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Central City, Nebraska Risk Assessment

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In cooperation with:
The University of Nebraska-Lincoln, Community and Regional Planning Program
The Nebraska Emergency Management Agency
Region 44 Emergency Manager
The City of Central City, Nebraska

A Professional Project Completed in Partial Fulfillment of Requirements for the Degree,
Master of Community and Regional Planning

Date: May 1, 2016



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Executive Summary

A Risk Assessment is a primary task needed to develop a hazard mitigation plan and provides factual data for planning jurisdictions to develop and prioritize planning and mitigation activities toward natural and man-made hazards (44 CFR Section 201(c)(2)). Risk Assessments, and ultimately hazard mitigation plans are built on likely exposures to populations in defined geographic extents, expected economic impacts, identification of population vulnerabilities, structural inventories and valuations, event damages, and the likelihood of a hazardous event occurring. The planning area encompasses Central City, Nebraska and the community's Extra Territorial Jurisdiction of a half-mile. Central City is the county seat and largest community in Merrick County with a population of 2,936 (2010 Census).

The Central City Risk Assessment was developed by obtaining data from observation, review of existing plans, input from multiple agencies and open sources, and as provided by the local emergency manager and community leaders. The project assessed hazards consistent with twenty hazard categories identified in survey results obtained during development of the State of Nebraska Hazard Mitigation Plan (SHMP), 2014. The SHMP prioritized, scored, and ranked hazards in four categories. The categories were magnitude (defined by percentage of geographic extent), frequency of occurrence, sectors likely to be affected, and probable amount of warning time (e.g. speed of onset). Composite scores were calculated and ranked all twenty hazards statewide, across eight geographic regions, and at county levels. In the state plan, hazards were not assessed at individual community levels, but rather at the county geographic extent; and did not include points for historical damages, fatalities or injuries. Comparisons to SHMP scores and ranks are made throughout the report, however subjectivity is introduced in the SHMP methodologies and should be considered during review of the local project. Summaries of historical damages by event type, probabilities, relative frequencies and fatalities and injuries are included as components of the Central City Risk Assessment.

During project development, some local data was found to be limited or not reported. Data collection expanded to encompass county or state level data if information was unavailable at the local level. Some hazards identified in the state plan were not consistent with local reported data and therefore were assessed as subcategories for Central City for a total of 35 hazard risk assessments for the community. Limited assessments were performed for Aircraft/Explosions, Earthquakes, Civil Disorder, Wildfires, Radiological Transportation and Radiological Fixed facility due to data limitations and low probabilities.

Hazards assessed for Merrick County as identified and ranked in descending order in the state plan include: Power Failure, Severe Thunderstorm, Severe Winter Storm, Chemical Fixed Facilities, Chemical Transportation, Tornadoes, Flooding, Drought, Agricultural Plant and Animal Disease, Dam/Levee Failure, Terrorism, Civil Disorder, Earthquake, Urban Fire, Radiological Fixed Facility, Transportation, Wildfire, Public Health, Aircraft, Explosions. The same hazards and associated rank are assumed to be the same for Central City.

Subcategories as defined in local data sets include: Hail, Lightning, Heavy Rains, High Winds, Winter Weather, Ice Storm, Blizzard, Cold/Wind Chill, Motor Vehicle and Railroad Transportation, and Land Subsidence (Sinkholes).

Vulnerability and Risk Assessment summary tables are provided by hazard type. Vulnerabilities are described as they relate to expected hazard impacts to People, Economic, Built Environment, Infrastructure, and Critical Facilities. Risk tables include information for the Historical number of events, Vulnerable locations, Extent (magnitude of hazard expected to impact the planning area), Annual Probability, Relative Frequency, Property and Crop Damage Summaries and Total Average Annual Losses. Additionally, the Risk Assessment summary tables include any fatalities, injuries, and categorical rankings and scores as they relate to the State Hazard Mitigation Plan.

Executive Summary (continued)

For hazards assessed, a suggested ranked order is provided in Section I, Table 3, on page 7. Rankings by hazard type were done via a review of the data provided in the Vulnerability and Risk Assessment Summary Tables.

Hazard types identified with the highest risk for Central City in descending order include, Power Failure due to lack of redundancies in power back-up and limited data in understanding the frequency of local outages. Furthermore, Power Failure is considered the greatest risk by the Central City Administrator at the time of this report. In second place is Severe Thunderstorms due to associated events (especially hail and high winds) that have caused the highest amount of local damages of over \$3M and a 100% annual probability as calculated from the previous 20-years of record. Drought competes for the second place in damage assessments with historically reported losses of greater than \$30M but is reduced in rank to a place of 7th due to a limited initial impacts to the population and reduced frequency of occurrence. Severe Winter Storms ranked third on the basis of associated events (e.g. Blizzard, Ice Storms), historical damages exceeding \$4M for ice storms. Frequencies of reported Severe Winter Storms and associated events were slightly lower than those reported under Severe Thunderstorms; resulting in a third place rank.

Transportation ranked 4th of Major Categories assessed and due to human injuries and fatalities. Chemical Transportation ranked 5th as related to transportation overall and possible exposures based on a number of intersecting major transportation corridors of Highway 30 and 14, Union Pacific and Nebraska Central Railroad Operations. Farm vehicles in rural areas and ag-businesses in town are also considered. Additionally, motor vehicle accidents involving animals and the number of at-grade rail crossings in the community increase the hazard risk for both Transportation, and Chemical Transportation categories. Pipelines and Airport Chemical transportation are considered and ranked as sub-categories due to their relation but may be prioritized to a lesser degree due to a lack of incidents occurring in the planning jurisdiction.

Floods-Flash Flooding, Tornadoes and Drought are ranked 6th, 7th, and 8th respectively based on numbers of Nebraska declared disasters (flooding 66.7%) and local events (reported), pre-disaster mitigation planning (flood water diversion construction and clean-outs). With the exception of drought (as discussed above), annual averaged damages are less than higher ranked categories, and local fatalities or injuries have not been reported for these hazards. Tornadoes are ranked higher than drought due to a lack of public shelters, a need for siren inventories, the destructive nature of tornadoes as an individual hazard, and geographic area of historical outbreaks.

Fixed Chemical Facility is ranked 9th due to the number of historical underground tank releases along Highway 30, and facilities storing extremely hazardous substances (grain elevator and ethanol production facility).

Urban fires are ranked 10th of Major Categories and Arson is ranked 10A by subcategory, due to direct impacts to the community, age of housing stock, as well as the relative high frequency of arson and seven events between 2001-2013 and calculations of a 53.8% probability. Dam and Levee failures are ranked 11th and assessed for the planning area in association with Kingsley Dam; located 230 river-miles upstream of Central City. If this event occurred advance warnings at greater than 60-hours is expected to reduce fatalities and injuries, however property damage is expected to be very high. Agricultural Plant and Animal Disease had limited data for assessment, but ag-lands primarily surround the community and are not directly within city boundaries, therefore lowering the risk. Public Health is ranked between ag-hazards due to an increased human-factors directly associated with vulnerable populations in the planning area, however events reported are non-existent. Remaining hazards Aircraft/Explosion, Earthquake, Civil Disorder, Radiological Transportation, and Radiological Fixed Facility had no historical events recorded or were not applicable to the planning area and were ranked based on knowledge of community perception terrorism, and knowledge of physical layout).

Project Purpose, Scope and Deliverables

This project provides a Risk Assessment for Central City, Nebraska and is expected to assist in developing a more robust hazard mitigation planning tool for the community and the Emergency Management Region of Merrick, Nance and Boone Counties. Additionally, the project serves as a professional project meeting Master's Program degree requirements of the Community and Regional Planning Department at the University of Nebraska-Lincoln. Two reports are provided, the first is a summary of key findings found in this publication, the second is a more comprehensive written report identifying data resources and research performed.

The community of Central City is a rural municipality having limited local governmental resources to take an in depth look at the hazards, exposures, and vulnerabilities that would be experienced during a disaster event. The community currently has a locally adopted, multi-jurisdictional hazard mitigation plan, however data is broad in scope and the community is expected to benefit from greater specificity and details as provided in this project. The existing hazard mitigation plan covers multiple surrounding communities that have populations of less than 500. It is the intent of this project to provide risk data with a focus on Central City, classified as a city of the second class and the county seat of Merrick County. Local data and resources were accessed to the maximum extent practicable, however some data is limited to the county or region and is noted accordingly.

After final completion and approval of the project by the Clients and the Graduate Committee, it is expected that a presentation will be made to the Central City Administrator and the Board of Supervisors for their review. They may choose to work on strategies for task completion as outlined in Figure 2 (page 2), or to adopt the risk assessment as part of their next revision to the Multi-Jurisdictional Hazard Mitigation Plan. Local leaders may choose to develop a Hazard Mitigation Plan specific to Central City. The Project Manager, and author of this report intends to hold and present findings to interested parties based on the discretion of the Emergency Manager and Central City Administrator. If the Risk Assessment is not adopted at the local level, it is the intent of the Region 44 Emergency Manager to integrate components of data presented in this Risk Assessment into the next Hazard Mitigation Plan update or to develop a regional risk assessment for Merrick, Nance and Boone counties (T. Smith, personal communications, January 2016).

The community was chosen due to the author's local familiarity as well as the opportunity to collaborate with City Administrator and the Region's Emergency Manager. The Risk Assessment intends to provide local information and visual aids to assist in future planning efforts. The community is centrally located in Nebraska covering an approximate two and a half-mile extent. As a city with a population meeting criteria of a second class community, the extra-territorial jurisdiction (ETJ) includes the geographic extent of one-half mile from city limit boundaries.

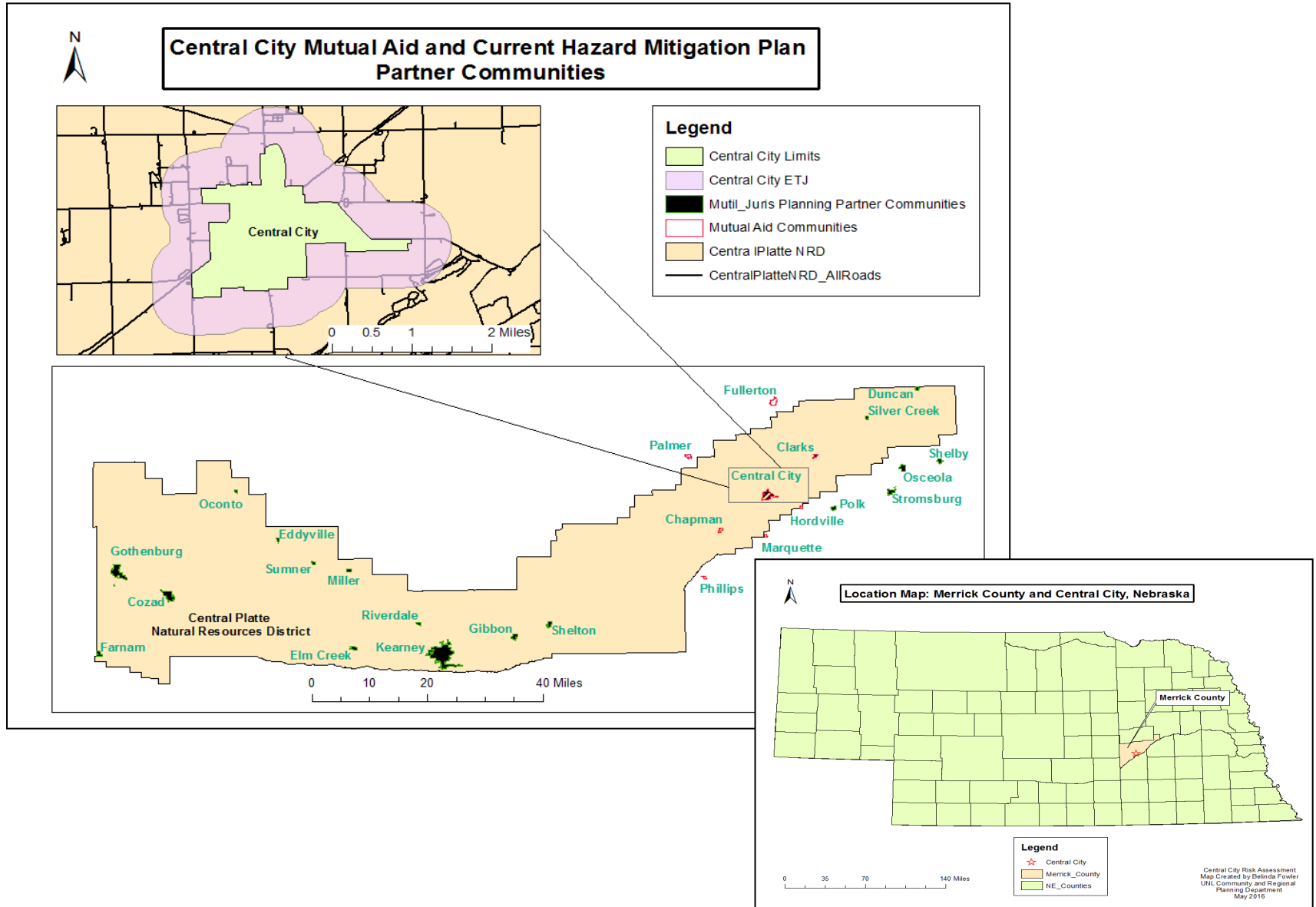
At a minimum, three hard-bound copies of the final project will be provided for local governmental distribution at the discretion of the Region 44 Emergency Manager. Upon request and approval, an electronic copy of the final project and supporting files may be provided to the Region 44 Emergency Manager and the Central City Administrator. Supporting files created or obtained as part of the project will be provided upon request (e.g. GIS shapefiles, geodatabase files, full-text resources, maps, worksheets, or calculations).

To meet UNL requirements for Graduation, the final project will meet the requirements and deadlines as established by the University of Nebraska-Lincoln, Office of Graduate Studies and as outlined in the Proposed Schedule of Events section. A final project defense and presentation will be provided to the Graduate Committee and the Region 44 Emergency Manager on April 15, 2016.

SECTION I

PLANNING AREA MAPS, KEY TERMS AND METHODS
MITIGATION PLANNING BACKGROUND
HAZARDS IDENTIFICATION FOR CENTRAL CITY

Planning Area Maps



Key Terms and Methods

Below are definitions of key terms that make up the majority of action items for the project. Definitions as excerpted from the Federal Emergency Management Agency's (FEMA) document 386-2, (Understanding Your Risks and Estimating Losses, August 2001) are provided in italics and underlined. Methods are provided in regular type font.

Hazard Analysis: Identifies natural or manmade hazards that would result in harm. These were identified via the State of Nebraska Hazard Mitigation Plan, and the National Climate and Data Center's Storm Event Database. Other hazards /potential threats to the community were identified through transportation statistics as published by the Nebraska Department of Highway Safety, the UNL Transportation Center's 2013 Commodity Flow Survey, a review of FBI Crime data, and discussions with governmental representatives, community departments, leaders, and residents. Internet resources were utilized when all local and state information avenues were exhausted.

Hazard Profile: Describing a hazard by determining the magnitude, frequency probability of an event, speed of onset, sector, impact information, expected duration and existing warning systems. Information was obtained from the National Oceanic and Atmospheric Administration, the National Weather Service, previously published periodicals and local plans, and via city documents and discussions with citizens and leaders in the local jurisdiction.

Exposure Assessment: People, property, systems or functions that can be lost due to a hazard event. Exposure is based on location and geographic extent of the hazard. Observations, open source data, existing plans and information provided by community officials were utilized to determine potential exposures for the community. Examples include: Annual public school reports, a review of city maps (zoning districts and potential development areas), FEMA flood hazard layers, licensed care facility rosters as published by the Nebraska Department of Health and Human Services.

Vulnerability: Susceptibility to physical injury, harm, damage or economic loss.

Vulnerable Populations: Includes the economically disadvantaged, racial and ethnic minorities, the uninsured, low-income children, the elderly, the homeless, those with human immunodeficiency virus (HIV), and those with other chronic health conditions, including severe mental illness (American Journal of Managed Care, 2006). Discussions of vulnerable populations are provided by hazard type and facility in each hazard section as it applies.

Vulnerability Assessment: Provides the extent of injury and damages that may result from a hazard event of a given intensity in a given area. For purposes of this project, the vulnerability assessment is provided in summary tables at the end of each hazard analysis section. Summary tables include descriptive criteria for impacts to vulnerable populations, community economic considerations, the built environment, infrastructure and critical facilities.

Risk: Depends on all three factors of hazard profiling and analysis, vulnerability and exposure assessments, and estimates of impacts that a hazard event would have on people, services, facilities and structures in a community. It is also defined as the likelihood (e.g. probability) that a hazard event will result in an adverse condition that causes injury, damage or loss.

Risk Assessment: Risk summary tables are provided for each hazard. The format provides a quick reference for the historical number of events, vulnerable locations, the extent or magnitude, annual probability, relative frequency, property and crop damage, and total average annual losses. Any historic fatalities or injuries in addition to the State Hazard Mitigation Plan Composite Scores and Ranking are listed in the tables. Specific data for some hazards was unavailable or limited for particular hazard topics. Some calculations could not be performed. This is noted in each appropriate section.

General Calculations and Individual Data Sets

Calculations used for individual event probabilities and relative frequencies were performed using the equations below:

Annual Probability (%): $\frac{\text{Total Number of Events Recorded (\#)}}{\text{Total Years of Record (Time)}}$

Relative Frequency (%): $\frac{\text{Total Count of Categorical Events (\#)}}{\text{Total Number of Hazard Events (\#)}}$

Fatalities and Injuries were reported only for categories of Motor Vehicle Accidents (MVA's), Railroad Transportation and Urban Fire.

Damage estimates are required components of a Risk Assessment under the Disaster Mitigation Act located at 44 CFR Part 201.6(c)(2)(ii)(B). Damages by hazard type were summed and provided an annual average loss estimation as provided by the equation below. Damages were estimated for some hazards and were not assessed for others on the basis of limited or inconsistent data availability.

Average Annual Damages (\$): $\frac{\sum \text{All Damages in Dollars}}{\text{Total Years of Record}}$

Parcel Data: Parcel data was obtained from the Merrick County Assessor's office (via GIS Workshop, Inc.) and was imported into Geographic Information System Software (GIS), ArcMap 10.3.1 for desktop and spatial analysis.

Structural Inventory, Critical Infrastructure and Key Resources: The Merrick County parcel database contains an inventory of 7,655 structures. All structural data was imported into GIS, extracted for Central City and combined with individual hazard data if spatial references were applicable. Structure valuations were extrapolated and averaged from 196 parcels identified in flood hazard layers as the data set is not complete for Central City. Critical infrastructure and Key Resources were mapped based on address, licensed facility type, observation and review of existing plans. A list of 41 Critical facilities is provided for reference.

National Flood Insurance Plan Coverages: As of October 1, 2008, structures experiencing repetitive flood loss are required to be included in Hazard Mitigation Plans. (44 CFR Part 201.6 (c)(2)(ii)). For Central City and Merrick County, data was obtained from the Nebraska Department of Natural Resources, Floodplain Management Section. No structures on current (2010), digital flood insurance rate maps have been identified in the community or within the county.

Warning System Locations and Ranges: Warning system siren locations were identified via a desktop review of the community's current Multi-Jurisdictional Hazard Mitigation Plan. An exact inventory including manufacturer information and expected ranges is not currently available. The Region's Emergency Manager has submitted a request to Central City to update the inventory to include ranges and has drafted an application to receive grant funding to update existing warning sirens if the community opts to participate. Vulnerable populations and areas not covered by emergency warning sirens could not be assessed due to the gap in data availability.

Mitigation Planning Background and Introduction

Disasters such as floods, earthquakes, tornadoes, tsunamis or other hazardous events created by nature or activities of mankind can disrupt the daily lives, activities and functions of private individuals and the communities in which they live. Disaster planning, mitigation and recovery requires extensive time and resources, and can overwhelm capacities of local and state resource availability. Resources are especially thin in small rural municipalities and mitigation planning has been shown to increase community resiliency in the face of a disaster (Frazier, et al. 2013). Mitigation is recognized as sustained efforts to reduce or eliminate long-term risk to life and property from a hazard event.

