Papio-Missouri River Natural Resources District

Multi-Jurisdictional Hazard Mitigation Plan

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PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT

JEO CONSULTING GROUP INC

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**Served as an advisory or consultant role*

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LIST OF ACRONYMS

ACS – American Community Survey
CF – Critical Facilities
CFR – Code of Federal Regulations
CIKR – Critical Infrastructure and Key Resources
CRS – Community Rating System
CWD – Chronic Wasting Disease
DEM – Digital Elevation Model
DFIRM – Digital Flood Insurance Rate Map
DHS – Department of Homeland Security
DMA 2000 – Disaster Mitigation Act of 2000
EAB – Emerald Ash Borer
EAP – Emergency Action Plan
EHD – Epizootic Hemorrhagic Disease
ELAP – Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish Program
EOC – Emergency Operation Center
EPZ – Emergency Planning Zone
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
HAZUS-MH – Hazards United States Multi-Hazard
HMA – Hazard Mitigation Assistance
HMGP – Hazard Mitigation Grant Program
HMP – Hazard Mitigation Plan
HSAS – Homeland Security Advisory System
HUD – Department of Housing and Urban Development
IBC – International Building Code
JEO – JEO Consulting Group, Inc.
LFD – Livestock Forage Disaster Assistance Program
LGA – Liquid Gallon
LIP – Livestock Indemnity Program
MRCC – Midwestern Regional Climate Center
NCDC – National Climactic Data Center
NDA – Nebraska Department of Agriculture
NDEQ – Nebraska Department of Environmental Quality
NDMC – National Drought Mitigation Center
NDNR – Nebraska Department of Natural Resources
NEMA – Nebraska Emergency Management Agency
NFIP – National Flood Insurance Program
NFS – Nebraska Forest Service
NIPP – National Infrastructure Protection Plan
NOAA – National Oceanic and Atmospheric Administration
NRC – National Response Center
NRD – Natural Resources District
NTAS – National Terrorism Advisory System
NWS – National Weather Service
P-MRNRD – Papio-Missouri River Natural Resources District
PAL – Provisionally Accredited Levee

PDM – Pre-Disaster Mitigation Program
PDSI – Palmer Drought Severity Index
PHMSA – U.S. Pipeline and Hazardous Material Safety Administration
RMA – Risk Management Agency
SBA – Small Business Administration
SFHA – Special Flood Hazard Area
SPIA – Sperry-Piltz Ice Accumulation Index
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
USDA – United States Department of Agriculture
USGS – United States Geological Survey
VS – Vesicular Stomatitis
WUI – Wildland Urban Interface

INTRODUCTION

This plan is an update to the Papio-Missouri River Natural Resources District (P-MRNRD) Multi-Hazard Mitigation Plan (HMP) approved in 2011. The plan update was developed in compliance with the requirements of the Disaster Mitigation Act of 2000 (DMA 2000).

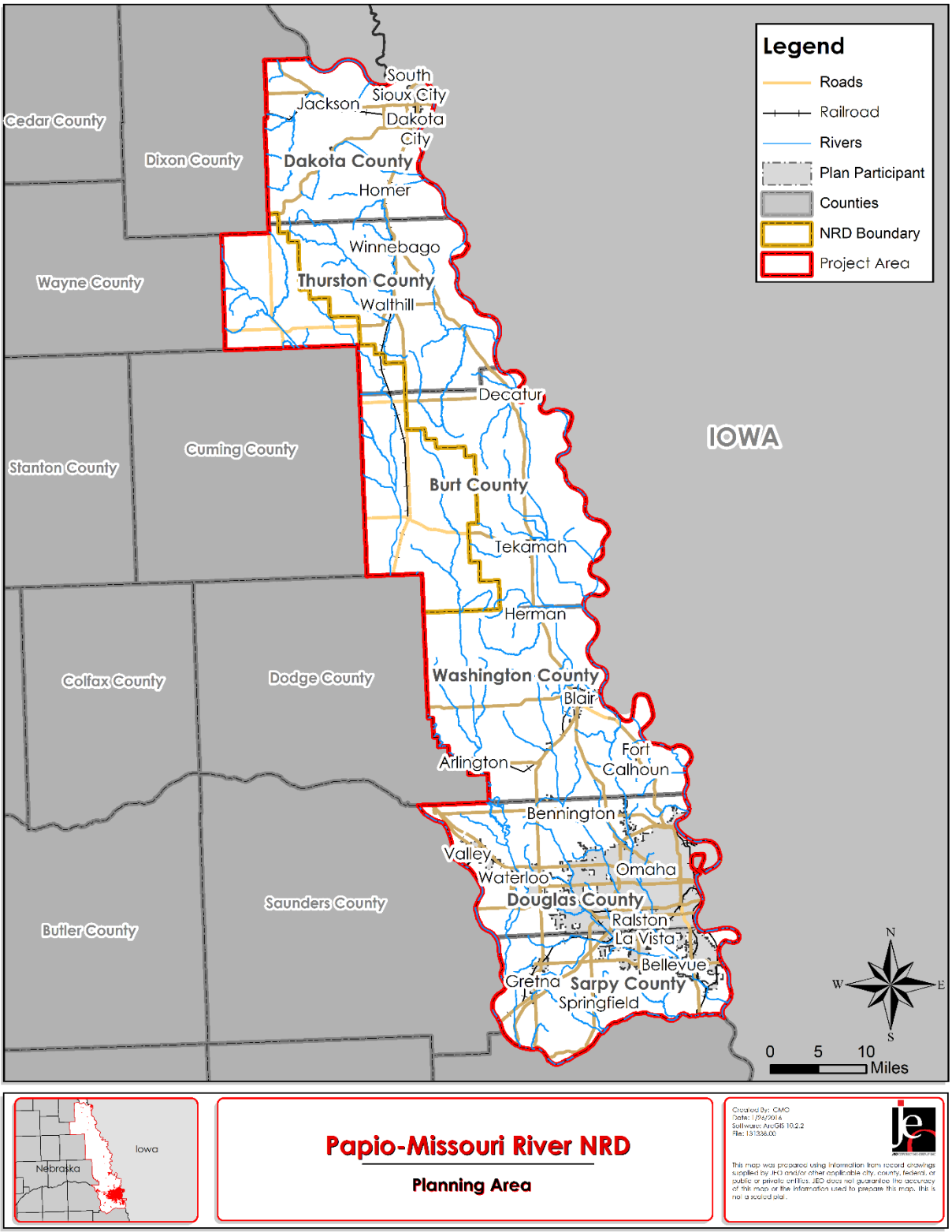
Hazard mitigation planning is a process in which hazards are identified and profiled, people and facilities at risk are identified and assessed for threats and potential vulnerabilities, and strategies and mitigation measures are identified. The goal of the process is to reduce risk and vulnerability,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

Thirty-seven jurisdictions participated directly in the planning process. This includes one NRD, six counties, 22 cities and villages, and eight school districts.

Table 1: Participating Jurisdictions

Participating Jurisdictions	
Papio-Missouri River Natural Resources District	
Burt County	Sarpy County
Village of Decatur	City of Bellevue
City of Tekamah	City of Gretna
Dakota County	City of La Vista
City of Dakota City	City of Papillion
Village of Homer	City of Springfield
Village of Jackson	Papillion-La Vista Community School District
City of South Sioux City	Thurston County
Homer Community School District	Village of Walthill
Douglas County	Village of Winnebago
City of Bennington	Washington County
City of Omaha	Village of Arlington
City of Ralston	City of Blair
City of Valley	City of Fort Calhoun
Village of Waterloo	Village of Herman
Millard Public School District	Arlington Public School District
Omaha Public School District	Blair Community School District
Westside Community School District	Fort Calhoun Community School District

Figure 1: Map of Planning Area



GOALS AND OBJECTIVES

The potential for disaster losses and the probability of occurrence of natural and manmade 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 Regional Planning Team and participating jurisdictions reviewed, updated, and approved goals and objectives 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.

These goals and objectives were reviewed, and the Regional Planning Team agreed that they are still relevant and applicable for this plan update. Jurisdictions that participated in this plan update were in agreement that the goals and objectives identified in 2011 would be carried forward and utilized for the 2016 plan. The goals and objectives for this plan update are as follows:

Goal 1: Protect the Health and Safety of the Public

Objective 1.1: *Continued compliance with National Flood Insurance Program (NFIP) for participating communities; join NFIP if not currently participating*

Objective 1.2: *Construct safe rooms in schools, public buildings, and in select locations, at public outdoor venues*

Objective 1.3*: Update or obtain additional outdoor warning sirens, as needed, in the project area*

Objective 1.4: *Develop additional emergency notification methods to alert the public of potential hazards*

Objective 1.5: *Provide educational opportunities for the public to promote preparedness in the project area*

Objective 1.6: *Reduce flooding of developed residential and commercial areas*

Goal 2: Reduce or Prevent Future Damage to Critical Facilities, Critical Infrastructure, and Maintain Their Operation after a Hazard

Objective 2.1: *Protect power lines throughout the NRD by burying them or reinforcing them*

Objective 2.2: *Obtain generators and other backup power systems required to keep critical facilities, critical infrastructure, and emergency operations running after a hazard event*

Objective 2.3: *Evaluate and identify infrastructure systems that require improvements in order to reduce or prevent damage from hazards*

Objective 2.4: *Protect all existing public infrastructure from flooding*

Goal 3: Reduce or Prevent Future Damage to Existing Properties and Natural Resources

Objective 3.1: *Enforce regulations and building codes promoting wise development and construction that reduces the potential for damage to existing or future structures and property*

Objective 3.2: *Protect existing streambanks and beds from erosion/downcutting*

Objective 3.3: *Perform studies to determine locations of concern and evaluate projects to mitigate against the damage caused by hazards*

Objective 3.4: *Develop projects to reduce or prevent damage to public structures*

Objective 3.5: *Improve local drainage and stabilize creeks where necessary*

Objective 3.6: *Improve protection procedures for structures throughout the planning area to reduce damage from hazard events*

Objective 3.7: *Implement a mitigation plan for tree trimming and tree removal*

Objective 3.8: *Improve and protect area roads and drainage structures against hazards*

Objective 3.9: *Maintain and improve surface water quality*

Goal 4: Promote Efficient Use of Public Funds

Objective 4.1: *Maximize funding opportunities through grant money and other outside sources*

Objective 4.2: *Prioritize projects based on greatest risk*

Objective 4.3: *Encourage individual property owners to develop independent measures to protect their property and not rely on public funding*

SUMMARY OF CHANGES

The following table identifies how this plan has evolved from the P-MRNRD HMP developed in 2011.

Table 2: Summary of Changes

Original Plan Table of Contents	Updated Plan Table of Contents	Update Status
1 Planning Process	**Section One: Introduction**	New section.
1.1 Introduction	Hazard Mitigation Planning	New sub-sections.
1.2 Purpose	Disaster Mitigation Act of 2000	
1.3 Planning Process	Hazard Mitigation Assistance	
1.3.1 Background	Plan Financing and Preparation	
1.3.2 Regional Planning Team and Meetings	**Section Two: Planning Process**	Section reviewed. New sub-sections added.
1.3.3 2006 All-Hazard Mitigation Plan Review and Update Methodology	Multi-Jurisdicitonal Approach	Sub-section reviewed, reorganized, and updated. Details added. Process refined.
1.3.4 Review and Incorporation of Existing Plans	Hazard Mitigation Planning Process	
	Organization of Resources	
	Regional Planning Team	
	Public Involvement and Participation	
	Round 1 and 2 Meetings	
	Plan Intergration	
	Plan Implementation and Progress Monitoring	New sub-section

Original Plan Table of Contents	Updated Plan Table of Contents	Update Status
2 Community Profiles	**Section Three: Demographics and Asset Inventory**	Section reviewed. New sub-sections added.
2.1 Demographic Summary	Planning Area Geographic Summary	New sub-section.
2.2 Climate Summary	Demographics	Sub-section reviewed and updated. Details (Housing) added.
2.3 School District and College Profiles	Built Environment and Structural Inventory	
	National Historic Registry	New sub-sections.
	Critical Infrastructure	Sub-section created. Facilities reviewed and updated.
	Agricultural Asset Inventory	New sub-sections.
3 Risk Assessment	**Section Four: Risk Assessment**	Section reviewed. New sub-sections added.
3.1 Hazard Identification	Introduction and Methodology	New sub-section
3.2 Community Assets	Average Annual Damages and Frequency	
3.3 Hazard Profiles and Vulnerability	Hazard Identification	Assessment criteria reviewed, updated, and better defined.
3.3.1 Agricultural Incidents – Animals/Livestock	Hazards Elimination	New sub-sections.
3.3.2 Agricultural Incidents-Plants/Crops	Hazard Assessment Summary Tables	
3.3.3 Dam Failure	Historical Disaster Declarations	
3.3.4 Drought	Climate Adaptation	
3.3.5 Earthquakes	Agricultural Animal and Plant Disease	Hazard Profile, Historical Occurrences, and Vulnerability Assessment sub-sections reviewed and updated. New Potential Losses methodology.
3.3.6 Flooding	Chemical and Radiological Fixed Sites	New hazard assessment.
3.3.7 Levee Failure	Chemical Transportation	
3.3.8 Severe Winter Storms/Ice Storms (also includes Extreme Cold)	Civil Disorder	
3.3.9 Thunderstorms/High Winds/Lightning/Hail (also includes Extreme Heat)	Dam Failure	Hazard Profile, Historical Occurrences, and Vulnerability Assessment sub-sections reviewed and updated. New Potential Losses methodology.
3.3.10 Tornados	Drought	
3.3.11 Wildfires	Earthquakes	
3.4 Future Land Use and Development	Extreme Heat	New sub-section. Data reviewed and updated.
3.5 Hazard Analysis Summaries	Flooding	Hazard Profile, Historical Occurrences, and Vulnerability Assessment sub-sections reviewed and updated. New Potential Losses methodology.
	Grass/Wildfire	
	Hail	New sub-section. Data reviewed and updated.
	High Winds	
	Levee Failure	Hazard Profile, Historical Occurrences, and Vulnerability Assessment sub-sections reviewed and updated. New Potential Losses methodology.
	Severe Thunderstorms	
	Severe Winter Storms	
	Terrorism	New hazard assessment
	Tornados	Hazard Profile, Historical Occurrences, and Vulnerability Assessment sub-sections reviewed and updated. New Potential Losses methodology.
	Urban Fire	New hazard assessment

Original Plan Table of Contents	Updated Plan Table of Contents	Update Status
4 Mitigation Strategy	**Section Five: Mitigation Strategy**	Section reviewed. New sub-sections added.
4.1 Mitigation Goals	Introduction	Sub-section added.
4.1.1 Mitigation Goals and Objectives	Goals and Objectives	Goals and objectives reevaluated.
4.2 Mitigation Actions	Mitigation Alternatives (Action Items)	Original projects reevaluated. New projects added.
	Completed Mitigation Efforts	New sub-section.
5 Plan Maintenance	**Section Six: Plan Implementation and Maintenance**	Section divided into sub-sections.
5.1 Incorporation into Existing Planning Mechanisms	Monitoring, Evaluating, and Updating the Plan	Sub-section created. Information reviewed and updated. Details added.
	Incorporation into Existing Planning Mechanisms	

PLAN IMPLEMENTATION

Various communities across the planning area have implemented hazard mitigation projects following the 2011 hazard mitigation plan. Many of these projects are related to hazard monitoring, warning systems and/or educating community members. Examples include: updating or improving warning and alert systems at the community level, property acquisition and demolition, and back-up power generators.

In order to build upon these prior successes and to continue to implement mitigation projects, despite limited resources, communities will need to continue relying upon multi-agency coordination as a means of leveraging resources. Communities across the P-MRNRD 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): P-MRNRD, Silver Jackets, Counties, Nebraska Department of Natural Resources (NDNR), Nebraska Emergency Management Agency (NEMA), local industry, and others.

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 occurrence and recurrence interval, historic losses (physical and monetary), impacts to the built environment (including privately owned structures as well as critical facilities), and the local risk assessment. These components were used to develop a balanced and well-rounded risk assessment. The following tables provide an overview of the risk assessment for each hazard and the losses associated with each hazard.

Table 3: Hazard Occurrence

Regional Risk Assessment			
Hazard	**Previous Occurrence Events/Years**	**Approximate Annual Probability**	**Likely Extent**
Agricultural Animal Disease	236/1.7	100%	Unavailable
Agricultural Plant Disease	220/15	100%	Unavailable
Chemical Fixed Sites	329/34	100%	Localized to the facilities and adjacent surroundings
Radiological Fixed Sites	0/43	<1%	10-mile evacuation radius
Chemical Transportation	1,167/35.7	100%	Limited (<0.5 mile from release site)
Civil Disorder	4/100	<5%	Localized; Likely peaceful protests

Regional Risk Assessment			
Hazard	**Previous Occurrence Events/Years**	**Approximate Annual Probability**	**Likely Extent**
Dam Failure	0	<1%	Varies
Drought	69/121	57%	Mild Drought
Earthquakes	0/42	<1%	<4.0
Extreme Heat	36/1	100%	>90°F
Flooding	133/19.6	100%	Some inundation of structures* (<1% of structures) and roads near streams. Some evacuations of people may be necessary (<1% of population)
Grass/Wildfires	1,155/13	100%	<100 acres
Hail	641/19.6	100%	H3 – H6 (0.8 – 1.00 inches)
High Winds	107/19.6	100%	9 BWF (47 – 54 mph)
Levee Failure	0/25	1%	3,244 structures located in leveed areas
Severe Thunderstorms	469/19.6	100%	Wind ≥ 58 mph and/or Hail ≤ 1.00 inch
Severe Winter Storms	372/19.6	100%	0.25 ice 20 - 40°F below zero (wind chills) 4 – 8" snow 25 – 40 mph winds
Terrorism	9/45	2%	Isolated to a single building
Tornados	28/19.6	100%	EF0 - EF1
Urban Fire	9,859/6	100%	Single structure

**Quantification of vulnerable structures provided in Section Seven: Participant Sections*

Table 4: Hazard Loss History

Hazard Type	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Agricultural Animal Disease	N/A	N/A	Unknown	Unknown
Agricultural Plant Disease	N/A	N/A	$1,293,430	$86,228
Chemical Fixed Sites	$185,000	$5,606	$0	$0
Radiological Fixed Sites	$0	$0	$0	$0
Chemical Transportation	$891,793	$24,980	Unknown	Unknown
Civil Disorder	Unknown	Unknown	N/A	N/A
Dam Failure	$0	$0	$0	$0
Drought	$0	$0	$134,222,235	$8,948,156
Earthquake	$0	$0	$0	$0
Extreme Heat	$6,460,000	$329,592	$9,816,312	$654,421
Flooding	$29,334,000	$1,496,633	$638,280	$1,109,219
Grass/Wildfires[3]	$0	$0	$184,238	$14,172
Hail Events	$52,157,000	$2,661,071	$30,477,259	$2,031,817
High Winds	$230,000	$11,735	$745,230	$49,682

Hazard Type	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Levee Failure	$0	$0	$0	$0
Severe Thunderstorms	$67,212,500	$3,446,795	$34,429,327	$2,295,289
Severe Winter Storms	$22,069,000	$1,125,969	$706,584	$47,106
Terrorism	$39,500	$877	N/A	N/A
Tornados	$5,085,000	$259,439	$305,673	$20,378
Urban Fire	Unknown	Unknown	N/A	N/A

1 Indicates data is from NCDC (January 1996 to July 2015)
2 Indicates data is from USDA (2000 to 2014)
3 Indicates data is from NFS (2000 to 2012)

Many of the natural hazards can be expected to occur annually within the planning area. Events like agricultural disease, flooding, extreme heat, grass and wildfires, severe thunderstorms, and severe winter storms will occur annually. Other natural hazards like drought will occur less often. What is not known regarding hazard occurrences is the scope of events and how they will manifest themselves locally. Historically, severe thunderstorms, hail, and flooding have resulted in the most significant structural damage within the planning area. These three hazards in addition to severe winter storms, tornados, extreme heat, and drought are summarized below.

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 having the potential to be impacted multiple times in one day. Severe thunderstorms are most likely to occur between the months of March and September with the highest number of events occurring in June. Typical impacts resulting from severe thunderstorms include (but are not limited to): loss of power, obstruction to transportation routes, grass/wildfires starting from lightning strikes, localized flooding, and damages discussed in the hazard profiles for hail and high winds as these are typical component of severe thunderstorms.

Vulnerable populations related to severe thunderstorms include: residents of mobile homes (two 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. Most participating jurisdictions have reported updates or improvements to risk communication and outdoor warning systems. In addition, the use of text notifications have helped decrease the human vulnerability to this hazard.

HAIL

Hail events occur on an annual basis in conjunction with severe thunderstorms. Hail is one of the more frequently occurring hazards and has impacted both the agricultural sector as well as the built environment. Common impacts resulting from hail include (but are not limited to): damage to roofs, windows, and siding; damage to mechanical systems located outdoors including HVAC systems; damage to vehicles; and destruction of crops.

Hail events are usually large scale events which can impact multiple communities as well as unincorporated areas of the county. While all segments of the population are vulnerable to the impacts of hail, there are a

few groups with higher levels of vulnerability. Community members who reside in mobile homes are at an increased risk of injury and loss resulting from hail storms. Elderly residents may also be more vulnerable to hail events due to decreased mobility and may suffer from prolonged power outages.

The property damages as provided in this plan does not include the damages that occurred from the June 3, 2014 hail storm that devastated Blair, Fort Calhoun, and portions of Washington County. At the time that the National Weather Service provided that storm report for this event, property damage estimates were not available and have not been updated since. Estimates of damages will be well into the millions of dollars. Hail sizes ranged between 2.5 and 4.75 inches from this storm. Over a year later, there are still homes and businesses that are trying to fix the damage caused to homes and buildings. Millions of dollars in insurance claims were submitted at one car dealership alone. The economic impact of this devastating hail storm will endure for an undetermined period of time.

FLOODING

Flooding is the third most costly hazard in the planning area behind severe thunderstorms and hail. Flash flooding, riverine flooding, and ice jam flooding are common for the planning area due to the regular occurrence of severe thunderstorms in spring and summer, and the proximity of many communities next to rivers. Flooding can occur on a local level, only affecting a few streets, but can also extend throughout an entire district, affecting whole drainage basins. During the spring and summer of 2011, the Missouri River flooded for months due to record releases from Gavins Point Dam and heavy rains in May over the Missouri River basin. The dam release was in response to record snowfall and heavy rains in Montana. All six counties were impacted and the following communities along the river experienced flooding: South Sioux City, Dakota City, Decatur, Blair, Fort Calhoun, Bellevue, and Omaha. Urban areas, industrial, utilities, transportation routes, and agriculture all suffered damages due to the 2011 flood.

The planning area expects loss inducing floods to occur on an annual basis with 133 flooding events being recorded by the National Climate Data Center (NCDC) over nearly 19 years. These 133 events have resulted in three fatalities and approximately $29,334,000 in property losses.

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 but early and late season storms have occurred in the past and can have dramatic impacts in the planning area. Impacts resulting from severe winter storms include (but are not limited to): hypothermia and frost bite, death to those trapped outdoors, closure of transportation routes, downed power lines and prolonged power outages, collapse of roofs from heavy snow loads, death of livestock, and closure of critical facilities.

The most vulnerable citizens within the planning area are children (15.3 percent of the total population), elderly (10.7 percent of the total population), individuals and families below the poverty line (12.6 percent of the total population), and those new to the area or state. The county has an even distribution of these segments of the population which would indicate there is not a significant difference in human vulnerability. Given the probability of occurrence and potential impacts participating jurisdictions identified a number of strategies that can help reduce the level of vulnerability related to severe winter storms. Multiple communities identified the increase of risk communication and warnings, developing a database of vulnerable populations, and improving snow routes and snow removal processes.

TORNADOS

Tornados occur in the planning area on a near annual basis. The NCDC reports 28 tornados for the six county area since 1996. Of the reported events, all were ranked between an F/EF0 and F/EF2 and eight of the events reported damages. The most damaging tornado since 1996 struck the Village of Jackson in August 2001. It heavily damaged the school, destroyed 10 homes, and knocked down power lines, poles, and trees, and in total caused of $3 million dollars in damages. Based on historic records, tornados have occurred most frequently in the months of May and April with four reported events each, and June with 10 events. Impacts from past tornados in the planning area include: damages to homes, vehicles, and agricultural buildings; snapping of power poles and downing of power lines; and destruction of silos and center pivot irrigation systems.

Vulnerable populations within the planning area include residents living in mobile homes (two percent of all housing units), facilities without storm shelters which house large numbers of people (such as nursing homes, schools, factories, etc.), homeowners without storm shelters or basements, and residents with decreased mobility. All communities in the planning area have outdoor warning sirens as well as access to voluntary SMS text message warnings.

EXTREME HEAT

It is known and understood that high and extreme temperatures are a regular part of the climate for the six county planning area. The months of June, July, and August are warmest months for the planning area with an average of 36 days annually where max temperatures are 90°F or greater. Since 1996, extreme heat caused seven deaths and $6 million in property damages.

Extreme heat impacts people, the built environment, and the agricultural sector. Anticipated impacts include (but are not limited to): heat exhaustion in both human and animal populations, heat stroke, possible death in both human and animal populations, power outages, depletion of water sources, damages to roofs, damages to transportation routes, and crop losses.

DROUGHT

Drought is a regular and reoccurring phenomenon in the planning area and the state of Nebraska. Historic 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 resulting from drought is focused on the agricultural industry. Over $134 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.

MITIGATION STRATEGIES

There are a wide variety of strategies that can be used to reduce the impacts of hazards for the residents of the planning area as well as the built environment. The following table shows the most common mitigation actions that can be implemented to prevent future losses.

Table 5: Key Mitigation Strategies

Hazard	Mitigation Strategies
Animal and Plant Disease	• Public education and awareness • Purchase crop insurance • Livestock insurance
Chemical Transportation and Fixed Sites	• Public education and awareness • Training exercises
Dam Failure	• Evacuation Plan • Dam failure exercise • Public education and awareness
Drought	• Identify and develop new/additional water sources (municipal wells) • Develop ground water/irrigation management plan(s) • Establish drought best management practices and develop an implementation plan • Upgrade rural water infrastructure
Extreme Heat	• Public education • Increased monitoring and community awareness • Developing a vulnerable populations database within the community
Flooding	• Limit or restrict development in flood-prone areas • Participate in the NFIP • Property acquisition or flood-proofing of structures in the floodplain
Grass/Wildfire	• Public education and awareness • Acquire training and equipment for local fire departments
Hail	• Use of hail resistant building materials • Bury power lines and electrical service • Looped electrical systems • Increased monitoring and community awareness
High Winds	• Design and construct storm shelters • Bury power lines and electric service • Looped electrical systems • Join Tree City USA (develop tree care program)
Severe Thunderstorms	• Bury power lines and electric service • Looped electrical systems • Join Tree City USA (develop tree care program) • Install static detectors
Severe Winter Storms	• Incorporate the use of snow fences to protect vulnerable transportation routes

Hazard	Mitigation Strategies
	• Bury power lines and electrical service • Looped electrical systems • Back-up power generators • Review and improve snow/ice removal protocols • Install windbreaks and living snow fences • Increased monitoring and community awareness
Tornados	• Design and construct storm shelters • Bury power lines and electric service • Looped electrical systems • Join Tree City USA (develop tree care program)

HAZARD MITIGATION PLANNING

Hazard events are inevitable, it is just a matter of when they happen and how well a community is prepared for such an event. Mitigation reduces risk and is a socially and economically responsible action to prevent long term risks from natural and man-made 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, tornados and high winds, severe thunderstorms, flooding, extreme heat, drought, agriculture diseases (plant and animal), earthquakes, and wildfires are a part of the world around us. Their occurrence is natural and inevitable, and there is little that can be done to control their force and intensity. Man-made hazards are a product of the society and can occur with significant impacts to communities. Man-made hazards include levee failure, dam failure, chemical and radiological fixed site hazards, major transportation incidents, terrorism, civil disorder, and urban fire. These hazard events can occur naturally or as a result of human error. All jurisdictions participating in this planning process are vulnerable to a wide range of natural and man-made 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.

P-MRNRD prepared this multi-jurisdictional hazard mitigation plan in an effort to reduce impacts from natural and manmade hazards and to better protect the people and property of the region from the effects of hazards. This plan demonstrates the communities' commitment to reducing risks from hazards and serves as a tool to help decision makers establish mitigation activities and resources. This plan was developed to make P-MRNRD 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 DMA 2000 to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Section 322 of the DMA 2000 requires that state and local governments develop, adopt, and routinely update a hazard mitigation plan in order to remain eligible for pre- and post-disaster mitigation funding. These funds include the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), and the Flood Mitigation Assistance Program (FMA). These programs are administered by the Federal Emergency Management Agency (FEMA) under the Department of Homeland Security (DHS).

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) and by FEMA's Final Rule (FR) 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.

Each HMA program was authorized by separate legislative action, 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 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

In regards to plan financing and preparation, in general, the local government of the P-MRNRD 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.

INTRODUCTION

The process utilized to develop a hazard mitigation plan is often as important as the final planning document. For this planning process the P-MRNRD 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; key 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 P-MRNRD utilized the multi-jurisdiction planning process recommended by FEMA (Local Mitigation Plan Review Guide [October 2011], Local Mitigation Planning Handbook [March 2013], and Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards [January 2013]) to develop this plan.

HAZARD MITIGATION PLANNING PROCESS

The hazard mitigation planning process as outlined by FEMA has four general steps, which include: organization of resources; assessment of risks; development of mitigation strategies; and, implementation and annual monitoring of the plan's progress. The mitigation planning process is rarely a linear process. It is characteristic of the process 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 may result in new goals or additional risk assessment.

- Organization of Resources
    - Focus on the resources needed for a successful mitigation planning process. Essential steps include:
        - Organizing interested community members
        - Identifying technical expertise needed
- Assessment of Risks
    - Identify the characteristics and potential consequences of the hazard. Identify how much of the jurisdiction can be affected by specific hazards and the impacts they could have on local assets.
- Mitigation Plan Development
    - Determine priorities and identify possible solutions to avoid or minimize the undesired effects. The result is a 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.

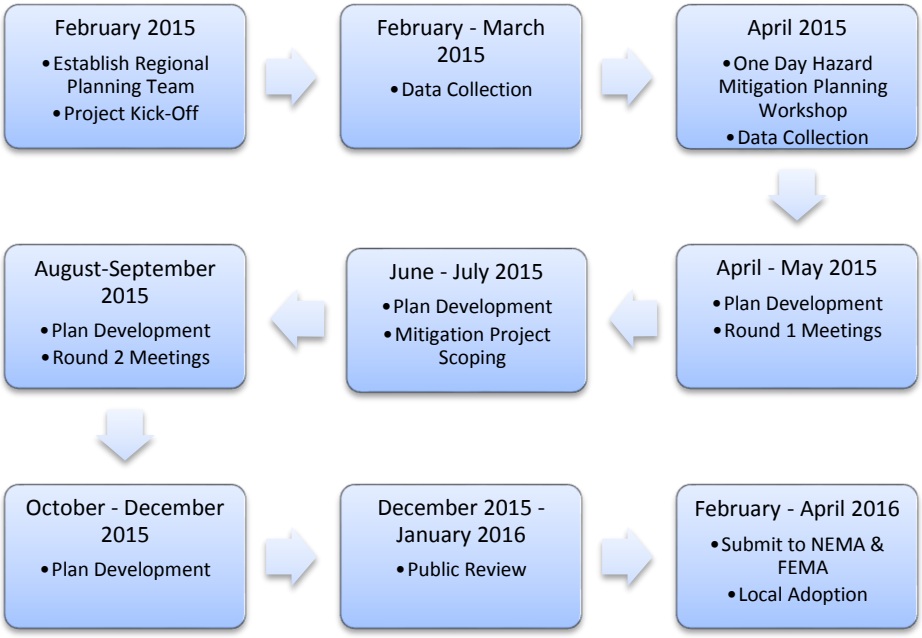
ORGANIZATION OF RESOURCES

PLAN UPDATE PROCESS

The P-MRNRD began the process of securing funding for their multi-jurisdictional hazard mitigation plan (HMP) on June 6, 2014. JEO Consulting Group, INC. (JEO) was contracted in January 2015 to guide and facilitate the planning process and assemble the multi-jurisdictional hazard mitigation plan. For the planning area, Lori Laster (Stormwater Management Engineer with P-MRNRD) led the development of the plan and served as the primary point-of-contact throughout the project.

The first activity in the development process for the P-MRNRD HMP update was coordination of efforts with local, state, and federal agencies and organizations. NDNR and NEMA became involved in the planning process. P-MRNRD and JEO worked together to identify elected officials and key stakeholders to lead the planning effort. A clear timeline of this plan update progress is provided in Figure 2, Project Timeline.

Figure 2: Project Timeline



REGIONAL PLANNING TEAM

At the beginning of the planning process, the Regional 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 Regional Planning Team members can be found in Table 6 Additional technical support was provided to the Regional Planning Team by staff from NEMA and the NDNR.

Table 6: Hazard Mitigation Regional Planning Team

Name	Title	Jurisdiction
Lori Laster	Stormwater Management Engineer	P-MRNRD
Bill Pook	Region 5/6 Emergency Management Director	Burt, Dodge, and Washington Counties
Phil Green	Assistant City Administrator/ Floodplain Administrator	City of Blair
Al Schoemaker	Director of Public Works	City of Blair
Terry Schroeder	Emergency Management Director	Burt County
Peggy Smith	Highway Superintendent/ Floodplain Administrator	Burt County
Deanna Beckman	Emergency Management Director	Dakota County
Doug Cook	Planning/Zoning Coordinator/ Floodplain Administrator	Douglas County
Paul Johnson	Emergency Management Director	Douglas County/City of Omaha
Travis Gibbons	City Planner/Floodplain Administrator	City of Omaha
Jeff Thompson	Engineer	City of Papillion
Michelle Wehenkel	City Planner	City of Papillion
Lynn Marshall	Emergency Management Director	Sarpy County
Donna Lynam	Assistant Director of Planning/ Floodplain Administrator	Sarpy County

Name	Title	Jurisdiction
Chad Fuller	Emergency Management Deputy Director	Thurston County
Michael Burns	Zoning Administrator/ Floodplain Administrator	City of Valley
Shawn Isom	Deputy Clerk	City of Valley
Tanna Wirtz	Planning Administrator/ Floodplain Administrator	Washington County
Matthew May	Emergency Management Director	Village of Winnebago
Mitch Paine*	Flood Mitigation Planning Coordinator	NDNR
Mary Baker*	State Hazard Mitigation Officer	NEMA
Nancy Ludden*	Hazard Mitigation Staff	NEMA
Lalit Jha*	Vice President, Water Resources	JEO
Jeff Henson*	Department Manager	JEO
Rebecca Appleford*	Project Coordinator/Planner	JEO
Phil Luebbert*	Planner	JEO
Caitlin Olson*	Planner Intern	JEO

**Served as a consultant or advisory role*

The first planning team meeting was held February 19, 2015 with the P-MRNRD, emergency managers from each county in the plan, additional community members, and JEO staff. The meeting provided an overview and discussion of the work to be completed over the next several months, including: whether to host a hazard mitigation workshop for plan participants, when and where to host public meetings, plan goals and objectives, discussion of what types of information would be needed to be collected for the HMP, and public outreach methods.

The second planning team meeting was held on June 24, 2015. The meeting provided an update on the progress to date, the current list of participants, meeting attendance and worksheets completed thus far by jurisdictions, brainstorming additional ways and who to contact in order to get additional jurisdictions to participate, and what to expect over the coming months.

Table 7 shows the data and location of meetings held for the Regional Planning Team.

Table 7: Meeting Locations and Times

Location and Time	Agenda Items
February 19, 2015	
P-MRNRD Offices, 1060 Wilbur Street, Blair, NE at 2:00 PM	Overview of HMP update, public involvement, planning process and schedule, set goals, next steps
June 24, 2015	
Blair City Hall Chambers, 218 S. 16th Street, Blair, NE at 2:00PM	Review progress to date, meeting attendance and worksheets collected from communities, public outreach, next steps

HMP WORKSHOP

A Hazard Mitigation Planning Workshop was also held prior to the start of Round 1 meetings on April 7, 2015. All jurisdictions within the planning area were invited to attend. The workshop enabled plan participants to better understand the hazard mitigation planning process. A tornado scenario table-top exercise kicked off the workshop where attendees were put into small groups for discussion on the response and impacts a tornado may have on their communities. The exercise was then followed by an introduction to hazard mitigation, the risk assessment process, identifying mitigation actions, and the importance of public outreach.

Figure 3: P-MRNRD HMP Workshop

Source: JEO photo

PUBLIC INVOLVEMENT AND OUTREACH

At the beginning of the planning process, the Regional Planning Team worked to identify stakeholder groups that could serve as "hubs of communication" throughout the planning process. A wide range of stakeholder groups were contacted and encouraged to participate. There were over 200 stakeholders that were identified and sent letters to participate. This included 8 airports, 21 hospitals, 52 nursing homes, 103 private schools, and 35 fire and rescue departments. The following groups were also invited to participate in the planning process. Two stakeholders attended Round 1 meetings.

Table 8: Notified Stakeholder Groups

Organization	Name	Title	Participation Summary
Eastern Nebraska Office on Aging	Governing Board	Chair	Did not participate
Eastern Nebraska CERT	Keith Deiml	Program Manager	Did not participate
Tri-County CERT	Shannon McVaney	Program Manager	Did not participate
Nebraska VOAD	Brent Curtis	Voluntary Agency Liaison	Did not participate
Union Pacific Railroad Company	Kelli O'Brien	Director, Public Affairs	Did not participate
BNSF Railroad Company	Andy Williams	Director, Public Affairs	Did not participate
Nebraska Resource and Referral System	Charlotte Lewis	Director	Did not participate
Omaha Public Power District	Cindy K. Godfrey	Supervisor Customer Services	Did not participate
Nebraska Public Power District	Doug Klug	Distribution Superintendent	Did not participate
Burt County Public Power District	Richard Ray	Manager	Did not participate
Northeast NPPD	Mark Shults	General Manager	Did not participate
Project Interfaith	John Levy	Board President	Did not participate
Red Cross – Heartland Chapter			Did not participate

Organization	Name	Title	Participation Summary
Omaha Economic Development Corporation	Michael Maroney	President	Did not participate
Greater Omaha Economic Development Partnership			Did not participate
Gateway Development Corporation	Sean Johnson	Executive Director	Did not participate
Siouxland Chamber of Commerce			Did not participate
Logan East Water System	Rick Wozniak	Water Resources Manager	Did not participate
Metro Omaha Builders Association	Jaylene Eilenstine	Executive Director	Did not participate
Regency Square Care Center – South Sioux City	Joel Hubert	Maintenance Director	Attended Round 1 Meeting
Memorial Community Hospital & Health System - Blair	Rod Coholdt	Director of Facilities	Attended Round 1 Meeting

NEIGHBORING JURISDICTIONS

Neighboring jurisdictions were notified and invited as well. The following table indicates which neighboring communities were notified of the planning process. Letters were sent to county/city/village clerks, county emergency managers, and NRDs, at their respective jurisdictions and disseminated appropriately. Pottawattamie County, IA's emergency manager called a member of the Regional Planning Team to discuss the ways that this county works with neighboring counties. They regularly coordinate with surrounding communities and counties and work together on disaster preparedness. Beyond this phone call, there was no participation from jurisdictions outside of the planning area.

Table 9: Neighboring Jurisdictions Notified

Notified Nebraska Jurisdictions	
Dixon County	Lower Platte North NRD
Wayne County	Lewis and Clark NRD
Cuming County	Village of Craig
Dodge County	City of Lyons
Saunders County	Village of Oakland
Lancaster County	Village of Pender
Cass County	Village of Rosalie
Lower Platte South NRD	Village of Thurston
Lower Elkhorn NRD	
Notified Iowa Jurisdictions	
Mills County	Monona County
Pottawattamie County	Woodbury County
Harrison County	

PARTICIPANT INVOLVEMENT

Elected officials, key stakeholders, and residents within P-MRNRD experience the area hazards first hand and play a key role in providing local information necessary to complete the plan. Participants play a key role in reviewing goals and objectives; identification of 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.

In order 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. Some jurisdictions were able to send multiple representatives to meetings. Furthermore, the Regional Planning Team required all participating jurisdictions to pass a signed resolution of participation to formally join the plan. Jurisdictions

also were encouraged to invite stakeholder groups from within their communities to participate in the public meetings. Sign-in sheets from all public meetings can be found in *Appendix B.*

Jurisdictions that were unable to attend the scheduled public meetings were able to request a meeting with members of the Regional Planning Team 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, and invitations to complete surveys and worksheets required for the planning process. Table 10 provides a summary of outreach activities utilized in this process.

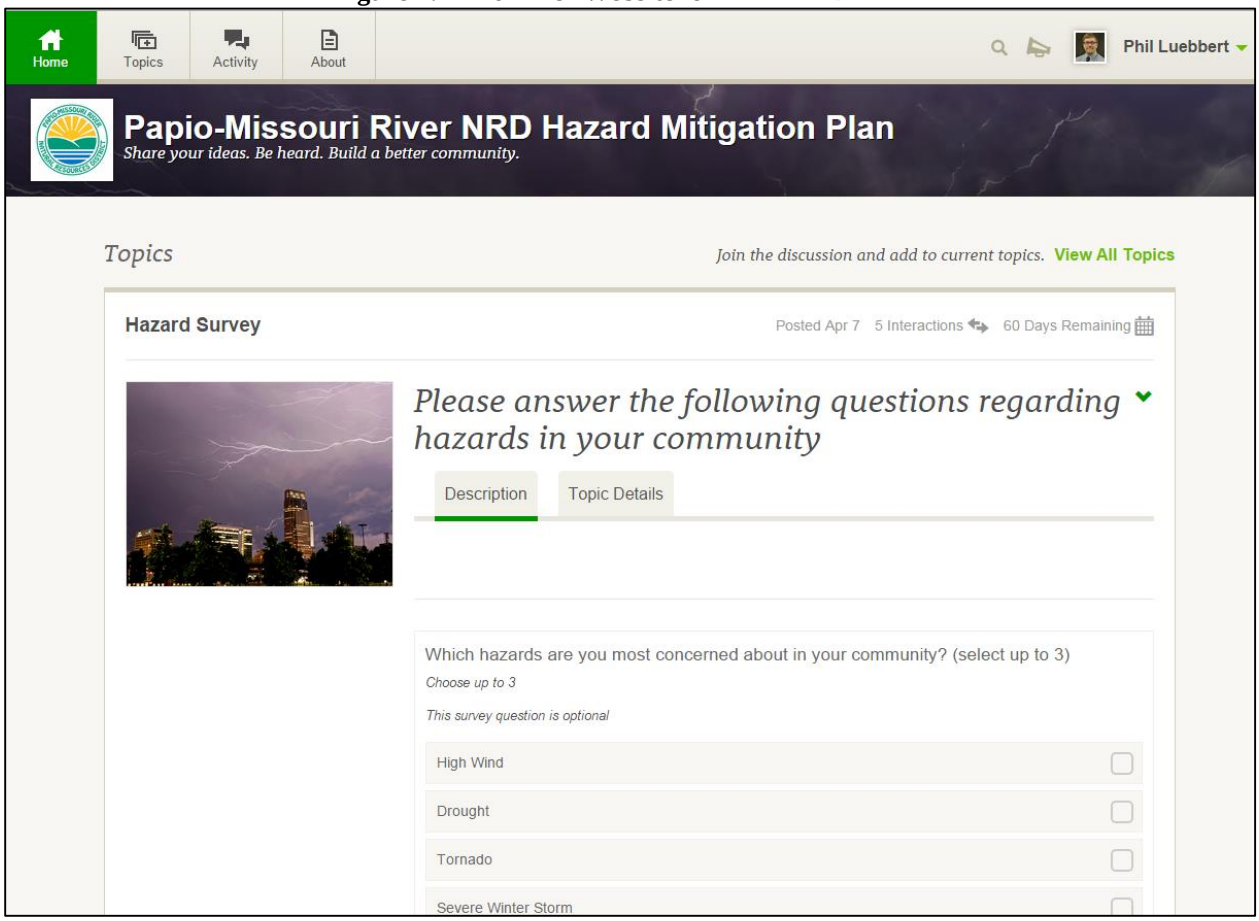
Table 10: Outreach Activity Summary

Action	Intent
Project Website	To inform the public and local/regional planning team members of past, current, and future activities (http://jeo.com/papiohmp/)
Posting of 2011 P-MRNRD HMP	Current HMP posted for public viewing on JEO Hazard Mitigation Planning project website (http://jeo.com/papiohmp/)
Project Announcement	Project announcement posted on P-MRNRD project website (http://jeo.com/papiohmp/)
Regional Planning Team Letter (30/15 day notification)	Informed the Regional Planning Team of upcoming meetings
Round 1 Meeting Letters or Postcards (30/15 day notification)	Sent to participants to discuss the agenda/dates/times/locations of the first round of public meetings
Round 2 Meeting Letters or Postcards (30/15 day notification)	Sent to participants to discuss the agenda/dates/times/locations of the second round of public meetings
Neighboring Jurisdictions Letter	Informed neighboring jurisdictions about the planning effort
Stakeholder Group Letters	Notification regarding the planning process and project meeting dates and locations
Press Release	Sent to local newspapers to describe the purpose of the plan
Notification Phone Calls	Potential participants were called 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 P-MRNRD HMP and how to get involved. Flyers were posted at multiple locations throughout all counties.
Word-of-Mouth	Staff discussed the plan with jurisdictions throughout the planning process
MindMixer Participation Website	Participants and general public were invited to a MindMixer website, which had survey questions about hazards in their community (http://papiohmp.mindmixer.com/)

MindMixer Website

MindMixer (also known as mySidewalk) is a website tool for starting conversations in communities, and the goal is to empower more people to take part in the process of engagement with projects occurring in their region. A MindMixer website (http://papiohmp.mindmixer.com/) was created in April 2015 prior to Round 1 meetings so that participants could login to participate as well as share the website with community members following the meeting. Survey questions were asked about the hazards of concern in their community, what weather events and their impacts had occurred, where had they seen flooding in their community, and could even indicate on a map where flooding was a concern. This information was captured and utilized in this plan, particularly in *Section Seven: Participant Sections*. For additional information and results from the MindMixer website, please see *Appendix B*.

Figure 4: MindMixer Website for P-MRNRD HMP



Source: http://papiohmp.mindmixer.com/

ASSESSMENT OF RISK

ROUND 1 MEETINGS: HAZARD IDENTIFICATION

The P-MRNRD is vulnerable to a wide array of natural, man-made, and technological hazards that threaten life and property. At the Round 1 meetings, jurisdictional representatives (i.e. the local planning team) 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**
Burt County: Tekamah, NE 2:00PM	April 28, 2015
Dakota County: South Sioux City, NE 2:00 PM	May 13, 2015
Douglas County: Omaha, NE 2:00PM	May 7, 2015
Sarpy County: Papillion, NE 2:00PM	May 6, 2015
Thurston County: Pender, NE 2:00PM	May 12, 2015
Washington County: Blair, NE 2:00PM	April 30, 2015

The intent of these meetings was to provide the public and jurisdictional representatives with an overview of the work to be completed over the next several months, discuss what types of information that would need to be provided to complete the plan, and preliminary data collection. Information regarding the completion of project worksheets, data that would be required for the update process, and the project schedule was provided to each jurisdiction. This information was distributed to provide an opportunity to gather input on the identification of hazards, records of historical occurrences, establishment of goals and objectives, and potential mitigation projects from jurisdictional representatives (refer to *Appendices B and C*). The local planning teams for each jurisdiction also completed worksheets to identify or update their jurisdiction's critical facilities, a capabilities assessment, and a status update on the mitigation projects from the 2011 HMP, if applicable. Meeting attendees are identified in Table 12.

Table 12: Round 1 Meeting Attendees

Name	Jurisdiction	Title
Burt County		
Peggy Smith	Decatur and Burt County	Highway Superintendent and Floodplain Administrator (Burt County)
Terry M. Schroeder	Burt County	Emergency Management Director
Ronald Grass	Tekamah	Mayor
Eugene TeSelle	Tekamah	Emergency Manager
Fred Hansen	Lyons-Decatur Northeast Schools	Superintendent
Lori Laster	P-MRNRD	Stormwater Management Engineer
Jeff Henson	JEO Consulting Group, Inc.	Department Manager
Rebecca Appleford	JEO Consulting Group, Inc.	Project Coordinator
Phil Luebbert	JEO Consulting Group, Inc.	Planner
Dakota County		
Deanna Beckman	Dakota County	Emergency Management Director
Nicholas Walsh	Dakota County	Emergency Response Coordinator
Alyssa Silhacek	Dakota City	City Administrator
Elvin Vavra	Homer	Maintenance
Donna Hirsch	Jackson	Village Clerk and Floodplain Administrator
Scot Ford	South Sioux City	Chief of Police
Tami Bailey	South Sioux City	Grant Administrator
Lance Hedquist	South Sioux City	City Administrator
Mario Andrade	South Sioux City	Firefighter and Paramedic
Matthew Rector	South Sioux City	Firefighter and Paramedic
Bill Baucher	South Sioux City	Firefighter
Greg Kanza	South Sioux City	Patrolman
Brian VanBerkum	South Sioux City	Firefighter
Kent Zimmerman	South Sioux City	Code Official and Floodplain Administrator
Joel Hubert	South Sioux City	Maintenance Director – Regency Square
Cheryll Malcom	Homer Schools	Superintendent
Lori Laster	P-MRNRD	Stormwater Management Engineer
Jeff Henson	JEO Consulting Group, Inc.	Department Manager
Rebecca Appleford	JEO Consulting Group, Inc.	Project Coordinator
Phil Luebbert	JEO Consulting Group, Inc.	Planner

Name	Jurisdiction	Title
Douglas County		
Paul Johnson	Douglas County	Emergency Management Director
Doug Cook	Douglas County	Planning and Zoning Coordinator and Floodplain Administrator
Mindi Laaker	Bennington	City Clerk and Floodplain Administrator
Matt Roth	Omaha	Planner – MAPA
Gordon Anderson	Omaha	Public Works
Travis Gibbons	Omaha	City Planner and Floodplain Administrator
Tracy Stratman	Omaha	Recreation Manager
Jake Lindner	Omaha	Park Supervisor
Dennis Bryers	Omaha	Park Planner II
Pat Slaven	Omaha	Park Planner II
Scott McIntyre	Omaha	Street Maintenance Engineer
Dan Freshman	Ralston	Public Works Director/Inspector and Floodplain Administrator
Michael Burns	Valley	Zoning Administrator and Floodplain Administrator
Shawn Isom	Valley	Deputy Clerk
Melissa Johnson	Waterloo	Village Clerk and Floodplain Administrator
Terri Connell	Millard Public Schools	Coordinator of Grants
Delicia Holland	Omaha Public Schools	Risk/Safety Specialist
Roddie Miller	Omaha Public Schools	District Safety Administrator
Melvin Miller	Omaha Public Schools	Tractor Operator
Jeremy Madson	Omaha Public Schools	Construction Manager
Mark Rickley	Omaha Public Schools	Maintenance Manager
Fred Clough	Omaha Public Schools	Fire Safety Specialist
Mark Warneke	Omaha Public Schools	Director of Building and Grounds
Jon Lucos	Omaha Public Schools	Supervisor Operations
Kim Thompson	Omaha Public Schools	Supervisor Schoolhouse Planning
Merle Stebbins	Omaha Public Schools	Supervisor Maintenance
Connie Telfeyan	Omaha Public Schools	Risk and Safety Manager
Shelley Bengtson	Omaha Public Schools	Environmental Specialist
Rick Avard	Westside Community Schools	Director of Safety, Transportation and Special Projects
Lori Laster	P-MRNRD	Stormwater Management Engineer
Jeff Henson	JEO Consulting Group, Inc.	Department Manager
Rebecca Appleford	JEO Consulting Group, Inc.	Project Coordinator
Phil Luebbert	JEO Consulting Group, Inc.	Planner
Sarpy County		
Donna Lynam	Sarpy County	Planning Director and Floodplain Administrator
Rolly Yost	Sarpy County	County Sheriff's Department
Lynn Marshall	Sarpy County	Emergency Management Director
Shannon McVaney	Sarpy County	Sarpy County EMA Specialist
Chris Shewchuk	Bellevue	Planning Director and Floodplain Administrator
Jeff Kooistra	Gretna	City Administrator

Name	Jurisdiction	Title
John Koffmann	La Vista	City Engineer
Chris Solberg	La Vista	City Planner
Jeff Thompson	Papillion	City Engineer
Michelle Wehenkel	Papillion	City Planner
Kathleen Gottsch	Springfield	City Administrator and Floodplain Administrator
Jeff Rippe	Bellevue Public Schools	Assistant Superintendent
Doug Lewis	Papillion-La Vista Community Schools	Assistant Superintendent
Mitch Paine	NDNR	Flood Mitigation Planner
Ron Woodle	P-MRNRD – District 11	Director
Lori Laster	P-MRNRD	Stormwater Management Engineer
Jeff Henson	JEO Consulting Group, Inc.	Department Manager
Rebecca Appleford	JEO Consulting Group, Inc.	Project Coordinator
Phil Luebbert	JEO Consulting Group, Inc.	Planner
Thurston County		
Joseph Painter	Winnebago Tribe	EPA Manager
Chad Fuller	Thurston County	Emergency Management Deputy Director
Tom Perez	Thurston County	Emergency Management Director
Roger Anderson	Walthill	Village Water, Maintenance
KayCe Hollman	Walthill	Assistant Village Clerk
Matthew May	Village of Winnebago	Emergency Management Director
Lori Laster	P-MRNRD	Stormwater Management Engineer
Jeff Henson	JEO Consulting Group, Inc.	Department Manager
Rebecca Appleford	JEO Consulting Group, Inc.	Project Coordinator
Phil Luebbert	JEO Consulting Group, Inc.	Planner
Washington County		
Paul Cerio	Washington County	County Supervisor District 1
Tanna Wirtz	Washington County	Planning Administrator and Floodplain Administrator
Bill Pook	Washington/Burt/Dodge Counties	Emergency Management Director – Region 5/6
Red Misfeldt	Arlington	Board Member
Phil Green	Blair	Assistant City Administrator and Floodplain Administrator
K. L.	Blair Memorial Hospital	Director of Facilities
Linda Welsher	Fort Calhoun	City Clerk/Treasurer and Floodplain Administrator
Vicky Kellogg	Herman	Village Clerk and Floodplain Administrator
Lynn Johnson	Arlington Public Schools	Superintendent
Leon Haith	Blair Community Schools	Director of District Services
Ron Johnson	Fort Calhoun Public Schools	Superintendent
David Genoways	Fort Calhoun Public Schools	Business Manager
Mary Baker	State of Nebraska	State Hazard Mitigation Officer
Lori Laster	P-MRNRD	Stormwater Management Engineer
Jeff Henson	JEO Consulting Group, Inc.	Department Manager
Rebecca Appleford	JEO Consulting Group, Inc.	Project Coordinator
Phil Luebbert	JEO Consulting Group, Inc.	Planner

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 2011 HMP to address the hazards of concern for their jurisdiction. 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 risk assessment results, identified critical facilities and their location within the community, concentrations of populations identified as 'highly vulnerable', future development areas, and expected growth trends (refer to *Appendix C*).

There was also a brief discussion about the last months of the planning process, when the plan would be available for public review and comment, annual review of the plan, and the grant application process once the plan was approved. Table 13 shows the date and location of meetings held for the Mitigation Strategies phase of this project.

Table 13: Round 2 Meeting Dates and Locations

Agenda Items	
Identify new mitigation actions, review of local data, annual review process, and applying for grants	
Location and Time	**Date**
Burt County: Tekamah, NE 2:00PM	September 1, 2015
Dakota County: South Sioux City, NE 10:00 AM	September 1, 2015
Douglas County: Omaha, NE 10:00AM	September 3, 2015
Sarpy County: Papillion, NE 10:00AM	September 2, 2015
Thurston County: Conference Call	October 8, 2015
Washington County: Blair, NE 10:00AM	September 4, 2015

Meeting attendees are identified in Table 14.

