Wyoming Region 2
Converse County, Natrona County
and Niobrara County
Regional Hazard Mitigation Plan
2018 Update

wood.

Wyoming Region 2

Converse County

Natrona County

Niobrara County

Regional
Hazard Mitigation Plan
2018

Developed by Converse County, Natrona County, and Niobrara County

With professional planning assistance from

Wood Environment & Infrastructure Solutions, Inc.
Hazard Mitigation and Emergency Management Program

wood.

TABLE OF CONTENTS

Chapters

Jurisdictional Annexes

Appendixes

EXECUTIVE SUMMARY

This plan is the product of a 2017-2018 planning process undertaken by the three counties in Wyoming Office of Homeland Security Region 2 – Converse, Natrona, and Niobrara Counties. The purpose is to meet the requirements of the Disaster Mitigation Act of 2000 (PL 106-390), and thereby maintain continued eligibility for certain Hazard Mitigation – or disaster loss reduction – programs from the Federal Emergency Management Agency (FEMA). This plan updates existing hazard mitigation plans for Converse, Natrona, and Niobrara Counties.

The process followed a methodology that adheres to FEMA guidance for local hazard mitigation plans. It consisted of two levels of planning teams; a steering committee/coordinating planning team comprised of each county's Emergency Management Coordinator, and a local Hazard Mitigation Planning Committee (HMPC) in each county. Every municipality within each county was invited to participate.

The planning process examined the recorded history of losses resulting from natural hazards, and analyzed the future risks posed to each county and participating municipalities by these hazards. A hazard identification and risk assessment was updated for the following hazards: dam failure, drought, earthquake, expansive soils, flood, hailstorm, hazardous materials, high winds, landslide, lightning, mine subsidence, tornadoes, severe winter storms and wildfire. Where applicable, these profiles were built on existing information found in the previous hazard mitigation plans. The hazards were assessed for geographic extent, potential magnitude probability, vulnerability and given a rating for overall significance. Drought, wildfire, floods and winter storms tend to cause the most damage or economic loss in the Region.

The plan's mitigation strategy includes goals for each county in the planning area. The plan also puts forth county-specific recommendations for mitigation, based on the risk assessment, that are designed to reduce future losses in each county and the Region. Lastly, the plan includes an implementation strategy to ensure the plan is carried out in practice.

CHAPTER 1 INTRODUCTION

1.1 Purpose

Wyoming Region 2, encompassing Converse, Natrona, and Niobrara Counties and their municipalities, prepared this regional hazard mitigation plan to guide hazard mitigation planning and to better protect the people and property of the planning area from the effects of hazard events. This plan demonstrates the region's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan also maintains the eligibility of participating jurisdictions in the planning area for certain federal disaster assistance under the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance (HMA) grant programs.

1.2 Background and Scope

Each year in the United States, disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters, because additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. According to the Natural Hazard Mitigation Saves: 2017 Interim Report released by the National Institute of Building Science, on average, each dollar spent on mitigation saves society an average of $6 in avoided future losses in addition to saving lives and preventing injuries.

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are developed, prioritized, and implemented. This plan documents the planning region's hazard mitigation planning process, identifies relevant hazards and risks, and identifies the strategies that each participating jurisdiction will use to decrease vulnerability and increase resiliency and sustainability.

This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the *Federal Register* on February 26, 2002 (44 CFR §201.6) and finalized on October 31, 2007 (hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act (DMA)). While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). Because the planning area is subject to many kinds of hazards, access to these programs is vital.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and property owners by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruption. The jurisdictions in the planning area have been affected by hazards in the past and are thus committed to reducing future disaster impacts and maintaining eligibility for federal funding.

1.3 Plan Organization

The Wyoming Region 2 Regional Hazard Mitigation Plan is organized in alignment with the DMA planning requirements and the FEMA plan review tool as follows:

- Chapter 1: Introduction
- Chapter 2: Community Profile
- Chapter 3: Planning Process
- Chapter 4: Risk Assessment
- Chapter 5: Mitigation Strategy
- Chapter 6: Plan Adoption, Implementation, and Maintenance
- County Annexes
- Appendices

County Annexes

Each of the three counties has its own annex, which provides a more detailed assessment of each participating jurisdiction's unique risks as well as its mitigation strategy to reduce long-term losses. Each annex contains the following:

- Community profile summarizing geography and climate, history, economy, and population
- Detailed, jurisdiction-specific hazard vulnerability information and unique risks, where applicable, for geographically specific hazards
- Hazard map(s) at an appropriate scale for each jurisdiction, if available
- Number and value of buildings, critical facilities, and other community assets located in hazard areas, if available
- Capability assessments describing existing regulatory, administrative, and technical resources
- Mitigation actions specific to the county and municipalities

1.4 Multi-Jurisdictional Planning

This plan was prepared as a regional, multi-jurisdictional plan. The planning region is comprised of three counties in Wyoming Region 2 (region), as established by the Wyoming Office of Homeland Security (WOHS); the region includes Converse, Natrona, and Niobrara Counties. All local units of government in each county were invited to participate in the planning process; the decision whether or not to participate in this process was a local decision, based on community needs. Communities have the options to not prepare a plan, to prepare a stand-alone plan for their jurisdiction, or to participate in a multi-jurisdiction or county-wide plan. All three counties in the region had previous multi-jurisdictional hazard mitigation plans prior to the development of this Regional Plan. The following table lists counties and their local governments that have opted to participate in this effort and are seeking FEMA approval of the 2018 version of this plan. All communities were updating a previously approved plan. Additional details about participation can be referenced in Chapter 3 and the county annexes.

Table 1-1 Multi-Jurisdictional Participation 2018

Jurisdiction	Participation Status
Converse County	Participated in 2011 original, 2018 county update, 2018 regional update
City of Douglas	Participated in 2011 original, 2018 county update, 2018 regional update
Town of Glenrock	Participated in 2011 original, 2018 county update, 2018 regional update
Town of Lost Springs	Participated in 2011 original, 2018 county update, 2018 regional update
Town of Rolling Hills	Participated in 2011 original, 2018 county update, 2018 regional update
Natrona County	
City of Casper	Participated in 2010 original, 2017 county update, 2018 regional update
Town of Bar Nunn	Participated in 2010 original, 2017 county update, 2018 regional update
Town of Edgerton	Participated in 2010 original, 2017 county update, 2018 regional update
Town of Evansville	Participated in 2010 original, 2017 county update, 2018 regional update
Town of Midwest	Participated in 2010 original, 2017 county update, 2018 regional update
Town of Mills	Participated in 2010 original, 2017 county update, 2018 regional update
Niobrara County	
Town of Lusk	Participated in 2018 update
Town of Mansville	Participated in 2018 update
Town of Van Tassell	Participated in 2018 update

CHAPTER 2 COMMUNITY PROFILE

The Community Profile provides a brief overview of the geography of the planning area. Additional geographic profiles of the participating jurisdictions are provided in the annexes.

2.1 Geography and Climate

Wyoming Region 2 is comprised of three counties in the east-central part of the state; the three counties are Converse, Natrona, and Niobrara. The region encompasses 12,269 square miles. It is bordered in the east by the State of South Dakota; in the north by Wyoming's Washakie, Johnson, Campbell and Weston Counties, in the south by Wyoming's Carbon, Albany, Platte, and Goshen counties, and in the west by Wyoming's Fremont County.

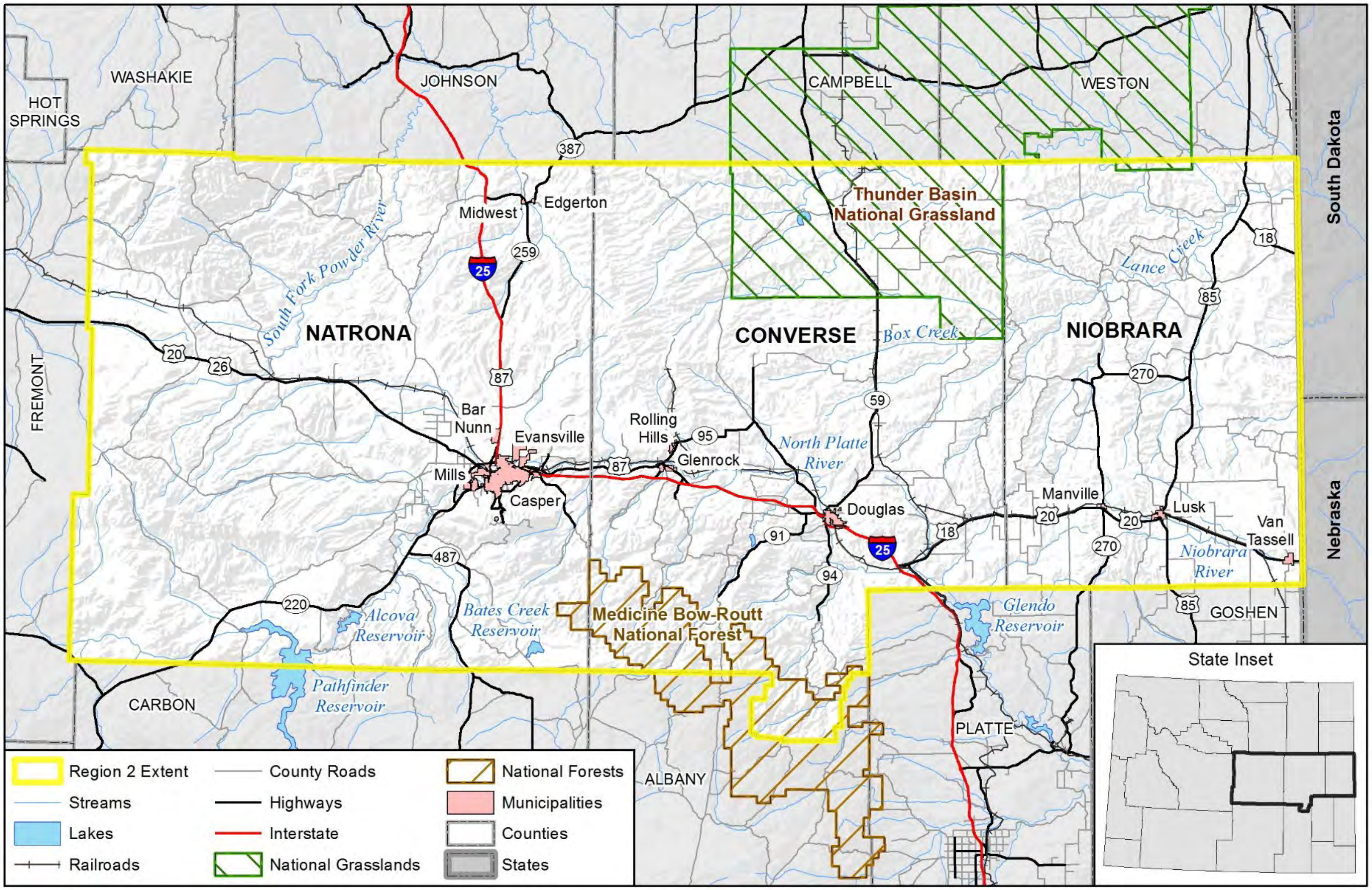
The region stretches from the Granite Mountains and Laramie Mountains eastward across the Great Plains. The highest point in the region is the Twin Peaks in the Laramie Mountains at 9,165 feet; the region's lowest point is near 3,000 feet in the northeast corner of Niobrara County. Most of the area between those two extremes consists of rolling grasslands between 3,000 and 600 feet.

The North Platte River runs west-to-east across the length of the region; other major rivers include the Sweetwater River and the South Fork of the Powder River. Major highways include Interstate 25; US Highways 18, 20, 26, 85, 87, and 287; and Wyoming State highways 59, and 220. Multiple rail lines cross the region as well.

Overall the region averages 27 days per year with temperatures above 90°F; during summer months, the average maximum temperature is 83.4°F, with a record high of 106°F. Growing season typically lasts 100-140 days a year. By contrast, the county averages 183 days a year with temperatures below 32°F; during winter months, the average minimum temperature is 13.5°F, with a record low of -43°F. The region averages 15 inches of precipitation and 60 inches of snow per year.

A base map of the planning region is illustrated in Figure 2-1. Details of land type and ownership can be found in Table 2-1 through 2-3.

Figure 2-1 Wyoming Region 2



Map compiled 4/2018;
intended for planning purposes only.
Data Source: WY Geospatial Hub,
WYDOT, HSIP Freedom 2015

The vast majority of land between the counties in the Region is grassland, forest or shrubland; cropland, water and urban development occurs on less than 1% of the total land area available.

Table 2-1 Region 2 Land Types

Land Type	Acreage	Percentage
Total Acres (2006)	7,851,948	
Forest	117,221	1.5%
Grassland	7,219,656	91.9%
Shrubland	358,960	4.6%
Mixed Cropland	37,318	0.5%
Water	16,555	0.2%
Urban	2,965	0.0%
Other	20,016	0.3%

Source: NASA MODIS Land Cover Type Yearly L3 Global 1km MOD12Q1, 2006.

The majority of land ownership in the Region is divided between private lands, federal lands and state lands, with private ownership making up the majority of land in the region.

Table 2-2 Region 2 Land Ownership

Land Ownership	Acreage	Percentage
Total Acres	7,851,948	---
Private Lands	4,946,654	63.0%
Conservation Easement	65,521	0.8%
Federal Lands	2,092,460	26.6%
Forest Service	306,221	3.9%
BLM	1,682,428	21.4%
National Park Service	0	0.0%
Military	0	0.0%
Other Federal	103,811	1.3%
State Lands	808,506	10.3%
*State Trust Lands**	807,918	10.3%
Other State	588	0.0%
Tribal Lands	0	0.0%
City, County, Other	4,327	0.1%

Source: U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS)

Residential land use increased 34% between 2000 and 2010.

Table 2-3 Region 2 Residential Land Use

Residential Land	2000	2010	% increase
Total Residential (acres)	38,579	58,370	34%
Urban/Suburban	10,530	11,961	12%
Exurban	28,049	46,410	40%

Source: Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University.

2.2 Population

Table 2-4 describes the population distribution and change for the region as a whole and for individual counties. 83% of the region's population lives in Natrona County, 14% in Converse County, and the remaining 3% in Niobrara County.

Table 2-4 Region 2 Population Distribution

Jurisdiction	2017 Estimated Population	% of Region Total
Converse County	13,809	14%
Natrona County	79,547	83%
Niobrara County	2,397	3%
Region 2 Total	**95,753**	

Source: US Census Bureau

Table 2-5 shows how the region's population has changed since the 2010 Census. As a whole, the Region increased in population by 4%, above the state's overall growth of 3%. However, this increase was almost entirely driven by Natrona County; the population of Converse County has stayed relatively flat, while Niobrara County saw a 4% decrease. Moreover, the region experienced an overall growth of 7.8% from 2010 through 2015, after which the population declined to its current level.

Table 2-5 Region 2 Population Change 2010-2017

Jurisdiction	2010 Census	2011	2012	2013	2014	2015	2016	2017	% change
Converse County	13,833	13,736	14,025	14,365	14,219	14,312	14,127	13,809	0%
Natrona County	75,450	76,421	78,583	81,101	81,439	82,134	80,892	79,547	5%
Niobrara County	2,484	2,483	2,476	2,544	2,489	2,496	2,470	2,397	-4%
Region 2 Total	91,767	92,640	95,084	98,010	98,147	98,942	97,489	95,753	4%

Source: US Census Bureau

Table 2-6 Region 2 Demographic Profile

Population	
Population estimate, 2017	95,753
Age and Sex	
Median Age (US median age is 37.7)	36.6
Population under 18	23,507
Population 18-34	23,148
Population 35-44	12,312
Population 45-64	25,853
Population 65 and over	12,772
Population male	50.4%
Population female	49.6%
Race and Ethnicity	

White alone	93.3%
Black or African American alone	1.0%
American Indian alone	1.0%
Asian alone	0.9%
Native Hawaiian & Other Pacific Islander alone	0.0%
Some other race alone	1.1%
Two or more races	2.7%
White alone, not Hispanic or Latino	87.4%
Hispanic or Latino (of any race)	8%
Education	
High school graduate or higher, age 25 years+	91.4%
Bachelor's degree or higher, age 25 years+	21.1%
Vulnerable Populations	
Percent of population under 5 years old	6.7%
Percent of population 80 years and older	1.8%
Percent of population that speak English "not well"	0.7%
Percent of population with disabilities	14.4%
Percent of population without health insurance	13.9%
Percent of population in poverty	10.3%
Percent of population in deep-poverty (<1/2 federal poverty level)	4.4%
Percent of population over 65 and in poverty	1.0%

Source: U.S. Census Bureau, American Factfinder, https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

*Hispanic or Latino is considered an ethnicity, not a race. People who identify as Hispanic or Latino can belong to one or more races. Therefore, the total percentage can be greater than 100%.

2.3 Economy

The counties in Region 2 have a diverse economy: 63.5% of workers in the region are employed in the service sector, led by education, health care, and the retail trade. 18.9% of workers are employed in non-service jobs, with construction and mining being the largest employers. The remaining 16.7% work in government sector jobs, primarily city and county government. There is considerable variation within the region: mining accounts for more than 18% of employment in Converse County, but less than 3% in Niobrara; 67% of Natrona County jobs are in the service sector, while in Niobrara it is less than 43%.

Table 2-7 Employment Statistics

Characteristic	Region 2	Converse County	Natrona County	Niobrara County
EMPLOYERS				
Total employer establishments, 2016	3490	448	2,953	89
Total annual payroll, 2016 ($1000)	$1,707,695	$252,379	$1,443,465	$11,851
Paid employees	38161	4,811	32,937	413
Total Private	81.6%	72.1%	84.9%	n/a
Non-Services	18.9%	29.3%	17.7%	n/a
Natural Resources and Mining	7.9%	21.1%	6.0%	4.5%
Ag., Forestry, Fishing, Hunting	0.7%	2.7%	0.4%	1.8%
Mining	7.2%	18.3%	5.6%	2.8%
Construction	7.8%	5.7%	8.3%	n/a

Characteristic	Region 2	Converse County	Natrona County	Niobrara County
Manufacturing (Incl. Forest Prod.)	3.3%	2.6%	3.5%	n/a
Services	63.5%	42.8%	67.2%	40.9%
Trade, Transportation, Utilities	21.7%	17.6%	22.5%	16.2%
Information	1.1%	0.9%	1.1%	n/a
Financial Activities	4.8%	3.5%	5.1%	2.8%
Professional and Business	6.6%	4.4%	7.1%	1.9%
Education and Health	14.4%	4.7%	16.0%	8.0%
Leisure and Hospitality	11.2%	9.0%	11.8%	n/a
Other Services	3.4%	2.6%	3.6%	n/a
Unclassified	0.0%	0.0%	0.0%	0.0%
Government	16.7%	27.9%	15.1%	13.1%
Federal Government	1.6%	1.1%	1.6%	1.2%
State Government	2.1%	2.4%	1.8%	11.9%
Local Government	13.0%	24.3%	11.6%	n/a
Travel & Tourism related jobs as a percentage of total private employment	15.9%	12.4%	16.3%	31.2%

Source: U.S. Census Bureau, American Factfinder, https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

The number of jobs in the region has grown by 115% from 1970 to 2016. The most jobs added have been in services; finance, insurance and real estate; and construction.

On average, job growth has kept pace with the region's population growth. The last few decades saw the region's unemployment rate decline steadily from 5.9% in 1990 to 2.6% in 2007; the Great Recession sent the region's unemployment rate as high as 6.7% in 2010, after which it has whipsawed down to 3.9% in 2014, back up to 6.9% in 2016, and back down to 5.2% in 2017. Volatility in the mining sector has been a major contributor to this instability.

Table 2-8 Economic Profile

Characteristic	Region 2	Converse County	Natrona County	Niobrara County
EMPLOYMENT				
Total Employment, 2016	64,506	8,811	53,907	1,788
Unemployment Rate, as of 2017 (US average: 4.4%)	5.2%	4.4%	5.5%	2.8%
Per capita income, 2016 (US average is $50,280)	$67,260	$52,257	$70,538	$45,992
Average earning per job, 2016 (US average: $59,598)	$68,726	$56,176	$71,787	$38,291
Population % change, 1970-2016 (US ave: 58.6%)	61.8%	133.7%	57.7%	-15.1%
Employment % change, 1970-2016 (US ave: 112.2%)	114.5%	218.9%	109.5%	13.7%
Personal Income % change, 1970-2016 (US ave: 201.1%)	278.1%	404.6%	276.8%	54.7%
Persons in poverty (US average is 15.1%)	10.3%	8.4%	10.5%	13.6%
Families in poverty (US average is 11.0%)	6.7%	4.4%	7.0%	12.4%

Source: U.S. Census Bureau, American Factfinder, https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

The region's per capita income is $67,260, well above the national average of $50,280; once again, there is considerable variability between the three counties in the region. Overall, per capita income grew by 134% from 1970 to 2016. Income from non-labor sources such as rents, dividends, or retirement income is 39% of total, which is close to the national average of 36.8%. 10.3% of county's population lives below the poverty level, well below the national average of 15.1%.

Table 2-9 Household Income

Characteristic	Region 2	Converse County	Natrona County	Niobrara County
HOUSEHOLD INCOME				
Total Households	38,979	5,576	32,422	981
Less than $10,000	5.2%	3.6%	5.3%	8.2%
$10,000 to $14,999	3.7%	3.8%	3.6%	5.8%
$15,000 to $24,999	9.6%	7.7%	9.7%	17.2%
$25,000 to $34,999	11.0%	12.2%	10.7%	14.0%
$35,000 to $49,999	14.0%	11.9%	14.5%	10.9%
$50,000 to $74,999	19.2%	17.4%	19.5%	19.0%
$75,000 to $99,999	13.6%	14.3%	13.6%	10.6%
$100,000 to $149,999	15.5%	21.5%	14.7%	10.3%
$150,000 to $199,999	4.7%	5.1%	4.7%	1.1%
$200,000 or more	3.5%	2.3%	3.8%	3.0%
Median household income	57,967	$66,737	$56,983	$40,640
Median monthly mortgage cost (US ave: $1,491)	$1,298	$1,337	$1,298	$1,066
Median monthly rent (US ave: $949)	$806	$685	$832	$627
Mean Annual Household Earnings by Source, 2016				
Labor earnings	81.6%	83.2%	81.6%	70.4%
Social Security	27.0%	27.3%	26.7%	34.3%
Retirement income	16.3%	18.1%	16.0%	18.5%
Supplemental Security Income	5.9%	6.9%	5.7%	6.9%
Cash public assistance income	2.5%	1.1%	2.8%	0.7%
Food Stamp/SNAP	7.5%	7.8%	7.5%	8.9%

Source: U.S. Census Bureau, American Factfinder, https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

CHAPTER 3 PLANNING PROCESS

Requirements §201.6(b) and §201.6(c)(1): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

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

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

3.1 Background on Mitigation Planning in Region 2

While Region 2 has never had a regional hazard mitigation plan prior to 2018, though all three counties in the region have adopted county-specific hazard mitigation plans in the past. Converse, Natrona and Niobrara Counties each have county-specific plans and this Regional Plan builds upon and updates those efforts. The following is a short description of those efforts by county.

Converse County. The Converse County components of this Regional Plan have their roots in the 2017-2018 planning process to update the Converse County Hazard Mitigation Plan. The planning process began in September of 2017 with a kick-off meeting at the Converse County Courthouse as well as being broadcasted online. All incorporated jurisdictions participated in the update process. Three meetings in total were held between September 2017 and January 2018. Pending FEMA approval, the Plan will be approved in 2018.

Natrona County. Natrona County began the planning process to update the County's Hazard Mitigation Plan in January of 2017. The Local Emergency Planning Commission (LEPC) reviewed and evaluated existing information, while clarifying the purpose and process of creating a hazard mitigation plan. The commission met three times between January 2017 and March 2017. The Plan is currently approved pending adoption.

Niobrara County. The Niobrara County Hazard Mitigation Plan was approved in December of 2015. The planning process for the Regional Plan gave the county and its participating jurisdictions an opportunity to review their existing goals and proposed mitigation actions from the 2015 plan. During the Regional Planning process, the County's Hazard Mitigation Planning

Committee (HMPC) met two times between January 2018 and June 2018 to review the existing plan and provide the consulting team with local information that was not included in the 2015 Plan.

Regional Planning. In Wyoming, the Wyoming Office of Homeland Security (WOHS) utilizes a regional support structure to assist the counties with all aspects of emergency management including planning. The counties that comprise Region 2 include Converse, Natrona and Niobrara. In 2016, the WOHS began supporting the development of regional hazard mitigation plans statewide, based on existing homeland security regions. This initiative recognized that the process of facilitating, developing, or updating multi-jurisdictional hazard mitigation plans compliant with the Disaster Mitigation Act of 2000 is often beyond local capabilities and expertise. Instead of each county hiring consultants, the WOHS took the lead in procuring and funding a professional hazard mitigation planning consultant through a competitive bid process. Wood Environment and Infrastructure, Inc. (Wood) (formally Amec Foster Wheeler) of Boulder, Colorado was selected in late 2017 to provide assistance to the Region.