Mitigation planning is required by the Disaster Mitigation Act 2000 (44 CFR Part 201), for local governments and communities to be eligible to receive Flood Damage Assistance, Pre- and Post- Disaster Mitigation Grants, or funding from the Department of Homeland Security (DHS). Hazard mitigation plans are also required for fund allocation from Emergency Management Agencies at State and Federal levels. In Nebraska, these funds are made available through collaborative partnerships between communities, Nebraska Emergency Management Agency, and through the Federal Emergency Management Agency (e.g. NEMA, FEMA respectively), before or after a disaster strikes.

In basic terms, mitigation planning is defined by FEMA as a four step process that includes Organizing Resources, Conducting a Risk Assessment, Developing a Mitigation Plan, Implementing the Plan and Monitoring Progress. Local governments have significant responsibilities to coordinate planning resources, contribute to baseline information, provide review and input, in addition to being the forefront experts and incident commanders during and after an event. These responsibilities are delegated to state and local subunits of government through federal and state emergency planning regulations. Furthermore, a hazard mitigation plan must be developed and locally adopted prior to a disaster declaration as provided by a State Governor to the President (FEMA, A Citizen's Guide, 2016).

While basic definitions are helpful to identify planning steps required to complete and maintain a hazard mitigation plan; tasks identified in Figure 2 outline planning complexities and need for stakeholder input throughout the process. While preliminary work has been done for tasks 1-4 during project development, all tasks in Figure 2 should be assessed and developed further by the local jurisdiction in order to build upon completion of the Central City Risk Assessment (Task 5).



Figure 1: Basic Hazard Mitigation Planning Steps.

Source: Federal Emergency Management Agency (2016). Hazard Mitigation Planning Process. Retrieved March 17, 2016 from <https://www.fema.gov/hazard-mitigation-planning-process>.



Figure 2. Planning Tasks for Creating a Hazard Mitigation Plan.

Source: Local Mitigation Planning Handbook (2013) Federal Emergency Management Agency. Retrieved March 17, 2016 from http://www.fema.gov/media-library-data/20130726-1910-25045-9160/fema_local_mitigation_handbook.pdf

Hazard Identification/Ranking

A Risk Assessment is required to be consistent with the state plan for hazards addressed. Therefore, the State Hazard Mitigation Plan was referenced to determine which hazards were applicable, how assignments of risk ranking, scores, and priority were defined across geographical extents.

Merrick County and therefore Central City, is included as a portion of Region 2 of the five regions identified statewide.



Figure 3. Regions as Identified by the State Hazard Mitigation Plan 2014, Identifying Merrick County as Part of Region 2.

Source: State of Nebraska Hazard Mitigation Plan, Nebraska Emergency Management Agency (2014). Retrieved January 11, 2016 from <http://www.nema.gov>

Surveys were distributed to all 93 counties in the state with responses and scores for each hazard identified. High Risk Rankings received a composite score greater than 80 points. Medium Risk received cumulative scores between 40-79 and Low categories were defined with composite point values less than 40.

Point values are not provided for Fatalities, Injuries, Vulnerable Populations, Critical Infrastructure or Key Resources likely to be impacted, and surveys did not appear to consider Historical Damages to Crops or Property.

Table 2. State Hazard Mitigation Plan Survey Criteria and Point Value Assignments to determine Ranking Priorities at the State, Regional and County Levels.

Potential Magnitude: Percentage of Geographic Area	
Catastrophic: More than 50%	40
Critical: 25-50%	32
Limited: 10-25%	16
Negligible: Less than 10%	8
Frequency of Occurrence	
Highly Likely: Near 100% probability in a year or at least one chance in the next 10 years.	36
Likely: Between 10-100% probability in a year or at least one chance in the next 100 years	12
Unlikely: Less than 1% probability in the next 100 years	6
Areas Likely to be Affected Most	
Agricultural	4
Residential	12
Business/Retail	8
Industrial	12
Potential Speed of Onset (Probable Amount of Warning Time)	
Minimal or no warning	8
6-12 Hours of warning	6
12-24 Hours of warning	4
More than 24 hours warning	2

Risk Assessment Hazard Categories for Central City

Table 3. Hazard Assessment Categories for Central City, Nebraska, 2016.

	Event Name/Type		Event Name/Type
1	Power Failure	5D	Air Chemical Transportation
2	Severe Thunderstorm	6	Flood/Flash Flood
2A	Hail	7	Drought
2B	High Wind	8	Tornado
2C	Lightning	9	Fixed Chemical Facility
2D	Heavy Rain	10	Urban Fire
3	Severe Winter Storm	10A	Arson
3A	Ice Storm	11	Dam/Levee Failure
3B	Blizzard	12	Ag-Animal Disease
3C	Winter Weather	13	Public Health
3D	Cold/Wind Chill	14	Ag-Plant Disease
4	Transportation	15	Terrorism
4A	Transportation MVA's	16	Aircraft/Explosion
4B	Railroad Transportation	17	Earthquake
5	Chemical Transportation	18	Civil Disorder
5A	Chemical Transportation-Railways	19	Radiological Transportation
5B	Chemical Transportation-Highways	20	Radiological Fixed Facility
5C	Chemical Transportation-Pipelines		

Indicates Local Hazards Identified and Assessed Separately from the State Hazard Mitigation Plan.

Hazards Not Assessed

Consistent with the State Hazard Mitigation Plan, below is a list of hazards not pertinent to the Risk Assessment for Central City. Where additional information was found that may be applicable to future planning efforts, extended descriptions are provided.

Avalanche: Low probability of any future event due to topography of the planning area. Consistent with the State Hazard Mitigation Plan (2014), there is not sufficient data available to examine historic impacts or to project future probability or losses.

Hurricane: The planning area is outside of tropical zones and in the Great Plains; hurricanes are not expected to occur.

Landslides: Landslides have been reported in Nebraska for counties of Burt, Dakota, Douglas, Sarpy, Thurston and Washington; none of which include Merrick or the community of Central City (JEO, Papio-Missouri NRD Hazard Mitigation Plan, 2016).

Coastal Erosion and Tsunamis: Central City is land locked and not exposed to any coastal zones therefore associated hazards associated with tsunamis and coastal erosion were not considered.

Radiological Transportation: No incidents have been reported in the State or Central City or its extraterritorial jurisdiction requiring assistance beyond regular roadside assistance (JEO, Papio-Missouri NRD, Hazard Mitigation Plan, 2016).

SECTION II

MERRICK ZONE AND CENTRAL CITY NATURAL HAZARD SUMMARIES
CRITICAL INFRASTRUCTURE AND KEY RESOURCES COMMUNITY MAP
AND LIST

Natural Hazard Frequencies and Damage Summaries for Merrick County Zone and Central City Data

Events and damages are recorded at county zone and community level, by the National Weather Service Office, located in Hastings, Nebraska. Events reported for the Zone of Merrick County in descending probability and frequency order were: Winter Storm, followed by High Winds, Winter Weather, Ice Storm, Blizzard, Cold/Wind Chill, and Drought. Events reported at the county level occur primarily in winter months. Because these events are usually widespread, they are assumed to have impacted Central City at the same frequency and probabilities as calculated. A few hazards identified in the state plan are not identified in the storm events database at the county level. Examples include severe thunderstorm, flooding and tornado. This data is found under data provided specific to Central City and as reported on following pages.

Drought damages were the most widespread, with \$30M reported. Comparative to the events reported in the winter, drought (which typically occurs in summer and fall months) accounted for 85% of the damages incurred at the county zone level. Total damages for the County Zone totaled \$35,164,000 dollars over the previous 20-years. Drought losses were recorded in the NCDC data set on September 1, 2000 and December 1, 2002. Damages of \$10M and \$20M were reported for each respective date. Cumulative totals for other hazards equaled \$5,164,000. The total average annual damage for all other hazards combined was \$258,200 over the same 20-year reporting period.

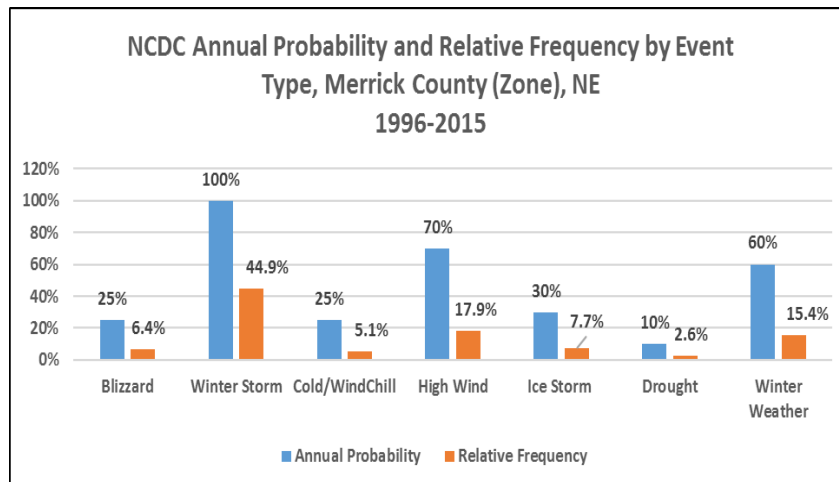


Figure 4. Annual Probability and Relative Frequency of Hazard Events Reported for Merrick County Zone, 1996-2015.

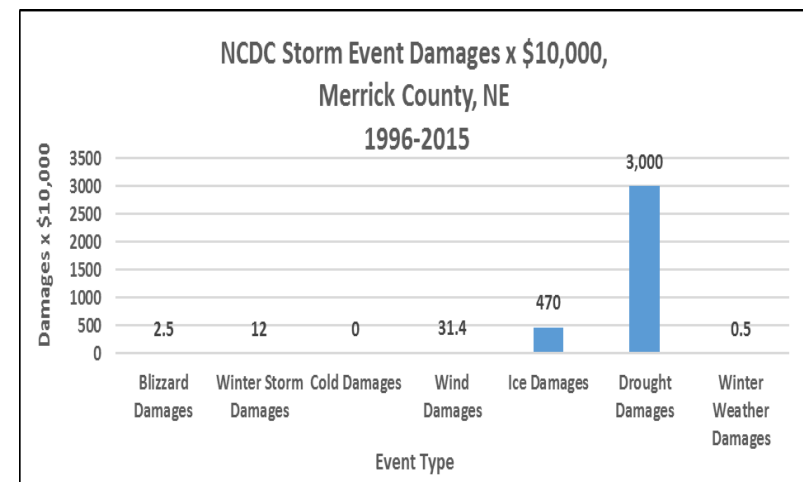


Figure 5. Hazard Event Damages Reported for Merrick County Zone., 1996-2015.

Source: Data compiled from NOAA's National Climate and Data Center Storm Events Database Retrieved February 28, 2016 from <http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=31%2CNEBRASKA>

Note: Data Sets as extracted from the Storm Event Database are included in appendices at the end of the report.

Natural Hazard Frequencies and Damage Summaries-Central City Data

Central City data provides a 100% annual probability for a Hail event and was the reported 32 times over the 20-year period, with a relative frequency of 57%. Thunderstorms, Wind and Heavy Rain events were assessed separately as reported and reflected in Figure 6. Annual probabilities and relative frequencies were the same for Lightning, Tornadoes and Flood/Flash Flood events.

Local hail events resulted in the largest amount of overall damages to agricultural crops and property with greater than \$3M reported. Damage estimates for all other local events were slightly more than half of total hail damages and totaled \$1.6 Million for the same period. Thunderstorms were reported as the second most damaging event to the Central City with over a \$1M in damages reported. Two tornadic events reported tornado and lightning events, flooding and heavy rains.

Flood reports for Central City through NCDC, resulted in \$80,000 dollars in damages over the last 20-years, with \$50,000 in damage to crops and \$30,000 to property. Based on received reports, flooding has a 10% annual probability and a 3.6% frequency of occurrence. Damage amounts were approximately the same across all hazards assessed, however, property damages were greater during Thunderstorms/Wind, Tornadoes, and Lightning. Crop damages outpaced property damage during Hail, Flash Flooding and Heavy Rain events.

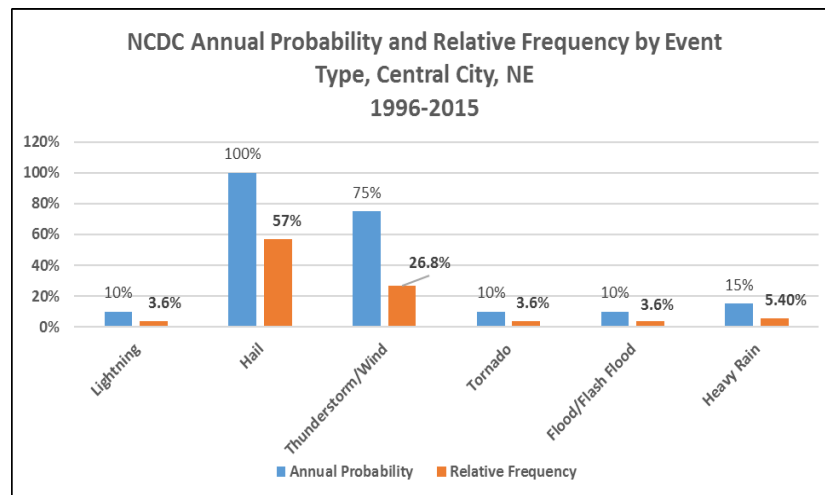


Figure 6. Annual Probability and Relative Frequency of Hazard Events Reported for Central City, Nebraska 1996-2015.

Source: Data compiled from NOAA's National Climate and Data Center Storm Events Database Retrieved February 28, 2016 from <http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=31%2CNEBRASKA>

Note: Data Sets as extracted from the Storm Event Database are included in appendices at the end of the report.

Table 4. Hazard Event Damages Reported for Central City, Nebraska 1996-2015.

Central City Damages 1996-2015	Property Damages	Crop Damages	Total Damages by Event Type
Hail	\$1,080,000	\$2,110,250	\$3,190,250
Thunderstorm/Wind	\$995,000	\$75,000	\$1,070,000
Tornado	\$300,000	\$25,000	\$325,000
Lightning	\$112,000	*	\$112,000
Flash Flood	\$30,000	\$50,000	\$80,000
Heavy Rain	*	\$50,000	\$50,000
Total Property and Crop Damages	\$2,517,000	\$2,310,250	\$4,827,250

* Indicates no reported damage.

Table 5. Critical Infrastructure and Key Resource Facilities, Central City, Nebraska, 2016.

	Facility	Street Address	Capacity	Telephone
1	Central City Fitness Center	2502 23rd Ave	100	(308) 946-2974
2	Merrick County Child Care Development Center	2412 23rd Ave.	85	(308) 946-3336
3	Central City Care Center	2720 17th Ave	64	(308) 946-3088
4	Cottonwood Estates	2316 28th St.	50	(308) 946-2100
5	Litzenberg Memorial County Hospital (LTC)	1715 26th St.	46	(308) 946-3015
6	Bader Westside Villa	2525 28th St.	32	(308) 946-3981
7	Pray and Play Preschool (St. Paul's Church)	820 G Ave.	24	(308) 850-1055
8	Lone Tree Medical Clinic	2510 18th Ave	20	(308) 946-3845
9	Central City Assisted Living Facility, Inc.	915 East 16th St.	20	(308) 946-5567
10	CC Live	1307 16th St.	16	(308) 946-2276
11	Lil Tots Daycare	2611 Terry Ln	12	(308) 550-0849
12	Silly Monkeys Daycare	2616 19th Ave.	10	(308) 850-3563
13	Aurora Cooperative Grain Elevator	517 D St.	10	(308) 946-3357
14	Life Essentials Assisted Living Facility	920 East 16th St.	8	(308) 946-3189
15	United States Post Office	1512 16th St	5	(308) 946-3272
16	Merrick County Courthouse	1510 18th St	30	(308) 946-2812
17	Central City Baptist Church	1119 17th St.	*	(308)-946-2475
18	Christ Episcopal Church	1414 15 th Ave	*	(308)-946-2640
19	Community Bible Church	403 F Ave	*	(308)-946-2114
20	First Christian Church	407 A Ave	*	(308)-946-2372
21	Grace Lutheran Church (ELCA)	1920 16 th Ave	*	(308)-946-2064
22	Heartland Evangelical Church	1620 19th St.	*	(308)-946-2595
23	Presbyterian Church	1801 17 th Ave	*	(308)-946-3108
24	St. Michael's Catholic Church	2402 20 th Ave	*	(308)-946-2855
25	St. Paul's Lutheran Church (Missouri Synod)	820 G Ave	*	(308)-946-2680

Continued on next page.....

Table 5 (continued). Critical Infrastructure and Key Resource Facilities, Central City, Nebraska, 2016.

	Facility	Street Address	Capacity	Telephone
26	United Methodist Church	2601 18 th Ave	*	(308)-946-2853
27	Aurora Cooperative Grain Elevator	610 C Ave	3	(308) 946-2161
28	Green Plains Central City	214 20th St.	50	308-946-9750
29	Central City High School	1510 18th Ave	222	308-946-3086
30	Central City Middle School	2815 17TH AVE	206	308-946-3056
31	Central City Elementary School	1711 15th Ave	296	308-946-3057
32	Nebraska Christian Parochial School	1847 Inskip Ave	204	(308) 946-3836
33	Central City Municipal Airport (Larry Reinke Field)	1346 Ormsby Rd	3	(308) 946-3450
34	Central City Police Department	1616 16th Ave	6	(308) 946-3003
35	Merrick County Sherriff's Office	1821 16th Ave	12	(308) 946-2345
36	Merrick County Jail	1821 16th Ave	12	(308) 946-2345
37	Merrick County Roads	1358 W. Highway 30	22	(308) 946-3191
38	Central City Ambulance Division	414 H St.	0	(308) 946-3807
39	Central City Volunteer Fire Department	716 16th St.	35-50	(308) 940-0028
40	Central City Wastewater Treatment Plant	5th Avenue	1	(308) 940-2230
41	Nebraska Department of Roads Maintenance Yard	1416 6th St.	5	(308) 946-2911

As defined by FEMA, Critical infrastructure includes those assets, systems, networks, and functions—physical or virtual—so vital to the United States that their incapacitation or destruction would have a debilitating impact on security, national economic security, public health or safety, or any combination of those matters. Key resources are publicly or privately controlled resources essential to minimal operation of the economy and the government. In the Central City Risk Assessment, the assets list was focused on vulnerable populations, public health and safety, and key resources that would be necessary during, or immediately following a hazard event. Warning sirens are considered key infrastructure, however local data in regard to these items was limited to location and mapping only. More information for age, range of existing siren systems is needed.

CIKR is organized into 17 sectors that together provide essential functions and services supporting various aspects of the U.S. Government, economy, and society. (See Table A-1 for a full list of sectors and designated Sector-Specific Agencies (SSAs).