Table 14: Round 2 Meeting Attendees

Name	Jurisdiction	Title
Burt County		
Peggy Smith	Decatur and Burt County	Highway Superintendent and Floodplain Administrator
Terry Schroeder	Burt County	Emergency Manager
Bill Pook	Region 5/6 Emergency Management	Director
Ronald Grass	Tekamah	Mayor
Lori Laster	P-MRNRD	Stormwater Management Engineer
Rebecca Appleford	JEO Consulting Group, Inc.	Project Coordinator
Caitlin Olson	JEO Consulting Group, Inc.	Planner Intern
Dakota County		
Deanna Beckman	Dakota County	Emergency Management Director
Nicholas Walsh	Dakota County Health Department	Emergency Response Coordinator
Kurt Peterson	Dakota City	Maintenance Supervisor
Stacey Janssen	Dakota City	Water/Wastewater Supervisor
Alyssa Silhacek	Dakota City	City Administrator
Elvin Vavra	Homer	Maintenance Supervisor
Donna Hirsch	Jackson	Village Clerk and Floodplain Administrator

Name	Jurisdiction	Title
Tami Bailey	South Sioux City	Grant Administrator
Cheryll Malcom	Homer Schools	Superintendent
Jeff Horner	Homer Schools	School Counselor
Randy Pirner	Homer Schools	Principal
Lori Laster	P-MRNRD	Stormwater Management Engineer
Rebecca Appleford	JEO Consulting Group, Inc.	Project Coordinator
Caitlin Olson	JEO Consulting Group, Inc.	Planning Intern
Douglas County		
Paul W. Johnson	Douglas County	Emergency Management Director
Aaron Alward	Douglas County	Emergency Manager Specialist
Doug Cook	Douglas County	Planning and Zoning Coordinator and Floodplain Administrator
Mike Schonlau	Douglas County	GIS Specialist
Mindi Laaker	Bennington	City Clerk and Floodplain Administrator
Travis Gibbons	Omaha	City Planner/Floodplain Administrator
Pat Slaven	Omaha	Park Planner
John Wynn	Omaha	Forester
Dennis E. Bryers	Omaha	Park Planner
Dan Freshman	Ralston	Public Works Director/Inspector and Floodplain Administrator
Michael Burns	Valley	Building/Zoning/Floodplain Administrator
Shawn Isom	Valley	Deputy Clerk
Jamie Bedar	Waterloo	Supervisor
Terri Connell	Millard Public Schools	Coordinator of Grants
Roddie Miller	Omaha Public Schools	Safety Administrator
Steve Selting	Omaha Public Schools	Jacobs - Project Manager
Connie Telfeyan	Omaha Public Schools	Risk and Safety Manager
Shelley Bengtson	Omaha Public Schools	Environmental Specialist
Jeremy Madson	Omaha Public Schools	Construction Manager
Merle Stebbins	Omaha Public Schools	Supervisor Maintenance
Jon Lucos	Omaha Public Schools	Supervisor Operations
Bob Zagozda	Westside Community Schools	Chief Financial Officer
Matt Roth	Metropolitan Area Planning Agency	Planner
Mitch Paine	NDNR	Flood Mitigation Planner
Lori Laster	P-MRNRD	Stormwater Management Engineer
Jeff Henson	JEO Consulting Group, Inc.	Department Manager
Rebecca Appleford	JEO Consulting Group, Inc.	Project Coordinator
Caitlin Olson	JEO Consulting Group, Inc.	Planning Intern
Sarpy County		
Rowen Yost	Sarpy County	Captian – Sherriff's Office
Shannon McVaney	Sarpy County	Emergency Manager Specialist
Lynn Marshall	Sarpy County	Emergency Management Director
Donna Lynam	Sarpy County	Assistant Director, Planning and Floodplain Administrator
Chris Shewchuk	Bellevue	Planning Director and Floodplain Administrator
Jeff Roberts	Bellevue	Public Works Director

Name	Jurisdiction	Title
Jeff Kooistra	Gretna	City Administrator
John Kottmann	La Vista	City Engineer
Jeff Sinnett	La Vista	Chief Building Official and Floodplain Administrator
Christopher Solberg	La Vista	City Planner
Michelle Wehenkle	Papillion	City Planner
Marty Leming	Papillion	Director of Public Works
Jeff Thompson	Papillion	City Engineer
Kathleen Gottsch	Springfield	City Administrator and Floodplain Administrator
Doug Lewis	Papillion-La Vista Community Schools	Assistant Superintendent
Mitch Paine	NDNR	Flood Mitigation Planner
Ron Woodle	P-MRNRD - District 11	Director
Lori Laster	P-MRNRD	Stormwater Management Engineer
Jeff Henson	JEO Consulting Group, Inc.	Department Manager
Rebecca Appleford	JEO Consulting Group, Inc.	Project Coordinator
Caitlin Olson	JEO Consulting Group, Inc.	Planning Intern
Thurston County		
Tom Perez	Thurston County	Emergency Management Director
Matthew May	Village of Winnebago	Emergency Management Director
Roger Anderson	Walthill	Village Water, Maintenance
KayCe Hollman	Walthill	Assistant Village Clerk
Rebecca Appleford	JEO Consulting Group, Inc.	Project Coordinator
Washington County		
Bill Pook	Region 5/6 Emergency Management	Director
Tanna Wirtz	Washington County	Planning Administrator Floodplain Administrator
Linda Douglas	Arlington	Village Clerk and Treasurer
Phil Green	Blair	Assistant City Administrator and Floodplain Administrator
Linda Welsher	Fort Calhoun	City Clerk and Treasurer and Floodplain Administrator
Vicky Kellogg	Herman	Village Clerk and Floodplain Administrator
Lynn Johnson	Arlington Public Schools	Superintendent
Lawrence Reed	Arlington Public Schools	Head of Maintenance
Leon Haith	Blair Community Schools	Director of District Services
Don Johnson	Fort Calhoun Public School	Superintendent
David Genoways	Fort Calhoun Public School	Business Manager
Lori Laster	P-MRNRD	Stormwater Management Engineer
Rebecca Appleford	JEO Consulting Group, Inc.	Project Coordinator
Caitlin Olson	JEO Consulting Group, Inc.	Planning Intern

Community Rating System Participants

Three communities in the planning area are currently participating in the Community Rating System (CRS): City of Omaha (Class 9), City of Papillion (Class 8), and City of Valley (Class 8). CRS recognizes and encourages community floodplain management activities that exceed the minimum NFIP standards. Jurisdictions that participate in CRS reduce insurance premium rates for policyholders. All three

communities indicated that they would pursue additional points through the hazard mitigation planning process as well as following the guidance in *510 Floodplain Management Planning*. Additional one-on-one meeting were held and open to the public for each of the three CRS participants. The first meeting was to discuss the CRS and HMP strategy for their community. The second meeting was primarily geared toward determining which flood mitigation alternatives would be included in the HMP. These jurisdictions and participants also attended the other meetings and provided information to satisfy the requirements of the HMP. The following table indicates the CRS meeting times and locations. For additional information on these three communities, please refer to their participant sections in *Section Seven*.

Table 15: CRS Meetings

CRS Meeting Location and Time	Date
First One-On-One Meeting	
Omaha, NE 2:00 PM	March 31, 2015
Papillion, NE 2:00 PM	March 27. 2015
Valley, NE 9:00 AM	April 9, 2015
Second One-On-One Meeting	
Omaha, NE 2:00 PM	September 8, 2015
Papillion, NE 10:00 AM	September 9, 2015
Valley, NE 2:00 PM	August 31, 2015

PLAN INTEGRATION

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

Table 16: General Plans, Documents, and Information

Documents	Source
Disaster Mitigation Act of 2000 DMA	http://www.fema.gov/media-library/assets/documents/4596?id=1935
Final Rule (2007)	http://www.fema.gov
Local Multi-Hazard Mitigation Planning Guidance (Blue Book) (2008)	http://www.fema.gov
Local Mitigation Planning Handbook (2013)	http://www.fema.gov/media-library-data/20130726-1910-25045-9160/fema_local_mitigation_handbook.pdf
Hazard Mitigation Assistance Unified Guidance (2013)	http://www.fema.gov/hazard-mitigation-assistance
What is a Benefit: Guidance on Benefit-Cost Analysis on Hazard Mitigation Projects	http://www.fema.gov/benefit-cost-analysis
The Census of Agriculture (2012)	http://www.agcensus.usda.gov/
National Flood Insurance Program Community Status Book (2014)	http://www.fema.gov/cis/NE.html
Local Mitigation Plan Review Guide (2013)	http://www.fema.gov
Plans/Studies	**Source**
Nebraska Drought Mitigation and Response Plan (2000)	http://carc.nebraska.gov/docs/NebraskaDrought.pdf
Flood Insurance Studies (where applicable)	http://www.fema.gov/floodplain-management/flood-insurance-study
State of Nebraska Hazard Mitigation Plan (2014)	http://www.nema.ne.gov/pdf/hazmitplan.pdf
Nebraska Geological Survey Landslide Study (2006)	http://snr.unl.edu/csd/surveyareas/geology.asp
Community Comprehensive Plans/Zoning and Subdivision regulations	From respective communities
Data Sources/Technical Resources	**Source**

Documents	Source
Federal Emergency Management Agency	http://www.fema.gov
United States Department of Commerce	http://www.commerce.gov/
National Oceanic Atmospheric Administration	http://www.noaa.gov/
National Environmental Satellite, Data, and Information Service	http://www.nesdis.noaa.gov/
National Climatic Data Center	http://www.ncdc.noaa.gov
Storm Prediction Center Statistics	http://www.spc.noaa.gov
United States Geological Survey	http://www.usgs.gov/
United States Department of Agriculture	http://www.usda.gov
United States Department of Agriculture – Risk Assessment Agency	http://www.rma.usda.gov
National Agricultural Statistics Service	http://www.nass.usda.gov/
High Plains Regional Climate Center	http://www.hprcc.unl.edu
United States Census Bureau	http://www.census.gov
National Consortium for the Study of Terrorism and Responses to Terrorism (START) (2013)	http://www.start.umd.edu/gtd/
National Flood Insurance Program	http://www.fema.gov http://dnrdata.dnr.ne.gov
National Flood Insurance Program Bureau and Statistical Agent	http://www.fema.gov/national-flood-insurance-program
FEMA Map Service Center	http://www.msc.fema.gov
National Drought Mitigation Center – Drought Monitor	http://drought.unl.edu/dm/monitor.html
National Drought Mitigation Center – Drought Impact Reporter	http://www.droughtreporter.unl.edu
National Historic Registry	http://www.nps.gov/nr
United States Small Business Administration	http://www.sba.gov
Nebraska Emergency Management Agency	http://www.nema.ne.gov
Nebraska Climate Assessment Response Committee	http://carc.agr.ne.gov
Nebraska Department of Education	http://reportcard.education.ne.gov/ http://educdirsrc.education.ne.gov/
Nebraska Department of Natural Resources	http://www.dnr.ne.gov
Nebraska Department of Natural Resource – GIS	http://dnrdata.dnr.ne.gov
Nebraska Department of Natural Resources – Dam Inventory	http://dnrdata.dnr.ne.gov/Dams/Search.aspx?mode=county
Nebraska Department of Natural Resources – Soils Data	http://www.dnr.ne.gov/databank/soilsall.html
Natural Resources Conservation Service	www.ne.nrcs.usda.gov
Nebraska Forest Service (NFS)	http://www.nfs.unl.edu/
Nebraska Forest Service – Wildland Fire Protection Program	http://nfs.unl.edu/program-wildlandfireprotection.asp
Nebraska Association of Resources Districts	http://www.nrdnet.org
Nebraska Public Power District Service	http://sites.nppd.com
Nebraska Department of Revenue – Property Assessment Division	www.revenue.ne.gov/PAD
UNL – College of Agricultural Sciences and Natural Resources – Schools of Natural Resources	http://casnr.unl.edu

Documents	Source
High Hazard Dam Inundation Area/Information	http://dnr.ne.gov/website

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, if any at that time. The public review period was open from December 22, 2015 through January 30, 2016. 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 (http://jeo.com/papiohmp/) to download the document, and a notification was posted to the P-MRNRD's website (http://www.papionrd.org) and Facebook page. Comments and changes that were received were incorporated into the plan.

A Public Hearing at the P-MRNRD Board Meeting was also scheduled during the public review period on January 14, 2016, giving the public and the P-MRNRD Board of Directors an opportunity to provide feedback on the plan. During this hearing, Lori Laster and JEO staff made a brief presentation on the plan. Afterwards, the floor was opened for a question and answer session.

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 and objectives and action items.

> ***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. 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. Copies of resolutions approved by each participant are located in *Appendix A*.

PLAN IMPLEMENTATION AND PROGRESS MONITORING

Hazard mitigation plans need to be a living document. 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 participating jurisdictions in the P-MRNRD 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: DEMOGRAPHICS AND ASSET INVENTORY

INTRODUCTION

This section includes information on: geography of the planning area; census data for each participating jurisdiction; structural inventory data; government owned lands; and an inventory of agricultural assets. The decennial United States Census and American Community Survey (ACS) data used in this plan update includes total population (2000, 2010, 2015 estimated); total housing units; housing tenure; housing occupancy (owner occupied, renter occupied, and vacant); selected housing characteristics; and relevant statistics related to at risk populations. Structural evaluation includes a structural inventory for participating jurisdictions; properties included on the National Historic Registry; state and federal owned facilities; and total count of critical facilities by type. The inventoried items related to agricultural assets include: number of farms (2007 and 2012); agricultural acreage; crops by acre; livestock population; and market value of agricultural products (2007 and 2012).

PLANNING AREA GEOGRAPHIC SUMMARY

Portions of six adjacent counties in extreme eastern Nebraska, on the Iowa border comprise the P-MRNRD, covering a total of 1,790 square miles. These six counties are: Burt, Dakota, Douglass, Sarpy, Thurston, and Washington Counties. Since all six counties are full participants in this plan, the planning area will be defined by the full county area. Thus, these counties cover a total of 2,140 square miles along the Missouri River in eastern Nebraska. The planning area, a region marked by dissected till plains and gently rolling hills, rests within the watersheds of the Missouri River, Lower Platte, Elkhorn River, and Papillion Creek.

DEMOGRAPHICS

Demographic and asset information can be used to determine differing levels of vulnerability by analyzing data on population and housing, structural inventories and valuations, critical facilities, and highly vulnerable areas and populations for each participating jurisdiction.

DEMOGRAPHIC CHANGES

As populations change, either growing or declining, the vulnerability of the community is impacted. If a community experiences rapid growth it may lack sufficient resources to adequately provide services for all members of the community in a reasonable timeframe. Examples of potential growth related complications include: insufficient snow removal and roadway maintenance; lack of emergency storm shelters in vulnerable areas; inability to complete repairs to damaged infrastructure; and tracking the location of vulnerable populations. Communities experiencing population decline may be more vulnerable to hazards due to: vacant and/or dilapidated structures; an inability to properly maintain critical facilities and/or infrastructure; and higher levels of unemployment and population living in poverty. It is important for communities to monitor their population changes and ensure that those issues are incorporated into hazard mitigation plans, as well as other planning mechanisms within the community.

In general, the planning area is a mixture of rural and large metropolitan areas. According to the US Census, the regional population for 2010 is 730,988 persons. This represents an increase of more than 14 percent from the 2000 census. The region accounts for about 40 percent of the total population for the state (2010 census).

Table 17 provides a summary of population from 2000, 2010, and an estimate for 2015. The percent change (2000 -2010) was utilized to project the population for 2020. This is a relatively simple method to predict population change and it does not account for predominant age cohorts in the community, birth and death rates, or in and out migration which will likely impact the rate of growth or decline.

Table 17: Population Trends 2000-2010

Jurisdiction	2000 Population	2010 Population	Population Change 2000-2010	2015 Population Estimates	2020 Projected Population
Burt County	7,791	6,858	-11.98%	6,447	6,037
Village of Decatur	622	481	-22.67%	426	372
City of Tekamah	1,899	1,736	-8.58%	1,661	1,587
Dakota County	20,253	21,006	3.72%	21,396	21,787
City of Dakota City	1,806	1,919	6.26%	1,979	2,039
Village of Homer	582	549	-5.67%	533	518
Village of Hubbard	249	236	-5.22%	230	224
Village of Jackson	216	223	3.24%	227	230
City of South Sioux City	11,967	13,353	11.58%	14,126	14,900
Douglas County	463,585	517,110	11.55%	546,962	576,815
City of Bennington	935	1,458	55.94%	1,866	2,274
City of Omaha	390,112	408,958	4.83%	418,836	428,714
City of Ralston	6,254	5,943	-4.97%	5,795	5,647
City of Valley	1,777	1,875	5.51%	1,927	1,978
Village of Waterloo	445	848	90.56%	1,232	1,616
Sarpy County	122,595	158,840	29.56%	182,320	205,801
City of Bellevue	44,320	50,137	13.13%	53,427	56,717
City of Gretna	2,339	4,441	89.87%	6,437	8,432
City of La Vista	11,719	15,758	34.47%	18,474	21,189
City of Papillion	16,254	18,894	16.24%	20,428	21,963
City of Springfield	1,451	1,529	5.38%	1,570	1,611
Thurston County	7,171	6,940	-3.22%	6,828	6,716
Village of Walthill	896	780	-12.95%	730	679
Village of Winnebago	868	774	-10.83%	732	690
Washington County	18,780	20,234	7.74%	21,017	21,801
Village of Arlington	1,186	1,243	4.81%	8,217	1,303
City of Blair	7,561	7,990	5.67%	1,273	8,443
City of Fort Calhoun	874	908	3.89%	926	943
Village of Herman	304	268	-11.84%	252	236
Village of Kennard	387	361	-6.72%	349	337
Village of Washington	148	150	1.35%	151	152
Planning Area Total	**640,175**	**730,988**	**14.19%**	**782,836**	**834,683**

Source: U.S. Census Bureau – 2000, 2010, 2013 (ACS Estimates)

Across the planning area, 15 of the 31 jurisdictions are experiencing significant population change greater than +/-10 percent. Jurisdictions with a population change greater than +10 percent include: South Sioux City, Douglas County, Bennington, Waterloo, Sarpy County, Bellevue, Gretna, La Vista, and Papillion. Jurisdictions with a population change greater than -10 percent include: Burt County, Decatur, Walthill, Winnebago, and Herman.

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."

Table 18 provides a breakdown of the population by age. The table shows that the largest demographic cohort for the planning area is that of residents between the ages of 35 and 54 years. Minors (ages 0 to 19) constitute an estimated 29.3 percent of the population while seniors comprise approximately 10.7 percent of the total population.

Table 18: Population by Age

Jurisdiction	<9	10 - 19	20 - 34	35 - 54	55 - 64	65 - 84	>85	Median	Total
Burt County	800	854	839	1,672	1,023	1,301	259	47.3	6,748
	11.9%	12.7%	12.4%	24.8%	15.2%	19.3%	3.8%		100%
Village of Decatur	39	68	42	94	51	129	15	52.3	438
	8.9%	15.5%	9.6%	21.5%	11.6%	29.5%	3.4%		100%
City of Tekamah	211	239	179	446	225	334	92	46.0	1,772
	11.9%	13.5%	10.1%	25.2%	12.7%	18.8%			100%
Dakota County	3,602	3,138	4,311	5,155	2,315	2,157	242	32.6	20,920
	17.2%	15.0%	20.6%	24.6%	11.1%	10.3%	1.2%		100%
City of Dakota City	295	326	338	523	324	179	12	36.4	1,997
	14.8%	16.3%	16.9%	26.2%	16.2%	9.0%	0.6%		100%
Village of Homer	92	100	73	162	54	77	10	37.7	568
	16.2%	17.6%	12.9%	28.5%	9.5%	13.6%	1.8%		100%
Village of Hubbard	32	18	24	82	38	14	3	48.3	211
	15.2%	8.5%	11.4%	38.9%	18.0%	6.6%	1.4%		100%
Village of Jackson	24	24	16	56	23	36	4	46.4	183
	13%	13%	9%	31%	13%	20%	2%		100%
City of South Sioux City	2,599	2,058	3,061	3,049	1,171	1,249	176	30.4	13,363
	19.4%	15.4%	22.9%	22.8%	8.8%	9.3%	1.3%		100%
	78,846	71,656	121,251	138,051	58,119	48,305	8,469	33.7	524,697

Jurisdiction	<9	10 - 19	20 - 34	35 - 54	55 - 64	65 - 84	>85	Median	Total
Douglas County	15.0%	13.7%	23.1%	26.3%	11.1%	9.2%	1.6%		100%
City of Bennington	231	170	260	350	152	158	30	35.9	1,351
	17.1%	12.6%	19.2%	25.9%	11.3%	11.7%	2.2%		100%
City of Omaha	60,503	57,809	99,651	108,906	47,260	40,896	7,474	33.9	422,499
	14.3%	13.7%	23.6%	25.8%	11.2%	9.7%	1.8%		100%
City of Ralston	787	901	1495	1541	901	901	63	37.5	6,589
	11.9%	13.7%	22.7%	23.4%	13.7%	13.7%	1.0%		100%
City of Valley	301	212	421	452	305	236	91	39.0	2,018
	14.9%	10.5%	20.9%	22.4%	15.1%	11.7%	4.5%		100%
Village of Waterloo	208	145	233	226	71	83	5	29.9	971
	21.4%	14.9%	24.0%	23.3%	7.3%	8.5%	0.5%		100%
Sarpy County	26,597	23,725	35,327	46,097	16,377	13,212	1,393	33.2	162,728
	16.3%	14.6%	21.7%	28.3%	10.1%	8.1%	0.9%		100%
City of Bellevue	7,585	7,390	10,942	14,055	5,796	5,729	443	35.1	51,940
	14.6%	14.2%	21.1%	27.1%	11.2%	11.0%	0.9%		100%
City of Gretna	801	884	822	1449	520	515	104	35.6	5,095
	15.7%	17.4%	16.1%	28.4%	10.2%	10.1%	2.0%		100%
City of La Vista	2,664	2,036	4,472	4,601	1,709	1,147	71	31.7	16,700
	16.0%	12.2%	26.8%	27.6%	10.2%	6.9%	0.4%		100%
City of Papillion	2,646	3,248	3,815	5,696	2,401	1,939	448	37.4	20,193
	13.1%	16.1%	18.9%	28.2%	11.9%	9.6%	2.2%		100%
City of Springfield	194	238	211	388	202	167	17	41.2	1,417
	13.7%	16.8%	14.9%	27.4%	14.3%	11.8%	1.2%		100%
Thurston County	1,403	1,284	1,210	1,511	677	666	164	28.6	6,915
	20.3%	18.6%	17.5%	21.9%	9.8%	9.6%	2.4%		100%
Village of Walthill	145	134	131	107	95	74	13	27.7	699
	20.7%	19.2%	18.7%	15.3%	13.6%	10.6%	1.9%		100%
Village of Winnebago	293	235	181	203	56	51	8	18.8	1,027
	28.5%	22.9%	17.6%	19.8%	5.5%	5.0%	0.8%		100%
Washington County	2,293	3,289	3,131	5,743	2,834	2,489	455	41.0	20,234
	11.3%	16.3%	15.5%	28.4%	14.0%	12.3%	2.2%		100%
Village of Arlington	152	182	184	353	121	137	11	37.9	1,140
	13.3%	16.0%	16.1%	31.0%	10.6%	12.0%	1.0%		100%
City of Blair	907	1,354	1,668	1,846	1,033	844	344	36.0	7,996
	11.3%	16.9%	20.9%	23.1%	12.9%	10.6%	4.3%		100%
City of Fort Calhoun	84	114	105	204	132	97	26	43.7	762
	11.0%	15.0%	13.8%	26.8%	17.3%	12.7%	3.4%		100%

Jurisdiction	<9	10 - 19	20 - 34	35 - 54	55 - 64	65 - 84	>85	Median	Total
Village of Herman	39	50	36	98	26	43	4	41.6	296
	13.2%	16.9%	12.2%	33.1%	8.8%	14.5%	1.4%		100%
Village of Kennard	47	59	64	87	26	59	5	36.8	347
	13.5%	17.0%	18.4%	25.1%	7.5%	17.0%	1.4%		100%
Village of Washington	2	24	7	33	14	17	3	47.5	100
	2.0%	24.0%	7.0%	33.0%	14.0%	17.0%	3.0%		100%
Planning Area	**113,541**	**103,946**	**166,069**	**198,229**	**81,345**	**68,130**	**10,982**	**36.1**	**742,278**
	15.3%	**14.0%**	**22.4%**	**26.7%**	**11.0%**	**9.2%**	**1.5%**		**100%**

Source: United States Census Bureau – ACS 2013 5-year estimate

Community specific demographics which have a significant deviation from the regional data with population age of 65 or greater include: Burt County at an approximate 23 percent of their population, Decatur with about a third of their population, Jackson with 20 percent of their population, Washington County which has an approximate 14.5 percent of their population. Additional communities with a significant deviation from the regional data with population under the age of 19 include: Dakota County with 32 percent of the population, Dakota City at 28 percent of the population, Herman with 30 percent of the population, and South Sioux City with 35 percent of the population.

Residents under the age of 18 experience higher levels of vulnerability related to hazards for a range of reasons. General vulnerabilities that can be identified for this group include: lack of independent transportation, significant concentrations of the demographic during daytime hours (attending schools), and the potential for greater impacts resulting from environmental stimuli (chemical release, extreme temperatures, contamination of air/water). As a result, this demographic group experiences increased vulnerability to the following list of hazards: tornados (especially daytime events), severe thunderstorms, severe winter storms, extreme heat, water shortage created by drought, and chemical releases. Lack of awareness can at times be a concern for people in this age range as well as an inability to recognize and respond to environmental stimuli, which could lead to increased vulnerability to flooding (especially flash flooding), severe thunderstorms, tornados, and severe winter storms.

In addition, there are a number of school districts within the planning area. Schools house a high number of "at risk" residents 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 5 is a map of the school district boundaries. This list is comprehensive and does not represent only the school districts that are participating in this plan.

Table 19: School Inventory

School District	Total Enrollment (2014-2015)
Lyons-Decatur Northeast School District	253
Tekamah-Herman Community School District	572
Emerson-Hubbard Community School District	263
Homer Community School District	421
South Sioux City Community School District	3,925
Bennington Public School District	1,922
Douglas County West Community School District	836
Elkhorn Public School District	7,553
Millard Public School District	23,702
Omaha Public School District	51,928

School District	Total Enrollment (2014-2015)
Ralston Public School District	3,179
Westside Community School District	6,106
Bellevue Publics School District	10,076
Gretna Public School District	3,953
Papillion-La Vista School District	11,401
Springfield Platteview School District	1,137
UMO N HO N Nation Public School District	498
Walthill Public School District	415
Winnebago Public School District	582
Arlington Public School District	590
Blair Community School District	2,329
Fort Calhoun Community School District	612

Source: Nebraska Department of Education

Like minors, seniors (age 65 and greater) are often times more significantly impacted by temperature extremes. During prolonged heat waves seniors may lack resources to effectively address the hazards and as a result my incur injury or potentially death. Prolonged power outages (either standalone events or as the result of other contributing factors) can have significant impacts on any citizen relying on medical devices for proper bodily functions. One study conducted by the Center for Injury Research and Policy found that increases in vulnerability related to severe winter storms (with significant snow accumulations) begin at age 55. The 2011 study found that on average there are 11,500 injuries and 100 deaths annually related to snow removal. People, especially males, over the age of 55 are 4.25 times more likely to experience cardiac symptoms during snow removal.

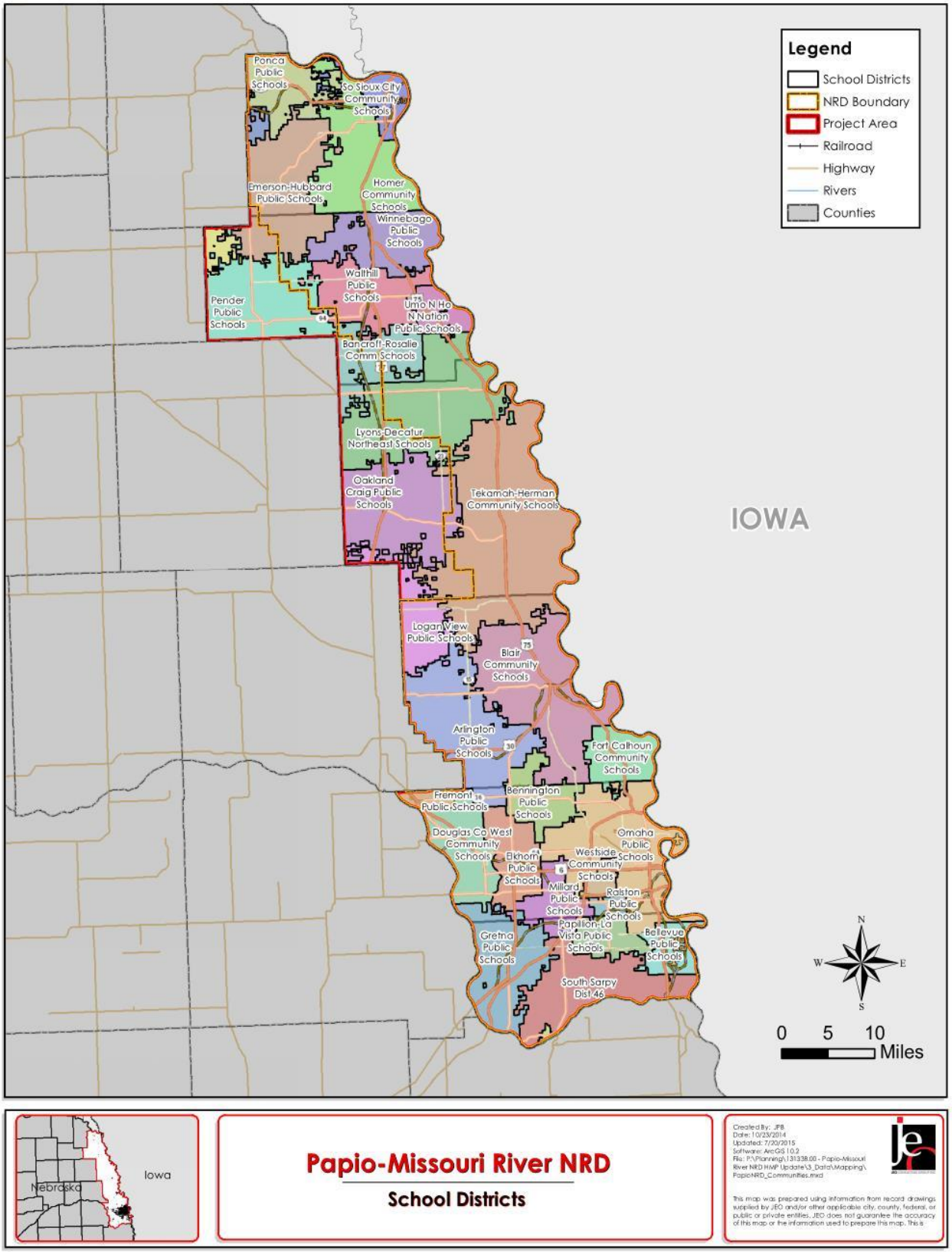
While the previously identified populations do live throughout the planning area, there is the potential that they will be located in higher concentrations at care facilities. The following table identifies the location and capacity of care facilities throughout the planning area.

Table 20: Inventory of Care Facilities

Jurisdiction	Number of Hospitals	Number of Hospital Beds	Adult Care Home	Adult Care Beds	Assisted Living Homes	Assisted Living Beds
Burt County	1	18	3	156	1	24
Dakota County	0	0	3	187	2	73
Douglas County	16	2,744	25	3,042	44	2,969
Sarpy County	3	208	6	626	7	504
Thurston County	2	34	2	67	1	16
Washington County	1	21	2	172	4	142

Source: Nebraska Department of Health and Human Services

Figure 5: Regional School Districts



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: At Risk Populations

County	Population that speaks English as Second Language	Percent of Total Population	Population Below Poverty Level	Percent of Total Population
Burt County	154	2.4%	655	9.7%
Dakota County	6,936	36.4%	3,535	16.9%
Douglas County	67,280	13.9%	75,032	14.3%
Sarpy County	12,246	8.2%	10,740	6.6%
Thurston County	454	7.3%	1,860	26.9%
Washington County	372	1.9%	1,558	7.7%

Source: Language Spoken at Home: 2009 – 2013 ACS 5-year estimate, Selected Economic Characteristics: 2009 – 2013 ACS 5-year estimate

Resident 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 not 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 most likely 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.

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.

BUILT ENVIRONMENT AND STRUCTURAL INVENTORY

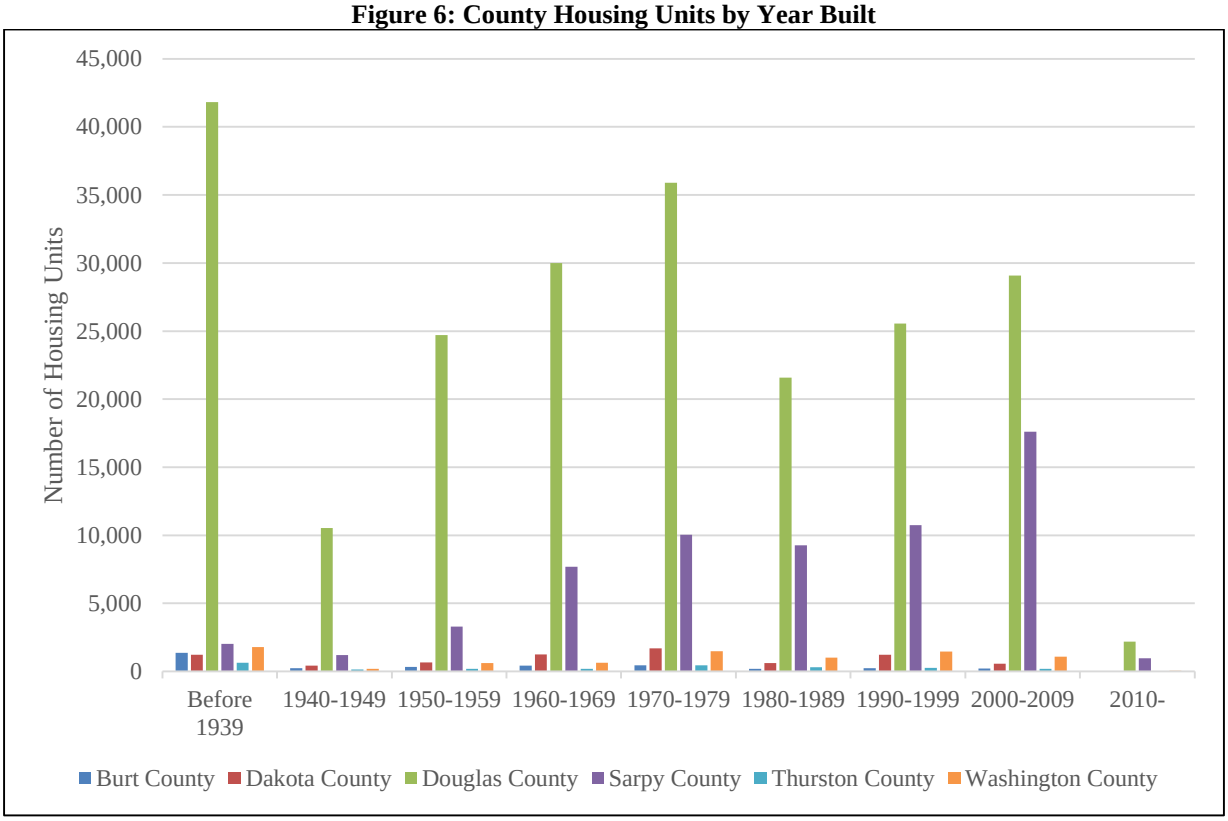
Data related to the built environment is an important component of a hazard mitigation plan. It is essential that during the planning process communities and participating jurisdictions display an understanding of their built environment and work to identify needs that may exist within their planning area. This section includes: inventory of housing units by year built; percent of owner occupied housing; percent of renter occupied housing; percent of vacant housing; selected housing characteristics; properties included on the National Historic Registry; regional inventory of critical facilities; state and federally owned properties; and community specific structural inventories.

HOUSING STATISTICS

Figure 6 displays the age of housing units across the planning area. Most of the housing units within the planning area were constructed before the 1980s. Across the state, the first building codes were adopted in 1987, but prior to this time, codes and building standards were established (or not) by each county and community. The State of Nebraska later adopted the International Building Code (IBC) 2000 codes (adopted in 2003) and most recently updated code requirements to the IBC 2009 codes (adopted in 2010). Structures built prior to 1987 (or 1990 for the data provided in this document) may have been built to

standards less restrictive and potentially less sturdy than what is required for structures since that time. According to the Department of Housing and Urban Development (HUD), older homes are at greater risk of poor repair and dilapidation resulting in blighted or substandard properties. This is significant in assessing hazard vulnerability because these housing units may result in living quarters that are prone to higher damages during disaster events which include high winds, tornados, hail, severe thunderstorms, and severe winter storms. For the planning area, 70 percent of housing units were built prior to 1990 when IBC codes were first introduced across the state.

Figure 6: County Housing Units by Year Built



Source: Selected Housing Characteristics: 2009 – 2013 ACS 5-year estimate

Housing occupancy has a direct correlation to mitigation planning. It is generally accepted that housing units that are occupied are better maintained and less likely to contribute to dangerous or hazardous situations. Owner occupied units are generally better maintained and updated. Rental housing often does not receive many of the updates and retrofits required for hazard resilience. Multi-family rental units may present specific concerns (such as lack of wind resistant building practices or storm shelters). Vacant homes are more likely to become derelict or fall into disrepair over time. This tendency can result in higher levels of vulnerability for communities. If vacant homes deteriorate they can be more easily damaged or destroyed during hazard events (specifically high winds, thunderstorms, and tornados), this can result in what were once homes becoming projectiles and wind-borne debris. Wind-borne debris can injure people, damage vehicles and other structures, as well as creating a post impact environment where debris management is intensified.

Table 22 provides occupancy and tenure for housing units in the planning area. According to 2009-2013 ACS 5-year estimates, there are 306,001 housing units in the planning area. Of these housing units, over seven percent of housing units are vacant. Of the occupied housing units, more than 35 percent are renter occupied.

Table 22: Housing Occupancy and Tenure

Jurisdiction	Total Housing Units				Occupied Housing Units			
	Occupied		Vacant		Owner		Renter	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Burt County	2,899	83.7%	564	16.3%	2,220	76.6%	679	23.4%
Village of Decatur	213	69.8%	92	30.2%	151	70.9%	62	29.1%
City of Tekamah	735	86.1%	119	13.9%	562	76.5%	173	23.5%
Dakota County	7,309	95.2%	367	4.8%	4,710	64.4%	2,599	35.6%
City of Dakota City	659	95.9%	28	4.1%	518	78.6%	141	21.4%
Village of Homer	206	96.3%	8	3.7%	169	82.0%	37	18.0%
Village of Hubbard	82	89.1%	10	10.9%	56	68.3%	26	31.7%
Village of Jackson	75	100.0%	0	0.0%	62	82.7%	13	17.3%
City of South Sioux City	4,542	96.4%	168	3.6%	2,573	56.6%	1,969	43.4%
Douglas County	204,226	92.3%	17,085	7.7%	128,058	62.7%	76,168	37.3%
City of Bennington	499	95.0%	26	5.0%	362	72.5%	137	27.5%
City of Omaha	167,120	91.7%	15,079	8.3%	97,747	58.5%	69,373	41.5%
City of Ralston	2,721	94.2%	167	5.8%	1,887	69.3%	834	30.7%
City of Valley	898	97.5%	23	2.5%	553	61.6%	345	38.4%
Village of Waterloo	332	94.1%	21	5.9%	193	58.1%	139	41.9%
Sarpy County	59,606	94.9%	3,229	5.1%	42,083	70.6%	17,523	29.4%
City of Bellevue	19,651	93.8%	1,289	6.2%	12,965	66.0%	6,686	34.0%
City of Gretna	1,756	97.2%	50	2.8%	1,318	75.1%	438	24.9%
City of La Vista	6,911	98.5%	104	1.5%	3,785	54.8%	3,126	45.2%
City of Papillion	7,566	97.5%	195	2.5%	5,224	69.0%	2,342	31.0%
City of Springfield	562	94.1%	35	5.9%	469	83.5%	93	16.5%
Thurston County	2,050	85.3%	354	14.7%	1,373	67.0%	677	33.0%
Village of Walthill	200	82.3%	43	17.7%	144	72.0%	56	28.0%
Village of Winnebago	211	81.2%	49	18.8%	79	37.4%	132	62.6%
Washington County	7,647	92.0%	665	8.0%	5,971	78.1%	1,676	21.9%
Village of Arlington	435	91.8%	39	8.2%	338	77.7%	97	22.3%
City of Blair	3,049	88.3%	403	11.7%	2,101	68.9%	948	31.1%
City of Fort Calhoun	355	90.1%	39	9.9%	230	64.8%	125	35.2%
Village of Herman	122	81.3%	28	18.7%	101	82.8%	21	17.2%
Village of Kennard	131	97.8%	3	2.2%	118	90.1%	13	9.9%
Village of Washington	37	84.1%	7	15.9%	37	100.0%	0	0.0%
Total	**283,737**	**92.7%**	**22,264**	**7.3%**	**184,415**	**65.0%**	**99,322**	**35.0%**

Source: Selected Housing Characteristics: 2009 – 2013 ACS 5-year estimate

The US Census provides some additional information related to housing units and potential areas of vulnerability. This information is taken from the 2009 – 2013 ACS 5-year estimate data regarding selected housing characteristics. The selected characteristic examined in Table 23 include: lack of 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

	Burt County	Dakota County	Douglas County	Sarpy County	Thurston County	Washington County	Total
Occupied housing units	**2,899**	**7,309**	**204,226**	**59,606**	**2,050**	**7,647**	**283,737**
Lacking complete plumbing facilities	16 (0.6%)	24 (0.3%)	427 (0.2%)	73 (0.1%)	9 (0.4%)	3 (0.0%)	**552 (0.2%)**
Lacking complete kitchen facilities	37 (1.3%)	38 (0.5%)	2,003 (1.0%)	260 (0.4%)	0 (0.0%)	72 (0.9%)	**2,410 (0.8%)**
No telephone service available	39 (1.3%)	245 (3.4%)	4,815 (2.4%)	802 (1.3%)	99 (4.8%)	72 (0.9%)	**6072 (2.1%)**
Mobile Homes	186 (5.4%)	779 (10.1%)	3,032 (1.4%)	730 (1.2%)	153 (6.4%)	283 (3.4%)	**5153 (1.8%)**
Housing Unit with No vehicles available	155 (5.3%)	319 (4.4%)	16,124 (7.9%)	1,642 (2.8%	210 (10.2%)	414 (5.4%)	**18864 (6.6%)**

Indicated percentage is determined based on total housing units
Source: Selected Housing Characteristics: 2009 – 2013 ACS 5-year estimate

Approximately 2.1 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 work to promote the registration of cell phone numbers with Reverse 911 systems.

Nearly two percent of housing units in the planning area are mobile homes. Mobile homes are at a higher risk of sustaining damages during high wind events, tornados, severe thunderstorms, and severe winter storms. Mobile homes that are either not anchored or are anchored incorrectly can be overturned by 60 mph winds. A thunderstorm is classified as severe when wind speeds exceed 58 mph, placing improperly anchored mobile homes at risk.

Furthermore, approximately 6.6 percent of all housing units 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.

NATIONAL HISTORIC REGISTRY

A list of national historic sites as provided by the Nebraska State Historical Society and a summary of the total number located within the planning area is shown below. Detailed information of the historic sites including a list of historic properties located within the floodplain is presented in *Section Seven: Participant Section* by participants. Structures identified as cultural or historic resources represent assets that are unique to the planning area and are, in many situations, irreplaceable and have local significance.

Table 24: National Historic Registry

County	Buildings	Districts	Site	Structure	Total
Burt	9	0	1	1	**11**
Dakota	4	0	1	0	**5**
Douglas	52	8	3	1	**64**
Sarpy	9	2	5	2	**18**
Thurston	4	0	1	1	**6**
Washington	8	1	3	0	**12**

Source: Nebraska State Historical Society

CRITICAL INFRASTRUCTURE/KEY RESOURCES

According to FEMA, "A critical facility is a structure that, if flooded (or damaged), would present an immediate threat to life, public health, and safety." Examples of critical facilities include hospitals, emergency operations centers, schools, wells, and sanitary sewer lift stations, etc.

Each participating jurisdiction identified critical facilities as vital for disaster response, providing shelter to the public, and essential for returning the jurisdiction's functions to normal during and after a disaster. Critical facilities were identified during the last hazard mitigation plan development. As an update of the previous efforts, a critical facilities' survey was conducted at the 'hazard identification' public meetings through the meeting worksheets (refer to *Appendix C*) to verify whether critical facilities identified from the last plan were still current or required any removals or additions. To view jurisdiction specific critical facility maps refer to *Section Seven: Participant Sections*.

STATE AND FEDERALLY OWNED PROPERTIES

The following table provides an inventory of state and federally owned properties within the planning area by county.

Table 25: State and Federally Owned Facilities

Facility	Nearest Community
Burt County	
Summit Reservoir State Recreation Area	Tekamah
Soldier Bend Wildlife Area	Tekamah
Pelican Point State Recreation Area	Tekamah
Middle Decatur Bend State Wildlife Management Area	Decatur
Onawa Materials Yard Wildlife Area	Decatur
Omaha Reservation	Decatur
Dakota County	
Basswood Ridge State Wildlife Management Area	Hubbard
Douglas County	
N.P. Dodge Park	Bennington
Hummel Park	Bennington
Neale Woods Nature Center	Bennington
Cunningham Lake Park	Bennington
Allwine Prairie Preserve	Bennington
Two Rivers State Recreation Area	Venice
Bluestem Prairie Preserve	Omaha

Facility	Nearest Community
Sarpy County	
Sarpy Park State Recreational Area	Springfield
Chalco Hills Recreation Area	Chalco
Walnut Creek Recreation Area	Papillion
Gifford Point WMA	Bellevue
Fontenelle Forest Nature Center	Bellevue
Schramm Park State Recreation Area	Springfield
Thurston County	
Omaha Reservation	South half of county
Winnebago Reservation	North half of county
Washington County	
Fort Atkinson State Historical Park	Fort Calhoun
Boyer Chute National Wildlife Refuge	Fort Calhoun
DeSoto National Wildlife Refuge	Fort Calhoun

PARCEL INVENTORY

To better understand the potential for losses in the planning area, a parcel inventory was completed for the corporate limits of each incorporated jurisdiction in the planning area using Geographic Information Systems (GIS) data. Parcel inventories were completed in order to determine the number of parcels and the value of their improved structures within each jurisdiction. This inventory provided valuable information on the vulnerability and potential losses to each plan participant.

Parcel inventory data was collected from GIS Workshop, a private firm handling GIS work for Burt, Dakota, Thurston, and Washington Counties, and also from the GIS Departments at Douglas and Sarpy Counties. GIS Workshop and Douglas and Sarpy Counties were able to provide a data set which includes the location of the parcel, parcel value, and value for improvements (structures), number of parcels, and parcel land value. This information was used for assessing risk to structures related to hazards with known geographic locations such as flooding.

Structures are categorized into the following classifications:

- *Dwelling*, including all residential structures, such as a house, apartment, or other place of residence.
- *Land Value*, price of the property, independent of any land improvements.
- *Outbuilding*, any nonresidential structure on a parcel.

The following table displays the structural valuation summaries for both the cities and counties in the planning area. An inventory for each jurisdiction can be found in the *Section Seven: Participant Sections*.

Table 26: Parcel Valuation Summary

Jurisdiction	Dwelling or Improvement	Land Value	Outbuilding	Total Value	Total Number of Parcels
Burt County	$34,742,598	$1,483,116,770	$217,662,700	$1,735,522,068	7,660
Decatur	$584,495	$5,333,570	$10,321,255	$16,239,320	502
Tekamah City	$787,280	$12,319,920	$54,124,520	$67,231,720	1041

Jurisdiction	Dwelling or Improvement	Land Value	Outbuilding	Total Value	Total Number of Parcels
Dakota County	$721,675,430	$756,685,405	$15,187,715	$1,493,548,550	9,879
Dakota City	$98,387,515	$12,484,275	$88,335	$110,960,125	820
Homer	$16,441,235	$1,437,475	$9,505	$17,888,215	287
Hubbard	$5,516,230	$1,701,445	$85,415	$7,303,090	145
Jackson	$39,222,155	$389,490	$42,980	$43,104,625	221
South Sioux City	$45,069,705	$97,278,870	$314,670	$548,290,645	4,260
Douglas County	$32,131,774,000	$6,555,012,095	Data Not Available	$38,686,786,095	200,654
Bennington City	$94,114,900	$20,312,990	Data Not Available	$114,427,890	771
Boys Town	$1,207,100	$127,300	Data Not Available	$1,334,400	14
Omaha	$23,739,271,700	$4,362,309,690	Data Not Available	$28,101,581,390	147,137
Ralston	$344,040,800	$80,177,700	Data Not Available	$424,218,500	2,405
Valley	$158,795,200	$46,052,250	Data Not Available	$204,847,450	1,404
Waterloo	$57,197,000	$11,740,600	Data Not Available	$68,937,600	632
Sarpy County	Data Not Available	$2,955,908,341	Data Not Available	$12,553,757,340	60,397
Bellevue	Data Not Available	$550,385,769	Data Not Available	$2,748,448,969	17,128
Gretna	Data Not Available	$67,801,424	Data Not Available	$365,442,846	1,629
La Vista	Data Not Available	$254,940,884	Data Not Available	$1,187,029,189	4,571
Papillion	Data Not Available	$283,037,218	Data Not Available	$1,404,078,357	6,117
Springfield	Data Not Available	$18,886,569	Data Not Available	$83,227,277	686
Thurston County	$23,029,195	$1,079,258,245	$86,935,585	$1,189,223,025	5,490
Walthill	$182,030	$4,457,545	$4,360,910	$9,000,485	468
Winnebago	$37,825	$541,120	$1,430,995	$2,009,940	197
Washington County	$1,242,644,250	$1,098,457,090	$42,150,420	$2,383,251,760	12,936
Arlington	$50,196,735	$10,837,345	$14,000	$61,048,080	636
Blair	$451,728,810	$97,555,165	$343,450	$549,627,425	3,503
Fort Calhoun	$52,499,080	$13,290,290	$144,620	$65,933,990	495
Herman	$8,156,630	$3,273,545	$112,970	$11,543,145	217

Source: GIS Workshop

AGRICULTURAL ASSET INVENTORY

Agriculture is a major component of the economy for the planning area and all of Nebraska. According to the Nebraska Department of Agriculture:

- The livestock industry contributes more than $6 billion annually to the state's economy
- Farmlands across the state accounted for 92% of the state's total land area
- More than 8.3 million acres of farmland are irrigated (44% of all farmland) in 2012
- 1 in 4 jobs are related to agriculture

The following tables present information from the United States Department of Agriculture (USDA) 2007 and 2012 Agricultural Census.

Table 27: Regional Farm Data

County	Number of Farms, 2007	Number of Farms, 2012	Percent Change	Farm Acreage, 2007	Farm Acreage, 2012	Percent Change
Burt	549	560	2.0%	275,041	309,934	11.3%
Dakota	278	243	-14.4%	166,555	157,976	-5.4%
Douglas	362	396	8.6%	84,374	86,123	2.0%
Sarpy	360	396	9.1%	100,835	91,718	-9.9%
Thurston	372	367	-1.4%	199,689	247,605	19.4%
Washington	762	821	7.2%	217,306	248,088	12.4%
Total	**2,683**	**2,783**	**3.6%**	**1,043,800**	**1,141,444**	**8.6%**

Source: USDA 2007 and 2012 Agricultural Census

CROP INVENTORY

The following table provides information related to the crops grown within the planning area. The data was collected from the 2012 USDA Agricultural Census.

Table 28: Crops by County

County	Wheat (acres)	Soybeans (acres)	Forage (acres)	Corn (acres)
Burt	269	117,512	7,405	135,570
Dakota	N/A	50,847	4,867	70,893
Douglas	180	31,647	4,500	35,920
Sarpy	129	34,892	3,839	38,339
Thurston	-	77,950	11,432	104,901
Washington	276	91,769	13,854	96,416
Total	**854**	**404,617**	**45,897**	**482,039**

Source: 2012 USDA Agricultural Census
N/A: Data withheld

LIVESTOCK INVENTORY

The following table provides information related to the livestock within the planning area. The data was collected from the 2012 USDA Agricultural Census.

Table 29: Livestock Inventory by County

County	Cattle and Calves	Hogs and Pigs	Horse and Ponies	Poultry Egg Layers	Poultry Broilers	Sheep and Lambs
Burt	25,088	24,073	413	472	500	478
Dakota	7,394	N/A	319	219	305	328
Douglas	3,324	N/A	1,529	717	N/A	271
Sarpy	7,255	N/A	1,126	562	124	114
Thurston	45,913	12,009	315	367	N/A	441

County	Cattle and Calves	Hogs and Pigs	Horse and Ponies	Poultry Egg Layers	Poultry Broilers	Sheep and Lambs
Washington	28,195	25,570	1,650	1,215	1,540	1,122
Total	**117,169**	**61,652**	**5,352**	**3,552**	**2,469**	**2,754**

Source: 2012 USDA Agricultural Census
N/A: Data withheld

AGRICULTURAL VALUATION PER COUNTY

The following table provides information related to the market value of agricultural resources located within the planning area. The data was collected from the 2007 and 2012 USDA Agricultural Census.

Table 30: Market Value of Agricultural Products Sold

County	Market Value of Products Sold, 2007	Market Value of Products Sold, 2012	Percent Change
Burt	$145,873,000	$226,941,000	35.7%
Dakota	$63,431,000	$72,977,000	13.1%
Douglas	$46,340,000	$58,019,000	20.1%
Sarpy	$68,104,000	$63,579,000	-7.1%
Thurston	$153,742,000	$197,685,000	22.2%
Washington	$131,435,000	$163,475,000	19.6%
Total	**$608,925,000**	**$782,676,000**	**22.2%**

Source: USDA 2007 and 2012 Agricultural Census

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 are able to 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 31: 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 (March 2013). This process consists of four primary steps: 1) Describe the hazard; 2) Identify vulnerable community assets; 3) Analyze Risk; and 4) Summarize vulnerability.

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

***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.*

Finally, for 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. The following table outlines the data sources utilized to examine each individual hazard. Further discussion relative to each hazard is discussed in the hazard profile portion of this section.

Table 32: Risk Assessment Data Sources

Type of Data	Data Source
Property Damage*	NCDC Storm Events Database
Crop Damage	USDA RMA
Sperry-Piltz Ice Accumulation Index (SPIA)	National Weather Service (NWS)
Temperature, Precipitation, Snowfall,	Weather Stations
TORRO Hailstone Scale	The Tornado and Storm Research Organization
Monthly Tornado Averages	National Oceanic and Atmospheric Administration (NOAA)
Tornado Time of Occurrence	NOAA
Tornado Activity in the United States	NOAA
Wind Zones in the United States	FEMA
Beaufort Wind Force Rankings	NWS
Historical Drought Impacts	National Drought Mitigation Center, University of Nebraska-Lincoln
Palmer Drought Severity Index	National Oceanic Atmospheric Administration, High Plains Regional Climate Center
USDA Secretarial Disaster Designations	U.S. Department of Agriculture
Heat Index	NOAA
Number of Wildfires by Cause in Nebraska 2004-2010	Nebraska Forest Service
Acres Burned by Cause in Nebraska 2004-2010	Nebraska Forest Service
Wildfire Risk Potential Map	USDA Forest Service 2013
NFIP Status	Nebraska Department of Natural Resources, National Flood Insurance Program
NFIP Policies - December 2012	Nebraska Department of Natural Resources, National Flood Insurance Program
NFIP Claims Statistics	National Flood Insurance Program Loss Statistics
2013 Recorded Animal Diseases	Nebraska Department of Agriculture
High Hazard Dams in the Planning Area	Nebraska Department of Natural Resources
Fault Lines in Nebraska	Nebraska Department of Natural Resources
Richter Scale	Federal Emergency Management Agency
Modified Mercalli Intensity Scale	Federal Emergency Management Agency
Nebraska Seismic Hazard Map	United States Geological Survey
Urban Fires by Type and Community	Nebraska State Fire Marshall
Fire Death Rates for the State of Nebraska	U.S. Fire Administration
Chemical Spills from 1980 to 2015	Pipeline and Hazardous Materials Safety Administration
Global Terrorism Database (1970-2014)	National Consortium for the Study of Terrorism and Responses to Terrorism
Database of Dam Failures	Stanford University's National Performance of Dams Program

**NCDC data was used for property damage, unless otherwise noted.*

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 that are 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 rather only officially recorded damages from reported events.
- **Total Years of Record:** This is the span of years there is data available for recorded events. Vetted and cleaned up NCDC data is available for January 1996 to July 2015. Although some data is available back to 1950, this plan update utilizes only the more current and more accurate data available. Wildfire data is available from the Nebraska Forest Service from 2000 to 2012.
- **Number of Hazard Event:** 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 in significant numbers are discussed in detail. It should be noted that the table below is calculated for the entire planning area that includes all the NCDC data including county-based and zonal. It should be noted NCDC data is not all inclusive and it provides very limited information on crop losses. In order 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. The collected data was from 2000 to 2014. Data for all the hazards are not always available, so only those with an available dataset are included in the loss estimation table (Table 36).