Prior to initiating the development of this regional hazard mitigation plan, a substantial coordination effort took place to ensure the participation of all three counties within Region 2. The WOHS received letters of commitment from each county (copies included in Appendix A) indicating their interest in and willingness to participate in the regional planning process. Each county has an Emergency Management Coordinator who was designated as the primary point of contact. Each Coordinator was required to undertake a coordination role within their respective counties to help fulfill the Disaster Mitigation Act of 2000 (DMA) planning requirements. The county Emergency Management Coordinators then contacted each of the incorporated communities, offering them the opportunity to participate in the development of the Region 2 Hazard Mitigation Plan. Every incorporated community within the counties chose to participate in the development of this Regional Plan.

Each Emergency Management Coordinator led a Hazard Mitigation Planning Committee (HMPC) working in concert with the hazard mitigation planning consultant. As the planning consultant, Wood's role was to:

- Provide guidance on a planning organization for the entire planning area representative of the participants;
- Ensure the plan meets all of the DMA requirements as established by federal regulations, following FEMA's most recent planning guidance;
- Facilitate the entire planning process;
- Identify the data requirements that the participating counties and municipalities could provide, and conduct the research and documentation necessary to augment that data;
- Develop and help facilitate the public input process;
- Produce the draft and final plan documents; and
- Ensure acceptance of the final Plan by WOHS and FEMA Region VIII

3.2 Government Participation

The DMA planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the Hazard Mitigation Planning Committee (HMPC),
- Detail areas within the planning area where the risk differs from that facing the entire area,
- Identify specific projects to be eligible for funding, and
- Have the governing board formally adopt the plan.

For the Region 2 Hazard Mitigation Plan's HMPCs, "participation" meant:

- Establishing or reconvening a HMPC;
- Attending and participating in HMPC meeting(s);
- Providing available data requested by the HMPC coordinator and Wood.;
- Providing and updating the hazard profile and vulnerability details specific to jurisdictions;
- Developing, updating, and providing input on the local mitigation strategy (action items and progress);
- Advertising and assisting with the public input process;
- Reviewing and commenting on plan drafts; and
- Coordinating the formal adoption of the plan by the governing boards.

This Regional Plan includes the participation of the counties and municipalities in Region 2 as noted in Chapter 1 and detailed further in Section 3.3.1. Documentation of participation is included in Appendix A in the form of meeting sign-in sheets, meeting summaries, and more.

3.3 The 10-Step Planning Process

Wood established the planning process for the Region 2 plan using the DMA planning requirements and FEMA's associated guidance. This guidance is structured around a four-phase process:

1) Organize Resources
2) Assess Risks
3) Develop the Mitigation Plan
4) Implement the Plan and Monitor Progress

Into this four-phase process, Wood integrated a more detailed 10-step planning process used for FEMA's Community Rating System (CRS) and Flood Mitigation Assistance (FMA) programs. Thus, the modified 10-step process used for this plan meets the requirements of six major programs: FEMA's Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, Community Rating System, Flood Mitigation Assistance Program, Severe Repetitive Loss Program, and flood control projects authorized by the U.S. Army Corps of Engineers. FEMA's

March 2013 *Local Mitigation Planning Handbook* recommends a nine-task process within the four-phase process. Table 3-1 summarizes the four-phase DMA process, the detailed CRS planning steps and the work plan used to develop the plan, the nine handbook planning tasks from FEMA's 2013 *Local Mitigation Planning Handbook*, and where the results are captured in the Plan. The sections that follow describe each planning step in more detail.

Table 3-1 Mitigation Planning Process Used to Develop the Regional Hazard Mitigation Plan

FEMA 4 Phase Guidance	Community Rating System (CRS) Planning Steps (Activity 510) and Wood Work Plan Steps	FEMA's Local Mitigation Planning Handbook Tasks (44 CFR Part 201)	Location in Plan
Phase I: Organize Resources	Step 1. Organize Resources	1: Determine the Planning Area and Resources	Chapters 1, 2 and 3
		2: Build the Planning Team 44 CFR 201.6(c)(1)	Chapter 3, Section 3.3.1
	Step 2. Involve the public	3: Create an Outreach Strategy 44 CFR 201.6(b)(1)	Chapter 3, Section 3.3.1
	Step 3. Coordinate with Other Agencies	4: Review Community Capabilities 44 CFR 201.6(b)(2) & (3)	Chapter 3, Section 3.3.1 and annexes
Phase II: Assess Risks	Step 4. Assess the hazard	5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) & (iii)	Chapter 4 and annexes
	Step 5. Assess the problem		Chapter 4 and annexes
Phase III: Develop the Mitigation Strategy	Step 6. Set goals	6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii)	Chapter 5, Section 5.2
	Step 7. Review possible activities		Chapter 5, Section 5.3
	Step 8. Draft an action plan		Chapter 5, Section 5.4 and annexes
Phase IV: Adopt and Implement the Plan	Step 9. Adopt the plan	8: Review and Adopt the Plan	Chapter 6
	Step 10. Implement, evaluate, revise	7: Keep the Plan Current	Chapter 6
		9: Create a Safe and Resilient Community 44 CFR 201.6(c)(4)	Chapter 6

3.3.1 Phase 1: Organize Resources

Planning Step 1: Organize the Planning Effort

With each jurisdiction's commitment to develop a Regional Plan, Wood worked with WOHS and each county Emergency Management Coordinator to establish the framework and organization for the process. Organizational efforts were initiated with each county to inform and educate the plan participants of the purpose and need for a regional hazard mitigation plan. During the development of this Regional Plan, the planning process was directed through a regional planning committee comprised of Emergency Management Coordinators for Converse, Natrona, and Niobrara counties. The planning consultant held an initial Uberconference call/webinar to discuss the organizational aspects of the planning process with the county coordinators. Using FEMA's planning guidance, representative participants for each county's HMPC base membership were established, with additional invitations extended as appropriate to other federal, state, local stakeholders, and the public throughout the planning process. The list of agencies and individuals invited to participate is provided in the following table. More details with documentation of participation included are in Appendix A.

Table 3-2 HMPC Members and Stakeholders by County

Converse County	
Jurisdictions and Stakeholders	**Representatives**
Converse County	County Emergency Management Coordinator
	Public Health Response Coordinator, Public Health Department
City of Douglas	Mayor
	Director of Public Works
	Chief of Fire Department
Town of Glenrock	Glenrock Health Center
Town of Lost Springs	Mayor
Town of Rolling Hills	Chief Water Operator, Public Works
State and Other Local Agencies	WOHS
Federal Agencies	None
Private Industry/Stakeholders	Safety and Regulations Compliance, Sinclair Transportation Company
	Safety Specialist, The Williams Company, Inc.
	Reporter, Douglas Budget
Natrona County	
Jurisdictions and Stakeholders	**Representatives**
Natrona County	Emergency Management Coordinator
	Public Health Preparedness Manager, Casper-Natrona County Health Department
	GIS Specialist, GIS Department

City of Casper	Deputy Chief, Fire Department
Town of Bar Nunn	Mayor
Town of Edgerton	Mayor
Town of Evansville	Mayor
Town of Midwest	Mayor
Town of Mills	Mayor
State Agency Stakeholders	WOHS
Federal Agencies Stakeholders	Deputy State Director, Congresswoman Liz Cheney
Private Industry/Stakeholders	Operation Supervisor, Black Hills Energy
	Gas Operations Supervisor, Black Hills Energy
	Utility Construction, Black Hills Energy
	Ambulance Manager, Wyoming Medical Center
	Disaster Specialist, Wyoming Medical Center
	Safety and Regulations, Sinclair Transportation Company
Niobrara County	
Jurisdictions and Stakeholders	**Representatives**
Niobrara County	Emergency Management Coordinator
	County Commissioners
	Deputy, County Sheriff
	Public Health Response Coordinator, Niobrara Public Health
Town of Lusk	Mayor
	Officer, Police Department
	City Council Member
	EMS
Town of Manville	Mayor
Town of Van Tassell	Mayor
State or Local Agencies Stakeholders	Lieutenant, Department of Corrections, Wyoming Women's Center

Wood and each Emergency Management Coordinator identified key county, municipal, and other local government and stakeholder representatives. Letters of invitation were sent to invite them to participate as members of the HMPC and to attend a series of planning workshops. During the plan development process communication amongst the county planning teams occurred through a combination of face-to-face meetings, conference calls, a web-based meeting, phone interviews, mail and email correspondence. Following the initial kickoff Uberconference call/webinar on February 20, 2018, a planning workshop with each county HMPC was held during the plan's development between February and June 2018. The meeting schedule and topics are listed below. The sign-in sheets and agendas for each meeting are documented in Appendix A. In addition, monthly conference calls were held as needed with the Emergency Management Coordinators, WOHS and Wood as needed to discuss the process, including upcoming milestones and information needs.

Kickoff Meeting

During the kickoff call/webinar, Wood presented information on the scope and purpose of the regional plan, participation requirements of HMPC members, and the proposed project work plan and schedule. A plan for public involvement (Step 2) and coordination with other agencies and departments (Step 3) was discussed. The HMPC reviewed the hazard identification information for the county as well as the Region and refined the list of identified hazards to mirror that of the Wyoming Hazard Mitigation Plan. In follow-up to the meeting, participants were provided a Geographic Information Systems (GIS) data needs worksheet to facilitate the collection of information needed to support the plan update.

Following the kickoff meeting a planning workshop was held with each county HMPC and scheduled as follows:

June 19, 2018 - Natrona County
June 20, 2018 - Converse County
June 21, 2018 - Niobrara County

The purpose of these workshops was to review the results of the risk assessment, review and update goals and update each county's mitigation strategy. Each HMPC workshop was followed by a public meeting in the evening (see the discussion under *Planning Step 2: Involve the Public* for further information on the public meetings).

Shortly after the adoption of the Niobrara County plan in 2015 the county experienced a major flood event. This planning process was an opportunity for the Niobrara HMPC to discuss how mitigation actions and strategies recommended in the 2015 plan worked or did not work during the flood event and brainstorm new mitigation actions that were not included in the existing plan. See Chapter 5 for further information on new, ongoing and deleted or deferred actions for Niobrara, Natrona, and Converse counties and the other participating jurisdictions.

In some cases, HMPC meetings were supplemented with additional meetings, emails and telephone discussions to further engage the municipalities in the process. During August 2018, Converse, Natrona and Niobrara Counties engaged communities that were not able to be represented at the in-person meetings. Summaries of these interactions are detailed in the Planning Process Appendix.

Planning Step 2: Involve the Public

The 2018 planning process informed and involved the public throughout the process. In some cases, the HMPC meetings included members of the public and/or local media. Public outreach included press releases, social media notices, a survey and newspaper postings.

Converse County had already released a public survey months earlier as part of their county-specific planning process; these results were incorporated during the development of their mitigation strategy.

The results of the regional public survey indicated that respondents were most interested in more information regarding the hazards they were vulnerable to and what they could do about them; this led directly to at least one new/updated mitigation action regarding public information on hazards that can affect each jurisdiction.

Public meetings were held in each county as part of the 2018 planning process. The meetings were an opportunity for the public to be active participants in the planning process and share anecdotes with the HMPC and planning consultant on how they have, or their community has been impacted by hazard events in the past. Meeting topics included, explaining what hazard mitigation is, an overview of the planning process, sharing the results of the hazard identification risk assessment and an overview of existing and potential mitigation actions.

The first public meeting was held on June 19, 2018 at the Natrona County Sheriff's Office. Wood Project Manager Kyle Karsjen and Natrona County Emergency Management Coordinator John Harlin were present to facilitate the meeting. One member of the public was present, as well as a representative for Congresswoman Liz Cheney.

Following the Converse County meeting, a public meeting was held at the Douglas City Hall in Converse County on June 20, 2018. The Project Manager, County Emergency Management Coordinator Russ Dalgarn and Assistant Emergency Management Coordinator Mary Schell were present to facilitate the meeting. In addition to the facilitators, one member of the public was present as well as representatives for Congresswoman Cheney and Senator Enzi.

The Niobrara County public meeting on June 21, 2018 was the final workshop in the region. The Wood Project Manager and County Emergency Management Coordinator James Santistevan facilitated the meeting. One member of the public was in attendance.

2018 Public Survey

During this regional planning process and drafting stage, a public survey was developed as a tool to gather public input. The survey enabled the public to provide feedback to the planning teams on topics related to hazard concerns and reducing hazard impacts. The survey provided an opportunity for public input during the planning process, prior to finalization of the plan update. The survey gathered public feedback on concerns about hazards and solicited input on strategies to reduce their impacts. The highest rated hazards in Region 2 were wind, wildfire, and winter storm. The highest rated mitigation strategies were indoor/outdoor warning systems, public education/awareness, and evacuation planning. This input is consistent with many of the mitigation strategies identified by each county and can be found in their respective annexes. The survey was released as both an online tool and a hardcopy form on or around May 3, 2018 and closed on July 1, 2018. The counties provided links to the public survey by distributing it using social media, email, and posting the link on websites. The survey received 106 responses and was shared with the county planning committees to inform the process. Summarized results of the survey are included in Appendix A, Planning Process Documentation.

Prior to finalizing, a draft of the regional plan was made available to the public for review and comment. The plan was placed on the WOHS's website and the counties used social media and email blasts to announce the public comment period. An online feedback form was provided to collect specific comments.

This accomplished task three (3) in the FEMA Local Mitigation Planning Handbook (Create an outreach strategy).

Planning Step 3: Coordinate with Other Departments and Agencies

Early in the planning process, the HMPC determined that data collection, mitigation strategy development, and plan approval would be greatly enhanced by inviting state and federal agencies and organizations to participate in the process. Neighboring communities and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, as well as other interests, businesses, academia and other private and non-profit interests were also invited to provide feedback. Based on their involvement in hazard mitigation or emergency management activities in the Region, representatives from several state and federal agencies and local businesses were included in the HMPCs in 2018 and are noted in Table 3-2. Many of these stakeholders participated in planning meetings or were provided an opportunity to review the draft plan before it was finalized.

Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is an important aspect of mitigation planning. Hazard mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability from natural hazards. Most of the counties and municipalities in the Region use a variety of comprehensive planning mechanisms, such as master plans and ordinances to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this plan establishes a credible and comprehensive plan that ties into and supports other community programs. The development of this plan incorporated information from the following existing plans, studies, reports, and initiatives as well as other relevant data from neighboring communities and other jurisdictions. Examples of this include:

- County Comprehensive Plans
- Community Wildfire Protection Plans
- Wyoming Hazard Mitigation Plan (2016)

During the development of this Regional Hazard Mitigation Plan, Niobrara County was also beginning the planning process for their County Comprehensive Community Development Plan. The idea for a county-wide comprehensive plan came from the Wyoming Business Council, which was designated as the coordinating agency for the State of Wyoming's recovery efforts following the 2015 flood. The Council recognized that a county-wide comprehensive plan would be vital for not only the recovery efforts for Niobrara but also to guide the area's growth and development. In future updates, opportunities to integrate and coordinate both the Regional Hazard Mitigation Plan and the Niobrara County Comprehensive Community Development Plan should and will be explored.

Other documents were reviewed and cited, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment and capability assessment.

3.3.2 Phase 2: Assess Risks

Planning Steps 4 and 5: Identify the Hazards and Assess the Risks

Wood led each HMPC to review, identify and document all the hazards that have, or could, impact the planning area. The existing hazard mitigation plans, and the Wyoming Hazard Mitigation Plan provided a basis for many of the hazard profiles. Where data permitted, GIS was used to display, analyze and quantify hazards and vulnerabilities. Sophisticated analyses for flood, landslide and wildfire hazards were performed by Wood that included an analysis of flood risk based on the Digital Flood Insurance Rate Maps (DFIRMs), where available. A more detailed description of the risk assessment process and the results are included in Chapter 4.

Also included in the 2018 plan is a capability assessment to review and document the planning area's current capabilities to mitigate risk and vulnerability from natural hazards. By collecting information about existing government programs, policies, regulations, ordinances and emergency plans, the HMPC can assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. The results of this assessment are captured in each annex.

3.3.3 Phase 3: Develop the Mitigation Plan

Planning Steps 6 and 7: Set Goals and Review Possible Activities

Wood facilitated discussion sessions with the HMPCs that described the purpose and the process of developing planning goals, a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This process was used to update and enhance the mitigation action plan, which is the essence of the planning process and one of the most important outcomes of this effort. The action plans are detailed in each county annex; the process used to identify and prioritize mitigation actions is described in greater detail in Chapter 5.

Planning Step 8: Draft an Action Plan

Based on input from the HMPCs regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7, Wood produced a complete first draft of the Regional Plan. This complete draft was shared for the HMPCs to review and comment by email from the consultant and posted on the project cloud-based share drive. The HMPC comments were integrated into the second draft, which was advertised and distributed to collect public input and comments. Other agencies and neighboring county emergency managers were invited to comment on this draft as well. Wood integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for the Wyoming Office of Homeland Security and FEMA Region VIII to review and approve, contingent upon final adoption by the governing boards of each participating jurisdiction.

3.3.4 Phase 4: Implement the Plan and Monitor Progress

Planning Step 9: Adopt the Plan

In order to secure buy-in and officially implement the plan, the plan was adopted by the governing boards of each participating jurisdiction. As the adoption process follows the FEMA plan review and approval, copies of the adoption resolution will be included electronically in Appendix B Records of Adoption.

Planning Step 10: Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. Each recommended action includes key descriptors, such as a lead /agency and possible funding sources, to help initiate implementation. Progress on the implementation of specific actions identified in the plan is captured in the mitigation action plan summary table in Chapter 5: Mitigation Strategy. An overall implementation strategy is described in Chapter 6: Plan Adoption, Implementation and Maintenance.

Finally, there are numerous organizations within the Region 2 planning area whose goals and interests interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is important to mitigation in Region 2 and the ongoing success of this plan; further information on coordination efforts can be found in Chapter 6. A plan update and maintenance schedule and a strategy for continued public involvement are also included in Chapter 6 and specifics can also be found in the annexes for the three counties.

CHAPTER 4 HAZARD ANALYSIS AND RISK ASSESSMENT

44 CFR Requirement 201.6(c)(2): [The plan shall include] a risk assessment that provides the factual basis for activities proposed in the strategy to reduce the losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

44 CFR Requirement 201.7(c)(2): [The plan shall include] a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Tribal risk assessments must provide sufficient information to enable the Indian tribal government to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

As defined by the Federal Emergency Management Agency (FEMA), risk is a combination of hazard, vulnerability, and exposure. "It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage."

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction's potential risk to hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment builds upon the methodology described in the 2013 FEMA Local Mitigation Planning Handbook, which recommends a four-step process for conducting a risk assessment:

1) Describe Hazards
2) Identify Community Assets
3) Analyze Risks
4) Summarize Vulnerability

Data collected through this process has been incorporated into the following sections of this chapter:

Section 4.1 Hazard Identification identifies the hazards that threaten the planning area and describes why some hazards have been omitted from further consideration.

Section 4.2 Hazard Profiles discusses the threat to the planning area and describes previous occurrences of hazard events, the likelihood of future occurrences, and the Region's vulnerability to particular hazard events.

County Annexes include summaries of community assets including population, building stock, critical facilities, and historic, cultural and natural resources. Additional details on vulnerability to specific hazards where they vary from those of the Region are noted in the annexes, with more details including maps, where appropriate.

4.1 Hazard Identification

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type of all natural hazards that can affect the jurisdiction.

Requirement §201.7(c)(2)(i): [The risk assessment shall include a] description of the type, location, and extent of all natural hazards that can affect the tribal planning area.

The Hazard Mitigation Planning Committee (HMPC) from each county in the Region conducted a hazard identification study to determine the hazards that threaten the planning area.

4.1.1 Results and Methodology

Using existing hazards data, plans from participating jurisdictions, and input gained through planning, the HMPCs of Converse, Natrona, and Niobrara Counties agreed upon a list of hazards that could affect the Region. Hazards data from FEMA, the Wyoming Office of Homeland Security (including the 2016 State of Wyoming Multi-Hazard Mitigation Plan), the National Oceanic and Atmospheric Administration, the Spatial Hazard Events and Losses Database for the United States (SHELDUS), and many other sources were examined to assess the significance of these hazards to the planning area. The hazards evaluated in this plan include those that have occurred historically or have the potential to cause significant human and/or monetary losses in the future.

The final list of hazards identified and investigated for the 2018 Region 2 Multi-Hazard Mitigation Plan includes:

- Dam Failure
- Drought
- Earthquake
- Expansive Soils
- Flood
- Hail
- Hazardous Materials
- High Winds and Downbursts
- Landslide/Rockfall/Debris Flow
- Lightning
- Mine and Land Subsidence
- Severe Winter Weather

- Tornado
- Wildland Fire

Members of each HMPC used a hazards worksheet to rate the significance of hazards that could potentially affect the region. They measured significance in general terms, focusing on key criteria such as the likelihood of the event, past occurrences, spatial extent, and damage and casualty potential. Table 4-1 represents the worksheet used to identify and rate the hazards, and is a composite that includes input from all the participating jurisdictions. Note that the significance of the hazard may vary from jurisdiction to jurisdiction. The county annexes include further details on hazard significance by county and municipality. Expansive soils and land subsidence hazards were added during the 2018 planning process to be consistent with the Wyoming Multi-Hazard Mitigation Plan. Other changes in the hazard identification list are noted with an asterisk in Table 4-1.

Table 4-1 Region 2 Hazard Significance Table

	Converse	Natrona	Niobrara
Dam Failure	Medium	Medium	Low
Drought	High	High	High
Earthquake	Medium	High	Low
Expansive Soils	Low	Low	Low*
Flood	Medium	High	Medium
Hail	Medium	Medium	Medium
Hazardous Materials	Medium	Medium	Low
High Winds and Downbursts	Medium	Medium	Medium
Landslide, Rockfall and Debris Flow	Low	Medium	Low
Lightning	Low*	Medium	Medium
Mine and Land Subsidence	Low	Low*	Low*
Severe Winter Weather	High	High	High
Tornado	Medium	Medium	Medium
Wildfire	High	High	High

Significance based on a combination of Geographic Extent, Potential Magnitude/Severity and Probability as defined below.
* Indicates hazard was not identified prior to 2018 in the county.

Geographic Extent
Negligible: Less than 10% of planning area or isolated single-point occurrences
Limited: 10 to 25% of the planning area or limited single-point occurrences
Significant: 25 to 75% of planning area or frequent single-point occurrences
Extensive: 75 to 100% of planning area or consistent single-point occurrences

Potential Magnitude/Severity
Negligible: Less than 10% of property is severely damaged, facilities and services are unavailable for less than 24 hours, injuries and illnesses are treatable with first aid or within the response capability of the jurisdiction.
Limited: 10 to 25% of property is severely damaged, facilities and services are unavailable between 1 and 7 days, injuries and illnesses require sophisticated medical support that does not strain the response capability of the jurisdiction, or results in very few permanent disabilities.
Critical: 25 to 50% of property is severely damaged, facilities and services are unavailable or severely hindered for 1 to 2 weeks, injuries and illnesses overwhelm medical support for a brief period of time, or result in many permanent disabilities and a few deaths.
Catastrophic: More than 50% of property is severely damaged, facilities and services are unavailable or hindered for more than 2 weeks, the medical response system is overwhelmed for an extended period of time or many deaths occur.

Probability of Future Occurrences
Unlikely: Less than 1% probability of occurrence in the next year, or has a recurrence interval of greater than every 100 years.
Occasional: Between a 1 and 10% probability of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Likely: Between 10 and 90% probability of occurrence in the next year, or has a recurrence interval of 1 to 10 years
Highly Likely: Between 90 and 100% probability of occurrence in the next year, or has a recurrence interval of less than 1 year.

Overall Significance
Low: Two or more of the criteria fall in the lower classifications or the event has a minimal impact on the planning area. This rating is also sometimes used for hazards with a minimal or unknown record of occurrences/impacts or for hazards with minimal mitigation potential.
Medium: The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is also sometimes utilized for hazards with a high impact rating but an extremely low occurrence rating.
High: The criteria consistently fall along the high ranges of the classification and the event exerts significant and frequent impacts on the planning area. This rating is also sometimes utilized for hazards with a high psychological impact or for hazards that the jurisdiction identifies as particularly relevant.

Hazards considered but not profiled further include avalanche, volcanism and windblown deposits. The HMPC concluded that avalanche is not a significant hazard in Region 2 due to the lack of steep terrain and minimal past impacts. The region is significantly vulnerable to an eruption of the Yellowstone Caldera due to its proximity to Yellowstone National Park. A large-scale eruption would have catastrophic global impacts. Because of the overly long expected occurrence of frequency (greater than 10,000 years) for explosive volcanism at Yellowstone, and the fact that a good response or mitigation plan is not possible for an event of this magnitude, it was not analyzed in this document. Windblown deposits include sands that can be mobilized by wind during extended drought. The HMPCs did not consider this to be a significant hazard in the region and thus did not profile it further.