For a full list, of sectors and support agencies, see Table A-1 in FEMA's document entitled, "Critical Infrastructure and Key Resources Support Annex" located at:

<https://www.fema.gov/pdf/emergency/nrf/nrf-support-cikr.pdf>

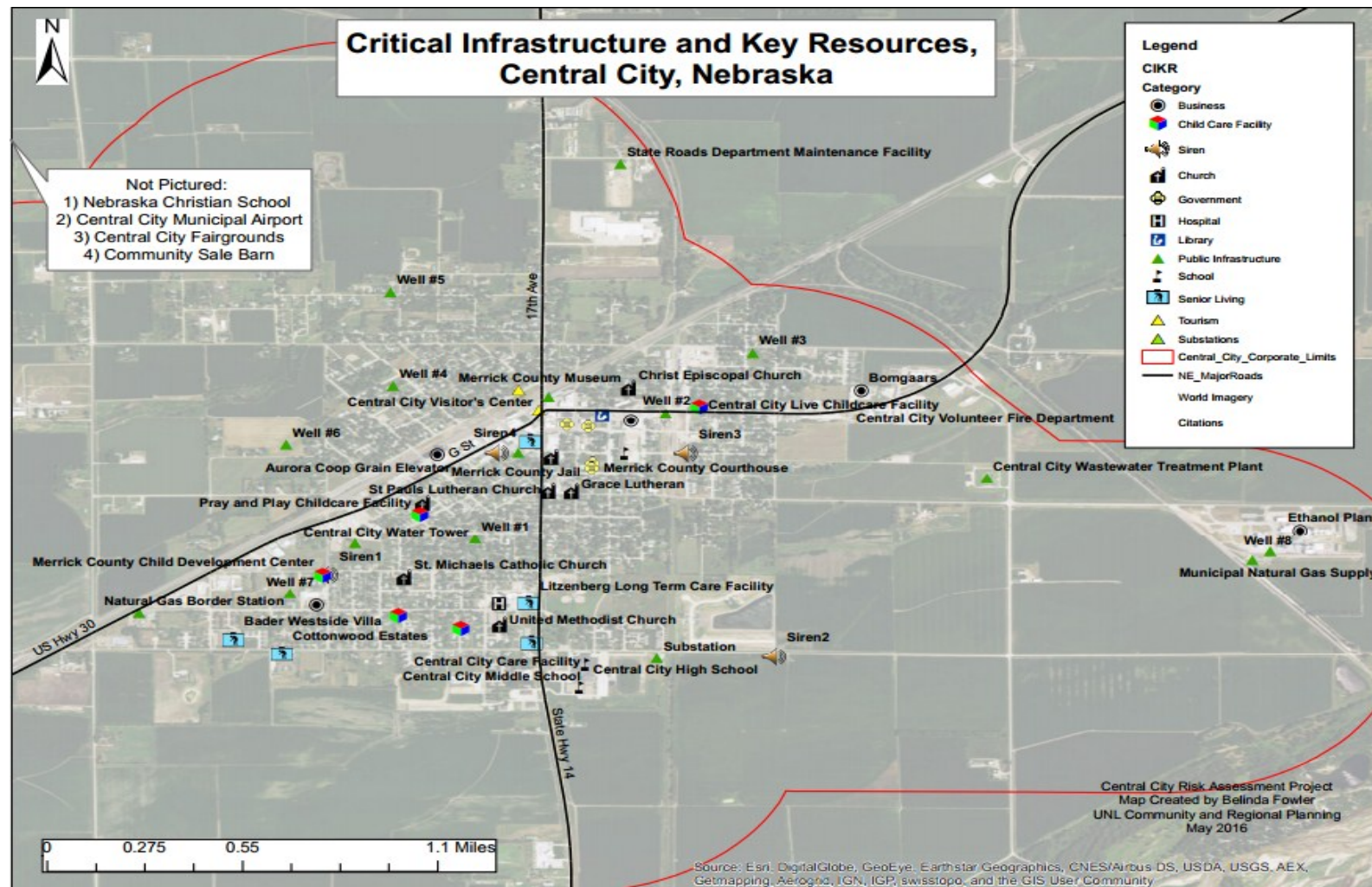


Figure 7. Map of Critical Infrastructure and Key Resources, Central City, Nebraska, 2016.

Source: Created in ArcMap 10.3.1 March, 2016.

SECTION III

HAZARD VULNERABILITY , EXPOSURE, AND RISK ASSESSMENTS

Power Failure



Figure 8. Photo of Nebraska Public Power Substation Providing Power to the City of Central City.

The potential magnitude of a power failure for Central City is considered Catastrophic (as assumed to have the potential to affect more than 50% of the jurisdictional area) and is perceived to be likely or highly likely to occur within the next year (C. Anderson, personal communications, 2016). The probable amount of warning time can be associated with extended weather forecasts (severe storms, high winds, or flooding), or can occur with no warning due to animal activity or human error. Actual probabilities could not be determined as frequency of power outages is not currently tracked at the local level.

Central City provides electrical utility and metering services to 1,611 customers of which 1,367 are residential through a Municipal Wholesale Agreement with Nebraska Public Power District (NPPD, “Wholesale...”, 2016). NPPD derives its power from the Cooper Nuclear Power Station (CNS) and transmits electricity through greater than 5,200 miles of overhead transmission lines and provides power to approximately 600,000 people in the state, including Central City (NPPD, About Us, 2016).

Central City receives and distributes electricity to the community from one 115 KVA, NPPD-owned substation located approximately .75 miles south of the Platte River along Highway 14 as shown in Figure 8.

Transmission lines owned by Central City transmit 34.5 KVA from a main NPPD substation and diverts power to three electrical substations (hubs) in town; stepping down power at these locations to 4,160 Y (phase to ground) systems. The majority of main transmission lines are located behind residential properties, in parks, and off the traveled right-of-way, limiting vulnerabilities related to transportation and terrorism (S. Lewis, personal communications, 2016).

Of the three city-owned substations, one is centrally located downtown and serves as a “split-station” that serves central, east, and west areas of town as well as many of the community’s commercial customers. The “west lines” include power capacity of 5,000 KVA and feeder lines 3,4,5, & 6. East lines from the combination substation has feeder lines identified as 1, 2, and 7 and transmits less than the west lines at 3,075 KVA.

A second substation known as the “North” Substation has two feeder lines (10 & 11), that serve power to the north and northeast sections of the community. Customers receiving power from these lines are primarily residential.

The third substation is known as the “South” and is located near the Central City High School and serves power to the east, south, and southeast areas and along a line following 28th Street, west of the high school. The south substation currently provides power to private residences, healthcare providers, senior care centers, two public schools, and the new Byer’s Subdivision. Based on populations served, the South Station may be considered the most vulnerable; however, if one substation fails or is taken down for maintenance, power can be routed to a second location as a redundancy. If more than two city-owned substations are compromised at the same time, some customers would have the potential to be subjected to a power outage. In this case, additional power back-up options may be necessary unless demand is below the supply capacity (S. Lewis, personal communications, 2016).

Per the GIS desktop analysis none of the city-owned substations are located within a flood hazard area.

Power Failure

The municipally owned electrical utility serves customers in Industrial, Commercial and Residential sectors. Raw data for 2015 was provided by Central City's Electrical Superintendent as provided in bold in Table (Sid Lewis, personal communications, 2016). Percentages for each sector compared to the total customer base, calculate as follows: Industrial use equals 0.66% with eleven customers, Commercial use is 17.03% with 283 customers, and 1,367 Residential customers make up approximately 82.3% of the consumer base.

Table 6. Electrical Use and Revenue by Industrial, Commercial and Residential Customers in Central City 2015.

Type of Use	Consumption in KWH 2015	Revenue Generated 2015	Average Customer Count 2015
Industrial	5,989,980	\$620,877.84	11
Average Daily Use and Revenue-Industrial	16,411	\$1,701.04	
Average Daily Use and Revenue by Hour-Industrial	684	\$70.88	
Commercial	9,247,713	\$1,000,371.19	283
Average Total Daily Use and Revenue-Commercial	25,336	\$2,740.74	
Average Total Revenue by Hour-Commercial	1,056	\$114.20	
Residential	16,898,600	\$1,721,014.50	1,367
Average Daily Use and Revenue-Residential	46,298	\$4,715.11	
Average Hourly Use and Revenue -Residential	1,929	\$196.46	
Average Total Daily Use/ Revenue-All Categories	88045	\$9,156.89	1,661
Average Total Use/Revenue by Hour-All Categories	3669	\$381.54	
Totals	32,136,293	\$3,342,263.53	

Based on the figures above, economic impacts may be estimated at \$9,157 per day or approximately \$382.00 per hour if all sectors are affected.

Critical Infrastructure and Key Resources within the community would be impacted by a power failure. See the map in Figure 7, identifying Critical Infrastructure and Key Resource facilities. Essential facilities within the CC jurisdiction that would be impacted by an interruption in power would include the following:

- Medical facilities- Litzenberg Memorial County Hospital, Lone Tree Medical Clinic
- First responder Stations-Police and Sherriff offices, Fire department and Ambulance service
- Community Services and Facilities- Wastewater Treatment Plant, Public Water Supply wells, Courthouse and Administrative Offices and Community Room, Schools, Public Library, Fitness Center, Churches, Lone Tree and North Parks, Baseball and Football fields.
Industrial Facilities, Grain Elevator, Railroad, and Business locations
- Care Facilities- Senior Centers (Assisted Living, Long-term Care) and Daycare Centers
Infrastructure, Communication Towers, Fire Suppression Systems, Water Conveyance Systems

Some of the CIKR facilities have generators for backup power (e.g. Litzenburg Memorial Hospital and Long-term Care Facility, the Wastewater Treatment Plant, Central City Care Center, and Cottonwood Estates), however most are limited and viable long-term operations are unlikely.

Power Failure Vulnerability and Risk Assessments

Power Failure Vulnerability Assessment	
Sector	Vulnerabilities
People	The young, elderly, and immunocompromised are vulnerable. Residents and business owners. Agricultural producers dependent on power for irrigation. Low income sectors may have a lack of advance warning through media outlets. Civil disorder may be increased. Communication systems may be compromised.
Economic	Revenue loss to the community-owned electrical utility (Total estimate \$9,157/day or \$382.00/hr.) across all sectors. Revenue loss due to business closures. Labor costs and repairs to transmission lines.
Built Environment	Structures close to live electrical power lines or transformers (explosions, fires). Traffic control devices, street lighting.
Infrastructure	Main substation proximal to the river (NPPD-owned). City owned substations and transmission lines. Residential meters. South Substation supporting vulnerable populations. Power line support structures made of wood. Backup power supply infrastructure to the community. Communication systems.
Critical Facilities	Residential homes, Public Water Supply or Treatment systems (backup power and storage available), Schools, Senior Care Centers (some have backup power-see community profile section), Daycares, Hospital, Shelters, Civil service locations Police/Fire/Ambulance Lone Tree Clinic, Commercial and Industrial facilities.

Power Failure Risk Assessment	
Historical Number of Events	Unknown
Vulnerable Locations	Entire Community, Focus on SSW portions of the community by south substation. Other Substations and transmission line.
Magnitude/Extent	Greater than a few hours. All sectors.
Annual Probability	Perceived High.
Relative Frequency	Unknown
Property and Crop Damages	None Reported
Total Average Annual Losses	Unknown, none reported
Fatalities	Unknown, none reported
Injuries	Unknown, none reported
SHMP Rank/Score	County-1 of 22 (116), Region-2 of 20 (113.14) State-3 of 20 (108.28)
Central City Rank	1st of 34 , Highest priority due to lack of redundancy for power backup, potential population impacts, and unknown factors.

Severe Thunderstorms, Hail, High Winds, Lightning, and Heavy Rain

Severe thunderstorms are caused by unstable atmospheric conditions causing significant precipitation, high winds, lightning and thunder, most commonly occurring in spring and summer when air temperatures are warming during seasonal transitions (NOAA, Storm Prediction Center, 2016). The National Weather Service defines a thunderstorm as severe if it results in winds greater than 58 mph or if hail is generated at an inch or more in diameter. Significant thunderstorms are classified by winds of 75 mph or greater in combination with hail in excess of two inches, and may be combined with EF-2 tornado damage or greater (NOAA, Storm Prediction Center (SPC), FAQs, 2016). By definition, all thunderstorms contain lightning and can develop quickly and may result in heavy rain, hail, lightning, and high winds.

For the same period (1996-2015), Hail was the most damaging event resulting in greater than \$3M locally for crop and property damage. Local report relative frequencies by hail type and diameter are found in Table 7, with damages typically reported starting at magnitudes of one-inch. Cumulatively, damaging hail events greater than an inch in diameter occurred approximately 55% of the time for the reporting period. Average hail size was 1.15 inches in diameter for local data, with two events exceeding the significance level of two inches. These events reported hail diameters at 2.50 and 2.75 inches in August 2007 and May 1998 respectively.

High winds were reported in combination with severe thunderstorms and resulted in \$1.07M in total damages. Magnitudes ranged between 52-69 mph with an average speed of 55.9 mph. In the county, wind events averaged 47.2 mph with reported damages of \$314,000.

Lightning was reported twice in local data with \$112,000 in property damage recorded.

Heavy rains were reported three times in the 20-year period and had \$50,000 in crop damage.

No events reached the combined criteria to be classified as a significant thunderstorm as defined by the SPC.

Table 7. Hail Size and Relative Frequency Reported in NCDC datasets from 1996-2015 for Central City, Nebraska.

Hail Description	Diameter (inches)	Hail size-Relative Frequency Central City
Pea	0.25	N/A
Marble or Mothball	0.50	N/A
Penny or Dime	0.75	25.0%
Nickel	0.88	19.4%
Quarter	1.00	33.3%
Half Dollar	1.25	N/A
Walnut or Ping Pong Ball	1.50	2.7%
Golfball	1.75	11.1%
Hen's Egg	2.00	N/A
Tennis Ball	2.50	2.7%
Baseball	2.75	5.5%
Tea Cup	3.00	N/A
Grapefruit	4.00	N/A
Softball	4.50	N/A

Source: National Weather Service Glossary. Retrieved March 31, 2016 from <http://w1.weather.gov/glossary/index.php?letter=h>.

Severe Thunderstorms and Associated Hazards Vulnerability and Risk Assessments

Severe Thunderstorm and Associated Hazards Vulnerability Assessment	
Sector	Vulnerabilities
People	The young and elderly are vulnerable as they are less mobile than other members of the community. Residents in mobile homes are at risk of injury and property damage due to high winds. Low income sectors may have a lack of advance warning through media outlets. Examples may include: Low income housing areas, Senior Living or Day Care Centers and hospitalized or immuno-compromised individuals.
Economic	Businesses may be affected due to closed roads, loss of power or damage from storm debris. Lost revenue may occur due to business closures.
Built Environment	Hail damage, Crop damage due to high winds or heavy precipitation, Fires due to lightning. Flash flooding. Limited access to storm shelters.
Infrastructure	Lightning may cause power outages and high winds may result in downed power lines. Heavy rains may wash out roadways or limit access. Rail crossing barrier failures due to a loss of power.
Critical Facilities	Power outages are possible and buildings may sustain damages from hail, lightning or wind. Examples may include: Hospital, Clinic, and Emergency Services. Wastewater treatment lift stations and public water supply wells may be impacted.

Severe Thunderstorm Risk Assessment	
Historical Number of Events (1996-2015)	15
Vulnerable Locations	Entire Community
Extent	Wind \geq 58 mph or hail \geq 1.00 inch
Annual Probability	75%
Relative Frequency	26.8%
Property and Crop Damages	Property Damage = \$995,000 Crops = \$75,000
Total Averaged Annual Losses	\$53,500
Injuries	Unknown, none reported
SHMP Rank/Score	County-1 of 22 (116), Region-2 of 20 (113.14) State-3 of 20 (108.28)
Central City Rank	2nd of 34 , based on priority rankings in the State Hazard Plan, and second most damaging event reported in local data.
Associated Event Rank: (see following page for details).	Hail : Rank 2A based on local damages, high probability and frequencies. High Wind: Rank 2B based on high probability, damages and frequencies. Lightning: 2C based on historical damages and less likely probability. Heavy Rain: 2D limited damages and loss, less frequent and low probability.

Risk Assessments for Hazard Events Associated with Severe Thunderstorms

Hail Risk Assessment Summary	
Historical Number of Events (1996-2015)	32
Vulnerable Locations	Entire Community
Extent	Torro Scale H1 and above
Annual Probability	100%
Relative Frequency	57%
Property and Crop Damages	Property Damage = \$1,080,000 Crops = \$2,110,750
Total Averaged Annual Losses	\$159,512.50
Fatalities Reported	0
Injuries Reported	0
SHMP Composite Score-Ranking	Not Reported as a singular event, see Severe Thunderstorm
Lightning Risk Assessment Summary	
Historical Number of Events (1996-2015)	3
Vulnerable Locations	Entire Community
Extent	All lightning, especially ground strikes
Annual Probability	10%
Relative Frequency	3.6%
Property and Crop Damages	Property Damage = \$112,00 Crops = \$0
Total Averaged Annual Losses	\$5,600
Fatalities Reported	0
Injuries Reported	0
SHMP Composite Score-Ranking	Not Reported as a singular event, see Severe Thunderstorm

Heavy Rain Risk Assessment Summary	
Historical Number of Events (1996-2015)	3
Vulnerable Locations	Entire Community
Extent	Greater than 1" an hour
Annual Probability	15%
Relative Frequency	5.40%
Property and Crop Damages	Property Damage = \$ None reported Crops = \$50,000
Total Averaged Annual Losses	\$2,500
Fatalities Reported	0
Injuries Reported	0
SHMP Composite Score-Ranking	Not Reported as a singular event, see Severe Thunderstorm
High Wind Risk Assessment Summary	
Historical Number of Events (1996-2015)	15
Vulnerable Locations	Power lines, substations, heavily treed areas, mobile homes
Extent	Sustained winds 40-73 mph (National Weather Service)
Annual Probability	70%
Relative Frequency	15%
Property and Crop Damages	Property Damage = \$312,000
Total Averaged Annual Losses	\$15,600
Fatalities Reported	0
Injuries Reported	0
SHMP Composite Score-Ranking	Not Reported as a singular event, see Severe Thunderstorm

Severe Winter Storm and Associated Hazards of Winter Weather, Ice Storms, Blizzards, Cold/Wind Chill

Severe winter storms occur annually across all of Nebraska, including Central City, and are classified by a combination of winter weather events creating hazardous conditions. Winter Storm Warnings are issued when the following is expected to occur. Five inches or more of snow or sleet within 12-hours; 7 or more inches within a 24-hour period; or when enough ice is expected to cause damage to power lines or trees (National Weather Service, Warnings, 2016). The Sperry Piltz-Ice Accumulation Index begins to classify utility interruptions with a range of ice build-up between 0.10-0.25 inches of ice (Sperry, Category 5 Ice Storm, 2016).

Winter events can bring freezing temperatures and rain, extreme cold, significant snowfall, ice and high winds resulting in blizzards. Blizzards are classified by the National Weather Service with snow occurring for greater than 3 hours or snow with winds greater than 35 mph, and with visibility less than 0.25 miles. Drifting or heavy snowfall can create localized hazards in the built environment through downed tree limbs, power outages, and structural damage. Hazardous traveling conditions or vulnerable populations may be affected due to lack of appropriate heat, clothing or when utility interruptions occur. Low temperatures and wind can result in frostbite with 5 minutes of exposure. The extreme events have not been reported in local data sets so therefore the magnitude of hazard that is considered for purposes of health and safety factors in the Risk Assessment is between 20-40 below with winds between 10-20 mph.

The National Climate and Data Center does not currently report Severe Winter Storm events at the local level for Central City. Five of seven categories reported for the Merrick County Zone data were separated on events associated with Winter Storms, Blizzards, Cold/Wind Chill, Ice Storms and Winter Weather. Like thunderstorms, winter storms are likely to impact large regions and are therefore, assumed reported by county and separate from localized data.

Combined, all of these hazards associated with winter months have a cumulative relative frequency of 79.4% for Merrick County and winter storms have a 100% annual probability for the region.

The majority of events were reported in the months of December through early March. The entire community of Central City has, and will be impacted by these events into the future. Property damages were reported for winter storms (2002, 2004) winter weather (2011) and a blizzard (2005). The total damages reported for these events totaled \$50,000. Cold and Wind Chill events were reported five times between 1996 and 2000, with zero damages, injuries or fatalities. Most notable, are the damages reported for Ice Storms. Two ice storms occurred between December 20th and 29th, 2006 and resulted in \$4,050,000 in damages, (possibly due to additive effects). The additional \$20,000 in ice storm damages was reported December 1, 2007. No injuries or fatalities were reported for any winter weather related events.