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 for this planning process are included in the following table.

Table 33: Hazards Addressed in the Plan

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

HAZARD ELIMINATION

Given the location and history of the planning area the following hazards were eliminated from further review. An explanation of how and why the hazards were eliminated is provided.

Avalanche: No historic occurrence; due to topography of the planning area this type of hazard has a very low probability of future occurrence.

Coastal Erosion: While it is likely that the planning area will be impacted by a changing climate there is no coast line located in the planning area, for this reason this hazard has been eliminated.

Expansive Soils: Consistent with the 2014 Nebraska HMP, this hazard has been eliminated from further examination. There is not sufficient data available to examine historic impacts or project future probability or losses. Any impact from expansive soils in Nebraska (and the planning area) are likely to be manifested as localized flooding and will be reported as such. This approach is consistent with the 2014 Nebraska HMP.

Hurricane: Given the location of the planning area in the central plains, hurricanes are not expected to occur. This is supported by the historical record.

Land Subsistence (Sinkholes): Land subsistence is common in areas of karst topography; there are no recognized areas of true karst topography in planning area or even in Nebraska. This approach is consistent with the 2014 Nebraska HMP.

Landslides: While there is data available related to landslides which have occurred in the planning area and across the state, the database has not been maintained in recent years. Further landslides that have occurred (in the planning area and across the state) have resulted in no reported damages. The following table outlined the number of recorded landslide events, which have occurred in the planning area. This is consistent with the 2014 Nebraska HMP.

Table 34: Landslides by County

County	Number of Landslides	Total Estimated Damages
Burt	12	$0
Dakota	2	$0
Douglas	7	$0
Sarpy	4	$0
Thurston	6	$0
Washington	0	N/A
Total	**31**	**$0**

Source: Nebraska Hazard Mitigation Plan, 2014

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 profiled further for this plan. This approach is consistent with the 2014 Nebraska HMP.

Tsunami: Given the location of the planning area in the central plains tsunami are not expected to occur. This is supported by the historical record.

Volcano: Given the location of the planning area, volcanos are not expected to occur. This is supported by the historical record.

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. 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 in this section.

Table 35: Regional Risk Assessment

Regional Risk Assessment			
Hazard	**Previous Occurrence Events/Years**	**Approximate Annual Probability**	**Likely Extent**
Agricultural Animal Disease	236/1.7	100%	Unavailable
Agricultural Plant Disease	220/15	100%	Unavailable
Chemical Fixed Sites	329/34	100%	Localized to the facilities and adjacent surroundings
Radiological Fixed Sites	0/43	<1%	10-mile evacuation radius
Chemical Transportation	1,167/35.7	100%	Limited (<0.5 mile from release site)
Civil Disorder	4/100	<5%	Localized; Likely peaceful protests
Dam Failure	0	<1%	Varies
Drought	69/121	57%	Mild Drought
Earthquakes	0/42	<1%	<4.0
Extreme Heat	36/1	100%	>90°F
Flooding	133/19.6	100%	Some inundation of structures* (<1% of structures) and roads near streams. Some evacuations of people may be necessary (<1% of population)
Grass/Wildfires	1,155/13	100%	<100 acres
Hail	641/19.6	100%	H3 – H6 (0.8 – 1.00 inches)
High Winds	107/19.6	100%	9 BWF (47 – 54 mph)
Levee Failure	0/25	1%	3,244 structures located in leveed areas
Severe Thunderstorms	469/19.6	100%	Wind ≥ 58 mph and/or Hail ≤ 1.00 inch
Severe Winter Storms	372/19.6	100%	0.25 ice 20 - 40°F below zero (wind chills) 4 – 8” snow 25 – 40 mph winds
Terrorism	9/45	2%	Isolated to a single building

Regional Risk Assessment			
Hazard	**Previous Occurrence Events/Years**	**Approximate Annual Probability**	**Likely Extent**
Tornados	28/19.6	100%	EF0 - EF1
Urban Fire	9,859/6	100%	Single structure

**Quantification of vulnerable structures provided in Section Seven: Participant Sections*

The following table provides loss estimates for hazards with sufficient data. Description of major events are include in the individual hazard profiles later in this section.

Table 36: Loss Estimation for the Planning Area

Hazard Type	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Agricultural Animal Disease	N/A	N/A	Unknown	Unknown
Agricultural Plant Disease	N/A	N/A	$1,293,430	$86,228
Chemical Fixed Sites	$185,000	$5,606	$0	$0
Radiological Fixed Sites	$0	$0	$0	$0
Chemical Transportation	$891,793	$24,980	Unknown	Unknown
Civil Disorder	Unknown	Unknown	N/A	N/A
Dam Failure	$0	$0	$0	$0
Drought	$0	$0	$134,222,235	$8,948,156
Earthquake	$0	$0	$0	$0
Extreme Heat	$6,460,000	$329,592	$9,816,312	$654,421
Flooding	$29,334,000	$1,496,633	$638,280	$1,109,219
Grass/Wildfires[3]	$0	$0	$184,238	$14,172
Hail Events	$52,157,000	$2,661,071	$30,477,259	$2,031,817
High Winds	$230,000	$11,735	$745,230	$49,682
Levee Failure	$0	$0	$0	$0
Severe Thunderstorms	$67,212,500	$3,446,795	$34,429,327	$2,295,289
Severe Winter Storms	$22,069,000	$1,125,969	$706,584	$47,106
Terrorism	$39,500	$877	N/A	N/A
Tornados	$5,085,000	$259,439	$305,673	$20,378
Urban Fire	Unknown	Unknown	N/A	N/A

1 Indicates data is from NCDC (January 1996 to July 2015)
2 Indicates data is from USDA (2000 to 2014)
3 Indicates data is from NFS (2000 to 2012)

HISTORICAL DISASTER DECLARATIONS

The following tables show disaster declarations that have been granted within the planning area in the past.

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.

Table 37: SBA Declarations

Disaster Declaration Number	Declaration Date	Description	Primary Counties	Contiguous Counties
NE-00063	7/28/2014	Tornados, Straight-line Winds, and Flooding	Burt, Thurston, Washington	N/A
NE-00062	7/24/2014	Severe Storms, Tornados, Straight-line Winds, and Flooding	Dakota, Thurston	N/A
NE-00055	11/26/2013	Severe Storms, Winter Storms, Tornados, and Flooding	Thurston	N/A
NE-00053	12/10/2013*	Drought	Burt, Dakota, Douglas, Sarpy, Thurston, Washington	Nemaha, Nuckolls, Pawnee
NE-00051	4/15/2013*	Drought	Douglas, Sarpy, Washington	Burt
NE-00050	4/8/2013*	Drought	Burt, Dakota, Thurston	Douglas, Sarpy, Washington
NE-00049	4/1/2013*	Drought	N/A	Dakota, Thurston
NE-00043	8/12/2011 & 12/12/2011	Flooding	Burt, Dakota, Douglas, Sarpy, Thurston, Washington	N/A
NE-00042	7/18/2011	Flooding	Burt, Dakota, Douglas, Sarpy, Thurston, Washington	N/A
NE-00041	9/7/2011 & 8/12/2011 & 11/18/2011	Flooding	Burt, Dakota, Douglas, Sarpy, Thurston, Washington	N/A
NE-00038	7/15/2010 & 8/29/2010 & 9/1/2010	Severe Storms, Flooding, and Tornados	Burt, Douglas, Sarpy, Thurston, Washington	N/A
NE-00035	4/21/2010 & 6/10/2010	Severe Storms, Ice Jams, and Flooding	Dakota, Thurston	N/A
NE-00033	2/25/2010 & 3/26/2010	Severe Winter Storms and Snowstorm	Burt, Dakota, Douglas, Sarpy, Thurston, Washington	N/A

Disaster Declaration Number	Declaration Date	Description	Primary Counties	Contiguous Counties
NE-00022	9/2/2008	Severe Storms, Heavy Rain, Hail, and Straight-line Winds	Douglas	Sarpy, Washington
NE-00021	6/20/2008 & 6/24/2008 & 7/29/2008	Severe Storms, Tornados, and Flooding	Burt, Douglas, Sarpy, Thurston	N/A
NE-00020	6/20/2008 & 6/24/2008 & 7/29/2008	Severe Storms, Tornados, and Flooding	Douglas, Sarpy	Washington

**Denotes date of grant application deadline, rather than disaster declaration date*

PRESIDENTIAL DISASTER DECLARATIONS

The presidential disaster declarations involving the planning area through October 2015 are summarized in the following table. Declarations prior to 1965 are available on the FEMA website, but do not list designated counties.

Table 38: Presidential Disaster Declarations

Disaster Declaration Number	Declaration Date	Disaster Type	Individual Assistance Counties	Total Individual Assistance	Public Assistance Counties	Total Public Assistance Grants
4185	7/28/2014	Severe Storms, Tornados, Straight-line Winds, Flooding	None	N/A	Burt, Thurston, Washington	$3,596,345
4183	7/24/2014	Severe Storms, Tornados, Straight-line Winds, Flooding	None	N/A	Dakota, Thurston	$14,222,959
4156	11/26/2013	Severe Storms, Winter Storms, Tornados, and Flooding	None	N/A	Thurston	$2,729,443
4013	8/12/2011	Flooding	Burt, Dakota, Douglas, Sarpy, Thurston, Washington	$4,311,497	Burt, Dakota, Douglas, Sarpy, Thurston, Washington	$65,392,060
3323	6/18/2011	Flooding	None	N/A	Burt, Dakota, Douglas, Sarpy, Thurston, Washington	N/A
1924	7/15/2010	Severe Storms, Flooding, and Tornados	None	N/A	Burt, Douglas, Sarpy, Thurston, Washington	$50,081,981

Disaster Declaration Number	Declaration Date	Disaster Type	Individual Assistance Counties	Total Individual Assistance	Public Assistance Counties	Total Public Assistance Grants
1902	4/21/2010	Severe Storms, Ice Jams, and Flooding	None	N/A	Dakota, Thurston	$3,112,391
1878	2/25/2010	Severe Winter Storms and Snowstorm	None	N/A	Burt, Douglas, Thurston, Washington	$6,582,498
1779	7/18/2008	Severe Storms, Straight-line Winds, and Flooding	None	N/A	Douglas, Sarpy	$12,064,643
1770	6/20/2008	Severe Storms, Tornados, and Flooding	Douglas, Sarpy	$1,560,229	Burt, Douglas, Sarpy, Thurston	$36,258,650
3245	9/13/2005	Hurricane Katrina Evacuation	None	N/A	All Counties	$393,813
1517	5/25/2004	Severe Storms, Tornados, and Flooding	Douglas, Sarpy, Washington	$829,908	Thurston, Washington	$413,351,657
1480	7/21/2003	Severe Storms and Tornados	None	N/A	Douglas	$3,891,329
1394	10/12/2001	Severe Storms and Flooding	None	N/A	Dakota County	$1,414,196
1286	8/20/1999	Severe Storms and Flooding	None	N/A	Burt, Douglas, Washington	$2,083,481
1190	11/1/1997	Severe Snow Storms	None	N/A	Douglas, Sarpy, Washington	N/A
998	7/19/1993	Flooding, Severe Storms	Burt, Douglas, Sarpy, Washington	N/A	Burt, Douglas, Sarpy, Washington	N/A
983	4/2/1993	Ice Jams, Flooding	None	N/A	Sarpy	N/A
873	7/4/1990	Flooding, Severe Storm, Tornado	Douglas, Sarpy, Thurston, Washington	N/A	Thurston, Washington	N/A
716	7/3/1984	Tornados, Flooding	Douglas, Sarpy, Washington	N/A	Burt, Thurston, Washington	N/A
552	3/24/1978	Storms, Ice Jams, Snowmelt, Flooding	Douglas, Sarpy, Washington	N/A	Douglas, Sarpy, Washington	N/A
467	5/7/1975	Severe Storms, Tornados	Douglas	N/A	Douglas	N/A

Disaster Declaration Number	Declaration Date	Disaster Type	Individual Assistance Counties	Total Individual Assistance	Public Assistance Counties	Total Public Assistance Grants
308	7/7/1971	Floods	None	N/A	Dakota, Thurston	N/A
303	2/23/1971	Floods	Burt, Dakota, Douglas, Sarpy, Thurston, Washington	N/A	Burt, Dakota, Douglas, Sarpy, Thurston, Washington	N/A
228	7/18/1967	Severe Storms, Flooding	Burt, Dakota, Douglas, Sarpy, Thurston	N/A	Burt, Dakota, Douglas, Sarpy, Thurston	N/A

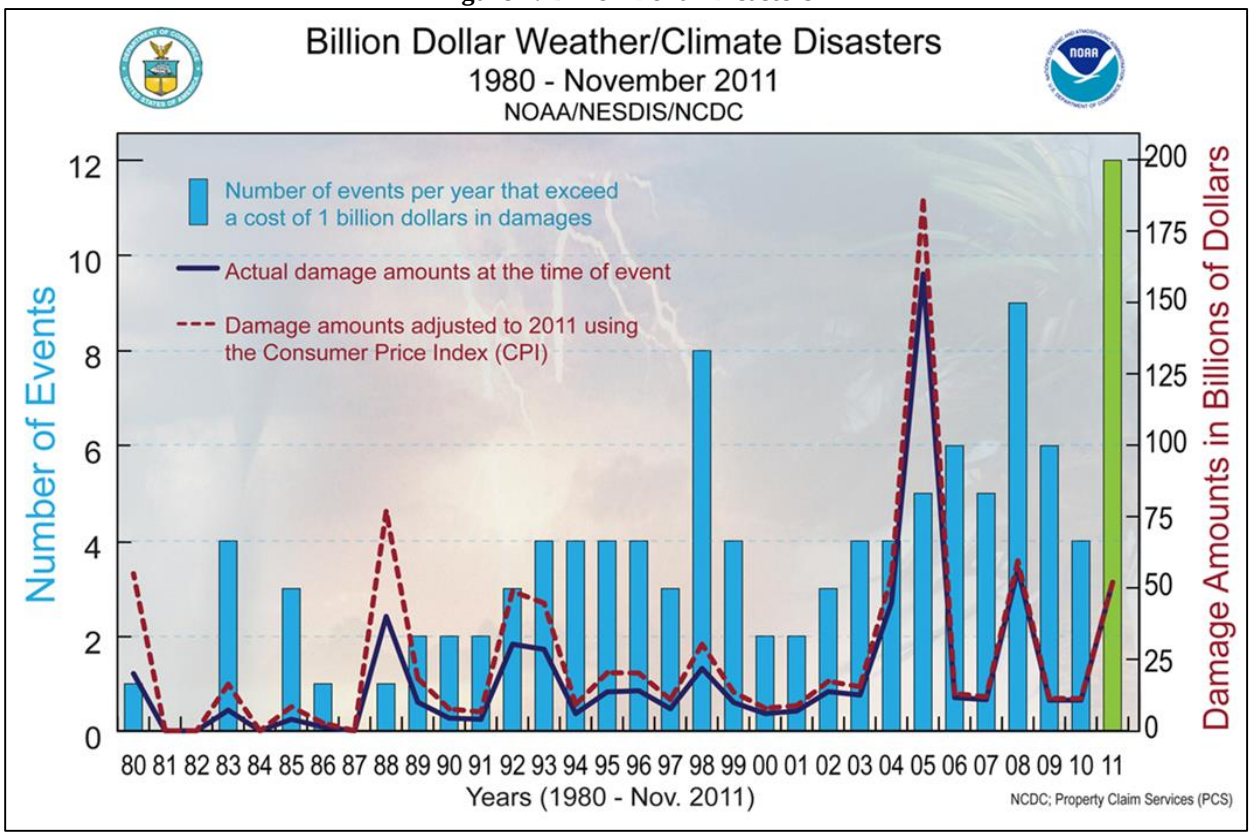
Source: Federal Emergency Management Agency, 1965-2015

CLIMATE ADAPTATION

Long term climate trends have and will continue to increase the risk to hazards within the planning area. Since 1895, Nebraska's overall average temperature has increased by about 1°F. This trend will lead to an increase in the frequency and intensity of hazardous events, which will cause a number of significant economic, social, and environmental impacts on Nebraskans.

As seen in Figure 7, 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.

Figure 7: Billion Dollar Disasters



Source: NOAA

According to a recent University of Nebraska report (*Understanding and Assessing Climate Change: Implications for Nebraska,* 2014), Nebraskan's 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

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 possibly leading 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, 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.

The planning area will have to adapt to these changes, or experience an increase in economic losses, loss of life, property damages, and crop 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 resiliency. 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 the 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 examine the identified hazards across the region, local concerns or deviations from the regional risk assessment will be addressed in *Section Seven* of this plan.

AGRICULTURAL ANIMAL AND PLANT DISEASE

HAZARD PROFILE

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 state of Nebraska has one of the country's largest economy's that is vested in both livestock and crop sales. According to the Nebraska Department of Agriculture (NDA) in 2012, the market value of agricultural products sold was estimated at more than $23 billion; this total is split between crops (estimated $11.37 billion) and livestock (estimated $11.69 billion). For the planning area, sold agricultural products were estimated at $782,676,000 with the cost split at $513,782,000 for crops and $268,894,000 for livestock.

LOCATION

Given the agricultural presence in the planning area, animal and plant disease have the potential to occur across the area. If a major infestation event were to occur, the economy in the entire planning area would be affected, including urban areas. As indicated in the following figure indicating land use in the planning area, Douglas County has a large metropolitan area and has the smallest land used for agricultural purposes at 62 percent (Table 39).

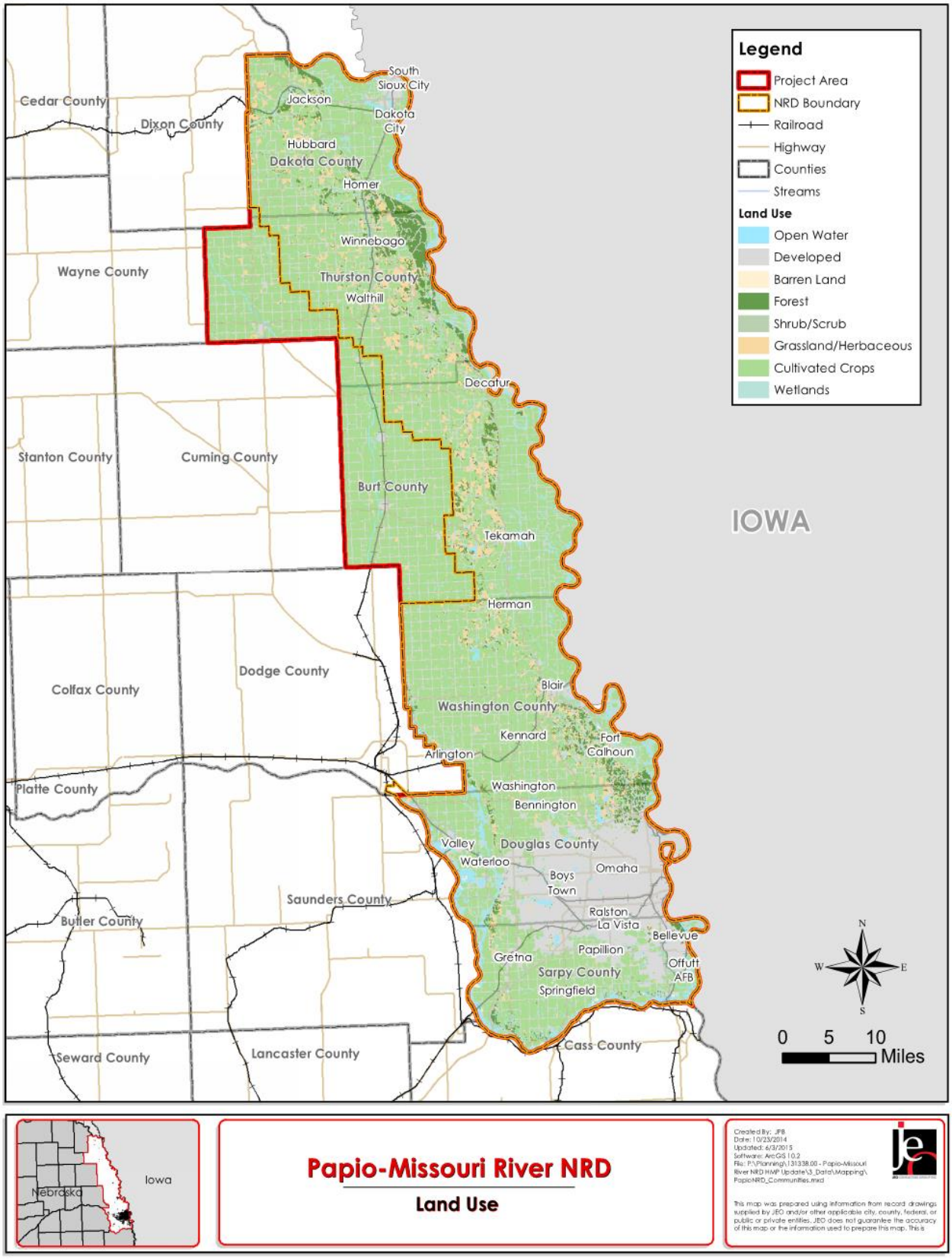
The land use data is from a 2005 dataset, and while some of the uses may have changed since 2005, it is the most recent data available. The main land uses where animal and plant disease will be observed include: agricultural lands, range or pasture lands, and forests. It is possible that animal or plant disease to occur in domestic animals or crops in urban areas.

The following table provides a tabulation of land use by type across the planning area.

Table 39: Land Use Types

Type of Land Use	Total Area in the Planning Area (Square Miles)	Percent of Total Lands
Open Water	40.74	1.9
Developed	310.39	14.5
Barren Land	1.17	0.1
Forest	102.04	4.8
Shrubland	0	0.0
Grassland/Herbaceous	314.12	14.7
Planted/Cultivated	1327.64	62.0
Wetlands	45.04	2.1

Figure 8: Land Use in the Planning Area



HISTORICAL OCCURRENCES

Animal Disease

According to the 2014 State of Nebraska Hazard Mitigation Plan and the NDA, the following first four diseases with impacts upon livestock were reported as having occurred throughout the 93 counties in Nebraska. In 2015, there was a large Avian Influenza outbreak affecting millions of poultry outside of the planning area.

Table 40: Livestock Diseases Reported in Nebraska

Disease	Date(s) Reported	Population Impacted	Effects of the disease
Chronic Wasting Disease (CWD)	1997 – 2006	117 positive test; Deer and Elk (wild populations)	Weight loss, incessant drinking and urination
Vesicular Stomatitis (VS)	2005; 2014	Three horses; Two cows (Wheeler County, NE)	Blistering on lips, tongues, coronary bands. Unable to eat or drink causing weight loss.
Epizootic Hemorrhagic Disease (EHD) (Blue Tongue)	Ongoing; usually occurs in late summer or fall	Wild deer	Extensive hemorrhaging
Bovine Tuberculosis	2009	Three head of cattle infected; 21,764 head tested; 61 quarantined	Emaciation, lethargy, weakness, anorexia, low-grade fever, and pneumonia with a chronic, moist cough
Avian Influenza (HPAI)	2015	4.9 million chickens disposed across 6 farms (Dixon County)	Decreased egg production; misshapen eggs; swelling of head, eyelids, comb, and wattles; respiratory disease; unstable coordination; sudden death

Source: 2014 State of Nebraska Hazard Mitigation Plan and NDA

Table 41 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 41: Livestock Inventory

County	Market Value of 2012 Livestock Sales	Cattle and Calves	Hogs and Pigs	Horse and Ponies	Poultry Egg Layers	Poultry Broilers	Sheep and Lambs
Burt	$76,678,000	25,088	24,073	413	472	500	478
Dakota	$7,759,000	7,394	N/A	319	219	305	328
Douglas	$3,843,000	3,324	N/A	1,529	717	N/A	271
Sarpy	$15,611,000	7,255	N/A	1,126	562	124	114
Thurston	$104,123,000	45,913	12,009	315	367	N/A	441
Washington	$60,880,000	28,195	25,570	1,650	1,215	1,540	1,122
Total	**$268,894,000**	**117,169**	**61,652**	**5,352**	**3,552**	**2,469**	**2,754**

Source: 2012 U.S. Census of Agriculture

In regard to diseases involving animals, NDA provides reports on diseases occurring in the planning area. The following table includes those animal diseases and numbers of occurrences within the planning area between January 1, 2014 and August 31, 2015.

Table 42: 2014-2015 Recorded Animal Diseases

Disease	Species Impacted	Number Of Occurrences
Caprine Arthritis/Encephalitis	Caprine/Ovine	1
Paratuberculosis	Bovine	21
Porcine Circovirus	Porcine	104
Porcine Epidemic Diarrhea	Porcine	3
Porcine Reproductive and Respiratory Disease	Porcine	107
	Total	**236**

Source: Nebraska Department of Agriculture, January 2014 - August 2015

Animals could be susceptible to diseases beyond those outlined above. Data related to diseases and rates of disease among "free range game" is limited due to lack of laboratory testing, reporting, and field study.

Plant Disease

A variety of diseases can impact crops and often vary from year to year. The Department of Agriculture provides information on some of the most common, being:

Table 43: Common Crop Diseases in Nebraska by Crop Types

Crop	Diseases	
Corn	• Anthracnose • Bacterial Stalk Rot • Common Rust • Fusarium Stalk Rot • Fusarium Root Rot • Gray Leaf Spot • Maize Chlorotic Mottle Virus	• Southern Rust • Stewart's Wilt • Common Smut • Goss's Wilt • Head Smut • Physoderma
Soybeans	• Anthracnose • Bacterial Blight • Bean Pod Mottle • Brown Spot • Brown Stem Rot • Charcoal Rot • Frogeye Leaf Spot • Phytophthora Root and Stem Rot • Pod and Stem Blight	• Purple Seed Stain • Rhizoctonia Root Rot • Sclerotinia Stem Rot • Soybean Mosaic Virus • Soybean Rust • Stem Canker • Sudden Death Syndrome
Wheat	• Barley Yellow Dwarf • Black Chaff • Crown and Root Rot • Fusarium Head Blight	• Leaf Rust • Tan Spot • Wheat Soil-borne Mosaic • Wheat Streak Mosaic

Crop	Diseases
Sorghum	• Ergot • Sooty Stripe • Zonate Leaf Spot

In addition to the viral and bacterial disease that could impact crops, pests can also result in crop loss or detract from the quality of crop. Those pests are:

- Grasshoppers
- Western Bean Cutworm
- European Corn Borer
- Corn Rootworm
- Corn Nematodes, Bean Weevil
- Mexican Bean Beatle
- Soybean Aphids
- Rootworm Beatles

The Regional Planning Team as well as several community representatives noted that infestation of the Emerald Ash Borer (EAB) is of concern. While the EAB has not been found in Nebraska to date, infestation may be inevitable as it has been found in neighboring states including Colorado, Kansas, and Iowa. This pest is a slender, emerald green beetle that is ½ inch long and responsible for the destruction of approximately 50 million ash trees across 25 states and two Canadian provinces. The Nebraska Forest Service (NFS) estimates that 2.2 million of Nebraska's ash trees could become vulnerable to the pest, but all 44 million ash trees in Nebraska are at risk. The replacement of these trees would cost the state approximately 1.5 billion dollars. The key to stopping this pest is education, monitoring, surveillance, containment, and communication. NFS has updated the Nebraska Emerald Ash Borer Response Plan in May 2015.

Nebraska farmers also lose a significant amount of crops each year as a result of wildlife foraging. This can be particularly problematic in areas where natural habitat has been diminished or in years where weather patterns such as early or late frost, deep snow, or drought has caused the wild food sources to be limited.

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

Table 44: Land and Value of Farms in the Planning Area

County	Number of Farms	Land in Farms (acres)	Percent of Land Area Used by Farms	Market Value of 2012 Crop Sales
Burt	560	309,934	98.4%	$150,263,000
Dakota	243	157,976	93.2%	$65,218,000
Douglas	396	86,123	41.0%	$54,176,000
Sarpy	396	91,718	60.0%	$47,968,000
Thurston	367	247,605	98.0%	$93,562,000
Washington	821	248,088	99.3%	$102,595,000
Total	**2,783**	**1,141,444**	**84.6%**	**$513,782,000**

Source: 2012 U.S. Census of Agriculture

Table 45: Crop Values

County	Corn		Soybeans		Wheat	
	Acres Planted	Value (2012)	Acres Planted	Value (2012)	Acres Planted	Value (2012)
Burt	135,570	$98,255,000	117,512	$48,638,000	269	-
Dakota	70,893	$46,372,000	50,847	$17,529,000	-	-
Douglas	35,920	$27,599,000	31,647	$11,880,000	180	-
Sarpy	38,339	$27,324,000	34,892	$16,481,000	129	-
Thurston	104,901	$58,757,000	77,950	$30,325,000	-	-
Washington	96,416	$60,386,000	91,769	$38,552,000	276	$114,000

Source: 2012 U.S. Census of Agriculture
- Data not available

The crops in Table 45 make up the bulk of the crop portion of the planning area's agricultural product. Burt County has the highest grain production followed by Washington and Thurston Counties.

AVERAGE ANNUAL LOSSES

Using data from the USDA RMA (2000-2014), annual crop losses from plant disease, insects, and wildlife can be estimated. However, the RMA does not track losses for livestock, so it is not possible to estimate losses due to animal disease, but a total of 236 events of animal disease were reported in the planning area over a 1.7 year period by the Nebraska Department of Agriculture.

Table 46: Agricultural Plant Disease Losses

Hazard Type	Number of Events	Total Crop Loss	Average Annual Crop Loss
Plant Disease	24	$196,200	$13,080
Insects	60	$248,764	$16,584
Wildlife	136	$848,466	$56,564
Total	**220**	**$1,293,430**	**$86,228**

Source: USDA RMA, 2000-2014

EXTENT

There is no standard for measuring the magnitude of animal disease. Historically events have impacted relatively small numbers of livestock. The average event to occur in the planning area is the infection of 5 or less animals per event. However, the largest historical event has been the infection of 104 porcine animals in 2015 with Porcine Reproductive and Respiratory Disease.

Again, there is no standard for measuring the magnitude of plant diseases. Further, the RMA data utilized for historic events does not provide a scale or quantification of impacts other than monetary losses. To measure extent related to plant disease, the average annual losses (including plant disease, insects, and wildlife in Table 46) will be divided by the total market value for crops (Table 44) to establish a percent loss annually:

$$Extent = \left(\frac{\$86{,}228}{\$513{,}782{,}000}\right) * (100\%) = 0.02\%\ crop\ loss\ annually$$

PROBABILITY

Given the historic record of occurrence (236 counts of animal disease reported in 1.7 years), the annual probability of occurrence for animal disease is 100 percent. For plant disease, the historic record of

occurrence (24 number of plant diseases reported in 15 years), the annual probability of occurrence is 100 percent.

FUTURE DEVELOPMENT

The differences between the 2007 to 2012 USDA Census of Agriculture indicate that the number of farms, acres in farmland, and livestock production has increased during this time frame. Compared to 2007, there were 100 more farms in 2012, an increase of 3.6 percent, and 97,644 more acres dedicated to farming, an increase of 8.6 percent. Many of the smaller participating communities anticipate that very little future development is expected over the next five years, and if development were to occur, it would be within municipal boundaries. The increase in the number of farms and acreage will likely continue in Burt, Thurston, and Washington Counties where future development is not likely to occur.

Douglas and Sarpy Counties' communities will continue to develop and see growth over the next several years. Dakota County, especially around South Sioux City and Dakota City, is also seeing some growth and development. These three counties are likely to see the number of farms and acreage decrease over the next 5 years.

REGIONAL VULNERABILITIES

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

Table 47: 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	-1.1% of people are employed in the agricultural industry -Large scale or prolonged events may impact tax revenues and local capabilities
Built Environment	None
Infrastructure	-Transportation routes can be closed during quarantine
Critical Facilities	None

RISK ASSESSMENT SUMMARY

Table 48: Summary

Number of Past Events	236 animal disease and 24 plant disease
Vulnerable Locations	All counties
Extent	5> animal infections/event and 0.02% crop loss annually
Annual Probability	100% (animal and plant disease)
Averaged Annual Losses	Animal losses not available and $86,228 (crops)

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Most agricultural producers purchase crop insurance
- USDA and Farm Service Agency (FSA) provide educational materials
- UNL Extension Offices provide community outreach materials

CHEMICAL AND RADIOLOGICAL FIXED SITES

HAZARD PROFILE

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

Chemicals are found everywhere. They purify drinking water, are used in agriculture and industrial production, fuel our vehicles and machines, and simplify household chores. But chemicals also can be hazardous to humans or the environment if used or released improperly. Hazards can occur during production, storage, transportation, use, or disposal. The community is at risk if a chemical is used unsafely or released in harmful amounts.

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

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

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

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

The 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.

Fixed-sites are those that involve chemical manufacturing sites and stationary storage facilities. Table 49 demonstrates the nine classes of hazardous material according to the 2012 Emergency Response Guidebook.

Table 49: Hazardous Material Classes

Class	Type of Material	Divisions
1	Explosives	Division 1.1 – Explosives with a mass explosion hazard Division 1.2 – Explosives with a projection hazard Division 1.3 – Explosives predominantly a fire hazard Division 1.4 – Explosives with no significant blast hazard Division 1.5 – Very insensitive explosives with a mass explosion hazard Division 1.6 – Extremely insensitive articles
2	Gases	Division 2.1 – Flammable gases Division 2.2 – Non-flammable, non-toxic gases Division 2.3 – Toxic gases
3	Flammable liquids (and Combustible liquids)	
4	Flammable solids; Spontaneously combustible materials	Division 4.1 – Flammable solids Division 4.2 – Spontaneously combustible materials Division 4.3 – Water-reactive substances/Dangerous when wet materials
5	Oxidizing substances and Organic peroxides	Division 5.1 – Oxidizing substances Division 5.2 – Organic peroxides
6	Toxic substances and 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, 2012

LOCATION

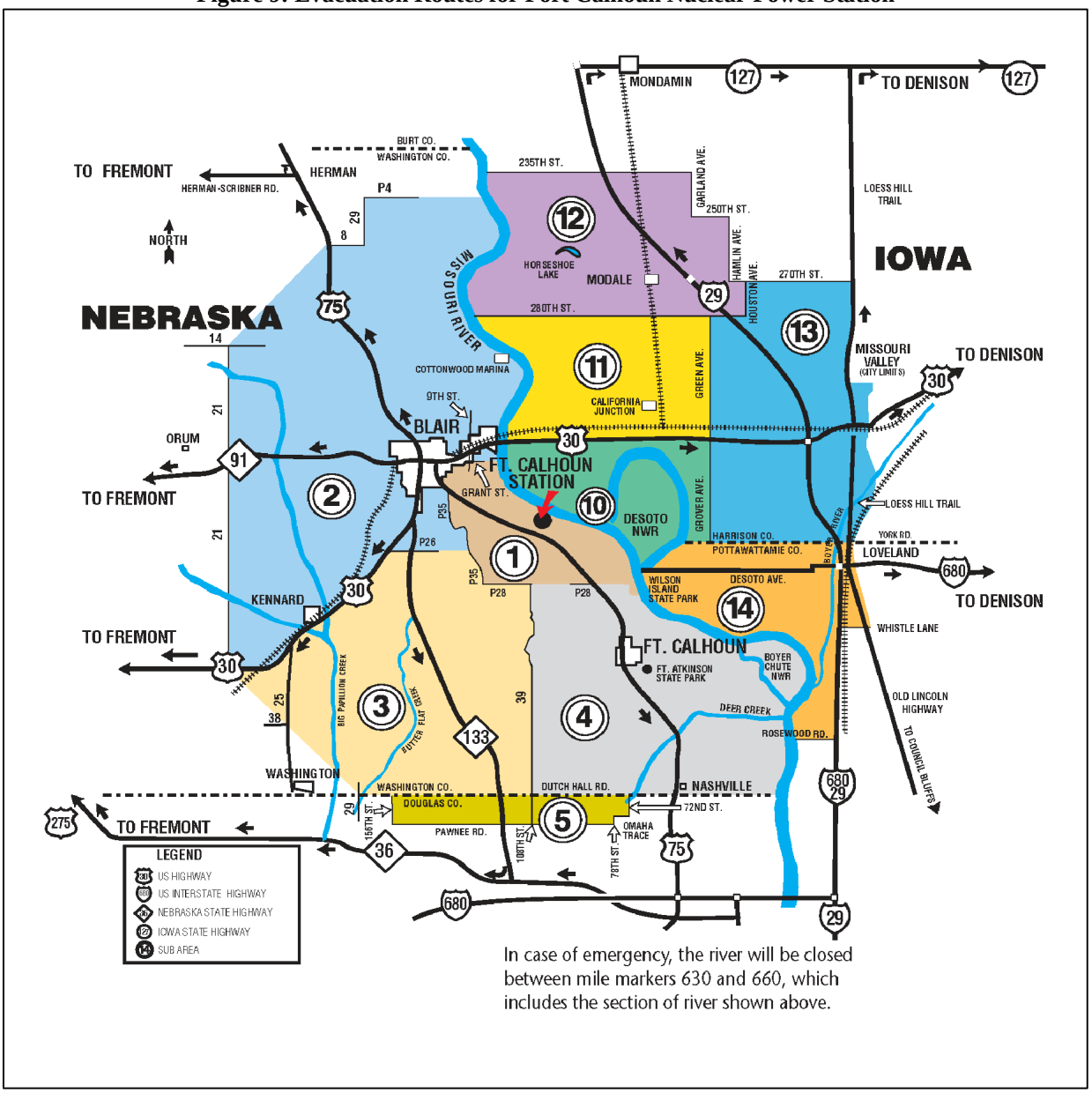
There are dozens of locations across the planning area that house hazardous materials, according to the Tier II reports submitted to the Nebraska Department of Environmental Quality (NDEQ) in 2014. A listing of chemical storage sites can be found in *Section Seven: Participant Sections* for each jurisdiction.

There is also one radiological fixed site in the planning area. Fort Calhoun Nuclear Power Station is located between the City of Fort Calhoun and the City of Blair in Washington County on 660 acres adjacent to the Missouri River. The plume emergency planning zone (EPZ) is a ten-mile radius around the plant and is shared by the states of Nebraska and Iowa. Counties falling within the plume EPZ in Nebraska are Washington and Douglas Counties. The ingestion EPZ is a 50-mile radius around the plant. Counties falling within the ingestion EPZ in Nebraska are: Burt, Butler, Cass, Colfax, Cuming, Dodge, Douglas, Lancaster, Sarpy, Saunders, Thurston, and Washington Counties.

The population within the plume EPZ according to NEMA is 14,800 people on the Nebraska side. In the event of an evacuation of the area, those needing shelter would go to Fremont High School in the City of Fremont (Dodge County) and First Baptist Church in the City of Bellevue (Sarpy County).

The following figure shows the evacuation area for Fort Calhoun Station, and Table 50 provides a description of the evacuation routes for the locations within the P-MRNRD.

Figure 9: Evacuation Routes for Fort Calhoun Nuclear Power Station



Source: Omaha Public Power District (OPPD)

Table 50: Evacuation Route Description for Nebraska

Area	Description	Evacuation Route
1	**This area includes the DeSoto National Wildlife Refuge, but does not include the city of Blair. This area is bounded:** **On the north** by and on a line with Grant Avenue from the Missouri River west to 9th Street. **On the west** by the eastern boundary of the Blair city limits south from Grant Avenue and 9th Street to Highway 75, south on county road P35 to county road P28. **On the south** from the intersection of county road P35 and county road P28 east to the DeSoto National Wildlife Refuge, following the southern boundary of DeSoto east to the Missouri River.	County Roads west to U.S. Hwy 30. (Do not drive past or toward Fort Calhoun Station) West on U.S. Hwy 30 to Fremont.

Area	Description	Evacuation Route
	On the east by that stretch of the Missouri River from the southern boundary of the DeSoto National Wildlife Refuge north to a line with Grand Avenue.	
2	**This area includes the city of Blair, the Blair Industrial Park, the village of Kennard, and the Cottonwood Marina, but does not include the village of Herman. This area is bounded:** **On the north** by and on a line with county road P4 from the Missouri River west to county road 29, south to county road 8, then west to Highway 75. **On the west** from the intersection of county road 8 and Highway 75 SSW to the intersection of county road 14 and county road 21, then south on county road 21 to Highway 30. **On the south** from the intersection of county road 21 and Highway 30 to county road P26. Then east to county road P35 north on county road P35 to Highway 75, the eastern boundary of the Blair city limits to the intersection of Grant Avenue and 9th Street, by and on a line with Grant Avenue and 9th Street east to the Missouri River. **On the east** by the Missouri River from a line with Grant Avenue north to a line with county road P4.	(Residents of Blair) west on State Hwy 91 to U.S. Hwy 77/275, south on U.S. Hwy 77/275 to Fremont. **Or,** west on U.S. Hwy 30 to Fremont. **Or,** (Residents north of Blair) County Roads to U.S. Hwy 75, north on U.S. Hwy 75 to the Herman-Scribner Road, west on the Herman-Scribner Road to U.S. Hwy 77/275, south on U.S. Hwy 77/275 to Fremont. **Or,** (Residents south and west of Blair) County Roads to U.S. Hwy 30, west on U.S. Hwy 30 to Fremont.
3	This area does not include the village of Washington, the village of Kennard, or the Blair Industrial Park. This area is bounded: On the north by and on a line with county road P28 from county road 39 west to county road P35, following county road P35 north to a line with county road P26, by and on a line with county road P26 west to Highway 30. On the west from the intersection of county road P26 and Highway 30 following Highway 30 SSW to county road 21. On the south from the intersection of Washington County Road 21 and Highway 30 SSE passing through the intersection of Washington county road 38 and county road 25 just north of the village of Washington, continuing SSE to the intersection of Washington county road 29 and Dutch hall Road (also known as the Washington/Douglas County Line), then east on Dutch Hall Road to Washington county road 39. On the east from the intersection of Dutch Hall Road and county road 39 north to county road P28 and the southern boundary of subarea 1.	South to NE Hwy 36, NE Hwy 36 west to U.S. Hwy 275, north on U.S. Hwy 275 to the Fremont Military Avenue exit, west on Military Avenue to Johnson Road, Johnson Road south to the Fremont Middle School.
4	This area includes the city of Fort Calhoun and the Boyer Chute Recreational Area, but does not include the DeSoto National Wildlife Refuge. This area is bounded: On the north by the southern boundary of the DeSoto National Wildlife Refuge west from the Missouri River to county road P28, county road P28 west to county road 39. On the west from the intersection of county road 39 and county road P28 south on county road 39 to Dutch Hall Road (also known as the Washington/ Douglas County Line. On the south from the intersection of Dutch Hall Road east by and on a line to the Missouri River. On the east by that stretch of the Missouri River from a line with Dutch Hall Road to the southern boundary of DeSoto National Wildlife Refuge.	South to NE Hwy 36, NE Hwy 36 west to U.S. Hwy 275, north on U.S. Hwy 275 to the Fremont Military Avenue exit, west on Military Avenue to Johnson Road, Johnson Road south to the Fremont Middle School.
5	This area is within Douglas County, but does not include the village of Washington or any part of Washington County. This area is bounded: On the north from the intersection of 72nd Street and Dutch Hall Road (also known as the Washington/Douglas County line) west to 156th Street. On the west from the intersection of 156th Street and Dutch Hall Road south to Pawnee Road. On the south from the intersection of 156th Street and Pawnee Road east to the intersection of 78th Street and Pawnee Road, north to Omaha Trace, then east to the intersection of Omaha Trace and 72nd Street. On the east from the intersection of Omaha Trace and 72nd Street north to Dutch Hall Road.	South to NE Hwy 36, NE Hwy 36 west to U.S. Hwy 275, north on U.S. Hwy 275 to the Fremont Military Avenue exit, west on Military Avenue to Johnson Road, Johnson Road south to the Fremont Middle School.

Source: OPPD

EXTENT

The extent of chemical spills at fixed sites varies and depends on the type of chemical that is released with a majority of events localized to the facility. There were 329 releases that have occurred in the planning area, and the total amount spilled ranged from 0.1 to 11,000 gallons or from two to 78,000 pounds. Also of the 329 spills, 12 spills lead to an evacuation, but 11 of those evacuations were localized to the facility only. Only one chemical release of ammonia anhydrous triggered a bigger evacuation at 0.13 miles, and one person was evacuated from that radius. 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.

The Nuclear Regulatory Commission has a classification scale for nuclear power plant events to ensure consistency in the communications and emergency response. Fort Calhoun Station has had an Unusual Event and an Alert in June 2011. Schools are notified at the Alert phase and evacuate according to their school district's plan. Sirens are sounded at the Site Area Emergency phase. The other event types are possible if the station were to not maintain the radioactive material in the proper way.

Table 51: Nuclear Power Plant Emergency Event Phases

Event Type	Description
Unusual Event	This is the lowest of the four emergency classifications. This classification indicates that a small problem has occurred. No release of radioactive material is expected and federal, state, and county officials are notified.
Alert	Events are in process or have occurred which involve an actual or potential substantial degradation in the level of safety of the plant. Any releases of radioactive material from the plant are expected to be limited to a small fraction of the EPA Protective Action Guide for Nuclear Incidents.
Site Area Emergency	Involves events in process or which have occurred that result in actual or likely major failures of plant functions needed for protection of the public. Any releases of radioactive material are not expected to exceed the levels established by the EPA Protective Action Guide for Nuclear Incidents except near the site boundary.
General Emergency	The most serious emergency classification and indicates a serious problem. A general emergency involves actual or imminent substantial core damage or melting of reactor fuel with the potential for loss of containment integrity. Emergency sirens will be sounded and federal, state, and county officials will act to ensure public safety. Radioactive releases during a general emergency can reasonably be expected to exceed EPA Protective Action Guide for Nuclear Incidents for more than the immediate site area.

Source: NRC

HISTORICAL OCCURRENCES

Chemical Fixed Sites

According to the U.S. Coast Guard's National Response Center database (NRC), there have been 329 fixed site chemical spills from 1982 – 2014 in the planning area. Property damages were reported for three separate chemical spill events totaling $185,000 which were all caused by fire from natural gas leaks. Twenty people were injured in five separate spills and no deaths were reported in the 329 spills since 1982.

The following table shows only the ten largest spills recorded in the planning area, events that caused property damages, or spills that caused injuries.

Table 52: Fixed Site Chemical Spills

Date of Event	Location of Release	Quantity Spilled	Material Involved	Number of Injuries	Property Damage
12/20/1990	Omaha	Unknown	Unknown Material	2	$0
3/22/1991	Omaha	Unknown	Chlorine	10	$0
3/31/1991	Fort Calhoun	7,500 Gallons	Sulfuric Acid Mixed with Water	0	$0
4/6/1991	Omaha	11,000 Gallons	Asphalt Emulsion	0	$0
5/19/1992	Omaha	2,800 Gallons	Sodium Hypochlorite	0	$0
6/1/1992	Omaha	5,000 Gallons	Sulfuric Acid (Diluted to 8% Solution)	0	$0
9/12/1992	Dakota City	100 Gallons	Ammonia, Anhydrous	4	$0
6/23/1996	Omaha	5,000 Gallons	Waste Oil	0	$0
11/25/1996	Omaha	78,000 Pounds	Sodium Hypochlorite	0	$0
10/31/1998	Omaha	10,000 Pounds	Sulfuric Acid	0	$0
2/28/2006	Omaha	Unknown	Unknown Material	1	$0
5/14/2006	Blair	50,000 Pounds	Sodium Bisulfite	0	$0
8/26/2010	Omaha	0	Natural Gas	0	$75,000
9/18/2010	Omaha	0	Natural Gas	0	$60,000
11/14/2010	Omaha	0	Natural Gas	0	$50,000
4/5/2012	Elkhorn	0	Natural Gas	3	$0
6/3/2014	Blair	3,900 Pounds	Ferric Chloride	0	$0
			Totals	**20**	**$185,000**

Source: National Response Center, 1982-2014

Radiological Fixed Site

There have been two incidences that have occurred at the Fort Calhoun Nuclear Power Plant. Only one of these events led to an Alert phase. During the summer flooding in 2011, the Missouri River flooding reached 1,004 feet above mean sea level on June 6, which lead to OPPD to declare an Unusual Event for the Fort Calhoun Nuclear Plant. Sandbags and earthen berms were installed around the plant to protect the facility from flooding, and these protective measures would protect the plant from flood waters reaching 1,012 feet above sea level. Fort Calhoun Nuclear Power Station had already been in safe cold shutdown mode since April 2011 for refueling and the anticipated flooding.

According to the U.S. Nuclear Regulatory Commission, the next day on June 7 an electrical component in a switch gear room caused a small fire, which forced a partial evacuation. The fire was quickly extinguished

and the officials stated that the public was never in any danger. As a result of the fire, pumping of coolant water through the spent fuel pool was impacted and cooling was interrupted for 90 minutes. In response, OPPD declared an Alert phase at 11:44 AM and parts of the plant were evacuated. Once the room was clear of smoke and confirmed that no fire remained in the area, the Alert phase was lifted at 1:15 PM that same day and resumed Unusual Event status. After the waters receded that summer and several corrective measures were made to the plant over the following two years, OPPD restarted Fort Calhoun Nuclear Station on December 26, 2013.

In 1992, the plant was evacuated when 20,000 gallons of coolant leaked into a containment building from the reactor. No other known evacuations have taken place.

AVERAGE ANNUAL DAMAGES

Using data from Table 52, average annual damages from chemical fixed site spills can be estimated.

Table 53: Chemical Fixed Site Average Annual Losses

Hazard Type	Number of Events	Events Per Year	Total Damages	Average Annual Chemical Spill Loss
Chemical Spills	329	10.0	$185,000	$5,606

Source: National Response Center, 1982-2014

PROBABILITY

Chemical releases at fixed site storage areas are likely in the future. Given the historic record of occurrence (329 chemical fixed site spills reported in 33 years), the annual probability of occurrence for chemical fixed site spills is 100 percent.

Localized plant (i.e. not a 10-mile radius) evacuations have occurred twice at the Fort Calhoun Nuclear Power Station since it came online in 1973. In the unlikely event of a General Emergency being issued and the 10-mile radius EPZ would be instituted, which would include the City of Fort Calhoun, City of Blair, and the Village of Kennard. Furthermore, if an event were to occur at the station, the entire 10-mile radius may not be affected depending on the type of accident and the weather conditions. Since the station has not had a General Emergency that lead to the 10-mile radius EPZ, the probability for a radiological event will be stated at less than 1 percent annually for this plan.

FUTURE DEVELOPMENT

To reduce the risk to people and property damage, future development should encourage chemical storage and manufacturing facilities to be built away from critical facilities such as hospitals, schools, daycares, nursing homes, and other residential areas.

REGIONAL VULNERABILITIES

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

Table 54: Regional Chemical and Radiological 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 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 at risk of evacuation

RISK ASSESSMENT SUMMARY

Table 55: Summary

Number of Past Events	329 chemical fixed site spills; 0 General Emergency but 1 Alert at Fort Calhoun Station
Vulnerable Locations	Locations with fixed chemical storage or manufacturing facilities; 10-mile radius around Fort Calhoun Station including City of Blair, City of Fort Calhoun, and Village of Kennard
Extent	Quarter mile or less evacuation radius for chemical spills; 10-mile radius for radiological event
Annual Probability	100 % for small, localized chemical spills; Less than 1 % for radiological event
Averaged Annual Losses	$5,606 for chemical spills

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Maintain a database of vulnerable populations
- Educational materials provided to residents, particularly those living near a chemical or radiological fixed site
- A radiological emergency preparedness plan for Fort Calhoun Nuclear Station has been developed and reviewed/updated annually
    - Annual training and exercises are conducted in coordination with OPPD, State of Nebraska, Washington County, and other designated response agencies
- Conduct training exercises on how to respond to an event
    - Fire departments and emergency management are trained
- Have all hazard weather radios in critical facilities
- Ensure emergency alert sirens are in working order

CHEMICAL TRANSPORTATION

HAZARD PROFILE

The transportation of hazardous materials are 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.

These items can be transported by highway, rail, air, or pipeline and can include anhydrous ammonia, chlorine gas, hydrochloric acid, natural gas liquids, derivatives of petroleum, white phosphorus, pesticides, solvents, and many other corrosive, toxic, unstable, or explosive chemicals and materials. Hazardous material releases can occur from vehicle accidents, defective valves or hoses on tankers, train derailments, pipeline ruptures or explosions, storage tank overtopping during delivery of products, and many other scenarios.

According to PHMSA, hazardous materials traffic in the U.S. now exceeds 800,000 shipments per day, transporting 3.1 billion tons of hazardous materials annually.

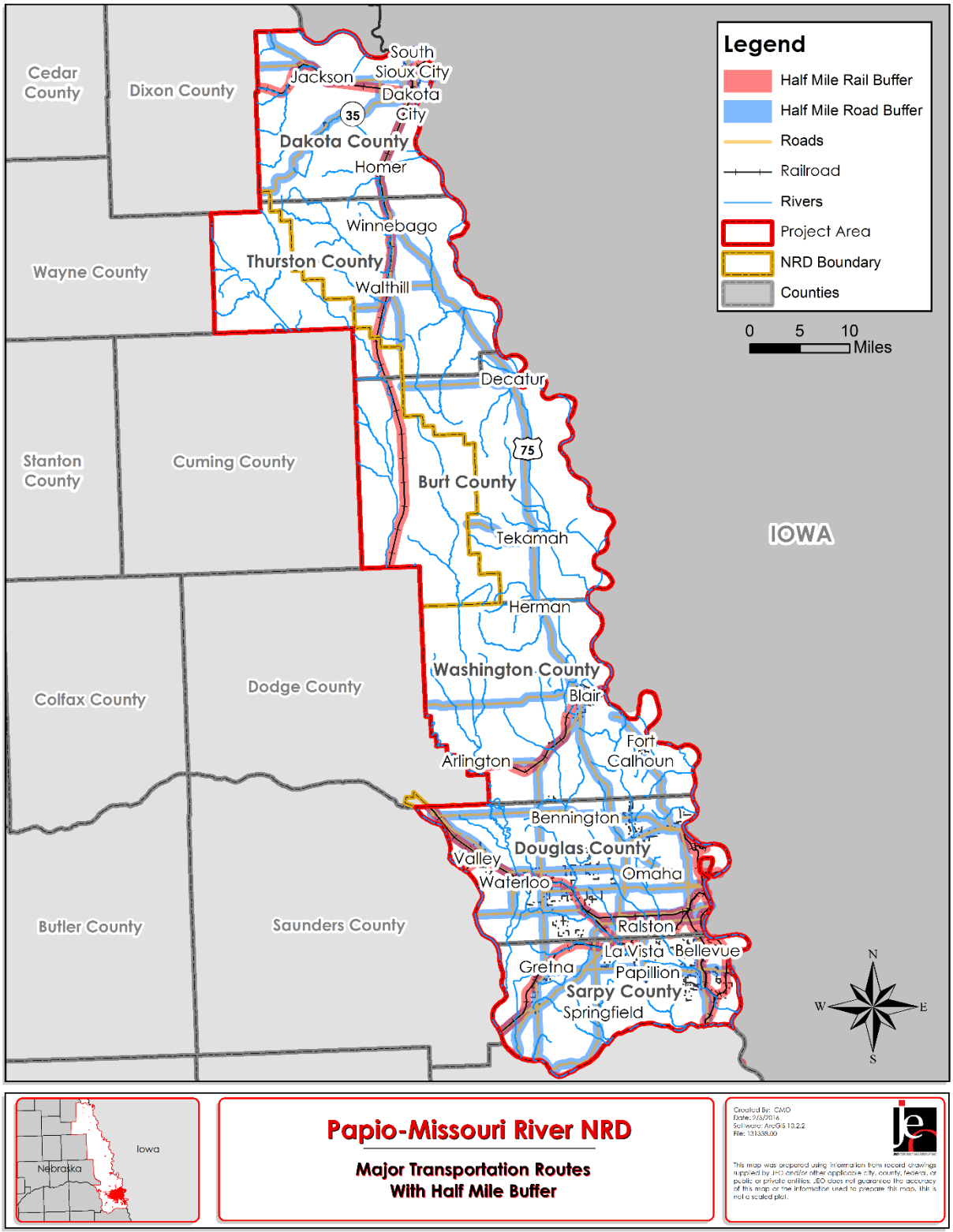
Nationally, the U.S. averages 28 deaths per year due to accidents resulting from the transportation of hazardous materials. While such fatalities are a low probability risk, even one event can harm many people. For example, a train derailment in Crete, Nebraska in 1969 allowed anhydrous ammonia to leak from a rupture tanker. The resulting poisonous fog killed nine people and injured 53.