4.1.2 Disaster Declaration History

As part of the hazard identification process, the HMPC researched past events that triggered federal and/or state emergency or disaster declarations in the planning area. Federal and/or state disaster declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, the state may declare a state disaster, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments' capacities are exceeded, the state can request a federal emergency or disaster declaration, to allow for the provision of federal assistance.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), and/or the Small Business Administration (SBA). FEMA also issues emergency declarations, which are more limited in scope and without the long-term federal recovery programs of major disaster declarations. The quantity and types of damage are the determining factors.

A USDA declaration will result in the implementation of the Emergency Loan Program through the Farm Services Agency. This program enables eligible farmers and ranchers in the affected county as well as contiguous counties to apply for low interest loans. A USDA declaration will automatically follow a major disaster declaration for counties designated major disaster areas and those that are contiguous to declared counties, including those that are across state lines. As part of an agreement with the USDA, the SBA offers low interest Economic Injury Disaster Loans for eligible businesses that suffer economic losses in declared and contiguous counties that have been declared by the USDA.

Table 4-2 provides information on federal emergencies and disasters declared in Wyoming between 1963 and 2017.

Table 4-2 Major Disaster Declarations in Wyoming that Included Region 2: 1963 – 2016

Event/ Hazard	Year	Declaration Type	Remarks/Description
Severe storms, flooding, mudslides	1978	Presidential – Major Disaster Declaration	Converse, Natrona & Niobrara Counties included in Declaration
Severe winter storm	1999	Presidential – Major Disaster Declaration	Niobrara County included in Declaration
Dead Horse Fire	2000	Fire Mgmt Assistance Declaration	Natrona County included in Declaration
Hensel Fire	2002	Fire Mgmt Assistance Declaration	Converse County included in Declaration
Jackson Canyon Fire	2006	Fire Mgmt Assistance Declaration	Natrona County included in Declaration
Arapahoe Fire	2012	Fire Mgmt Assistance Declaration	Converse County included in Declaration
Sheep Herder Hill Fire	2012	Fire Mgmt Assistance Declaration	Natrona County included in Declaration
Severe Storms and Flooding	2015	Presidential-Major Disaster Declaration	Niobrara County included in Declaration
Station Fire	2015	Fire Mgmt Assistance Declaration	Natrona County included in Declaration

Source: FEMA, https://www.fema.gov/disasters

From 1963 through 2017, Wyoming experienced 26 additional disaster incidents that didn't include one of the three counties in Region 2. These included nine Presidential Disaster Declarations, two Presidential Emergency Declarations, four USDA Declarations and eleven Fire Management Assistance declarations.

4.2 Hazard Profiles

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the…location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
Requirement §201.7(c)(2)(i): [The risk assessment shall include a] description of the type, location, and extent of all natural hazards that can affect the tribal planning area. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

This section profiles each of the hazards identified in Section 4.1, Identifying Hazards. Much of the profile information came from the same sources used to initially identify the hazards.

4.2.1 Profile Methodology

Hazard profiles follow this format:

Hazard/Problem Description

This subsection gives a description of the hazard and associated problems, followed by details on the hazard specific to the Region.

Geographical Area Affected

This subsection discusses which areas of the Region are most likely to be affected by a hazard event.

Limited: Less than 10% of the planning area
Significant: 10 to 50% of the planning area
Extensive: 50 to 100% of the planning area

Past Occurrences

This subsection contains information on historic incidents, including impacts where known. The subsection includes information provided by the HMPC, along with information from other data sources, including the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI – formerly the National Climatic Data Center (NCDC)) and SHELDUS where available.

SHELDUS is a county-level data set for the United States that tracks 18 types of natural hazard events along with associated property and crop losses, injuries, and fatalities. In 2014 this formerly free database transitioned into a fee-based service. Due to this and the availability of similar data in NCEI databases, it was not used as a resource during the 2018 regional plan development except for when the data was already available.

When available, tables showing county-specific data from the NCEI and SHELDUS databases may be found in each hazard profile.

Frequency/Likelihood of Occurrence

The frequency of past events is used in this section to gauge the likelihood of future occurrences. Based on historical data, the likelihood of future occurrences is categorized into one of the following classifications:

- **Highly Likely**—Near 100% chance of occurrence in next year or happens every year.
- **Likely**—Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less.

- **Occasional**—Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
- **Unlikely**—Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

The frequency, or chance of occurrence, was calculated where possible based on existing data. Frequency was determined by dividing the number of events observed by the number of years and multiplying by 100. Stated mathematically, the methodology for calculating the probability of future occurrences is:

$$\frac{\textbf{\# of known events}}{\textbf{years of historic record}} \textbf{ x100}$$

This gives the percent chance of the event happening in any given year. An example would be three droughts occurring over a 30-year period which equates to 10% chance of that hazard occurring any given year.

Potential Magnitude

This subsection discusses the potential magnitude of impacts, or extent, from a hazard event. Magnitude classifications are as follows:

- **Catastrophic**— More than 50% of property severely damaged, and/or facilities are inoperable or closed for more than 30 days. More than 50% agricultural losses. Multiple fatalities and injuries. Critical indirect impacts.
- **Critical**— 25 to 50% of property severely damaged, and/or facilities are inoperable or closed for at least 2 weeks. 10-50% agricultural losses. Injuries and/or illnesses result in permanent disability and some fatalities. Moderate indirect impacts.
- **Limited**— 10 to 25% of area affected. Some injuries, complete shutdown of critical facilities for more than one week, more than 10% of property is severely damaged.
- **Negligible**— Less than 10% of area affected. Minor injuries, minimal quality-of-life impact, shutdown of critical facilities and services for 24 hours or less, less than 10% of property is severely damaged.

Vulnerability Assessment

Vulnerability is the measurement of exposed structures, critical facilities or populations relative to the risk of the hazard. For most hazards, vulnerability is a best-estimate. Some hazards, such as flood, affect specific areas so that exposure can be quantified, and vulnerability assessments result in a more specific approximation. Other hazards, such as tornados, are random and unpredictable in location and duration that only approximate methods can be applied.

Assets Summary

Assets inventoried for the purpose of determining vulnerability include people, structures, critical facilities, and natural, historic, or cultural resources. For the regional planning process locally-available GIS databases were utilized. Parcel and assessor data for all counties was obtained from the Wyoming Department of Revenue. This information provided the basis for building exposure and property types. This information provided the basis for building exposure and property types. A critical facility is defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. Much of this data is based on GIS databases associated with the 2015 and 2017 Homeland Security Infrastructure Program (HSIP) Freedom dataset. Where applicable, this information was used in an overlay analysis for hazards such as flood and landslide. More detail on assets potentially exposed to hazards can be found in the county and reservation annexes.

Future Development

This section describes how the hazard could impact future development.

Summary

The summary section summarizes risk by county according to the area affected, likelihood, and magnitude of impacts. If the hazard has impacts on specific towns or cities in the region they are noted here, where applicable.

4.2.2 Dam Failure

Hazard/Problem Description

Dams are man-made structures built for a variety of uses, including flood protection, power, agriculture, water supply, and recreation. Dams typically are constructed of earth, rock, concrete, or mine tailings. Dams and reservoirs serve a very important role for Wyoming residents and industry. While dam failures are rare, should a complete or partial failure occur it will create a significant hazard for those downstream.

Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, which can affect life and property. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded and the density, type, and value of development and infrastructure located downstream.

Dam failure occurs when the retention function of the dam is compromised partially or entirely. Damage to a dam structure that results in a failure may be caused by any of the following sources:

- Prolonged periods of rainfall and flooding resulting in overtopping
- Earthquake

- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment, foundation leakage, piping or rodent activity
- Improper design
- Age
- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway
- Vandalism or terrorism

Failure is not the only type of emergency associated with dams. Other types of emergencies may include spillway discharges that are large enough to cause flooding in downstream areas or flooding in upstream areas due to backwater effects or high pool levels. Both are considered dam emergencies that could lead to significant property damage or loss of life. (Source: U.S. Army Corps of Engineers *Flood Emergency Plans: Guidelines for Corps Dams*. Hydrologic Engineering Center, June 1980, p 4.).

Dam failures can be grouped into four classifications: overtopping, foundation failure, structural failure, and other unforeseen failures. Overtopping failures result from the uncontrolled flow of water over, around, and adjacent to the dam. Earthen dams are most susceptible to this type of failure. According to the Wyoming State Hazard Mitigation Plan, hydraulic failures account for approximately 28 percent of all dam failures. Foundation and structural failures are usually tied to seepage through the foundation of the main structure of the dam. Deformation of the foundation or settling of the embankment can also result in dam failure. According to the same plan, structural failures account for approximately 28% of all dam failures, and foundation problems account for another 25%. Earthquakes or sabotage account for 12% of all dam failures, while inadequate design and construction account for the remaining 7% of failures.

The State of Wyoming has adopted FEMA's risk classifications as set forth in FEMA's *Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams*, which classifies dams into three classes: high, significant and low hazard classes. These guidelines define High Hazard (Class I) dams as those rated based on an expected loss of human life should the dam fail. Significant Hazard (Class II) dams as those rated based on expected significant damage but not loss of human life. Significant damage refers to damage to structures where humans live, work, or play or public or private facilities, exclusive of unpaved roads and picnic areas, that are made inhabitable or inoperable. Failure of a low hazard dam would have minimal downstream impacts.

Geographical Area Affected

In 1981, the U.S. Army Corps of Engineers completed an inspection program for nonfederal dams under the National Dam Inspection Act (P.L. 92-367). This was a four-year effort that included compiling an inventory of about 50,000 dams and conducting a review of each state's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of dams. Part of the inspection included evaluating the dams and assigning a hazard classification based on the effects dam failure would have on downstream areas. The dams were rated (1) High, (2) Significant, and (3) Low hazard. The Corps of Engineers based the hazard potential designation on such items as acre-feet capacity of the dam, distance from nearest downstream community, population density of the community, and age of the dam**.**

There were 1,458 dams in Wyoming that were reviewed by the Corps of Engineers in the 1981 inspection program. Of that number 38 were rated high hazard, 56 were rated significant hazard, and the remaining 1,364 were rated low hazard. The Wyoming State Engineers Office (WSEO) inspects dams over 20 feet high or with a storage capacity of 50 acre-feet or more, as well as smaller dams in highly populated areas. According to the Association of State Dam Safety Officials web site, as of 2016 the WSEO regulates 1,544 dams. As a part of the regulatory process the WSEO inspects these dams once every five years. Of these dams, 87 are rated high hazard, 107 are rated significant hazard, and 1,350 are rated low hazard potential (https://damsafety.org/wyoming). Figure 4-1 shows the dams affecting Region 2. Nine are classified as High Hazard (Class I) and eighteen are classified as Significant Hazard (Class II). Table 4-3 below provides details of the High and Significant Hazard Dams sorted by the county.

Figure 4-1 Locations of High and Significant Hazard Dams Affecting Region 2

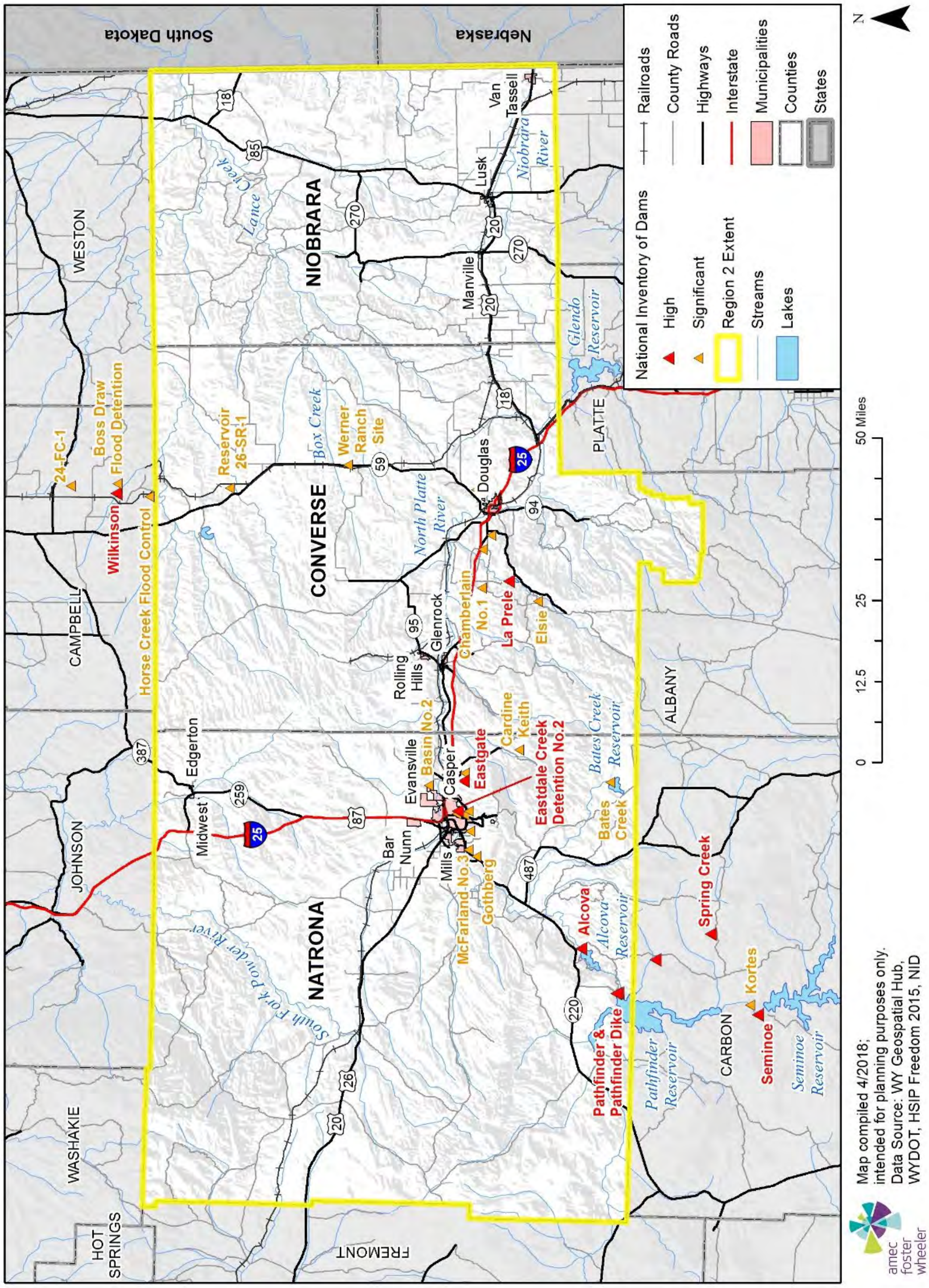


Table 4-3 High and Significant Hazard Dams in Region 2

Hazard	Dam	River	Maximum Storage (Acre Ft)	Nearest Downstream City	Distance to Nearest Downstream Community (Mi.)	EAP
			Converse County			
H	LaPrele	LaPrele CR, TR N Platte River	26850	Douglas	14	Y
S	Antelope No. 1	Antelope Creek N.	202	Douglas	3	N
S	Chamberlain No.1	LaPrele Creek	727	Douglas	16	N
S	Douglas Fishing Lake No.1	Six Mile Creek	193	Douglas	4	N
S	East Side No. 3	Five Mile Creek	200	Douglas	6	N
S	Elsie	Moss Agate Creek	51	Douglas	28	N
S	Reservoir 26-SR-1*	-		Wright	-	N
S	Werner Ranch	Werner Draw	113	Unnamed Ranch	15	N
			Natrona County			
H	Alcova	North Platte River	184,300	Casper	30	Y
H	Eastdale Creek Detention No. 2	Holman Draw	83	Casper	0	Y
H	Eastgate	Jones Draw	717	Hat Six Road	1	Y
H	Pathfinder	North Platte River	1,016,500	Casper	45	Y
H	Pathfinder Dike	North Platte River	1,016,500	Casper	46	Y
H	Pathfinder Dike*	North Platte River Off stream	1,128,087	Casper	45	Y
H	Seminoe*	North Platte River	1,017,279	Red Buttes	64	Y
H	Spring Creek*(Enlargement)	Spring Creek	58	Leo	7	N
S	Basin No. 2 Flood Detention Pond	Airport Draw	0	Casper	1	N
S	Bates Creek	Dry Fork Bates Creek	8,885	Casper	44	N
S	Cardine Keith	Skeen Creek	169	Glenrock	23	N
S	Casper Parks No. 2	Holman Draw	48	Casper	1	N
S	Casper Sage Creek	Sage Creek	165	Casper	2	N
S	East Fork Wolfe Creek	East Fork Wolf Creek	45	Casper	5	N
S	Gothberg	Dobbins Spring Creek	0	Casper	1	N
S	Kortes*	North Platte River	4,739	None	0	Y
S	McFarland No. 3	East Fork Webb Creek	20	Hwy 220	0.5	N
S	Nicolaysen	Dry Muddy Creek	475	Big Muddy Oil Field	10	N
S	Spicer Lower	Holman Draw Off stream	0	Casper	0	N

Source: National Inventory of Dams; *Located outside County but dam failure would have significant impact on County.

There are 79 dams located in Niobrara County, all of which are earthen dams used for irrigation or stock fish ponds. All are rated as low hazard dams according to the National Inventory of Dams. Despite this low hazard rating from NID, the Niobrara County Emergency Operations Plan rates three dams, the Duel Reservoir on Cow Creek, the Field Reservoir on Cottonwood Draw and Pfister no. 2 Reservoir on Oat Creek, as dams that could be a significant hazard.

Past Occurrences

According to the 2016 Wyoming State Mitigation Plan, there has been a minimal history of dam failures that have led to a loss of life or damage to property in the state's history. One of the most significant dam failure events, in terms of loss of life, occurred in Natrona County on March 1, 1906. Flooding due to snow and ice melt along the North Platte River near Casper led to a diversion dam failure. The flooding caused a stream to return to its natural channel with a culvert that was too small to handle the increased amount of water. The water began to rise against a railroad embankment causing it to fail. The failure led to damage to a railroad bridge resulting in a train wreck in which caused twelve individuals to lose their lives. All counties within Region 2 have experienced a dam failure event in the past.

On July 22, 1983 a dam connected to the LaPrele Range Drainage Basin in Converse County collapsed after a heavy thunderstorm event that caused intense flooding and runoff to inundate the dam. A wall of water estimated to be 10-15 feet high rushed through a nearby ranch southwest of Douglas. No damage information is available from the incident and HMPC members have confirmed that the impact of the failure was isolated to that single ranch.

In addition to the 1906 dam failure event, Natrona County experienced another significant dam failure in 1984. Snow melt flooding caused a dam to fail leading to dozens of residences, businesses, and farms to be impacted and resulted in a total of $5 million in damages to the area. Natrona County's 2017 HMP also noted a dam failure event that occurred on September of 1982. The Shriner Reservoir Dam located along South Casper Creek was reported as having completely failed. No impacts were recorded from this failure.

The State HMP identifies two dam failure events that took place within Niobrara County. On August 10, 1955 heavy rains caused several dams to break resulting in one ranch losing twenty-one head of cattle. The second identified dam failure event took place on July 21, 1973 and affected both Niobrara and Weston counites. Torrential rainfall accompanied by hail caused flash flooding to damage bridges, make roads impassable in some areas and result in several earthen dams to fail. Crop and property damaged was substantial with an estimated $225,000 in property damage. The Niobrara HMP identifies an additional dam failure event that occurred in July of 1969. Although the dam failure took place in nearby Platte County it had a substantial impact on Niobrara County. The dam break resulted in a wall of water that was 50 feet high that damaged crops, killed livestock and forced evacuations. Property damage is estimated to be over $1 million.

Frequency/Likelihood of Occurrence

It is estimated that the counties in Region 2 will be affected by dam failure **occasionally** in the future, or a probability between 1% and 10% of occurring in any given year. The structural integrity of dams depends on regular inspections and maintenance, which do not always occur.

Additionally, a number of the dam failures in Wyoming and other Rocky Mountain states occurred because of snow melt flooding that exceeded the capacity and strength of levees and dams. Wyoming's dams will continue to be tested by snow melt, heavy rains, and other types of floods every year, continuing the potential of dam failure for the foreseeable future.

Potential Magnitude

Potential impacts of a dam failure may include injury, loss of life, property damage, damage to infrastructure, water contamination, loss of crops and livestock, evacuations and sheltering, interruption of commerce and transportation, search, and clean-up costs. In addition, dam failure and associated flooding can cause damage to and loss of irrigation structures such as headgates and ditches. Loss or damage to water structures would negatively impact agricultural producers of crops and livestock, and can be costly to repair.

The severity and magnitude of a given dam failure will vary by county and case-by-case basis. Information on potential impacts of specific dam failures is not detailed in this plan due to Homeland Security concerns. Emergency management coordinators have access to inundation maps contained in the emergency action plans for the High Hazard dams in the state. High Hazard (Class I) dams, by definition, would merit a magnitude/severity rating of **catastrophic**, whereas Significant Hazard (Class II) dams rate as **critical** and Low Hazard dams fall into the **limited** rating. The magnitude/severity rating for the hazard in Converse and Natrona counties is considered mostly **critical,** due to the number of Class I dams that could impact highly populated communities such as Douglas in Converse County and Casper in Natrona County. The low hazard classification of the dams located in Niobrara and the low population density in the county result in the magnitude/severity ratings for the hazard in in the county to be **limited.**

Vulnerability Assessment

As noted in Table 4-2 , Converse and Natrona counties both contain high hazard dams that could affect downstream areas and communities. Jurisdictions should consult dam EAPs to ensure that they recognize the potential impacts from the failure of these dams and plan for them.

The previous hazard mitigation plan for the Converse and Natrona counties note the following information on the impacts of failures of specific dams:

Converse County

LaPrele Dam

The LaPrele Dam, the only high hazard classified dam in Converse County, is a 135-foot tall concrete dam located 14 miles southwest of Douglas along LaPrele Creek. The dam was constructed in 1909 for the purpose of irrigation and as part of a federal campaign to promote western settlement. After falling into disrepair in the 1970's, the dam was modified in the 1980's, even winning the "Outstanding Civil Engineering Achievement of 1979". According to the

Wyoming Irrigation Systems Report by Wyoming Water Development Commission, the LaPrele Dam irrigates 14,612 acres of land. Although the probability of dam failure is low, a failure could be catastrophic and would result in hundreds of millions of dollars in damage to downstream communities. Areas of inundation may include, Natural Bridger Park recreation area, City of Douglas, nearby unincorporated areas, rural ranches, and portions of Interstate 25. Although the area experienced high traffic volumes with the 2017 solar eclipse, the HMPC voiced concerns of the possibility of high volumes of traffic if an evacuation were to take place due to an unexpected failure of the LaPrele Dam.

Natrona County

Alcova and Pathfinder Dam

The Alcova and Pathfinder Dams, both located close to active faults, are classified as high hazard dams in Natrona County. Failure of either dam may result in hundreds of millions of dollars in damage to downstream communities including Casper, Evansville and Mills. Alcova Dam is a 265-foot tall earthfill dam that is operated by the U.S. Bureau of Reclamation for the purpose of water and hydroelectric power generation. The Pathfinder Dam is a cyclopean masonry dam located on the North Platte River. The dam was completed in June of 1909 and was immediately tested with unusual summer rains that overtaxed the spillways and threatened to overtop an unfinished auxiliary dike south of the dam. The potential overtopping led to sensational stories in Denver newspapers and caused annual nervousness in Casper for years following. The reservoir exceeded capacity in 1984, 2010, and 2011 causing overflow water to divert into the spillway immediately north of the dam. The dam's spillway overflowed in June 2016 as a result of snowmelt runoff, making this the fourth time in three decades overflow has occurred.

Seminoe Dam

The Seminoe Dam is a 295-foot tall concrete thick-arch dam that covers more than 20,000 acres. It is located in a narrow, isolated canyon formed by the North Platte and cutting through the Semione Mountains and is the uppermost dam located on the North Platte River. The dam is owned and operated by the U.S. Bureau of Reclamation and is used to store water for irrigation and generate hydroelectricity. Although the dam is located outside the county, due to its classification as a high hazard dam and being located upstream from other dams classified as significant and high hazard, if the Seminoe Dam was to fail it may result in serious property damage to downstream communities

Aging dams is another factor to consider when assessing the vulnerability of dams. According to the State Hazard Mitigation Plan, of the 1,548 dams in the state inventory, 860 dams or 56% were constructed before 1965 and are over fifty years old. In Converse County, of the eight aging dams that could impact the county, four were constructed before 1965 and are over fifty years old. However, the Converse County 2018 Hazard Mitigation Plan notes that two of those four dams have been modified in the last forty years. Within Natrona County, there are 19 aging dams that could impact the county, thirteen of which were constructed before 1965 and are over fifty years old.

Future Development

As communities or unincorporated areas grow, previously lower-classified dams may pose greater risks, leading to their hazard classification to be elevated. Inundation maps and emergency action plans should be consulted in the planning of new development, where applicable to ensure that risks from a potential dam failure are recognized. Growth rates in the region do not indicate that risk is increasing substantially.