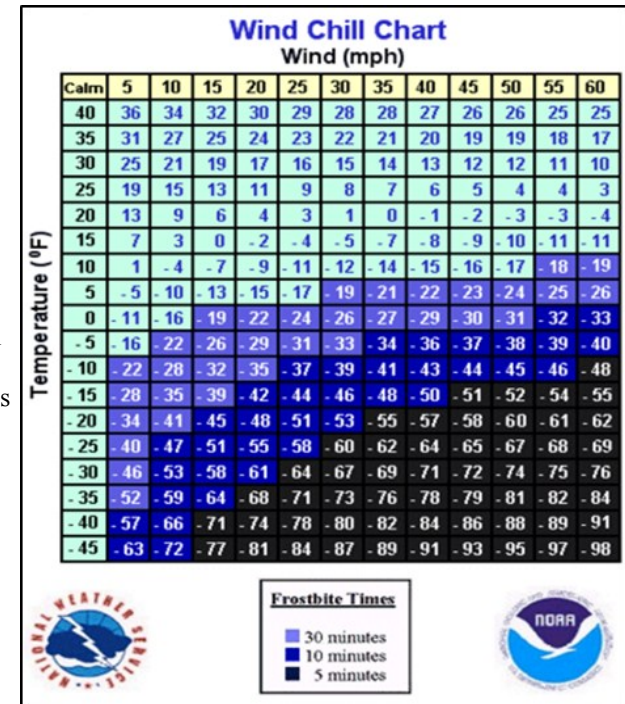


Figure 9. Wind Chill Chart for Extreme Cold.

Source: NOAA, Chart obtained from The National Weather Service. Retrieved March 12, 2016 from <http://www.nws.noaa.gov/om/winter/windchill.shtml>

Severe Winter Storms, Winter Weather, Blizzard, Ice Storms, Cold/Wind Chill Vulnerability and Risk Assessments

Severe Winter Storm Vulnerability Assessment	
Sector	Vulnerabilities
People	The traveling public in areas with reduced visibility or slick surfaces. Residents in mobile homes are at risk of injury and property damage due to high winds or lack of residential insulation. Low income sectors may have a lack of advance warning through media outlets. Examples may include: Low income housing areas, Senior Living or Day Care Centers and hospitalized or immuno-compromised individuals.
Economic	Businesses may be affected due to closed roads, loss of power, or ice buildups preventing product and service transfer. Lost revenue may occur due to business closures.
Built Environment	High winds, ice accumulation and reduced visibility. Power lines, electrical substations, roads, railroads, bridges, and trees. Hail and/or lightning damage possible in rare events.
Infrastructure	High winds and ice accumulation may result in downed power lines. Heavy rains may wash out roadways or limit access. Rail crossing barrier failures due to a loss of power. Extended periods of extreme cold may harm main water lines or supply wells.
Critical Facilities	Power outages are possible and buildings may sustain damages from hail or lightning (in rare events) or wind. Examples may include: Hospital, Clinic, and Emergency Services. Wastewater treatment lift stations and public water supply wells may be impacted.

Severe Winter Storm Risk Assessment	
Historical Number of Events (1996-2015)	35
Vulnerable Locations	Entire Community
Magnitude/Extent	An event with more than one significant hazard or exceeds 12-and 24-hour warning criteria for at least one of the precipitation events.
Annual Probability	100%
Relative Frequency	44.9%
Property and Crop Damages	Property Damage = \$20,000
Total Average Annual Losses	\$1,000
Fatalities	0
Injuries	0
SHMP Rank/Score	108 (County-3 of 22), 112.86 (Region-3rd of 20), 109.57 (State-2nd of 20)
Central City Rank	3rd based on a combination of events and historical damages for Ice Storms exceeding \$4M in damages and an annual probability of 100% and a relative frequency of approximately 45% for events meeting Winter Storm criteria.
Associated Event Rank (see following page for details).	Ice Storm 3A -significant damages recorded. Blizzard-3B -based on probability and general risk. Winter Weather-3C -Limited Damages. Cold/Wind Chill-3D -Limited risk, no damages, injuries or fatalities reported.

Risk Assessments for Hazard Events Associated with Severe Winter Storms

Winter Weather Risk Assessment Summary	
Historical Number of Events (1996-2015)	12
Vulnerable Locations	Entire Community
Extent	Winter weather event causing death, injury or has a significant impact on commerce or transportation but does not exceed winter storm warning criteria.
Annual Probability	60%
Relative Frequency	15.4%
Property and Crop Damages	Property Damage: \$5,000
Total Averaged Annual Losses	\$250
Fatalities Reported	0
Injuries Reported	0
SHMP Composite Score-Ranking	Not reported as a singular event, see Severe Winter Storm
Ice Storm Risk Assessment Summary	
Historical Number of Events (1996-2015)	6
Vulnerable Locations	Entire Community
Extent	Ice at 0.25 inches or greater
Annual Probability	30%
Relative Frequency	7.7%
Property and Crop Damages	Merrick Zone Property Damage Reports \$4,070,000 Crop Damage \$0
Total Averaged Annual Losses	\$203,500
Fatalities Reported	0
Injuries Reported	0
SHMP Composite Score-Ranking	Not reported as a singular event, see Severe Winter Storm

Blizzard Risk Assessment Summary	
Historical Number of Events (1996-2015)	5
Vulnerable Locations	Entire Community
Extent	Greater than 3 hours, Snow with winds greater than 35 mph and visibility less than 0.25 miles.
Annual Probability	25%
Relative Frequency	6.4%
Property and Crop Damages	Property Damage \$25,000
Total Averaged Annual Losses	\$1,250
Fatalities Reported	0
Injuries Reported	0
SHMP Composite Score-Ranking	Not reported as a singular event, see Severe Winter Storm
Cold and Wind Chill Risk Assessment Summary	
Historical Number of Events (1996-2015)	5
Vulnerable Locations	Entire Community
Extent	20-40 below zero (mid-range of wind chill chart, with health/safety implications at 10 minute exposure)
Annual Probability	25%
Relative Frequency	5.1%
Property and Crop Damages	None Reported
Total Averaged Annual Losses	None Reported
Fatalities Reported	0
Injuries Reported	0
SHMP Composite Score-Ranking	Not reported as a singular event, see Severe Winter Storm

Transportation and Chemical Transportation

The majority of the population in Central City commutes to work by car (18-20 minute average), resulting in higher traffic volumes in the morning and late afternoon (Census.gov, American Fact Finder 2014). Commuting times and geographies indicate highway transportation is highly likely for the local area. Local transportation has strong ties to the surrounding farms via a local grain elevator, ag-based businesses and the ethanol facility. Throughout the year, the highways in the area see significant travel by semi-trucks hauling chemicals, grain and farming equipment; the latter of which typically travel at lower speeds than posted speed limits. Rail transportation incidents may involve derailments, raking collisions (impacts with other trains), and Highway-Rail Collisions at any of the 26 junctions defined in the planning area. Special rail focus areas include lines near the ethanol facility and adjacent to Highway 30, in addition to at-grade junctions. The airport is primarily used for business, aerial chemical applications (limited), and recreational flying (Donald Shorney, Central City Airport Mgr., personal communications, 2016). Fatalities and Injuries have been reported within the planning area for every mode of transportation, except aircraft. No incidents have been reported for chemical transportation in pipelines. Damages were only available for rail with approximately \$8.4 Million reported between 1975-2015.

Motor vehicle incidents most likely to occur include in-town intersections and highway collisions with other vehicles or animals (Nebraska Department of Roads (NDOR), Office of Highway Safety, 2015). NDOR's 2014 annual traffic safety report, states for upcoming fiscal years 2015-2016, Merrick County is not ranked as a priority area of focus for traffic safety, based on a low crash rate per 100 million miles traveled.

Higher traffic volumes were observed in the morning and late afternoon on weekdays, especially close to schools and employment locations downtown. Moderate traffic volumes are observed throughout the day along Highway 30 and 14 with access to Grand Island to the west and smaller communities of Clarks, Palmer, Silver Creek, and Columbus to the east. Statistics derived from the Census Bureau and the American Community Survey, indicate 77% of the people in Central City travel alone, 10% carpool, 0.27% travel by bicycle, 5% walk and approximately 8% work from home.

Chemical Transportation

Chemicals may be transported via air, water, rail, pipeline or over-the road. In the 2013 Commodity Flow Study statewide transport of hazardous materials by mode are as follows: Highways 72%, Railroads 15%, Pipelines 10%, and Air 3% (Khattak, Rilett & Mohlman, 2013). On average, the state experiences fifty-two highway, seven pipeline, eleven railroad, and three air transportation hazmat incidents annually. No incidents are reported for pipelines or air at the local level.

Chemical hazard events and overall risk is dependent on the level of preparedness training, capabilities and equipment available to first responders, physical features of the built environment, and weather conditions combined with chemical properties and quantities of materials in transport (DOE, Transportation Emergency Preparedness Planning Manual, 2016). Chemical properties are reflected by nine class designations of Hazardous Materials defined in 49 CFR Parts 100-185, known as the Hazardous Materials Regulations (HMR); published by the Federal Department of Transportation (DOT). The Pipeline and Hazardous Material Administration is part of the DOT and governs pipeline chemical transport of liquid and gaseous materials (U.S. DOT, PHMSA, 2016).

Nine different chemical categories are classified in the HMR and further subdivide classes into divisions in order to more closely define the material and associated risk (DOT, HMR, 2016). Regulatory requirements include proper labeling, packaging, marking, documentation, security and emergency preparedness. Classes and divisions of chemicals most frequently involved in Merrick County incidents are Corrosive, (Class 8) Combustible Liquids (Class 3), and Oxidizers (Class 5) and materials having a possible mass explosion potential (Class 1, Division 1.1).

Transportation and Chemical Transportation

For the county, nine motor vehicle crashes resulted in 11 fatalities (2010-2014). Fatality totals reported include one in 2010, two in 2011, three in 2012, one in 2013 and four in 2014, with an average annual fatality rate of 2.2 (NDOR, Office of Highway Safety, 2015). Crash totals for the five-year period were 225 (45 per year on average) under categories of Fatal Crashes (9), Disabling Injuries (42), Visible Injuries (82) and Possible Injuries (92). Annual probabilities and frequencies for fatal and injury categories is provided in the Motor Vehicle Risk Assessment Summary Table.

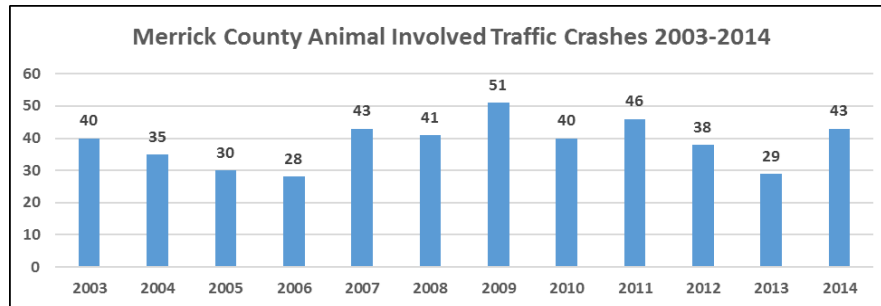


Figure 9. Animal Involved Traffic Crashes, 2003-2014, Merrick County, Nebraska.

In contrast to low fatality rates, MVA's involving animals were high between 2003-2014 with a total of 464 traffic crashes involving animals for county level data. For temporal comparison to fatality statistics (above) there were 196 of animal involved incidents over the same period. The total average number of animal-involved crashes is 38.7 over 12 years. These numbers suggest motor vehicle incidents with animals increased over the last 5-years and are approximately equivalent to 87% of the 5-year average crash rate in the county.

Railroad Transportation

Union Pacific, Nebraska Central, and Burlington Northern Santa-Fe are the major rail companies operating in Central City (Nebraska Commodity Flow Study, 2013). Federal Railroad Administration (FRA) data was utilized to find incident records for each railroad by type and major cause for the community and as summarized in the adjacent table (FRA, Office of Safety Analysis, 2016). The state Commodity Flow Study provided additional data to develop the Risk Assessment Summaries on the following page. The Department of Homeland Security published a new Homeland Infrastructure GIS dataset in February of 2016 that unclassified 275 GIS layers across the U.S., and includes information on the 26 rail junctions located in Central City's jurisdiction. These were compared to CIKR facilities shown in previous maps.

Rail incidents have occurred 34 times between 1975-2015 with a 85% annual probability, three injuries and three fatalities (FRA, Office of Safety Analysis 2016). All rail-related injuries and one fatality occurred in a single highway-rail incident in 1985. Two other fatalities occurred in 1993 and 2002 and were also due to highway-rail collisions. The period of record did not include the current year, however on January 26, 2016 a 53-year old man was fatally injured at the junction of Highway 30 and 19th Road in Central City (Grand Island Independent, 2016).

Type/Cause Rail Incidents (1975-2015)	Count	Annual Probabilities	Relative Frequency
Derailments	21	52.50%	62.00%
Highway-Rail Impact	10	25.00%	29.40%
Raking Collision	1	2.50%	2.90%
Other Event	2	5.00%	5.80%
Total	34	85.00%	100%
Equipment Failure	5	12.50%	15.60%
Human Error	9	22.50%	28.10%
Hwy-Rail Collision	9	22.50%	28.10%
Track	5	12.50%	15.60%
Other Causes	4	10.00%	12.50%
Total	32	80.00%	100%
Fatalities Reported	4	10%	100%
Injuries Reported	3	7.50%	75%

Transportation and Chemical Transportation Vulnerability and Risk Assessment Summaries

Transportation/Chemical Transportation Vulnerability Assessment	
Sector	Vulnerabilities
People	Drivers, pedestrians (and school age children), few bicyclists. Rural residents or residents near or crossing railroad junctions. Highway Travelers at higher fatality risk. Employees Delivering to or working at facilities reliant on the transportation sector. Business and Property owners in downtown Central City.
Economic	Road, Airport, and Rail Closures. Cleanup, response costs. Company or individual property damages. Utility interruptions.
Built Environment	Buildings, Railways, Highways, Bridges, Traffic signals, pedestrian/rail crossings or roadway lighting, Crop lands or wetlands. Parking at entrances to facilities with high traffic volumes. Increased pollution concentrations.
Infrastructure	Possible closure of transportation routes. Mutual Aid Fire Districts. Local Police and Inter-Agency Involvement. Fires, explosions, impacts.
Critical Facilities	Volunteer Fire Department and Ambulance Service. Post Office near Hwy 30. Schools. Historical buildings or tourism attractions. Hospital, Clinics.

Transportation/Chemical Transportation Risk Assessment	
Historical Number of Events (2003-2014)	464 Animal-Involved Crashes (2003-2014) 225 Total Crashes with Injuries and Fatalities (2003-2014) 196 Animal (2010-2014) Rail-34 1975-2015)
Vulnerable Locations	Highway 14, Highway 30, Hordlake Road, 17 th Road, Intersections and Junctions. Airfield and surrounding area. Downtown Business Corridor.
Magnitude/Extent	Central City Limits and ETJ, nearby Highways
Annual Probability	Highway 45% (with fatalities and injuries-NDOR), Rail 72% (UNL's CFS), 85% per FRA records
Relative Frequency	Motor Vehicles- Fatalities 4% , Disabling Injuries 18.67% , Visible Injuries 36.4% Possible Injuries 40.88% Rail Incidents- Derailments 62%, Highway-Rail Impacts 29.4% Raking Collision 2.9% Other Event: 5.8%
Property and Crop Damages	Motor Vehicles- n/a, Rail Incidents- \$8,414,643 (1975-2015) FRA
Total Average Annual Losses	Motor Vehicles- n/a Rail- \$210,366
Fatalities	13 total between Highway and Rail Incidents. Highway = 9, Rail = 4. Air = 0
Injuries	Highway (NDOR)- Disabling Injuries = 42, Visible Injuries = 82, Possible Injuries = 92, Rail = 3 (1975-2015-FRA)
SHMP Rank/Score	County- 36.0 (14 th) Region 2-72.19 (13 th) State-69.31(13 th)
Central City Rank	Transportation- 4th Motor Vehicle Accidents (4A) Railroad Transportation (4B)
Associated Event Rank	Chemical Transportation-5th Railway Chemical Transportation (5A) Highway Chemical Transportation (5B) Pipelines Chemical Transportation (5C) Aircraft Chemical Transportation (5D)

Flooding/Flash Flooding

Due to the high density of properties (196 total) within the 100-year flood plain slightly north of downtown Central City and beyond, spatial analysis and potential loss calculations were performed for parcels located within the extent of the floodway and 100-year flood hazard areas (see Figure 11, page 29). Approximately 67% of all major presidential declared disasters in the State, the potential loss calculation estimations by property type is expected to be valuable information for the Emergency Manager and Central City Administration.

If a future need arises for the community to request assistance for recovery, data in regard to assessed property values, land valuations, commercial properties, residences, and outbuildings in addition to improved and sales value estimations as provided in Table 8 may be used to estimate property valuations during a time of need. Data provided by the Merrick County Assessor's Office and GIS Workshop (2016), was utilized to provide the associated calculations for properties within flood hazard areas. County parcel data was 82.7% complete, therefore data in Table 8 are considered estimates.

Table 9. Central City Total and Average Property Valuations within the 100-year Floodplain.

Property Valuations within Flood Zone Boundaries					
	Residential (159 Properties)	Commercial (3 Properties)	Undefined (34 Properties)	Total	Maximum Value of Individual Parcels
Assessed Valuation	\$11,790,150	\$1,223,905	\$2,521,235	\$15,535,290	\$1,218,605
Average Assessed Value	\$74,152	\$611,953	\$74,154	\$79,262.00	*
Land Valuation	\$4,534,670	\$120,300	\$2,521,235	\$7,176,205	\$1,019,705
Average Land Valuation	\$28,520	*	\$74,154	\$36,613.00	*
Improved Valuation	\$6,599,965	*	\$0	\$6,599,965	\$255,590
Average Improved Valuation	\$41,772	*	*	\$33,673	*
Sales Valuation	\$3,355,966	\$7,200	\$80,000	\$3,443,166	\$140,000
Average Sales Value	\$21,107	*	*	\$17,567	*
OUTBUILDINGS VALUATION	\$682,475	\$212,940	\$0	\$895,415	\$1,019,705
Average Outbuildings Valuation	\$4,432	*	*	\$4,568	*
* Data missing or unavailable					

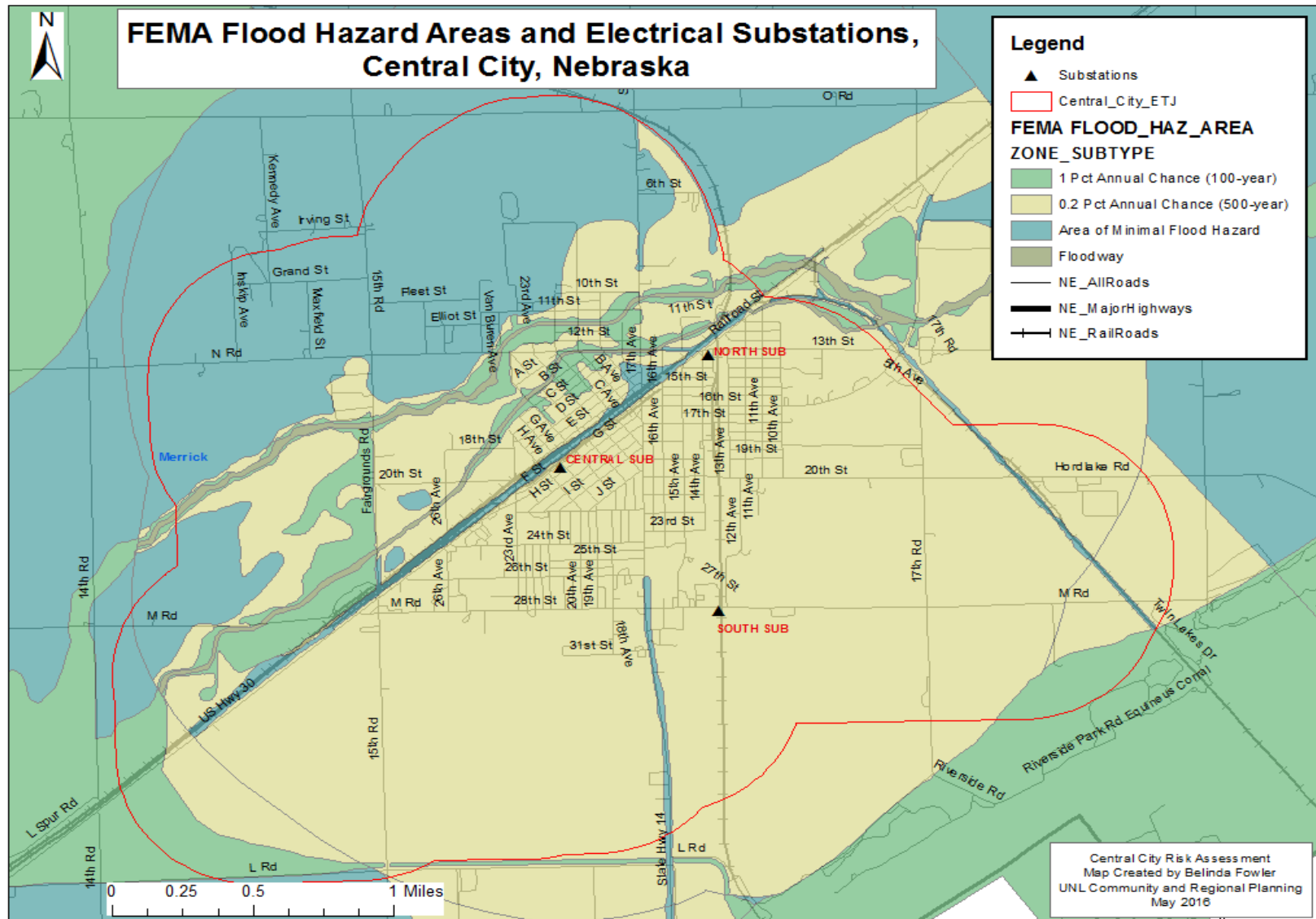


Figure 10. Flood Hazard Areas showing the 100-year and 500-year Floodplains (1% or 0.2% annual probabilities respectively), Central City, Nebraska.