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

LOCATION

Chemical releases can occur during transportation primarily on major transportation routes as identified in Figure 10. A large number of spills also occur during the loading and unloading of chemicals. Participating communities specifically reported transportation along railroads as having the potential to impact communities. Railroads providing service through the planning area have developed plans to respond to chemical release along rail routes.

Figure 10: Major Transportation Routes with Half Mile Buffer



EXTENT

The probable extent of chemical spills during transportation is difficult to anticipate and depends on the type of chemical that is released. Releases that have occurred during transportation in the planning area ranged from less than 1 Liquid Gallon (LGA) to 6,500 LGAs. Also five of the incidents lead to an evacuation, but two of the evacuations were precautionary as the substance was unknown at the time. Only one evacuation was as large as a half mile from the incident. Thus, it is likely that hazardous material spills during transportation will not affect an area larger than a half mile from the spill location.

HISTORICAL OCCURRENCES

PHMSA reports that 1,167 chemical spills occurred during transportation in the planning area between January 1, 1980 and August 31, 2015. During these events, there have been 21 of injuries, no fatalities, and $891,793 in damages from transportation spills.

The following table provides a list of the largest spills, incidents with injuries, or whether an evacuation was ordered due to transportation incidents involving hazardous materials.

Table 56: Historical Chemical Spills 1980 – 2015

Date of Event	Location of Release	Failure Description	Material Involved	Method of Transportation	Total Damage	Injuries	Evacuation (Yes/No)
7/6/1983	Omaha	Vehicle Accident	6500 LGA Combustible Liquid	Highway	$0	0	No
10/29/1991	South Sioux City	N/A	6000 GCF Flammable Gas	Highway	$150,000	2	No
1/16/1990	Omaha	Over-pressurized	2500 LGA Carbon Dioxide - Liquid	Rail	$0	0	No
10/12/1992	Omaha	Vehicle Accident	1500 LGA Ethanol	Highway	$143,000	0	No
7/6/1983	Omaha	Vehicle Accident	1500 LGA Combustible Liquid	Highway	$0	0	No
6/23/1996	Omaha	Vandalism	1200 LGA Combustible Liquid	Highway	$0	0	No
12/16/1988	Omaha	N/A	700 LGA Combustible Liquid	Highway	$0	0	No
6/3/2002	Bennington	Defective Component	585 GCF Ammonia Anhydrous	Highway	$39,300	0	Yes
11/22/1981	Omaha	N/A	440 SLB Corrosive Material	Highway	$0	0	No
6/7/2006	Omaha	Dropped	313 LGA Corrosive Material	Highway	$1,882	0	No

Date of Event	Location of Release	Failure Description	Material Involved	Method of Transportation	Total Damage	Injuries	Evacuation (Yes/No)
9/12/1999	Omaha	Loose Closure Component	0.25 LGA Corrosive Liquids	Highway	$360	4	No
12/9/1991	Omaha	Dropped	1 LGA Corrosive Material	Highway	$4,000	2	No
6/25/1981	Omaha	N/A	55 LGA Corrosive Material	Highway	$0	1	No
2/12/1992	Omaha	Defective Component	10 LGA Corrosive Material	Highway	$30	1	No
5/20/2001	Omaha	N/A	4 SLB Corrosive Material	Air	$708	1	No
6/6/1994	Omaha	N/A	2.5 Combustible Liquid	Highway	$80	1	No
1/12/1999	Omaha	Defective Component	1.34 GCF Ammonia Anhydrous	Highway	$660	1	No
1/14/2004	Blair	Loose Closure Component	1 LGA Sulfuric Acid	Rail	$0	1	No
7/1/1994	Omaha	N/A	0.66 LGA Corrosive Material	Highway	$125	1	Yes
6/12/2013	Bellevue	Human Error	0.27 GCF Flammable Gas	Highway	$0	1	No
8/7/1992	Omaha	Improper Preparation for Transportation	0.125 LGA Oxidizer	Highway	$275	1	No
12/2/2001	Omaha	Defective Component	0 Ammonia Anhydrous	Rail	$1,000	1	No
10/6/1986	Omaha	Loose Closure Component	0 Sulfuric Acid	Highway	$0	1	No
10/10/1981	Omaha	Loose Closure Component	0 Ammonia Solution	Rail	$0	1	No
7/25/1980	Omaha	Loose Closure Component	0 Corrosive Material	Highway	$0	1	No
5/28/2008	Omaha	Corrosion – Exterior; Aging	300 LGA Hydrochloric Acid	Rail	$100,150	0	Yes (0.5 mile)

Date of Event	Location of Release	Failure Description	Material Involved	Method of Transportation	Total Damage	Injuries	Evacuation (Yes/No)
8/23/2013	Omaha	Defective Component	20 SLB Fire Extinguishers containing Compressed Gas	Highway	$0	0	Yes*
4/23/1990	Omaha	Dropped	0.25 LGA Acetone	Highway	$25	0	Yes*

Source: PHMSA, 1980-2015
**Localized evacuations due to unknown substances at the time*

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon PHMSA's Incidents Reports since 1980 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. This hazard causes an average of $24,772 per year in property damages.

Table 57: Chemical Transportation Losses

Hazard Type	Number of Events	Events Per Year	Total Property Loss	Average Annual Property Loss
Chemical Transportation Spills	1,167	32.7	$891,793	$24,980

Source: PHMSA January 1980 – August 2015

PROBABILITY

The historical record indicates that chemical releases during transport have a 100 percent chance of occurring annually in the planning area with 1,167 events over a 35.6 year period.

FUTURE DEVELOPMENT

Future development and critical facilities could minimize their risk to this hazard by building away from major transportation corridors. Presently, there are a number of critical facilities that were identified during this planning process that are located adjacent to these heavily trafficked corridors and may be vulnerable to this hazard. Please see *Section Seven: Participant Sections* for information regarding these critical facilities.

REGIONAL VULNERABILITIES

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

Table 58: 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 at risk

RISK ASSESSMENT SUMMARY

Table 59: Summary

Number of Past Events	1,167 chemical spills during transportation
Vulnerable Locations	Residents and businesses near major transportation corridors, especially hospitals, nursing homes, and the elderly
Extent	Half mile or less evacuation radius
Annual Probability	100 %
Averaged Annual Losses	$24,980

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Drills and exercises within potential impact zones
- Provide educational materials
- Studies to identify the primary hazardous materials transported along specific routes;
    - Highly dangerous chemicals and radiological materials are required to provide routing information

CIVIL DISORDER

HAZARD PROFILE

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

LOCATION

Civil disorder typically occurs in urbanized areas, like the City of Omaha. Tribal areas in Thurston County also have a history of civil disorder. Historical occurrences suggests that the most likely location for civil disorder is at governmental offices and other gathering sites for large crowds. The only known recorded instances of civil disorder occurred in the City of Omaha. However, the Village of Winnebago and Westside Community Schools identified civil disorder as a top concern for their jurisdiction. Please refer to their Participant Section in *Section Seven: Participant Sections* for specific their specific concerns.

EXTENT

Any civil disorder that does occur in the planning area is likely to remain peaceful or deescalated quickly by local police departments.

HISTORICAL OCCURRENCES

There have been four instances of civil disorder in the planning area in recent history. The following table lists the civil disorder events that occurred in Omaha during the 1960s.

Table 60: Civil Disorder

Date	Issue	Event
July 4, 1966	Racial tension	After a 103 degree day, a crowd of African Americans gathered at the intersection of North 24th and Lake Streets in the evening. They responded violently when the Omaha Police Department requested their dispersal. The crowd demolished police cars and roamed the North 24th Street business corridor for hours, throwing firebombs and demolishing storefronts. Millions of dollars of damage was caused to businesses in the Near North Side community. The riot lasted three days.
August 1, 1966	Racial tension	Riots erupted after a 19 year-old was shot by a white, off-duty policeman during a burglary. Three buildings were firebombed, and 180 riot police were required to quell the crowds.
March 4, 1968	Racial tension	A crowd of high school and university students were gathered at the Omaha Civic Auditorium to protest the presidential campaign of George Wallace, the segregationist governor of Alabama. After counter-protesters began acting violently toward the youth activists, police intervention led to the injury of dozens of protesters. An African-American youth was shot and killed by a police officer during the melee, and fleeing students caused thousands of dollars of damage to businesses and cars.
June 24, 1969	Racial tension	An African-American teenager named Vivian Strong was shot and killed by police officers in an incident at the Logan Fontenelle Housing Projects. Young African Americans in the area rioted in response to the teenager's death, with looting along the North 24th Street business corridor. During this initial surge, eight businesses were destroyed by firebombing or looting.

Source: Nebraska Hazard Mitigation Plan, 2014

AVERAGE ANNUAL DAMAGES

Due to lack of data on historic impacts, average losses will not be calculated for this hazard.

PROBABILITY

There are four occurrences of civil disorder reported within the planning area and all of which occurred in the 1960s. The absence of civil unrest in recent years does not necessarily indicate that there will not be events in the future. Probability of future occurrence related to this threat is stated at less than five percent annually.

FUTURE DEVELOPMENT

The impact to people and property from civil disorder is low as most protests are peaceful and generally dissipated by police without event. However, increases in population can proportionally increase the risk of major conflicts between police and protestors during instances of civil disorder. Any newly constructed critical facilities, especially government buildings, should consider the installation of vehicular barriers, facility security and monitoring, nighttime lighting, and the development of an emergency plan.

REGIONAL VULNERABILITIES

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

Table 61: Regional Civil Disorder Vulnerabilities

Sector	Vulnerability
People	-Possible injury to protesters
Economic	-Low risk of businesses damaged and closed for a short time as a result
Built Environment	-Risk of property damage
Infrastructure	-Transportation routes may be temporarily closed
Critical Facilities	-Critical facilities may require more security

RISK ASSESSMENT SUMMARY

Overall, the risk and vulnerability assessment shows that civil disturbance is a low probability hazard with limited impacts.

Table 62: Summary

Number of Past Events	4 civil disorder events during the 1960s
Vulnerable Locations	Urban areas
Extent	Localized and likely peaceful protests
Annual Probability	Less than 5%
Averaged Annual Losses	N/A

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Training and education
- The use of vehicular barriers and other mechanisms to protect critical facilities

DAM FAILURE

HAZARD PROFILE

According to the Nebraska Administrative Code, Title 458, Chapter 1, Part 001.09, dams are " any artificial barrier, including appurtenant works, with the ability to impound water, wastewater, or liquid-borne materials and which is:

- 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. Dam does 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."

The NDNR uses a classification system for dams throughout the State including those areas participating this plan. The classification system includes three classes, which are defined as:

Table 63: Dam Size Classification

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

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.

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

- Reservoir inflows in excess of design flows
- Flood pools higher than previously attained
- 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

NDNR 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.

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

Table 64 lists those dams classified as "High Hazard Potential." The planning area has six of the top 30 ranked high hazard dams in the state based on population at risk (2014 Nebraska HMP). These six dams are shaded in blue.

Table 64: High Hazard Dams

NID	Dam Name	Owner	Location	Stream Name	Maximum Storage (acre-feet)	Last Inspection Date
Burt County						
NE01597	Tekamah-Mud Creek 22-A	P-MRNRD	Tekamah	Tekamah Creek	499	6/25/2015
NE01690	Tekamah-Mud Creek 5-A	P-MRNRD	Tekamah	Tekamah Creek	6,861	6/25/2015

NID	Dam Name	Owner	Location	Stream Name	Maximum Storage (acre-feet)	Last Inspection Date
NE03103	Silver Creek 11	P-MRNRD	Rural Tekamah	Silver Creek	1,317	6/25/2015
Dakota County						
NE02700	Hubbard Dam	P-MRNRD	Hubbard	Pigeon Creek	86	6/25/2015
NE03270	Pigeon/Jones Creek Dam Site 15	P-MRNRD	None	Jones Creek	7,430	6/25/2015
Douglas County						
NE02631	Bennington Lake Basin No 2	Newport Landing Homeowners Association	Bennington	Tr-Big Papio Creek	175	9/10/2015
NE02585	Newport Landing Dam	P-MRNRD	Bennington	Big Papio Creek	8,855	9/10/2015
NE00307	Boys Town Dam No 1	Father Flanagan's Boys Home	Omaha	Hell Creek	243	7/14/2015
NE00031	Boys Town Dam No 2	First National Business Park Owners Assoc.	Omaha	Big Papio Creek	79	7/14/2015
NE00138	Candlewood Dam	P-MRNRD	Omaha	Big Papio Creek	1,256	7/14/2015
NE02426	Indian Creek Golf Course 1	Gottsch Enterprises LLC	Rural Elkhorn	W. Papio Creek	125	8/4/2015
NE02427	Indian Creek Golf Course 2	Gottsch Enterprises LLC	Rural Elkhorn	W. Papio Creek	206	8/4/2015
NE00032	Legacy Dam	Legacy Homeowners Assoc	Omaha	Box Elder Creek	121	7/23/2015
NE00030	Lonergan Dam	Conagra Foods	Omaha	Little Papio Creek	2,623	9/10/2015
NE02784	Papio Dam Site 13-Youngman	P-MRNRD	Omaha	W. Papio Creek	1,770	8/4/2015
NE01518	Papio Site 11-Cunningham Lake	US Army Corps	Omaha	Little Papio Creek	23,320	9/9/2013
NE01065	Papio Site 16-Standing Bear Lake	US Army Corps	Omaha	Papio Creek	7,300	9/9/2013
NE02185	Papio Site 18-Zorinsky Lake	US Army Corps	Omaha	Box Elder Creek	18,282	9/11/2013
NE02638	Sachs-Palmer Dam	P-MRNRD	Rural Elkhorn	North Branch W. Papillion Creek	352	8/4/2015
NE02735	Zorinsky Basin No 3-Whitehawk	P-MRNRD	Omaha	Box Elder Creek	1,423	8/4/2015
NE03289*	Papio Creek 15-A	P-MRNRD	Omaha	North Branch W. Papillion Creek	9,195.8	N/A
NE09714*	Adams Park Dam	City of Omaha	Omaha	Tributary to Missouri River	85.8	N/A
Sarpy County						

NID	Dam Name	Owner	Location	Stream Name	Maximum Storage (acre-feet)	Last Inspection Date
NE02653	Hanson Lake Dam	P-MRNRD	Hanson Lakes	Platte River	56	9/30/2015
NE02513	Lakewood Villages Lower Dam	Lakewood Villages	Bellevue	Papio Creek	143	4/17/2015
NE02512	Lakewood Villages Upper Dam	Lakewood Villages	Bellevue	Papio Creek	140	4/7/2015
NE02831	Midland Lake Dam	P-MRNRD	Papillion	Midland Creek	401	10/13/2015
NE01818	Papio Creek S-27	P-MRNRD	Bellevue	Papio Creek	51	9/30/2015
NE01751	Papio Creek S-31	P-MRNRD	Bellevue	Papio Creek	188	9/30/2015
NE00092	Papio Creek S-32	P-MRNRD	Bellevue	Big Papio Creek	318	5/22/2015
NE02430	Papio Dam Site 21 – Walnut Creek	P-MRNRD	Papillion	Walnut Creek	3,347	10/13/2015
NE01882	Papio Site 20-Wehrspann Lake	US Corp Engineers	Omaha	South Branch Papio Creek	16,929	9/11/2013
NE02830	Shadow Lake Dam	P-MRNRD	Papillion	Midland Creek	1,171	10/13/2015
NE02217	Thompson Creek Project	City of La Vista	La Vista	Thompson Creek	122	4/13/2015
NE05082	Prairie Queen Main Dam	P-MRNRD	Papillion	Trib. To South Papillion Creek	5,060	10/13/2015
Washington County						
NE01883	Papio Creek W-3	PMRND	Kennard	Tr-Big Papio Creek	269.7	9/10/2015

Source: NDNR
**Approved for construction*

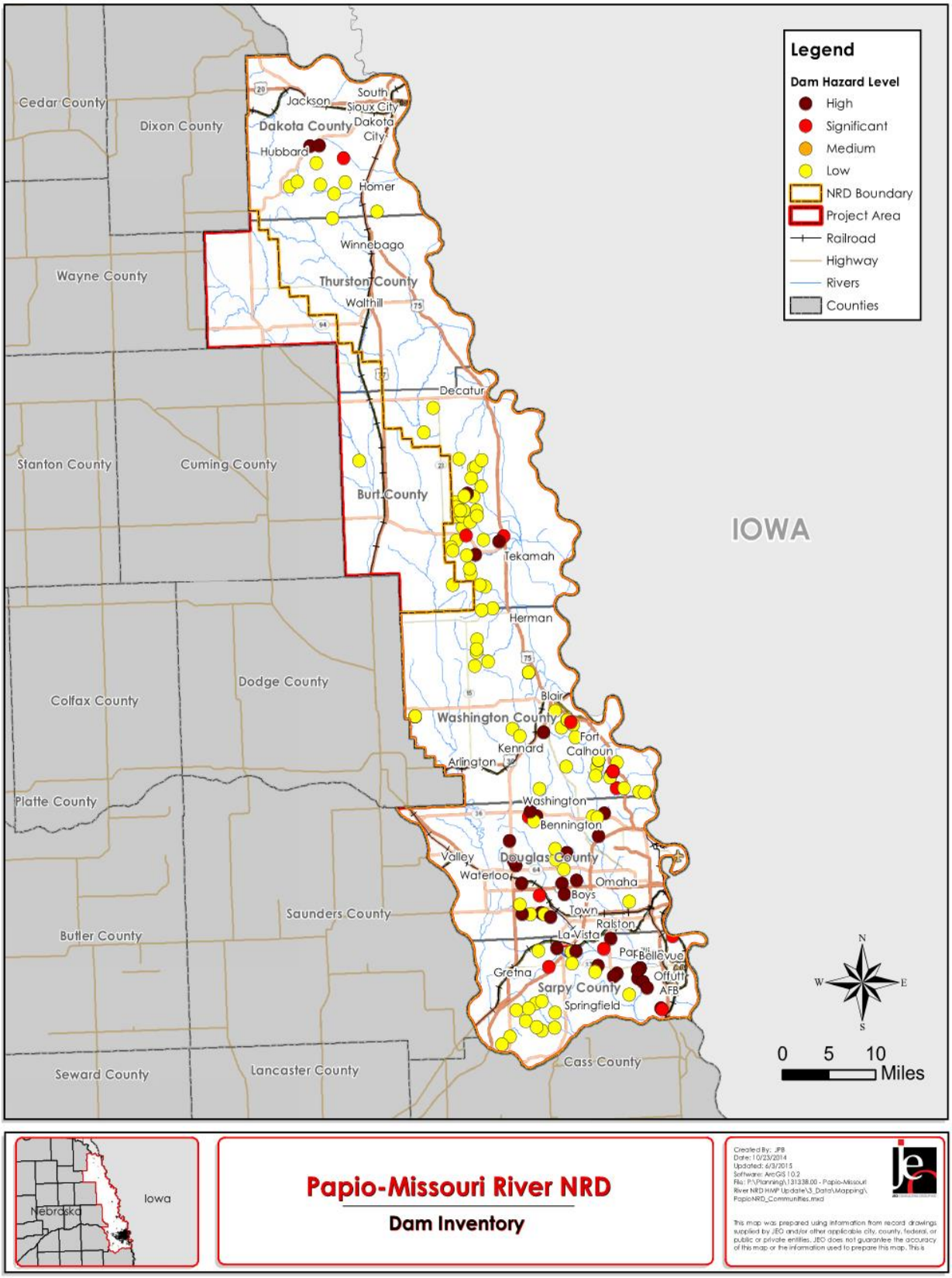
In total, there are 150 dams located within the planning area with classifications ranging from low hazard to high hazard. Most of the dams (102) are rated low, 13 are significant, and 35 are rated a high hazard dam. Figure 11 maps the location of these dams in the planning area.

Table 65: Dams in the Planning Area

County	Minimal Hazard	Low Hazard	Significant Hazard	High Hazard
Burt	0	32	2	3
Dakota	0	8	1	2
Douglas	0	15	2	17*
Sarpy	0	18	4	12
Thurston	0	0	0	0
Washington	0	29	4	1
Total	**0**	**102**	**13**	**35**

Source: NDNR
**Two are approved for construction*

Figure 11: Dam Locations



Upstream Dams Outside the Planning Area

Several dams and reservoirs are located in the Missouri River basin upstream from the P-MRNRD boundary. 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 in the NRD counties from the Missouri River. Data on these dams are provided in the following table.

Table 66: Upstream Missouri River Dams

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

The following dam is located in western Nebraska on the North Platte River.

Table 67: Upstream Platte River Dam

Dam	Location	Year Operational
Kingsley Dam (Lake McConaughy)	Keystone, Nebraska (Keith County)	1941

All dams are inspected on a regular basis and after area 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. For more information, a request can be made to the county emergency managers, P-MRNRD, or NDNR.

Due to public safety concerns, dam breach inundation maps are not provided in this plan, and it is against NDNR's policy to provide inundation maps for use in HMPs. Therefore, neither jurisdiction-specific inundation data nor maps will be included in this plan update. A request can be made at NDNR to view inundation maps at their offices and will be decided on a case-by-case basis. Additionally, for more information on dams in the planning area or to make a request to view an EAP, contact the county emergency manager or P-MRNRD.

LOCATION

Communities or areas downstream of a dam, especially high hazard dams, are at greatest risk of dam failure. Figure 11 shows the location of the dams, and to view the mapped location of dams by county or jurisdiction, please see *Section Seven: Participant Sections.* As noted earlier, inundation maps are not available for inclusion in this plan.

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. Since inundation maps are not made publicly available for security reasons, the following is provided as a description of areas affected in the inundation area from the County's Local Emergency Operations Plan (LEOP) where available for specific high hazard dams. Note that not all of the high hazard dams in each county are given extended descriptions in the EOP.

Burt County
Tekamah-Mud Creek 5-A – The inundation would affect the Tekamah Creek as far as Tekamah. In Burt County, the area affected would be slightly greater than the 1 percent floodplain with the greatest effect on Summit and Arizona Townships which would approach 100 percent inundation.

Approximately 23 percent of the population of Burt County could be affected by the failure of one or another of these dams.

Dakota County
Gavins Point Dam (outside the planning area) – The inundation area would affect the Missouri River as far south as Rulo in Richardson County (the southern-most point in Nebraska on the Missouri River). In Dakota County, the area affected would be slightly greater than the 1 percent floodplain with the greatest effect on South Sioux City and Dakota City, which would approach 100 percent inundation.

Approximately four percent of the population of Dakota County could be affected by the failure of one or another of these dams.

Douglas County
Papio Creek 11 – Cunningham Lake – The inundation area would affect the entire Little Papillion Creek as far Harrison Street. In Douglas Creek, the area affected would be slightly greater than the 1 percent floodplain with the greatest effect on areas along the creek through Omaha, which would approach 100 percent inundation.

Papio Creek 16 – Standing Bear Lake – The inundation area would affect the Big Papillion Creek as far Harrison Street. In Douglas County, the area affected would be slightly greater than the 1 percent floodplain with the greatest effect on areas along the creek through Omaha, which would approach 100 percent inundation.

Approximately 10 percent of the population of Douglas County would be affected by the failure of one or another of these dams.

Sarpy County
Upper Missouri River Dams (Oahe, Big Bend, Fort Randall, and Gavins Point) – The combined failure of all four dams would affect Bellevue, Papillion, and La Vista. Inundation areas would be greater than the 1 percent floodplain. Papillion Creek would be affected to the west of Papillion. The Platte River would be affected to just southeast of Springfield.

Papio Creek 16 – Standing Bear Lake – The inundation would affect the Big Papillion Creek through Sarpy County. The area affected would be less than the 1 percent floodplain with the greatest effect on Chalco and portions of Papillion.

Papio Creek 18 - Zorinsky Lake – The inundation area would affect the west branch of the Papillion Creek beyond its confluence with the Big Papillion Creek. The area affected would be greater than the 1 percent floodplain with the greatest effect on downtown Papillion.

Papio Creek 20 – Wehrspann Lake – The inundation area would affect the entire Papillion Creek as far east as it extends. In Sarpy County, area affected would be slightly greater than the 1 percent floodplain with the greatest effect on Chalco and portions of Papillion, which would approach 100 percent inundation.

Papio Dam Site 21 – Walnut Creek – Failure would be equivalent to slightly less than a 1 percent chance flood in the west branch of the Papillion Creek, from north of the dam to the confluence with the Papillion Creek.

Kingsley Dam (outside the planning area) – Failure would be equivalent to a 0.2 percent chance flood throughout western and southern Sarpy County, including much of the area south of Offutt Air Force Base. Backwater rises can also be expected on the Buffalo, Springfield, and Papillion Creeks, and the Missouri River.

Approximately 3.8 percent of the population of Sarpy County could be affected by the failure of one or more of these dams.

Thurston County
Gavins Point Dam (outside of planning area) – The inundation area would affect the Missouri River as far as Rulo, Nebraska. In Thurston County, the area affected would be slightly greater than the 1 percent floodplain with the greatest effect on the sparsely populated eastern border of the county which would approach 100 percent inundation.

Approximately five percent of the population of Thurston County could be affected by the failure of this dam.

Washington County
Approximately five percent of the population of Washington County could be affected by the failure of any of the dams in the county or from Gavins Point Dam upstream.

HISTORICAL OCCURRENCES
To determine previous occurrences of dam failure within the P-MRNRD counties, the previous mitigation plan was referenced as well as the 2014 Nebraska HMP and the Stanford University's National Performance of Dams Program. No record of dam failure within the P-MRNRD was found. However, in 1999, Summit Lake Dam operators in Burt County were within inches of opening the auxiliary spillway during the August 1999 flood event. This dam is located on Tekamah Creek approximately three miles west of Tekamah near Highway 32 in Burt County.

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, P-MRNRD, or the NDNR.

PROBABILITY
Dam failure has a low probability of occurring in the future. The plan recognizes that while there have not been occurrences in the past, that is not necessarily indicative of future occurrences. For the purpose of this plan, the probability of dam failure will be stated as one percent annually.

FUTURE DEVELOPMENT
According to the *Classification of Dams (2013)* developed and updated by NDNR, "the potential for future development must be taken into consideration when determining the hazard potential class for a dam. Any dam located in close proximity to a city or village as detailed in Table 68 must be designed to meet the requirements for a high hazard potential structure. The design requirements can be adjusted if development in the downstream breach inundation area is sufficiently curtailed due to zoning restrictions, easements, deed restrictions, or other methods of restriction acceptable to the Department."

Table 68: Distance from Dam

Incorporated Class	Population	Located Within or Within Given Distance of Jurisdictional Limits, of City, or of Village
Metropolitan	≥ 300,000	3 miles
Primary	> 100,000 up to 300,000	3 miles
First	> 5,000 up to 100,000	2 miles
Second	> 800 up to 5,000	1 mile
Village	100 up to 800	1 mile

Sources: NDNR

REGIONAL VULNERABILITIES

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

Table 69: 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

RISK ASSESSMENT SUMMARY

Table 70: Summary

Number of Past Events	None
Vulnerable Locations	Residents, businesses, and transportation corridors downstream of dams
Extent	Total inundation in floodplain downstream from dam
Annual Probability	1%
Average Annual Losses	N/A

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Evacuation Plan
- Land-use regulations preventing development in area protected by existing dams
- Encourage structures protected by dams to purchase flood insurance
- Education on the potential impacts of a dam failure
- Preserve natural open spaces in floodplains

DROUGHT

HAZARD PROFILE

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 actually 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.

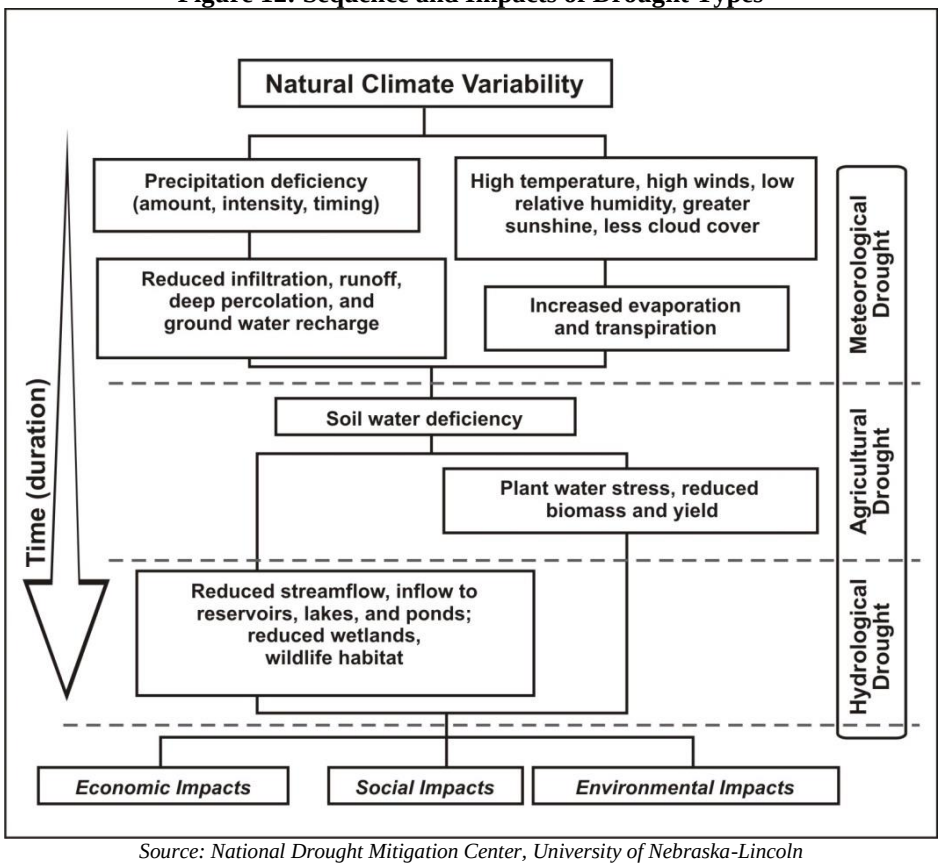
*According to the National Drought Mitigation Center, "**drought** is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another."*

Drought is a slow-onset, creeping phenomenon that can effect 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:

- **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 include, but are not limited to, water, forage, food grains, fish, and hydroelectric power.

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

Figure 12: Sequence and Impacts of Drought Types



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

HISTORICAL OCCURRENCES

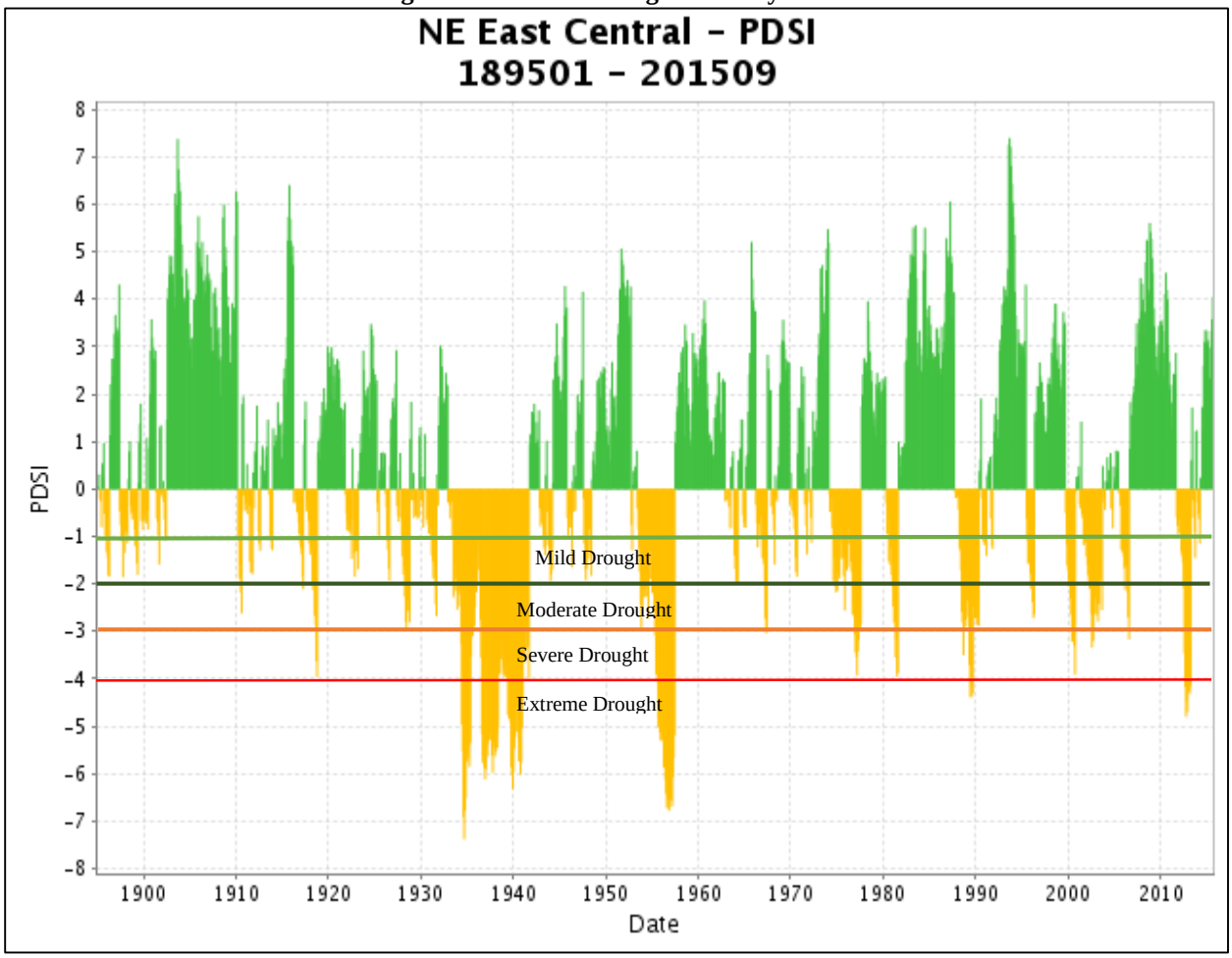
The Palmer Drought Severity Index (PDSI) is utilized by climatologists to standardize global long-term drought analysis. The PDSI was developed in 1965 to measure dryness based on recent precipitation and temperatures. The PDSI has data for more than one hundred years, which allows for the review and analysis of past drought trends. The data for the planning area was collected from Climate Division 6 – East-Central Nebraska, which includes the planning area, between the years of 1895 and 2015. Figure 12 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 71 shows the details of the Palmer classifications. According to this dataset, extreme droughts were recorded every 15-20 years dating back to 1895 and major events include the Dust Bowl in the 1930s and the 1980s and the recent 2012 drought.

Table 71: 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

Figure 13: Palmer Drought Severity Index



Source: NCDC

Using the data from the PDSI, the planning area had extreme droughts 16 times since 1895 (1934-1940, 1952-1957, 1989, and 2012-2013). Severe droughts occurred in most decades dating back to the 1910's with the exception of the 1920s, 1950s, and 1990s. Over half of all years dating back to 1895 experienced precipitation levels below what is considered normal for the planning area. The most recent drought of note for the planning area began in 2012 and ended in early 2013. Local planning teams reported a few impacts from the 2012 drought which were primarily lower water well levels and some communities encouraged voluntary water conservation during the drought.

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 over 200 drought related impacts throughout region. Table 72 demonstrates the sectors that have previously reported impacts in the planning area. The table shows the number of drought impacts reported for the planning area since 2000, based on media reports, public reports, NWS Drought Statements, burn bans issued by local governments, or water restrictions. Although somewhat skewed by the number of media reports, generally a higher number of reported drought impacts to the National Drought Mitigation Center is correlated with the severity of a drought.

Examples of reported drought impacts include:

- Farm Aid grants to assist drought-affected farms, families;
- The average ethanol plant in the U.S. lost $7.3 million in 2012 ; and
- Beef prices rose 23.6 percent in 2014

Table 72: Reported Drought Impacts (January 2000 to December 2014)

Report Type	Agricultural	Business and Industry	Energy	Fire	Plant and Wildlife	Relief, Response, and Restrictions	Society and Public Health	Tourism and Recreation	Water Supply and Quality
Planning Area	154	40	7	11	29	57	49	5	46

Source: NDMC

LOCATION

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

EXTENT

Using the data presented in Figure 12 (PDSI) it is reasonable to expect extreme drought to occur in 13 percent of years for the planning area (16 extreme drought years in 121 years). Severe drought occurred in approximately 9 years of the 121 years of record (7 percent of years). Moderate drought occurred in approximately 12 years of the period reviewed (10 percent of years), and mild drought occurred in approximately 32 of the 121 years recorded (27 percent of years). Non-drought conditions (incipient dry spell, near normal, or wet spell conditions) occurred in 43 percent of years. It is important to remember that any given year can include months with some or all of the drought conditions. For instance, a year that starts out rainy and ends very dry can include months with no drought, mild drought, and moderate drought.

AVERAGE ANNUAL LOSSES

The annual property estimate was determined based upon NCDC 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.

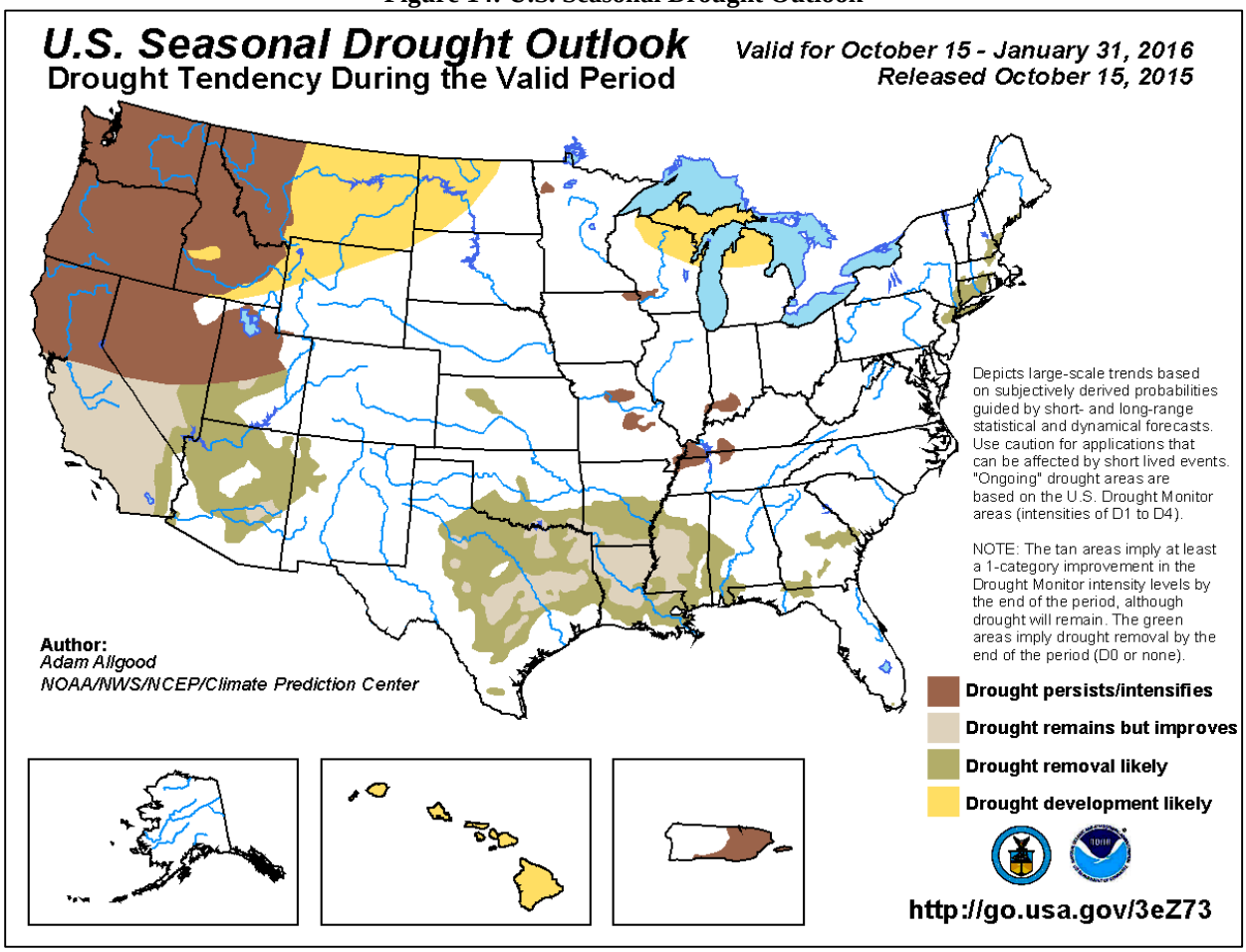
Table 73: Loss Estimate for Drought

Hazard Type	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Drought	$0	$0	$134,222,235	$8,948,156

1 Indicates the data is from NCDC (January 1996 to July 2015); 2 Indicates data is from USDA RMA (2000 to 2014)

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).

Figure 14: U.S. Seasonal Drought Outlook



Source: NOAA CPC

PROBABILITY

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

Table 74: Drought Magnitude and Probability

Magnitude	Years of Record	Annual Probability
No Drought	52/121	43%
Mild Drought	32/121	27%
Moderate Drought	12/121	10%
Severe Drought	9/121	7%
Extreme Drought	16/121	13%

Source: NCDC

The U.S. Seasonal Drought Outlook 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 October 15, 2015 through January 2016. According to the U.S. Seasonal Drought Outlook drought is likely to persist in the western United States, but the planning area should experience seasonal norms relative to precipitation and temperatures.

FUTURE DEVELOPMENT

Future development and growth would likely increase the intensity of drought impacts across the planning area. Future development and growth would likely have the following impacts:

- Increase demand on water systems and supply
- Increased demand on electric providers
- Increased dependence on the agricultural industry

REGIONAL VULNERABILITIES

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

Table 75: Regional Drought Vulnerabilities

Sector	Vulnerability
People	-Insufficient water supply -Loss of jobs in agricultural sector -Residents in poverty if food prices increase
Economic	-1.1% of people are employed in the agricultural industry -Closure of water intensive businesses (carwashes, pools, etc.) -Loss of tourism dollars
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
Other	-Increase in wildfires and wildfire intensity

RISK ASSESSMENT SUMMARY

Table 76: Summary

Number of Past Events	16 years of extreme drought; 9 years of severe drought
Vulnerable Locations	Entire planning area
Extent	Mild drought most likely at 27%
Annual Probability	Extreme Drought = 13%; Severe Drought = 7%; Moderate Drought = 10%
Averaged Annual Crop Losses	$8,948,156

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

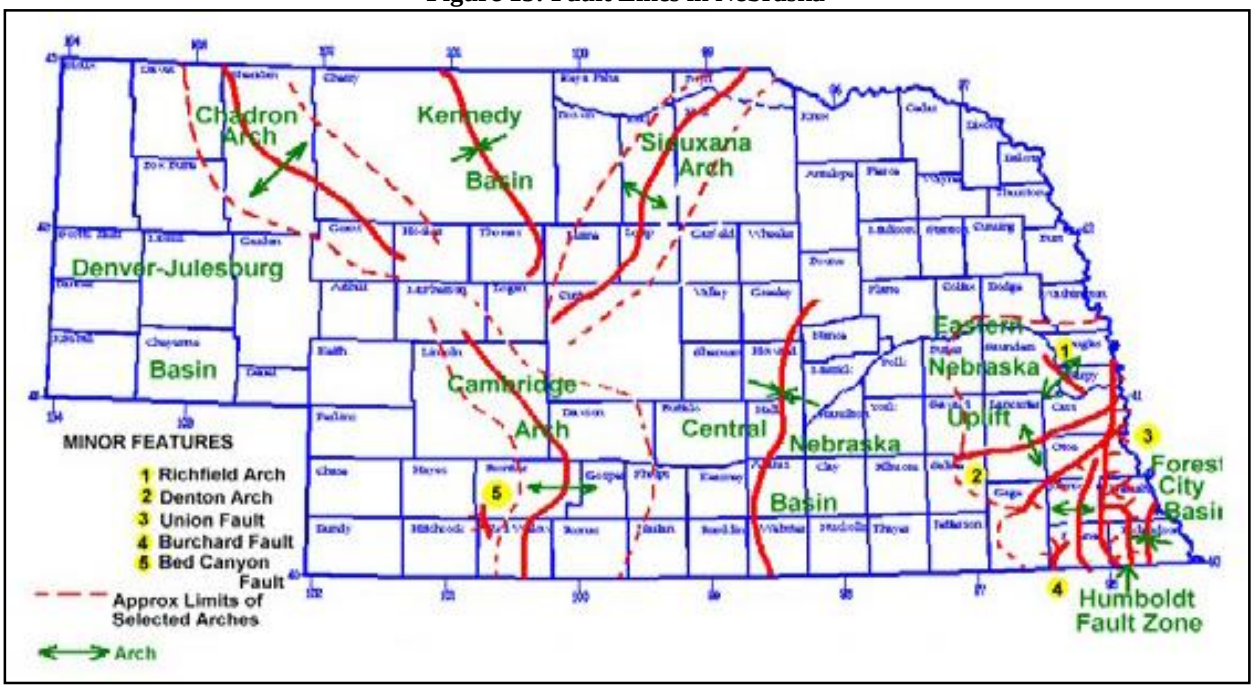
- Most agricultural producers purchase crop insurance
- USDA and FSA provide educational materials

EARTHQUAKES

HAZARD PROFILE

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.

Figure 15: Fault Lines in Nebraska



Source: Nebraska Department of Natural Resources

Table 77: 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: Federal Emergency Management Agency

Table 78: 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: Federal Emergency Management Agency

LOCATION

Burt, Dakota, Thurston, and Washington Counties are the least likely to experience an earthquake as they are not located near a fault line area. Douglas and Sarpy Counties have fault lines within their borders and are therefore more likely to experience seismic events.

EXTENT

If an earthquake were to occur in the planning area, it would likely measure 4.0 or less on the Richter Scale.

HISTORICAL OCCURRENCES

According to the USGS Earthquake Hazards Program, there have been no earthquakes in recent history within the planning area. However, one account of an earthquake, which was probably the strongest in the state history, from November 15, 1877 was felt in the Omaha area. There were two shocks 45 minutes apart; the second was the strongest. In North Platte, the shock was reported to have lasted 40 seconds and intensity VII effects were noted. Buildings rocked in Lincoln, and walls were damaged in Columbus. The shock was strongly felt in Omaha. Cracked walls were reported in Sioux City, Iowa. The total felt area covered approximately 360,000 square kilometers including most of Nebraska and portions of Iowa, Kansas, the Dakotas, and northwestern Missouri.

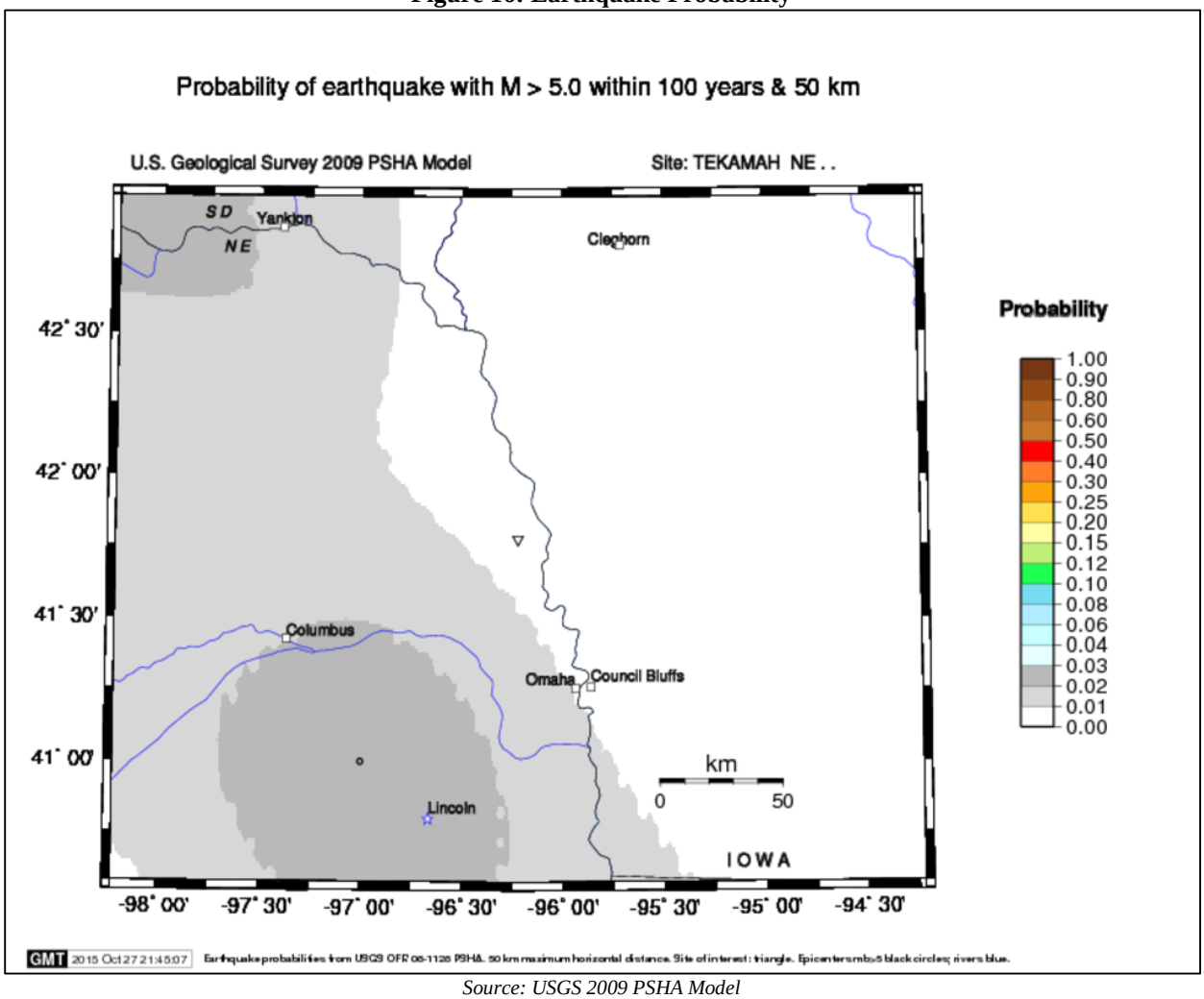
AVERAGE ANNUAL LOSSES

Due to the lack of sufficient earthquake data, limited resources, extremely low earthquake risk for the area, and zero reports of historical occurrences with recorded damages, it is not feasible to utilize the 'event damage estimate formula' to estimate potential losses for the planning area.

PROBABILITY

The following figure summarizes the probability of a 5.0 or greater earthquake occurring in the planning area within 100 years, which is less than 0.2 percent.

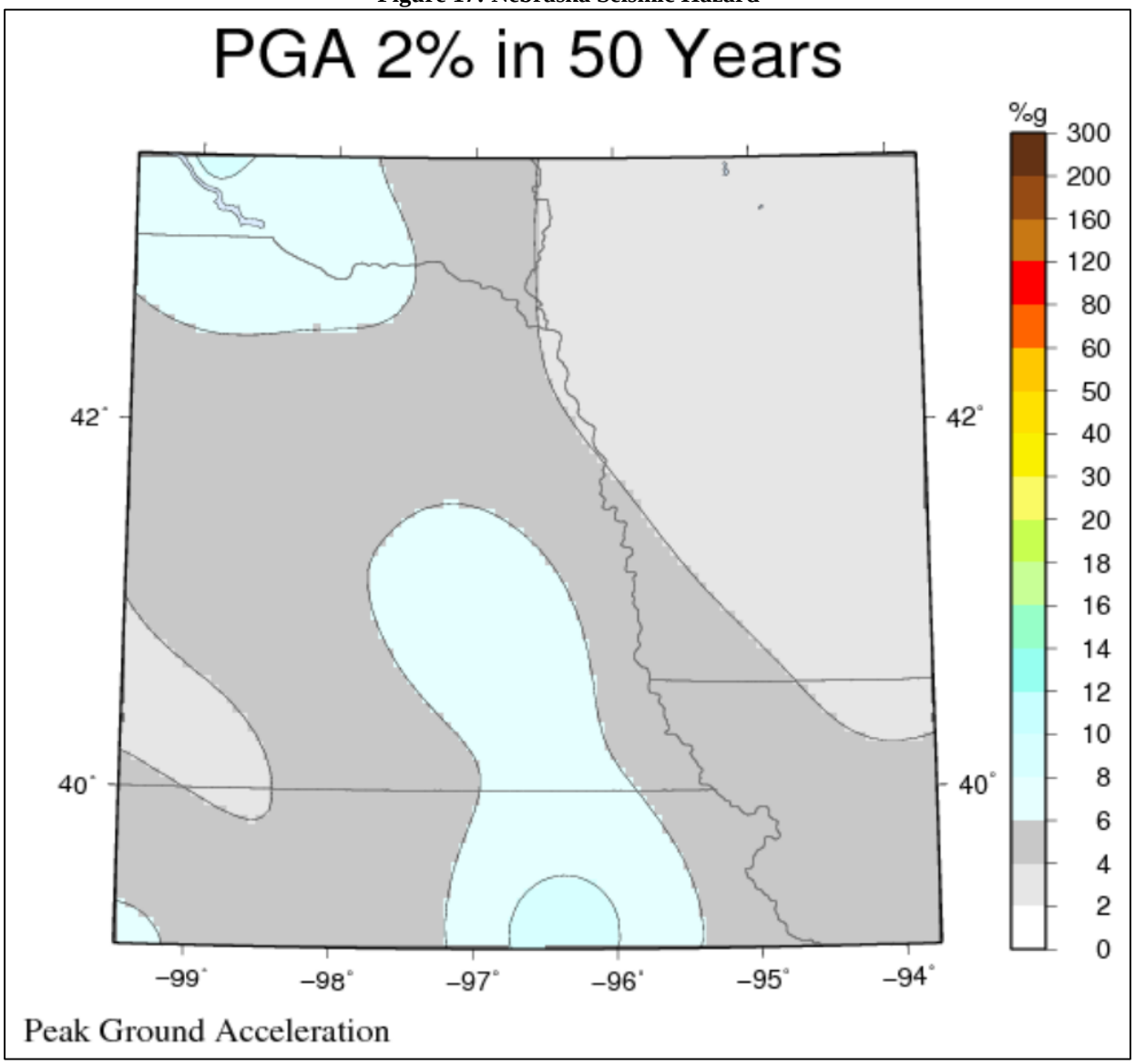
Figure 16: Earthquake Probability



Source: USGS 2009 PSHA Model

The following figure presents a worst-case scenario, depicting the shaking level that has a 2 percent chance of being exceeded over a period of 50 years. Typically, significant earthquake damage occurs when accelerations are greater than 30 percent of gravity.

Figure 17: Nebraska Seismic Hazard



Source: United States Geological Survey

FUTURE DEVELOPMENT

Future development and growth would likely increase the intensity of earthquake impacts across the planning area. Future development and growth would likely have the following impacts:

- Increased development near dams and levees (increased potential for failure during earthquakes)
- Increased density in urban areas
- New structures built without reinforcements

REGIONAL VULNERABILITIES

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

Table 79: Regional Earthquake Vulnerabilities

Sector	Vulnerability
People	-Falling objects
Economic	-Short-term interruption of business
Built Environment	-Cracking of foundations (residential and commercial structures) -Damage to structures
Infrastructure	-Damages to subterranean infrastructure (e.g. waterlines, gas lines, etc.) -Damages to roadways
Critical Facilities	-Same as all other structures

RISK ASSESSMENT SUMMARY

Table 80: Summary

Number of Past Events	None since 1973
Vulnerable Locations	Douglas and Sarpy Counties have fault lines
Extent	M < 4.0
Annual Probability	<1%
Averaged Annual Losses	N/A

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Building codes updated
- Education outreach and participating in national ShakeOut day

EXTREME HEAT

HAZARD PROFILE

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 difficulties 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.