Summary

Overall, dam failure significance in the Region ranges from low to medium depending upon its location. Due to the number of dams classified as high and significant hazard, the greatest risk of dam failure in the Region is in Converse (1 high; 7 significant) and Natrona (8 high; 11 significant) counites. Although the probability of a dam failure event to occur in Converse or Natrona counties is unlikely, if a high hazard dam such as LaPrele in Converse or Alcova in Natrona were to fail it would have a significant impact on either county due to the highly populated downstream communities in Casper and Douglas that would be affected.

Table 4-4 Dam Failure Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Limited	Occasional	Significant	Medium
Natrona	Limited	Occasional	Significant	Medium
Niobrara	Limited	Low	Limited	Low

4.2.3 Drought

Hazard/Problem Description

Drought is described as a protracted period of deficient precipitation resulting in extensive damage to vegetation. Of all the natural weather-related disasters, drought is by far the costliest to our society. It indirectly kills more people, animals, and plants than the combined effects of hurricanes, floods, tornadoes, blizzards, and wildfires. And, unlike other disasters that quickly come and go, drought's long-term unrelenting destruction has been responsible in the past for mass migrations and lost civilizations. The 1980 and 1988 droughts in the U.S. resulted in approximately 17,500 heat-related deaths and an economic cost of over $100 billion. Drought occurs in four stages and is defined as a function of its magnitude (dryness), duration, and regional coverage. Severity, the most commonly used term for measuring drought, is a combination of magnitude and duration.

The first stage of drought is known as a meteorological drought. The conditions at this stage include any precipitation shortfall of 75% of normal for three months or longer. The second stage is known as agricultural drought. Soil moisture is deficient to the point where plants are stressed and biomass (yield) is reduced. The third stage is the hydrological drought. Reduced stream flow (inflow) to reservoirs and lakes is the most obvious sign that a serious drought is in progress. The fourth stage is the socioeconomic drought. This final stage refers to the situation that occurs when physical water shortage begins to affect people.

As these stages evolve over time, the impacts to the economy, society, and environment converge into an emergency situation. Without reservoir water to irrigate farms, food supplies are in jeopardy. Without spring rains for the prairie grasslands, open range grazing is compromised. Without groundwater for municipalities, the hardships to communities can result in increases in mental and physical stress as well as conflicts over the use of whatever limited water is available. Without water, wetlands disappear. Other animal and plant species also suffer from lack of (or degraded) proper food, nutrients, water, and habitat. The quality of any remaining water decreases due to its higher salinity concentration. There is also an increased risk of fires, and air quality degrades as a result of increased soil erosion particles in strong winds (blowing dust).

Geographical Area Affected

According to estimates by the Region 2 Hazard Mitigation Plan Committee, the Region is at high risk to drought events over an extensive spatial area which covers all three counties in the region. Since droughts are often regional events that impact multiple counties and states simultaneously, given the climate of the planning area being contiguous, it is reasonable to assume that a drought will impact the entire planning region and affect a large geographic extent, so that the hazard proves **significant** across the counties. According to the Wyoming State Climate Office, Wyoming is the 5th driest state in the United States and since 1999, moderate to severe droughts have been normal occurrences in much of the state due to its natural climate.

The Region primarily falls within three major river drainage basins in the state (North Platte, Cheyenne, and Powder-Tongue Basins). The Laramie Mountains, on the eastern edge of the Rocky Mountains of the Wyoming side, provide some snowpack during the winter months that discharge flow through major local streams (e.g., South Fork Powder River, North Platte River, Cheyenne River). However, as of 2018, parts of the Powder River and the North Platte River were declared as impaired waters by the Wyoming Water Resources Data System & Wyoming State Climate Office services (WRDS-UWY, 2018); streams falling under this impairment criteria are considered threatened, significantly degraded, or too contaminated to meet the water quality standards set by the Environmental Protection Agency's Clean Water Act (EPA, 2017). Given the Region's lack of widespread access to large amounts of fresh water locally, and because some major streams contain segments deemed impaired, effects from droughts may be exacerbated and the areas impacted may be quite large within the three region counties.

Past Occurrences

The Region 2 area has experienced several multi-year droughts over the past century. The most significant statewide drought in recent history began in earnest in the spring of 2000 and endured through 2004. 2005 was a wetter year, technically signifying the end of the drought period. Dry conditions returned in the following years and became severe between 2006 and 2007. According to the Wyoming State Climate Office, "conditions [had] eased somewhat in mid-2008, but a near decade with warm temperatures and relatively little precipitation has left [Wyoming] very vulnerable" (http://www.wrds.uwyo.edu/sco/drought/drought.html). The driest year to date occurred in 2012, with only 10.9 inches of precipitation, or 69.06% of the normal precipitation observed across the state.

The 2000-2004 drought is considered by many to be the most severe in collective memory. However, some older residents have indicated that they remember streams drying up in the 1930s and 1950s. According to instrument records, since 1895 there have been only six multi-year (three years or longer) statewide droughts. Based on deficit precipitation totals (negative departures from the long-term average), they are ranked statewide. Refer to Table 4-5 for a summary of the years that suffered drought, their average precipitation records, and the percent of those years' precipitation compared to the average annual records (i.e., average precipitation in the range of years, which corresponds to an average annual precipitation of 15.87).

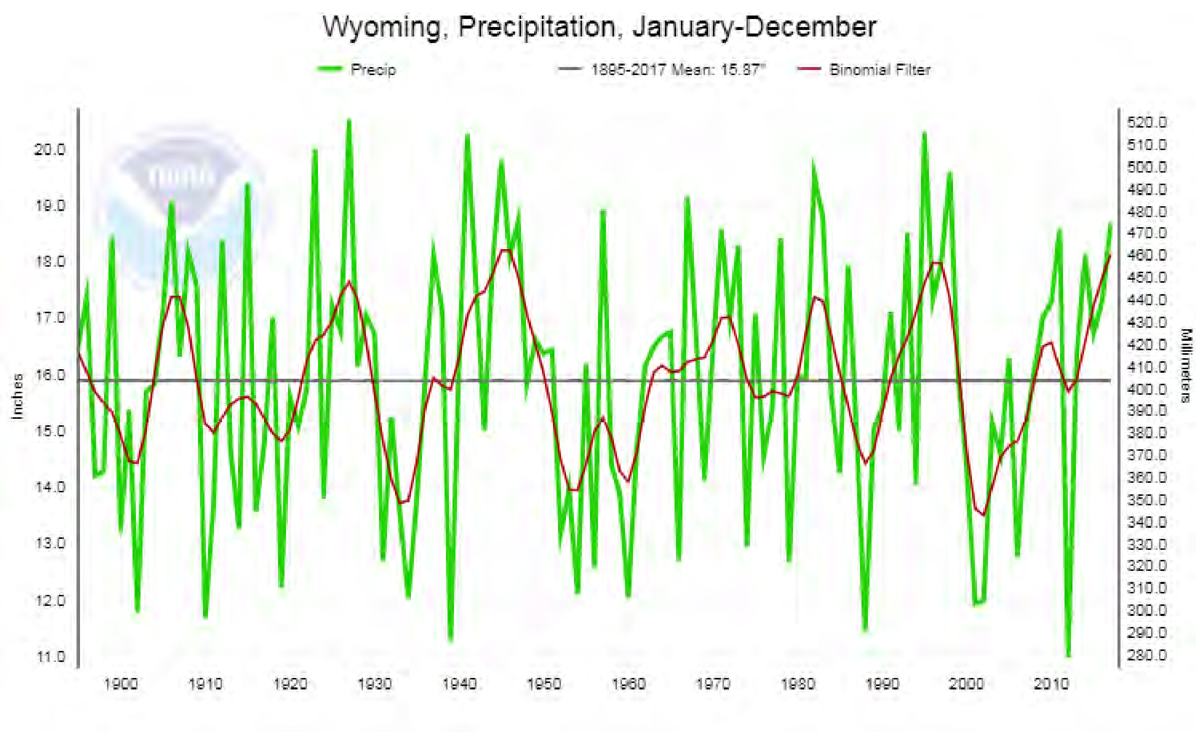
Table 4-5 Significant Multi-Year Wyoming Droughts since 1895 (Modern Instrumented Era)

Years	Average Annual Precipitation (inches)	Percent of 1895-2017 Average Annual Precipitation (15.87")
1900-1903	13.53	85.28%
1931-1935	13.43	84.65%
1952-1956	12.93	81.47%
1958-1960	13.23	83.36%
1987-1990	14.17	89.29%
2000-2004	13.44	84.67%

Source: NOAA – National Centers for Environmental Information

Overall, Wyoming's precipitation record from 1895-2017 reveals that, for the first half of the 20th century (except for the Dust Bowl years of the 1930s and the localized event in the mid-1950s), there was generally a surplus of moisture. During the second half of the 20th century and into the 21st century there was a trend of increased periods of drought (Figure 4-2Figure 4-2). The dry years are denoted by the binomial filter troughs (i.e., red line dips).

Figure 4-2 Wyoming Annual Precipitation: 1895-2017

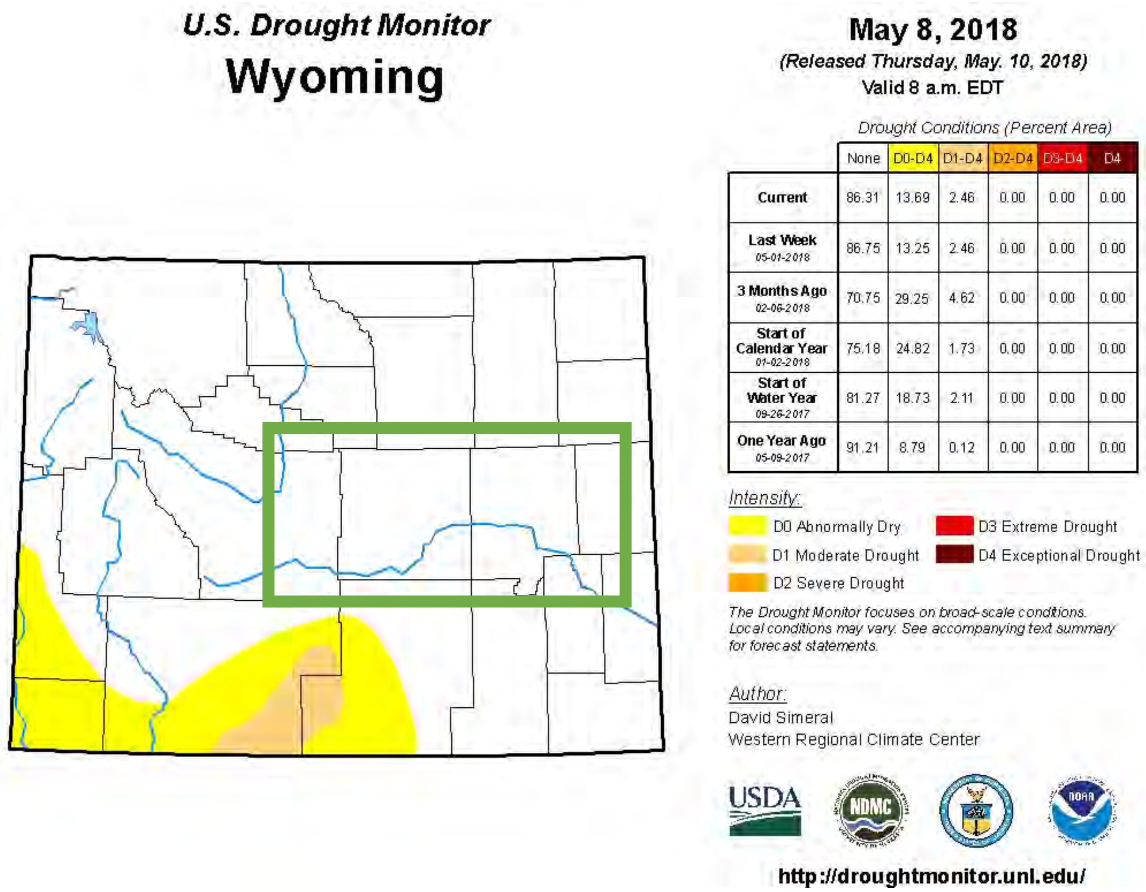


Source: NOAA – National Centers for Environmental Information (http://www.ncdc.noaa.gov/cag/time-series/)

The U.S. Drought Monitor is another useful source related to drought, and it provides a general summary of current drought conditions. The U.S. Department of Agriculture (USDA), the National Oceanic and Atmospheric Administration (NOAA), and the National Drought Mitigation Center (University of Nebraska-Lincoln) collaborate on this weekly product, which is released each Thursday. Multiple drought indicators, including various indices, outlooks, field reports, and news accounts are reviewed and synthesized. In addition, numerous experts from other agencies and offices across the country are consulted. The result is the consensus assessment presented on the U.S. Drought Monitor map (with Wyoming's current drought conditions portrayed in). The image is color-coded for six levels of drought intensity. The first drought category, "Abnormally Dry," is used to show areas that might be moving into a drought, as well as those that have recently come out of one. The last category is called "Exceptional Drought", and is reserved to classify the most severe drought events. The remaining four categories define droughts ranging from less to more severe, while a lack of yellow-red coloring indicates no drought conditions are present (Source: https://www.drought.gov/drought/).

As of May 8, 2018, no drought conditions were identified in any parts of the Region. Nevertheless, some "Abnormally Dry" and "Moderate Drought" areas are present in the southwestern parts of the state. Since no part of the Region is currently impacted by drought, the three counties are displayed in white by Figure 4-3 (found within the green square below).

Figure 4-3 U.S. Drought Monitor

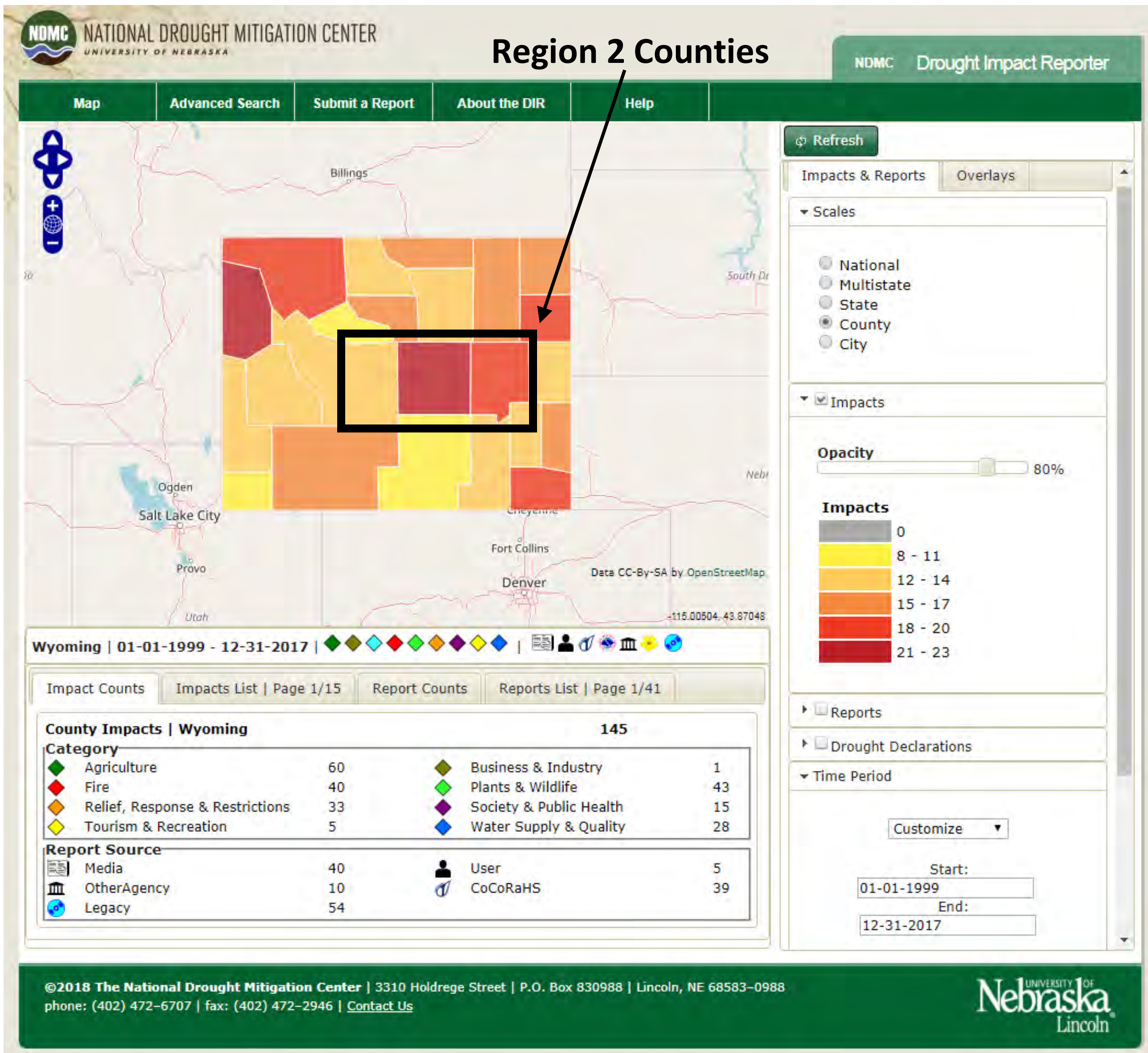


Source: U.S. Drought Monitor; Region 2 counties highlighted in green square

A particularly useful resource to determine the impacts of drought is the Drought Impact Reporter (DIR), launched by the National Drought Mitigation Center in July 2005 as the nation's first comprehensive database accounting for a range of drought impacts. The Drought Impact Reporter is an interactive web-based mapping tool designed to compile and display impact information across the United States in near real-time. Information within the DIR is collected from a variety of sources including the media, government agencies and reports, and citizen observers. Each of these sources provides different types of information at different spatial and temporal scales. (Source: http://drought.unl.edu/monitoringtools/droughtimpactreporter.aspx)

A search of the database for the entire State of Wyoming from 1999 to 2017 (which includes the most recent severe droughts) shows a total of 145 reported impacts. Figure 4-4 below contains the breakdown of reported impacts by county, with color-coding ranging from fewest (yellow) to most reported impacts (reds). The majority of reported impacts fall within the Agriculture Category. Drought effects associated with agriculture include damage to crop quality; income loss for farmers due to reduced crop yields; reduced productivity of cropland; reduced productivity of rangeland; forced reduction of foundation stock; and closure/limitation of public lands to grazing, among others. Note that the three counties in Region 2 account for 54 out of the total (145) drought reports in the time period queried: 23 for Natrona, 19 for Converse, and 12 for Niobrara County.

Figure 4-4 Number of Reported Drought Impacts from 1999 to 2017 in Region 2



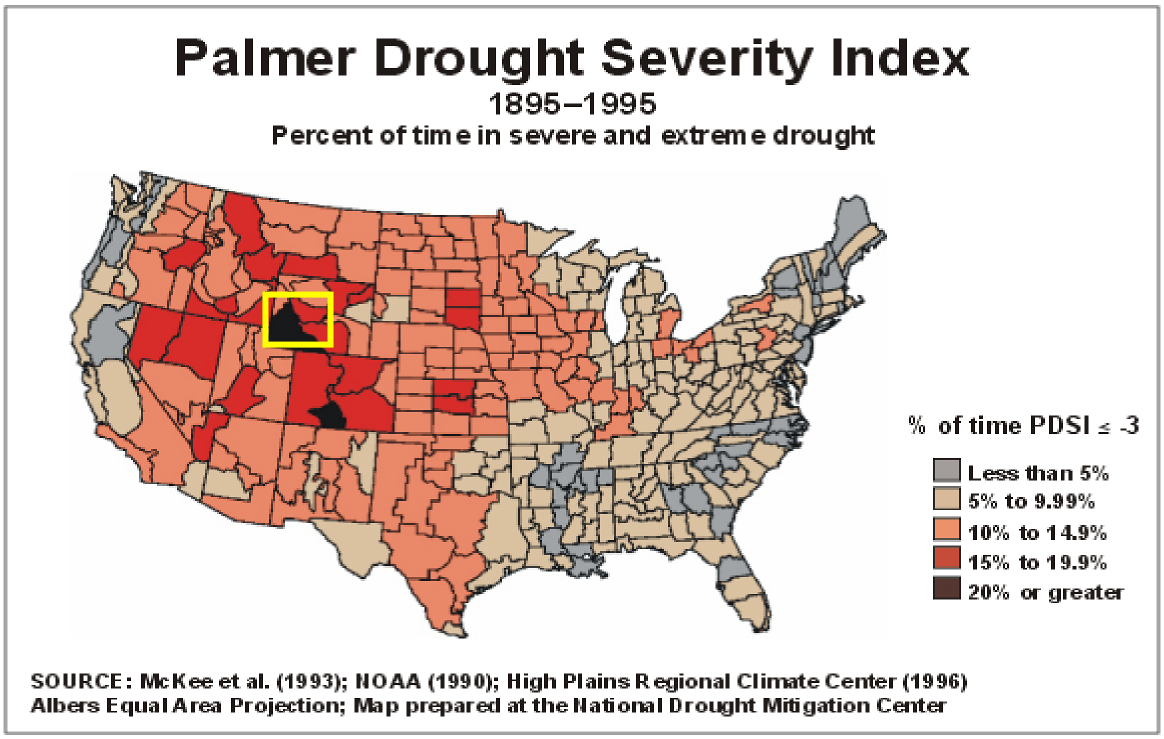
Source: http://droughtreporter.unl.edu/map/

All areas in Region 2 have, at various times, been included in county or regional USDA disaster declarations for droughts (by either Secretarial and/or Presidential Disaster Declarations). In 2016 specifically, all three counties were included in the Secretarial Drought Designation statement as a primary disaster designated county. In 2017, only Converse County received a Secretarial Disaster Declaration for drought. The occurrence of drought in the Region, however, is frequent and expected, as can be seen from the various records and declarations. More details on drought frequency are discussed below.

Frequency/Likelihood of Occurrence

Figure 4-5 indicates that the Region 2 planning area spent approximately 15-20% of the 100-year span from 1895 to 1995 in severe or extreme drought. This is consistent with the data in the Past Occurrences subsection which highlights that severe multi-year droughts have occurred roughly every twenty years, since the beginning of precipitation data collection in 1895. In addition, single year or partial year drought events are also common in each of the three region counties. An occurrence interval of roughly once every twenty years for the Region until 1995 may not seem like a frequent interval, but given more recent data records since then, the trend has changed (https://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/psi/199601-201712). From 1996 to 2017, including both of those years, Region 2 has experienced ten additional years of drought, averaging to a drought (of at least one year) every 2.2 years.

Figure 4-5 Palmer Drought Severity Index Time Series for the Continental U.S.: 1895-1995



Potential Magnitude

In order to calculate a magnitude and severity rating for comparison with other hazards, and to assist in assessing the overall impact of the hazard on the planning area, information from the event of record is used. Impacts can help understand the effects of a hazard, and potentially assist in preparing for and preventing against said hazard (e.g., drought). In some cases, the event of record represents an anticipated worst-case scenario, and in others, it is a reflection of a common occurrence. Based upon Table 4-7, the drought of 2000-2004 was more significant, in terms of losses and changes in productivity, than some of the other droughts in the last 100 years for the entire state. The droughts noted previously in Table 4-5, derived from NOAA's National Center for Environmental Information database, indicate that the most significant droughts in the last century, in terms of precipitation deficit, were in 1952-1956, 1958-1960, 1931-1935, and 1999-2004. To determine how the drought periods had significant negative impacts on Wyoming, crop production and livestock inventory data for the driest period (1952-1956) and the latest multi-year drought period (2000-2004) were compared. 1957 and 2005 were wetter years, with annual statewide precipitation totals above the 1895-2017 average. Those two years were used as endpoints for the droughts that started in 1952 and 2000 respectively. In both cases, the years following saw a return to drier conditions. Because of this, the most recent drought impacts were also calculated for 2005 and 2006, and are included in summary tables. Table 4-6 and Table 4-7 show peak decline (%) in one or more production categories during drought compared to the 5-year pre-drought production averages for various commodities.

A comparison of Table 4-6 and Table 4-7 indicate that drought impacts to the entire Wyoming agricultural community were greater in the 2000-2004 drought than in the 1952-1956 drought. With the exception of dry beans, all commodities in the worst years of the 2000-2004 drought showed a greater percentage decline in production than in the 1952-1956 drought. As a result, the 2000-2004 drought will be used as the drought of historic record to calculate dollar impacts. (Note that the abbreviation 'Bu.' means *bushel*, and 'cwt' stands for *hundredweight*.)

