complete Citywide Flood Project Master Plan	6.1		X						X													
Comprehensive City Disaster/Emergency Response Plan	4.1					X												X		X		
Conservation Plan	2.2						X															
Continue & Expand Water Conservation Awareness Program	3.1																					
Continuity Planning	2.2	X							X	X	X				X							
Dam Failure Exercise	4.1														X							
Designate Snow Routes	6.1																					
Develop Dam Failure Emergency Action and Evacuation Plans	4.2														X							
Develop Levee Failure Evacuation Plans	4.2																			X		
Drought Education	3.1															X						
Drought Response Plan and Drought Contingency Plan	4.1																					

Mitigation Alternatives	Goal	Lancaster County	Village of Bennet	Village of Davey	Village of Denton	Village of Firth	Village of Hallam	City of Hickman	City of Lincoln	Village of Malcolm	Village of Panama	Village of Raymond	Village of Roca	Village of Sprague	City of Waverly	Village of Brainard	City of Ashland	Village of Ceresco	Village of Valparaiso	Cass County SID #1	Cass County SID #5	Cass County RWD #1
		Lancaster County														**Special Districts**						
Educate Local Businesses about Continuity Planning	3.1										X											
Educate Public and Businesses on Flood Mitigation Projects	3.1		X								X											
Education Program for Chemical Releases	3.1																	X				
Electric Pump	2.1																			X		
Elevate Infrastructure	2.1							X														X
Emergency Action Plans	4.1																					
Emergency Exercise: Hazardous Spill	2.2																	X				
Emergency Fuel Supply Plan	4.1																					
Emergency Operations Center	4.1	X							X		X											
Emergency Preparedness Plan	2.2																				X	
Evacuation Planning	4.2						X				X				X		X					
Facility Monitoring	2.1																					
Facility Security	2.1																					
Feasibility Study	2.2																					
First Aid Training	3.1																					

Mitigation Alternatives	Goal	Lancaster County	Village of Bennet	Village of Davey	Village of Denton	Village of Firth	Village of Hallam	City of Hickman	City of Lincoln	Village of Malcolm	Village of Panama	Village of Raymond	Village of Roca	Village of Sprague	City of Waverly	Village of Brainard	City of Ashland	Village of Ceresco	Village of Valparaiso	Cass County SID #1	Cass County SID #5	Cass County RWD #1
		Lancaster County														**Special Districts**						
Flood Impact and Flood Risk Assessment	2.2																				X	
Flood Reduction within Deadman's Run Watershed	2.1								X													
Floodplain Management	2.3							X														
Floodproof Facilities	2.1								X													
Green Mitigation	3.1								X													X
Hail Insurance	2.3																					
Hail Resistant Roofing	2.1	X																				
Hazard Education	3.1								X													X
Hazard Risk Reduction	5.1																					
Hazardous Tree Inventory	2.1														X				X			
Hazardous Tree Removal	2.1			X								X						X				
High Risk Properties	2.2								X													
Improve Construction Standards and Building Survivability	2.3																		X			
Improve Drainage at Forest Lake Blvd	2.1								X													
Improve Emergency Communication	4.3																					

Mitigation Alternatives	Goal	Lancaster County	Village of Bennet	Village of Davey	Village of Denton	Village of Firth	Village of Hallam	City of Hickman	City of Lincoln	Village of Malcolm	Village of Panama	Village of Raymond	Village of Roca	Village of Sprague	City of Waverly	Village of Brainard	City of Ashland	Village of Ceresco	Village of Valparaiso	Cass County SID #1	Cass County SID #5	Cass County RWD #1
		Lancaster County														**Special Districts**						
Improve Emergency Response Resources	4.1								X													
Improve Snow Removal Resources	4.1		X																			
Improve Water Supply	2.1													X								
Improve/Provide Facilities for Vulnerable Populations	1.1																					
Incorporate Hazards in Planning Mechanisms	6.1																					
Infrastructure Assessment Study	2.2																					
Infrastructure Hardening	2.1																					
Infrastructure Protection	2.1																				X	
Install Weather Station	4.1	X							X													
Integrated Water Management Plan	2.2																					
Intergovernmental Support	5.1																					
Investigate New Sources of Water	2.1		X																			
Join the CRS	2.3		X																			
Lagoon Expansion and Elevation	2.1				X																	

Mitigation Alternatives	Goal	Lancaster County	Village of Bennet	Village of Davey	Village of Denton	Village of Firth	Village of Hallam	City of Hickman	City of Lincoln	Village of Malcolm	Village of Panama	Village of Raymond	Village of Roca	Village of Sprague	City of Waverly	Village of Brainard	City of Ashland	Village of Ceresco	Village of Valparaiso	Cass County SID #1	Cass County SID #5	Cass County RWD #1
		Lancaster County														**Special Districts**						
Levee/Floodwall Construction and/or Improvements	2.1																					
Lightning Rods	2.1																					
New Bridge Construction	2.1				X																	
New Fire Hall	2.1														X							
New Overpass Construction	2.1														X							
New Sewer Plant	2.1											X										
Participate in the Community Rating System	2.3																					
Power and Service Lines	2.1																					
Prepare Sample Water Conservation Ordinances	2.3																					
Preserve Floodplain	2.1	X							X	X												
Preserve Natural and Beneficial Functions	2.1		X				X				X				X		X					
Promote Use of Higher Codes and Standards	2.3		X	X					X	X							X					
Property Acquisitions	2.1																					
Public Education	3.1	X		X	X		X	X		X	X				X					X		