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. The hotter the animal is, the more it will begin to shut down body processes not vital to its survival, such as milk production, reproduction, or muscle building.

Other related hazards include water shortages brought on by drought-like conditions and high demand. Local advisories, which list priorities for water use and rationing, are common during heat waves. Government authorities report that civil disturbances and riots are also 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 May, June, July, August, and September. The National Weather Service 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. Finally, 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.

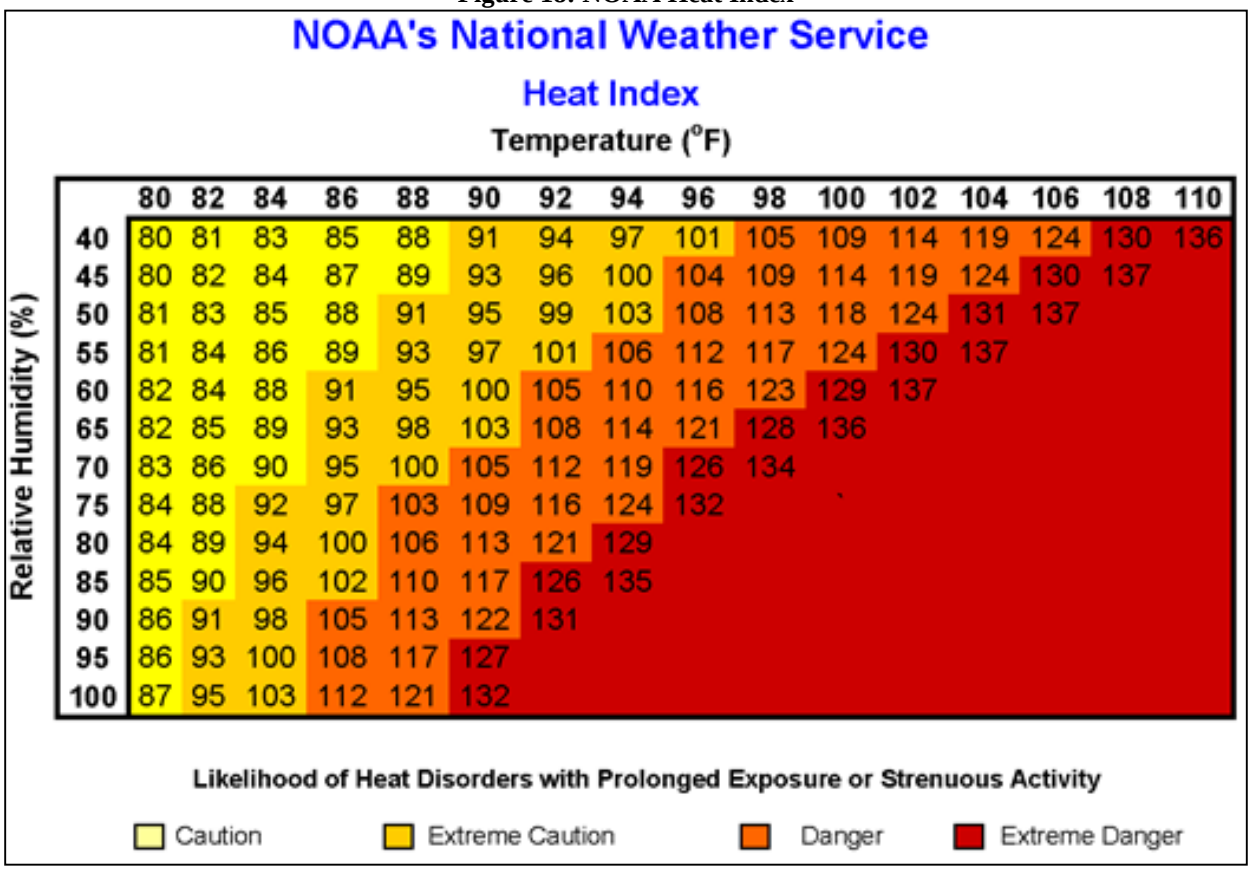
LOCATION

This hazard may occur anywhere in the planning area.

EXTENT

A key factor to consider in regards to extreme heat situations is the humidity level relative to the temperature. As is indicated in the following figure, 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: 100 percent Relative Humidity + 86°F = 112° Heat Index.

Figure 18: NOAA Heat Index



Source: NOAA

For the purpose of this plan extreme heat is being defined as temperatures of 90°F or greater.

HISTORICAL OCCURRENCES

The Midwestern Regional Climate Center (MRCC) reports an average of 36 days annually where max temperatures are 90° Fahrenheit or greater, which generally occur from June through September but are most prevalent in the months of July and August.

The following accounts of extreme heat events in the planning area are from the NCDC Storm Events database (1996 – 2015) and the previous P-MRNRD HMP. In total, these events caused seven deaths, $6 million in property damages and $150,000 in crop damages.

Table 81: Extreme Heat Events (1995-2015)

Date	Type	Deaths	Injuries	Property Damages	Crop Damages	Burt	Dakota	Douglas	Sarpy	Thurston	Washington
7/10/1995	Heat	3	0	$160,000	$150,000	x		x	x		x
7/19/1999	Heat	2	0	$3,300,000	$0	x		x	x	x	
7/28/1999	Excessive Heat	1	0	$0	$0		x				
7/28/2001	Excessive Heat	1	0	$0	$0	x		x			x
8/1/2001	Excessive Heat	0	0	$0	$0	x		x	x		x
7/22/2005	Excessive Heat	0	0	$3,000,000	$0			x	x	x	x

Date	Type	Deaths	Injuries	Property Damages	Crop Damages	Burt	Dakota	Douglas	Sarpy	Thurston	Washington
6/22/2009	Excessive Heat	0	0	$0	$0			x	x		
6/26/2010	Heat	0	0	$0	$0	x		x	x		x
7/14/2010	Heat	0	0	$0	$0	x		x	x		x
7/17/2010	Heat	0	0	$0	$0	x		x	x	x	x
7/22/2010	Heat	0	0	$0	$0				x		
8/8/2010	Excessive Heat	0	40	$0	$0	x		x	x	x	x
8/11/2010	Heat	0	0	$0	$0	x					
8/12/2010	Heat	0	0	$0	$0					x	
6/30/2011	Heat	0	0	$0	$0	x		x	x		x
7/10/2011	Heat	0	0	$0	$0			x	x		x
7/15/2011	Excessive Heat	0	0	$0	$0	x	x	x	x	x	x
7/27/2011	Heat	0	0	$0	$0			x	x		
7/31/2011	Heat	0	0	$0	$0	x		x	x		x
8/1/2011	Excessive Heat	0	0	$0	$0	x		x	x	x	x
6/27/2012	Heat	1	45	$0	$0	x	x	x	x		x
7/2/2012	Excessive Heat	0	0	$0	$0	x	x	x	x	x	x
7/15/2012	Heat	0	0	$0	$0	x	x	x	x	x	x
7/18/2012	Excessive Heat	0	0	$0	$0		x				
8/1/2012	Excessive Heat	0	0	$0	$0		x				
8/30/2013	Heat	0	30	$0	$0	x		x	x		x
Totals		**8**	**115**	**$6,460,000**	**$150,000**	**17**	**7**	**20**	**20**	**9**	**17**

Source: NCDC and 2011 P-MRNRD HMP

July 10, 1995 Heat Wave: One hundred degree heat over a five day period resulted in three deaths, numerous livestock losses, and damage to roads.

July 19, 1999 Heat Wave: From July 19th through the 30th high temperatures over eastern Nebraska and southwest Iowa reached 90 degrees or better all but a day or two, and even then highs were well into the 80s. In addition, overnight lows stayed mostly above 70 degrees. The high temperatures were accompanied by high humidity which caused afternoon heat indices to reach between 105 and 120 degrees. The highest temperatures in this period were observed on the 29th and 30th with highs both days in the upper 90s to low 100s across the region. Lincoln recorded 104 degrees on the 29th while Omaha Eppley reached 100. Two deaths were determined to be caused from the heat. A 34 year old male died while jogging near Macy on July 27th and a 75 year old man died in his mobile home on July 28th after his air-conditioner broke and temperatures inside the trailer reached over 110 degrees. The heat was directly responsible for also killing at least 5,000 head of cattle worth an estimated $3.3 million dollars.

July 28, 1999 Excessive Heat: Excessive heat occurred with heat indices above 120 degrees. Several cattle were lost, and a 68 year old woman died in an uncooled apartment in South Sioux City.

July 28 to August 1, 2001 Excessive Heat: A heat wave of which lasted over one week affected much of eastern Nebraska and southwest Iowa from late July into early August. The heat was finally broken by a cold front that pushed afternoon temperatures down into the 80s on August 9th. During the heat wave, high temperatures were consistently in the mid to upper 90s with overnight lows in the mid to upper 70s. The heat index during this time frequently reached 105 to 115 degrees from mid-afternoon into early evening. The extreme heat caused a 39 year old male to die of heat stroke while on a work-release construction site near Beatrice on July 30th.

July 22, 2005 Excessive Heat: High temperatures from the upper 90s to around 105 and lows of 75 to 80 with afternoon heat index values of 105 to 115 degrees impacted the planning area. A temperature of 105 in Omaha was a record for the date and the hottest in ten years. The excessive heat caused many cattle deaths over the region, especially over northeast Nebraska. One rendering company collected 1,250 head of dead cattle over the weekend, 200 alone from one producer. The rendering company estimated that losses to cattle producers would be in the millions of dollars. Although no human deaths were confirmed due to the heat, University of Nebraska Medical Center officials believed the death of an infant that was left in a vehicle on Saturday was related to the weather. Also there was at least one report of a highway buckling because of the heat, Highway 75 in Cass County Nebraska.

June 22, 2009 Excessive Heat: A period of hot and very humid conditions was observed over eastern Nebraska and southwest Iowa on June 22nd and 23rd. High temperatures were in the lower to upper 90s. Overnight lows were in the mid to upper 70s. The combination of the heat and humidity brought heat index values up into the 108 to 118 degree range. Since these extremely uncomfortable temperatures occurred with light winds, generally less than 10 mph, conditions became deadly for livestock, especially during the afternoon of the 23rd. It was estimated that at least 2,000 head of cattle died because of the heat in eastern Nebraska and western Iowa, most of them on the 23rd.

August 8, 2010 Excessive Heat: A large portion of Nebraska experienced high temperatures into the mid and upper 90s with dew point temperatures reaching near 80, which produced a prolonged period of afternoon and early evening heat index values that reached from 105-115 degrees. In the Omaha area, about 30-40 people were treated at local hospitals for heat related issues.

July 15-16, 2011 Excessive Heat: An extended period of excessive heat produced daytime temperatures reaching the 90s with dew points in the lower 80s, which caused heat indices to reach or even exceed 115. Nighttime temperatures often in the mid-70s to lower 80s with continued high humidity provided little if any relief. The heat and humidity caused prolonged stress on people and livestock.

June 27, 2012 Heat: One of the first prolonged heat waves of the season sent around 45 people to local hospitals in the Omaha area due to heat exhaustion. The heat was also responsible for one death when a 48 year old man was found dead after crashing his vehicle in a construction zone and then attempting to walk for help a half mile down the road.

August 30, 2013 Heat: Heat index values peaked in the 104 to 109 degree range as temperatures approached 100 with dew points around 70 degrees. At least 30 people were treated at area hospitals for heat related ailments during the heat wave in the Omaha area.

AVERAGE ANNUAL LOSSES

The direct and indirect effects of extreme heat are difficult to quantify. There is no way to place a value on the loss of human life. Potential losses such as power outages could affect businesses, homes, and critical facilities. High demand and intense use of air conditioning can overload the electrical systems and cause damages to infrastructure.

It is estimated from the NCDC database that $6,460,000 million in property damages were reported over just three events. The majority of these property damages were a result of the loss of livestock during extreme heat.

Table 82: Extreme Heat Loss Estimation

Hazard Type	Number of Average Days Per Year at 90°F[1]	Property Damages[2]	Average Annual Property Damage	Total Crop Loss[3]	Annual Crop Loss[3]
Extreme Heat	36	$6,460,000	$329,592	$9,816,312	$654,421

Source: 1 indicates the data is from MRCC; 2 NCDC; 3 USDA RMA (2000-2014)

PROBABILITY

Extreme Heat is a regular part of the climate for the planning area; there is a 100 percent probability that temperatures greater than 90°F will occur annually.

FUTURE DEVELOPMENT

Future development and growth would likely increase the intensity of extreme heat impacts across the planning area. Future development and growth would likely have the following impacts:

- Increased stress on electrical systems during peak demand times
- Add to exposure by increasing agricultural production within the area

Urban heat island effect may become more pronounced or compound extreme heat events that occur as communities and metropolitan areas grow

REGIONAL VULNERABILITIES

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

Table 83: 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	None
Infrastructure	-Overload of electrical systems -Damages to roadways
Critical Facilities	-Loss of power

Estimated Loss of Electricity

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

Table 84: Loss of Electricity - Assumed Damage by Jurisdiction

Jurisdiction	2010 Population	Population Affected (Assumed)	Electric Loss of Use Assumed Damage Per Day
Burt County	6,858	686	$86,436
Dakota County	21,006	2,101	$264,726
Douglas County	517,110	51,711	$6,515,586
Sarpy County	157,840	15,784	$1,988,784
Thurston County	6,940	694	$87,444
Washington County	20,234	2,023	$254,898

RISK ASSESSMENT SUMMARY

Table 85: Summary

Number of Past Events	Annually 36 days of >90°F on average
Vulnerable Locations	Entire planning area
Extent	>90°F and dependent on relative humidity for higher heat indices
Annual Probability	100 %
Averaged Annual Losses	$329,592 for property damage; $654,421 for crop loss

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Assist vulnerable populations (i.e. creating a database to track those individuals at high risk such as the elderly)
- Identify existing community shelters/centers
- Increase awareness of extreme heat risk and safety (i.e. educating citizens regarding the dangers of extreme heat and the steps they can take to protect themselves)

FLOODING

HAZARD PROFILE

Flood events are the most damaging and costly hazards in the United States, and account for 66 percent of all presidential disaster declarations. Flooding has been a major problem for many of the communities in the P-MRNRD as well. Many of the communities were settled and developed largely because of their proximity to water resources. 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 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 1 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, result from convective precipitation usually due to intense thunderstorms or sudden release from an upstream impoundment created behind a dam, landslide, or levee. Flash floods are distinguished from a regular flood by a timescale less than six hours and 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 man-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" (particularly in the Platte and Elkhorn Rivers). 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. On the Platte River, especially, this ice sheet can freeze to the bottom of the channel in places. During spring thaw, the Platte and Elkhorn Rivers frequently become clogged with this winter accumulation of ice. Because of relatively low stream banks

and channels blocked with ice, these rivers overtop existing banks and flow overland. Ice formation in the Missouri River is somewhat different from that in the Platte and Elkhorn Rivers. In the Missouri River, because of relatively fast velocities, "frazil ice" is not able to form "sheet ice." Instead, the "frazil ice" particles gradually enlarge and combine forming pads of ice commonly known as "pad ice." As this ice floats downstream, snags, bridge piers, or other obstructions or constrictions create conditions where ice pads may accumulate or stop flowing. Once this occurs, other ice pads may accumulate, gradually covering the entire river with "pad ice." This is commonly known as an "ice bridge." This condition can result in severe stage fluctuation as the "ice bridge" forms, as it consolidates, or breaks up. As additional "pad ice" floats downstream, the "ice bridge" grows in an upstream direction. As the "ice bridge" continues to form, it may thicken to the point where an "ice gorge" blocks the flow of the river in the channel. This can result in extremely rapid increases in upstream water surface elevations (WSELs) and resultant overbank flooding.

LOCATION

The P-MRNRD has the distinction of having three of Nebraska's major rivers within its boundary: the Platte River, Missouri River, and Elkhorn River.

Missouri River

Before large, Missouri River main stem dams were completed by the U.S. Army Corps of Engineers (USACE) in the 1940s to 1960s, Nebraska communities' on the Missouri River had an extensive history of flooding. These communities include South Sioux City, Dakota City, Decatur, Blair, and Omaha. The entire reach of the Missouri River from the northwest corner of Dakota County to the southeast corner of Sarpy County is under the P-MRNRD's administration, which means that the P-MRNRD bears responsibility to manage the stormwater issues associated with the steep tributaries draining to the Missouri River bottomlands.

Platte River

The second major Nebraska river, which impacts the P-MRNRD, is the Platte River, which flows along Sarpy County's southern border. Problems with the Platte River in the planning area have not been significant when compared to other communities outside the planning area that are on the Platte River, such as North Bend, Columbus, and Grand Island. However, Valley, Waterloo, and unincorporated areas of Sarpy County have historically been impacted by Platte River flooding. The most devastating and frequent flood events have been the result of ice jams typically forming just above highway or railroad bridges crossing the river.

Elkhorn River

The third major Nebraska river to impact the P-MRNRD is the Elkhorn River, which acts as the NRD's western border for Washington County. Like the Platte River, the Elkhorn's flood history is not as significant in the P-MRNRD as in other upstream locations such as Norfolk, West Point, Hooper, and Nickerson. However, the communities on the Elkhorn located in the P-MRNRD boundary that have experienced flooding include Arlington, Valley, Waterloo, and King Lake. The Elkhorn River can experience extreme flooding from both riverine and ice jam events. Large areas located in between the Platte and Elkhorn Rivers in Douglas and Sarpy County are especially prone to inundation.

Other Rivers

In addition to the three major Nebraska rivers, the Papillion Creek and its tributaries, which drains the majority of the Omaha metropolitan area, is within the P-MRNRD. The Papillion Creek Watershed is moderately sloped compared to other Missouri River tributaries, but is capable of causing extreme flash flooding due to its shape and extent of urbanization.

FLOODPLAIN MAPS

Effective Digital Flood Insurance Rate Maps (DFIRM) were available for Dakota, Douglas, Sarpy, Thurston, and Washington Counties. Although Burt County has a regulatory mapped floodplain (see Burt County's participant section), DFIRMs have not been produced. Therefore, the best available digital data for depicting the flood hazard for this county is a modeled floodplain using Hazards United States Multi-Hazard (HAZUS-MH). In the absence of DFIRM data, HAZUS-MH was used to generate a 1 percent annual flood event for major rivers and creeks (those with a 10 square mile minimum drainage area). A USGS 30 meter resolution digital elevation model (DEM) was used as the terrain base in the model. Figure 20 shows the DFIRMs and modeled floodplain 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*.

EXTENT

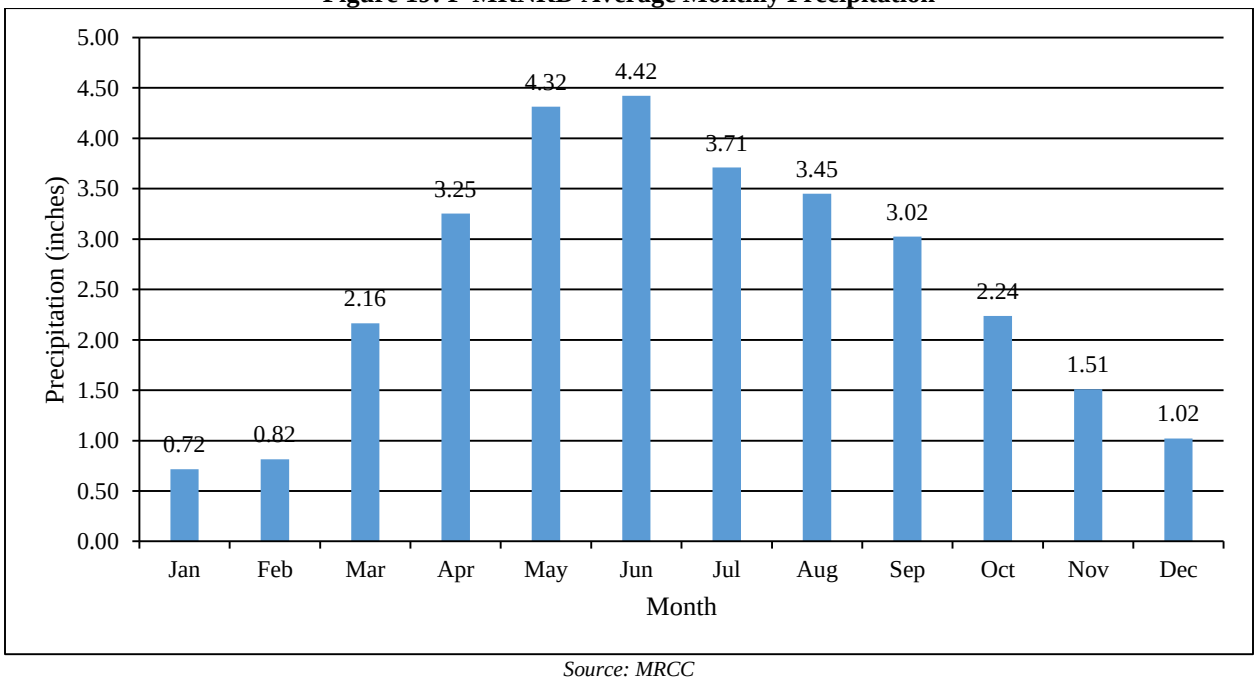
The NWS has three categories to define the severity of a flood once a river reaches flood stage as indicated in Table 86. Figure 19 shows the normal average monthly precipitation for the planning area, which is helpful in determining whether any given month is above, below, or near normal in precipitation. As indicated in Figure 21, the most common months for flooding within the planning area are May, June, and August. While it is possible that major flood events will occur, the likely extent of flood events within the planning area is classified as moderate (Table 86).

Table 86: Flooding Stages

Flood Stage	Description of flood impacts
Minor Flooding	Minimal or no property damage, but possible 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

Figure 19: P-MRNRD Average Monthly Precipitation



Source: MRCC

Figure 20: 1% Annual Chance Flood Risk Area

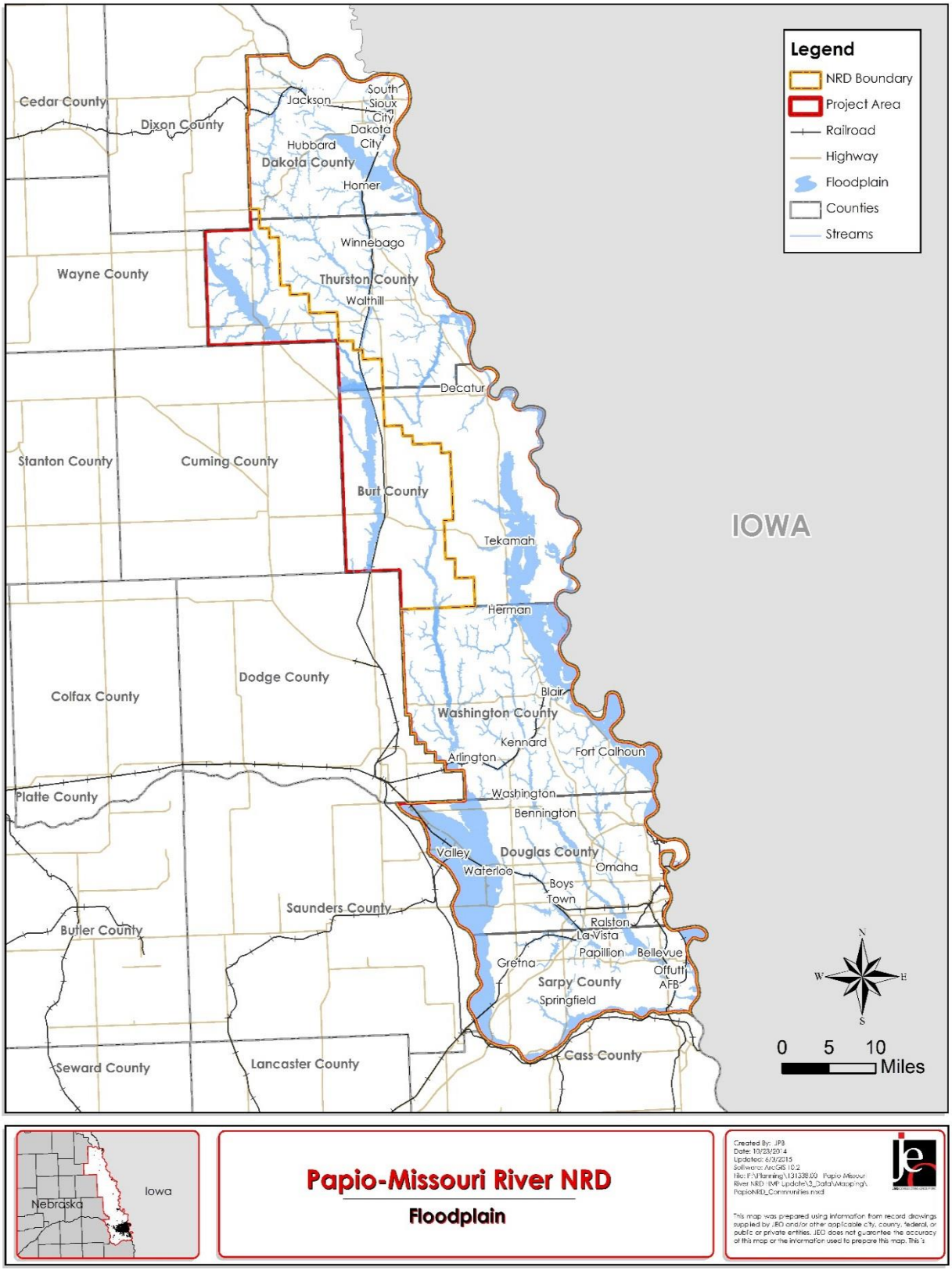
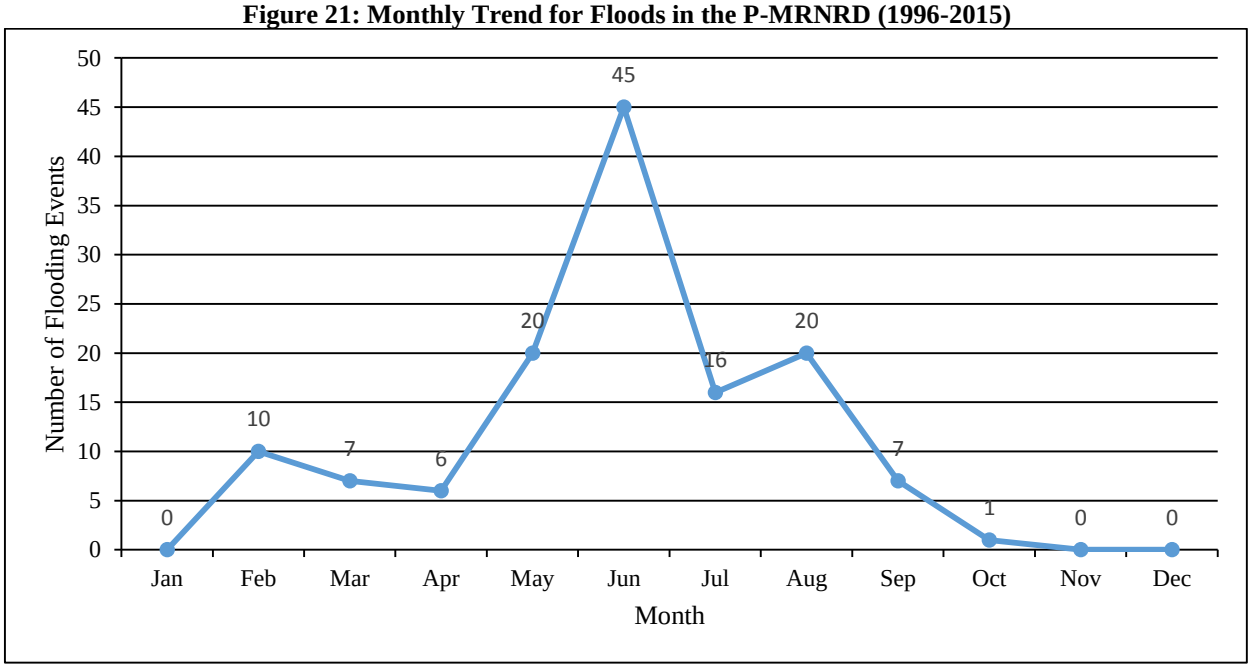


Figure 21: Monthly Trend for Floods in the P-MRNRD (1996-2015)



Source: NOAA

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 that participate in the NFIP must agree to adopt and enforce floodplain management standards to regulate development in special flood hazard areas (SFHA) as defined by FEMA's flood maps. One of the strengths of the program has been keeping people away from flooding rather than keeping the flooding away from people - through historically expensive flood control projects.

As of October 2015, Nebraska has 11,279 policies in force representing $2 billion worth of coverage. The following tables summarize NFIP participation and active policies within the planning area.

Table 87: NFIP Participants

Jurisdiction	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded	Participation in NFIP
Burt County	9/1/2005	9/1/2005	-	-	-	Yes
Decatur	6/16/1992	6/16/1992	-	-	-	Yes
Tekamah	8/1/1979	8/11/1981	-	-	-	Yes
Dakota County	4/15/1982	1/6/2012	-	-	-	Yes
Dakota City	9/16/1981	1/6/2012	-	-	-	Yes
Homer	4/3/1984	1/6/2012	-	-	-	Yes
Jackson	9/4/1987	1/6/2012	-	-	-	Yes
South Sioux City	8/15/1979	1/6/2012	-	-	-	Yes

Jurisdiction	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded	Participation in NFIP
Douglas County	1/16/1981	5/19/2014	-	-	-	Yes
Bennington	12/4/1979	5/3/2010	-	-	-	Yes
Omaha	10/7/80	5/19/2014	-	-	-	Yes
Ralston	5/15/1980	12/2/2005	-	-	-	Yes
Valley	3/18/1980	5/19/2014	-	-	-	Yes
Waterloo	1/14/1977	5/19/2014	-	-	-	Yes
Sarpy County	1/16/1981	5/3/2010	-	-	-	Yes
Bellevue	1/16/1980	5/3/2010	-	-	-	Yes
Gretna	9/21/2010	5/3/2010	-	-	-	Yes
La Vista	1/16/1980	5/3/2010	-	-	-	Yes
Papillion	8/18/1972	5/3/2010	-	-	-	Yes
Springfield	2/15/1978	12/2/2005	-	-	-	Yes
Thurston County	1/6/2010	1/6/2010	-	-	-	Yes
Walthill	9/1/1986	1/6/2010	-	-	-	Yes
Winnebago	9/1/1986	1/6/2010	-	-	-	Yes
Washington County	2/4/1981	1/6/2012	-	-	-	Yes
Arlington	1/16/1981	1/6/2012	-	-	-	Yes
Blair	7/16/1981	1/6/2012	-	-	-	Yes
Fort Calhoun	12/1/1983	1/6/2012	-	-	-	Yes
Herman	3/18/1985	1/6/2012	-	-	10/28/1977	Yes

Source: Nebraska Department of Natural Resources, National Flood Insurance Program

Table 88: NFIP Polices in Place and Total Payments

Jurisdiction	Policies In-force	Total Coverage	Total Premium	Closed Losses*	Total Payments
Burt County	19	$2,398,800	$11,729	12	$622,290
Decatur	3	$615,400	$4,565	2	$124,943
Tekamah	5	$430,000	$1,725	1	$766
Dakota County	9	$1,782,500	$9,429	6	$37,904
Dakota City	7	$2,380,000	$2,953	4	$78,652
Homer	3	$1,060,000	$3,529	1	$3,427
Jackson	20	$4,382,800	$44,487	0	$0
South Sioux City	49	$16,580,200	$41,017	10	$439,906
Douglas County	309	$51,865,200	$287,932	261	$2,079,250
Bennington	6	$875,500	$6,584	0	$0
Omaha	975	$259,639,700	$1,073,999	131	$1,585,052
Ralston	15	$4,938,500	$15,602	0	$0
Valley	423	$66,095,900	$458,747	65	$370,736
Waterloo	20	$4,360,000	$35,315	5	$54,048

Jurisdiction	Policies In-force	Total Coverage	Total Premium	Closed Losses*	Total Payments
Sarpy County	526	$119,340,100	$491,120	767	$7,614,430
Bellevue	205	$44,881,100	$172,345	86	$1,243,038
Gretna	3	$672,000	$1,056	0	$0
La Vista	40	$13,212,900	$103,856	1	$977
Papillion	154	$39,212,900	$491,120	6	$32,277
Springfield	5	$1,870,000	$5,301	12	$74,701
Thurston County	0	N/A	N/A	0	$0
Walthill	3	$106,000	$1,800	0	$0
Winnebago	1	$20,000	$319	0	$0
Washington County	25	$5,152,500	$14,795	68	$1,660,383
Arlington	11	$977,500	$9,163	15	$281,549
Blair	72	$13,305,000	$86,118	13	$527,641
Fort Calhoun	2	$275,000	$1,188	15	$216,977
Herman	2	$210,000	$519	0	$0
Planning Area Total	**2,912**	**$656,639,500**	**$3,376,313**	**1,481**	**$17,048,947**

Source: NFIP Community Status Book, August 2015; NFIP Claim Statistics
*N/A: Not Applicable; *Closed Losses are those flood insurance claims that resulted in payment*

This plan highly recommends and strongly encourages each plan participant to remain in good standing and continue involvement 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 CRS Coordinator's Manual (FIA-15/2013).

In order to qualify for HMA, plan participants must have a good standing in the NFIP, if the project is located in a Flood Hazard Risk Area. For any questions regarding the NFIP, contact the NDNR.

NFIP REPETITIVE LOSS STRUCTURES

NDNR was contacted to determine if any existing buildings, infrastructure, or critical facilities are classified as an NFIP Repetitive Loss Structure. There are a total of 186 repetitive loss properties in the P-MRNRD, and none are located in Burt, Dakota, and Thurston Counties. The following table indicates the number, type, and location of these properties in the planning area (as of August 2014).

Table 89: Repetitive Loss Structures

Jurisdiction	Number of Properties	Type of Property
Burt County	0	-
Decatur	0	-
Tekamah	0	-
Dakota County	0	-
Dakota City	0	-
Homer	0	-
Jackson	0	-
South Sioux City	0	-

Jurisdiction	Number of Properties	Type of Property
Douglas County	18	16 Single Family Residential; 1 Assumed Condo; 1 Non-Residential
Bennington	0	-
Omaha	9	2 Single Family Residential; 2 Non-Residential; 5 Other Residential*
Ralston	0	-
Valley	2	2 Single Family Residential
Waterloo	0	-
Sarpy County	123	120 Single Family Residential; 2 Assumed Condo; 1 Non-Residential
Bellevue	15	14 Single Family Residential; 1 Other Residential*
Gretna	0	-
La Vista	0	-
Papillion	0	-
Springfield	3	3 Single Family Residential
Thurston County	0	-
Walthill	0	-
Winnebago	0	-
Washington County	8	7 Single Family Residential; 1 Assumed Condo
Arlington	4	4 Single Family Residential
Blair	0	-
Fort Calhoun	4	4 Single Family Residential
Herman	0	-

Source: NDNR, August 2014
**Other Residential = not single family or 2-4 family residential*

HISTORICAL OCCURRENCES

The NCDC reports 133 flooding events from January 1996 to July 2015. Of these events, 64 were flash flooding and 69 were riverine flooding. According to the NCDC, flash flooding resulted in $18,508,000 in property damage, while riverine flooding caused $10,826,000 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 $16,638,280.

Moreover, there were three flash flood events that resulted in three fatalities. In 1999, one Omaha man died after extensive flooding along Cole Creek caused his basement wall to wash out and carried him 40 yards downstream. The second fatality occurred in 2004 during a flash flood event in Omaha when a man left his stalled vehicle for help. He was likely swept away in a nearby drainage ditch and was found 20 miles downstream in the Missouri River. The third fatality also occurred after his vehicle became stalled in flooded waters in Sarpy County during a flash flood event in 2014.

Prior to 1996, some of the significant flood events which impacted communities in the P-MRNRD area were (*denotes floods of record):

- Missouri River: 1881, 1943, 1947, 1950, 1952*, 1978, 1984
  Communities Impacted: South Sioux City, Dakota City, Blair, Omaha, Bellevue
- Elkhorn River: 1881, 1917, 1920, 1940, 1944*, 1960, 1962, 1970, 1978, 1990
  Communities Impacted: Waterloo, Valley, Arlington, King Lake
- Platte River (at Louisville): 1881, 1882, 1912, 1936, 1944, 1947, 1952, 1960* (highest stage from ice jam), 1962, 1967, 1970, 1978, 1984, 1993* (highest flow volume)
- Big Papillion Creek: 1950, 1952, 1959, 1964*, 1965
  Communities Impacted: Omaha, Irvington, Fort Crook, Papillion, Millard, Ralston, Bennington, Bellevue
- Little Papillion Creek: 1960, 1964, 1965*
  Communities Impacted: Omaha
- West Branch Papillion Creek: 1948, 1959, 1964*, 1965
  Communities Impacted: Elkhorn, Papillion
- Omaha Creek: 1922, 1940*, 1954, 1957, 1967, 1993
  Communities Impacted: Homer
- Tekamah Creek: 1904, 1915, 1944*, 1963, 1974
  Communities Impacted: Tekamah

Missouri River Flood 2011

The most recent and devastating flood occurred during the spring and summer of 2011 along the Missouri River, which was the largest on record for the entire basin in terms of volume of water, and record peak flows were also experienced in some reaches. The flooding situation was complex and evolved throughout the summer. The initial trigger of the flood occurred far upstream from the record snowfall in the Rocky Mountains of Montana and Wyoming, which was then compounded by near-record spring rainfall in central and eastern Montana. This lead to all six major dams along the Missouri River to release record amounts of water to prevent overflow, which led to flooding threatening several towns and cities from Montana south to Missouri. Communities in the planning area that were threatened included South Sioux City, Dakota City, Decatur, Blair, Fort Calhoun, Bellevue, and Omaha. Furthermore, more heavy rains in the second half of May 2011, which was almost a year's worth of rain, fell over the Missouri River basin. Thus, extremely heavy rainfall in conjunction with an estimated 212 percent of normal snowpack in the Rocky Mountains contributed to this flooding event.

The USACE attempted to regulate the release of water through 850 miles of river from North Dakota through South Dakota to the confluence with the Mississippi River in St. Louis. The following table indicates the progression of the release flows from the six dams along the Missouri River, which ultimately impacted areas along the Missouri River in the P-MRNRD.

Table 90: Release of Water by Dam 2011

Dam Name	Previous Record Flow	Previous Record Year	Flow May 1, 2011	Flow May 31, 2011	Flow June/July 2011
Fort Peck Dam	35,000	1975	7,000	9,700	65,500
Garrison Dam	65,000	1975	17,400	80,400	150,200
Oahe Dam	59,000	1997	29,400	86,300	160,300
Big Bend Dam	74,000	1997	21,200	83,900	165,000
Fort Randall Dam	67,000	1997	42,300	76,600	157,000
Gavins Point Dam	70,000	1997	45,000	77,000	160,700

Source: USACE

These releases lead to high flood stages all along the Missouri River, including the P-MRNRD area. Urban areas, industrial, utilities, transportation routes, and agriculture all suffered damages due to the 2011 flood. In Dakota County, South Sioux City reached its highest stage at 5.2 feet above flood stage on June 27th. Additionally, many residents were evacuated from their homes and at least 100 businesses were closed and evacuated. During July, the river levels did not improve and in fact increased slightly to 5.3 feet above flood stage on July 21st. The river slowly fell during the month of August and went below flood stage on August 25th at South Sioux City. Those evacuated from homes and businesses were able to return late in August after nearly two months away.

For Thurston County, flooding was mostly confined to agricultural lowlands, recreation areas, and roads near the river. However, flooding did force the evacuation of 12 people near Macy. Flooding persisted into late August.

In Burt County, the flooding generally began during the first week of June as the gauge at Decatur didn't surpass flood stage until around June 6th. The level climbed to around 40 feet (5 feet above flood stage) by the end of June and remained around that level through July. Flooding in Burt County affect agricultural lowlands, recreation areas, and roads near the river but also forced the evacuation of 150-200 homes. Late in June, the Highway 175 Bridge over the Missouri between Decatur and Onawa was closed due to erosion of the abutment on the Iowa side of the bridge. The flooding persisted into August.

By the end of May, the river at Blair reached its flood stage of 26.5 feet and continued rising through June to over 32 feet. The river fell slightly during July but remained in the moderate category into August. Areas near Fort Calhoun were especially impacted by the flood waters where at least 60 homes or cabins were flooded or cutoff by flood waters. At least 200 residences in the county were evacuated leaving at least 500 people displaced. The high school in Fort Calhoun was opened as a shelter for flood victims. Blair spent $500,000 to build up a levee surrounding its water treatment plant. The Fort Calhoun Nuclear Power Station also was in shut down and emergency sand bagging helped keep flood waters out.

In Douglas County, the river climbed to 29 feet, which is flood stage, at Omaha on May 27th and continued to rise into June. Flooding from the Missouri closed a park and baseball fields on the northwest side of Omaha and low areas around downtown on the river side of the levee began flooding when flood gates were installed. By the end of June at Omaha, the river had reached 35 feet and briefly hit 36 feet in late July. The south Omaha wastewater treatment plant was forced to send 6 million gallons of waste water daily into the river beginning in early June due to flood waters affecting the facility. The high water and persistent pressure on levees forced Eppley airfield and other businesses to constantly monitor the situation and have pumps on standby as either rains, storm sewer backups, or minor boils near the levee would force pumping of the water back over the levee. By June 22nd, Eppley had spent $2.5 million on flood prevention. Burlington Northern Railroad had to shut down one of its tracks to allow it to be used as a levee. Flood waters decreased to 34 feet by mid-August and continued to drop to 31 feet by the end of August. The USACE estimated to have spent a little over $2 million on levee repair work in Omaha during the event. By the end of August, the City of Omaha's tab for the flood fight had totaled $10 million. The river had fallen below flood stage by mid-September.

In Sarpy County, river flooding spread into one park causing its closure and a section of the rail track that Amtrak used had to be closed to allow for its use as a levee during the height of the flooding. The USACE estimated that close to $1 million was spent on levee repair work in Sarpy County during the flooding.

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCDC Storm Events Database since 1996 and the number of historical occurrences. This does not include losses from displacement, functional

downtime, economic loss, injury, or loss of life. Flooding causes an average of $1,496,633 in property damages and $1,109,219 in crop losses per year for the planning area.

Table 91: Flood Loss Estimate

Hazard Type	Number of Events[1]	Number of Events Per Year	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Flood Events	133	6.8	$29,334,000	$1,496,633	$16,638,280	$1,109,219

1 Indicates data from NCDC (January 1996 to July 2015) 2 Indicates data from RMA (2000 to 2014)

PROBABILITY

Based on the historic record and reported incidents by participating communities, there is a 100 percent probability of flooding will occur annually in the planning area.

POTENTIAL LOSSES FROM HAZUS-MH

HAZUS-MH was utilized to determine the potential losses that could occur from a 1 percent annual chance flood event. This section provides detailed information regarding vulnerable populations, potential building losses, economic losses, and potential agricultural losses as provided by the loss estimates.

There are several limitations to this data, including:

- Losses can only be generated for communities participating in the NFIP although all of the participating communities are members of the NFIP
- Communities joined the NFIP at various times since 1978
- The number of flood insurance policies in effect may not include all structures at risk to flooding
- Some of the historic loss areas have been mitigated with property buyouts

Descriptions of potential losses to existing development will include analyses of estimated population displaced, numbers and types of buildings impacted, economic losses, and agricultural losses.

Estimated Population Displaced

Potential losses to the planning area were estimated based on the location of population and building assets in relation to the 1 percent annual chance flood. Population displaced was aggregated from HAZUS-MH data at the census-block level, the most detailed information available from the U.S. Census. Table 92 provides the numbers of people that would be displaced and those that would need shelter in each city. According to this analysis, over 14,000 people in the planning area are at risk of being displaced if a 1 percent annual chance flood impacted their area. The city at highest risk for having the most displaced people is Omaha with 7,030 people displaced.

Table 92: Displaced Populations Resulting from 1 Percent Annual Chance Flood

Jurisdiction	Displaced Population	Population Needing Short-Term Shelter
Burt County	898	294
Decatur	46	32
Tekamah	476	206
Dakota County	704	146
Dakota City	0	0
Homer	0	0
Jackson	0	0

Jurisdiction	Displaced Population	Population Needing Short-Term Shelter
South Sioux City	539	473
Douglas County	8,032	6,840
Bennington	11	1
Omaha	7,030	6,033
Ralston	65	65
Valley	926	741
Waterloo	0	0
Sarpy County	3,528	2,919
Bellevue	143	111
Gretna	6	0
La Vista	21	10
Papillion	139	89
Springfield	13	3
Thurston County	481	137
Walthill	1	0
Winnebago	0	0
Washington County	392	97
Arlington	32	11
Blair	103	76
Fort Calhoun	17	1
Herman	46	5
Planning Area Total	**14,035**	**10,433**

Source: HAZUS-MH

Estimated Building and Economic Losses

To estimate economic losses due to a 1 percent flood chance, HAZUS-MH provides reports on the types and number of buildings impacted, estimates of the building repair costs, and the associated loss of building contents and business inventory, as well as building damage loss ratios. For each county in the planning area, this section provides three sets of analysis reports.

- *Building Counts and Types of Damaged Buildings:* This provides an approximation of the total number of buildings expected to be impacted and is further broken down by usage types. The damaged building counts utilized include any structure that may sustain damage to 1-10% of the structure and up to and including being substantially damaged (i.e. greater than 50% of the structure is damaged). The damaged building counts generated by HAZUS-MH are susceptible to rounding errors and are likely the weakest output of the model due to the use of census blocks for analysis. These numbers should not be used to asses a real, structure-by-structure risk. HAZUS-MH attempts to assess risk with a wider lens, to provide an estimation of risk across an area.

- *Building Damage Loss Ratio:* This is an indication of the community's ability to recover after an event. Building Damage Loss Ratio percent is calculated by taking the Building Structural Damage divided by Building Structural Value (or Building Exposure) and then multiplying by 100. Loss ratios exceeding 10 percent are considered significant by FEMA.

- *Economic Losses:* Building damage can result in additional losses to a community as a whole, by restricting a building's ability to function properly. Income loss data accounts for business interruption and rental income losses, as well as the resources associated with damage repair and employment and housing losses. These losses are calculated by HAZUS-MH using a methodology based on the building damage estimates. There could be errors and inadequacies associated with the hydrologic and hydraulic modeling of the HAZUS-MH model. Flood damage is directly related to the depth of the potential flooding. For example, a two-foot flood generally results in approximately 20 percent damage to the structure, which translates to 20 percent of the structure's replacement value. The planning area's building inventory loss estimates, which are linked to census block geography were separated by jurisdiction, according to the HAZUS-MH analysis results, illustrate how the potential for loss varies across the planning area, on average.

Table 93: Counts and Types of Damaged Buildings (1 Percent Annual Chance Flood)

Jurisdiction	Agriculture	Commercial	Education	Government	Industrial	Religion	Residential	Total
Burt County	0	4	0	0	0	1	82	87
Decatur	0	0	0	0	0	0	16	16
Tekamah	0	1	0	0	0	0	30	31
Dakota County	0	4	0	1	0	0	36	41
Dakota City	0	0	0	0	0	0	0	0
Homer	0	0	0	0	0	0	0	0
Jackson	0	0	0	0	0	0	0	0
South Sioux City	0	4	0	1	0	0	5	10
Douglas County	0	62	0	1	10	1	1,796	1,870
Bennington	0	0	0	0	0	0	0	0
Omaha	0	34	0	1	7	1	962	1,005
Ralston	0	0	0	0	0	0	6	6
Valley	0	0	0	0	3	0	73	76
Waterloo	0	0	0	0	0	0	0	0
Sarpy County	0	6	0	4	0	0	429	439
Bellevue	0	0	0	0	0	0	15	15
Gretna	0	0	0	0	0	0	0	0
La Vista	0	0	0	0	0	0	0	0
Papillion	0	3	0	0	0	0	29	32
Springfield	0	0	0	0	0	0	0	0
Thurston County	0	0	1	0	0	0	11	12
Walthill	0	0	0	0	0	0	0	0
Winnebago	0	0	0	0	0	0	0	0
Washington County	8	0	0	0	0	0	2	10
Arlington	8	0	0	0	0	0	0	8
Blair	0	0	0	0	0	0	0	0
Fort Calhoun	0	0	0	0	0	0	0	0

Jurisdiction	Agriculture	Commercial	Education	Government	Industrial	Religion	Residential	Total
Herman	0	0	0	0	0	0	0	0
Planning Area Total	**8**	**76**	**1**	**6**	**10**	**2**	**2,356**	**2,459**

Source: HAZUS-MH

Table 94: Building Damage Loss Ratio (1 Percent Annual Chance Flood)

Jurisdiction	Building Exposure	Building Damage	Loss Ratio
Burt County	$877,339,000	$25,861,000	2.95%
Decatur	$66,672,000	$3,142,000	4.71%
Tekamah	$205,027,000	$12,619,000	6.15%
Dakota County	$1,825,147,000	$16,458,000	0.90%
Dakota City	$149,803,000	$77,000	0.05%
Homer	$37,180,000	$102,000	0.27%
Jackson	$25,788,000	$1,390,000	5.39%
South Sioux City	$1,166,444,000	$5,878,000	0.50%
Douglas County	$62,074,369,000	$727,576,000	1.17%
Bennington	$200,014,000	$733,000	0.40%
Omaha	$49,315,594,000	$409,812,000	0.83%
Ralston	$732,206,000	$1,929,000	0.26%
Valley	$277,090,000	$9,811,000	3.54%
Waterloo	$95,157,000	$0	0.00%
Sarpy County	$17,598,140,000	$158,317,000	0.90%
Bellevue	$5,204,517,000	$3,286,000	0.06%
Gretna	$494,462,000	$0	0.00%
La Vista	$1,490,356,000	$0	0.00%
Papillion	$2,120,014,000	$14,986,000	0.70%
Springfield	$146,421,000	$596,000	0.41%
Thurston County	$591,232,000	$12,493,000	2.11%
Walthill	$49,786,000	$0	0.00%
Winnebago	$34,348,000	$0	0.00%
Washington County	$2,483,379,000	$6,079,000	0.25%
Arlington	$143,188,000	$22,000	0.02%
Blair	$989,966,000	$848,000	0.09%
Fort Calhoun	$128,681,000	$918,000	0.71%
Herman	$39,585,000	$277,000	0.70%
Planning Area Total	**$85,449,606,000**	**$946,784,000**	**1.11%**

Source: HAZUS-MH

Table 95: Economic Losses (1 Percent Annual Chance Flood)

	Building Loss			Business Interruption				
Jurisdiction	**Building Damage**	**Contents Damage**	**Inventory Loss**	**Relocation Loss**	**Capital Related Loss**	**Wages Loss**	**Rental Income Loss**	**Total**
Burt County	$25,861,000	$34,528,000	$812,000	$12,000	$47,000	$130,000	$6,000	$61,396,000
Decatur	$3,142,000	$2,529,000	$5,000	$2,000	$0	$66,000	$0	$5,744,000
Tekamah	$12,619,000	$17,333,000	$332,000	$3,000	$23,000	$44,000	$2,000	$30,356,000
Dakota County	$16,458,000	$15,315,000	$519,000	$22,000	$7,000	$50,000	$3,000	$32,374,000
Dakota City	$77,000	$119,000	$0	$0	$0	$13,000	$0	$209,000
Homer	$102,000	$89,000	$1,000	$0	$0	$0	$0	$192,000
Jackson	$1,390,000	$809,000	$15,000	$0	$0	$0	$0	$2,214,000
South Sioux City	$5,878,00	$14,382,000	$769,000	$22,000	$36,000	$224,000	$12,000	$21,323,000
Douglas County	$727,576,000	$962,266,000	$31,292,000	$1,103,000	$2,480,000	$3,399,000	$641,000	$1,728,757,000
Bennington	$733,000	$543,000	$10,000	$0	$0	$0	$0	$1,286,000
Omaha	$409,812,000	$602,219,000	$22,871,000	$696,000	$1,687,000	$2,193,000	$395,000	$1,039,873,000
Ralston	$1,929,000	$2,299,000	$21,000	$3,000	$4,000	$9,000	$0	$4,265,000
Valley	$9,811,000	$14,240,000	$890,000	$22,000	$18,000	$133,000	$4,000	$25,118,000
Waterloo	$0	$0	$0	$0	$0	$0	$0	$0
Sarpy County	$158,317,000	$166,702,000	$6,211,000	$192,000	$228,000	$784,000	$95,000	$332,529,000
Bellevue	$3,286,000	$2,552,000	$49,000	$3,000	$0	$1,000	$0	$5,891,000
Gretna	$0	$0	$0	$0	$0	$0	$0	$0
La Vista	$0	$0	$0	$0	$0	$0	$0	$0
Papillion	$14,986,000	$26,359,000	$555,000	$17,000	$82,000	$257,000	$7,000	$42,263,000
Springfield	$596,000	$470,000	$6,000	$0	$0	$0	$0	$1,072,000
Thurston County	$12,493,000	$23,500,000	$449,000	$15,000	$43,000	$187,000	$2,000	$36,689,000
Walthill	$0	$0	$0	$0	$0	$0	$0	$0
Winnebago	$0	$0	$0	$0	$0	$0	$0	$0
Washington County	$6,079,000	$6,428,000	$282,000	$3,000	$1,000	$4,000	$0	$12,797,000
Arlington	$22,000	$25,000	$0	$0	$0	$0	$0	$47,000
Blair	$848,000	$1,049,000	$81,000	$3,000	$0	$1,000	$0	$1,982,000

	Building Loss			Business Interruption				
Jurisdiction	**Building Damage**	**Contents Damage**	**Inventory Loss**	**Relocation Loss**	**Capital Related Loss**	**Wages Loss**	**Rental Income Loss**	**Total**
Fort Calhoun	$918,000	$538,000	$14,000	$0	$0	$0	$0	$1,470
Herman	$277,000	$400,000	$0	$0	$1,000	$2,000	$0	$680,000
Planning Area Total	**$946,784,000**	**$1,208,739,000**	**$39,565,000**	**$1,347,000**	**$2,806,000**	**$4,554,000**	**$747,000**	**$2,204,520,000**

Source: HAZUS-MH

The following table is a summary of the county data available in Tables 93-95.

Table 96: Flood Loss Estimates Summary

County	Building Damage	Displaced Population	Population Needing Shelter	Number of Damaged Buildings	Loss Ratio
Burt	$25,861,000	898	294	87	2.95%
Dakota	$16,458,000	704	146	41	0.90%
Douglas	$727,576,000	8,032	6,840	1,870	1.17%
Sarpy	$158,317,000	3,528	2,919	439	0.90%
Thurston	$12,493,000	481	137	12	2.11%
Washington	$6,079,000	392	97	10	0.25%
Total	**$946,784,000**	**14,035**	**10,433**	**2,444**	**1.11%**

Source: HAZUS-MH

Agricultural Potential Losses

HAZUS-MH also provides estimates on the potential agricultural losses that may be sustained from a 1 percent annual chance flood. Table 97 provides the estimated amount and types of crops available on a preset date of July 1. This date was picked to best determine the 'worst-case scenario' for agricultural losses when fields have been planted and well established by this point in the season.