Table 4-6 Peak Commodity Production Changes from Pre-Drought (1947-1951) to Drought (1952-1956)

Commodity	5-Year Pre-Drought Production Average (1947-1951)	Units	Lowest Production During Drought (1952-1956)	Year of Lowest Production (1952-1956)	Percent Change
Winter Wheat	5,072	1,000 bu.	2,346	1954	-54%
Spring Wheat	1,579	1,000 bu.	600	1954	-62%
Barley	4,414	1,000 bu.	2,700	1956	-39%
Oats	4,577	1,000 bu.	2,470	1954	-46%
Dry Beans	1,009	1,000 cwt.	589	1955	-42%
Sugarbeets	413	1,000 tons	421	1955	+2%
Corn	227	1,000 bu.	161	1953	-29%
Alfalfa Hay	490	1,000 tons	675	1954	+38%
Other Hay	674	1,000 tons	442	1954	-34%
Cattle/ Calves Inventory	1,050	1,000 head	1,096	1954	+4%

Source: USDA

Table 4-7 Peak Commodity Production Changes from Pre-Drought (1994-1998) to Drought (2000-2004)

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	Lowest Production During Drought (1999-2006)	Year of Lowest Production (1999-2006)	Percent Change
Winter Wheat	6,029	1,000 bu.	2,375	2002	-61%
Spring Wheat	648	1,000 bu.	96	2002	-84%
Barley	8,383	1,000 bu.	4,680	2002	-44%
Oats	1,648	1,000 bu.	600	2005	-64%
Dry Beans	691	1,000 cwt.	514	2001	-26%
Sugarbeets	1,151	1,000 tons	659	2002	-43%
Corn	6,328	1,000 bu.	4,165	2002	-34%
Alfalfa Hay	1,581	1,000 tons	1,150	2002	-27%
Other Hay	817	1,000 tons	450	2002	-45%
Cattle/ Calves Inventory	1,536	1,000 head	1,300	2004	-16%

Source: USDA

Economic Impacts

Agricultural dollar impacts can also be used to show the effects of drought. For Wyoming, historic data from the 2000-2004 drought and the two subsequent years was obtained from the U.S. Department of Agriculture (USDA) Quick Stats database (https://quickstats.nass.usda.gov).

The data below represent changes in production value for crops, and changes in inventory value for cattle and calves. As such, the data should be considered to summarize impact value versus economic loss value. For example, with cattle and calves inventory (Table 4-8 through Table 4-14), the inventory decreased during the drought. Therefore, the value of inventory on hand decreased. The inventory decreased, however, because of the reduced sales in cattle and calves, due to hardships in raising the cattle, feeding, etc. The net result, therefore, is an overall decrease in inventory value, which is a negative impact stemming from drought. Although these summaries have been obtained state-wide, they serve as a good indicator of how drought can affect a specific industry or business over time.

Table 4-8 2000 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2000 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	4,080	$2.70/bu	- $ 5,262,300
Spring Wheat	648	1,000 bu.	232	$2.70/bu	- $ 1,124,280
Barley	8,383	1,000 bu.	7,885	$3.08/bu	- $ 1,533,840
Oats	1,648	1,000 bu.	1,156	$1.55/bu	- $ 252,650
Dry Bean	691	1,000 cwt.	762	$16.80/cwt	+ $ 1,196,160
Sugar Beet	1,150	1,000 tons	1,556	$32.50/ton	+ $ 195,000
Corn	6,328	1,000 bu.	7,656	$2.02/bu	+ $ 2,682,560
Alfalfa Hay	1,581	1,000 tons	1,449	$85.00/ton	- $ 11,220,000
Other Hay	817	1,000 tons	650	$80.00/ton	- $ 13,392,000
Cattle/Calves Inventory	1,536	1,000 head	1,550	$780.00/head	+$10,920,000
TOTAL					**-$17,791,350**

Source: USDA

Table 4-9 2001 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2001 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	2,880	$2.70/bu	- $ 8,502,300
Spring Wheat	648	1,000 bu.	168	$2.90/bu	- $ 1,393,160
Barley	8,383	1,000 bu.	6,970	$3.32/bu	- $ 4,691,160
Oats	1,648	1,000 bu.	1,344	$1.65/bu	- $ 501,600
Dry Bean	691	1,000 cwt.	514	$23.00/cwt	- $ 4,066,400
Sugar Beet	1,150	1,000 tons	794	$39.70/ton	- $ 14,133,200
Corn	6,328	1,000 bu.	6,375	$2.30/bu	+ $ 108,100
Alfalfa Hay	1,581	1,000 tons	1,276	$110.00/ton	- $ 33,550,000
Other Hay	817	1,000 tons	605	$105.00/ton	- $ 22,302,000
Cattle/Calves Inventory	1,536	1,000 head	1,470	$780.00/head	- $ 51,480,000
TOTAL					**-$140,511,720**

Source: USDA

Table 4-10 2002 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2002 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	2,375	$3.70/bu	- $ 13,519,800
Spring Wheat	648	1,000 bu.	96	$3.90/bu	- $ 2,154,360
Barley	8,383	1,000 bu.	4,680	$3.23/bu	- $ 11,960,690
Oats	1,648	1,000 bu.	750	$2.20/bu	- $ 1,975,600
Dry Bean	691	1,000 cwt.	624	$18.30/cwt	- $ 1,222,440
Sugar Beet	1,150	1,000 tons	659	$42.30/ton	- $ 20,769,300
Corn	6,328	1,000 bu.	4,165	$2.60/bu	- $ 5,623,800
Alfalfa Hay	1,581	1,000 tons	1,150	$111.00/ton	- $ 47,841,000
Other Hay	817	1,000 tons	450	$106.00/ton	- $ 38,944,400
Cattle/Calves Inventory	1,536	1,000 head	1,320	$760.00/head	- $164,160,000
TOTAL					**-$308,171,390**

Source: USDA

Table 4-11 2003 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2003 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	3,915	$3.40/bu	-$ 7,187,600
Spring Wheat	648	1,000 bu.	180	$3.15/bu	-$ 1,474,200
Barley	8,383	1,000 bu.	6,975	$3.46/bu	-$ 4,871,680
Oats	1,648	1,000 bu.	1,104	$1.80/bu	-$ 979,200
Dry Bean	691	1,000 cwt.	645	$17.40/cwt	-$ 800,400
Sugar Beet	1,150	1,000 tons	752	$41.20/ton	-$16,397,600
Corn	6,328	1,000 bu.	6,450	$2.50/bu	$ 305,000
Alfalfa Hay	1,581	1,000 tons	1,625	$80.00/ton	$ 3,520,000
Other Hay	817	1,000 tons	770	$73.00/ton	-$ 3,431,000
Cattle/Calves Inventory	1,536	1,000 head	1,350	$890.00/head	-$ 165,540,000
TOTAL					**-$ 196,856,680**

Source: USDA

Table 4-12 2004 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2004 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	3,510	$3.20/bu	-$ 8,060,800
Spring Wheat	648	1,000 bu.	240	$3.25/bu	-$ 1,326,000
Barley	8,383	1,000 bu.	7,050	$3.41/bu	-$ 4,545,530
Oats	1,648	1,000 bu.	795	$1.55/bu	-$ 1,322,150
Dry Bean	691	1,000 cwt.	541	$25.90/cwt	-$ 3,885,000
Sugar Beet	1,150	1,000 tons	812	$41.70/ton	-$ 14,094,600
Corn	6,328	1,000 bu.	6,550	$2.48/bu	$ 550,560
Alfalfa Hay	1,581	1,000 tons	1,305	$74.50/ton	-$ 20,562,000
Other Hay	817	1,000 tons	756	$69.50/ton	-$ 4,239,500
Cattle/Calves Inventory	1,536	1,000 head	1,300	$1020.00/head	-$ 240,720,000
TOTAL					**-$ 298,205,020**

Source: USDA

Table 4-13 2005 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2005 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	4,350	$3.50/bu	-$ 5,876,500
Spring Wheat	648	1,000 bu.	315	$3.19/bu	-$ 1,062,270
Barley	8,383	1,000 bu.	5,580	$3.28/bu	-$ 9,193,840
Oats	1,648	1,000 bu.	600	$1.60/bu	-$ 1,676,800
Dry Bean	691	1,000 cwt.	776	$18.70/cwt	$ 1,589,500
Sugar Beet	1,150	1,000 tons	801	$42.80/ton	-$ 14,937,200
Corn	6,328	1,000 bu.	6,860	$2.45/bu	$ 1,303,400
Alfalfa Hay	1,581	1,000 tons	1,560	$75.00/ton	-$ 1,575,000
Other Hay	817	1,000 tons	756	$72.00/ton	-$ 4,392,000
Cattle/Calves Inventory	1,536	1,000 head	1,400	$1140.00/head	-$ 155,040,000
TOTAL					**-$ 190,860,710**

Source: USDA

Table 4-14 2006 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2006 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	3,645	$4.58/bu	-$ 10,918,720
Spring Wheat	648	1,000 bu.	234	$3.80/bu	-$ 1,573,200
Barley	8,383	1,000 bu.	4,845	$3.32/bu	-$ 11,746,160
Oats	1,648	1,000 bu.	684	$2.15/bu	-$ 2,072,600
Dry Bean	691	1,000 cwt.	590	$22.00/cwt	-$ 2,222,000
Sugar Beet	1,150	1,000 tons	798	$46.80/ton	-$ 16,473,600
Corn	6,328	1,000 bu.	5,805	$2.64/bu	-$ 1,380,720
Alfalfa Hay	1,581	1,000 tons	1,400	$101.00/ton	-$ 18,281,000
Other Hay	817	1,000 tons	715	$103.00/ton	-$ 10,506,000
Cattle/Calves Inventory	1,536	1,000 head	1,400	$1010.00/head	-$ 137,360,000
TOTAL					**-$ 212,534,000**

Source: USDA

Table 4-15 Production and Inventory Value Impact for Worst Year of Drought

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	Worst Yearly Production of Drought	Year	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	2,375	2002	$3.70/bu	-$13,519,800
Spring Wheat	648	1,000 bu.	96	2002	$3.90/bu	-$2,152,800
Barley	8,383	1,000 bu.	4,505	2007	$3.62/bu	-$14,038,360
Oats	1,648	1,000 bu.	376	2007	$2.82/bu	-$3,587,040
Dry Bean	691	1,000 cwt.	514	2001	$23.00/cwt	-$4,071,000
Sugar Beet	1,150	1,000 tons	658	2007	$40.20/ton	-$19,778,400
Corn	6,328	1,000 bu.	4,165	2002	$2.60/bu	-$5,623,800
Alfalfa Hay	1,581	1,000 tons	1,150	2002	$111.00/ton	-$47,841,000
Other Hay	817	1,000 tons	450	2002	$106.00/ton	-$38,902,000
Cattle/Calves Inventory	1,536	1,000 head	1,300	2004	$1,020/head	-$240,720,000
TOTAL						**-$390,234,200**

Source: USDA – National Agricultural Statistics Service

The 2000-2004 drought made historical record impacts in Wyoming, with significant negative ramifications particularly on the agricultural industry. The worst-case year was 2002, with a negative dollar impact of $308,171,390 statewide. The counties of Region 2 comprise 12.52% of the State of Wyoming in land area. While drought impacts are not always equally distributed across the state, the potential drought impact in Region 2 could nevertheless be estimated to be over $120 million for the five-year period, based on the region's size alone. The total impact statewide for the 2000-2004 drought was $961,536,160. The 2002 year alone caused Region 2 roughly $38,521,423 in production losses.

Another tool provided by the USDA and used to assess commodity and crop losses is the Risk Management Agency's indemnity summaries, which highlight insurance payments to counties based on damages caused to different crops, by specific hazards (such as drought). From 2007 to 2017, the Region 2 counties experienced drought-caused damages to 22,529 acres of land, totaling $816,288 in indemnity payments. Table 4-16 below breaks down the drought impacts by county, acreage, and commodity type.

Table 4-16 Indemnities Paid for Commodities that Suffered from Drought in Region 2, 2007-2017

Commodity	Counties Affected	Acres Damaged	Indemnity Amount
Forage Production	Niobrara	14,988	$422,739
Forage Seeding	Niobrara	318	$36,294
Oats	Converse, Niobrara	127	$3,009
Wheat	Converse, Niobrara	684	$69,028
All Other Crops	Converse, Natrona	6,412	$285,218
TOTAL		**22,529**	**$816,288**

Source: USDA – Risk Management Agency

In addition to hurting the agricultural industry as well as ranching businesses, drought can exacerbate the risk of wildfires, increase the cost of municipal water usage, and deplete water resources used for recreation and tourism, hence negatively affecting the economy in various ways.

Vulnerability Assessment

The vulnerability of the people, buildings, and economy of Region 2 to drought is very difficult to quantify. Typically, people and structures are not directly vulnerable to drought, though secondary or indirect impacts may eventually increase vulnerability ratings. However, some areas are more vulnerable overall than others and, therefore, benefit from adequate mitigation planning and implementation. For Region 2, the agricultural sector is the most vulnerable to drought and will benefit the most from mitigation efforts. Economic resources tied to agricultural production are extremely vulnerable to drought. Water supply and quality issues are also of concern during times of drought, as are relief, response, and restriction efforts. Outdoor recreation, which is important to the region's economy, is vulnerable to drought too. The geographic extent of the hazard is considered extensive. The probability of future occurrences is considered **likely**, and the potential magnitude/severity is **critical**. In addition, the HMPC considers the hazard to have an overall impact rating of **high** for the entire Region.

Vulnerability is tempered somewhat for Natrona and Niobrara counties with the Laramie Mountains being a headwaters area. The snowpack in the Laramie Mountains typically helps contribute to streamflow during normal years, but can be affected by drier, low snowpack winters.

Future Development

Future development in the Region is not anticipated to change its vulnerability to drought in a significant way.

Summary

Drought is considered a high significance hazard for all counties in the Region due to the extensive economic and environmental impacts. Drought can be widespread and pervasive for several years.

Table 4-17 Drought Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Significant	Likely	Critical	High
Natrona	Significant	Likely	Critical	High
Niobrara	Significant	Likely	Critical	High

4.2.4 Earthquake

Hazard/Problem Description

An earthquake is generally defined as a sudden motion or trembling in the Earth caused by the abrupt release of strain accumulated within or along the edge of the earth's tectonic plates. The most common types of earthquakes are caused by movements along faults and by volcanic forces, although they can also result from explosions, cavern collapse, and other minor causes not related to slowly accumulated strains.

The amount of energy released during an earthquake is usually expressed as a Richter magnitude and is measured directly from the earthquake as recorded on seismographs. The moment magnitude scale (abbreviated as MMS and sometimes denoted as MW or M) is used by seismologists to measure the size of earthquakes in terms of the energy released. The scale was developed in the 1970s to succeed the Richter magnitude scale. Even though the formulas are different, the new scale retains a similar continuum of magnitude values to that defined by the older one. Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface as felt by humans or based on the resulting damage to structures. Intensity is defined in the Modified Mercalli Scale, or MMI, shown in Table 4-18 along with the relevant Peak Ground Acceleration, or PGA (expressed as gravitational/g force percentages). Seismic shaking is typically the greatest cause of losses to structures during earthquakes.

Table 4-18 Modified Mercalli Intensity (MMI) Scale

MMI	Felt Intensity	Acceleration (%g) (PGA)
I	Not felt except by a very few people under special conditions. Detected mostly by instruments.	<0.17
II	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.	0.17 – 1.4
III	Felt noticeably indoors. Standing automobiles may rock slightly.	0.17 – 1.4
IV	Felt by many people indoors, by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.	1.4 – 3.9
V	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned.	3.9 – 9.2
VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.	9.2 – 18
VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction.	18 – 34
VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, great in poorly built structures. Heavy furniture is overturned.	34 – 65
IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.	65 – 124
X	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Considerable landslides occur on steep slopes.	>124
XI	Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.	>124
XII	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.	>124

Source: USGS. http://earthquake.usgs.gov/learn/topics/mercalli.php; Modified Mercalli Intensity and peak ground acceleration (PGA) (Wald, et al 1999).

Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks such as water, power, communication, and transportation lines. Other damaging effects of earthquakes include surface rupture, fissuring, ground settlement, and permanent horizontal and vertical shifting of the ground. Secondary impacts can include landslides, seiches, liquefaction, fires, and dam failure, which in turn could lead to flooding. The combination of widespread primary and secondary effects from large earthquakes make this hazard potentially devastating.

Part of what makes earthquakes so destructive is that they generally occur without warning. The main shock of an earthquake can usually be measured in seconds, and rarely lasts for more than a minute. Aftershocks can occur within the days, weeks, and even months following a major earthquake.

By studying the geologic characteristics of faults, geoscientists can often determine when the fault last moved and estimate the magnitude of the earthquake that produced the last movement. Because the occurrence of earthquakes is relatively infrequent in Region 2 and the historical earthquake record is short, accurate estimations of magnitude, timing, or location of future dangerous earthquakes in the Region are difficult to estimate.

Liquefaction

During an earthquake, near surface (within 30 feet), relatively young (less than 10,000 years old), water-saturated sands and silts may act as a viscous fluid. This event is known as liquefaction (quicksand is a result of liquefaction). Liquefaction occurs when water-saturated materials are exposed to seismic waves. These seismic waves may compact the material (e.g., silts and sands), increasing the interior pore water pressure within the material mass.

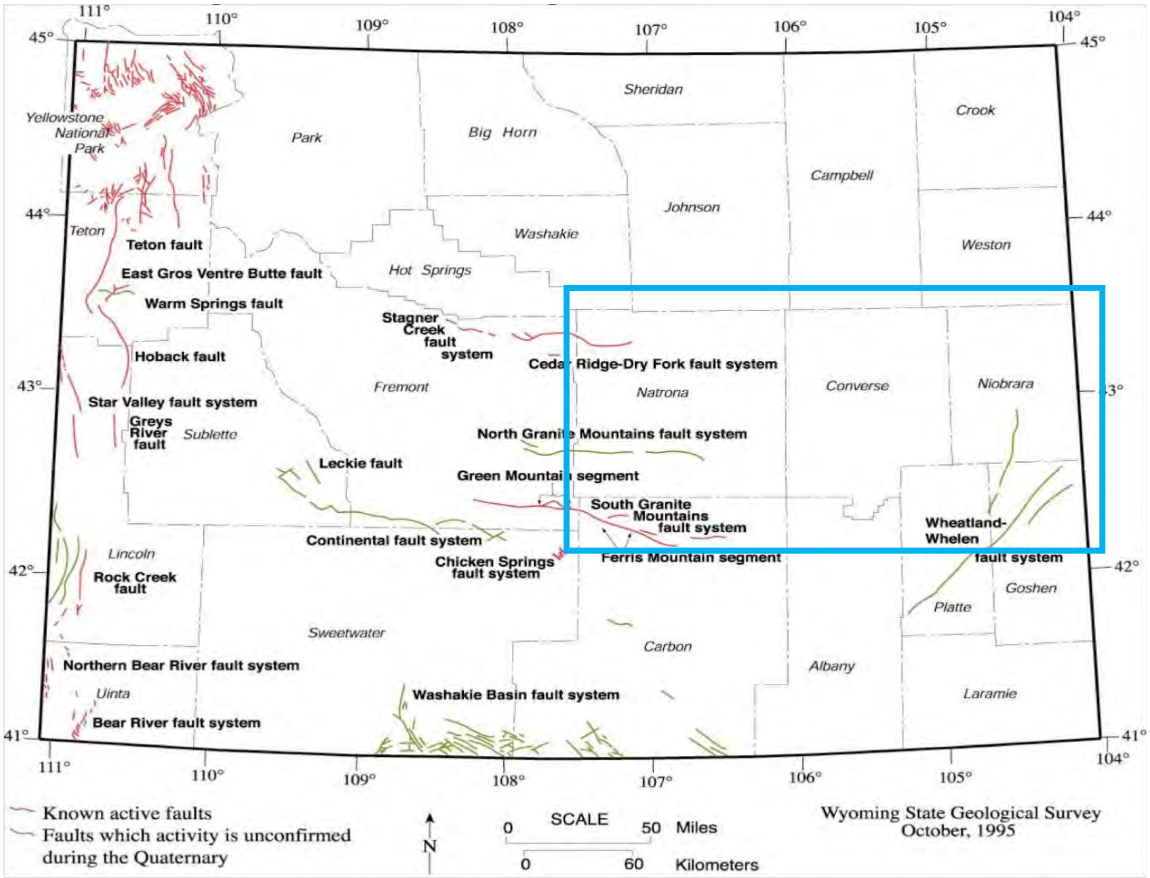
When the pore pressure rises to about the pressure of the weight of the overlying materials, liquefaction occurs. The result of the saturated soil's loss in strength and stiffness from ground moving and shaking ends up making that soil/sand behave like a liquid. If the liquefaction occurs near the surface, the soil bearing strength for buildings, roads, and other structures may be lost. Buildings can tip on their side, or in some cases sink. Roads can shift and become unstable to drive on. If the liquefied zone is buried beneath more competent material, cracks may form in the overlying material, and the water and sand from the liquefied zone can eject through the cracks as slurry.

Geographical Area Affected

Most Wyoming earthquakes outside of Yellowstone National Park occur as a result of movement on faults. If the fault has moved within the Quaternary geological period, or last 1.6 million years, the fault is considered to be active. Active faults can be exposed at the surface or deeply buried with no significant surface expression. Historically, no earthquakes in Wyoming have been associated with exposed active faults. The exposed active faults, however, have the potential to generate the largest earthquakes. As a result, it is necessary to understand both exposed and buried active faults in order to generate a realistic seismological characterization of the state.

As shown in Figure 4-6, there are approximately 80 Quaternary faults mapped in Wyoming, with 26 considered active.

Figure 4-6 Exposed Known or Suspected Active Faults in Wyoming



Source: Wyoming Geological Survey - www.wsgs.wyo.gov
Blue square denotes the Region 2 planning area

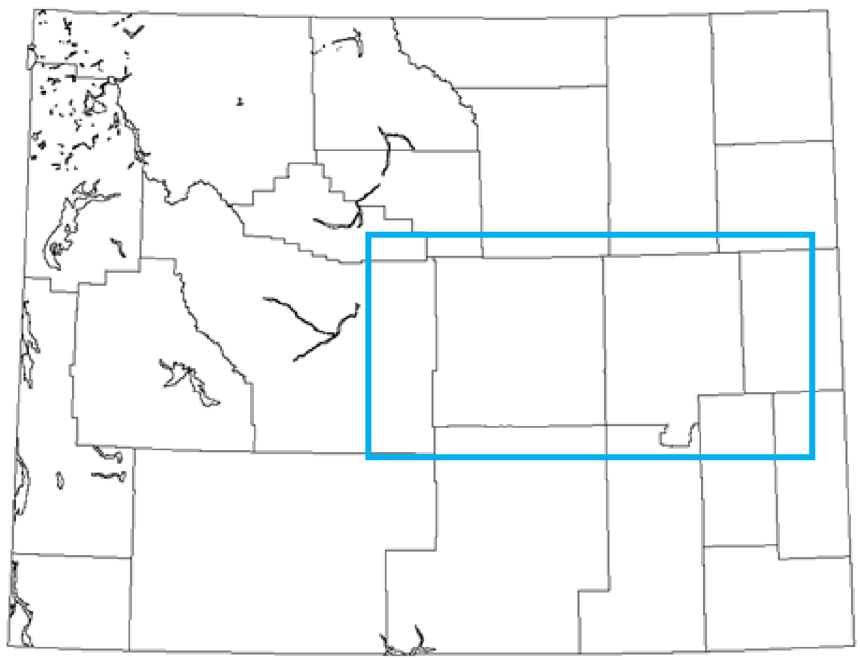
The only known active fault in Region 2 is the Cedar Ridge-Dry Fork fault system in northern Natrona county, which is believed to be capable of generating a magnitude 6.5+ earthquake. The 35-mile long Cedar Ridge fault comprises the western portion of the fault system, and the 15-mile long Dry Fork fault makes up the eastern portion. After various assessments, the Geomatrix Corporation concluded that it is not possible to conduct a reliable deterministic analysis on the fault system; however, general estimates can be made. Although there is no compelling reason to believe that the Dry Fork fault system is currently active, if it did activate as an isolated system, it could potentially generate up to a magnitude 6.7 earthquake.

Additional fault lines in Region 2 that are not confirmed as being active include the Wheatland-Whelen fault system that runs from southern Niobrara County south through Goshen and Platte Counties. The South Granite Mountains fault system south of Natrona County (across north

Carbon County and running into Fremont County) is in very close proximity, and could affect said county or even the Region were it to cause an earthquake, though an area sparsely populated.

Figure 4-7 shows areas in Wyoming that could experience liquefaction during an intense earthquake. Areas shown as black lines have sands and coarse silts that are less than 10,000 years in age and are within 30 feet of the surface. Region 2 does not contain any areas susceptible to liquefaction; however, there is liquefaction potential in neighboring Fremont, Hot Springs, and Washakie Counties. Overall, the geographic extent of this hazard across the Region is **limited**.