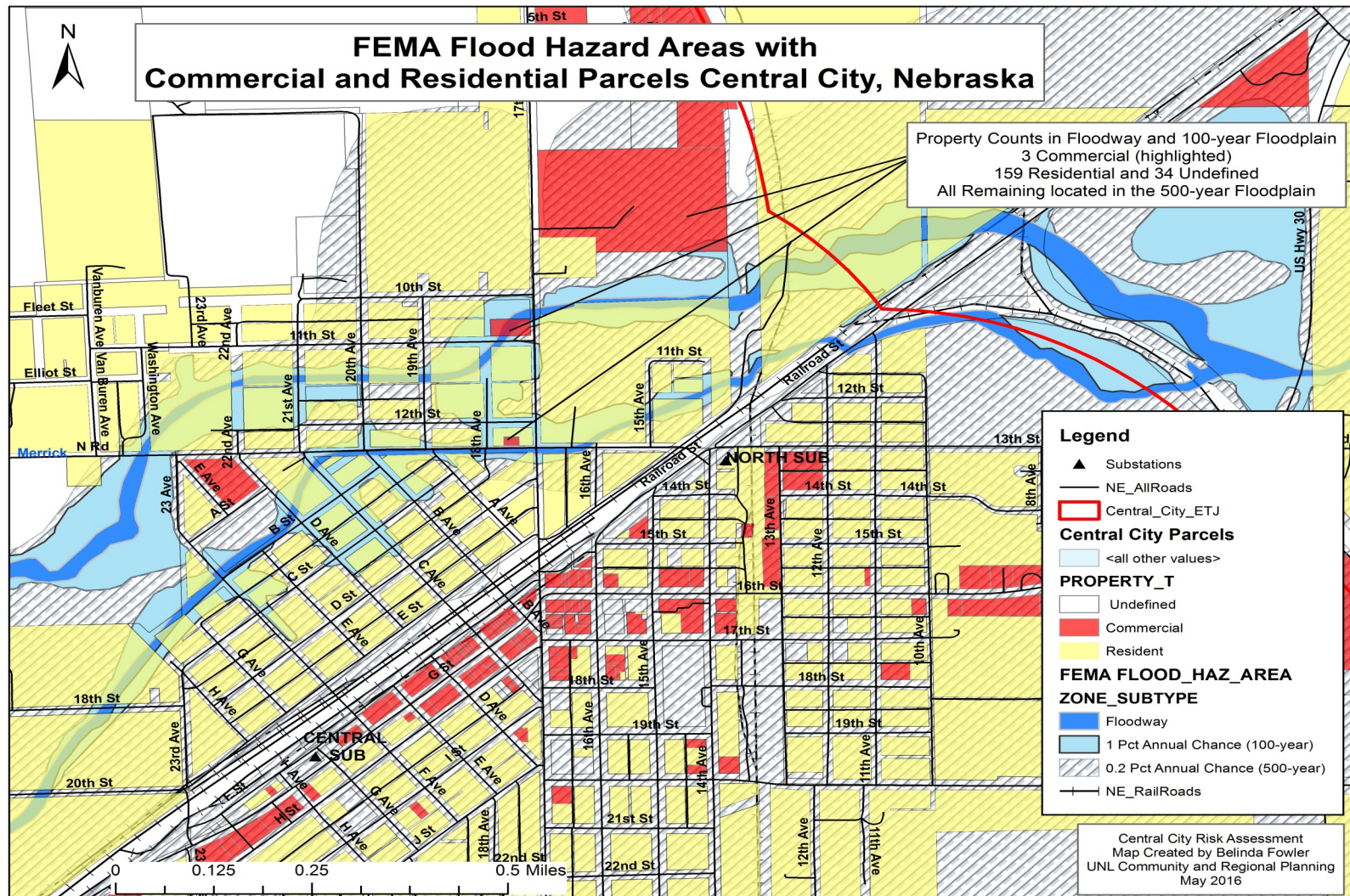


Figure 11. Flood Hazard Areas showing the 100-year and 500-year Floodplains (1% or 0.2% annual probabilities respectively), Across Residential and Commercial Properties, Central City, Nebraska.

Flood/Flash Flood Vulnerability and Risk Assessment Summaries

Flooding /Flash Flood Vulnerability Assessment	
Sector	Vulnerabilities
People	The young and elderly are vulnerable as they are less mobile than other members of the community. Residents and business owners located within flood prone areas, sewer backups and exposure to pathogens. Low income sectors may have a lack of advance warning through media outlets. Children playing in nearby parks or along floodway control channels.
Economic	Businesses may be affected due to closed roads, loss of power or damage from storm debris. Lost revenue may occur due to business closures
Built Environment	Water inundation zones, Crop damage due to flood waters or sustained inundation. Railways and traveled roads.
Infrastructure	Heavy rains may wash out roadways or limit access. Rail crossing barrier failures due to a loss of power.
Critical Facilities	Flood waters can cause infiltration to sewer treatment lines overloading treatment capacity of the wastewater plant. Examples may include: Hospital, Clinic, and Emergency Services. Wastewater treatment lift stations and public water supply wells may be impacted

Flooding/Flash Flood Risk Assessment	
Historical Number of Events	2 (NCDC, 1996-2015), 5 (NFIP claims 2010-2015) Total = 7
Vulnerable Locations	North of Highway 30 and proximal to the Platte River. Commercial and Residential Properties, Rail Lines, Areas near Warm Slough/Trouble Creek and Residences South by the Platte River.
Magnitude/Extent	Warm Slough floodway area, Waters above Base-flood Elevations in Zone AE, 100-year and 500-year floodplain areas with low ground -surface elevations
Annual Probability	10% (NCDC)
Relative Frequency	3.6% (NCDC)
Property and Crop Damages	Property Damage \$30,000 Crop Damage \$50,000
Total Average Annual Losses	\$4,000
Fatalities	0
Injuries	0
SHMP Rank/Score	County– 7th (84.00), Region-6th (88.27), State –6th (88.27).
Central City Rank	6th of 35

Drought

Drought is defined by periods of time when water supplies are short and precipitation is below-average for a given region (NDMC, UNL, 2016). Usually conditions are exacerbated by accompanying higher temperatures and dry winds. Water shortages may occur in the atmosphere, underground or on the ground surface. Drought is difficult to forecast as it develops slowly and typically occurs over large regional areas. Drought impacts are more difficult to visualize than other naturally occurring hazards such as floods or severe storms. The initial stages of drought may be difficult to see and local weather patterns may change over a short time period, mitigating an impending event. According to the National Drought Mitigation Center (2016), many climatologists find it difficult to forecast drought more than a month in advance. The two major climate variables, precipitation and temperature are not easy to forecast and predict. Many drought conditions are dependent on previous weather patterns and ground surface conditions (e.g. crops planted or surface dryness).

The U.S. Drought Monitor is produced through a partnership between the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration (NDMC, U.S. Drought Monitor Map, 2016). The current map dated March 29, 2016, does not show that Nebraska has any current concerns in regard to drought or abnormally dry conditions although extents can change within a few weeks. Abnormally dry conditions currently border Nebraska in Wyoming and North and South Dakota.

Drought Prediction Indices and Measurement for Central City

According to the National Drought Mitigation Center (2016), administrative officials typically use the Palmer Drought Severity Index (PDSI) to trigger drought relief assistance programs based on previous and relatively successful long-term drought condition predictions (NDMC, Comparison, 2016). The PDSI takes advantage of the longest periods of record to forecast drought and is strong in identification of weather events that are significantly different than normal variations. Severe drought was most frequently recorded at 13.2% (Table 10) as adapted from Grand Island Weather Station data.

Table 10. Palmer Drought Severity Index Scale and Likelihood of Occurrence via Grand Island Regional Airport Data 1908-2012.

PDSI Values	Description	Annual Probability	PDSI Values	Description	Annual Probability
4.0 or higher	Extremely wet	9.36%	-0.5 to -0.99	Incipient Dry Spell	5.0%
3.0 - 3.99	Very wet	11.7%	-1.0 to -1.99	Mild Drought	8.1%
2.0 - 2.99	Moderately wet	12.5%	-2.0 to -2.99	Moderate Drought	8.2%
1.0 -1.99	Slightly wet	10.5%	-3.0 to -3.99	Severe Drought	7.5%
0.5 - 0.99	Incipient wet spell	4.7%	-4.0 or lower	Extreme Drought	13.2%
0.49 to -0.49	Near Normal	9.2%			

Source: Adapted from the National Drought Mitigation Center, University of Nebraska-Lincoln, NOAA, and U.S. Department of Agriculture. Retrieved March 5, 2016 from <http://drought.unl.edu/Planning/Monitoring/ComparisonofIndicesIntro/PDSI.aspx>

Drought

Data from a weather station was not located in Central City and therefore specific data was not available to determine historical drought events. However, two weather stations near Central City were assessed from the Drought Risk Atlas interactive map viewer (UNL, Drought Risk Atlas, 2016). These two stations are listed as geographically similar and within the same hydro-geographical cluster containing Central City. Results from both stations were reviewed and assessed to extrapolate risk for Central City.

The first station selected is located in Climate Division 6-in Aurora, NE approximately 17 miles due south of Central City on Highway 14. Records at the Aurora station spanned 64-years between 1948-2012 and only the PDSI index was available for historical assessment. The second station is located at the Grand Island Airport (Station no. 253395) and located in Climate Region 5. Data availability had a range of 104 years from 1908-2012. Two drought indices were compared at the G.I. Station (SPEI and PDSI) were and did not appear significantly different. Therefore, PDSI was used for comparison to the Aurora Station.

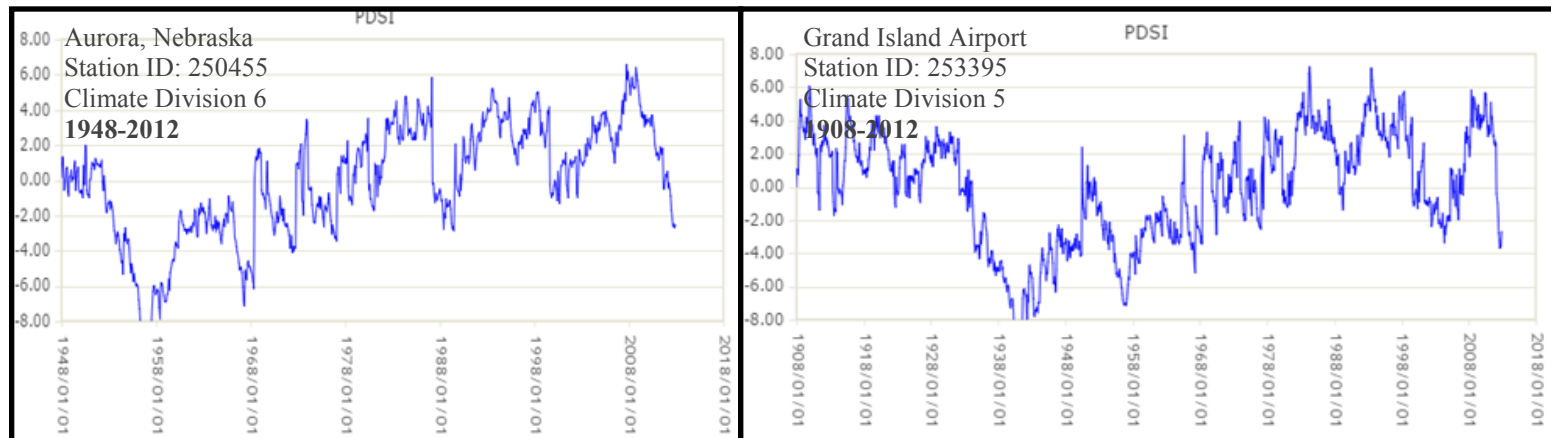


Figure 12. Palmer Drought Severity Index Trend line for stations located near Central City, Nebraska. Data on the left is from Aurora for 64-years, while data on the right is from the Grand Island Airport weather station and includes 124-years of record beginning in 1908.

The NCDC, records drought in county level data and is not in collected data at the local level. Fifteen total NCDC drought events have been recorded over the last 20-years, with total damages of \$35M from reports in 2000, 2002, and 2012. The other 12 events had no damages assigned, although the remainder occurred in 2012 and 2013, when much of the state was impacted by a significant dry spell. Based on NCDC data, the annual probability for drought events is 75% and has a relative frequency of 15%.

PDSI monthly data available through the Drought Risk Interactive Map was downloaded for the Grand Island Station for the period of record between 01/01/1908 and 12/31/2012 (124 years). There were 522 of 1260 records that fell below the -0.49 indicator value for incipient dry spell, indicating some form of drought for the Grand Island hydro-geographical cluster has historically and cumulatively occurred 41.4% of the time.

Drought Vulnerability and Risk Assessments

Drought Vulnerability Assessment	
Sector	Vulnerabilities
People	Insufficient water supply. Increased food and water pricing. Income loss in agricultural, manufacturing, tourism, and recreational sectors. Stress and depression. Possible land subsidence or emigration after long dry periods. Dust and public health concerns.
Economic	Community dependent on agricultural base. \$35M in previous crop losses recorded at the county level. Population: 1.3% Employed in Agriculture and 6.8% Employed in Manufacturing. Secondary effects to employment in services (50.8%), government (34.7%) and retail (20.4%). Loss of tax and utility revenue, default loans. Local government utilities, recreation, and business revenue losses. Land valuation reductions. Emergency planning and coordination
Built Environment	Lack of fire suppression systems. Water pressure drops. Foundations may crack without support of surrounding soils. Crop damage. Landscaping and tree damage. Loss of fertile topsoil on ag-lands. Reduced visibility due to dust/winds. Possible land subsidence is drastic scenarios or with significant climate change.
Infrastructure	Electrical system demands. Public water supply wells and pumps. Reduced water table elevation and increasing water supply distance; increased threat of contamination possible. Water supply lines (underground) and water storage impacts (water tower). Roads, railroads, bridges, and natural water resources
Critical Facilities	City Water Department and community water tower. Public wells and Wastewater Treatment plant. Hospital and Clinic

Drought Risk Assessment	
Historical Number of Events	173 months or 14.4 years of 104 total years in the period of record by Grand Island Weather Station and Comparison to PDSI. NCDC data (1996-2015) = 15 events reported.
Vulnerable Locations	Entire Community and surrounding Agricultural Lands
Magnitude/Extent	Extended periods of dryness with a PDSI - 0.49 or lower
Annual Probability	10.9% - 13.7% between Aurora and Grand Island Stations and comparison to PDSI. 75% Annual Probability NCDC data. 13.2% Severe Drought Probability (GI weather station).
Relative Frequency	15% NCDC data , 13.2% Grand Island data
Property and Crop Damages	\$35 Million to Crops No property damage reported Largest loss category
Total Average Annual Losses	\$1,750,000
Fatalities	0
Injuries	0
SHMP Rank/Score	82.00-County (6 th), Region 2-101.24 (5 th), State-94.09 (5 th)
Central City Rank	7th by Major Categories, or 21 of 35 total hazards assessed.

Tornadoes

Central City is located in the Midwest area of the United States, and is located in an area so commonly impacted by tornadoes that a term “tornado-alley” has been assigned throughout the region (NOAA, Tornado Alley, 2016). Central City and Merrick County fall in one of the highest risk (e.g. most frequently impacted) areas of the nation. Tornadoes are typically generated in association with large supercell thunderstorms and have been a component of 17 of the 60 (or 28%) disaster declarations for the state since 1960 (NCDC, Storm Prediction Center, 2016; FEMA, Presidential Disaster Declarations, 2016).

Tornadic activity is unpredictable and may occur at any time although usually these events are associated with supercell severe thunderstorms (NOAA, SPC, 2016). Tornadoes vary in speed and may travel long distances. Some tornadic paths repeat during the same storm, as was the case of Grand Island’s “Night of the Twisters” in 1980. Central City is located approximately 35-miles away and to the east of Grand Island.

NCDC data for Central City was examined and found to have only two tornadoes reported, although as seen in Figure 13, tornadoes occur in a relative frequent and dense pattern that either intersect or originate from within the county.

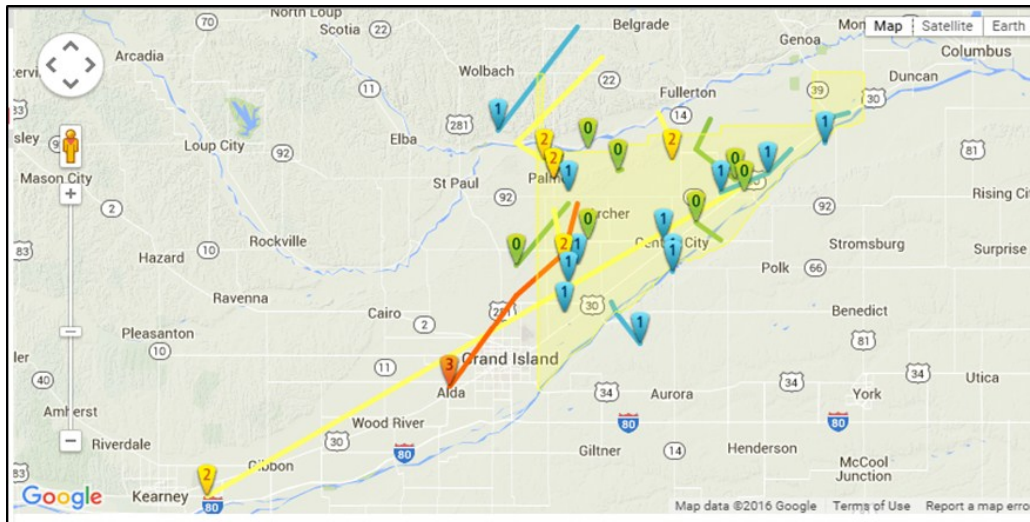


Figure 13. Historical Tornadoic Pathways and Strength of Each, Intersecting or Originating from Within the Merrick County Boundary.

Source: Adapted from NCDC data and Tornado Project Website. (2016). Retrieved on March 11, 2016 from www.tornadoproject.com.

Both tornado events reported in Central City occurred in 2001 and prior to the implementation of the Enhanced Fujita Scale (EF-scale). Therefore, the scale of the two tornadoes reported were F0 and F2 with estimated maximum wind speeds up to 156 mph. The two tornadoes reported to have impacted Central City over the last 20-years have occurred in May (F0) and October 2001 (F2). Tornadoes were reported in the late evening and early afternoon hours. No damages were reported for F0 event, however damages from the second, F-2 scale tornado were reported with \$325,000 in damages (NCDC, Storm Event Database, 2016). Due to the “after-harvest” timeframe only \$25,000 of total damages was to crops.