Table 97: Agriculture Products Dollar Exposure (Average Total Yield)

Jurisdiction	Alfalfa Hay (Ton)	Corn (BU)	Oats (BU)	Soybeans (BU)
Burt County	50,897,469	70,639,499	40,093,786	70,417,358
Decatur	31,520,405	39,537,769	24,829,768	39,411,195
Tekamah	29,205,682	36,634,286	23,006,377	36,517,007
Dakota County	21,246,050	38,611,953	15,535,345	38,076,766
Dakota City	10,119,503	11,007,437	4,792,369	10,854,867
Homer	-	-	-	-
Jackson	20,917,759	23,697,758	9,906,180	23,369,292
South Sioux City	10,119,503	11,007,437	4,792,369	10,854,867
Douglas County	10,028,690	35,111,033	12,824,297	34,457,384
Bennington	-	19,291,113	11,393,009	21,667,485
Omaha	9,953,811	30,558,950	12,793,345	34,323,348
Ralston	-	-	-	-
Valley	9,953,811	11,953,560	-	9,992,671
Waterloo	9,953,811	8,896,729	-	9,992,671
Sarpy County	14,381,660	40,761,585	4,033,455	40,889,070
Bellevue	-	9,456,396	-	9,485,971
Gretna	14,281,557	29,929,137	2,164,069	25,007,104
La Vista	-	-	-	-
Papillion	-	4,945,844	1,749,853	4,961,312
Springfield	10,540,688	15,379,354	-	15,427,454
Thurston County	42,848,902	54,44,485	24,423,934	56,120,454
Walthill	14,177,733	18,001,214	8,081,327	18,568,989

Jurisdiction	Alfalfa Hay (Ton)	Corn (BU)	Oats (BU)	Soybeans (BU)
Winnebago	14,177,733	18,001,214	8,081,327	18,568,989
Washington County	20,839,308	74,776,638	27,071,208	69,124,909
Arlington	2,930,783	5,194,427	2,105,029	4,801,825
Blair	8,558,481	40,482,995	16,405,637	37,423,230
Fort Calhoun	-	25,264,855	10,238,522	23,355,300
Herman	8,558,481	15,168,784	6,147,114	14,022,305
Planning Area Total	**160,242,079**	**259,900,708**	**123,982,025**	**309,085,941**

Source: HAZUS-MH

Table 98 provides the estimated maximum total loss of agricultural crops that could occur during a 1 percent annual chance flood. The maximum total loss is defined as being an agricultural field being flooded for 14 days or longer. Corn would experience the greatest losses with 10.4 percent of total yield loss during a flood. Oats would be second at 9.8 percent total yield loss.

Table 98: Economic Loss for Agriculture Products (Max Total Loss)

Jurisdiction	Alfalfa Hay (Ton)	Corn (BU)	Oats (BU)	Soybeans (BU)
Burt County	5,022,340	9,735,544	5,726,107	8,896,196
Decatur	8,668	19,502	10,158	17,224
Tekamah	5,291	11,904	6,200	10,513
Dakota County	3,643,744	5,021,430	2,308,699	4,437,880
Dakota City	-	-	-	-
Homer	-	-	-	-
Jackson	-	-	-	-
South Sioux City	173,010	187,571	97,163	160,130
Douglas County	-	-	-	-
Bennington	-	23,634	10,777	20,009
Omaha	3,296	443,025	191,370	374,035
Ralston	-	-	-	-
Valley	55,898	136,230	-	54,336
Waterloo	-	-	-	-
Sarpy County	515,659	3,374,245	302,351	2,971,870
Bellevue	-	79,829	-	69,802
Gretna	5,393	13,423	1,422	12,069
La Vista	-	-	-	-
Papillion	-	85,844	11,358	74,502
Springfield	1,658	3,167	-	2,893
Thurston County	2,237,491	3,626,893	1,622,999	3,475,105
Walthill	2,259	2,987	1,433	3,286
Winnebago	117	155	74	170
Washington County	1,900,731	5,195,467	2,156,898	4,463,411
Arlington				

Jurisdiction	Alfalfa Hay (Ton)	Corn (BU)	Oats (BU)	Soybeans (BU)
Blair	9,350	19,177	7,417	15,883
Fort Calhoun	-	454	198	408
Herman	558	1,122	433	3,040
Planning Area Total	**13,319,965**	**26,953,579**	**12,117,054**	**24,244,462**

Source: HAZUS-MH

FUTURE DEVELOPMENT

Any future development in floodplains should be discouraged to protect future assets. Land-use regulations should be used to limit development in floodplains and other flood prone areas as well as a protecting natural flood mitigation features. Buyout programs, which the P-MRNRD has been heavily involved with, can be used to eliminate properties located in floodplains, especially properties that have experienced repetitive losses. Communities may also consider incorporating "Green Infrastructure" to address flooding concerns, and examples of this would include using permeable surfaces for parking areas, using rainwater retention swales, developing rain gardens, developing green roofs, and establishing greenways. Existing structures can be retrofitted to withstand potential flood events by elevating structures and utilities.

The State of Nebraska has adopted floodplain regulations that are more restrictive than the NFIP minimum standards. Nebraska's minimum standards for floodplain management require that all new construction and substantial improvements of residential structures shall have the lowest floor (including basements) elevated to or above one foot above the base flood elevation. The national standard is that new or substantially improved structures shall have the lowest floor elevated to or above the base flood elevation. Additionally, Nebraska does not allow new structures for human habitation to be built in the floodway. The more stringent requirements for the State of Nebraska will help reduce flood impacts and damages by requiring a one foot "freeboard" to allow for known flood hazards. This requirement for Nebraska will also result in lower premiums for those participating in the NFIP.

Future development maps and one percent annual floodplain maps, when available, can be found in each jurisdiction's profile in *Section Seven: Participant Sections*.

REGIONAL VULNERABILITY

A 2008 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 resources 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. Also, elderly residents may suffer from a decrease or complete lack of mobility and as a result, be caught in flood-prone areas.

In order to quantify the types of vulnerable populations that are living in the floodplain in the two counties with the highest population in the planning area, Douglas and Sarpy Counties, further analysis was completed. ArcGIS was utilized to analyze the floodplain area as it compares to median income, percentage of people over 65, and percentage of households below the poverty line. Data from the U.S. Census 2013 5-year estimates and GIS Workshop data of parcel improvements (i.e. a parcel of land with a structure on it) was used to quantify the number of parcels and census block groups in the floodplain. The following table provides the number of census block groups in the floodplain as well as the number of parcels in the census blocks groups that are in the floodplain.

Table 99: Vulnerable Populations in Douglas and Sarpy Counties' Floodplain

	Number of Census Block Groups - Total	Number of Census Block Groups – Only in the Floodplain	Number of Parcels with Improvement Values within Census Blocks in the Floodplain
Median Household Income is < $40,000	169	32	7,356
≥ 25% of Individuals are above 65	44	17	13,413
≥ 20% of population is below poverty line	138	23	36,547

Source: US Census 2013 5-year estimates and GIS Workshop

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

Table 100: 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 -The elderly have decreased mobility -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 -Closed roads and railways would impact commercial transportation of goods
Built Environment	-Buildings damages
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

RISK ASSESSMENT SUMMARY

Table 101: Summary

Number of Past Events	133 or about 7 events/year
Vulnerable Locations	Entire planning area, particularly in the floodplain
Extent	Moderate - Some inundation of structures and roads near streams. Some evacuations of people.
Annual Probability	100%
Averaged Annual Losses	$1,496,633

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Limit or restrict development in flood-prone areas
    - This is common throughout the planning area
- Revise and update floodplain maps
- Manage the Floodplain Beyond Minimum Requirements (i.e. adopting a " no-rise" in base elevation clause for the flood damage prevention ordinance)
    - All new structures in the floodplain are required to elevate above the base flood elevation

- Participate in the NFIP
    - Currently 28 communities participate and there are 2,912 policies
- Participate in CRS
    - Omaha, Papillion, and Valley participate
- Encourage property owners in areas protected by dams and levees to purchase flood insurance
    - This is common throughout the planning area
- Remove existing structures from flood-prone areas
    - P-MRNRD is active in removing repetitive loss properties
    - Nine jurisdictions have repetitive loss properties
- Construct flood control measures
    - P-MRNRD has several projects planned
- Evaluate and update municipal stormwater systems
- Establish education programs to educate the public about the risks of flooding and ways to protect their families and property
    - P-MRNRD has an educational program that talks about flooding
- Preserve natural open spaces in floodplains
- Elevate or retrofit structures and utilities

GRASS/WILDFIRE

HAZARD PROFILE

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, and other vegetated areas. Wildfires differ from other fires by their extensive size, the speed at which they can spread out 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, the zone of transition between developed areas and undeveloped wilderness.

Wildfires are a growing hazard in most regions of the United States, posing a threat to life and property, particularly where native ecosystems meet urban developed areas. 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.

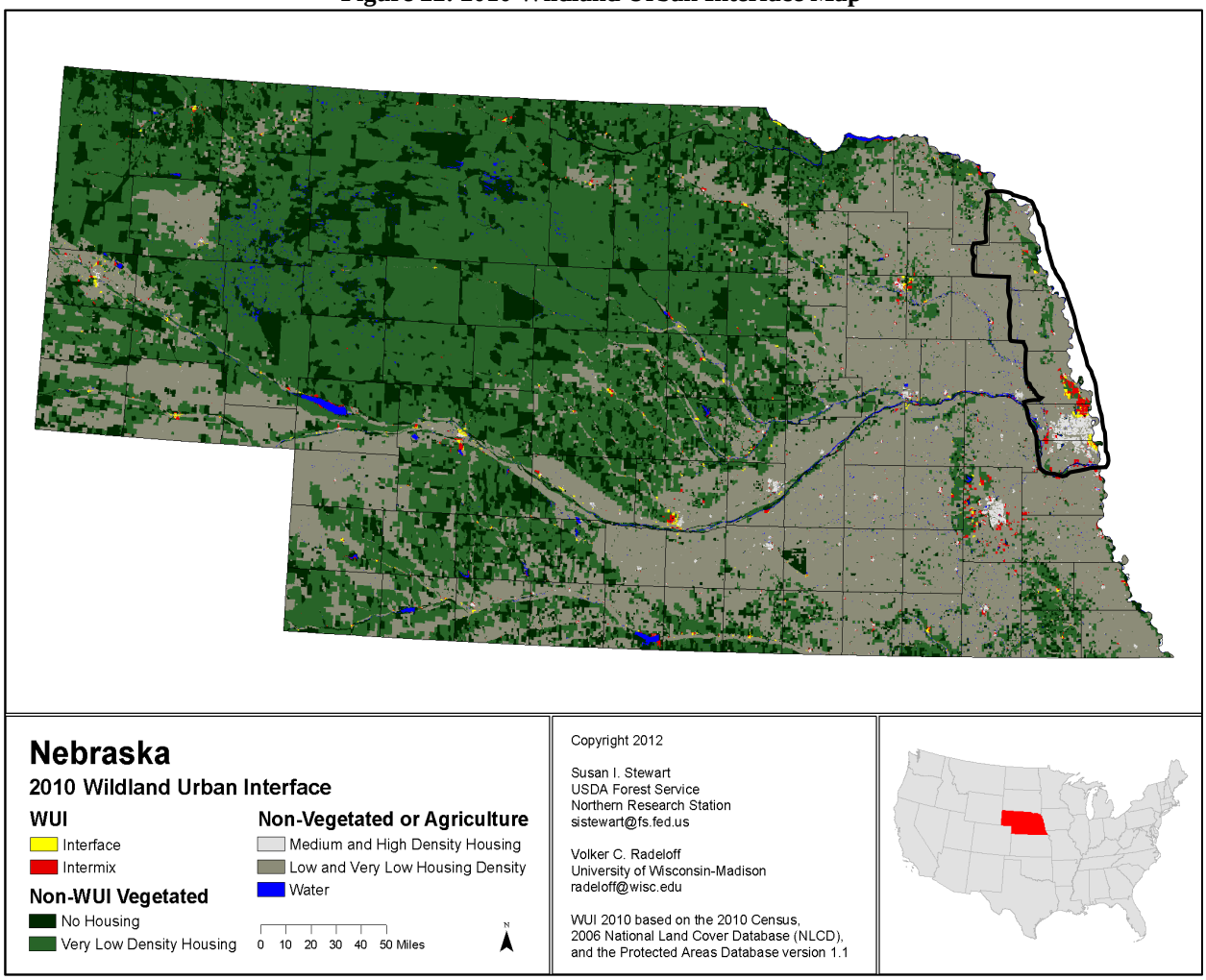
Lightning starts approximately 10,000 ***forest fires*** *each year, yet ninety percent of forest fires are started by humans.*

-National Park Service

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.

In recent decades, as the population of the United States has decentralized and residents have moved farther away from the center of villages and cities, the area known as the wildland urban interface (WUI) has developed significantly, in both terms of population and building stock. The WUI is defined as the zone of transition between developed areas and undeveloped wilderness, where structures and other human development meet wildland. The expansion of the WUI increases the likelihood that wildfires will threaten people and homes, making it the focus of the majority of wildfire mitigation efforts. The following map produced by the USDA Forest Service displays the nation's WUI conditions as of 2010. The approximate location of the planning area is indicated by the black outline. Areas that are indicated by the WUI (Figure 22), either interface (yellow) or intermix (red) are in portions of Douglas and Sarpy Counties, eastern Washington County and parts of eastern Thurston County. The rest of the planning area is located in a non-WUI vegetated designated area, with no or low density housing with a mix of vegetated, non-vegetated, and agricultural land.

Figure 22: 2010 Wildland Urban Interface Map



Source: University of Wisconsin SILVIS Lab (http://silvis.forest.wisc.edu/maps/wui/2010/download)

Based on the Nebraska Forest Service's 'Wildfire by Cause' report, the most common causes of wildfires include lightning, debris burning, equipment use, and arson.

LOCATION

As the WUI indicates and also by the number of reported wildfires by county, the greatest threat of wildfire that could impact people and homes is in portions of Douglas and Sarpy Counties, the eastern portion of Washington County, and eastern Thurston County.

Table 102: Reported Wildfires by County

County	Reported Wildfires	Acres Burned
Burt County	103	5,590.2
Dakota County	48	1,419.4
Douglas County	258	2,526.3
Sarpy County	120	202.2
Thurston County	376	5,043.4
Washington County	250	5,528.0
Total	**1,155**	**20,309**

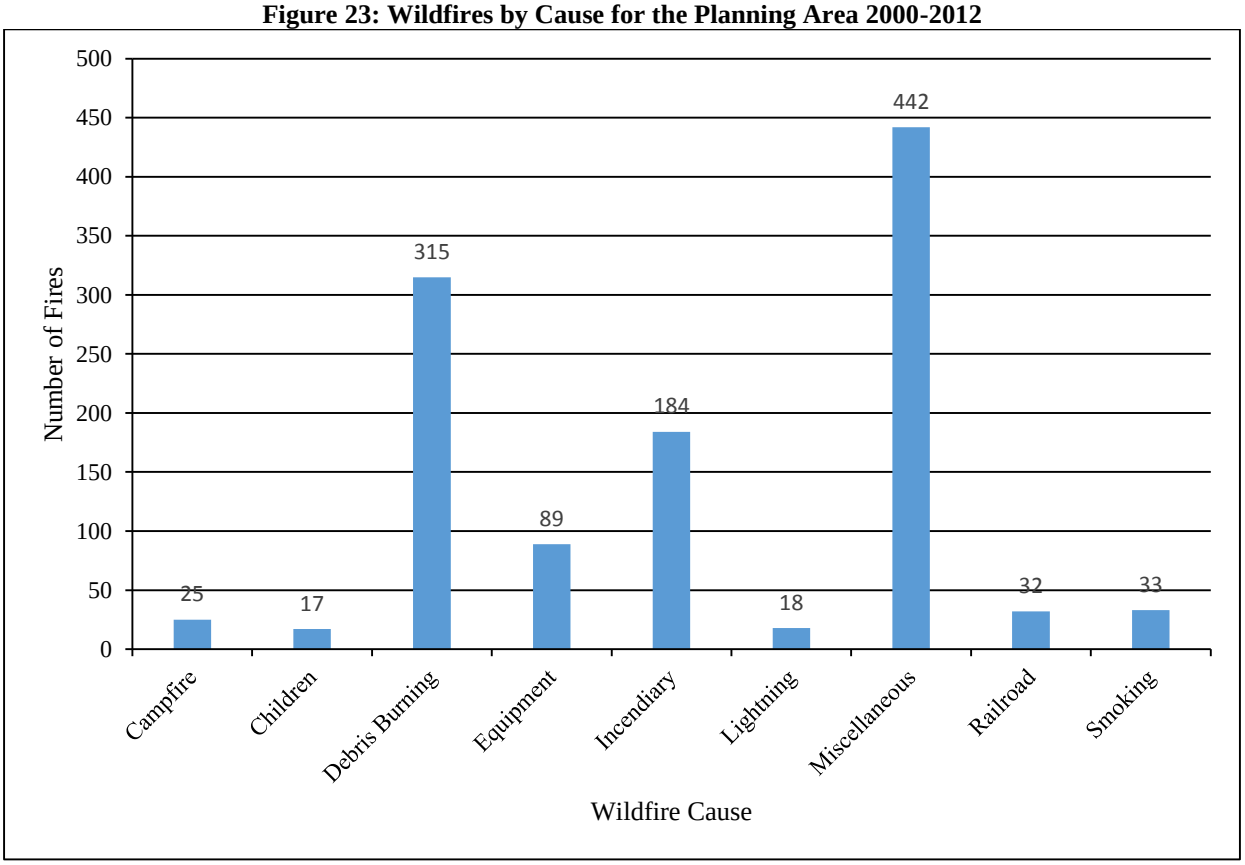
Source: Nebraska Forest Service, 2000-2012

EXTENT

Figure 23 illustrates the number of wildfires by cause in the planning area from 2000 to 2014, which burned 20,309 acres in total. There were 1,155 reported wildfires in the planning area between 2000 and 2014. Forty of the fires burned 100 acres or more, with the largest wildfire burning 3,500 acres in Burt County in February 2000.

Wildfires are most likely to be started by miscellaneous causes (38%). Debris burning (27%) and incendiary (16%) are the second and third leading causes of fires in the planning area. Most wildfires that occur in the planning area will likely be kept to under 100 acres.

Figure 23: Wildfires by Cause for the Planning Area 2000-2012

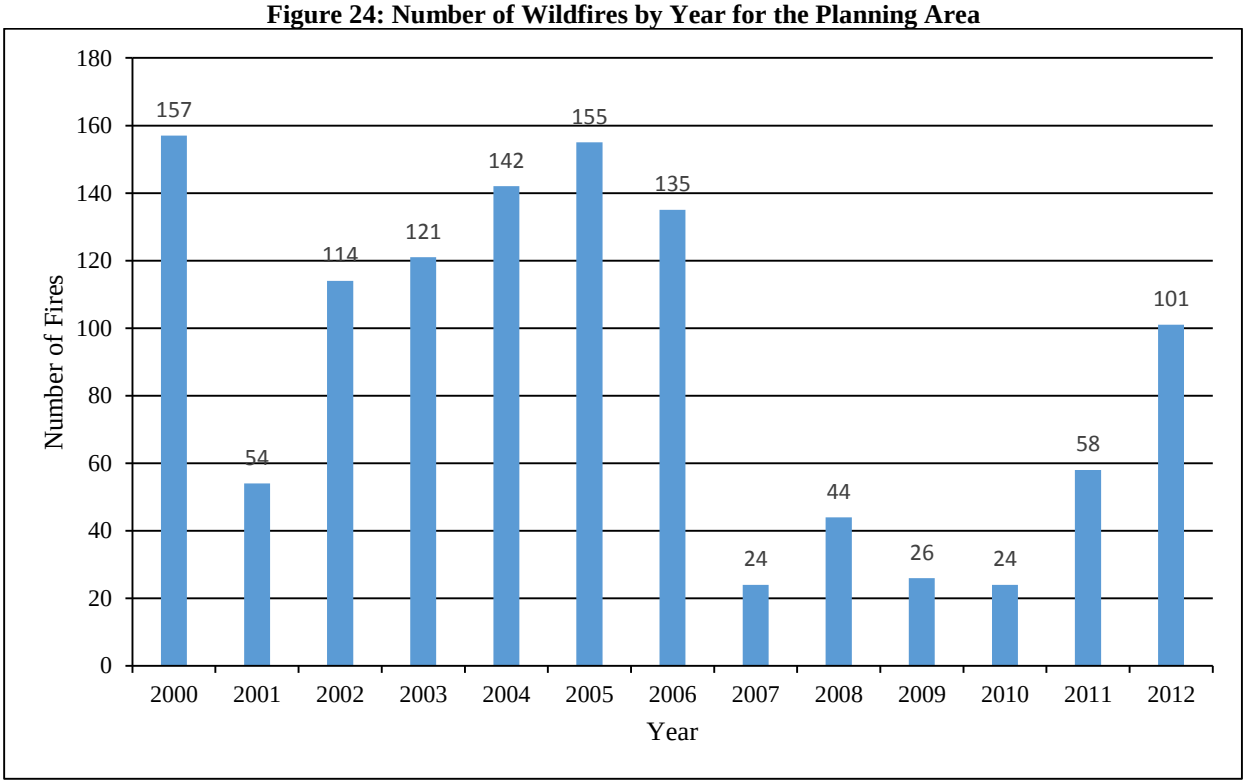


Source: Nebraska Forest Service

HISTORICAL OCCURRENCES

For the planning area, there were 1,155 reported wildfires by 28 different fire departments according to the NFS from 2000 to 2012. The reported events burned 17,826 acres of range land, 109 acres of forest land, and 2,377 acres of crop land. The reported fire events caused $184,238 in crop damages according to the NFS.

Figure 24: Number of Wildfires by Year for the Planning Area



Source: Nebraska Forest Service

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon U.S. Forest Service wildfires database from 2000 to 2012 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. During the 13 year period, wildfires caused no damages in property damage, and $14,172 per year in crop damage in the planning area.

Table 103: Wildfire Loss Estimation

Hazard Type	Number of Events[2]	Events Per Year	Total Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Grass/Wildfires	1,155	88.9	$0	$184,238	$14,172

1 Indicates data is from NCDC (1996-2015); 2 Indicates data is from NFS (2000 to 2012)

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 or about 89 wildfires happening in the planning area each year.

FUTURE DEVELOPMENT

Future development in the wildland urban interface would increase vulnerability to this hazard, particularly in Douglas, Sarpy, and Washington Counties where population growth is anticipated to continue. Communities that are particularly at risk are Omaha, Bellevue, Fort Calhoun, and Blair.

REGIONAL VULNERABILITIES

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

Table 104: Regional Wildfire Vulnerabilities

Sector	Vulnerability
People	-Risk of injury or death -Displacement of people and loss of homes -Lack of transportation poses risk to low income individuals, families, and elderly
Economic	-Loss of businesses
Built Environment	-Property damages
Infrastructure	-Transportation routes may be closed -Damage to power lines
Critical Facilities	-Risk of damages
Other	-Increase chance of landslides and erosion -May lead to poor water quality

RISK ASSESSMENT SUMMARY

Table 105: Summary

Number of Past Events	1,155 (~88.9 events/year)
Vulnerable Locations	Portions of Douglas, Sarpy, Thurston, and Washington Counties
Extent	Most wildfires will be <100 acres
Annual Probability	100%
Averaged Annual Losses	Property = $0; Crop = $14,172

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- New municipal wells
- Civil service improvements (New fire trucks)
- Educate property owners about wildfire mitigation techniques
- Wildland fire fighting training for fire departments

HAIL

HAZARD PROFILE

Hail is usually associated with severe thunderstorms, and this association makes hail just as unpredictable as a severe thunderstorm. 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 in the planning area usually occur in the evening during the spring and summer months. These often large storms can include heavy rain, hail, lightning, high winds, and can produce tornados with little or no advanced warning. Furthermore, hail can destroy property and crops with their shear force as some hail stones can fall at 100 mph.

The moisture from the thunderstorms that are 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, 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 TORRO scale is used to classify hailstones and provides some detail related to the potential impacts from hail. Table 106 outlines the TORRO Hailstone Scale.

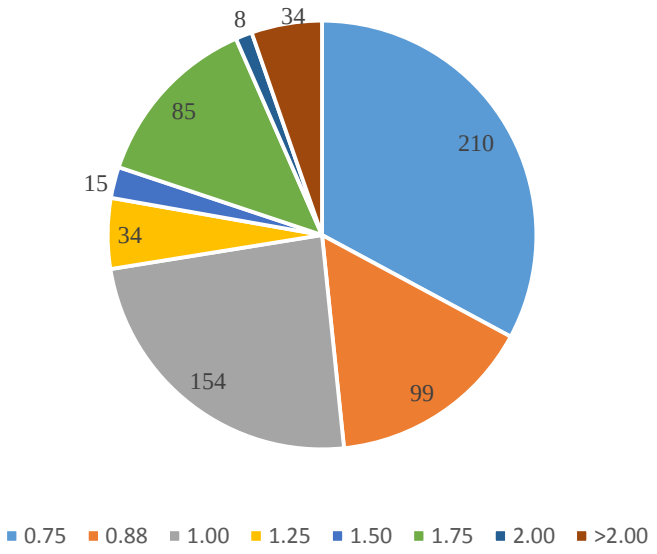
Table 106: TORRO Hail Scale

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

Source: TORRO

Of the 641 hail events reported for the planning area, the average hailstone size is 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 occurrence, to expect larger hailstones to occur in the planning area annually. The planning area has endured six H10 hail events (>4.0 inches) during the period of record. For this area it is realistic to expect an H6 event (2.0-2.4 inches) or larger to occur approximately every year in the planning area. Figure 25 shows hail events based on the size of the hail.

Figure 25: Hail Events by Size



Source: NCDC, 1996--2015

HISTORICAL OCCURRENCES

The NCDC reports events as they occur in each community. A single hail event can affect multiple communities and counties at a time; the NCDC 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 that could be reported by the NCDC as several events. The NCDC reports a total of 641 hail events in the planning area between 1996 and 2015. These events were responsible for $52,157,000 in property damages and $30,477,259 in crop damages. These events resulted in two injuries and no fatalities.

The property damages total does not include the damages that occurred during the June 3, 2014 hail storm event because data is not available at this time. A severe thunderstorm moved through Blair and Fort Calhoun with hail ranging from 2.5 – 4.75 inches. Local planning teams from this area reported the destructive hail damaged homes, buildings, and vegetation across much of Blair and portions of Fort Calhoun. Siding, gutters and downspouts, roofs, windows, cars, etc. were severely damaged. Woodhouse Auto Family Car Dealership in Blair had 4,300 vehicles parked outside during the event and every single vehicle was damaged. This dealership alone estimated $162 million damages from this one hail event.

Hail events from NCDC reported by each community are listed in the participant sections in *Section Seven: Participant Sections*.

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was based on the NCDC 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 107: Hail Loss Estimate

Hazard Type	Number of Events[1]	Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Hail Events	641	32.7	$52,157,000	$2,661,071	$30,477,259	$2,031,817

1 Indicates the data is from NCDC (January 1996 to July 2015); 2 Indicates data is from USDA RMA (2000 to 2014)

PROBABILITY

Based on historic records and reported events, severe thunderstorms with hail are likely to occur several times annually within the planning area. The NCDC reported 641 hail events between 1996 and 2015, or on average 63 hail occurrences per year.

FUTURE DEVELOPMENT

Future development will increase the risk of damages to buildings and infrastructure from hail. It is recommended that hail resistant materials and hail guards for HVAC systems be considered during construction and renovations. Building codes can be enhanced so that they require or recommend the use of hail resistant material as well. Existing structures can also incorporate hail resistant products such as concrete roof tiles and siding. Communities can also establish Tree Boards and tree ordinances to ensure urban canopies are safe and healthy, reducing the potential impacts of severe thunderstorms.

REGIONAL VULNERABILITIES

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

Table 108: Regional Hail Vulnerabilities

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

RISK ASSESSMENT SUMMARY

Table 109: Summary

Number of Past Events	641 or about 33 events/year
Vulnerable Locations	Entire planning area
Extent	H3 (0.80-1.00 inches)
Annual Probability	100%
Averaged Annual Losses	Property=$2,661,071; Crop=$2,031,817

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Continue to participate, or become a participant, in Tree City USA; establish a tree maintenance ordinance
- Establish a tree board to assist in the development of a tree management program
    - This is a requirement of Tree City USA
- Bury power and service lines
    - Many communities have buried some of their power lines
- Establish community severe weather warning protocols
    - Most communities follow National Weather Service protocols
- Incorporate text messaging into severe weather messaging programs
- Incorporate cable TV interruption warning systems
- Purchase and issue weather radios to critical facilities and vulnerable populations
    - Most communities have weather radios and four are interested
- Establish mutual aid agreements with neighboring communities and privately owned businesses
    - Agreements exist between most communities
- Establish public education programs to increase awareness of the dangers posed by hail events and ways the public can mitigate the potential impacts
    - Most county emergency managers have some education programs
- Establish data recovery program and backup program for municipal employees
- Use of hail resistant materials
    - Some jurisdictions have hail resistant roofing and hail guards on A/C units on critical facilities

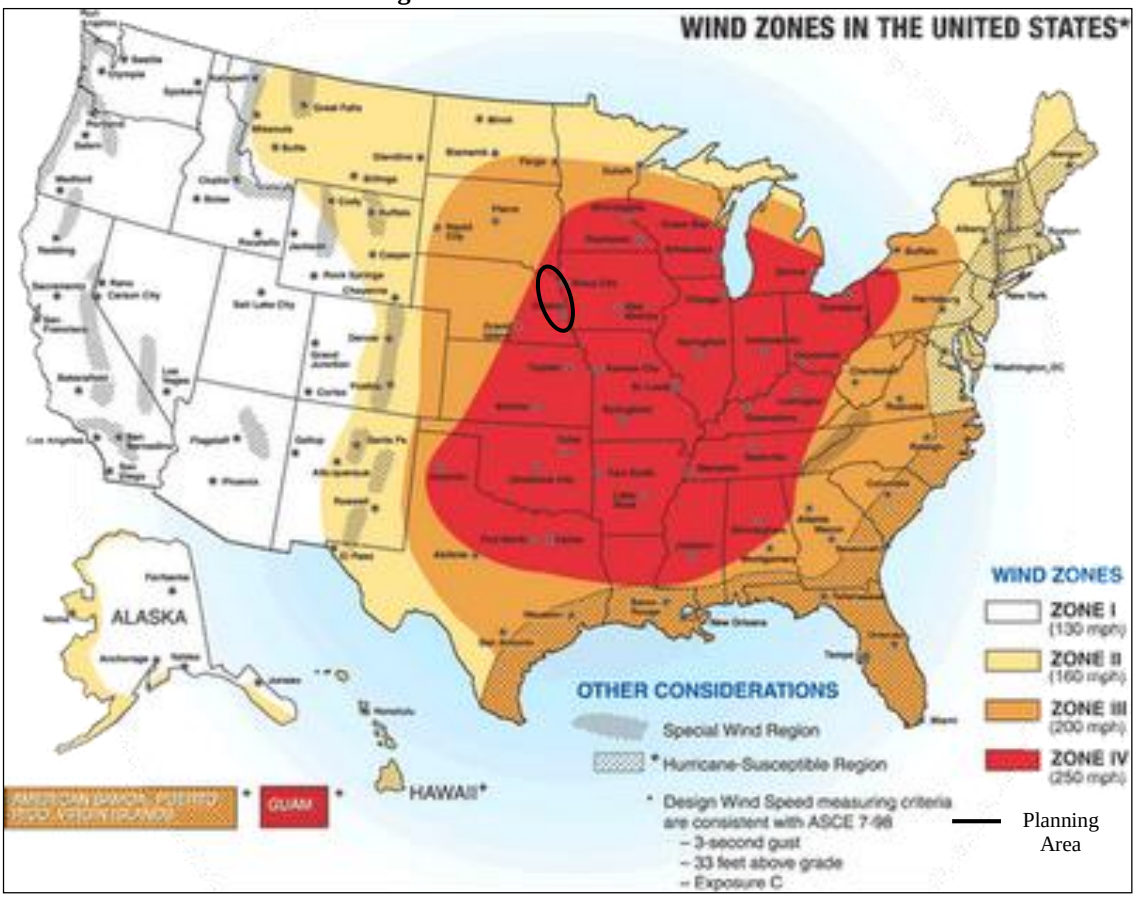
HIGH WINDS

HAZARD PROFILE

High winds typically accompany severe thunderstorms, severe winter storms, and other large low pressure systems, which can cause significant property and crop damage, downed power lines, loss of electricity, obstruction to traffic flow, and significant damage to trees and center-pivot irrigation systems. All building stock and above ground infrastructure, including critical facilities, are at risk of being damaged or affected by high winds. High wind speeds and flying debris can pose a significant threat to human life.

Figure 26 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 IV which has maximum winds of 250 mph equivalent to an EF5 tornado.

Figure 26: Wind Zones in the U.S.



Source: FEMA

LOCATION

High winds commonly occur throughout the planning area. Rural, agricultural areas are at a greater risk of damages than the developed areas based on total crop damages versus property damages (see Historical Occurrences).

EXTENT

The 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. The NWS issues High Wind Advisories when there are

sustained winds of 25 to 39 miles per hour and/or gusts to 57 mph. The Beaufort Wind Scale can be used to classify wind strength. Table 110 outlines the scale, providing wind speed ranking, range of wind speeds per ranking, and a brief description of conditions for each ranking.

Table 110: Beaufort Wind Ranking

Beaufort Wind Force Ranking	Range of Wind Speeds	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

Using the NCDC reported events, the most common high wind event is a level 9. The reported high wind events had an average of 50 mph winds. It is likely that this level of event will occur several times annually.

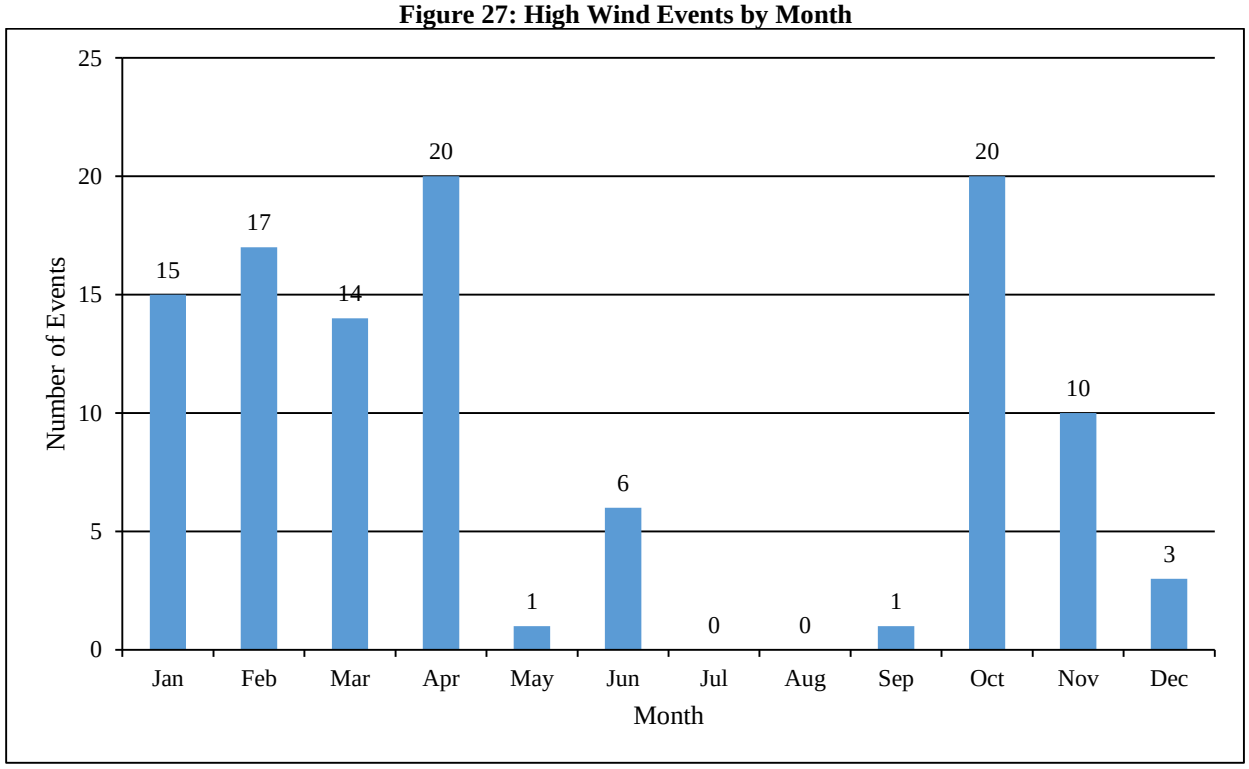
HISTORICAL OCCURRENCES

Due to the regional scale of high winds, the NCDC reports events as they occur in each county. While a single event can affect two or more counties at a time, the NCDC reports them as separate events.

There were 107 high wind events that occurred between January 1996 and July 2015. As seen in Figure 27, most high wind events occur in the fall, winter, and spring months. One fatality and one injury were reported. The fatality occurred when sustained winds of 20-40 mph with gusts up to 70 mph on April 25, 1996 caused a 65 foot tree to topple onto a 13 year old boy playing outside in Omaha. The injury occurred in Decatur (Burt County) when a roof of a building under construction blew on top of his house causing substantial damage.

Furthermore, these recorded events caused a total of $230,000 in property damages. Crop damages total $6,435,481 as a result of a high wind events in the planning area. These events from NCDC reported by county are listed in the county participant sections in *Section Seven: Participant Sections*.

Figure 27: High Wind Events by Month



Source: NCDC

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCDC 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 $11,795 per year in property damage, and an average of $49,682 per year in crop damage for the planning area.

Table 111: High Wind Loss Estimate

Hazard Type	Number of Events[1]	Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
High Winds	107	5.5	$230,000	$11,735	$745,230	$49,682

1 Indicates the data is from NCDC (January 1996 to July 2015); 2 Indicates data is from USDA RMA (2000 to 2014)

PROBABILITY

Based on historical records and reported events, it is likely that high winds will occur within the planning area several times annually. For the 19.6 years examined, there were 107 reported high wind events reported.

FUTURE DEVELOPMENT

There are some changes that communities can make to partially mitigate against strong winds. Building codes for new structures can be strengthened, requiring increased rebar in foundations, enhanced nailing patterns for wall sheathing, and the use of Simpson Strong Ties and Straps. Building codes can also be strengthened to require the use of anchors and tie-downs on mobile homes. Additionally, individuals can choose to build to an optional Code Plus Standard, such as Fortified for Safer Living. Safe rooms can be installed in new structures as well as made to adapt to existing structures. In-ground safe rooms can be

installed in existing structures for as little as $4,000. The installation of public safe rooms in areas around vulnerable populations, such as mobile home parks, can increase safety of residents in those areas.

REGIONAL VULNERABILITIES

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

Table 112: Regional Vulnerabilities

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

RISK ASSESSMENT SUMMARY

Table 113: Summary

Number of Past Events	107 or about 5.5 events/year
Vulnerable Locations	Entire planning area
Extent	Level=9 or an average 50 mph
Annual Probability	100%
Averaged Annual Losses	Property=$11,735 and crop=$49,682

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Bury overhead power lines
  - Many communities have started to bury power lines
- Continue to participate, or become a participant, in Tree City USA; establish a tree maintenance ordinance
  - Many communities participate or are interested in participating
- Establish a Tree Board to assist in the development of a tree management program
  - This is a requirement of Tree City USA
- Encourage the construction of safe rooms
- Enhance building codes to incorporate wind –resistant building techniques
  - State requires home to be built to withstand winds of 130 mph which is what most jurisdictions require
- Establish data recovery program and backup program for municipal employees

LEVEE FAILURE

HAZARD PROFILE

According to FEMA on their website:

> "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 often occur is when the levee 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 nine federal levees that are located within the planning area as reported in FEMA Region VII. There are five levees in Douglas County, two levees in Sarpy County, and two levees in Thurston County. See Figure 28 and Table 114 for levee protected areas in the planning area. Additionally, there are levees located along the West Papio and Big Papio Creeks, which are sponsored by the P-MRNRD.

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.

Figure 28: Leveed Areas in the Planning Area

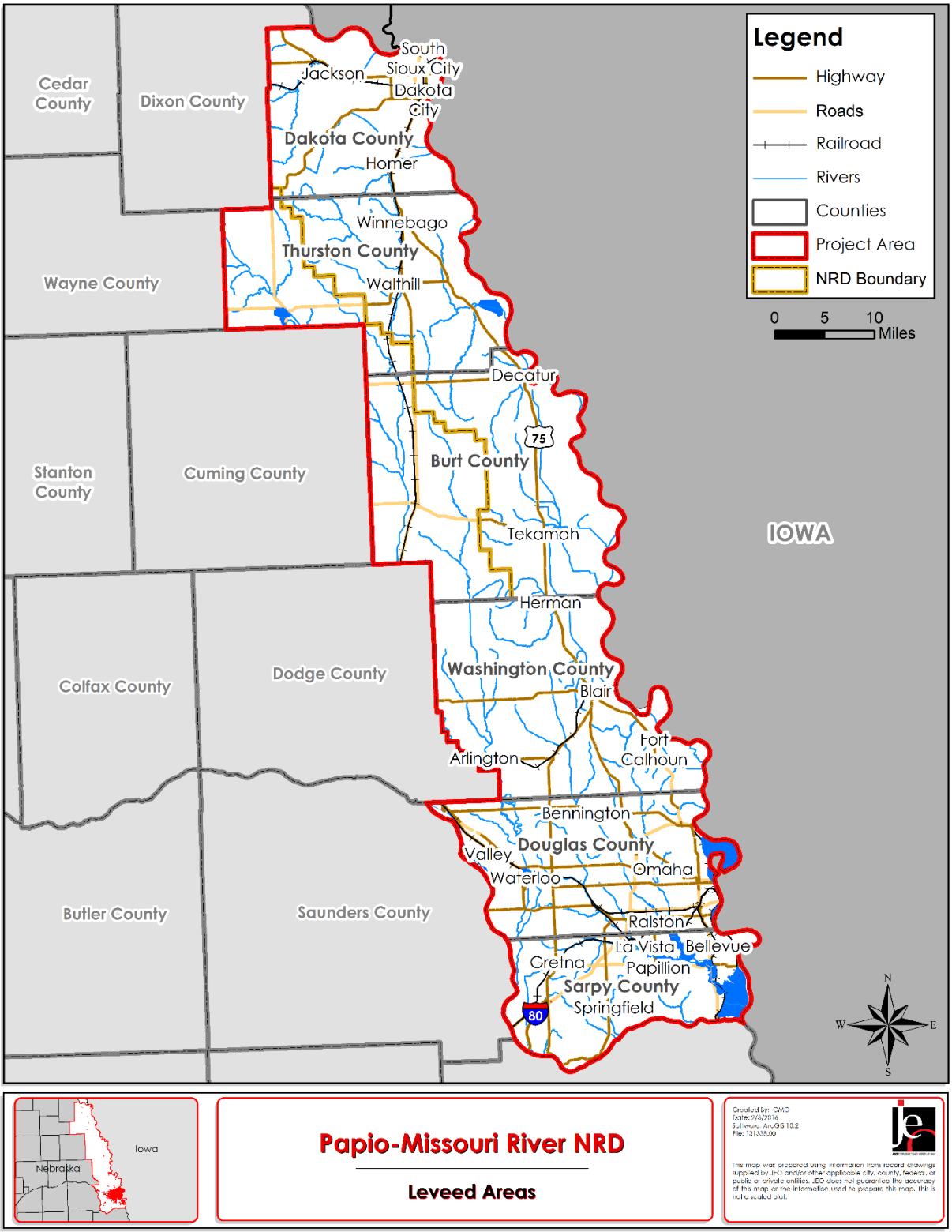


Table 114: P-MRNRD Levees

Name	Sponsor	City	County	River	Length (miles)	Type of Protection	Protected Area (sq miles)	Approximate Level of Protection
No-Name Dike	P-MRNRD	Valley	Douglas	Platte	2.3	Agriculture	25-49	50-99 year flood
Union Dike	P-MRNRD	Valley	Douglas	Platte	10	Urban	25-49	50-99 year flood
Omaha Channel Improvements	P-MRNRD	Omaha	Douglas	Little Papio Creek	6.9	Urban	25-49	0-24 year flood
Omaha FPP	City of Omaha	Omaha	Douglas	Missouri	12.76	Urban	5-24	100-500 year flood
Waterloo	Village of Waterloo	Waterloo	Douglas	Elkhorn	3.4	Urban	25-49	100-500 year flood
MR R-613	P-MRNRD	Bellevue	Sarpy	Missouri	13.9	Urban	25-49	100-500 year flood
MR R-616	P-MRNRD	Bellevue	Sarpy	Missouri	4.5	Urban	25-49	100-500 year flood
Macy FCP	Omaha Tribe of Nebraska	Macy	Thurston	Blackbird	4.9	Agriculture	25-49	50-99 year flood
Pender*	Village of Pender	Pender	Thurston	Logan Creek	2.9	Urban	25-49	100-500 year flood

*Source: P-MRNRD HMP 2011 and USACE Levee Database; *Outside NRD area*

EXTENT

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

Table 115: 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

Of the nine federal levees in the planning area, none of them received an Acceptable rating. Eight were rated Minimally Acceptable and the ninth, Macy FCP, was rated Unacceptable.

Macy FCP Levee

The Unacceptable rating for the Macy levee was a result of issues observed at the time of the inspection, which occurred on May 19, 2015, that threatened the integrity of the system during the next flood event. The following items warranted the rating of Unacceptable as USACE Periodic Inspection Report (PI) from August 28, 2015 states:

Table 116: Macy Levee PI Unacceptable Rating

Feature Category	Inspection Item
General Items	Operations and Maintenance Manuals
Levee Embankments	-Unwanted Vegetation Growth -Depressions/Rutting -Animal Control
Flood Damage Reduction Channel	Erosion

Source: USACE PI, August 2015

The PI goes on to identity additional deficiencies that must be corrected to prevent conditions from deteriorating further and to improve levee safety. These deficiencies are listed in the following table:

Table 117: Macy Levee PI Deficiencies

Feature Category	Inspection Item
General Items	-Emergency Supplies and Equipment -Flood Preparedness and Training
Levee Embankments	-Encroachments -Riprap Revetments & Bank Protection
Flood Damage Reduction Channels	-Vegetation and Obstructions -Shoaling (Sediment Deposition) -Encroachments -Riprap Revetments & Banks

Source: USACE PI, August 2015

FEMA Accreditation

In 2004, as it initiated work under the Flood Map Modernization Initiative (Map Mod), FEMA determined that analysis of the role of levees in flood risk reduction would be an important part of the mapping efforts. A report issued in 2005 noted that the status of the Nation's levees was not well understood and the condition of many levees and floodwalls had not been assessed since their original inclusion in the NFIP. As a result, FEMA established policies to address existing levees. As DFIRMs are developed, levees fall under one of the three following categories:

1) Accredited Levee - With the exception of areas of residual flooding (interior drainage), if the data and documentation specified in 44 CFR 65.10 is readily available and provided to FEMA, the area behind the levee will be mapped as a moderate-risk area. There is no mandatory flood insurance purchase requirement in a moderate-risk area, but flood insurance is strongly recommended.

2) Provisionally Accredited Levee (PAL) - If data and documentation is not readily available, and no known deficiency precludes meeting requirements of 44 CFR 65.10, FEMA can allow the party seeking recognition up to two years to compile and submit full documentation to show compliance with 44 CFR 65.10. During this two-year period of provisional accreditation, the area behind the levee will be mapped as moderate-risk with no mandatory flood insurance purchase requirement.

3) De-Accredited Levees – If the information established under 44 CFR 65.10 is not readily available and provided to FEMA, and the levee is not eligible for the PAL designation, the levee will be de-accredited by FEMA. The area behind the levee will be mapped as a high risk area, subject to mandatory flood insurance purchase.

Two levees, MR R-613 and MR R-616, which protect southeastern Bellevue, are currently at risk of losing their FEMA accreditation and have received a PAL. These levees provide protection for a significant number of infrastructure including Offutt Air Force Base, the City of Omaha's Papillion Creek Wastewater Treatment Plant, major transportation corridors, Highway 34 bridge access, Union Pacific Railroad and Burlington Northern Railroad lines, and residential areas. A loss of accreditation from FEMA would lead to a loss of protection from the 1 percent annual flood on FEMA's FIRMs unless the levees are significantly

reconstructed and upgraded to meet FEMA's requirements. It is estimated that the total cost of construction and upgrades will be $25 million. The P-MRNRD has proposed a cost share agreement with the City of Omaha, City of Bellevue, and Sarpy County to fund the needed modifications. The P-MRNRD will also request funds through the Nebraska State Water Sustainability Fund.

The P-MRNRD has hired independent engineering consultants to evaluate and analyze the problem and design the needed improvements. The Corps of Engineers will review the work to ensure that it meets criteria and their approval. As of the fall of 2015, the design work is near completion and has applied for 404 and 408 permits from the USACE. The P-MRNRD anticipates that construction on the levees will begin in late summer or early fall of 2016, and the total construction time will take about two years.

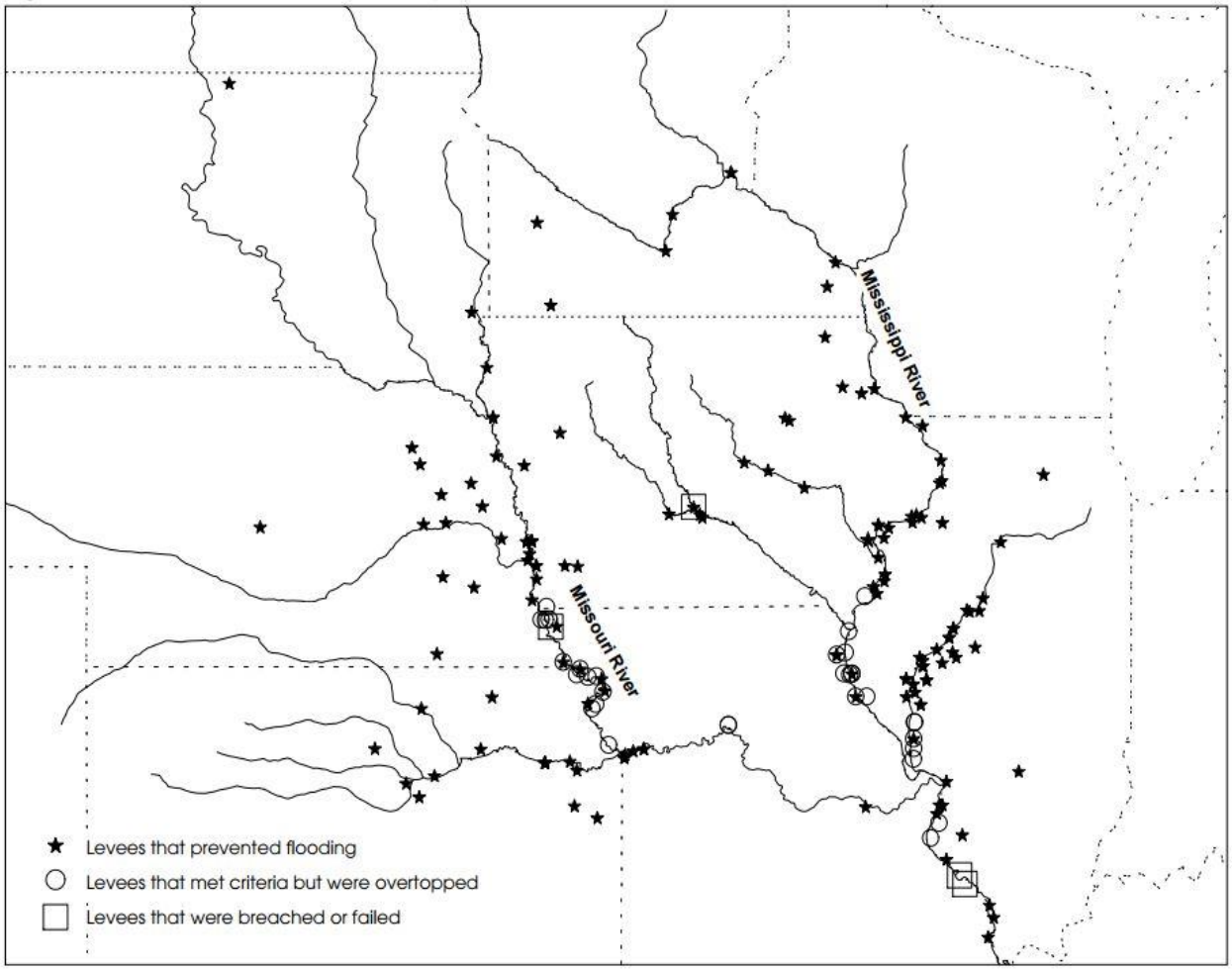
HISTORICAL OCCURRENCES

Levees along the Missouri River were tested by the 1993 and 2011 floods and have not been breached.

The Union Dike levee and the right bank levees in Douglas County have been breached numerous times during past flood events. Following the 1978 flood event, substantial improvements to the Union Dike levee system were recommended. These improvements were completed in 1990 and the levee withstood the March 1993 flood.

According to the USACE, the levees in the planning area withstood the 1993 and 2011 floods. Figure 29 shows the location and performance of USACE levees during the 1993 flood. According to this depiction, USACE levees on the Platte and Missouri Rivers north of the Platte River did not fail or overtop.

Figure 29: Levee Performance during the 1993 Midwest Flood



Source: Midwest Flood Information on the Performance, Effects, and Control of Levees, US-GAO August 1995

POTENTIAL LOSSES

To determine potential losses for levee failure, structural inventory from the levee breach areas was utilized. Structural inventory from GIS Workshop, which is hired by many counties to manage their GIS data such as county assessor data, was utilized for this estimation for Thurston County. Douglas and Sarpy Counties manage their own GIS data including the County Assessor data, which is why the data is in a different format. "Structures" for Thurston County are defined as any non-zero improvement value from the database. The following table summarizes the number and total value of structures in the federal levee breach areas that are at risk to a levee failure. A total of 3,244 structures are located in the levee protected areas and are at risk of loss if a breach was to occur. The total value of these structures across three counties is $1,050,651,508.

Table 118: Potential Losses in Levee Breach Area

DOUGLAS COUNTY			
Structures in Levee Breach Area		**Structure Valuation**	
Structure Type	**Number of Structures**	**Average Value**	**Total Value**
Rural Residential	5	15,290	$764,500
Residential	1,038	66,499	$69,025,500
Multiple Residential	24	143,970	$3,455,300
Multiple Comm	21	216,752	$45,518,000
Industrial	216	107,228	$231,601,300
Commercial	212	1,542,938	$327,102,900
Agricultural	8	92,825	$742,600
TOTAL STRUCTURES	**1,524**	**-**	**$678,210,100**
SARPY COUNTY			
Structure Type	**Number of Structures**	**Average Value**	**Total Value**
Ag-Trust	60	224,466	$13,467,977
Commercial	210	1,093,102	$229,551,523
Exempt	65	29,034	$1,887,221
Farm	97	248,030	$24,058,864
Unknown	74	9,475	$701,133
Residential	425	142,518	$60,570,212
Other	2	11,429	$22,828
TOTAL STRUCTURES	**933**	**-**	**$330,259,758**
THURSTON COUNTY			
"Structure Type"	**Number of "Structures"**	**Average Value**	**Total Value**
Improvements	253	10,881	$2,752,790
Outbuildings	534	73,837	$39,428,860
TOTAL STRUCTURES	**787**	**-**	**$42,181,650**

PROBABILITY

The Union Dike levee had been breached several times in the past, but following the 1978 flood, substantial improvements were recommended and were completed in 1990. Since the levee withstood the 1993 flood, no other breaches or failures have occurred to federal levee systems in the P-MRNRD. Thus, levee failure has a low probability of occurring in the future. For the purpose of this plan, the probability of levee failure will be stated as one percent annually.

FUTURE DEVELOPMENT

Additional development in the areas protected by federal levees would increase the vulnerability of this hazard.