Figure 4-7 Wyoming Liquefaction Coverage



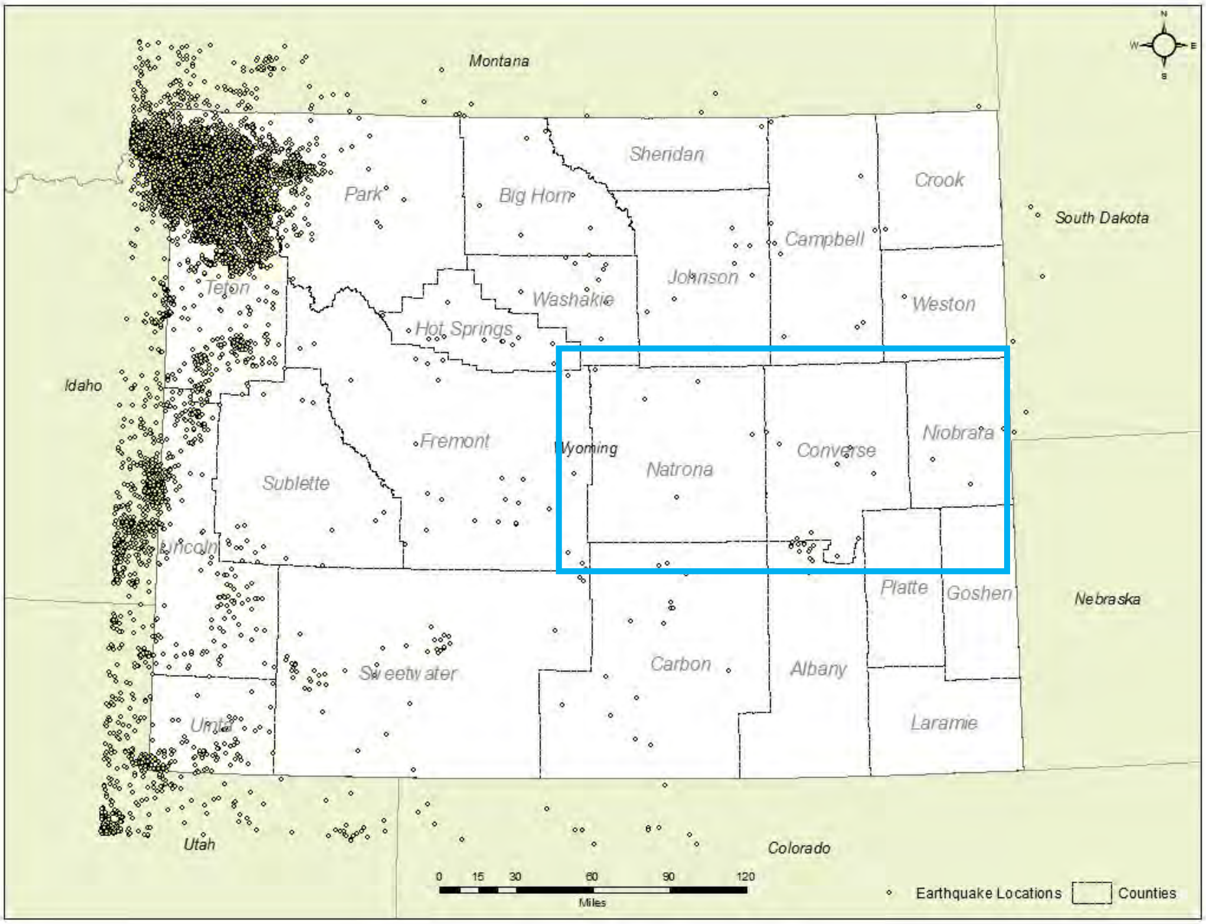
Source: Wyoming Geological Survey - www.wsgs.wyo.gov
Blue square denotes Region 2 planning area

Past Occurrences

Prior to the 1950s, most earthquakes were detected and located by personal reports. After the Hebgen Lake earthquake in 1959 near Yellowstone Park, monitoring in Wyoming started to improve and earthquakes were more commonly located by seismometers.

Since 1871, the state has logged some 47,000 earthquakes, with the majority of the events taking place in the western third of the state (see Figure 4-8) where the majority of the active, or Quaternary Period faults, are identified.

Figure 4-8 Wyoming Historic Earthquake Occurrences Statewide 1963- 2010



Source: Wyoming Geological Survey - Wyoming Earthquake Hazard and Risk Analysis: HAZUS-MH Loss Estimations for 16 Earthquake Scenarios Report
Blue square denotes Region 2 planning area

Historically, earthquakes have occurred in every county in Wyoming, to varying magnitude and intensity degrees. The first was reported in Yellowstone National Park in 1871. Data on instrumentally recorded earthquakes is available from the USGS Earthquake Hazards Program dating back to 1973. Thirty-two earthquakes of magnitude 2.5 and greater have been recorded in the Region's recent history (since 1889), with seven of these events taking place in Natrona County, sixteen in Converse County, and nine in Niobrara County. These earthquakes are noted in the tables below, along with discussions of notable events by county. For more details on the specific events, and previous (older) historical record of earthquakes in any of the three counties, please refer to the individual County Plans included in the annex.

Converse County

There have been sixteen earthquake events recorded in Converse County since 1947. Most of these events fall in the IV intensity category, ranging from a magnitude of 2.9 to 5.5. These events are presented in Table 4-19, with the most recent described further in the following text.

Table 4-19 Converse County Seismic Events, 1947 – 2018

Location	Date	Magnitude / Intensity	Damage, Injuries, Additional Information
LaPrele Creek, southwest of Douglas	1947-04-14	V	The earthquake was felt by everyone in a ranch house and by a few outdoors. Windows were rattled, chairs were moved, and buildings shook
7 miles north-northeast of Esterbrook	1952-04-21	IV	Felt by several people in the area and was reportedly felt 40 miles to the southwest of Esterbrook
7 miles north-northeast of Esterbrook	1952-19-02	N/A	Small magnitude event; no damage reported
7 miles north-northeast of Esterbrook	1957-01-05	III	No damage reported
7 miles north-northeast of Esterbrook	1964-03-31	IV	No damage reported
About 2.5 miles northeast of Esterbrook, near Sunset Hill	1978-01-16	3.0	No damage reported
About 11.5 miles northwest of Glenrock, and 6 miles east of the boundary with Natrona County	1983-11-15	3.0	No damage reported
4 miles west of Toltec in norther Albany County, 21 miles south of Esterbrook	1984-10-18	5.5	Felt in Wyoming, South Dakota, Nebraska, Colorado, Utah, Montana, and Kansas. It cracked buildings and shook items from shelves in grocery stores in Douglas.
About 0.7 miles north of the boundary with Albany, on Chimney Ridge and northwest of Coverdale Basin (half a mile east of Campbell Creek)	1984-12-06	2.9	No damage reported
About 11 miles northeast of Orpha, 5.7 miles west of Highway 59, and 5 miles south of Highland Loop Rd	1993-06-30	3.0	No damage reported
About 3.2 miles north of the boundary with Albany County, running parallel to Old Fort Fetterman Rd (between Reed and Jackson Creeks)	1993-07-23	3.7	The event was felt as far away as Laramie
Almost 9 miles southeast of Esterbrook, between Esterbrook Rd and Horseshow Creek	1993-12-13	3.2	No damage reported
About 29 miles northwest of Glenrock, and 1 mile east of the boundary with Natrona County	1996-10-19	4.2	No damage reported

Location	Date	Magnitude / Intensity	Damage, Injuries, Additional Information
About 7.6 miles northeast of Orpha, and 9.7 miles north of the Converse Airport	2004-02-15	3.5	n/a
About 2.3 miles northeast of Orpha, and 7.5 miles northwest of the Converse Airport	2004-08-29	3.8	n/a
On Bill Hall Rd. 0.4 miles west of the intersection with the train rail tracks	2008-11-03	3.5	n/a

Source: http://earthquake.usgs.gov and Wyoming Geological Survey

The latest earthquake in the County occurred early November of 2008, with its epicenter about 11.3 miles northeast of Douglas, 11.8 miles north of Orin, and 10.25 miles northwest of Shawnee, right on Bill Hall Rd. It had a magnitude of 3.5, and a reported depth of 5 kilometers (about 3.1 miles).

The previous most recent event was a 3.8 earthquake on August 29, 2004, with the epicenter approximately 11 miles northwest of Douglas. There was no reported damage, but the earthquake was felt throughout the city and even on nearby highways. Members from the HMPC commented on this event, remarking that this quake occurred in the middle of vacant land and there was no damage reported because there were no structures or infrastructure near the epicenter.

Natrona County

Natrona County has record of 7 earthquakes since 1993. These earthquakes are detailed in Table 4-20, with key events described further in the following text.

Table 4-20 Natrona County Seismic Events, 1993 – 2018

Location	Date	Magnitude / Intensity	Damage or Injuries
About 4 miles southwest of Devils Monument, and 11.7 miles west of Interstate 25	1993-03-10	3.2	No damage reported
About 1.6 miles south of the northwest corner of the county, and 2.9 miles east of the same corner	1999-11-09	3.1	No damage reported
About 5.3 miles west of the boundary with Converse County, and 12.7 miles south of the Naval Petroleum Reserve	2003-02-01	3.7	n/a
About 5.6 miles west of Thirtythree Mile Rd, near the Big Sulfur Draw	2012-11-30	3.1	n/a
11.2 miles SSW of Midwest	2015-11-30	3.1	n/a
8.7 miles WSW of Midwest	2015-12-27	2.5	n/a
17.4 miles SSE of Mills	2016-08-22	3.2	n/a

Source: http://earthquake.usgs.gov and Wyoming Geological Survey

The seven earthquakes in Natrona County range from magnitudes of 2.5 to 3.7. The event of highest magnitude took place February 1, 2003, about 5.3 miles west of the boundary with Converse County, and 12.7 miles south of the Naval Petroleum Reserve. It was a 3.7 magnitude earthquake, but no damage information was available in the USGS database. In late November of 2015 another earthquake was reported, of magnitude 3.1. Its epicenter was located about 11.2 miles south-southwest of Mills. The latest took place August 22 of 2016, being a magnitude 3.2 quake. No damage details were available from the USGS database for this event, but its epicenter was found about 17.4 miles south-southeast of Mills. Four other earthquakes were reported in the County's recent history, ranging from 1993 to 2015, and 2.5 to 3.2 in M magnitude.

Niobrara County

Niobrara County has experienced eleven seismic events since 1889. They are identified in Table 4-21, with key events described further in the following text.

Table 4-21 Niobrara County Seismic Events, 1889 – 2018

Location	Date	Magnitude / Intensity	Damage or Injuries
Lusk, Manville, and Muskrat Canyon	1889-10-08	?	Unknown
18 miles south of Lusk	1942-02-25	V	No damage reported
near Guernsey, approximately 38 miles south-southwest of Lusk	1954-10-03	IV	Event felt from Douglas to Wheatland, but no damage reported. Train traffic between Douglas and Wheatland temporarily halted
21 miles southeast of Lusk	1964-03-28	V	No damage reported
17 miles northwest of Lusk	1964-08-22	4.5 / V	Much of the town was attending a concern. When attendees felt the tremor, they thought the furnace had blown up. However, no damage was reported
Few miles south of Lusk	1992-11-02	3.0	Little damage reported
26 miles northeast of Lusk	1996-04-09	3.7	Quake felt in Lusk but no damage reported.
Southwestern corner of South Dakota	1996-05-03	3.1	No damage reported
19 miles outside of Lance Creek	2008-08-22	3.1	No damage reported
Lusk and much of the county	2008-12	?	No damage reported
13 miles away from Van Tassell	2011-03-10	2.9	No damage reported

Source: http://earthquake.usgs.gov and Wyoming Geological Survey

The earthquakes on record for Niobrara ranged from intensity IV-V, with magnitudes of 2.9 to 4.5. None of the events resulted in damages or injuries. The earliest recorded earthquake in Niobrara County occurred on October 8, 1889. The event was felt in Lusk, Manville, and Muskrat Canyon and traveled in a northeasterly direction (Case, 1993). The most recent earthquake took place March 10 of 2011, about 13 miles away from Van Tassell. Its magnitude was of 2.9 M. For a more detailed history of these earthquakes in Niobrara County, please visit the County Annex.

Regional Summary

Table 4-22 Earthquakes Greater than 2.5 in Region 2: 1889 – 2018

County	Magnitude 2.5-2.9 Intensity I	Magnitude 3.0-3.9 Intensity II-III	Magnitude 4.0-4.9 Intensity IV-V	Magnitude 5.0-5.9 Intensity VI-VII	Not Rated	Total
Converse	1	9	4	1	1	16
Natrona	1	6	--	--	--	7
Niobrara	1	4	2	2	2	11
Total	**3**	**19**	**6**	**3**	**3**	**34**

Source: Analysis of data from USGS Earthquake Hazards Program and Wyoming Geological Survey

Table 4-23 Top Ten Highest Magnitude* Earthquakes in Region 2: 1942 – 2018

County	Magnitude/Intensity	Date
Converse	5.5	1984-10-18
Niobrara	4.5 / V	1964-08-22
Converse	4.2	1996-10-19
Converse	3.8	2004-08-29
Converse	3.7	1993-07-23
Natrona	3.7	2003-02-01
Niobrara	3.7	1996-04-09
Converse	3.5	2004-02-15
Converse	3.5	2008-11-03
Converse	3.2	1993-12-13
Natrona	3.2	1993-03-10
Natrona	3.2	2016-08-22

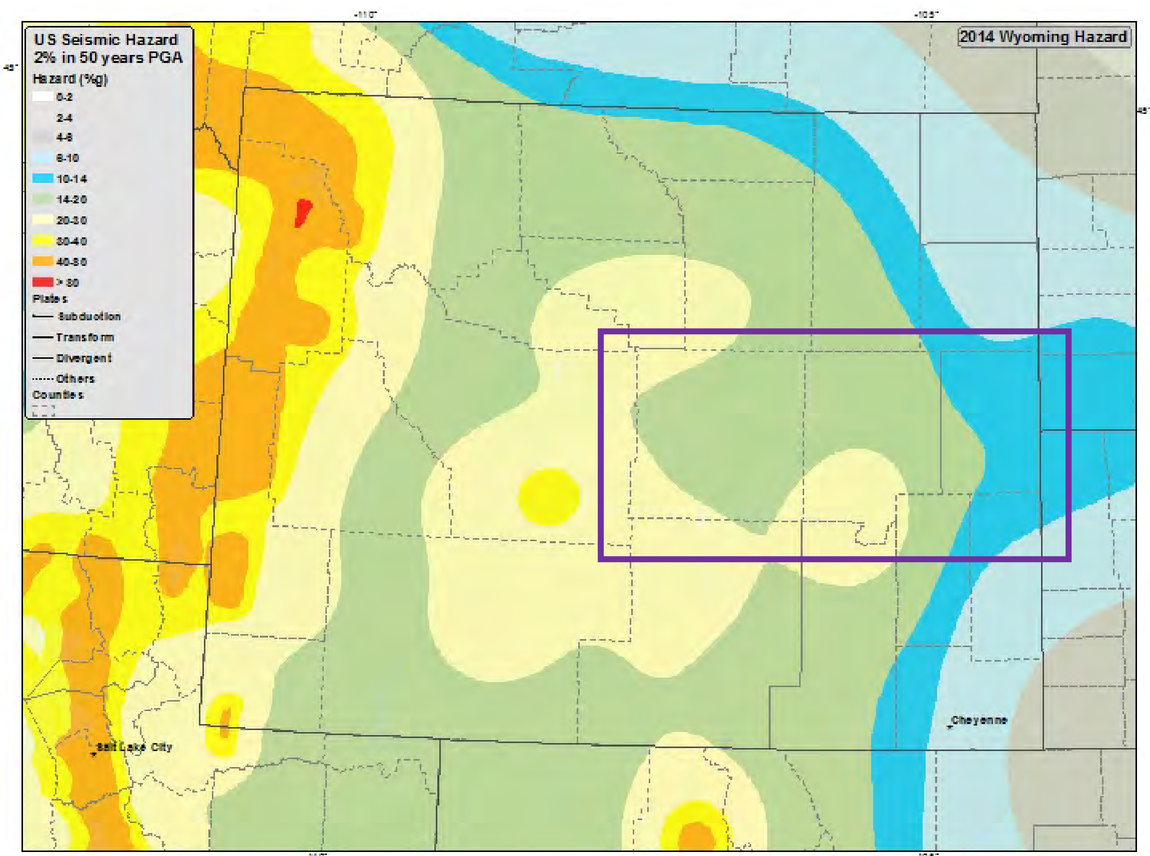
*Based on instrumentally recorded earthquakes.
Source: USGS Earthquake Hazards Program and Wyoming Geological Survey

Frequency/Likelihood of Occurrence

With a total of 34 recorded earthquakes with a magnitude greater than 2.5 in the last 130 years, the Region is likely to experience an earthquake almost every three years; or an **occasional** occurrence rating. Considering past occurrences, however, the earthquakes are likely to cause little to no damage. To determine the likelihood of damaging earthquakes, the U.S. Geological Survey (USGS) publishes probabilistic ground acceleration maps for 500-, 1000-, and 2,500-year time frames. The maps show what accelerations may be met or exceeded in those time frames by expressing the probability that the accelerations will be met or exceeded in a shorter time frame. For example, a 10% probability that ground acceleration may be met or exceeded in 50 years is roughly equivalent to a 100% probability of exceedance in 500 years. The 2,500-year (2% probability of exceedance in 50 years) map is shown in the figure below. The International Building Code uses a 2,500-year map as the basis for building design. The maps reflect current perceptions on seismicity in Wyoming based on available science. In many areas of Wyoming, ground accelerations shown on the USGS maps can be increased further due to local soil conditions. For example, if the ground/soil is fairly soft, saturated sediments are expected to be present at the surface, and seismic waves passed through them, so that surface ground accelerations will usually be greater than would be experienced if only bedrock (i.e., solid ground mass/rock) was present. In this case, the ground accelerations shown on the USGS maps would underestimate the local hazard, as they are based upon accelerations that would be expected if firm soil or rock were present at the surface.

As the historic record is limited, it is nearly impossible to determine when a 2,500-year event last occurred in the county. Because of the uncertainty involved and based upon the fact that the new International Building Code utilizes 2,500-year events for building design, it is suggested that the 2,500-year probabilistic maps be used for regional and county analyses. This conservative approach is in the interest of public safety.

Figure 4-9 2,500-year Probabilistic Acceleration Map (2% Probability of Exceedance in 50 years)



Source: Wyoming Geological Survey
Purple square denotes Region 2 planning area

Potential Magnitude

Very limited damages have been documented in the Region from historic earthquakes. Because of the limited historic record, however, it is possible to underestimate the seismic hazard in the Region if historic/reported earthquakes are used as the sole basis for analysis. Earthquake and ground motion probability maps give a more reasonable estimate of damage potential in areas with or without exposed active faults at the surface. Current earthquake probability maps that are used in the newest building codes suggest a scenario that would result in moderate damage to buildings and their contents, with ground shaking potential higher in Natrona and Converse counties. Overall, however, the potential magnitude/severity of earthquakes to the Region could be **critical**.

Vulnerability Assessment

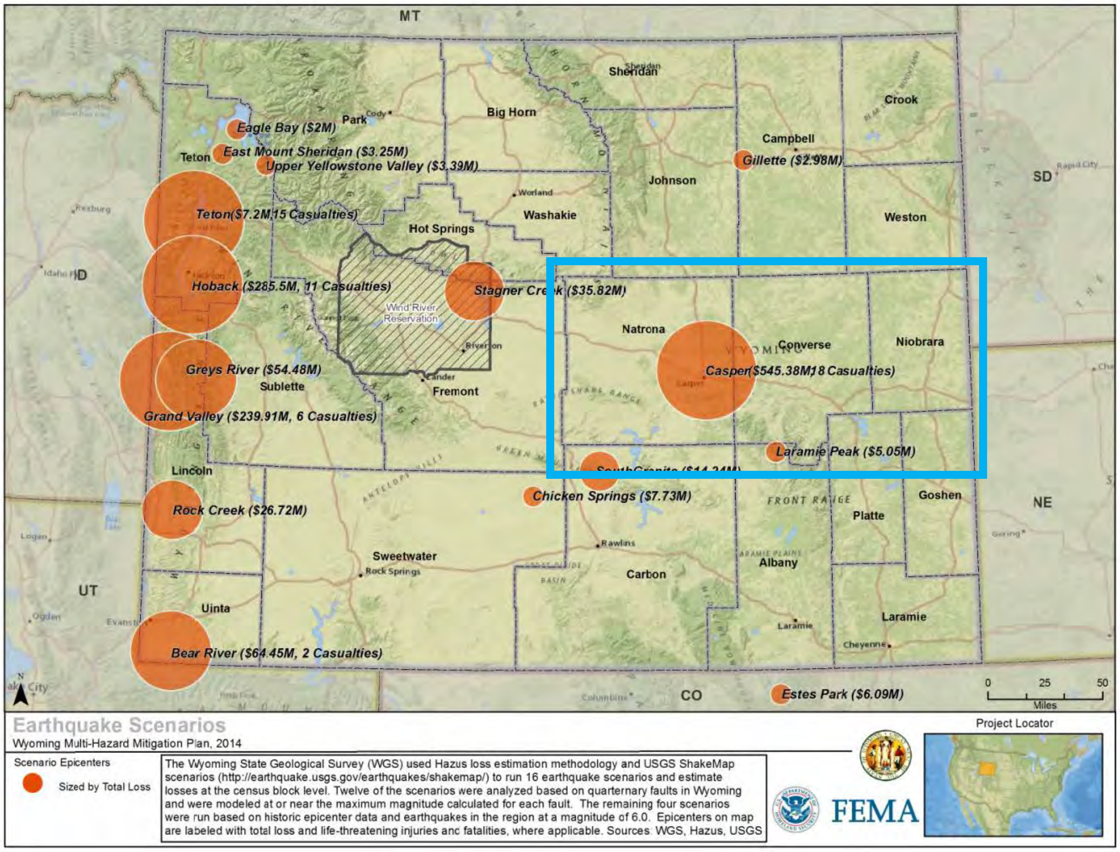
The Wyoming State Geological Survey conducted a study in 2011 to model loss estimations for 16 earthquake scenarios, in order to quantify the magnitude of earthquake impacts around the state. The scenarios included four random event scenarios run on the basis of data from historic earthquakes that occurred near Casper, Gillette, Laramie Peak, and Estes Park, Colorado. Each of the historic, random event earthquake scenarios registered a 6.0 magnitude. The Estes Park Scenario was based on an event occurring in 1882, the Casper area event in 1897, and the Gillette and Laramie Peak events in 1984 (Source: Wyoming Geological Survey, "Wyoming Earthquake Hazard and Risk Analysis: HAZUS-MH Loss Estimations for 16 Earthquake Scenarios, 2011).

HAZUS (Hazards U.S.) is a nationally standardized, GIS-based risk assessment and loss estimation computer program that was originally designed in 1997 to provide the user with an estimate of the type, extent, and cost of damages and losses that may occur during and following an earthquake. It was developed for FEMA by the National Institute of Building Sciences (NIBS). There have been a number of versions of HAZUS generated by FEMA since then, with HAZUS-MH 4.2 (HAZUS -- Multi-Hazard version 4.2) being the most recent release.

The study included information regarding the likelihood of damage to local and regional infrastructure, including fire stations, police stations, sheriffs' departments, schools, and hospitals. The scenarios reflect anticipated functionality of each infrastructure system immediately following the scenario earthquake, on day seven following the earthquake as well as one month after the earthquake. Additional information provided includes anticipated households displaced or seeking temporary shelter, electrical outages predicted, number of households without potable water, debris generated by the scenario, and economic losses resulting from three categories: buildings, transportation, and utilities.

The map in Figure 4-10 shows epicenter locations of the scenarios, sized by total loss. Epicenters on the map are labeled with their total loss and, if applicable, life-threatening injuries and fatalities.

Figure 4-10 AZUS-MH Earthquake Scenarios for Wyoming, 2011



(Source: Wyoming Multi-Hazard Mitigation Plan, 2014)

Note that a more focused Hazus Earthquake model was run specifically for Converse County, and is included in the recent Converse County Hazard Mitigation Plan attached in the county annexes. In addition, more information on general earthquake vulnerability, potential losses estimated by the Wyoming State Geological Survey, and Hazus derived results can also be found in the respective County Plans (included in the annexes) as well as in the Wyoming State Hazard Mitigation Plan from 2016.

Casper Area Historic Random Earthquake Event Scenario

The Casper Area "random event" scenario, which was based on a repeat of the November 14th, 1897 earthquake, had the most impact on the counties in Region 2, with significant effects felt in Natrona and Converse Counties. The earthquake scenario was modeled at magnitude 6.0. Scenario results estimate a total economic loss of $564.11 million dollars in the Region. $545.38M of the loss was in building losses and 8 casualties. The regional direct economic loss for utilities would be 15.302 million dollars. Natrona County would expect the highest losses at $15.137 million dollars. The losses reflect damage to potable water, waste water, and natural gas pipelines;

as well as losses to waste water, oil system, natural gas, electrical power, and communication facilities. The scenario results show that 7,832 of those would sustain at least moderate damage from the earthquake. The earthquake would generate 266,000 tons of debris. Schools in the Casper area, with the exception of Red Creek Elementary, would be between 29-72% functional the day of the earthquake, with those closest to the epicenter having the lowest functionality. The schools would be between 44-93% functional on day 7 and over 74% functional on day 30.