Tornado Vulnerability and Risk Assessment Summaries

Tornado Vulnerability Assessment	
Sector	Vulnerabilities
People	The traveling public in unprotected vehicles and lack of shelter availability. Reduced visibility, high winds or flying debris. Residents in mobile homes are at higher risk of injury and property damage due to high winds, lack of anchoring or structural integrity. Low income sectors may have a lack of advance warning. Young and elderly populations may not be able to hear or assess warnings or access shelters. Public Information on shelter locations. Low income housing areas, Senior Living or Day Care Centers and hospitalized or immuno-compromised individuals. Post-traumatic stress for first responders and medical professionals
Economic	Businesses may be affected due to structural damage, loss of power, or lack of access due to road closures and debris. Long term revenue loss may occur due to closures and property damage. Places of employment may be affected long-term
Built Environment	All structures are vulnerable and mobile homes may be more susceptible to damage. More densely populated areas. Low lying areas may flood. Downed power lines, transformer explosions, electrical substations and fires from electrical hazards. Lack of fire suppression systems. Crop damage likely. Roads, railroads, bridges, and trees. High winds, lightning and associated hail damage
Infrastructure	Identify or build public shelters. Heavy rains may wash roadways and limit access. Low lying flooding or overflows to sewers and receiving streams. Communication systems. High winds and power losses. Rail crossing barrier failures due to a loss of power. Extensive damage may impact continuity of services and operations. Major economic costs to businesses and the community.
Critical Facilities	Emergency services and transport may be affected. Chemical facilities, Day cares, senior centers, schools, financial institutions, and governmental facilities and gas stations. Power outages are likely and buildings may sustain damages from hail, lightning (in rare events) or wind. Examples may include: Hospital, Clinic, and Emergency Services. Wastewater treatment facility and public water supply wells may be impacted.

Tornado Risk Assessment			
Historical Number of Events (1996-2015)	2 (May and October 2001)	Total Average Annual Losses	\$16,250
Vulnerable Locations	Entire Community	Fatalities	0
Magnitude/Extent	F-0 (no damage) to F-5 (complete destruction). Hail, Wind, Lightning	Injuries	0
Annual Probability	10% (Central City) 32.3% (County)	SHMP Rank/Score	County-92.0 (4C tied with Chem. Transportation and Fixed Facility).
Relative Frequency	3.6%		Region-107.33 (4th), State-106 (4th)
Property and Crop Damages	Property \$300,000 Crops \$25,000	Central City Rank	8th Major, or 22 of 35 overall

Fixed Chemical Facilities

On average, fixed chemical facilities in Central City experience one reportable release a year according to Nebraska Department of Environmental Quality (NDEQ) Data obtained for years between 1982-2013, resulting in an equivalent annual probability of 3.2%. Facilities with bulk quantities of chemical storage are governed by a number of environmental protection laws to prevent accidental releases, require proper waste management and to periodically report pollutant inventories or chemical storage quantities.. These regulations provide the information that enables local governments to meet their Emergency Planning and Community Right-to-Know (EPCRA) obligations by including appropriate locations that require incorporation into the Local Emergency Operations Plan (e.g. facilities storing Extremely Hazardous Substances in significant quantities) and gives pertinent information to the Local Emergency Planning Committee when conducting plan reviews. Information is available on open source internet sites due to Freedom of Information Act requirements.

EPCRA was specifically enacted to assist with emergency planning and greater public knowledge. By law, citizens have a “right-to-know” what facilities store significant quantities of hazardous substances or introduce pollutants in environments where they live and work (EPA, “What is EPCRA?”, 2016). Under EPCRA Sections 302 and 304, facilities must submit written reports at least once when their chemical use or storage exceeds threshold planning quantities and must immediately report releases of any such chemical.

Under EPCRA Section 303, and Nebraska Revised Statutes §81-829.46(9), local governments are required to establish comprehensive emergency response plans for their districts; and to have the Local Jurisdiction and Emergency Planning Committees review annually and update plans every five-years (NEMA, Emergency Manager’s Handbook, 2013). Involvement in the planning process leads to local understanding and improved response if plans meet the following minimum requirements; as required by law (EPCRA, Fact Sheet, 2012).

- ⇒ Identification of facilities subject to EPCRA and routes likely to be used to transport Extremely Hazardous Substances (EHS’s).
- ⇒ Methods and procedures to be followed by facility owners/operators and local responders when releases occur;
- ⇒ Designation of facility and community emergency coordinators with authority to implement the emergency plan;
- ⇒ Procedures to provide public notification by the emergency coordinators when a release occurs;
- ⇒ Methods for determining the occurrence of a release and the likely affected population/area;
- ⇒ A description of emergency equipment and facilities in the community and at each facility;
- ⇒ Evacuation plans;
- ⇒ Training programs; and Methods and Schedules for exercising the Emergency Plan.

NDEQ publishes an Interactive Map and spreadsheets for Spill Facilities in the planning area (NDEQ, Spill Facilities, 2016). The majority of reportable chemicals released have been gasoline, fuel oils, waste oils, or diesel and primarily associated with underground storage tanks at businesses primarily along Highway 30. Surface spills have been related to the railroad, MVA’s or occurring at locations equipped with power generators having fuel tanks (e.g. schools and hospital). Less frequent events have been associated with ag-chemicals, acid and corn mash.

Of the 32 facilities on the historical list, three are considered active for ongoing remediation they are Mustard Oil, Bomgaars, and Joe Clark. The Bomgaars site is listed as “Not yet completely resolved or is temporarily suspended” while the other two are “pending further investigative action and clean-up.” Data from the National Response Center (NRC) Spill Database was also reviewed for the last 5-year period to determine if any reportable releases have occurred in the planning area. One incident was investigated and found invalid by the NRC.

Fixed Chemical Facilities

Chemical fixed facilities must annually report threshold amounts (Section 312) and provide Safety Data Sheets (formerly MSDS) to their local VFD, SERC, and LEPC under Section 311. The need to report a given chemical is based on annual manufacturing, processing, importing (25,000 lbs.), or 10,000 pounds of use in a year for general chemicals with moderate risk (EPA, EPCRA Sections 311-312). Chemicals considered acutely hazardous are reported at lower threshold amounts. EPA publishes a list containing more than 600 chemicals; and an additional 20 categories that identify high-risk chemicals considered highly toxic; specifying which chemicals and what threshold quantities must be reported (EPA, List of Lists, 2015).

The Tier II system (Section 312) is used by Nebraska reporting facilities and provides data for chemical use, storage, maximum daily amounts, average daily amounts, container or vessel type the chemical is stored in and whether it is considered an extremely hazardous substance (EHS) with acute or chronic effects. Facilities with EHS's are required to be included in the LEOP. Active and ongoing participation is needed at the local level by emergency services and local emergency planning committees in order to facilitate a safe and orderly response to the facility and the community in the event a release occurs (NDEQ, NEPCRA Information, 2016).

Facility ID	Facility Name	Street	City	County	Zip Code	Table Key
60980	Adrian's One Stop	2012 19th Rd	Central City	Merrick	68826	Inactive
36234	Aurora Co-op Elevator Company	1313 13th Ave	Central City	Merrick	68826	T-2 with EHS
36277	Aurora Co-op Elevator Company	1561 13th Rd	Central City	Merrick	68826	T-2 NO EHS
36289	Bomgaars	719 16th St	Central City	Merrick	68826	No T-2 for 2015
36280	Bosselman Oil Inc	925 F Ave	Central City	Merrick	68826	
36208	Cascata Homes	909 17th Ave	Central City	Merrick	68826	
62493	Casey's General Store 1804	902 G St	Central City	Merrick	68826	
60983	Central City Mall	1414 16th St	Central City	Merrick	68826	
55189	Central City Municipal Airport	1346 Ormsby Rd	Central City	Merrick	68826	
60985	CenturyLink	1707 16th Ave	Central City	Merrick	68826	
60981	Community Sale Barn	1208 Taylor Ave	Central City	Merrick	68826	
36408	Dairy Queen Brazier	519 G St	Central City	Merrick	68826	
36274	Ferrellgas	803 F Ave	Central City	Merrick	68826	
82836	Green Plains Central City LLC	214 20th St	Central City	Merrick	68826	
36272	Mustard Motor Company	510 G St	Central City	Merrick	68826	
100287	Overland Sand & Gravel	1576 L Rd	Central City	Merrick	68826	
36404	Pump & Pantry 09	1310 16th St	Central City	Merrick	68826	
60984	Pump & Pantry 29	1110 G St	Central City	Merrick	68826	
36409	Reineke Ag Flying	1346 Ormsby Rd	Central City	Merrick	68826	
36394	Roads Dept Central City Yard	1406 6th St	Central City	Merrick	68826	
60986	Sprint Nextel	Jct E St & C Ave	Central City	Merrick	68826	
36239	Trinity Car Care	1403 16th St	Central City	Merrick	68826	

Table 11. Current and Historical EPCRA and Tier II Reporting Facilities in Central City, Nebraska.

Red cells include those facilities that must be included in the Local Emergency Operations Plan. Yellow cells show facilities that historically reported for underground storage tanks or are now inactive. Gas stations were removed from requirements in 1980. Blue Cells indicate reporting facilities that do not store Extremely Hazardous Substances, and therefore, information must only be submitted to the Local Fire Department and Emergency Planning Committees on an annual basis.

Source: Nebraska Department of Environmental Quality, Mark Lohnes, SARA Title III Administrator, March 2016.

Chemical Fixed Facility Vulnerability and Risk Assessment Summaries

Chemical Fixed Facility Vulnerability Assessment	
Sector	Vulnerabilities
People	Planning Committee, Volunteer Fire Department. The traveling public along major transportation corridors. Employees at facilities with Threshold Planning Quantities of Extremely Hazardous Substances or large quantities of chemical storage. Residents in close proximity to chemical release sites (above- or underground) or subject to possible groundwater pathway exposure. Injury or property damage due to industrial or commercial chemical accidents. Low income sectors may have a lack of advance warning through media outlets.
Economic	Businesses may be affected due to closures or evacuations. Short and long-term cleanup costs. Collaborative response and planning efforts.
Built Environment	Roadways, Downtown buildings, Railways, Industrial or Commercial Facilities. Consider future or potential Planned Development Areas.
Infrastructure	Public Water Supply Wells, Groundwater, Roads-Alternate Routes, Railway Notifications.
Critical Facilities	First Responders and Critical Care Facilities expected to be impacted during a large or significant event. Wastewater Treatment Facility near ethanol facility but outside of worst-case scenario planning distances.

Chemical Fixed Facility Risk Assessment	
Historical Number of Events (1982-2013)	32 (NDEQ)
Vulnerable Locations	Major Transportation Routes, Large Chemical Storage or EHS substances Stored, Facilities with underground storage tanks.
Magnitude/Extent	Air, Surface or Groundwater release at reportable release quantities
Annual Probability	3.2%
Relative Frequency	Once Annually
Property and Crop Damages	No reports available
Total Average Annual Losses	None reported
Fatalities	0
Injuries	0
SHMP Rank/Score	County- 92.00 (4a), Region- 86.86 (8th), State-75.59 (10th)
Central City Rank	9th by Major Category, or 23 of 35 total hazards assessed.

Urban Fire and Arson

Urban fires can be high risk events that occur unexpectedly and have the potential to rapidly spread to adjoining structures. Urban fires may occur before or after a natural event or has the possibility to be a man-made event alone. Fires may be attributed to overloading or malfunction of electrical circuits, impacts to the electrical grid during or after an event (e.g. tornado), explosions due to gas leaks, (e.g. gas lines, sewer gas), transportation, hazardous material transportation, accidents, or by deliberate attempts of a nefarious nature such as arson. After a hazard event, lack of adequate heating or unusual cooking techniques have the potential to increase urban fire potentials.

Observations and a review of parcel data indicate many older buildings and residential structures exist in Central City. Many residential homes are built in compliance with older electrical and building codes and are therefore more susceptible to fires. Many downtown buildings and businesses are interconnected buildings sharing dividing walls where a fire is likely to affect more than one structure. Older homes and facilities have a tendency to burn hotter and more completely than newer construction due to drier timbers (B. Wells, VFD Chief, personal communications, 2016). To substantiate observations, County Assessor Parcel Data was reviewed to determine age of housing stock. Oldest residential structures in the county are approximately 156-years old. Almost 1500 homes were built between 1900, 1910, and 1930. This is approximately 18.5% of the total housing stock in the county or about 1 in 5 homes.

On or around December 17, 1975 a downtown city block was impacted by a methane/ sewer gas explosion on the northwest corner at the junction of Highways 30 and 14. Buildings impacted were mostly two story brick faced buildings built at the turn of the century. Businesses occupied space on the ground floor and meeting rooms were the primary use for upper levels. The initial explosion occurred at the meat locker (now the Eye Care Center) and breached all buildings behind and to the west (up to the current day restaurant Waffles and More). The explosion resulted in one fatality.

The E-free church had a fire in 2014, with the official cause assigned as arson (B. Wells personal communications, 2016). A total of seven arson events are reported between 2001-2013 and equates to a 53.8% annual probability (CityData.com, 2016). Two other residential fires occurred in 2014. No additional data was available through the Uniform Crime Statistics Database (FBI, 2016) or the National Fire Protection Association's Annual Report (2015) and website. Local data via the volunteer fire department estimates 39 calls in 2015 with most related to automobile accidents and injury counts of 10-12 individuals (B. Wells, personal communications, 2016). The exact number of urban fires was not available. Remaining calls were to grass fires (ROW ditches outside the ETJ) or false alarms. In 2015, one major fire was reported for a residential structure.

The National Fire Protection Association states on average, residential fires result in damages of \$19,500 per structure (NFPA, Hytton, Hanes, J.G., 2015). Most residential fires in the community are related to wood burners or utilizing multiple space heaters and overloading electrical circuits. Most happen in older residential structures having antiquated heat and electrical utilities.

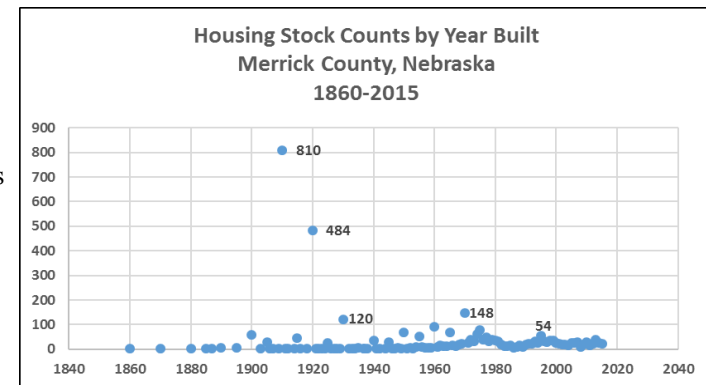


Figure 14. Number of Homes Built, by Year, Merrick County, Nebraska.

Source: Merrick County Assessor, Parcel Database, 2016.

Urban Fire and Arson Vulnerability and Risk Assessments

Urban Fire Vulnerability Assessment	
Sector	Vulnerabilities
People	Young, elderly and vulnerable populations. Business and Property owners in downtown Central City. Fatalities and Injuries possible. Long-term medical treatment and recovery. Loss of wages.
Economic	Domestic Structures, Downtown structures, Historical character loss, loss of sales tax receipts due to business closures. Loss of use. First Responder mobilization, training and equipment.
Built Environment	Older structures, Public facilities, interconnected buildings, Downtown businesses of multi-level structures. Mixed use development and downtown revitalization hindered. Fire Hydrants, Water tower or access to surface water resources.
Infrastructure	Possible closure of transportation routes. Mutual Aid Fire Districts. Underground piping, utilities (especially sewer). Governmental Buildings.
Critical Facilities	Volunteer Fire Department. Water Tower, Water Supply wells. Historical buildings or tourism attractions. Hospital, Clinics.

Urban Fire Risk Assessment Summary	
Historical Number of Events	1 Major Residential Fire in 2015 and two in 2014. 1 Major Commercial Building Event/Explosion, 1975. 8 Arson Events 2001-2014 (http://www.city-data.com/crime/crime-Central-City-Nebraska.html and local reports).
Vulnerable Locations	Interconnected buildings, apartments, older residential homes, Historical Structures, Governmental Buildings and other Public facilities.
Extent	Central City Jurisdiction
Annual Probability	Urban Fires Total = 25.6% (10 total events/39-years of record-see Historical Number of Events above). Arson 57.1% (2001-2014)
Relative Frequency	2.56% Major Residential Fire (1 of 39 calls-2015)
Property and Crop Damages	Property Estimate \$19,500 per structure (NFPA), therefore Estimated loss = \$195,000 Crops—not reported
Total Averaged Annual Losses	\$5,000
Fatalities Reported	1 (1975-downtown Central City)
Injuries Reported	0
SHMP Composite Scores-Ranking	County- 48.0 (11 th) Region 2-77.24 (12 th) State-71.74 (12 th)
Central City Rank	Urban Fire 10th, Arson 10A, or 24 and 25 respectively of 35 total hazards assessed.

Dam and Levee Failure

In all of Merrick County, one dam exists within county boundaries and is unique as compared to other counties' dam inventories. The singular dam is located on the northwest corner of the uppermost reaches of the county, is not expected to impact the planning area, and is defined by the Nebraska Department of Natural Resources Interactive Dam Inventory Map as existing, and considered a low-priority hazard potential (DNR, 2016). Furthermore, flood diversion channels have been constructed in northern and southern portions of Central City, helping to prevent flows from Trouble Creek, Warm Slough and the Platte River from impacting the community. The diversion channels are below ground-surface elevations and are therefore not classified as an earthen berm embankment levees. The Dam/Levee Failure Assessment relies upon information and maps specific to Kingsley Dam, an earthen and hydraulically filled structure completed in 1941. Information is excerpted from the Central Public Power District's, Kingsley Dam Emergency Action Plan (2008) and recently revised by Kleinschmidt and Associates in 2015.

Central City is within the inundation zones of 133 cross sections modeled on the basis of hypothetical dam breach scenarios. The community is located approximately 230.4 miles downstream of Kingsley Dam or at 60% of the total downstream river-mile distance of 380 miles. Two modeled scenarios of a Sunny Day Breach and the Maximum Peak Flow event, provide an initial wave estimates and time of travel to Central City at 72.5 hours and 63.1 hours respectively. Peak water cresting heights are expected at 77.2 and 66.5 hours and would result in respective incremental river rises of 8.1 and 6.3 feet. For each hypothetical scenario, inundation zones are outlined in following maps, with orange areas indicative of the Sunny Day Breach model and pink areas identifying larger impact areas expected during the modeled Peak Flow Event. A comparison of water flow velocities results in a difference of approximately 183,000 cfs, with the highest volumes estimated at 396,736 cfs during the worst-case event.

Highway 14-south may be used as an evacuation corridor, however water travel times to this location are estimated at approximately an hour in advance of the times impacting the city. Inundation zones are assumed to impact evacuation routes in the following order: to the south, north, and east of Central City. The best path for evacuation may be to the north and west of Central City or toward the airport where the water is not expected to reach and areas are not expected to be under water. Water travel time to bridges to the east show longer times before these routes would be impacted, however routes would be completely under water for both scenarios, not making this a primary choice for evacuation unless ample warning time is provided.

Bridges spanning the Platte River and located east of Central City would be impacted by downstream flows resulting from a breach at Kingsley Dam. Bridge impacts include Central City Bridge, two railroad bridges, Hordlake Bridge and two bridges located further downstream near Highway 92 as shown in Figure . Time of travel is expected to impact bridge areas between 64.5 and 75 hours after the breach with modeled flows.

While a complete dam failure of the Kingsley Dam is remote, it is necessary to note that the entire community of Central City would be inundated even under the Sunny Day scenario. Damages would be catastrophic to residents. Losses are expected to be even more substantial during the Peak Maximum Flow, worst case event as a larger areal extent would be underwater.

Planning considerations include life/safety considerations, first responder actions, evacuation routes, preventative measures for Critical infrastructure and Key Facilities. Mass notification and warning to vulnerable populations, residents and businesses within the community, traffic control for roads surrounding the inundation areas, and post-event clean-up prioritization.