REGIONAL VULNERABILITIES

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

Table 119: Regional 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	-Offutt Air Force Base provides a $1.5 billion annual economic impact to the metro area economy and employs over 10,000 people -Business and industry protected by levees are at risk
Built Environment	-All buildings within levee protected areas are at risk to damages
Infrastructure	-Major transportation corridors and bridges at risk to levee failure
Critical Facilities	-Critical facilities such as the Papillion Creek Wastewater Treatment Facility are at risk if located in levee protected areas

RISK ASSESSMENT SUMMARY

Table 120: Summary

Number of Past Events	Union Dike levee breached several times but was improved in 1990
Vulnerable Locations	Levee protected areas
Extent	3,244 number of parcels
Annual Probability	1%
Potential Losses	$1,050,651,508

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Evacuation plan
- Encourage structures protected by levees to purchase flood insurance
- Education on the potential impacts of a levee failure
- P-MRNRD hired independent engineering consultants to evaluate levees

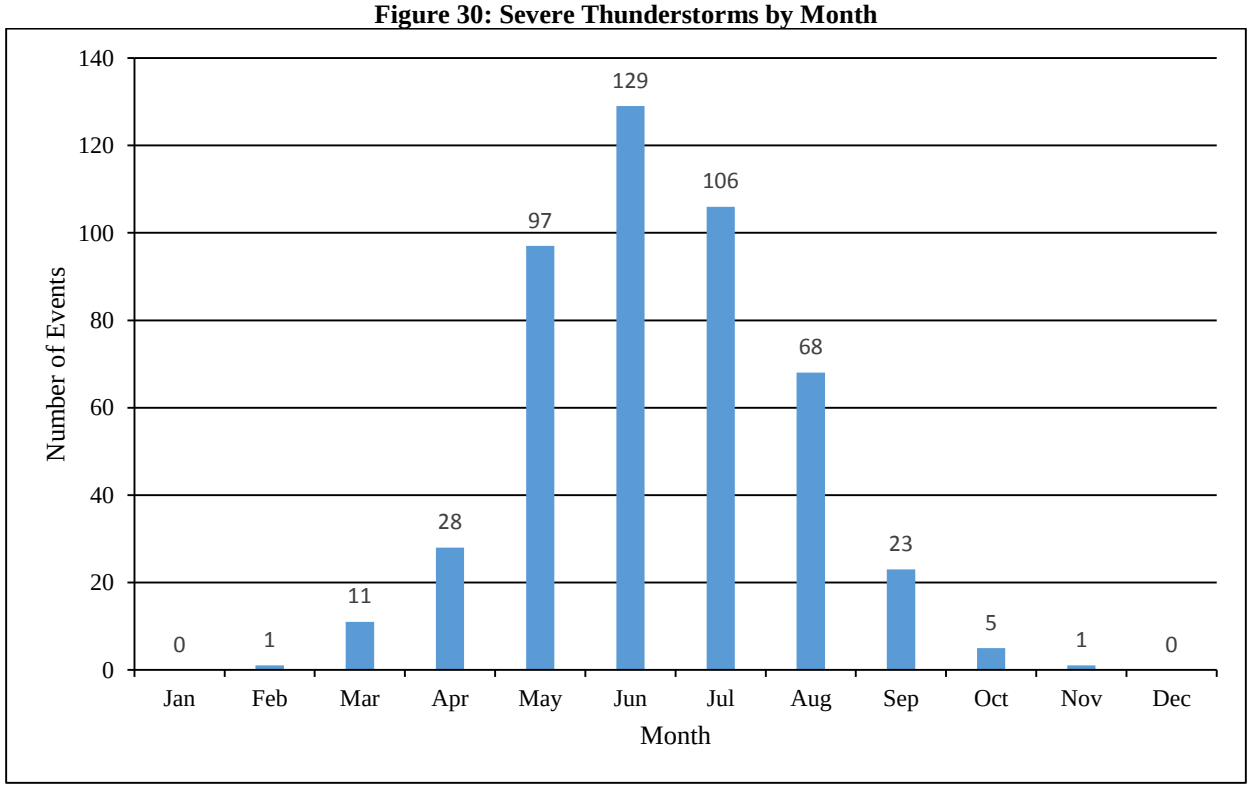
SEVERE THUNDERSTORMS

HAZARD PROFILE

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

Severe thunderstorms in the planning area usually occur in the afternoon and evening during the spring and summer months (Figure 30). These often massive storms can include heavy rain, hail, lightning, high wind, and can produce tornados with little or no advanced warning. Furthermore, heavy rains can cause flooding, lightning can cause wildfires, and high winds can down trees, cause power outages, and destroy property with their shear force.

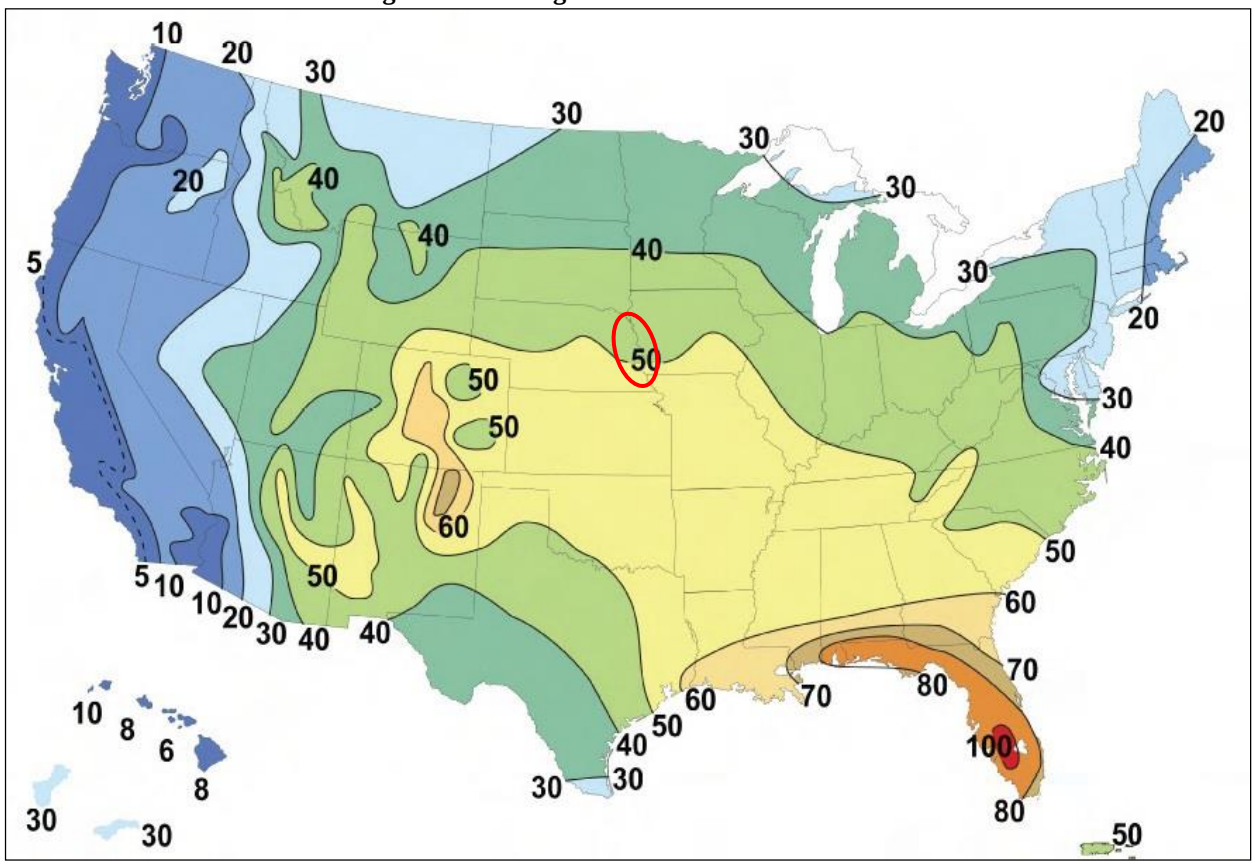
Figure 30: Severe Thunderstorms by Month



Source: NCDC, 1996-2015

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 the point of becoming severe, the potential for damages include crop losses from wind and hail, property losses due to building and automobile damages due to hail, wind, or flash flooding, and death or injury to humans and animals from lightning, drowning, or getting struck by falling or flying debris. Figure 30 displays the average number of days with thunderstorms across the country each year. The planning area experiences an average of 50 to 60 thunderstorms over the course of one year, as shown in Figure 31.

Figure 31: Average Number of Thunderstorms



Source: NWS

Thunderstorms can develop in less 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 be harmful to humans and animals, cause fires to buildings and agricultural lands, and cause electrical outages in municipal electrical systems. Lightning can strike up to 10 miles from the portion of the storm depositing precipitation. There are three primary types of lightning: intra-cloud, inter-cloud, and cloud to ground. While intra and inter-cloud lightning are more common, it is when lightning comes in contact with the ground that society is potentially impacted. Lightning generally occurs when warm air is mixed with colder air masses resulting in atmospheric disturbances necessary for polarizing the atmosphere. Between 2006 and 2013, an average of 33 people were killed each year by lightning in the United States. In Nebraska one fatality was attributed to lightning between 2004 and 2013.

LOCATION

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

EXTENT

The 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. As noted earlier, the NWS defines a severe thunderstorm with having either damaging winds at 58 mph or higher, and/or one inch hail or larger.

HISTORICAL OCCURRENCES

The NCDC reports events as they occur in each community. A single severe thunderstorm event can affect multiple communities and counties at a time; the NCDC 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 NCDC as several events. The NCDC reports a total of 427 thunderstorm (wind) and 42 lightning events in the planning area from January 1996 to July 2015. Severe thunderstorm events were responsible for $63,577,000 in property damages, and $34,304,474 in crop damages. The USDA RMA data does not specify severe thunderstorms as a cause of loss. However, excessive moisture or precipitation (rain) was used to indicate crop loss from heavy rain events which were likely associated with severe thunderstorms. Lightning events caused $3,635,500 in property damages and $124,853 in crop damages. There were no deaths from these storms, but a total of six injuries occurred.

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCDC 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 $224,195 per year in property damages.

Table 121: Severe Thunderstorms Loss Estimate

Hazard Type	Number of Events[1]	Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Severe Thunderstorms	427	21.8	$63,577,000	$3,260,359	$34,304,474	$2,286,965
Lightning	42	2.1	$3,635,500	$186,436	$124,853	$8,324
Total	**469**	**23.9**	**$67,212,500**	**$3,446,795**	**$34,429,327**	**$2,295,289**

1 Indicates the data is from NCDC (January 1996 to July 2015); 2 Indicates data is from USDA RMA (2000 to 2014)

PROBABILITY

Based on historical records and reported events, severe thunderstorms are likely to occur on an annual basis. The NCDC reported 359 severe thunderstorms between 1996 and 2015; this results in 100 percent chance annually for thunderstorms.

FUTURE DEVELOPMENT

Future development projects should consider windstorm hazards at the planning, engineering, and architectural design stage with the goal of reducing vulnerability. Additionally, hail-resistant roof materials should be considered to reduce the risk of hail damage in the future.

REGIONAL VULNERABILITIES

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

Table 122: Regional Vulnerabilities

Sector	Vulnerability
People	-The elderly are vulnerable as they are less mobile than other members of the community -Mobile home residents are risk of injury and damage to their property if the mobile home is not anchored properly
Economic	-Closed businesses from damage or closed roads are likely to lose revenue and loss of income to workers

Sector	Vulnerability
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

RISK ASSESSMENT SUMMARY

Table 123: Summary

Number of Past Events	469 Severe Thunderstorm Wind and Lightning Events or 23.9 events/year
Vulnerable Locations	Entire planning area
Extent	Wind = 58 mph and/or Hail ≤ 1.00 inch
Annual Probability	100%
Averaged Annual Losses	Property = $3,446,795 and Crops = $2,295,289

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Bury overhead power lines
    - Many communities have started to bury power lines
- Continue to participate, or become a participant, in Tree City USA; establish a tree maintenance ordinance
    - Many communities participate or are interested in participating
- Establish a Tree Board to assist in the development of a tree management program
    - This is a requirement of Tree City USA
- Encourage the construction of safe rooms
    - Some jurisdictions would like to add safe rooms
- Establish community severe weather warning protocols
    - Most communities follow the National Weather Service protocols
- Incorporate text messaging into severe weather messaging programs
- Incorporate cable TV interruption warning systems
- Purchase and issue weather radios to critical facilities and vulnerable populations
    - Most communities have weather radios
- Establish mutual aid agreements with neighboring communities and privately owned businesses
    - Agreements exist between most communities
- Establish public education programs to increase awareness of the dangers posed by severe thunderstorms and ways the public can mitigate the potential impacts
    - Most county emergency managers have some education programs
- Establish data recovery program and backup program for municipal employees
- Install and maintain surge protection for critical facilities
- Use of hail resistant materials
    - Some jurisdictions have hail resistant roofing and hail guards on A/C units on critical facilities

SEVERE WINTER STORMS

HAZARD PROFILE

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 inhibits 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 causing structural damage to buildings.

Extreme Cold

Along with snow and ice storm events, extreme cold can be dangerous to the well-being of people and animals. What constitutes extreme cold varies from region to region, but is generally accepted as being temperatures that are significantly lower than the average low temperature. For the planning area, the coldest months of the year are January, February, March, November and December. The average low temperature for these months are all below freezing (average low for the five months 19.1°F). The average high temperatures for the months of January, February, and December are near 33.7°F. Record lows for the region range from -28°F in December, -37°F in January, -33°F in February, and -22°F in March.

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 ice falls in the form of rain 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 rail 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, and causing structural damage to buildings.

LOCATION

The entire planning area is at risk of severe winter storms due to the regional nature of this type of storm.

EXTENT

The Sperry-Piltz Ice Accumulation Index (SPIA) was developed by the NWS to predict the accumulation of ice and resulting damages. The SPIA looks at total precipitation, wind, and temperatures to predict the intensity of ice storms. Figure 32 shows the SPIA index.

Figure 32: SPIA Index

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	* AVERAGE NWS ICE AMOUNT (in inches) *Revised-October, 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 & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 - 35	
	0.75 – 1.00	15 - 25	
	1.00 – 1.50	< 15	
5	0.50 – 0.75	> = 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.
	0.75 – 1.00	> = 25	
	1.00 – 1.50	> = 15	
	> 1.50	Any	

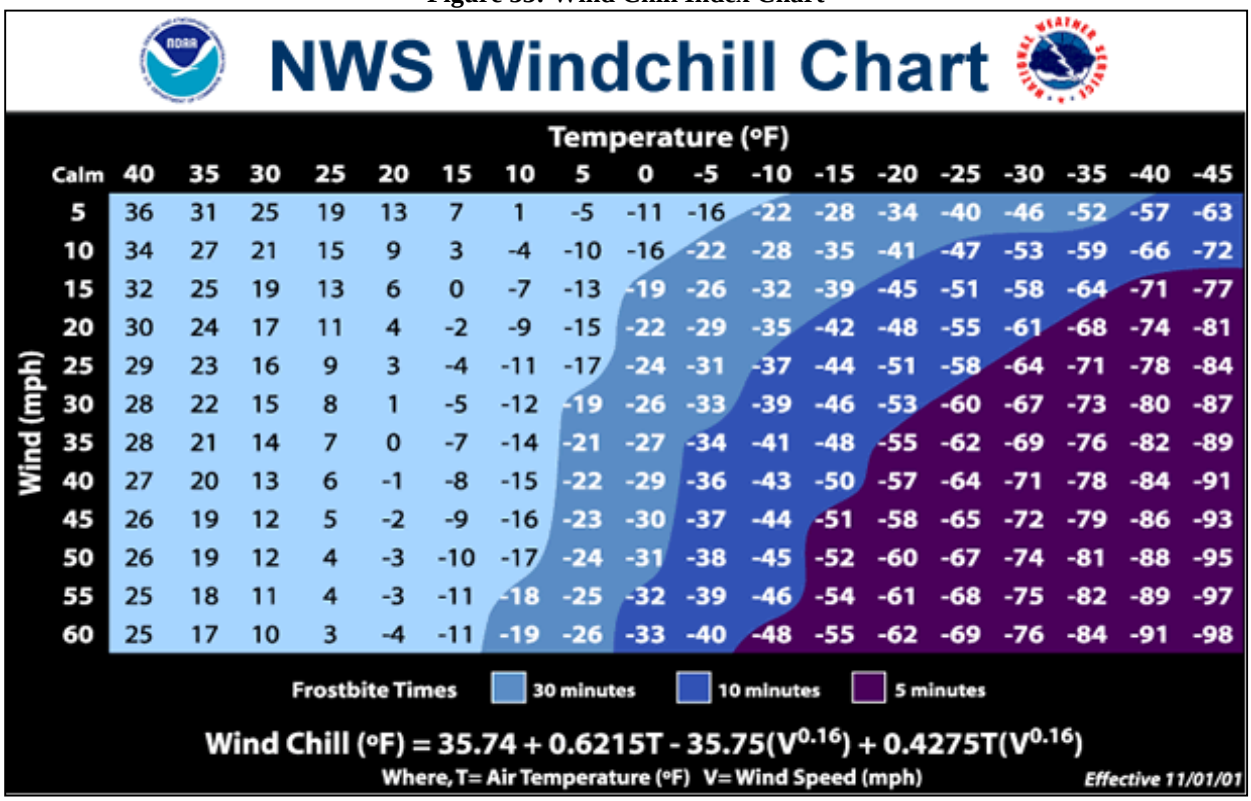
(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Source: http://www.spia-index.com/index.php

Reviews of historical severe winter storms across the planning area show that there is a range of events that can occur. Ice Storm Warnings are issued when accumulation of at least 0.25 inches is expected from a storm, which controlling for high winds, would tend to classify ice storms in Nebraska as SPIA Level 2 or higher. The most common accumulation during ice storms was a quarter of an inch.

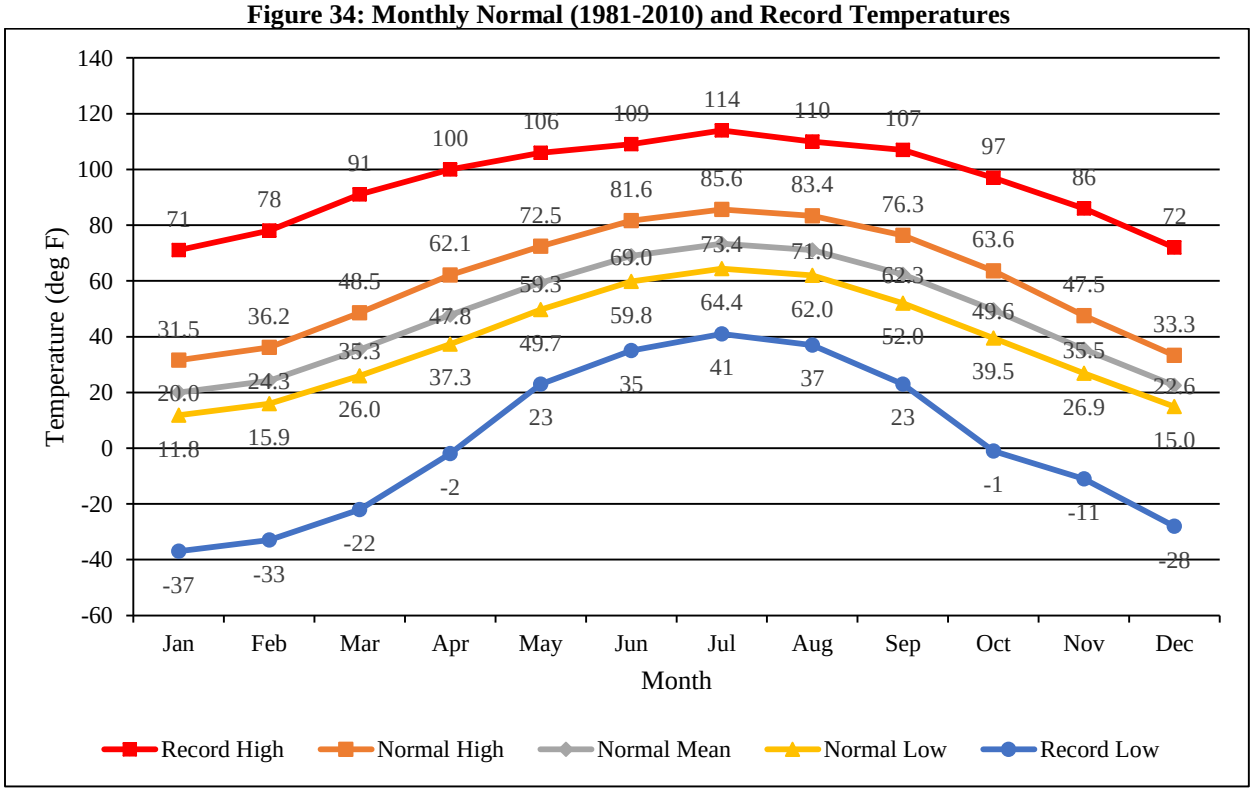
The Wind Chill Index was developed by the NWS to determine the decrease in air temperature felt by the body on exposed skin due to wind. The wind chill is always lower than the air temperature and can quicken the effects of hypothermia or frost bite as it gets lower. Figure 33 shows the wind chill index used by the NWS.

Figure 33: Wind Chill Index Chart



Source: NWS

Figure 34: Monthly Normal (1981-2010) and Record Temperatures

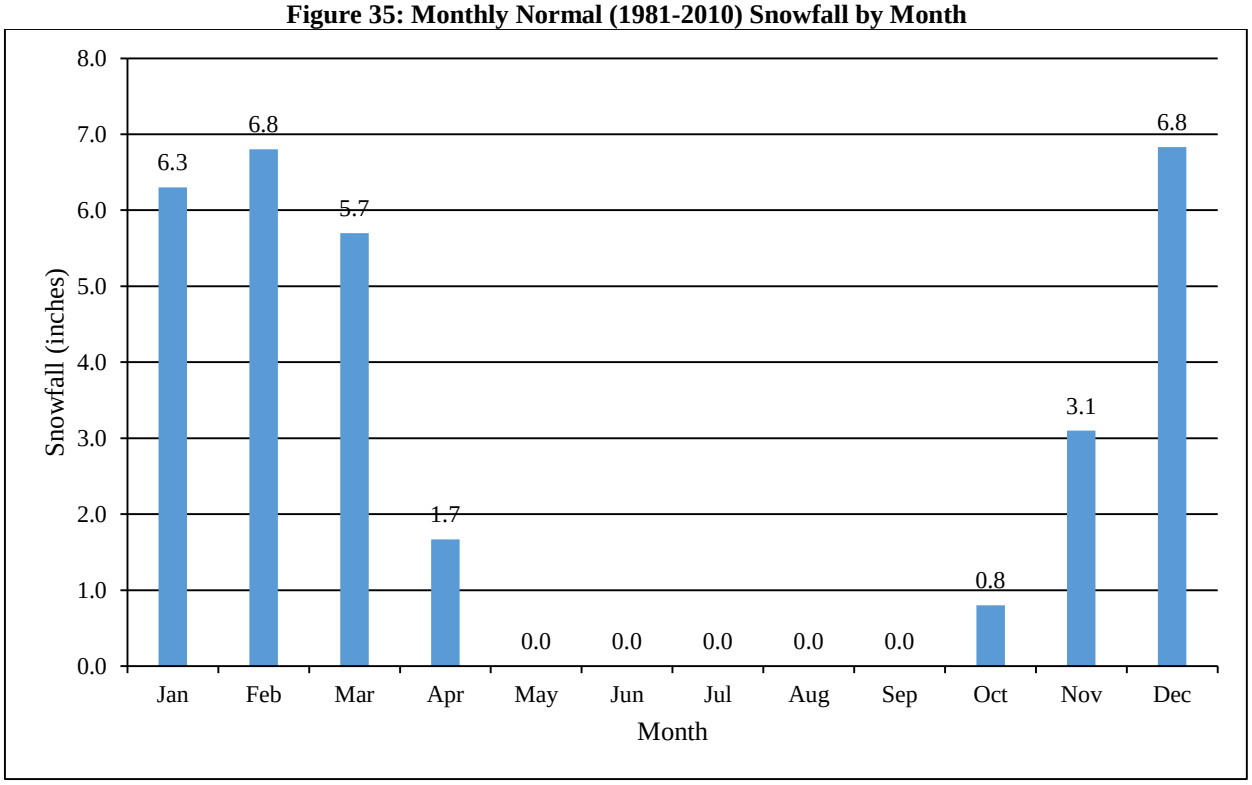


Source: Midwestern Regional Climate Center

The coldest months of the year are January, February, March, November, and December and normal lows for these months average around 19°F as shown in Figure 34.

Average monthly snowfall for the planning area is shown in Figure 35, which shows the snowiest months are between December and March. A common snow event (likely to occur annually) will result in accumulation totals between four and eight 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 35: Monthly Normal (1981-2010) Snowfall by Month



Source: Midwestern Regional Climate Center

HISTORICAL OCCURRENCES

Due to the regional scale of severe winter storms, the NCDC reports events as they occur in each county. According to the NCDC, there was a combined 372 severe winter storm events for the planning area from January 1996 to July 2015. These recorded events caused a total of $22,069,000 in property damages and three fatalities. USDA RMA data also reported $706,584 in crop damages between 2000 and 2014.

The NCDC recorded a total of 47 blizzard events, causing $35,000 in property damages; 23 heavy snow events, causing $22,000,000 in property damages; 13 ice storm events, causing $10,000 in property damages; 75 winter weather events with no reported property damages; and 214 winter storm events, causing $24,000 in property damages and three fatalities.

Table 124: Severe Winter Storm Events by County

County	Number of Events
Burt	57
Dakota	69
Douglas	65

County	Number of Events
Sarpy	65
Thurston	52
Washington	64

Source: NCDC Storm Events Database, 1996-2015

Additional details are provided in the following descriptions of some of the notable severe winter storm events in the planning area:

October 25-26, 1997, Winter Storm
This major snow and ice storm ranks as a snow event likely to be experienced once in 200 years. A heavy wet snowfall of 6 to 14 inches fell. It caused extensive damage and/or total destruction to many of the trees that were still fully-or partially-leafed. At least 205,000 residents in the affected area were without power for several days. Omaha Public Power District (OPPD) estimated that it was the worst outage in 50 years. Nearly 85 percent of the trees in the Omaha area sustained damage or were totally destroyed. This storm also affected the urban forests of other metropolitan areas in the NRD but not to the same extent as Omaha. Many emergency shelters in and around Omaha were opened for use by those who suffered hardships from the storm. Property damage was estimated at $56.5 million with crop damage an additional $1.6 million.

November 28, 2005, Winter Storm/Blizzard
Six to 13 inches of snow fell during this storm with some ice accumulation as well. There was one fatality caused by a vehicle collision during blizzard conditions and over $3 million in property damages.

February 2004, Snow Storms
Multiple snow storms led to concerns about access to emergency services and the strain on the City's resources in Blair (Washington County). However, all emergency services remained operational.

January 4, 2005, Winter Storm
During this 8-14 inch snowfall, two fatalities occurred when two motorists were stranded southwest of Omaha.

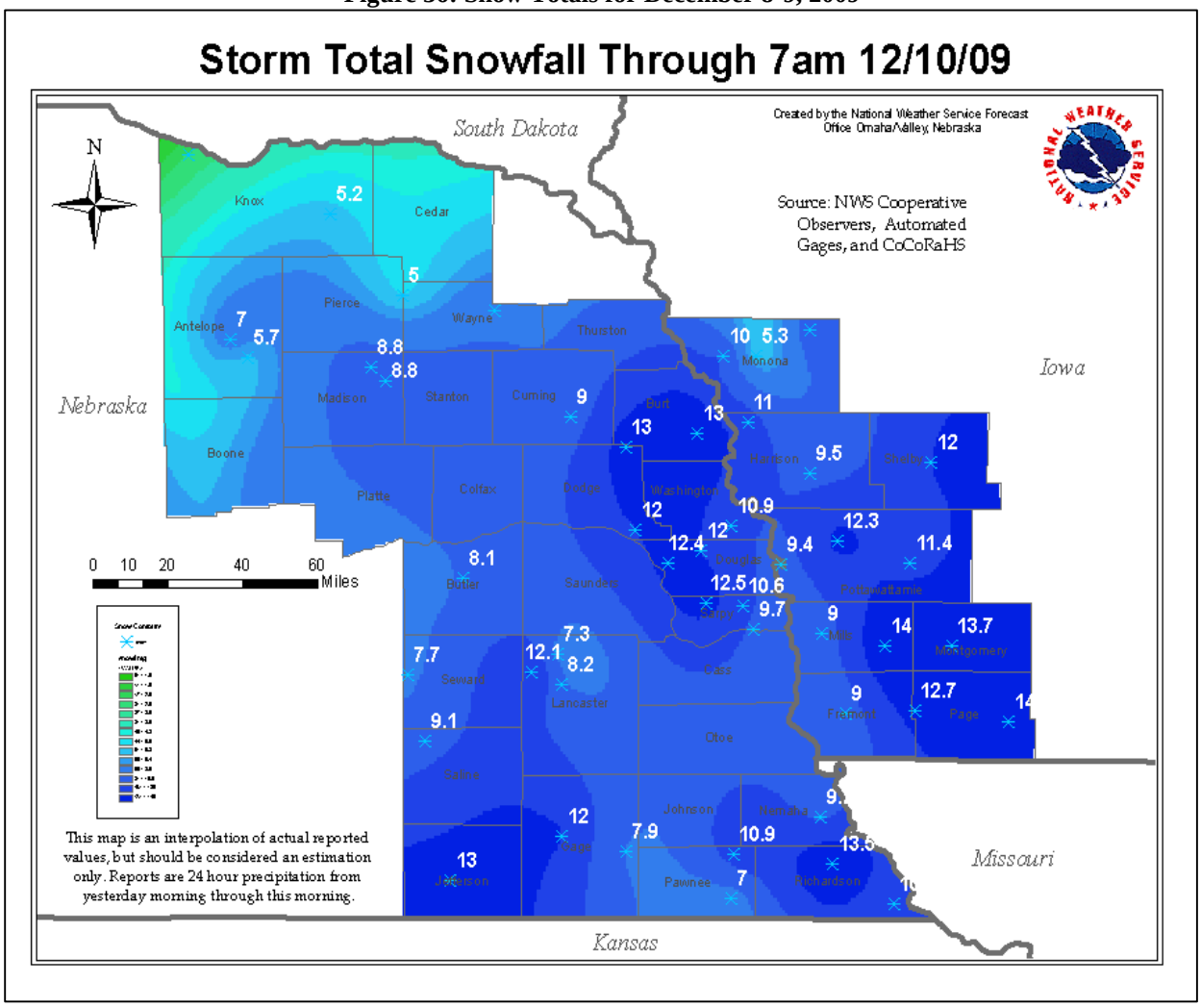
December 7-9, 2009, Blizzard
A large and relatively slow-moving storm brought a prolonged winter storm and even, for a short time, blizzard conditions to most of eastern Nebraska and western Iowa from late in the evening of the 7th through the early morning hours of the 9th. The heaviest snow fell in advance of the stronger winds, which occurred mainly during the morning and afternoon of the 8th. However, as north winds increased to 30 to 50 mph during the night of the 8th and early on the 9th, visibility intermittently dropped to near zero, especially in open areas.

Considerable drifting snow also occurred in many cases closing roads almost as fast as they could be cleared by plows. Many schools were closed for three days because of the storm.

An elderly Omaha man was found dead during the evening of the 8th when he apparently had car trouble and returned to his apartment, where he was found sitting down in a chair outside.

Total snowfall from the storm was 6-15 inches over most of eastern Nebraska. Higher amounts in eastern Nebraska included 15 inches in Union, 12-13 inches at the NWS in Valley, Tekamah, and Gretna. The following figure provides the snow totals for this event.

Figure 36: Snow Totals for December 8-9, 2009



Source: NWS Omaha/Valley, http://www.crh.noaa.gov/images/oax/news/OAX_snow_stormtotal121009.png

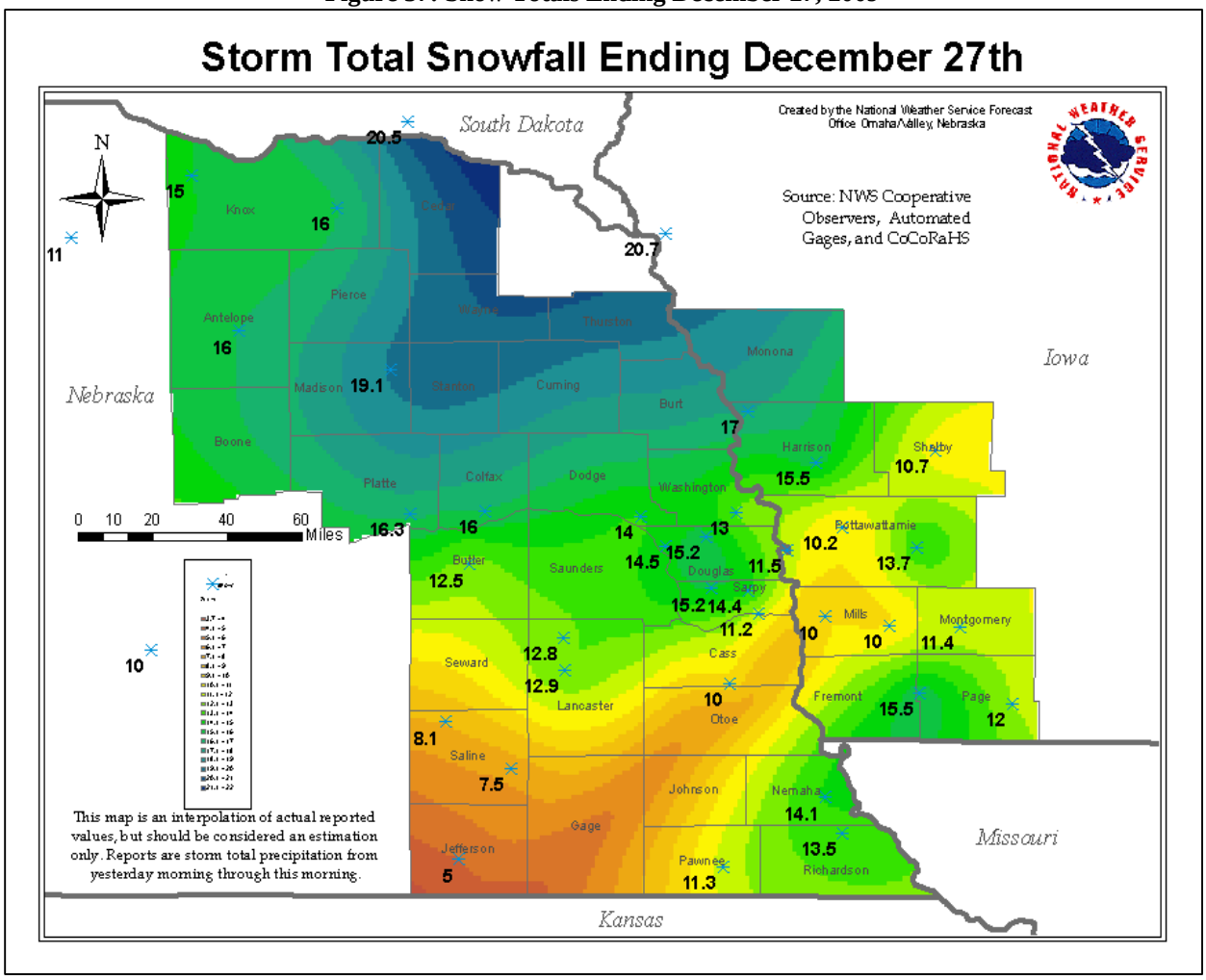
December 24-29, 2009, Blizzard/Winter Storm

The second major winter storm of the month hit eastern Nebraska as a complex weather pattern brought a prolonged period of winter weather, including blizzard conditions, to the region around Christmas. Low pressure a lot in the southern Plains lifted northeast into Missouri as another low pressure system dropped south out of Canada. These two systems then merged over the central United States and eventually pulled Atlantic moisture westward into the Plains. Before they merged, the southern system pulled up Gulf of Mexico moisture and brought areas of freezing rain to the southeast Nebraska and three to five inches of snow to northeast Nebraska on the 23rd. The second system pulled down Arctic air as north winds gusted between 40 and 50 mph over most of the region. This not only changed all the precipitation to snow on the 24th, but also brought blizzard conditions to much of eastern Nebraska on Christmas Eve and much of Christmas Day. Snow and blowing snow and occasional blizzard conditions then continued through much of the 26th.

Snowfall from the prolonged winter storm totaled 10-18 inches over most of eastern Nebraska. Heavier totals included 18 inches in Norfolk, 14 inches near Gretna and Bennington, and 13 inches at the NWS in Valley, Fort Calhoun, and Papillion. The snow and strong winds drifted most rural roads closed and even

made many highways impassable, especially in northeast Nebraska and sections of southeast Nebraska where winds were a bit stronger. The following figure provides the snow totals for this event.

Figure 37: Snow Totals Ending December 27, 2009



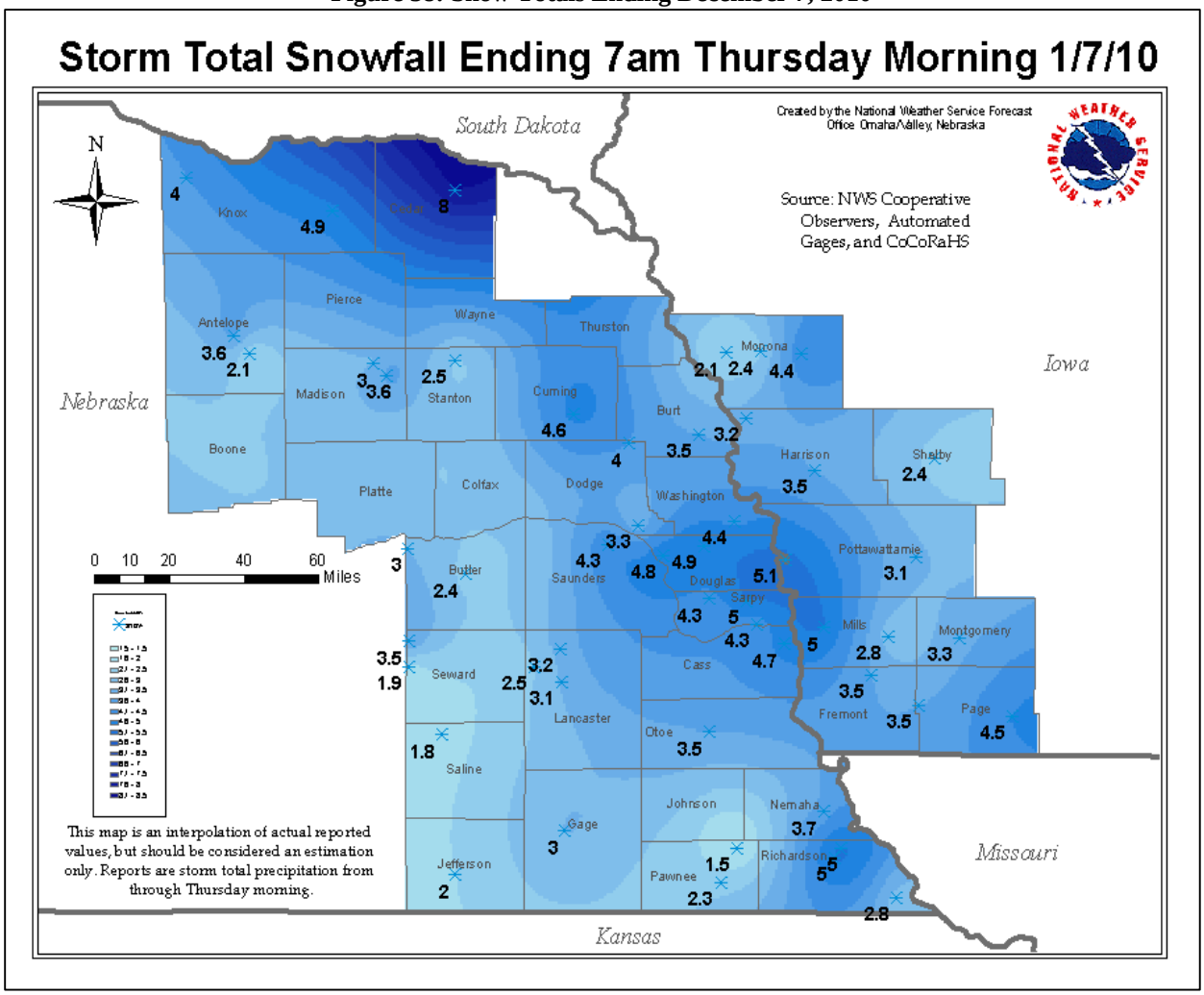
Source: NWS Omaha/Valley, http://www.crh.noaa.gov/images/oax/news/OAX_snowstormtotal122709.png

January 6, 2010, Winter Storm

The third winter storm in a month hit eastern Nebraska and southwest Iowa. This storm was caused by an upper-level disturbance that dropped out of Canada and strengthened over the Central Plains before moving off to the east. This system pulled down Arctic air behind it and not only produced strong winds but also dangerously cold wind chill values. Even though snow amounts from this storm were about half as much or less than the storms that hit in December of 2009, and winds were similar or perhaps even a bit lighter, they lasted a relatively long time. Also, the snow from this storm fell on top of a base of older snow that already was around 10-20 inches deep over much of the area. Thus, substantial blowing and drifting snow was observed, with visibilities frequently one mile or less. In addition, the drifting snow from this storm was possibly worse than the prior two storms and many rural roads became impassable for several days, as did many highways and interstates over the region. The task of snow removal was so daunting in some areas that the Nebraska Department of Roads sent large rotary plows and other equipment from western Nebraska to help churn snow off the roads in eastern Nebraska. Many schools were closed for three days because of the snow, blowing snow, and dangerously cold wind chills.

Snow totals were generally three to six inches from the storm, with around five inches at NWS Valley, Omaha Eppley Airport, and Papillion. The following figure provides the snow total for this event.

Figure 38: Snow Totals Ending December 7, 2010

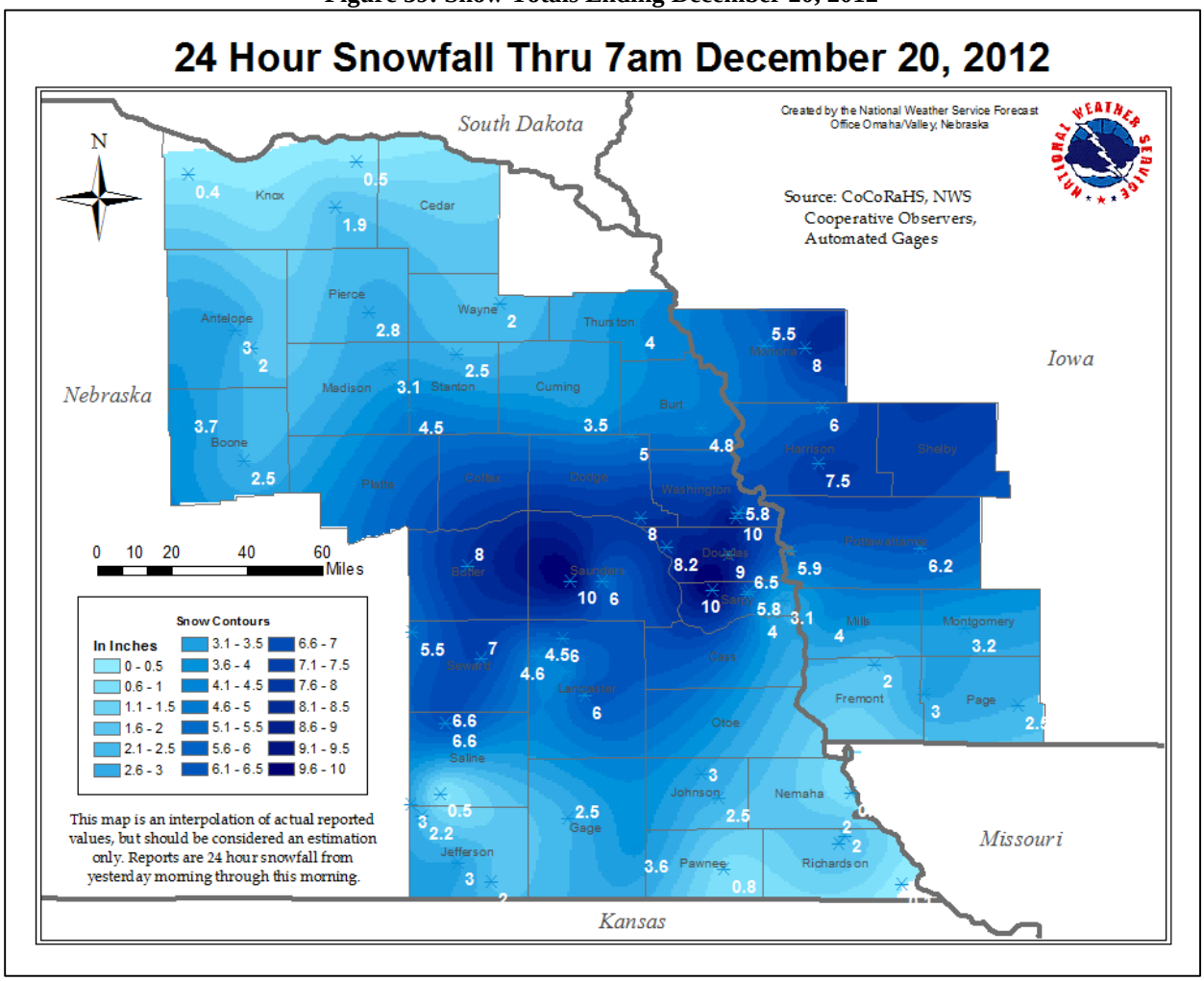


Source: NWS Omaha/Valley, http://www.crh.noaa.gov/images/oax/news/OAX_snow010710_2.png

December 19-20, 2012, Winter Storm

A winter storm developed over the western United States on December 18th, and then moved into the central Plains on the 19th producing heavy snow, localized areas of sleet and freezing rain, and in some areas blizzard conditions. Light rain developed during the late morning and early afternoon on December 19th as moisture spread north into the area from the south, but then changed to snow as cold air worked in from the north. Areas of thunder snow were reported in parts of east-central Nebraska. Wind speeds began to pick up between 40 to 50 mph during the overnight hours. The combination of falling temperatures and increasing winds led to significant blowing and drifting of snow and areas of blizzard conditions. Winds also combined with the initially heavy wet snow to create power outages for over 45,000 customers across the area. The heaviest snow fell in a band through the Omaha and Lincoln metro areas. In this band of 8-10 inches of snow were common with isolated amounts up to 10 inches in Sarpy County. The storm came to an end by mid-day on the 20th as the system pushed off to the east and the winds diminished. The following figures provides the snow totals for this event.

Figure 39: Snow Totals Ending December 20, 2012

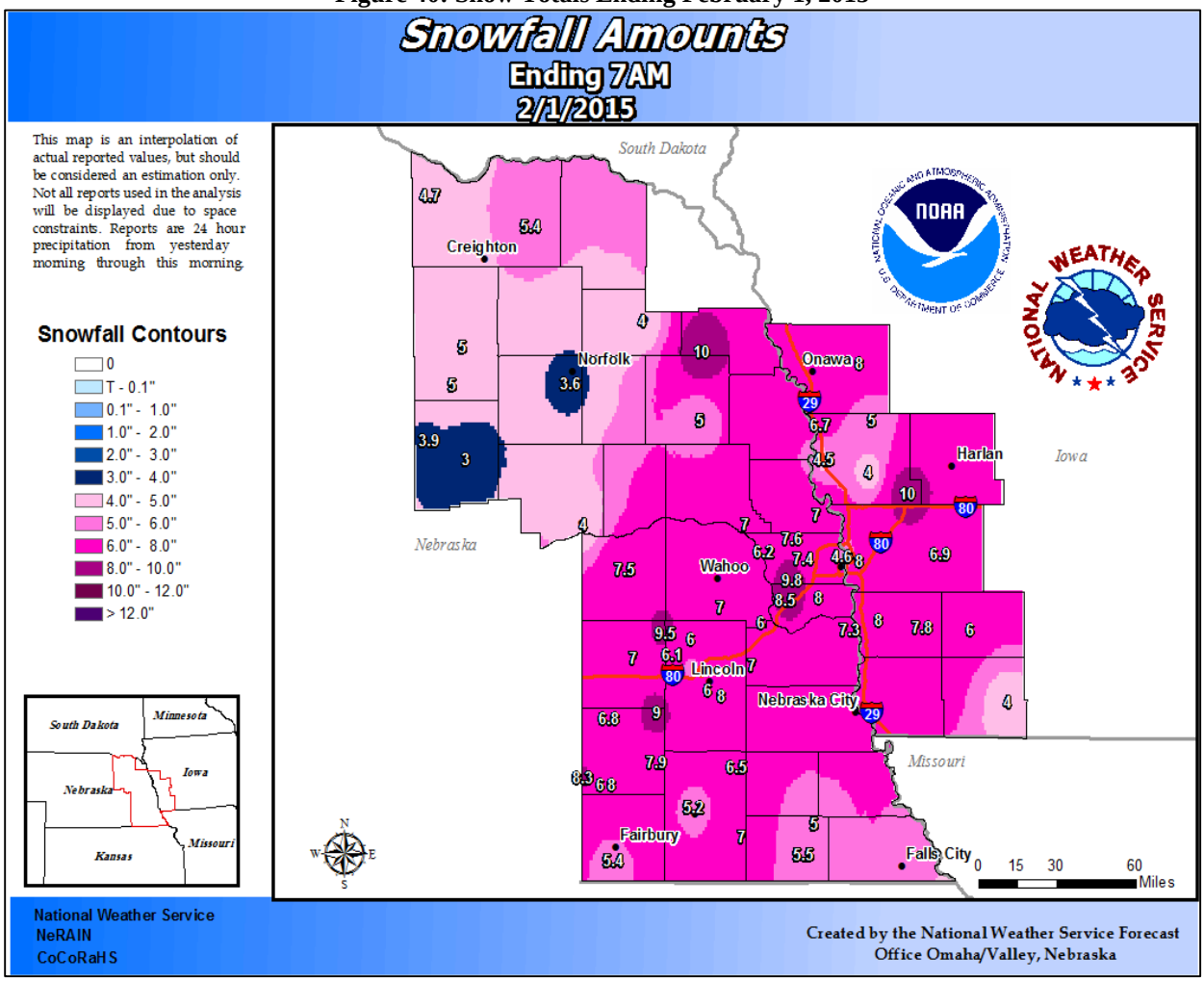


Source: NWS Omaha/Valley, http://www.crh.noaa.gov/images/oax/news/OAXsnow122012.png

February 1, 2015, Winter Storm

A deep trough across the southwest United States moved into the southern Plains early on January 31st. Ahead of this system, deep moisture spread northward across the central Plains. This broad, but persistent area of warm air advection led to increasing showers over Kansas, which moved northward into eastern Nebraska and western Iowa early on the 31st. This initial precipitation was a mix of light rain and snow through mid-afternoon. As colder air, associated with a stronger northern stream trough and cold front, started to move into the area late Saturday afternoon and evening the precipitation turned to all snow and began to accumulate. Snow, occasionally moderate, continued into Saturday night diminishing to light snow on Sunday morning, before ending Sunday afternoon. Snowfall totals of 5-9 inches were common across east-central and southeast Nebraska. Winds of 20-30 mph with gusts over 40 mph were common into the day on Sunday that led to considerable bowing and drifting snow. The combination of falling and blowing snow resulted in reduced visibilities and very difficult driving conditions. The following figure provides the snow totals for the event.

Figure 40: Snow Totals Ending February 1, 2015



Source: NWS Omaha/Valley, http://www.crh.noaa.gov/images/oax/news/Precip_Maps/snow_20150201.png

Additional information from these events from NCDC and reported by each community are listed in each participant section in *Section Seven: Participant Sections*.

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCDC Storm Events Database since 1996 and includes aggregated calculations for each of the five 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 $1,125,969 per year in property damage, and an average of $47,106 per year in crop damage for the planning area. It should be noted that the crop loss data from the USDA RMA only specifies cold wet weather, cold winter, freeze, and frost as the cause of loss during the winter events. These events were summed together into one group and placed with the winter weather row below.

Table 125: Severe Winter Storm Loss Estimate

Hazard Type	Number of Events[1]	Average Number of Events Per Year[1]	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Blizzard	47	2.4	$35,000	$1,785	N/A	N/A
Heavy Snow	23	1.2	$22,000,000	$1,122,449	N/A	N/A
Ice storm	13	0.7	$10,000	$510	N/A	N/A
Winter Weather	75	3.8	$0	$0	$706,584	$47,106
Winter Storm	214	10.9	$24,000	$1,225	N/A	N/A
Severe Winter Storms	**372**	**19.0**	**$22,069,000**	**$1,125,969**	**$706,584**	**$47,106**

1 Indicates the data is from NCDC (January 1996 to July 2015); 2 Indicates data is from USDA RMA (2000 to 2014)

PROBABILITY

Based on historical records, it is likely that severe winter storms will occur annually within the planning area.

FUTURE DEVELOPMENT

Future development would likely increase vulnerability to this hazard by increasing demand on utilities and increasing the exposure of more roadways and infrastructure.

REGIONAL VULNERABILITIES

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

Table 126: Regional Vulnerabilities

Sector	Vulnerability
People	-Elderly citizens at higher risk of 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.

RISK ASSESSMENT SUMMARY

Table 127: Summary

Number of Past Events	372 or 19/year
Vulnerable Locations	Entire planning area
Extent	Ice = 0.25; Snow = 4 to 8 inches; Winds = 40mph; Wind chill 20-40°F below zero
Annual Probability	100%
Averaged Annual Losses	Property = $1,125,969 and Crops = $47,106

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Incorporate text messaging into severe weather messaging programs
- Incorporate cable TV interruption warning systems
- Establish road closure policies and procedures necessary to protect the public
- Continue to participate, or become a participant, in Tree City USA; establish a tree maintenance ordinance
    - Many communities participated or would like to participate
- Establish a Tree Board to assist in the development of a tree management program
    - This is a requirement of Tree City USA
- Develop a database of "vulnerable populations"
- Establish public education programs to increase awareness of the dangers posed by severe winter storms and ways the public can mitigation the potential impacts
    - Most county emergency managers have some education programs
- Work with community groups serving "vulnerable populations" such as Meals on Wheels programs to help monitor vulnerable groups
- Retrofit buildings and infrastructure to withstand snow loads

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 a 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 primarily with local law enforcement. The Office of Infrastructure Protection within the Federal Department of Homeland Security is a component within the National Programs and Protection Directorate.

The Office of Infrastructure Protection 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 and to strengthen sectors' ability to respond and quickly recover from an attack or other emergency. This is done through the National Infrastructure Protection Plan (NIPP).

Under the NIPP, a Sector-Specific Agency (SSA) is the federal agency assigned to lead a collaborative process for infrastructure protection for each of the 18 sectors. The NIPP's comprehensive framework allows the Office of Infrastructure Protection 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.

The 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 Office of Infrastructure Protection 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). 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 replaced HSAS in 2011.

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 whether a threat alert of one kind or the other 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 then 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 that there is 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. In rural areas, concerns are primarily related to agro-terrorism and tampering with water supplies. In urban areas, concerns are related to political unrest, activists groups, and others that may be targeting businesses, police, and federal buildings.

EXTENT

Previous terrorist attacks in the planning area have been limited to primarily individual buildings. However, terrorist attacks can vary greatly in scale and magnitude.

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 nine terrorist attacks since 1970 causing well over $39,500 in property damages, and there was one death and seven injuries within the planning area.

Table 128: Terrorist Incidents in the Planning Area

Date	Location	Perpetrator Group	Fatalities	Injuries	Target Type	Property Damage
January 22, 1970	South Sioux City	Strikers	0	0	Private Citizens & Property	Damage sustained from blast, which left hole in a house. Damages unknown
January 30, 1970	South Sioux City	Strikers	0	0	Business	$2,500
January 30, 1970	South Sioux City	Strikers	0	0	Unknown	Unknown
February 23, 1970	South Sioux City and Dakota City	Strikers	0	0	Utilities	Four power transmission poles bombed
June 11, 1970	Omaha	Black Panthers (suspected)	0	0	Police	Four foot hole in the corner of building from bomb blast
July 2, 1970	Omaha	Black Panthers (suspected)	0	0	Business	Building destroyed. Damages unknown
August 17, 1970	Omaha	Black Panthers	1	7	Private Citizens & Property	$2,000
August 18, 1977	Omaha	Anti-Abortion Activists	0	0	Abortion Related	$35,000
September 6, 1991	Bellevue	Anti-Abortion Activists	0	0	Abortion Related	Private residence including farm and horses were destroyed in a fire. Damages unknown.

Source: START Global Terrorism Database, 1970-2014, http://www.start.umd.edu/gtd/

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, economic loss, injury, or loss of life. It should also be noted that damage estimates were only provided for three of the nine terrorist attacks.

Table 129: Terrorism Incidents Loss Estimate

Hazard Type	Number of Events	Average Number of Events Per Year	Total Property Loss	Annual Property Loss	Total Crop Loss	Annual Crop Loss
Terrorism	9	0.2	$39,500	$877	N/A	N/A

Source: START Global Terrorism Database, 1970-2014

PROBABILITY

Given nine incidences over the course of 45 years with most occurring during the 1970s, the annual probability for terrorism in the planning area is stated at 2 percent during any given year.

FUTURE DEVELOPMENT

Future development would likely increase the risk and vulnerability from terrorist incidents. Additional critical facilities, businesses, and residential areas would potentially be exposed. Communities should consider vehicular barriers around schools and critical facilities for added protection.