Fault Based Scenario – South Granite Mountains System

Of the 16 fault-based scenarios modeled by the Wyoming Geological Survey, the South Granite Mountains fault system had the most impact on the region, primarily affecting Natrona County. The earthquake scenario was modeled at magnitude 6.75. The earthquake would also cause damage in Carbon, Fremont, and Sweetwater Counties, though. Scenario results estimate that very light damage would be expected up to 45 miles from the epicenter. Light damage would be expected as far as 30 miles, including the town of Alcova. The total population in the scenario region is 16,732 based on the 2000 census. In this assessment, only 3 households would be displaced, and one person would seek temporary shelter. There are 12,197 buildings in the area, and scenario results show that 437 of those would sustain at least moderate damage from the earthquake. The earthquake would generate 6,000 tons of debris. The modeled earthquake would cause a total economic loss of $22.387 million dollars for the region. Direct economic losses are estimated in three categories: buildings, transportation, and utilities.

Buildings

Direct economic losses for buildings, which include structural and content damage, would total $14.245 million dollars for the South Granite Mountains fault region. Natrona County is modeled to have $2.992 million dollars in direct economic losses for buildings.

Transportation

Direct transportation losses for the region are expected to be $1.145 million dollars. Natrona County would be expected to see $144,000 in damage to bridges and airports.

Utilities

The South Granite Mountains fault regional direct economic loss for utilities would be $6.997 million dollars. Natrona County's losses are predicted to be $586,000 from damage to wastewater and natural gas pipelines and facilities, as well as electrical facilities.

Essential Facilities

Essential facilities include fire stations, hospitals, police stations, and schools. Several details on the estimated impacts to these facilities can be referenced in the WYGS report. As a general consensus, damage to essential facilities in Natrona is projected to be minimal to non-existent.

Probabilistic Scenario

In the Wyoming Multi-Hazard Mitigation Plan, HAZUS 2.1 was used to develop losses associated with a 2,500-year probabilistic earthquake scenarios for each county in the State of Wyoming. This scenario uses USGS probabilistic seismic contour maps to model ground shaking with a 2% probability of being exceeded in 50 years (or a 2,500-year event). Total losses include building, contents, inventory, and income-related losses.

The following table lists total loss, loss ratio (total loss/total building inventory value), and ranges of casualties within severity levels. HAZUS provides casualty estimates for 2 am, 2 pm, and 5 pm to represent periods of the day that different sectors of the community are at their peak occupancy loads. The casualty ranges represent the lowest to highest casualties within these times of day. Casualty severity levels are described as follows:

- Level 1: Injuries will require medical attention but hospitalization is not needed
- Level 2: Injuries will require hospitalization but are not considered life-threatening
- Level 3: Injuries will require hospitalization and can become life-threatening if not promptly treated
- Level 4: Victims are killed by the earthquake

The table is sorted and ranked by total loss, with the Region 2 counties highlighted in light orange.

There are two methods for ranking counties to determine where earthquake impacts may be the greatest. Either loss ratios or total damage figures can be used. The loss ratio is determined by dividing the sum of the structural and non-structural damage by the total building value for the county. The loss ratio is a better measure of impact for a county, since it gives an indication of the percent of damage to buildings.

Table 4-24 2500-Year Probabilistic Scenario Loss Estimates

Rank	County	Total Loss ($M)	Loss Ratio	Casualties Level 1	Casualties Level 2	Casualties Level 3	Casualties Level 4
1	Teton	$654	27%	150-300	40-90	0-20	10-30
2	Lincoln	$528	63%	190-220	50-60	0-20	10-20
3	Natrona	$268	11%	50-60	10	0	0
4	Uinta	$247	18%	90-120	20-30	0-10	0-10
5	Sweetwater	$181	19%	50	10	0	0
6	Fremont	$115	25%	20	0	0	0
7	Laramie	$105	4%	20	0	0	0
8	Sheridan	$84	9%	20	0	0	0
9	Albany	$81	21%	20	0	0	0
10	Campbell	$79	14%	20	0	0	0
11	Park	$79	1%	20	0	0	0
12	Sublette	$74	6%	20	0-10	0	0
13	Carbon	$64	1%	10	0	0	0
14	Converse	$50	28%	10	0	0	0
15	Washakie	$28	1%	10	0	0	0
16	Big Horn	$26	4%	0-10	0	0	0
17	Johnson	$25	1%	0-10	0	0	0
18	Platte	$20	3%	0	0	0	0
19	Hot Springs	$20	1%	0	0	0	0
20	Goshen	$11	1%	0	0	0	0
21	Weston	$7	0%	0	0	0	0
22	Crook	$5	1%	0	0	0	0
23	Niobrara	$4	1%	0	0	0	0
	Total	**$2,755**					

Source: Wyoming State Hazard Mitigation Plan 2016

The total damage figure by itself does not reflect the percentage of building damage, since small damage to a number of valuable buildings may result in a higher total damage figure than may be found in a county with fewer, less expensive buildings with a higher percentage of damage.

Liquefaction Vulnerability

There have been little, if any, reported damages from liquefaction in Wyoming. Given that ground motions associated with Intensity VIII or larger are usually needed to trigger liquefaction, and that only small areas of the region would experience that level of shaking during the 2% event (2%

probability of exceedance in 50 years), liquefaction would be a rare occurrence in the Region. The 2016 Wyoming State Hazard Mitigation Plan notes that all three counties in the region have $0 in exposure to liquefaction.

Future Development

Future development in the Region is not anticipated to change vulnerability to earthquake hazards significantly.

Summary

Due to the Cedar Ridge-Dry active fault in the region and the South Granite Mountains system just south of Natrona County, as well as previous occurrence data, there is an indication for potential for damaging seismic activity in the Region. Within Region 2, the two counties that have the highest level of susceptibility and exposure are Natrona and Converse, respectively. In addition, and although the probability is low, WSGS studies indicate the possibility that a 6.5 magnitude could occur anywhere in the state. For more details on each county's earthquake studies and the state-wide assessment performed by the WSGS, refer to individual county annexes or the 2016 Wyoming State Hazard Mitigation Plan.

Table 4-25 Earthquake Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Limited	Occasional	Critical	Medium
Natrona	Significant	Occasional	Critical	High
Niobrara	Limited	Occasional	Limited	Low

4.2.5 Expansive Soils

Hazard/Problem Description

Expansive soils contain clay which causes the material to increase in volume when exposed to moisture and shrink as it dries. They are also commonly known as expansive, shrinking and swelling, bentonitic, heaving, or unstable soils.

The clay materials in swelling soils are capable of absorbing large quantities of water and expanding 10% or more as the clay becomes wet. The force of expansion is capable of exerting pressures of 15,000 pounds per square foot or greater on foundations, slabs, and other confining structures. (Ibid., p 17.) The amount of swelling (or potential volume of expansion) is linked to five main factors: the type of mineral content, the concentration of swelling clay, the density of the materials, moisture changes in the environment, and the restraining pressure exerted by materials on top of the swelling soil. Each of these factors impact how much swelling a particular area will experience, but may be modified, for better or worse, by development actions in the area.

- **Low**—this soils class includes sands and silts with relatively low amounts of clay minerals. Sandy clays may also have low expansion potential, if the clay is kaolinite. Kaolinite is a common clay mineral.
- **Moderate**—this class includes silty clay and clay textured soils, if the clay is kaolinite, and also includes heavy silts, light sandy clays, and silty clays with mixed clay minerals.
- **High**—this class includes clays and clay with mixed montmorillonite, a clay mineral which expands and contracts more than kaolinite.

Geographical Area Affected

Expansive soils occur throughout the Region. Figure 4-11 and Figure 4-12 illustrate possible expansive soils locations in Wyoming. Figure 4-12is based on select geologic formations that have characteristics that could lead to expansive soils where they outcrop.

The HMPCs reported that the U.S. Bureau of Land Management is working with the Wyoming Department of Transportation (DOT) to update expansive soils mapping.

Figure 4-11 Expansive Soil Potential in Region 2

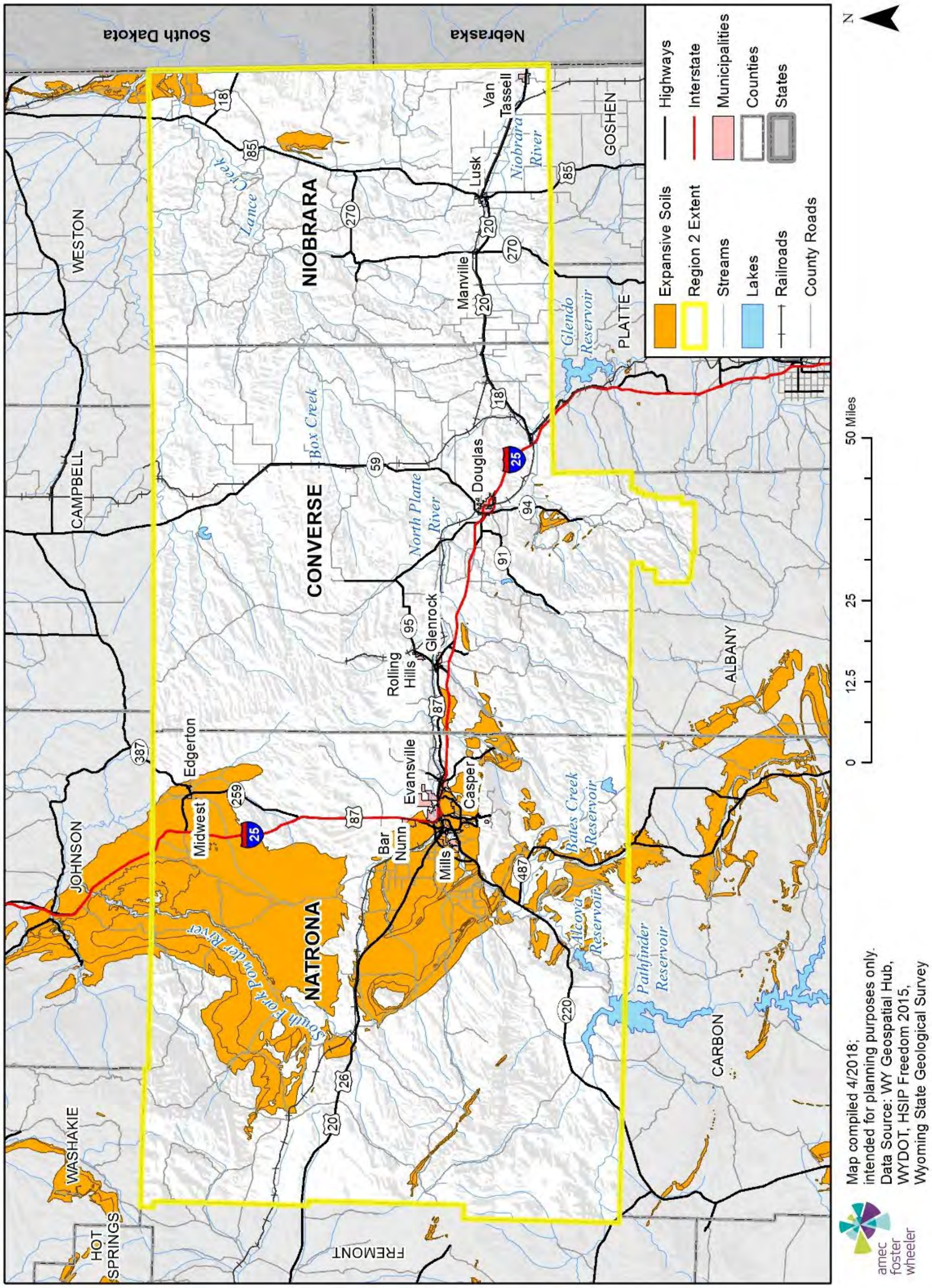


Figure 4-12 Wyoming Mapped Formations with Potential for Expansive Soils

Source: State of Wyoming Multi-Hazard Mitigation Plan 2016

Table 4-26 Percentage of Land Area Estimated to be Susceptible to Expansive Soils

County	% Expansive Soils based on Total Area
Converse	1.2%
Natrona	29.5%
Niobrara	2.0%
Region 2	**13.5%**

Data Source: WY Geospatial Hub

Based on the figures above, expansive soils have the potential to affect a **limited** portion of the planning area. Note however that there is a significant variation between counties. The geographic extent of any individual expansive soil incident is likely to be extremely localized.

Past Occurrences

Very little data exists on expansive soil problems and damages in Wyoming. Studies on the issue have not been performed and no database exists to catalog occurrences. The 2016 State of Wyoming Multi-Hazard Mitigation Plan states "Although there have been instances in the Casper area where foundations and other concrete work have fractured and been displaced, historical accounts of actual damaging events caused by expansive soils have been difficult to locate." Damages due to expansive soils such as foundation cracks, parking lot/sidewalk cracks, etc. do occur but are generally handled by individual property owners. Other damages to supply lines, roads, railways, bridges and power lines typically occur over time and are not attributed to or reported as an event.

Frequency/Likelihood of Occurrence

Historical data on expansive soils issues was not readily available, making frequency difficult to extrapolate. Based on HMPC discussions, expansive soils are **likely** to continue to be an occasional problem for the jurisdictions in Region 2.

Potential Magnitude

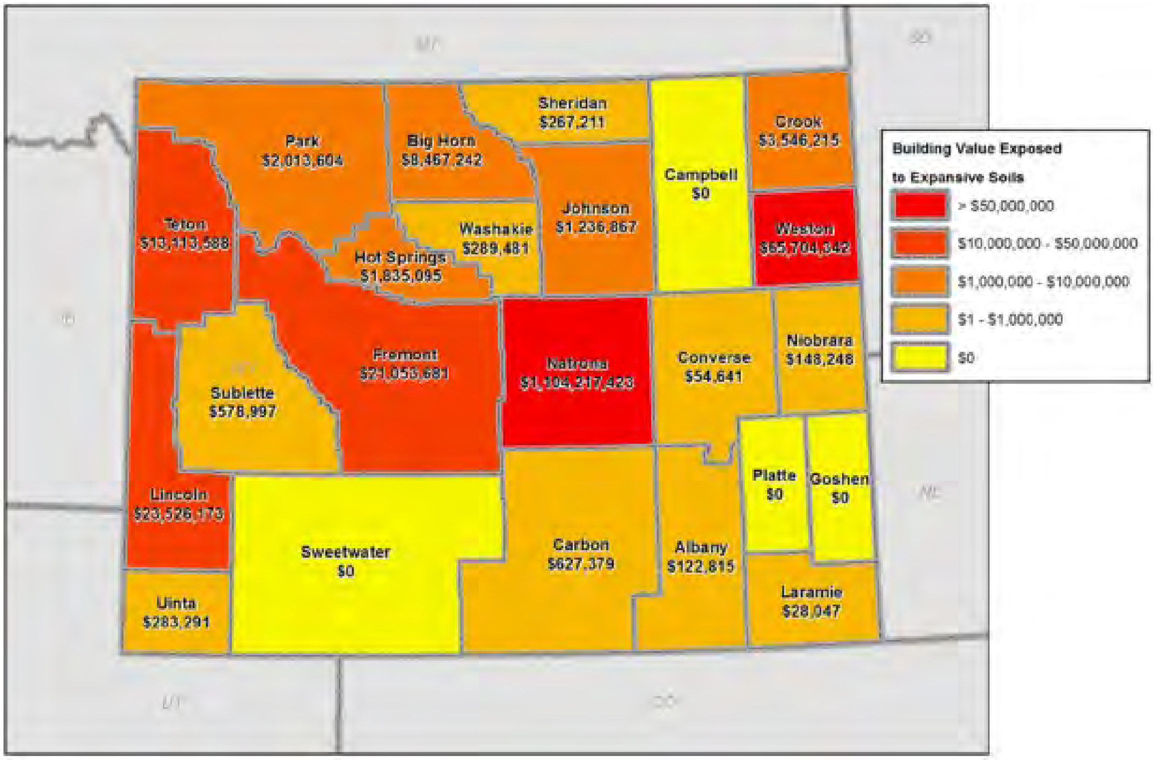
The potential magnitude of expansive soils events and damages is estimated to be **negligible** for the counties in the Region, with limited and isolated impacts. Because damages from expansive soils are difficult to track due to limited reporting, it is difficult to estimate the potential severity of a problem. Expansive soils can create localized damage to individual structures and supply lines, such as roads, railways, bridges and power lines, but no significant impacts have been reported.

Vulnerability Assessment

According to the Wyoming State Multi-Hazard Mitigation Plan there are two measurements used for calculating potential impacts: historic dollar damages and building exposure values. There is not enough current data to accurately estimate historic damages.

The Wyoming State Geological Survey (WSGS) calculated the building exposure values for buildings that may occur within the areas of expansive soils. All expansive soils mapped have been digitized and the expansive soil layer was then digitally crossed with the Census block building values. In the event of an expansive soil boundary dissecting a census block, the proportional value of the buildings in the census block will be assigned to the expansive soil. In a case where a census block is within an expansive soil, the combined values of all the buildings in the census block are assigned. The values for each county are shown in the map below.

Figure 4-13 Wyoming Building Exposure to Shrinking-Swelling Clays



Source: Wyoming State Hazard Mitigation Plan 2016

These values represent exposure and the potential for damage, not a true loss estimate. Natrona County is the highest in the state ($1.1B) for value of buildings at risk due to expansive soils. The risk in Converse and Niobrara Counties is several orders of magnitude lower at $54,641 and $148,248 respectively.

Critical facilities within expansive soils areas include emergency response facilities (police, fire, EMS, etc.), infrastructure nodes (transmission towers, electric substations, refineries), and community resources (schools, nursing homes, daycare facilities). Damage from these soils will be individual events, which will cause damage to a small number of buildings or road segments over time.

Table 4-27 Critical Facilities Vulnerable to Mapped Expansive Soil Hazards

County	Jurisdiction	Critical Facility Type	Facility Count
Converse	Unincorporated	Bridge	4
	Converse County Total		4
County	**Jurisdiction**	**Critical Facility Type**	**Facility Count**
Natrona	Bar Nunn	Day Cares	3
		EPA FRS Location	1
		Fire Department	1
		National Shelter System Facility	2
		School	1
		Total	8

County	Jurisdiction	Critical Facility Type	Facility Count
	Casper	Air Facility	1
		Assisted Living	7
		Bridge	3
		College/University	1
		Community Support	16
		Day Cares	74
		EPA FRS Location	102
		Fire Department	4
		Hospital	1
		Law Enforcement	1
		Medical Facility	1
		National Shelter System Facility	25
		Nursing Home	7
		Private School	3
		School	21
		Special Medical Facility	27
		Tier II	4
		Urgent Care Facility	2
		Total	300
	Edgerton	Community Support	1
		Total	1
	Evansville	Day Cares	2
		Total	2
	Midwest	Fire Department	1
		Law Enforcement	1
		National Shelter System Facility	1
		School	1
		Total	4
	Mills	Day Cares	4
		EPA FRS Location	10
		EPA Regulated Facility	3
		Law Enforcement	1
		Tier II	8
		Total	26
	Unincorporated	Air Facility	2
		Bridge	46
		Day Cares	4
		Electrical Facility	1
		EPA FRS Location	158
		EPA Regulated Facility	6
		Fire Department	1
		Law Enforcement	2
		National Shelter System Facility	2
		Non-Union Communications	6
		School	2
		Substation	7
		Tier II	24
		Union Communications	5
		Total	266
	Natrona County Total		607
County	**Jurisdiction**	**Critical Facility Type**	**Facility Count**
Niobrara	NA	None	0
		Region Total =	**611**

Source: Homeland Infrastructure Foundation-Level Data (HIFLD)

Future Development

Modern building practices incorporate mitigation techniques, provided proper geotechnical testing is employed to identify expansive soils. If areas prone to expansive soils are identified, future areas for development will need to take this hazard into account.

Summary

While there are areas of potential risk from expansive soils identified in the county, expansive soils are a low significance hazard for the counties in the region overall.

Table 4-28 Expansive Soil Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Negligible	Likely	Negligible	Low
Natrona	Negligible	Likely	Negligible	Low
Niobrara	Significant	Likely	Negligible	Low

4.2.6 Flood

Hazard/Problem Description

Floods can and have caused significant damage in Region 2, and are one of the more significant natural hazards in the Region. Certain flood events have even caused millions of dollars in damage in just a few hours or days. A flood, as defined by the National Flood Insurance Program, is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area, or of two or more properties from: overflow of waters; unusual and rapid accumulation or runoff of surface waters from any source; or, a mudflow. Floods can be slow or fast rising, but generally develop over a period of hours or days. Causes of flooding relevant to the Region include:

- Rain in a general storm system
- Rain in a localized intense thunderstorm
- Melting snow
- Rain or melting snow
- Urban stormwater drainage
- Ice Jams
- Dam failure
- Levee Failure
- Rain on fire damaged watersheds

The area adjacent to a river channel is its floodplain. In its common usage, "floodplain" most often refers to any area that is inundated by the 100-year flood, or a flood that has a 1% chance in any given year of being equaled or exceeded. The 100-year flood is the national standard to which communities regulate their floodplains through the National Flood Insurance Program.

Region 2 is susceptible to multiple types of floods including riverine flooding, flash floods, slow rise floods, ice jams, and possibly dam or levee failure.

Riverine flooding occurs when a watercourse exceeds its "bank-full" capacity; this is usually the most common type of flood event. Riverine flooding generally occurs as a result of prolonged rainfall, or rainfall that is combined with soils already saturated from previous rain events. Slow rise floods associated with snowmelt and sustained precipitation usually are preceded with adequate warning, though the event can last several days.

Floods can also occur with little or no warning and can reach full peak in only a few minutes. Such floods are called flash floods. A flash flood usually results from intense storms dropping large amounts of rain within a brief period. Flash floods, by their nature, occur very suddenly but usually dissipate within hours. Even flash floods are usually preceded with warning from the National Weather Service, in terms of flash flood advisories, watches, and warnings.

Floods can occur for reasons other than precipitation or rapidly melting snow. They can also occur because of ice jams. An ice jam is a stationary accumulation of ice that restricts flow. Ice jams can cause considerable increases in upstream water levels, while at the same time downstream water levels may drop. Types of ice jams include freeze up jams, breakup jams, or combinations of both. Floods arising from these types of ice jams can be slow or fast rising, but generally develop over a period of many hours or days.

Levee failure can also cause a flash flood and poses a risk in the region. A levee is an earthen embankment constructed along the banks of rivers, canals, and coastlines to protect adjacent lands from flooding by reinforcing the banks. By confining the flow, levees can also increase the speed of the water, however. Levees can be natural or man-made. A natural levee is formed when sediment settles on the river bank, raising the level of the land around the river. To construct a man-made levee, workers pile dirt or concrete along the river banks, creating an embankment. This embankment is flat at the top, and slopes at an angle down to the water. For added strength, sandbags are sometimes placed over dirt embankments. Natural disasters such as Hurricane Katrina demonstrate that, although levees can provide strong flood protection, they are not failsafe. Levees can *reduce* the risk to individuals and structures behind them, but they do not eliminate risk entirely. Levees are designed to protect against a specific flood level; severe weather could create a higher flood level that the levee cannot withstand. Levees can fail by either overtopping or breaching. Overtopping occurs when floodwaters exceed the height of a levee and flow over its crown. As the water passes over the top, it may erode the levee, worsening the flooding and potentially causing an opening, or breach, in the levee. A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning. Unfortunately, in the rare occurrence when a levee system fails or is overtopped, severe flooding can occur due to increased elevation differences associated with levees and the increased water velocity that is created. It is also important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

The potential for flooding can also change and increase through various land use changes and changes to land surface. A change in the built environment can create localized flooding problems inside and outside of natural floodplains, by altering or confining watersheds or natural drainage channels. These changes are commonly created by human activities. Flooding in the communities in Region 2 could be exacerbated by inadequate drainage and channel systems that would not stand up to the 1% annual chance flood. Inadequate culverts and drainage systems can flood and adjacent properties. Refer to the specific county annexes for a description of localized problems.

Increased flooding can also be created by other hazards such as wildfires. Wildfires create hydrophobic soils, a hardening or “glazing” of the earth’s surface that prevents rainfall from being absorbed into the ground; this effect increases runoff, erosion, and downstream sedimentation of channels.

Geographical Area Affected

All counties within the planning region have the potential for flooding. The extent of the flooding varies based on the location of the county, and on what part of the county is being examined. Detailed geographic flood assessments are provided in each attached county annex.

The counties of Region 2 are predominantly located in the North Platte, Cheyenne, and Powder-Tongue River Basins. However, the northwest corner of Natrona County crosses onto the Big Horn Basin, while the southeast portion of Niobrara County falls within the Niobrara Basin. The part of the North Platte River Basin in the region encompasses the North Platte River, Casper Creeks, Box Elder Creek, Dry Creek, and the Sweetwater River, among other smaller streams. The Cheyenne River Basin contains the Cheyenne River primarily, which crosses Niobrara on the northeast portion of the county. Finally, the Powder-Tongue Basin area in the region contains primarily the South Fork Powder River, Cottonwood Creek, Salt Creek, Castle Creek, and Wallace Creek, among others.