Dam and Levee Failure Modeled Inundation Zone Maps

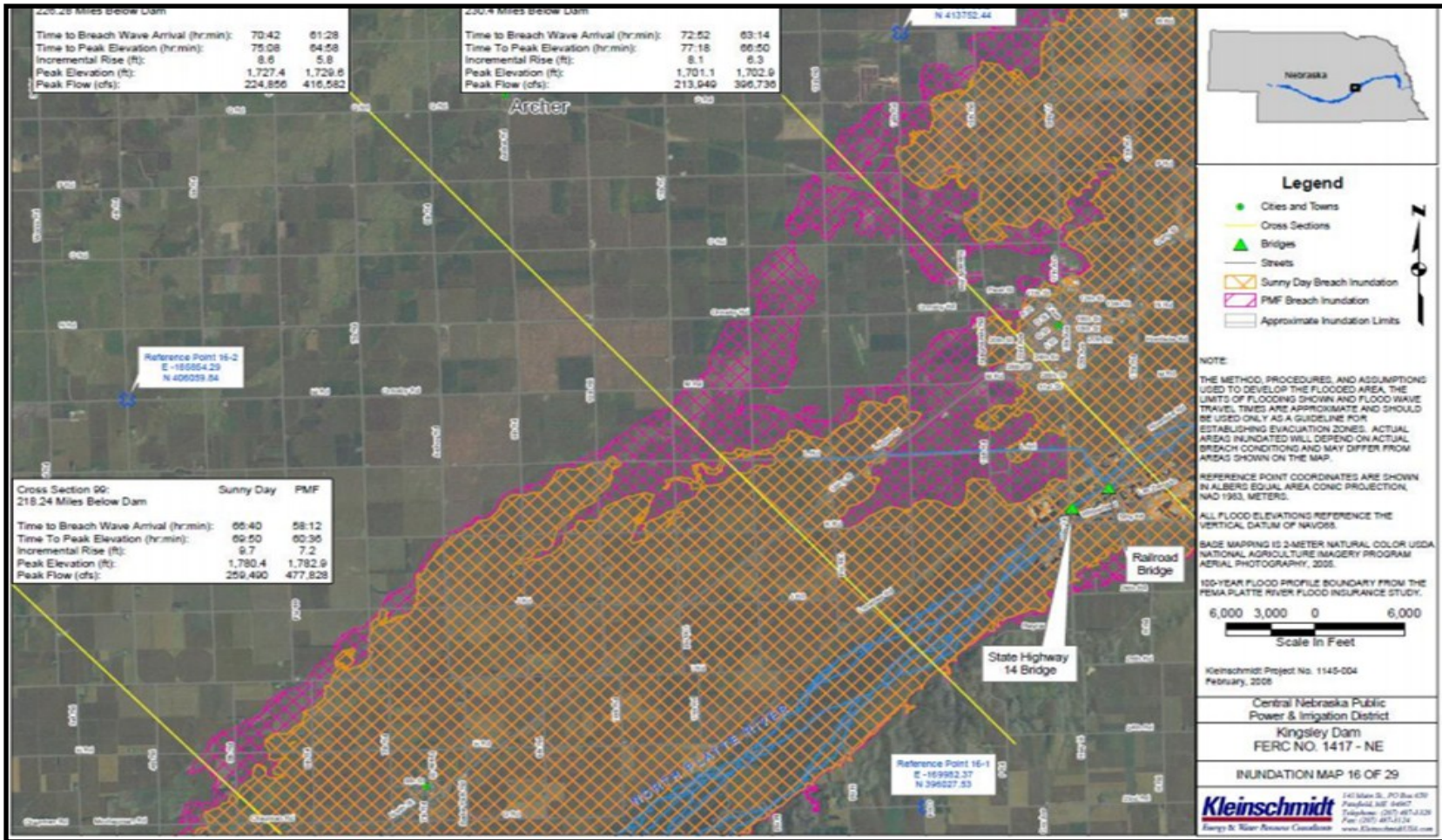


Figure 15. Modeled Inundation Zone Map, Southern and Western Edges of Central City for Sunny Day and Peak Maximum Flow Discharge Scenarios in Relation to a Dam Breach at Kingsley Dam.

Source: Region 44 Emergency Manager, via Central Public Power District's "Kingsley Dam Emergency Action Plan" (2008, revised 2015 by Kleinschmidt and Associates).

Dam and Levee Failure Modeled Inundation Zone Maps

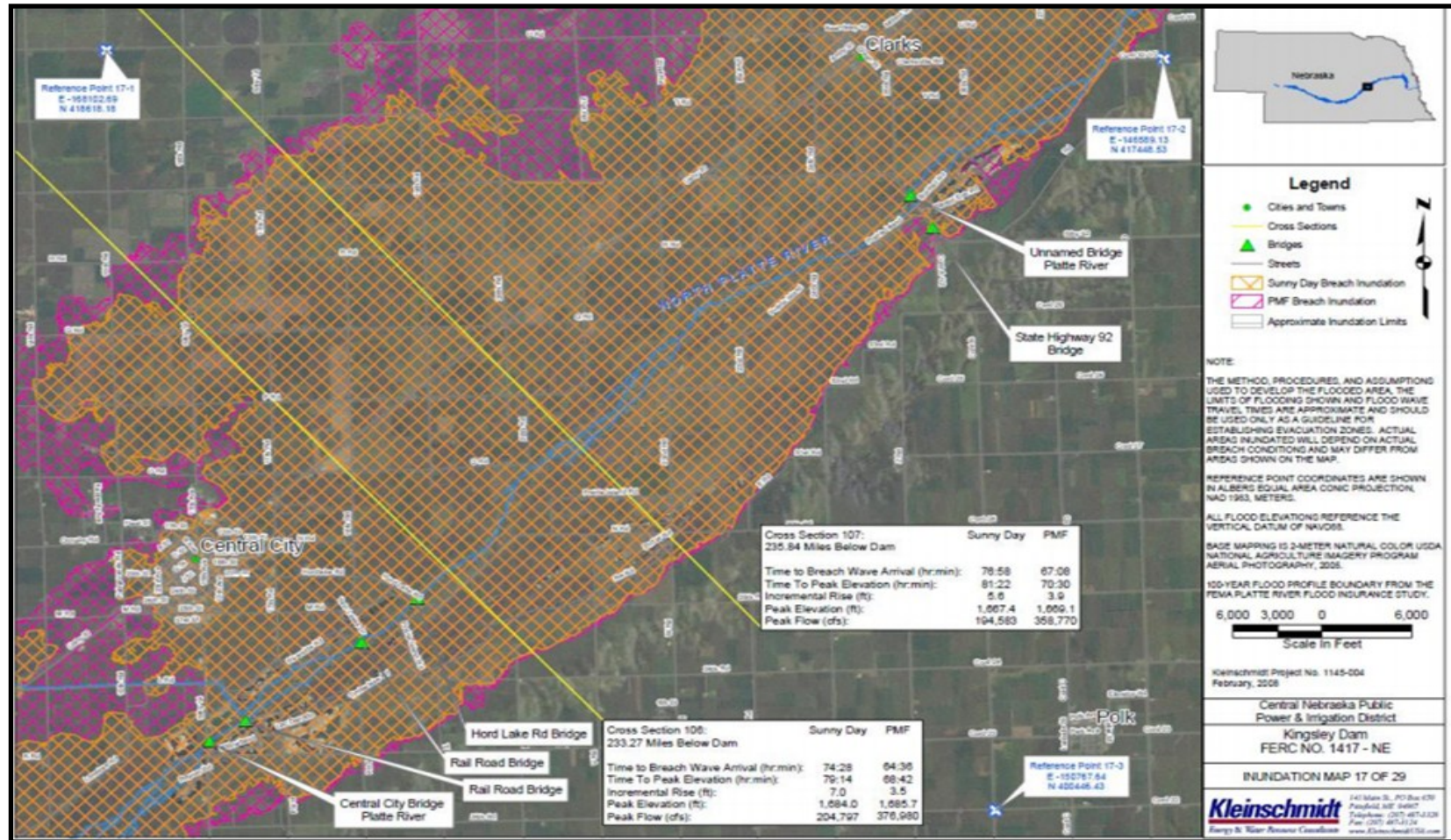


Figure 16. Modeled Inundation Zone Map for Central City and Bridges East, for Sunny Day and Peak Maximum Flow Discharge Scenarios in Relation to a Dam Breach at Kingsley Dam.

Source: Region 44 Emergency Manager, via Central Public Power District's "Kingsley Dam Emergency Action Plan" (2008, revised 2015 by Kleinschmidt and Associates).

Dam and Levee Failure Vulnerability and Risk Assessments

Dam and Levee Failure Vulnerability Assessment	
Sector	Vulnerabilities
People	People may be stranded in inundation zones, have lack of transportation or access to homes and evacuation routes. Swift moving water. Those recreating or living near the Platte River and not in direct communications with media outlets. Damages to personal property and homes. Debris flows and sediment deposition. Increased exposure to mold/pathogens/sewage/chemicals. Vulnerable populations may be impacted more readily. Extended temporal impacts such as increased food and water pricing. Income loss in agricultural, manufacturing, tourism, and recreational sectors.
Economic	Community dependent on agricultural base. \$80,000 in previous losses recorded for floods and flash floods but none at the flooding extent of a dam breach of Kingsley Dam. Entire community would be inundated in the least catastrophic scenario. Loss of employment 1.3% Employed in Agriculture. 6.8% Employed in Manufacturing. Secondary effects to employment in services (50.8%), government (34.7%) and retail (20.4%). Loss of tax and utility revenue, default loans. Local government utilities, recreations, and business revenue. Land valuation reductions. Emergency planning and coordination. Shelters may be needed.
Built Environment	All within Central City. Roads, bridges, evacuation routes, homes, schools, critical care or assisted living facilities, trees, livestock operations, habitat, wetlands, agricultural grounds, businesses etc.
Infrastructure	Electrical, sewer, water, and gas systems. Public water supply wells and pumps. Significant Public health, governmental services, and law enforcement resources needed. National Guard activation likely. Increased threat of contamination possible. Sand mining operations to the south of the community may be used for sandbagging/protective measures prior to timelines referenced above.
Critical Facilities	Hospital, Clinic, Courthouse, Emergency Shelters, Senior Centers, Assisted Living Facilities, Daycares, Schools and Airport.

Dam and Levee Failure Risk Assessment Summary	
Historical Number of Events	Dam Failure: None. Levee Failure: N/A.
Vulnerable Locations	Entire Community. Special focus areas needed for riverside residential and recreational locations. Critical Facilities and Agricultural Land would be impacted.
Extent	Time sensitive (between 63 and 72.5 hours after the breach). Inundation zones as identified in maps. High water flow velocities estimated between 213,000 – 397,000 cfs
Annual Probability	Extremely Remote per Central City Public Power Kingsley Dam Emergency Action Plan
Relative Frequency	Not calculated, no historical events.
Property and Crop Damages	Gross losses significant, Long term recovery plan
Total Averaged Annual Losses	Not estimated as event has not occurred and likelihood is remote.
Fatalities Reported	None.
Injuries Reported	None.
SHMP Composite Scores-Ranking	County 76.0 (7 th and tied with Ag-Plant/Animal Disease), Regional 64.33 (16 th), State 55.25 (17 th).
Central City Rank	11th by Major Category or 26 of 35 Total Hazards Assessed.

Agricultural Plant and Animal Disease

Agriculture disease is any biological disease or infection that can reduce the quality or quantity of either livestock or vegetative crops (JEO, Papio-NRD Hazard Mitigation Plan, 2016). In some cases, bacterial or viral pathogens responsible for agricultural disease have the potential to be transmitted to humans and other animals, especially through food supplies. The United States Department of Agriculture (USDA) reports the following agricultural economic data for Merrick County. Economic values of Crop Sales at \$161,195,000 (59 percent) and Livestock Sales of \$114,027,000 (41 percent) were major economic drivers, according to the 2012 Agricultural Census (USDA, Ag-Census, 2012).

The current State Hazard Mitigation Plan (2014), addresses data limitations in loss estimates for plant (crops) and animal disease due to a lack of official reporting mechanisms, although progress is underway to capture information for these hazards. Traceability to crops, animals and specific production locations in addition to data of where products are introduced into the food supply or final destinations are of paramount importance for mitigation planning into the future. Examples of improvements can be found in Nebraska when in 2002, the Nebraska Department of Agriculture began implementation of a Livestock Disease Reporting System. The system relies on training for containment or quarantine, response education, surveillance, reporting and recruitment of local veterinarians.

Furthermore, the Food and Drug Administration administers the Food Safety Modernization Act (FSMA), which intends to limit pathogenic microorganisms from entering the food supply chain. On January 4, 2011 President Obama signed a major reform of food safety laws (FDA.gov, FSMA, 2016). The FDA website states "It (the FSMA) aims to ensure the U.S. food supply is safe by shifting the focus from responding to contamination to preventing it." Proactive measures are newly required (as of 2015) for agricultural producers and for manufacturers producing feed or feed by-products. As an example, if a recall is ordered, manufacturers must have adequate records to trace source origination and to identify the final destination (FDA.gov, FSMA, 2016).

In 2014, 521 animal disease events were recorded by the Nebraska Department of Agriculture in Merrick County for domestic cattle and pigs (NDA, Disease Reporting, 2016). No events as historically identified in the SHMP were assigned in Merrick County. One event of Anaplasmosis was recorded for cattle (a disease transmitted by ticks and related to Texas fever) and 520 infections to swine were recorded under categories of Porcine Circovirus and Reproductive and Respiratory Syndrome. No data was available for 2015 and no active reports were found in year-to-date data for 2016. A total of 521 events as recorded in 2014 result in an annual animal disease probability of 100%. Loss data was not located, however when available, would be estimated on the basis on animal fatalities and livestock prices at the time of occurrence.

Data from the Risk Management Agency of the Department of Agriculture reported Merrick County annual crop losses in 2015, in the amount of \$379,082.50 (USDA, RMA, 2016). Probability was calculated by dividing the 2015 losses by the total adjusted crop value. The dividend of which results in most recent annual probability of 0.23% crop loss due to disease in Merrick County. Losses reported to crops in previous assessments throughout the report were related to severe or extreme weather events and based on damages estimated in the NCDC climate dataset; the most significant of which was drought related.

Land use within the Central City limits is primarily urban, however agricultural ground is located near the edges of town and within the ETJ. Dense agricultural production occurs on surrounding lands, and provides a strong economic foundation for the community in regard to employment in manufacturing and agriculture. Disease to plants or animals could significantly impact local economics or populations.

Agricultural Land Use Maps

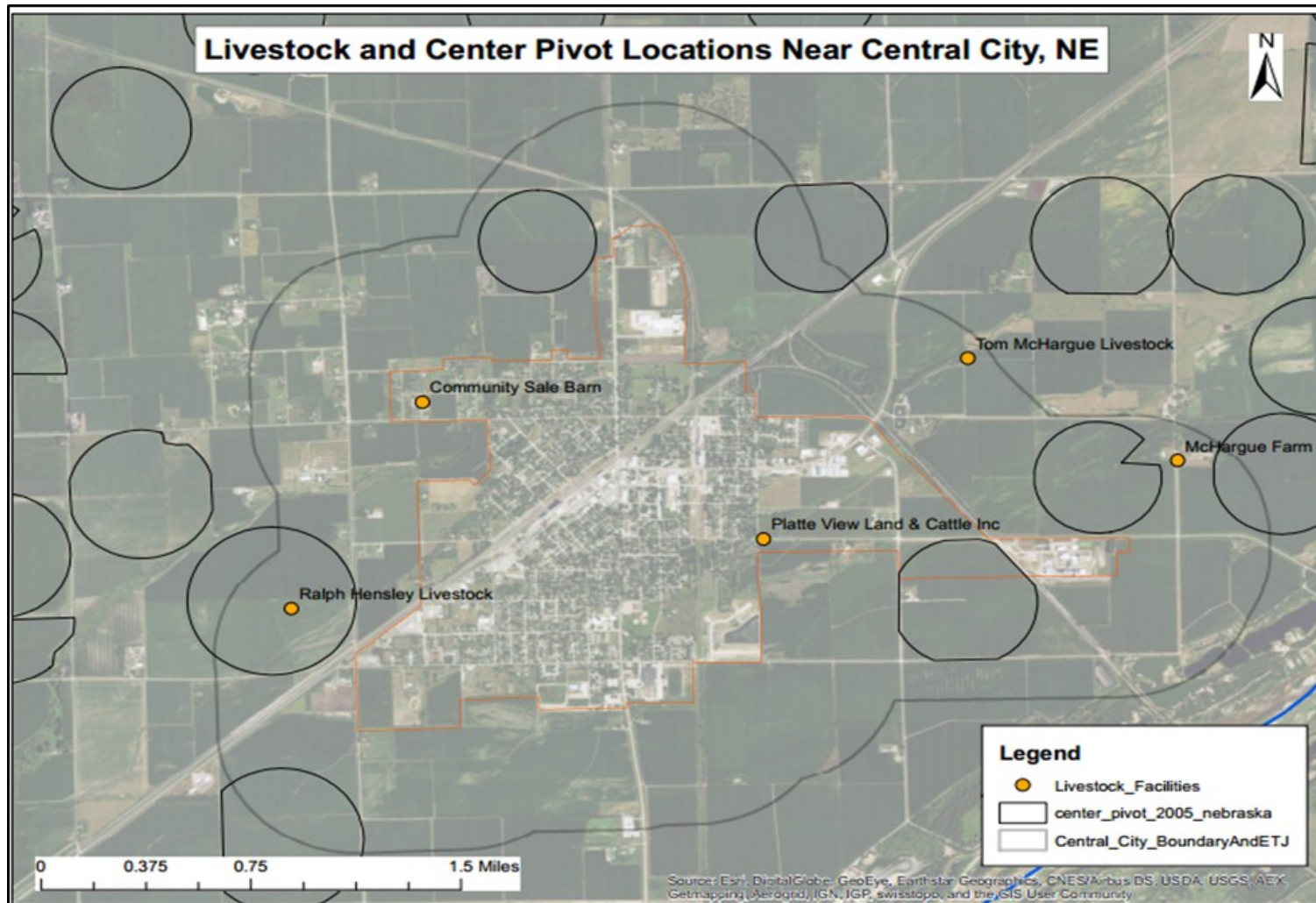


Figure 17. Map of Livestock and Center Pivot Locations Near Central City, Nebraska, 2016.

Source: Adapted from GIS data provided by University of Nebraska-Lincoln, School of Natural Resources. (2016) Retrieved March 12, 2016 from <http://snr.unl.edu/data/geographygis/NebrGISland.asp#landuse05>

Agricultural Animal and Plant Disease Vulnerability and Risk Assessment Summaries

Agricultural Plant and Animal Disease Vulnerability Assessment	
Sector	Vulnerabilities
People	Farmers, Ranchers, Veterinarians, Employees in Ag-Manufacturing or Grain Storage Facilities. Immunocompromised individuals. Potential food shortage or increased food supply expenses. Limited official reporting and warning mechanisms.
Economic	Direct crop or animal losses to Ag-business owners. Increased costs for domestic products. Wild game hunting stamp and permit losses. Employee resources and testing for implementation of FSMA. Enforcement (typically not local economic factors).
Built Environment	Grain Bins, Agricultural Equipment or Farm Trucks, Rendering Locations, Veterinary Clinics, locations for mass destruction if necessary. Domestic stock or mass production facilities. Exposure adjacent to farm ground by those recreating in or near affected areas.
Infrastructure	Major transportation corridors, landfills or disposal locations. Wetlands and Waterbodies supporting wild birds and animals.
Critical Facilities	May need mass destruction facility or ability to bury en masse, Landfills. Farms with domestic stock. Veterinarian Clinics.