REGIONAL VULNERABILITIES

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

Table 130: Regional Vulnerabilities

Sector	Vulnerability
People	-Police offices and first responders at risk of injury or death
Economic	-Damaged businesses can cause loss of revenue and loss of income for workers -Agricultural attacks could cause significant economic losses for the region
Built Environment	-Targeted buildings may sustain heavy damage
Infrastructure	-Water supply, power plants, utilities
Critical Facilities	-Police stations and government offices are at a higher risk

RISK ASSESSMENT SUMMARY

Table 131: Summary

Number of Past Events	9 incidences in 45 years or 0.2 events/year
Vulnerable Locations	Entire planning area
Extent	Isolated to a single building
Annual Probability	2%
Averaged Annual Losses	$877

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Training and exercises
- Education and outreach
- Vehicular barrier and other building protection measures
- General awareness raising programs such as "See Something, Say Something."

TORNADOS

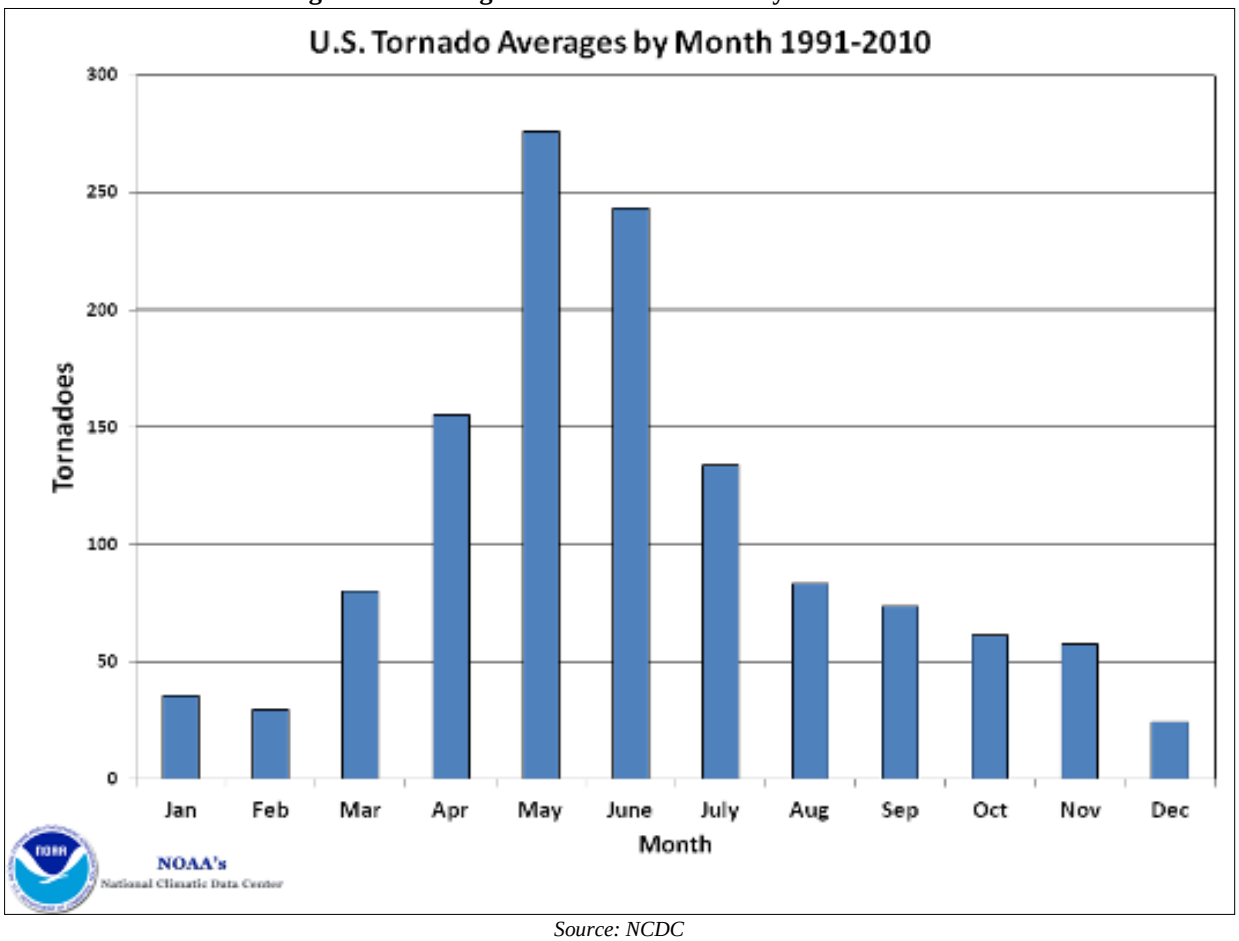
HAZARD PROFILE

A tornado is typically associated with a supercell thunderstorm. In order 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.

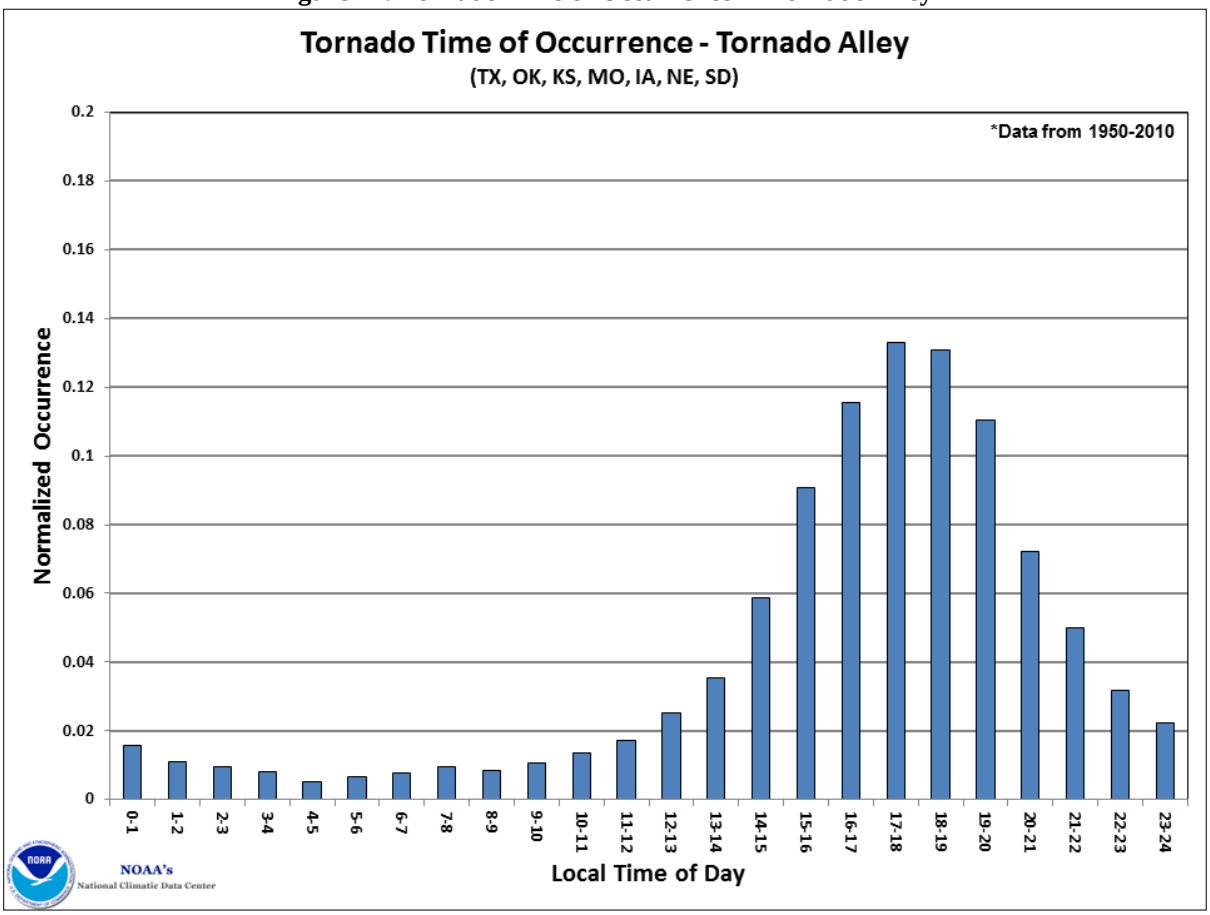
Once tornados are formed, they can be extremely violent and destructive. They have been recorded all over the world, but are most prevalent in the American Midwest and South, in an area known as "Tornado Alley." Approximately 1,000 tornados are reported annually in the contiguous United States (NOAA 2012). Tornados can travel distances over 100 miles and reach over 11 miles above ground. Tornados 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 tornados occur between noon and midnight. In Nebraska, 77 percent of all tornados occur in the months of May, June, and July.

Figure 41: Average Number of Tornados by Month in U.S.



Source: NCDC

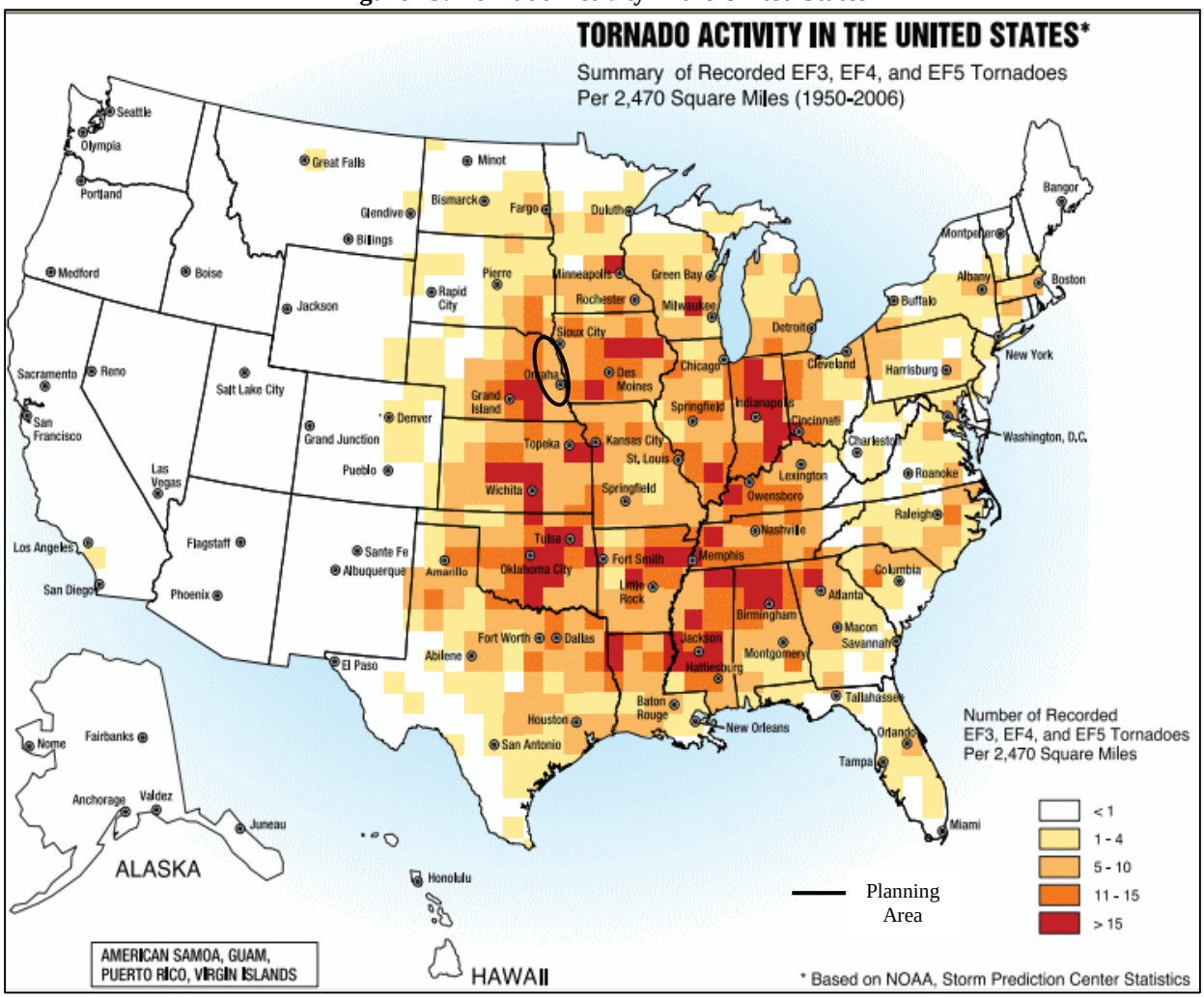
Figure 42: Tornado Time of Occurrence in Tornado Alley



Source: NCDC

Nebraska is ranked fifth in the nation for tornado frequency with an annual average of 45 tornados between 1953 and 2004 (NOAA 2011). The annual average number of tornados for Nebraska from 1991 to 2011 has increased slightly to 57 (NOAA 2013). The following figure shows the tornado activity in the United States as a summary of recorded F3, F4, and F5 tornados per 3,700 square miles form 1950-1998.

Figure 43: Tornado Activity in the United States

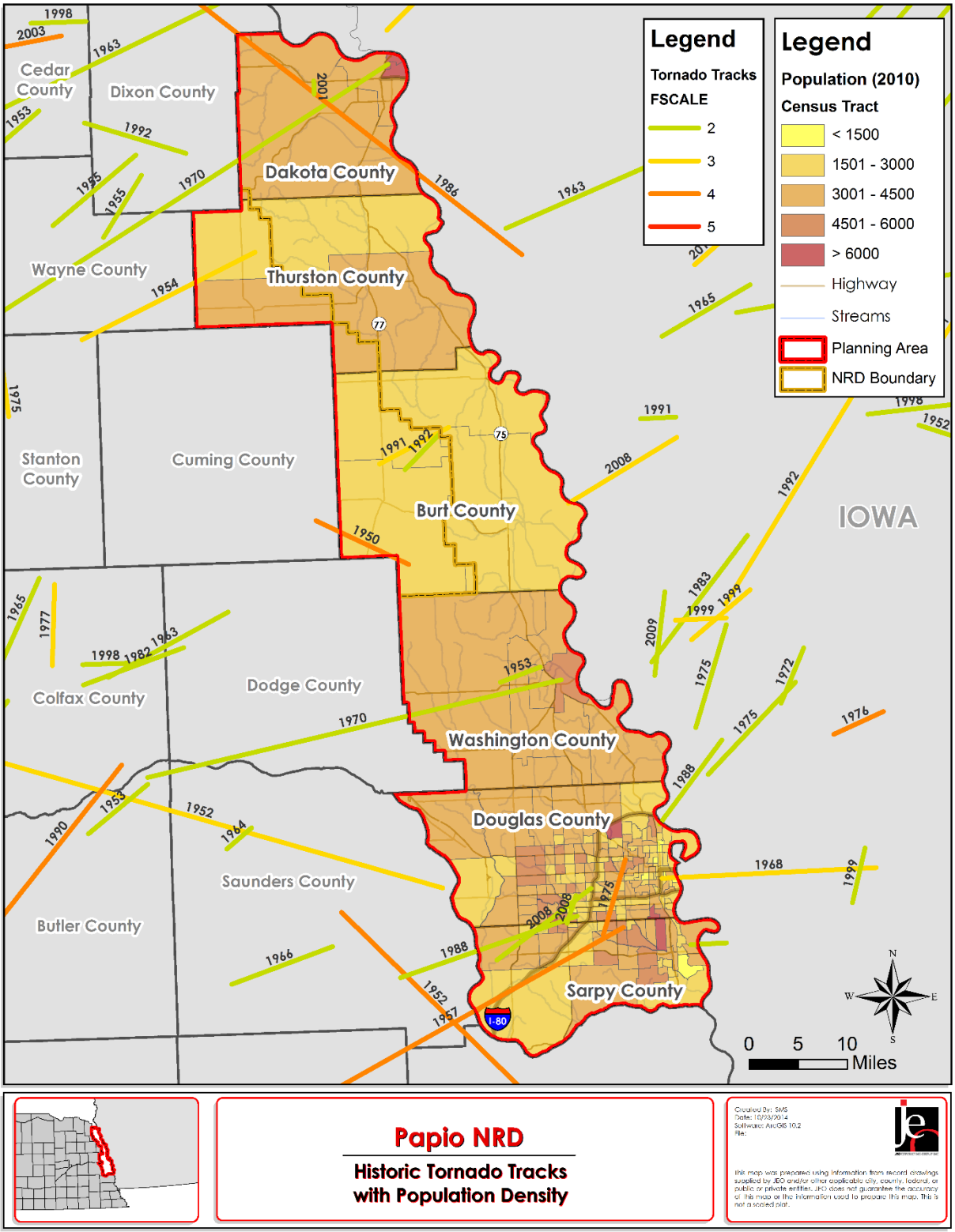


Source: Storm Prediction Center

LOCATION

Tornados can occur anywhere in the planning area. The impacts would likely be greater in more densely populated areas such as in the Omaha metropolitan area and South Sioux City. The following map shows the historical track locations across the region since 1950 along with the population density in each census tract in the NRD. Note that this map does show tornado tracks for EF-0 and EF-1.

Figure 44: Historic Tornado Tracks with Population Density



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 tornados. The magnitude of tornados is measured by the Enhanced Fujita Scale. The Enhanced Fujita Scale does not measure tornados 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. In order 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. Tables 125 and 126 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, tornados rated EF3 or lower account for around 96 percent of all tornado damages.

Table 132: Enhanced Fujita Scale

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

Source: NOAA; FEMA

Table 133: Enhanced Fujita Scale Damage Indicator

Number	Damage Indicator
1	Small barns, farm outbuildings
2	One- or two-family residences
3	Single-wide mobile home (MHSW)
4	Double-wide mobile home
5	Apartment, condo, townhouse (3 stories or less)
6	Motel
7	Masonry apartment or motel
8	Small retail bldg. (fast food)
9	Small professional (doctor office, branch bank)
10	Strip mall
11	Large shopping mall

Number	Damage Indicator
12	Large, isolated ("big box") retail bldg.
13	Automobile showroom
14	Automotive service building
15	School - 1-story elementary (interior or exterior halls)
16	School - Junior or Senior high school
17	Low-rise (1-4 story) bldg.
18	Mid-rise (5-20 story) bldg.
19	High-rise (over 20 stories)
20	Institutional bldg. (hospital, govt. or university)
21	Metal building system
22	Service station canopy
23	Warehouse (tilt-up walls or heavy timber)
24	Transmission line tower
25	Free-standing tower
26	Free standing pole (light, flag, luminary)
27	Tree - hardwood
28	Tree - softwood

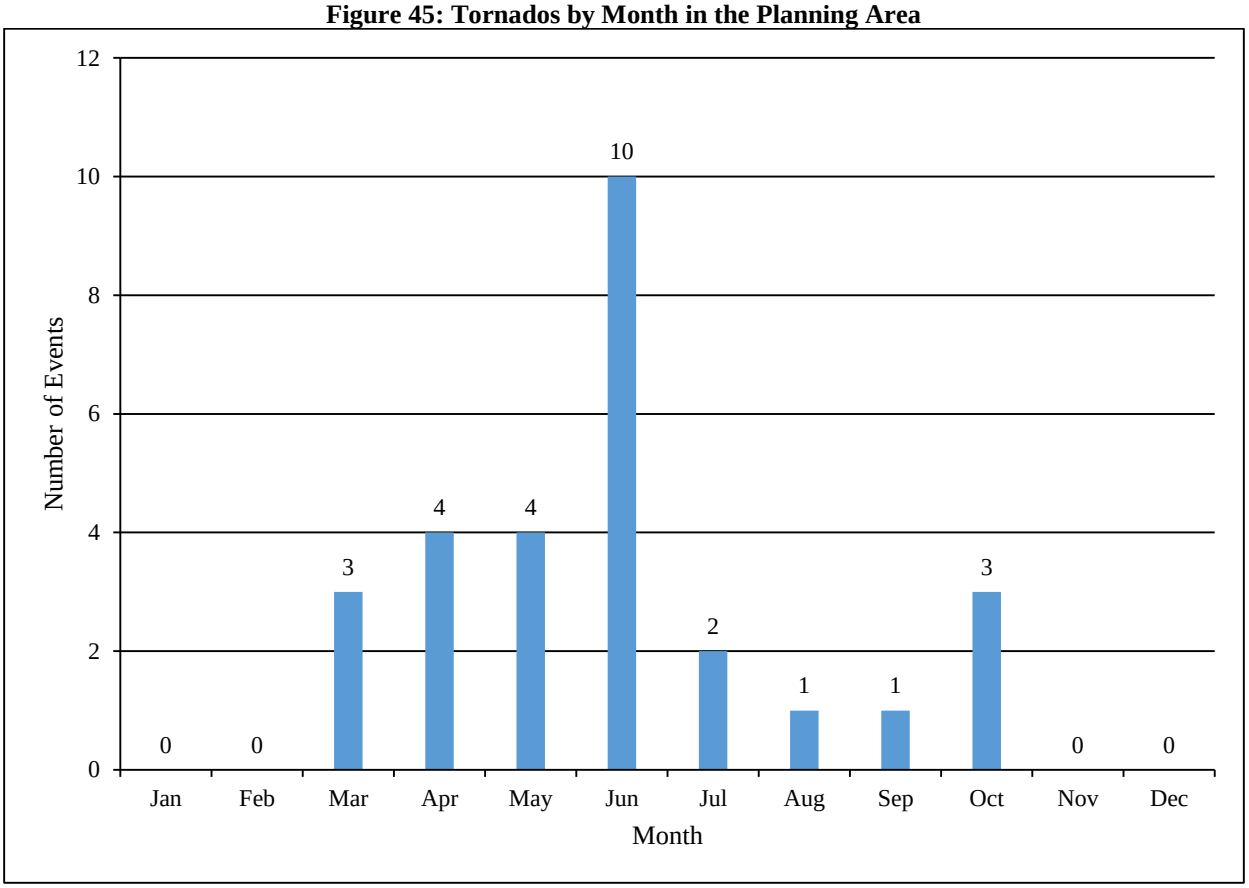
Source: NOAA; FEMA

Based on the historic record, it is most likely that tornados that do occur within the planning area will be of EF0 or EF1 strength. Of the 28 reported events, 12 were F/EF0, 12 F/EF1 tornados, and four were F/EF2 tornados.

HISTORICAL OCCURRENCES

NCDC cites 28 tornado events ranging from a magnitude of EF0 to EF2 between 1996 and 2015. These events were responsible for $5,085,000 in property damages. No deaths were reported, however nine injuries were cited. The jurisdiction specific events from NCDC and reported by each community are listed in each participant section in *Section Seven: Participant Sections*. The following figure shows that the month of June is the busiest month of the year with the highest number of tornados in the planning area.

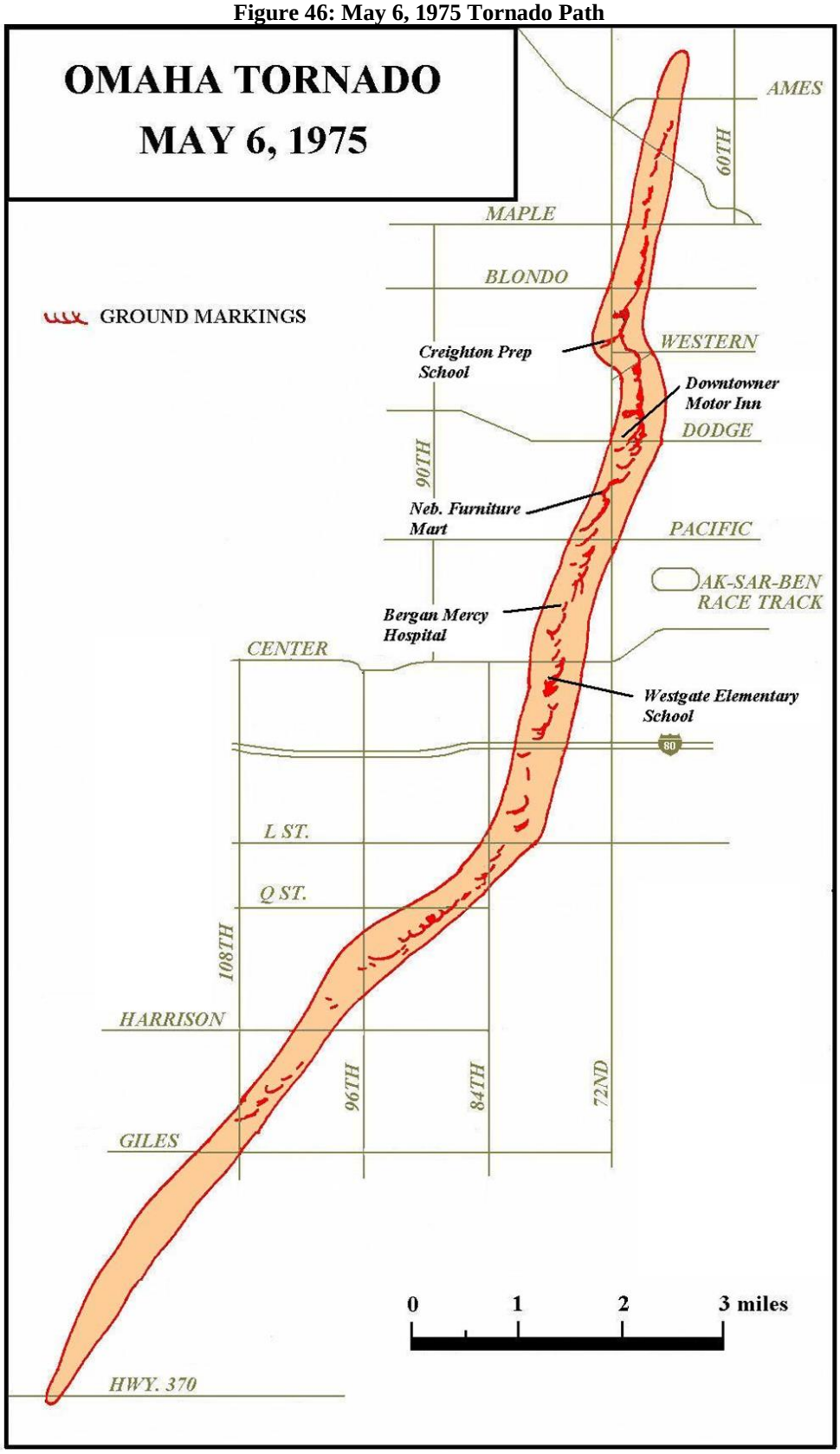
Figure 45: Tornados by Month in the Planning Area



Source: NCDC, 1996-2015

One tornado event, which occurred prior to 1996, significantly impacted the Omaha metropolitan area. On May 6, 1975, an F4 tornado touched down in the extreme western portion of La Vista and also impacted the northwest corner of Ralston. However, most of the damage was in Omaha. A good storm spotting network and advanced and adequate warning kept the death toll from exceeding three people. A ten mile swath was destroyed through the heart of the city. About 2,000 homes, 120 businesses, and many public facilities were destroyed including a hospital and several schools. The final damage estimate was $250 million (in 1975 dollars), three deaths, and an estimated 2,600 persons were injured. The following figure shows the path of the tornado.

Figure 46: May 6, 1975 Tornado Path



Source: NWS Omaha/Valley, http://www.weather.gov/oax/may675

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCDC 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. Tornados cause an average of $259,439 per year in property damage, and $20,378 in crop damages.

Table 134: Tornado Loss Estimate

Hazard Type	Number of Events[1]	Average Number of Events Per Year	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Tornados	28	1.4	$5,085,000	$259,439	$305,673	$20,378

1 Indicates the data is from NCDC (January 1996 to July 2015); 2 Indicates data is from USDA RMA (2000 to 2014)

PROBABILITY

Given the 28 events over the course of 19.6 years, there is a 100 percent probability that a tornado event will occur in the planning area in any given year.

FUTURE DEVELOPMENT

There are some changes that communities can make to partially mitigate the impacts resulting from tornados. Building codes for new structures can be strengthened, requiring increased rebar in foundations, enhanced nailing patterns for wall sheathing, and the use of Simpson Strong Ties and Straps. Building codes can also be strengthened to require the use of anchors and tie-downs of mobile homes. Additionally, individuals can choose to build to an optional Code Plus Standard, such as Fortified for Safer Living. Safe rooms can be installed in new structures as well as made to adapt to existing structures. In-ground safe rooms can be installed in existing structures for as little as $4,000. The installation of public safe rooms in areas around vulnerable populations, such as mobile home parks, can increase safety of residents in those areas.

Considerations for future development should include developing tornado safe rooms in or near mobile home parks. The 2003 Tornado Shelters Act authorizes communities to use Community Development Block Grant (CDBG) funds for construction of tornado-safe shelters in manufactured home parks with 20 or more housing units consisting predominately of low- and moderate-income residents.

REGIONAL VULNERABILITIES

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

Table 135: Regional 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 -Lack of multiple ways of receiving weather warnings, especially at night
Economic	-Significant economic losses possible, especially with EF3 tornados 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

RISK ASSESSMENT SUMMARY

Table 136: Summary

Number of Past Events	28 tornados or 1.4 per year
Vulnerable Locations	Entire planning area
Extent	EF0-EF1
Annual Probability	100%
Averaged Annual Losses	Property = $259,439 and Crops = $20,378

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Bury power and service lines
    - Many have started to bury power lines
- Continue to participate, or become a participant, in Tree City USA; establish a tree maintenance ordinance
    - Many communities participate or would like to participate
- Establish a Tree Board to assist in the development of a tree management program
    - This is a requirement of Tree City USA
- Encourage the construction of safe rooms
    - Some jurisdictions would like to build a safe room
- Ensure outdoor warning sirens are functional and located adequately to warn the public of potential tornadic events
    - All communities have warning sirens
- Incorporate text messaging into severe weather messaging programs
- Incorporate cable TV interruption warning systems
- Establish mutual aid agreements with neighboring communities and privately owned businesses
    - All communities have mutual aid agreements
- Establish public education programs to increase awareness of the dangers posed by severe tornados and strong winds and ways the public can mitigate potential impacts.
    - Most county emergency manages have some education programs
- Enhance building codes to incorporate wind –resistant building techniques
    - State requires home to be built to withstand winds of 130 mph which is what most jurisdictions require
- Establish data recovery program and backup program for municipal employees

URBAN FIRE

HAZARD PROFILE

Urban fires are classified as "uncontrolled burning in a residence or building from natural, human or technical causes". These fires have a potential to spread to adjoining structures. Local city and county fire departments are tasked with the response and control of urban fires.

According to the United States Fire Administration, fire risk "varies from region to region in the United States". This often is a result of climate, poverty, education, demographics, and other causal factors. Often times, all that is needed to cause an uncontrolled urban fire is a heat source to spark a fire, flammable materials that act as a fuel source, and oxygen.

Within the State of Nebraska, and the planning area specifically, urban fires can occur throughout the region, to any fire prone structure.

LOCATION

Urban fires are most likely to occur in developed, incorporated areas. The probability of fire occurrence has a direct correlation to the density and age of the structure. Older wood-built structures are at a greater risk of fire. Densely urbanized areas also have increased vulnerability to urban fire.

EXTENT

Urban fire has a history of occurring throughout the planning area. While urban fires are often localized events typically contained to an individual structure, it is possible for widespread outbreaks, which could involve multiple structures in close proximity to one another.

HISTORICAL OCCURRENCES

Table 137 shows the number of fires that occurred between 2007 and 2012 in the planning area. The information for the table comes from the Nebraska State Fire Marshal's Office. The database being used is a voluntary reporting system so not all incidents will be reported. This is the best data available for urban fires for the planning area.

Table 137: Urban Fires by Fire Department

Fire Department	Number of Urban Fire Incidents						
	2007	2008	2009	2010	2011	2012	Total
Burt County							
Craig Vol Fire Dept.	1	2	0	-	0	0	3
Decatur Vol Fire Dept.	-	-	0	-	0	0	0
Lyons Vol Fire Dept.	-	-	0	-	0	0	0
Oakland Vol Fire Dept.	-	-	0	0	0	0	0
Tekamah Vol Fire Dept.	-	-	0	-	0	0	0
Dakota County							
Dakota City Vol Fire	-	-	0	-	0	0	0
Emerson Vol Fire Dept.	8	2	7	-	0	1	18
Homer Vol Fire Dept.	4	3	2	-	0	0	9
South Sioux City Vol Fire Dept.	-	20	42	-	0	0	62
Douglas County							
Bennington Vol Fire Dept.	19	28	27	33	47	0	154
Boys Town Fire & Rescue	43	56	56	39	53	47	294
Elkhorn Suburban Fire Dist.	4	-	0	-	0	0	4
Millard Suburban Fire	-	-	0	-	0	0	0
Omaha Fire Department	1,756	1,555	1,529	1,528	1,450	199	8,017
Ponca Hills Vol Fire Dept.	1	5	6	6	6	9	33
Ralston Vol Fire Dept.	24	10	7	-	0	0	41

Fire Department	Number of Urban Fire Incidents						
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Valley Vol Fire Dept.	2	-	0	0	18	6	26
Waterloo Vol Fire Dept.	4	15	1	0	0	0	20
Irvington Vol Fire Dept.	32	40	29	30	38	28	197
Omaha Airport Authority Fire & Rescue	2	3	1	-	0	0	6
Sarpy County							
Bellevue Vol Fire Dept.	145	-	37	-	0	0	182
Gretna Vol Fire Dept.	32	-	40	30	33	68	203
Papillion Vol Fire Dept.	92	9	25	-	0	73	199
Springfield Vol Fire Dept.	-	-	0	-	0	0	0
La Vista Vol Fire Dept.	40	-	1	-	37	38	116
Thurston County							
Omaha Nation Firefighters	-	-	0	-	0	0	0
Pender Vol Fire Dept.	-	-	0	-	0	0	0
Rosalie Vol Fire Dept.	-	-	0	-	0	0	0
Thurston Vol Fire Dept.	-	-	0	-	0	0	0
Walthill Vol Fire Dept.	5	3	0	-	0	0	8
Winnebago Vol Fire Dept.	29	8	43	25	33	58	196
Washington County							
Arlington Vol Fire & Rescue	-	-	0	-	0	0	0
Blair Vol Fire Dept.	-	-	0	-	0	0	0
Fort Calhoun Vol Fire Dept.	15	23	7	-	0	2	47
Herman Rural Vol Fire Dept.	7	-	17	-	0	0	24
Kennard Vol Fire Dept.	-	-	0	-	0	0	0
Total	**2,265**	**1,782**	**1,877**	**1,691**	**1,715**	**529**	**9,859**

Source: Nebraska State Fire Marshal's Office, 2007-2012

AVERAGE ANNUAL DAMAGES

Based on the data from the Nebraska State Fire Marshal, there are approximately 1,643 fires annually across the planning area. Due to lack of data, potential losses are not being calculated for this threat.

PROBABILITY

There is a 100 percent probability that urban fires will occur within the planning area in the future, particularly in more urban areas.

FUTURE DEVELOPMENT

There are many strategies that can be undertaken to protect both existing and future assets. Any future development that occurs in the region with respect to residential and non-residential structures has the potential for fire damage or destruction. The use of building codes and Fire Wise building practices will reduce some of the damages that could occur or reduce the risk that neighboring structures could catch fire as easily.

REGIONAL VULNERABILITIES

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

Table 138: Regional Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations include adults older than 65 and children under 4 are at a higher risk of fire death
Economic	-If several businesses are damaged in a fire, economic losses could occur
Built Environment	-All building stock are at risk, but particularly those without smoke alarms or fire sprinkler system
Infrastructure	-Minimal impacts
Critical Facilities	-All critical facilities at risk

RISK ASSESSMENT SUMMARY

Table 139: Summary

Number of Past Events	9,859 during 2007-2012
Vulnerable Locations	Entire planning area, especially developed areas
Extent	Single structure to multiple structures
Annual Probability	100%
Average Annual Losses	Not available

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- New municipal wells
- Civil service improvements (New fire trucks)
- Firefighter training
    - All fire departments have training that they must complete

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 development of goals and objectives took place during the Planning Team meetings.

Meeting participants reviewed the goals from the 2011 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 participants at the Round 1 public meetings. Each participant was asked to review all of the goals and objectives and comment on possible improvements or suggest how to make them meet the needs of their jurisdiction. Each participating jurisdiction decided to utilize the same goals and objectives.

***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 selectin process, and the incorporation of mitigation actions for the additional hazards addressed in the update.

GOALS AND OBJECTIVES

Below is the final list of goals and objectives as determined by the participants and Planning Team. These goals and objectives provide specific direction to guide participants in reducing future hazard related losses. The goals and objectives were numbered to assist in the development and organization of mitigation alternatives or 'action items', as discussed in *Section Seven: Participant Sections*.

Goal 1: Protect the Health and Safety of the Public

***Objective 1.1:** Continued compliance with NFIP for participating communities; join NFIP if not currently participating*

***Objective 1.2:** Construct safe rooms in schools, public buildings, and in select locations, at public outdoor venues*

***Objective 1.3**: Update or obtain additional outdoor warning sirens, as needed, in the project area*

***Objective 1.4:** Develop additional emergency notification methods to alert the public of potential hazards*

Objective 1.5: *Provide educational opportunities for the public to promote preparedness in the project area*

Objective 1.6: *Reduce flooding of developed residential and commercial areas*

Goal 2: Reduce or Prevent Future Damage to Critical Facilities, Critical Infrastructure, and Maintain Their Operation after a Hazard

Objective 2.1: *Protect power lines throughout the NRD by burying them or reinforcing them*

Objective 2.2: *Obtain generators and other backup power systems required to keep critical facilities, critical infrastructure, and emergency operations running after a hazard event*

Objective 2.3: *Evaluate and identify infrastructure systems that require improvements in order to reduce or prevent damage from hazards*

Objective 2.4: *Protect all existing public infrastructure from flooding*

Goal 3: Reduce or Prevent Future Damage to Existing Properties and Natural Resources

Objective 3.1: *Enforce regulations and building codes promoting wise development and construction that reduces the potential for damage to existing or future structures and property*

Objective 3.2: *Protect existing streambanks and beds from erosion/downcutting*

Objective 3.3: *Perform studies to determine locations of concern and evaluate projects to mitigate against the damage caused by hazards*

Objective 3.4: *Develop projects to reduce or prevent damage to public structures*

Objective 3.5: *Improve local drainage and stabilize creeks where necessary*

Objective 3.6: *Improve protection procedures for structures throughout the planning area to reduce damage from hazard events*

Objective 3.7: *Implement a mitigation plan for tree trimming and tree removal*

Objective 3.8: *Improve and protect area roads and drainage structures against hazards*

Objective 3.9: *Maintain and improve surface water quality*

Goal 4: Promote Efficient Use of Public Funds

Objective 4.1: *Maximize funding opportunities through grant money and other outside sources*

Objective 4.2: *Prioritize projects based on greatest risk*

Objective 4.3: *Encourage individual property owners to develop independent measures to protect their property and not rely on public funding*

MITIGATION ALTERNATIVES (ACTION ITEMS)

After the establishment of the goals and objectives, mitigation alternatives were prioritized. The alternatives considered included: the mitigation actions in the previous plan, additional mitigation actions discussed during the planning process, and recommendations from JEO for additional mitigation actions. In addition, JEO provided each participant a preliminary list of mitigation alternatives to be used as a starting point. The 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 at which each action should be implemented.

These projects are the core of a hazard mitigation plan. The group was instructed that each alternative must be directly related to the goals and objectives. 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: information on the associated hazard mitigated, description of the action, responsible party, priority, cost estimate, potential funding sources, and 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 included implemented due to limited capabilities, prohibitive costs, low benefit/cost ratio, or other concerns. 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 additional mitigation actions not identified.

PARTICIPANT MITIGATION ALTERNATIVES

The following are specific actions listed by participants of the P-MRNRD HMP intended to be utilized in the implementation of mitigation alternatives. Each action is described by the following:

- Description – general summary of the action item
- Analysis – brief summary of what the action item will accomplish
- Goal/Objective – which goal and objective the action item falls under
- Hazard(s) Addressed – which hazard the mitigation action aims to address
- Potential funding – a list of any potential funding mechanism used 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 smaller communities. Establishment of a cost-benefit analysis is out of 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, ongoing and new mitigation alternatives for each participating jurisdiction can be found in *Section Seven: Participant Sections.*

MITIGATION ALTERNATIVE PROJECT MATRIX

During public meetings, each participant was asked to review mitigation projects listed in the 2011 HMP and also review a list of potential mitigation alternatives which would lead to action items to reduce the effects of hazards. Projects selected varied from community to community depending upon the significance of each hazard present. The information listed in Tables 140a and 140b is a compilation of the mitigation alternatives identified by jurisdiction and organized by the goal and objective to be met.

Table 140: Mitigation Alternatives Selected by Each Jurisdiction

Mitigation Alternatives		P-MRNRD	Burt County	Decatur	Tekamah	Dakota County	Dakota City	Homer	Homer Schools	Jackson	South Sioux City	Douglas County	Bennington	Omaha	Millard Schools	Omaha Schools	Westside Schools	Ralston	Valley	Waterloo
Goal 1																				
Objective 1.1	**Maintain good standing in National Flood Insurance Program (NFIP)**		X	X	X	X	X			X	X	X	X	X				X	X	X
	Continue Community Rating System (CRS)										X			X					X	
Objective 1.2	**Storm Shelter/Safe Room**		X	X	X		X	X			X	X			X	X	X	X	X	X
Objective 1.3	**New/Upgrade/Replace Warning Sirens**		X			X	X	X		X	X	X								
	Bury power supply to warning sirens											X								
Objective 1.4	**Emergency Notification System**		X													X				X
	Weather Radios		X					X			X	X		X	X	X	X			
	Emergency Communications		X					X	X		X				X	X	X			
	Reverse 911																		X	
	Improvements to Flood Warning System	X												X					X	
	Mutual Aide Through WARN Program																		X	
	Emergency Operations										X							X		

Mitigation Alternatives		P-MRNRD	Burt County	Decatur	Tekamah	Dakota County	Dakota City	Homer	Homer Schools	Jackson	South Sioux City	Douglas County	Bennington	Omaha	Millard Schools	Omaha Schools	Westside Schools	Ralston	Valley	Waterloo
Objective 1.5	**Public Awareness / Education / Risk Communication**	X	X							X	X	X		X			X		X	
	Establish Snow Routes					X					X									
	Use Snow Fences										X									
	Identify Location of Tornado Shelters										X			X						
	Emergency Management Exercise	X				X		X						X					X	
	Identify Population Centers at Risk to Dam Failures																			
	Shelter in Place Education							X												
	Develop Flood Assistance Strategies													X						
Objective 1.6	**Construct Concrete Barrier**										X									
Goal 2																				
Objective 2.1	**Bury Power Lines**				X		X				X			X						
Objective 2.2	**Backup Generators**	X					X	X	X	X	X		X		X	X	X	X	X	X

Mitigation Alternatives		P-MRNRD	Burt County	Decatur	Tekamah	Dakota County	Dakota City	Homer	Homer Schools	Jackson	South Sioux City	Douglas County	Bennington	Omaha	Millard Schools	Omaha Schools	Westside Schools	Ralston	Valley	Waterloo
	Surge Protectors										X									
Objective 2.3	**Stormwater Management**							X			X								X	
	Stormwater Management Committee										X			X					X	
	Upgrades and Improvements to Levees	X												X						
	Infrastructure Assessment Study										X									
	High-Resolution Aerial Photography/LiDAR											X								
Objective 2.4	**Flood Proofing of Flood-prone Buildings**											X		X		X				
	Lift Station Improvements																		X	
	Transportation Drainage Improvements										X									
	Site Hardening													X						
Goal 3																				
Objective 3.1	**Floodplain Regulation Enforcements and Updates**	X	X	X										X					X	
	Require Mobile Home Anchoring				X															

Mitigation Alternatives		P-MRNRD	Burt County	Decatur	Tekamah	Dakota County	Dakota City	Homer	Homer Schools	Jackson	South Sioux City	Douglas County	Bennington	Omaha	Millard Schools	Omaha Schools	Westside Schools	Ralston	Valley	Waterloo
	Acquisition/Elevation Repetitive Loss Properties	X										X		X						
	Enforce Stormwater Management Ordinance													X						
	Development Restrictions										X			X					X	
	Update Comprehensive Plan							X			X		X							
	Land Use Regulations							X			X									
	Higher Building Codes										X									
	School Continuity Plan																X			
Objective 3.2	**Grade Control Structures**		X																	
	Stream Bank Stabilization					X								X				X		
Objective 3.3	**GIS Mapping**		X																	
	Structural Inventory													X				X		
	Improve Disaster Recovery Time and Effectiveness																			X
	Drainage Study/Stormwater Master Plan	X										X							X	
	Flood Mitigation and Watershed Study																			

Mitigation Alternatives		P-MRNRD	Burt County	Decatur	Tekamah	Dakota County	Dakota City	Homer	Homer Schools	Jackson	South Sioux City	Douglas County	Bennington	Omaha	Millard Schools	Omaha Schools	Westside Schools	Ralston	Valley	Waterloo
	Parcel Level Evaluation of Flood Prone Properties											X		X						
	Stormwater System Improvements																	X		
Objective 3.4	**Maintain Water Supply**																			X
	Emergency Lighting															X				
	Improve Snow Removal															X				
	Roof Hardening/Hail Resistant Roofing								X							X		X		
	Install Snow Fencing															X				
	Safety Improvements															X				
	Stormwater Improvements																		X	
	Construct Detention Ponds																			
	Civil Service Improvements							X			X									X
Objective 3.5	**Ditch Clearing/Drainage Ditches**					X														X
	Drainage and Erosion Control																	X		
	Drainage Improvements	X									X								X	X
	Remove Flow Constriction																		X	
	Wetlands Protection													X						
	Promote Infiltration													X						

Mitigation Alternatives		P-MRNRD	Burt County	Decatur	Tekamah	Dakota County	Dakota City	Homer	Homer Schools	Jackson	South Sioux City	Douglas County	Bennington	Omaha	Millard Schools	Omaha Schools	Westside Schools	Ralston	Valley	Waterloo
Objective 3.6	Response and Prevention Railroad Plan										X									
	Levee Maintenance																			X
	Fuel Tank Anchoring																		X	
	Reduce Impacts of Stormwater																			
Objective 3.7	Tree Management Plan/Tree Removal Plan					X				X	X			X		X	X			
	Tree City USA									X	X									
	Tree Assistance/Tree Planting										X									
Objective 3.8	Upgrade/Elevate Bridges and/or Culverts	X																		
	Snow Plow										X							X		
Objective 3.9	Maintain and Improve Water Quality																			
Goal 4																				
Objective 4.1	Funding Opportunities																			

Mitigation Alternatives		P-MRNRD	Burt County	Decatur	Tekamah	Dakota County	Dakota City	Homer	Homer Schools	Jackson	South Sioux City	Douglas County	Bennington	Omaha	Millard Schools	Omaha Schools	Westside Schools	Ralston	Valley	Waterloo
Objective 4.2	**Community-Wide Plan to Prioritize Flood Related Projects**																		X	
	Intergovernmental Support							X			X									
Objective 4.3	**Low Impact Development**													X					X	
	Education Program on Mitigation Actions										X									

Table 141: Mitigation Alternatives Selected by Each Jurisdiction - Continued

Mitigation Alternatives		Sarpy County	Bellevue	Gretna	La Vista	Papillion	Papillion-La Vista Schools	Springfield	Thurston County	Walthill	Winnebago	Washington County	Arlington	Arlington Schools	Blair	Blair Schools	Fort Calhoun	Fort Calhoun Schools	Herman
Goal 1																			
Objective 1.1	**Maintain good standing in National Flood Insurance Program (NFIP)**	X	X		X	X		X	X	X	X		X		X		X		X
	Community Rating System (CRS)					X													
Objective 1.2	**Storm Shelter/Safe Room**		X		X	X	X	X			X	X			X	X	X		X
Objective 1.3	**New/Upgrade/Replace Warning Sirens**	X						X	X	X	X	X	X						
Objective 1.4	**Emergency Notification System**													X	X				
	Weather Radios	X		X				X	X	X		X				X			
	Emergency Communications	X		X			X					X		X		X		X	
	Reverse 911																		
	Improvements to Flood Warning System					X													

Mitigation Alternatives		Sarpy County	Bellevue	Gretna	La Vista	Papillion	Papillion-La Vista Schools	Springfield	Thurston County	Walthill	Winnebago	Washington County	Arlington	Arlington Schools	Blair	Blair Schools	Fort Calhoun	Fort Calhoun Schools	Herman
	Mutual Aid through WARN Program																		
	Install Railroad Crossing Arms										X								
	Short Term Shelters											X							
	Emergency Response Plan											X							
Objective 1.5	**Public Awareness / Education/Risk Communication**	X				X		X	X	X		X		X					
	Establish Snow Routes																		
	Identify Location of Tornado Shelters	X			X										X				
	Emergency Management Exercise	X				X													
	Shelter in Place Education											X							
	Use Snow Fences																		
	Flood Assistance Strategies					X													
Objective 1.6	**Construct Concrete Barrier**																		
Goal 2																			

Mitigation Alternatives		Sarpy County	Bellevue	Gretna	La Vista	Papillion	Papillion-La Vista Schools	Springfield	Thurston County	Walthill	Winnebago	Washington County	Arlington	Arlington Schools	Blair	Blair Schools	Fort Calhoun	Fort Calhoun Schools	Herman
Objective 2.1	Bury Power Lines				X														
	Elevate Pad Mounted Transformers and Switch Gear					X													
Objective 2.2	Backup Generators	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X
	Surge Protectors							X											
	Backup Municipal / County Records			X				X				X							X
Objective 2.3	Stormwater Management																		
	Stormwater Management Committee	X																	
	Upgrades and Improvements to Levees	X	X																
	Infrastructure Assessment Study	X																	
	Facilities for Vulnerable Populations	X										X							
Objective 2.4	Flood Proofing of Flood-prone Buildings					X													
	Lift Station Improvements																		

Mitigation Alternatives		Sarpy County	Bellevue	Gretna	La Vista	Papillion	Papillion-La Vista Schools	Springfield	Thurston County	Walthill	Winnebago	Washington County	Arlington	Arlington Schools	Blair	Blair Schools	Fort Calhoun	Fort Calhoun Schools	Herman
	Site/Infrastructure Hardening			X				X											
	Intake Structure for Water Plant														X				
Goal 3																			
Objective 3.1	**Floodplain Regulation Enforcements and Updates**	X				X													
	Require Mobile Home Anchoring							X											
	Acquisition/Elevation Repetitive Loss Properties	X																	
	Enforce Stormwater Management Ordinance														X				
	Development Restrictions	X																	
	Update Comprehensive Plan	X						X											X
	Land Use Regulations																		
	Higher Building Codes	X		X															

Mitigation Alternatives		Sarpy County	Bellevue	Gretna	La Vista	Papillion	Papillion-La Vista Schools	Springfield	Thurston County	Walthill	Winnebago	Washington County	Arlington	Arlington Schools	Blair	Blair Schools	Fort Calhoun	Fort Calhoun Schools	Herman
Objective 3.2	Grade Control Structures																		
	Stream Bank and Channel Stabilization				X	X		X							X				
Objective 3.3	GIS Mapping																		
	Structural Inventory														X				
	Improve Disaster Recovery Time and Effectiveness																		
	Drainage Study/Stormwater Master Plan									X									
	Flood Mitigation and Watershed Study											X	X						
	Parcel Level Evaluation of Flood Prone Properties																		
	Stormwater System Improvements							X											
Objective 3.4	Maintain Water Supply																		
	Emergency Lighting																		
	Improve Snow Removal					X													

Mitigation Alternatives		Sarpy County	Bellevue	Gretna	La Vista	Papillion	Papillion-La Vista Schools	Springfield	Thurston County	Walthill	Winnebago	Washington County	Arlington	Arlington Schools	Blair	Blair Schools	Fort Calhoun	Fort Calhoun Schools	Herman
	Roof Hardening/Hail Resistant Roofing											X		X					
	Install Snow Fencing																		
	Safety Improvements																		
	Stormwater Improvements																X		
	Construct Detention Ponds																X		
	Civil Service Improvements			X				X				X							
	Install Vehicular Barriers													X					
	Build a Berm																		X
Objective 3.5	**Ditch Clearing**																		
	Drainage and Erosion Control																		
	Drainage Improvements			X											X				
	Remove Flow Constrictions																		
	Floodplain Management	X				X		X											
Objective 3.6	**Response and Prevention Railroad Plan**																		
	Levee Maintenance																		

Mitigation Alternatives		Sarpy County	Bellevue	Gretna	La Vista	Papillion	Papillion-La Vista Schools	Springfield	Thurston County	Walthill	Winnebago	Washington County	Arlington	Arlington Schools	Blair	Blair Schools	Fort Calhoun	Fort Calhoun Schools	Herman
	Fuel Tank Anchoring																		
	Reduce Impacts of Stormwater				X														
Objective 3.7	**Tree Management Plan**				X										X		X		
	Tree City USA		X					X											
	Tree Assistance/Tree Planting							X											
	Hazardous Tree Removal Plan		X					X											
Objective 3.8	**Upgrade/Elevate Bridges and/or Culverts**		X		X	X		X											
Objective 3.9	**Maintain and Improve Water Quality**																		
Goal 4																			
Objective 4.1	**Funding Opportunities**																		

Mitigation Alternatives		Sarpy County	Bellevue	Gretna	La Vista	Papillion	Papillion-La Vista Schools	Springfield	Thurston County	Walthill	Winnebago	Washington County	Arlington	Arlington Schools	Blair	Blair Schools	Fort Calhoun	Fort Calhoun Schools	Herman
Objective 4.2	**Community-Wide Plan to Prioritize Flood Related Projects**					X													
	Intergovernmental Support			X				X											
Objective 4.3	**Low Impact Development**					X													
	Education Program on Mitigation Actions							X											

COMPLETED MITIGATION EFFORTS

Previously completed mitigation actions identified by the communities can be found in their specific participant section in *Section Seven: Participant Sections.*

MONITORING, EVALUATING, AND UPDATING THE PLAN

Participants of the P-MRNRD HMP will be responsible for monitoring (annually at a minimum), evaluating, and updating of the plan. 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 should 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 may 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 shall 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 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 D* may also be used to assist with plan updates.

In addition, the governing body will be responsible for ensuring that the Hazard Mitigation Plan goals and objectives are incorporated into applicable revisions of each participant's comprehensive plan and any new planning projects undertaken by the participant. The HMP should also take into account any changes in the 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 should remain a top priority for each participant. Notices for public meetings involving discussion of or action on mitigation updates should 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 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 P-MRNRD should compile a list of proposed amendments received annually and prepare a report 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* Guidance, as well as FEMA's *2014 Plan Integration Guide*, each community engaged in a plan integration discussion. Each community referenced all relevant existing planning mechanisms and provided information on how these did or did not address hazards and vulnerability. Recommendations for improving this integration were discussed at the public meetings, but several communities did not have other relevant planning mechanisms. For these communities that lack existing planning mechanisms, especially smaller villages, the Hazard Mitigation Plan should be used as a guide for future activity and development in the community. Each community that has a comprehensive plan was encouraged to incorporate elements of the Hazard Mitigation Plan within it. This ensures that the mitigation component of the comprehensive plan would be consistently revisited and reviewed. In order to determine which pieces of the comprehensive plan overlap with the Hazard Mitigation Plan, communities can use the American Planning Association's Safe Growth Audit. However, care must be taken so that this mitigation portion is reviewed and updated every five years, as the evaluation and updating of the comprehensive plan is typically performed on a 10-year basis.

SECTION SEVEN: PARTICIPANT SECTIONS

PURPOSE OF PARTICIPANT SECTIONS

Participant sections contain information specific to jurisdictions which have participated in the P-MRNRD planning effort. Information from individual communities was collected at public and one-on-one meetings and used to establish the plan. Participant sections include: location and geography, climate, transportation, demographics, future development trends, critical facilities, risk assessment, capability assessment, plan integration, and mitigation actions. In addition, maps specific only to each jurisdiction are included such as: critical facilities as identified by the jurisdiction, 1 percent annual chance floodplain boundaries, and land use map.

The risk assessment information, as provided by individual participants, in *Section Four: Risk Assessment* and *Section Seven: Participant Sections* 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. For example, a jurisdiction located near a river may list flooding as highly likely in probability and severe in extent of damage, where a jurisdiction located on a hill may list flooding as unlikely in probability and limited in extent of damage. The overall risk assessment for the identified hazard types represents the presence and vulnerability to each hazard type area wide throughout the entire planning area. . The discussion of certain hazards selected for each participant section 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 referred to in *Section Four: Risk Assessment.*