Mitigation Alternatives	Goal	Lancaster County	Village of Bennet	Village of Davey	Village of Denton	Village of Firth	Village of Hallam	City of Hickman	City of Lincoln	Village of Malcolm	Village of Panama	Village of Raymond	Village of Roca	Village of Sprague	City of Waverly	Village of Brainard	City of Ashland	Village of Ceresco	Village of Valparaiso	Cass County SID #1	Cass County SID #5	Cass County RWD #1
		Lancaster County														**Special Districts**						
Redundancy Power for Water System	4.1								X													
Relocate Water Treatment Plant	2.1																					
Rural Drainage Study	2.2	X																				
Safety Action Plan	4.1																					
Sanitary System Improvements	2.1																					
Shelter-in-Place Training	3.1		X												X		X		X			
Short Term Residency Shelters and Identification	3.1																					
Snow Fences	2.1																					
Source Water Contingency Plan	2.2							X	X													
Staff Safety Training	3.1																					
Storm Shelter Identification	4.1																					
Storm Shelters	1.1	X		X	X		X	X	X		X		X		X	X				X		
Stormwater Management	2.1																					
Stormwater System and Drainage Improvements	2.1	X	X			X	X				X		X	X	X		X	X		X		
Stream Stabilization	2.1	X																				
Surge Protectors	2.1			X														X				

Mitigation Alternatives	Goal	Lancaster County	Village of Bennet	Village of Davey	Village of Denton	Village of Firth	Village of Hallam	City of Hickman	City of Lincoln	Village of Malcolm	Village of Panama	Village of Raymond	Village of Roca	Village of Sprague	City of Waverly	Village of Brainard	City of Ashland	Village of Ceresco	Village of Valparaiso	Cass County SID #1	Cass County SID #5	Cass County RWD #1
		Lancaster County														**Special Districts**						
Transportation Route	1.1																					
Tree City USA	2.3						X	X	X													
Tree Education	3.1		X																			
Tree Planting	2.3																					
Update Comprehensive Plan	6.1										X											
Upgrade Security Software	2.1																					
Urban Drainage Study	2.2																					
Utilize Low-Impact Development and Green Infrastructure	2.3	X							X		X				X		X					
Vehicular Barriers	2.1																	X				
Vulnerable Population Assistance Database	4.3	X									X								X			
Water Conservation Awareness	3.1		X														X	X				X
Water Distribution Line/Primary Water Source Line	2.1																					
Water Level Control Structure	2.1																					
Weather Radios	4.3																					
Well Improvements	2.1																					
West and East Levees	2.1																					

Mitigation Alternatives	Goal	Lancaster County	Village of Bennet	Village of Davey	Village of Denton	Village of Firth	Village of Hallam	City of Hickman	City of Lincoln	Village of Malcolm	Village of Panama	Village of Raymond	Village of Roca	Village of Sprague	City of Waverly	Village of Brainard	City of Ashland	Village of Ceresco	Village of Valparaiso	Cass County SID #1	Cass County SID #5	Cass County RWD #1
		Lancaster County														**Special Districts**						
Windbreaks	2.1																					

Mitigation Alternatives	Goal	Conestoga Public Schools	Lincoln Public Schools	Norris School District	Raymond Central Public School District	Waverly Public Schools	Weeping Water Public Schools
		Schools					
Alert Sirens	4.3			**X**			
Backup Generators	2.1			**X**	**X**	**X**	
Continuity Planning	2.2	**X**		**X**			**X**
Facility Monitoring	2.1					**X**	
Facility Security	2.1				**X**	**X**	
Hail Resistant Roofing	2.1		**X**				
Improve Emergency Communication	4.3	**X**					**X**
Lightning Rods	2.1					**X**	
Public Education	3.1			**X**			
Safety Action Plan	4.1		**X**				
Shelter-in-Place Training	3.1	**X**					**X**
Staff Safety Training	3.1		**X**				
Storm Shelters	1.1	**X**		**X**			**X**
Upgrade Security Software	2.1					**X**	
Vehicular Barriers	2.1			**X**			
Weather Radios	4.3					**X**	

**Note: only mitigation actions identified by the school districts participating in this plan are identified in the table above.*

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SECTION SIX: PLAN IMPLEMENTATION AND MAINTENANCE

MONITORING, EVALUATING, AND UPDATING THE PLAN

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

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.

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

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

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

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

In addition, the governing body will be responsible for ensuring that the HMP's goals are incorporated into applicable revisions of each participant's comprehensive plan and any new planning projects undertaken by the participant. The HMP will also consider any changes in comprehensive plans, and incorporate the information accordingly in its next update.

CONTINUED PUBLIC INVOLVEMENT

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

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

UNFORESEEN OPPORTUNITIES

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

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. Utilizing FEMA's *Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan*[87] guidance, as well as FEMA's *2015 Plan Integration*[88] guide, each community engaged in a plan integration discussion. This discussion was facilitated by a Plan Integration Worksheet, created by the Planning Team. This document offered an easy way for participants to notify the Planning Team of existing planning mechanisms, and if they interface with the HMP.

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

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

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

SECTION SEVEN: COMMUNITY PROFILES

PURPOSE OF COMMUNITY PROFILES

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

- Local Planning Team
- Location/Geography
- Climate (County Level)
- Demographics
- Transportation
- Future Development Trends
- Parcel Improvements and Valuations
- Critical Infrastructure and Key Resources
- Historical Hazard Events (County Level)
- Hazard Prioritization
- Governance
- Capability Assessment
- Plan Integration
- Mitigation Actions

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

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

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