Agricultural Plant and Animal Disease Risk Assessment Summary	
Historical Number of Events	Plant Losses: 26 events (2015) Animal Disease: 521 events
Vulnerable Locations	Ag-businesses, production areas, grain elevators, Vet Clinics
Extent	Plant: Greater than .23% annual probability. Animal: As reported to Risk Management Agency, USDA.
Annual Probability	Plant: 0.23% Animal Disease: 100% Mortality Rate Unknown.
Relative Frequency	Not calculated due to limited data.
Property and Crop Damages	Plants (Crops) = \$379,082.50 Animals: Based on fatalities and commodity pricing per animal, current damages not located
Total Averaged Annual Losses	\$379,082.50 (based on 2015 data) and Animals based on fatalities and pricing per animal. Medicinal costs may be considered.
Fatalities Reported	None.
Injuries Reported	None.
SHMP Composite Scores-Ranking	County-Plant 76.0, Animal 76.0 (tied for 7 th). Regional-Plant 71.43 (14 th) and Animal 85.71 (9 th). State-Plant 72.99 (11 th) Animal 82.74 (7 th).
Central City Rank	Animal– 12th of Major Categories and 27 of 35 total hazards assessed. Plant– 14th of Major Categories, and 29 of 35 total hazards assessed. Public Health ranked between Animal and plant disease due to an increased focus on human populations.

Public Health

Threats to public health may be generated by unintended consequences of a disaster. For instance, the loss of power can result in alternative methods of cooking inside homes and lead to carbon monoxide buildup. Flood waters can lead to disease or sickness from exposure to mold, rodents, or contaminated water supplies. First responders, medical professionals, and the general public may need mental health resources to address traumatic stress. Food supplies may be threatened by high animal mortalities or infections to plants and animals. In large-scale incidents, antibiotic and antiviral drug supplies can be diminished or depleted.

Communicable diseases such as influenza, West Nile Virus, Hepatitis, Ebola, Zika Virus, Meningitis, AIDS/HIV, Avian-Bird Flu (only communicable between animals), SARS, STDs, and others can be a disaster without any relation to severe weather events. According to the Nebraska Health and Human Services website, the Health Alert Network provides data to public health service providers in order to facilitate a faster response. A quick response prevents greater numbers of individuals from being exposed, becoming ill or worse.

Nefarious activities such as terroristic acts can also result in threats to the population through critical utility supplies. Food borne illnesses can result in many becoming ill simultaneously and have the potential to overwhelm local medical treatment facilities.

Nebraska has multiple health department districts that help support local governments and communities when responding to a public health emergency or to provide services that help counter-act disease transmission (e.g. vaccinations) proactively. The Nebraska Central District Health Department is based in Grand Island and covers counties of Hamilton, Hall, and Merrick County. Vaccination and Flu Shot clinics are often held at the Merrick County Courthouse located in the Central City.

Locations susceptible to public health emergencies are public gathering locations such as the senior centers, schools, assisted living facilities, hospitals, daycares, restaurants, and facilities with larger numbers of workers or locations where workers perform daily tasks in close proximity to one another. Lifestyle choices such as drugs or alcohol abuse have been shown to be correlated with the transmission of sexually transmitted diseases.

No significant public health outbreaks were evident in public data sets and no events were specific to Central City. Reports from the Central District Health Department did not highlight any significant public health concerns for the community of Central City (J. Eischilman, CDHD, personal communications, 2016).

Public Health Vulnerability and Risk Assessment Summaries

Public Health Vulnerability Assessment	
Sector	Vulnerabilities
People	Healthcare workers, first responders. Young and old or immunocompromised individuals. Low income sectors may have a lack of vaccinations or access to warnings. Concentrated public gathering places.
Economic	Businesses may be affected due to lack of employee resources. Medicinal treatments, laboratory testing, personal protective equipment, disinfection and decontamination supplies.
Built Environment	Transportation corridors, schools, public gathering locations.
Infrastructure	Water supplies and treatment systems. Central District Health department. Decontamination or Quarantine Equipment.
Critical Facilities	Hospitals, clinics, Central District Health Department, Emergency service locations, schools, wastewater treatment plant.

Public Health Risk Assessment Summary	
Number of Historical Events	None were evident in the historical record review
Vulnerable Locations	Entire Community, Public Facilities
Extent	Central City jurisdiction
Annual Probability	Low *Not calculated due to a lack of historical impacts
Property and Crop Damages	None
Total Averaged Annual Losses	Not assessed due to a lack of historical impacts
Fatalities Reported	None in the planning area, however, one reported in the nearby community of Clarks, NE-school aged boy with meningitis without vaccination.
Injuries Reported	0
SHMP Composite Scores-Ranking	Last of 20 surveyed categories across all regions County-0.00

Terrorism

Terrorism, as defined by the Federal Bureau of Investigation (FBI) is the unlawful use of force against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives. It must incorporate all four of these elements before an incident is considered to be an act of terrorism. Events or acts may be classified as international or domestic and are typically alerted to the public under either an imminent or elevated alert level as issued by the Department of Homeland Security's National Terrorism Advisory System. Definitions of each type of terror threat are defined below.

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

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

According to the Nebraska State Emergency Operations Plan (Nebraska Department of Homeland Security and the Nebraska Emergency Management Agency, 2014), "A release of selected biological or chemical agents targeting Nebraska's civilian population will require a rapid, coordinated and planned response and require access to potentially large quantities of pharmaceuticals, antidotes, and other medical supplies that may deplete state and local caches."

If an effective response to a biological or chemical attack is beyond the local or state government's capability, the governor may then proclaim a "state of emergency" under provisions and responsibilities outlined in the State Emergency Operations Plan (Nebraska, SEOP, 2014). In this event, the Nebraska Strategic National Stockpile Plan will be activated. According to the SEOP, Weapons of Mass Destruction, bombs, and internet recruiting may be other avenues to consider in local plans.

Targets of terroristic threats or attacks may select Critical Infrastructure and Key Resources within any community including those found in Central City, although no evidence is apparent that the community has been targeted. Historical events have typically targeted more populous areas in order to do the most harm, however speculation has suggested in recent reports that terrorism in the center of the country may be a prime target due to the unexpectedness and nationwide impact to targets "In the Heartland" (KSFY News, February 2016).

Terrorism Vulnerability and Risk Assessment Summaries

Terrorism Vulnerability Assessment	
Sector	Vulnerabilities
People	Entire community, dependent on target method used. Those in close proximity to target (for WMDs or explosives) or connected to supply lines (biological agent) would be exposed and impacted. Immunocompromised, young and elderly would experience greater effects of chemical or biological exposure. Impressionable populations-possibly younger individuals with internet and social media access.
Economic	Businesses and tourism shut down. Lack of revenue, tax receipts. Lack of future economic development. Decontamination, clean-up and recovery costs. Long standing economic damages due to negative press or lengthy effects of public perception. Targets to agricultural operations could impact economy state and nationwide.
Built Environment	All built structures within Central City. Large chemical storage tanks, railroad tank cars or transportation routes, aircraft, highways, cyber-security risks to data resources or personal information access. Communication systems. Roads, bridges, railroads, airport, rivers, streams, evacuation routes, homes, schools, critical care or assisted living facilities, livestock operations, habitat, wetlands, agricultural grounds, businesses etc.
Infrastructure	Electrical, sewer, water, and gas systems. Public water supply wells and pumps. Airport and key transportation corridors. Significant public health, governmental services, and law enforcement resources would be needed. National Guard activation likely. Increased threat of contamination possible
Critical Facilities	Hospital, Clinic, Courthouse, Emergency Shelters, Senior Centers, assisted living facilities, day cares and schools

Terrorism Risk Assessment Summary	
Historical Number of Events	None.
Vulnerable Locations	Entire Community. Electronic data storage resources (cyber-security measures), Automated Communication systems and controls (SCADA). Examples may include: pipelines, dam controls, industrial facilities, utility systems. Community communications, governmental operations. Large chemical storage areas, transportation routes. Critical Facilities and Agricultural land.
Extent	Biological, Chemical, WMD's, bombs, cyber-terrorism, Dependent on attack methodology
Annual Probability	Extremely Remote
Relative Frequency	Not calculated, no previous occurrences.
Property and Crop Damages	Gross losses potentially significant, Long term recovery plan
Total Averaged Annual Losses	Not calculated, no previous occurrences.
Fatalities Reported	None.
Injuries Reported	None.
SHMP Composite Scores-Ranking	County-72.0 (8 th), Regional-84.29 (11 th) State-64.61 (14 th)
Central City Rank	15 of Major Categories, or 30 of 35 total hazards assessed.

Aircraft/Explosion, Wildfires, Earthquake, Civil Disorder, Radiological Transportation and Radiological Fixed Facility

The six hazard categories assessed for Central City have a limited probability of occurrence and have no significant records to support historical events. No injuries, fatalities, damages or losses were found for any of these categories. Below are brief summaries for future planning considerations.

Aircraft/Explosion

This category was assessed only at the county level in the SHMP. Based on the previous Commodity Flow Study for the State of Nebraska, as published by UNL (2013), the number of aircraft housed at the Central City Municipal Airport (Larry Reinke Field) matches current records obtained from the City in 2016. Twenty-four aircraft are stored at the airport and most are single engine models used for recreation and business. Two aircraft housed at the facility are capable of aerial pesticide applications (Personal Communications, Donald Shorney, Airport Manager, 2016). Nearby residences and Nebraska Christian School could be considered vulnerable to airport operations.

The airport has fuel storage, agricultural chemicals and buildings on site. Buildings are internally divided to include 13 hangers at 972 square feet each, six hangers at 1,152 square feet; four “T” hangers at 1,400 square feet and two commercial hangers at 4,000 square feet each. The City of Central City owns the airport and receives revenue from hanger rents, fuel sales and cash rent from surrounding agricultural lands. The community expects to add four commercial hangers with an additional total estimated area of 16,000 square feet of storage in 2017, resulting in a total square foot storage capacity of almost 50,000 square feet after expansion (Donald Shorney, Airport Manager, personal communications, 2016).

Chemical compatibility should be assured at the airport facility during fuel and chemical loading and unloading activities. The airport manager reports that limited chemicals are stored on site as operators take out what they bring in. Mr. Shorney reports that the airport has designated routes for aircraft and a left-hand flying pattern that reduces exposure to populated areas. A 2,000-gallon low-lead fuel tank is available on site and no jet fuel is currently stored at the facility. Due to above-ground fuel storage capacity, the airport is subject to the federal Spill Prevention Control and Countermeasures regulation (40 CFR part 112) that requires secondary containment and regular inspection of their fuel storage areas. Fire suppression is supplied by multiple fire extinguishers around the facility. No incidents or accidents have been reported for the Central City Municipal Airport.

Wildfires

Grass fires have impacted rural areas outside of the planning jurisdiction, however none have affected Central City or the ETJ (B. Wells, VFD Chief, personal communications, 2016).

Earthquake

The Home-Facts website (2016), states there is a 0.830% chance of a major earthquake within 50 kilometers of Central City, Nebraska over the next 50 years. Only one event has been recorded nearby on October 9, 1981. This earthquake was measured with a Richter Scale magnitude of 3.3 and 5.5 miles below the ground surface. The event was located 3.2 miles east of Dannebrog, Nebraska and 37 miles WNW of Central City.

Civil Disorder

Aircraft/Explosion, Wildfires, Earthquake, Civil Disorder, Radiological Transportation and Radiological Fixed Facility

Radiological Transportation

No incidents have been reported in the State or Central City or its extraterritorial jurisdiction requiring assistance beyond regular roadside assistance (Papio-Missouri NRD, Hazard Mitigation Plan, 2016). No additional information was located in the State Commodity Flow Study, however data may be obtained from major rail companies operating within the planning area.

Radiological Fixed Facility

The Nebraska Emergency Management Agency (NEMA) reports two major radiological fixed facilities in Nebraska. The first is the Fort Calhoun Nuclear Power Plant located between Blair and Omaha, Nebraska. This location has no bearing on the planning area.

The second major radiological fixed facility is the Cooper Nuclear Station located in the southeast corner of the state in Brownville, Nebraska. Central City is located in the Cooper Nuclear Power Plant service area and receives a portion of the total 791 megawatts of power generated by the Cooper Station (NPPD, Cooper Nuclear Station Emergency Planning, 2016). Geographically Brownville is located in the southeast portion of the state and is adjacent to the State of Missouri border. The Cooper facility has no potential radiological effects within Merrick County or Central City. Emergency Planning areas for the CNS include a ten and fifty-mile radius from the plant. The CNS is owned by the Nebraska Public Power District and has been in operation since July 1974. The facility conducts annual monitoring for radiological impacts based on requirements from the Nuclear Regulatory Commission. No adverse human or environmental impacts have ever been recorded in any monitoring performed by the facility (NPPD, Cooper Nuclear Station Emergency Planning, 2016). Vulnerability and Risk Assessments for Radiological Fixed Facility are assumed to be the same as those outlined for power failure to the community.

Conclusions

FEMA broadly defines Risk Assessments as a required task toward the development of a comprehensive hazard mitigation plan. The Community of Central City, Nebraska has a current multi-jurisdictional plan that includes surrounding rural communities and provides baseline information that supports disaster assistance requests in the event of a hazard impacting the community. This project focused on individual hazards identified in the State and Multi-Jurisdictional Hazard Mitigation Plan, although hazard ranking methods have subjective components (e.g. perceptions based on survey data, and point values assigned based on opinion). Rankings could be improved by incorporation of underlying factual data in regard to loss estimates or historical damages, fatalities, and injuries. Accurate record keeping at the local level would greatly improve these estimates in future Risk Assessments and hazard mitigation plans.

A Risk Assessment depends on three factors of hazard profiling and analysis, vulnerability and exposure assessments, and estimates of impacts that a hazard event would have on people, services, facilities and structures in a community. It is also defined as the likelihood (e.g. probability) that a hazard event will result in a condition that causes injury, damage or loss. Utilizing best available data, the author of this report suggests hazard rankings as identified in Section I, Table 3, page 7. The Risk Assessment is divided into three sections, the first of which identifies the planning area, provides an introduction to hazard mitigation planning and key terms, and identifies hazards consistent with the State Hazard Mitigation Plan as well as those hazards identified specific to the local level. Natural events were readily identifiable for probability and relative frequencies, while man-made hazards (e.g. Public Health, Agricultural Plant and Animal Disease, Terrorism, Civil Disorder) lacked background information and official reporting mechanisms to determine priority rankings. Subcategories were identified when local hazards were considered sub-sets of hazards identified in the SHMP. Section II of the report provides summary graphs of natural weather hazard events identified at the Merrick County Zone and Central City levels in addition to a list of Critical Infrastructure and Key Resource Facilities and estimated capacities. Section III summarizes each hazard, data obtained and provides Vulnerability Assessments by sector of People, Economic, Built Environment, Infrastructure, and Critical Facilities. Risk Assessment tables provide a historical number of past events, annual probability and averaged annual losses, relative frequency, injuries, fatalities, a comparison to SHMP rankings, and a suggested local rank based on data reviewed.

Much work is left to be done to develop a local or regional hazard mitigation plan and to create a safer, more resilient community. Suggestions include tasks outlined in Section I, Figure 2, page 5. The first of which is to identify the desired planning area and associated resources. Identification of local or regional resources should include stakeholders that are committed and remain engaged in the planning process. Determining outreach strategies would enable dissemination of information, increase public education and awareness, and encourage integrated involvement at the local level.

While many community leaders were engaged in development of the Central City project, public involvement would have enhanced data acquisition, vulnerability assessments and provided a more comprehensive review of community assets, responsibilities (e.g. reporting), and capabilities, as suggested in Task 4. For instance, one daycare owner recommended community tornado shelters be implemented in the community. Resident needs and desires should be addressed in future plans. This Risk Assessment (Task 5) provides baseline information to prioritize hazards and defines the likelihood of occurrence, although some data gaps exist. Rankings as provided in Risk Assessment tables throughout the report may have different hazards identified or be prioritized differently by local planning team members and based on order of local importance. Planning members may accept current rankings or re-prioritize identified hazards. Based on a review, mitigation strategies can be proposed and implemented in an order agreeable to stakeholders involved in the process. Planning officials and Local Emergency Planning Committees are instrumental in keeping plans current and updated. With limited local governmental resources, the reliance on stakeholder involvement is paramount to maintain plans (Task 7), implement and improve programs to keep their communities safe. Task 8 requires local jurisdictions to review and adopt hazard plans in order to qualify for federal and state assistance in times of need. Continuous improvement, engagement, and pre-planning will continue to make Central City safer and more resilient into the future.

Key Points for Future Planning Consideration

- Natural weather hazard data is collected at the local and county levels and estimates of damages are provided to the Weather Forecast Office for Central City through various sources (trained and untrained individuals), so reports are subject to a wide margin of error.
- Winter weather events were primarily assessed at the county level while local events were typically related to hazards occurring in the spring and summer for Central City.
- Fatalities and Injuries were only reported for Transportation Incidents and Urban Fires.
- Power Failure remains the highest ranked hazard priority for the community, however local data collection for frequency of power outages is recommended to determine frequencies and probabilities for future planning efforts.
 - Economic impacts to the community for Electrical Service Disruption was calculated by the hour, by day and by each consumptive sector.
 - The south electrical substation supports the highest numbers of vulnerable populations.
 - The central substation is ranked second in priority and the north substation is considered last.
 - The main NPPD substation south of the river may be susceptible to flood damage. A formal assessment may be needed.
- Drought has resulted in the greatest damage totals reported in county level data.
- Hail has resulted in the greatest damage totals and has the greatest frequency of any hazard event for the community.
- Warning Siren Locations were determined through a desktop analysis of existing maps. Additional data is needed to determine age, range, and assessment for population served or outside of the warned area.
- Central City has successfully engaged in proactive planning to mitigate floods/flash floods. Nine properties have been removed from effective flood zones and the community participates in the National Flood Insurance Claim Program but currently has no facilities reported as Repetitive Loss Structures.
 - All Electrical substations in town are outside of the effective flood hazard area.
 - Future planning efforts should include an educational and outreach strategy for evacuation routes in the event of a dam failure at Kingsley Dam
- The LEPC should include three facilities in their LEOP for those identified as storing Extremely Hazardous Substances in Tier II reports.
- Building occupancies or permitted capacities (Nebraska State Fire Marshal, 2016) for churches and public facilities was not readily available to determine number of individuals expected to be impacted by hazard events, however licensed facility capacities were well documented by DHHS, and enabled a comprehensive review of vulnerable populations in the community.
- Transportation data was not specific for total number of crashes, but was specific to major events involving fatalities and injuries. According to NDOR, Merrick County is not a focus area due to low fatality rates, however the high number of animal involved crashes may be considered in local wildlife management plans.
- Chemical transportation incidents typically involve corrosive, flammable and oxidizing materials in Merrick County.
- Radiological Fixed Facilities were previously ranked as a moderate hazard in the SHMP, however no evidence was found to support this in the Central City Risk Assessment.
- Additional data resources are needed to comprehensively assess Agricultural Plant and Animal Disease, Urban Fires, Wildfires, Public Health, Civil Disorder, and Terrorism.

Acknowledgements

This project would not have been possible without the assistance and invaluable input from the following individuals. The author would like to acknowledge the valuable time spent in support of this project for the community and toward the completion of Master's Degree requirements at the University of Nebraska-Lincoln in the Community and Regional Planning Department.

- **Thomas Smith– Region 44 Emergency Manager—Merrick, Nance and Boone Counties**
- **Chris Anderson - Central City Administrator**
- **Dr. Zhengong Tang- UNL Graduate Committee, Major Advisor**
- **Dr. Gordon Scholz – UNL Graduate Committee, Community and Regional Planning Department Chair**
- **Dr. Yunwoo Nam- UNL Graduate Committee, GIS Professor**
- **Sid Lewis- Central City Electrical Superintendent**
- **Janet Placke- Merrick County Assessor and GIS Workshop**
- **Jean Polzkill– Central City Clerk, LEPC/CERT Member, Ambulance Service Supervisor**
- **Brad Wells-Central City Volunteer Fire Department Chief**
- **Tom Cordsen– Central City Planning, Zoning and Infrastructure**
- **Donald Shorney– Central City Municipal Airport Manager**
- **Russell Kreachbaum– Central City Board of Supervisors, Union Pacific Railroad representative**
- **Jeff Henson– Hazard Mitigation Planner, JEO Consulting**
- **Mitch Paine– Floodplain Management Section, Nebraska Department of Natural Resources**
- **Mark Lohnes– SARA Title III Coordinator, Nebraska Department of Environmental Quality**
- **Daycare and Critical Care Facility Administrators, LEPC Members and Green Plains, Inc.**

THAN K YOU!

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