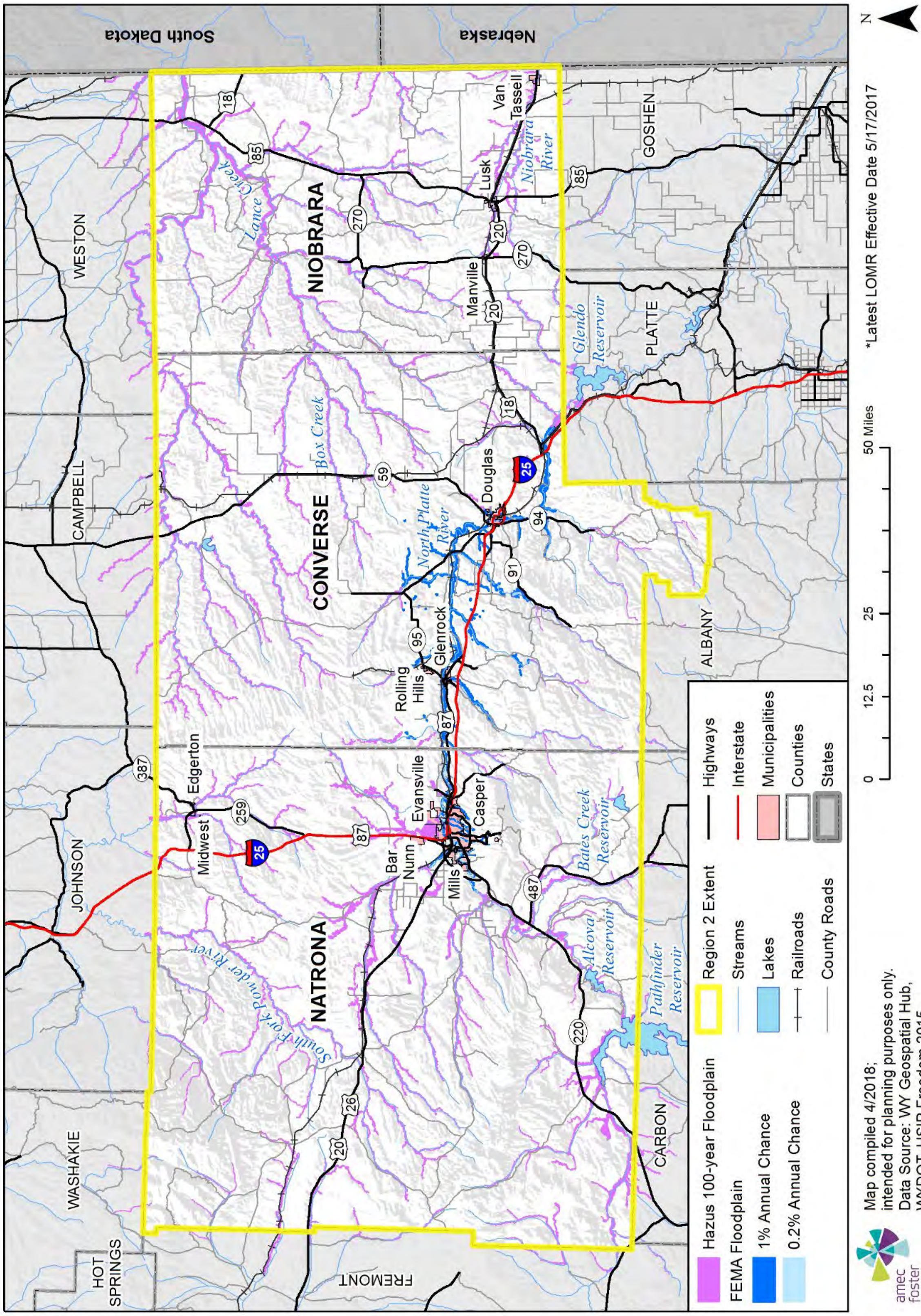
The North Platte River is over 700 miles in length. It is a tributary of the Platte River, and originates in Jackson County, Colorado. From northern Colorado it flows up through Carbon County in Wyoming, entering the Region via the south of Natrona County. It then moves northeast through to Converse County, making its way south again and out of the state just south of Torrington, Goshen County.

The Cheyenne River originates north of the Region, on the edge of Converse County. The river flows east to South Dakota, and north onto the Missouri River. The Cheyenne River is approximately 295 miles long, and drains over 24 thousand square miles into the basin named after it. The river has some major tributaries including Dry Fork Creek and Antelope Creek. From Converse it flows through Niobrara before leaving the state.

The South Fork Powder River is a major tributary of the Powder River, which feeds to its main vein just north of north-central Natrona County. The South Fork, along with the other two Powder River forks (North and Middle Forks), meet on the foothills east of the Bighorn Mountains, which then join the larger Yellowstone River in Montana. The Powder River is about 375 miles long.

The geographic extent rating for Region 2 ranges from **limited** to **significant**, meaning that a flood event could impact 10-50% of the planning area due the presence of major rivers/streams across the three counties. The following sections detail the extent and history of flood hazards in the Region. Figure 4-14 below shows the Region 2 Flood Hazards, highlighting both the available Digital Flood Insurance Rate Maps (DFIRM) layers from FEMA, for parts of Converse and Natrona, as well as Hazus-derived flooding area estimates (portrayed in purple) to supplement those provided by the federal agency. Both DFIRM and Hazus derived datasets are utilized in the maps to follow, as only limited parts of the region contain updated flooding study information.

Figure 4-14 Region 2 Flood Hazards



Past Occurrences

A brief history of significant floods is presented below by county, while a more extensive summary is included in the county annexes. A damaging flood occurs in the area every year or two on average, based upon the historical data presented below.

Table 4-29 Flood Events in Converse County, 1941-2017

Location	Date	Property Damage	Crop Damage
--	7/27/1941	--	--
Esterbrook	6/26/1952	--	--
Esterbrook	7/24/1955	--	--
Douglas, Antelope, East Antelope	01/00/1962	--	--
Glenrock, Deer Creek	5/14/1965	$175,000	--
Bill	6/16/1965	$2,250	--
Glenrock, Deer Creek	6/12/1970	$1,000,000	--
--	5/1/1978	--	--
Laramie Range drainage, eastward southwest of Douglas near LaPrele Reservoir	7/22/1983	--	--
Glenrock	8/1/1984	$2,250	--
--	5/1/1991	--	--
50 NW Douglas to 30 N Douglas	7/1/1998	$2,000	--
--	7/1/2008	--	--
Douglas	7/12/2009	--	--
--	6/1/2010	--	--
--	8/9/2013	--	--
--	5/7/2016	--	--
TOTAL		**$1,181,500**	**$0**

Source: NCEI

Table 4-30 Flood Events in Natrona County, 1895-2017

Location	Date	Property Damage	Crop Damage
Casper, Garden Creek	07/00/1895	--	--
Casper, North Platte River	3/1/1906	--	--
Big Horn River, Powder River, North Platte River, North Platte River tributaries near Casper	9/27/1923	--	--
North Platte River, near Glendo	5/1/1935	--	--
Southeast, Central Wyoming	9/1/1938	--	--
Casper and vicinity	7/6/1961	$225,000	--
Big Horn, North Platte, and Tongue Rivers, Beaver Creek	2/00/1962		--
Casper 30 NW	6/15/1962	$225,000	--
Glendo	6/1/1965		--
Casper	7/15/1967	$1,000,000	--
Casper	7/16/1968	$22,500	--
West of Casper	7/6/1971	--	--
Casper	6/23/1974	$225,000	--
Casper	6/19/1986	$2,250,000	--

Location	Date	Property Damage	Crop Damage
Casper	5/8/1995	--	--
--	1/29/1996	$2,000	$0
--	3/13/1996	$0	$0
Midwest	5/29/2001	$0	$0
Midwest	5/29/2001	$0	$0
Midwest	5/29/2001	$0	$0
9 SW Casper	6/16/2003	--	--
10 W Casper	7/13/2004	--	--
Casper	7/25/2005	$500,000	--
Casper	8/3/2005	$85,000	--
MILLS	7/19/2007	$50,000	$0
GOOSE EGG	7/19/2007	$5,000	$0
MILLS	7/25/2007	$300,000	$0
(CPR)NATRONA CO ARPT	8/2/2007	$500,000	$0
CASPER	8/3/2007	$50,000	$0
CASPER	8/3/2007	$15,000	$0
CASPER	6/13/2009	$2,000	$0
MOUNTAIN VIEW	7/3/2009	$5,000,000	$0
BROOKHURST	7/29/2013	$200,000	$0
BADWATER	8/9/2013	$17,000	$0
BISHOP	8/9/2013	$0	$0
ARMINTO	8/5/2014	$200,000	$0
SALT CREEK COLUMBINE	5/24/2015	$100,000	$0
BAR NUNN	5/24/2015	$0	$0
(CPR)NATRONA CO ARPT	6/5/2015	$0	$0
ARMINTO	10/2/2015	$40,000	$0
RED BUTTES VILLAGE	6/5/2017	$0	$0
TOTAL		**$11,013,500**	**$0**

Source: NCEI

Table 4-31 NCEI Flood Events in Niobrara County, 1938-2018

Location	Date	Property Damage	Crop Damage
Cheyenne River	6/1/1938	--	--
--	6/7/1945	--	--
4 miles north of old Whitman Post Office	8/10/1955	--	--
South of Lusk	6/11/1960	$2,250	$2,250
Lusk and county-wide	6/1/1962	--	--
County wide	7/1/1973	--	--
state wide	5/1/1978	--	--
Lusk	7/1/1980	--	--
Niobrara River	Spring 1990	--	--
Niobrara River	Spring 1991	--	--
County wide	5/7/1995	--	--
Redbird	8/6/2006	$40,000	--
County wide	Spring 2008	--	--
Keeline, Lusk	9/29/2014	--	--
WEST LANCE CREEK	5/26/2015	--	--
KEELINE	6/3/2015	--	--
VAN TASSELL	6/4/2015	$1,500,000	--

Location	Date	Property Damage	Crop Damage
TOTAL		$1,542,250	$2,250

Source: NCEI

Figure 4-15 and Figure 4-16 were created by Western Water Assessment based on their analysis of NCEI data; they show the number of flood and flash flood events in Wyoming per county from 1996-2017.

Figure 4-15 Flood Events in Wyoming, 1996-2017

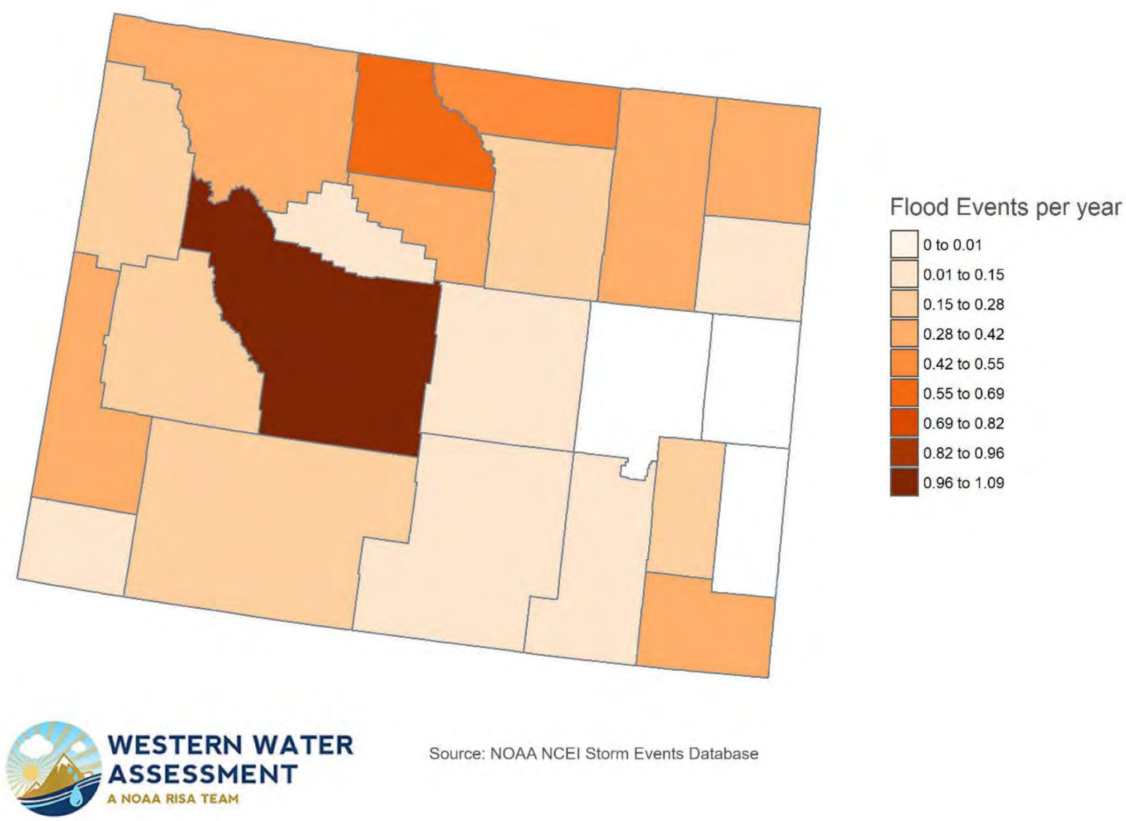
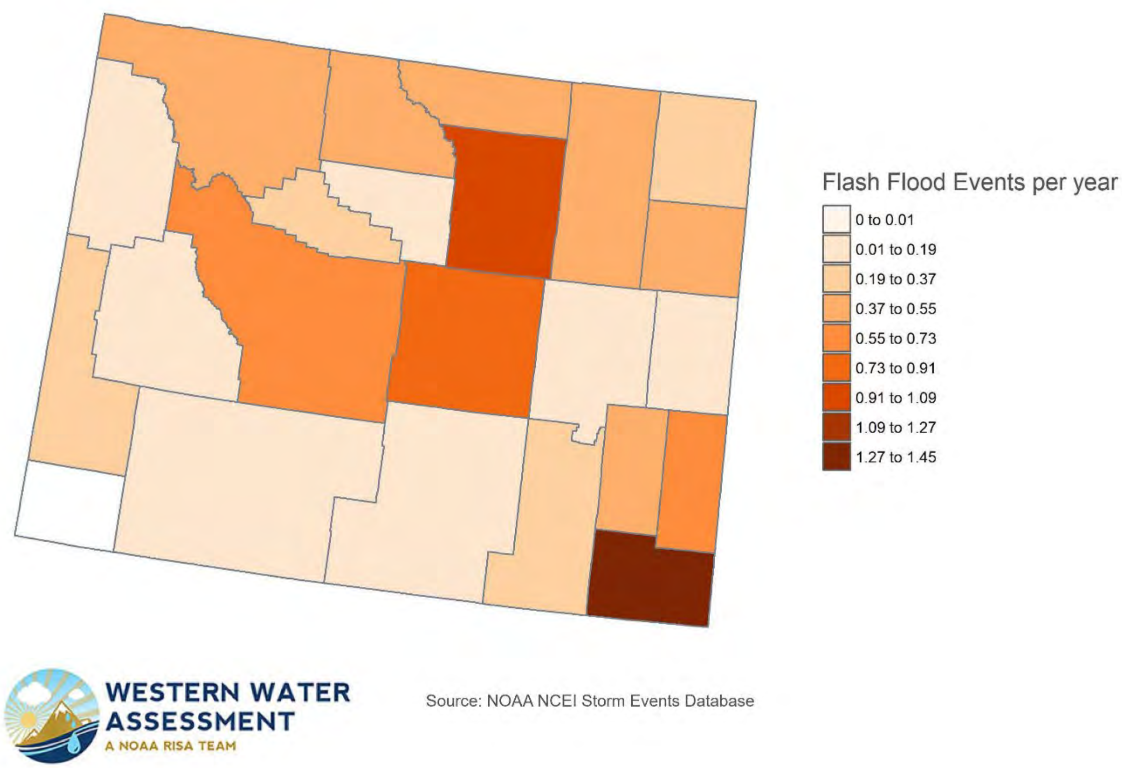


Figure 4-16 Flash Flood Events in Wyoming, 1996-2017



Converse County

The principal flooding sources in the county are heavy rains and rapid snowmelt, which turn into flash flooding often in a matter of just hours. River flooding is also common, particularly overflowing of the North Platte River and major tributaries in the county (e.g., Deer Creek, Sand Creek, Box Elder Creek).

The largest USGS gage-recorded flood took place on the North Platte River, May 15, 1965, with around 16,000 cubic feet per second (cfs) of flow eight miles down of Glenrock and 23,800 cfs near Orin. A following flood, just a month after the May event, took place near Bill, reportedly taking one life in its path, though details on the incident are not available. One of the financially costliest flood event in the history of Converse County then occurred June 12 of 1970, when high flows occurred in the North Platte River again and caused about $1,000,000 in property damages near Glenrock and Deer Creek areas.

Another notable flood event in Converse County was in May of 1978, when a severe thunderstorm produced up to 4.5 inches of rain overnight. Bridges and sections of roads were washed out, power lines were downed, and there was extensive damage to homes, property, crops, and livestock. Damages throughout the entire flooded area, including outside counties, were estimated at approximately $15.5 million (information from Converse County).

Other floods that resulted in property damages include a Glenrock/Deer Creek area flood in May 14, 1965, accruing $175,000 in losses; a flood near Bill on June 16, 1965, costing $2,250; a flood of the same cost but taking place near Glenrock August of 1984; and an early July 1998 flood, causing $2,000 in damages. The most recent reported flood in the county happened May 7th of 2016 but did not incur any property or crop damages.

Figure 4-17 though Figure 4-21 are maps of FEMA and HAZUS designated floodplains in Converse County, overlaid by the parcels/infrastructure at risk of flooding (displayed as yellow or red dots, depending on the type of floodplain they intersect), if applicable. Converse County is shown first with flooding only, then its jurisdictions with the parcels/structures on top (if present).

Figure 4-17 Converse County Flood Hazards

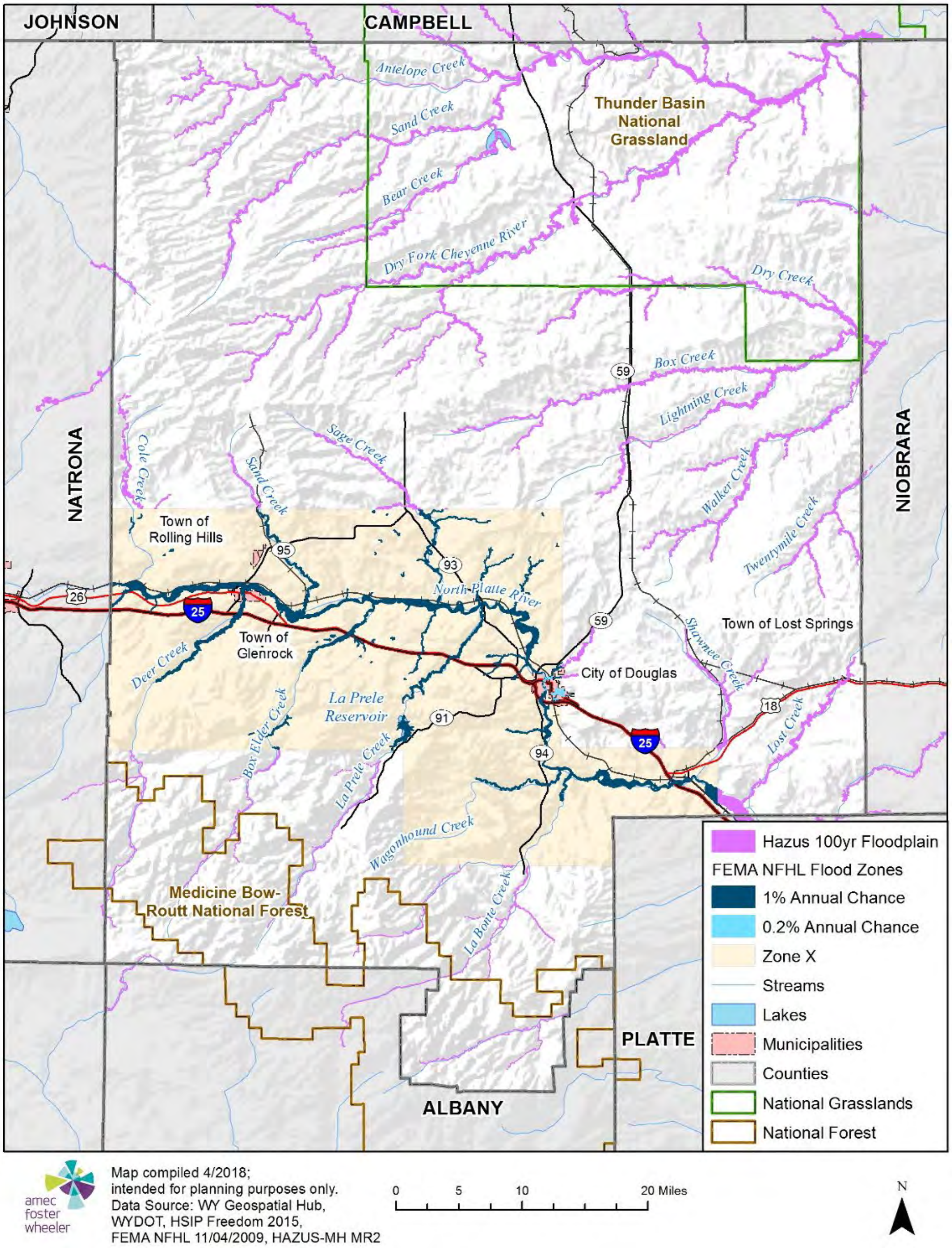


Figure 4-18 Douglas Flood Hazards and Parcels/Structures at Risk

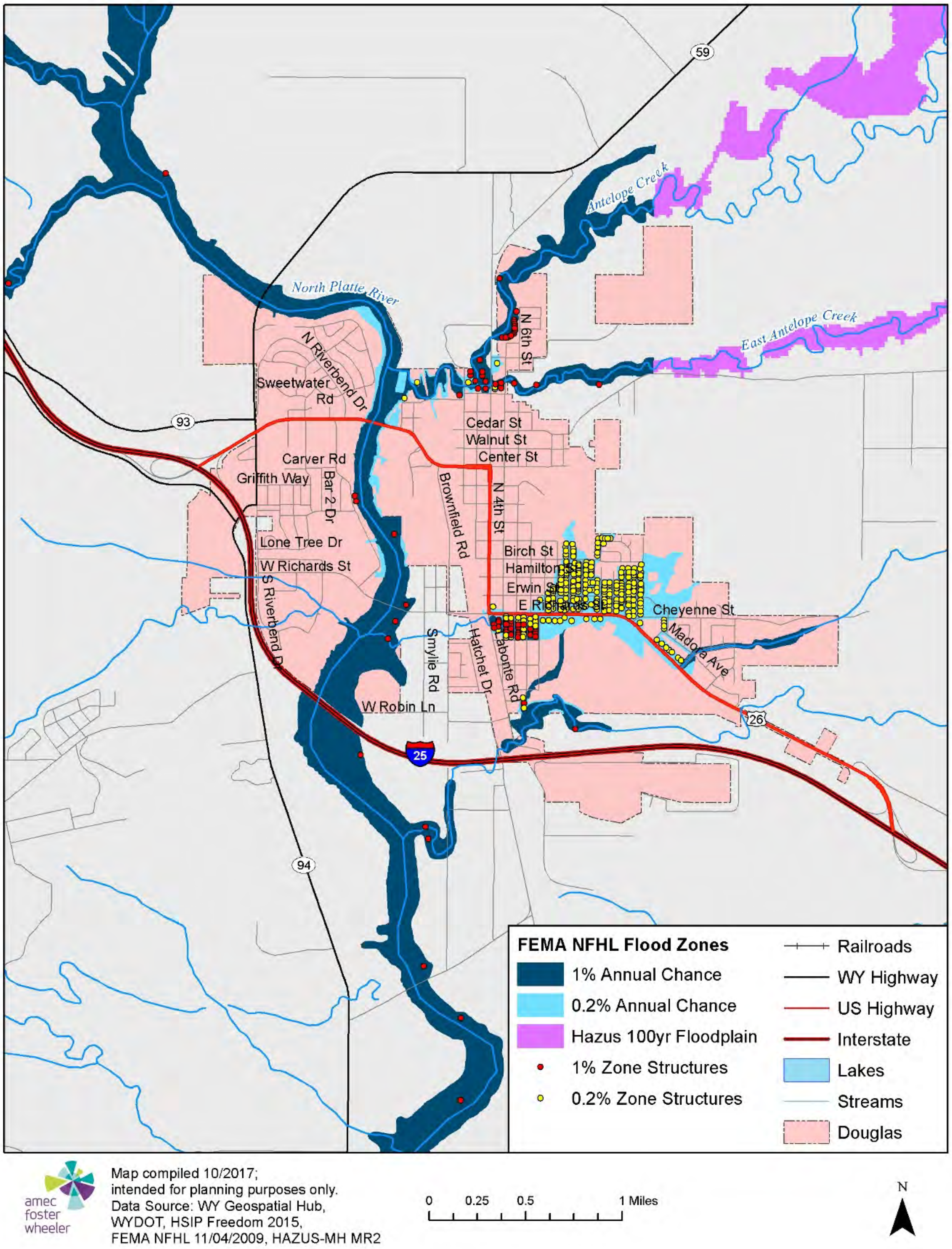


Figure 4-19 Glenrock Flood Hazards and Parcels/Structures at Risk

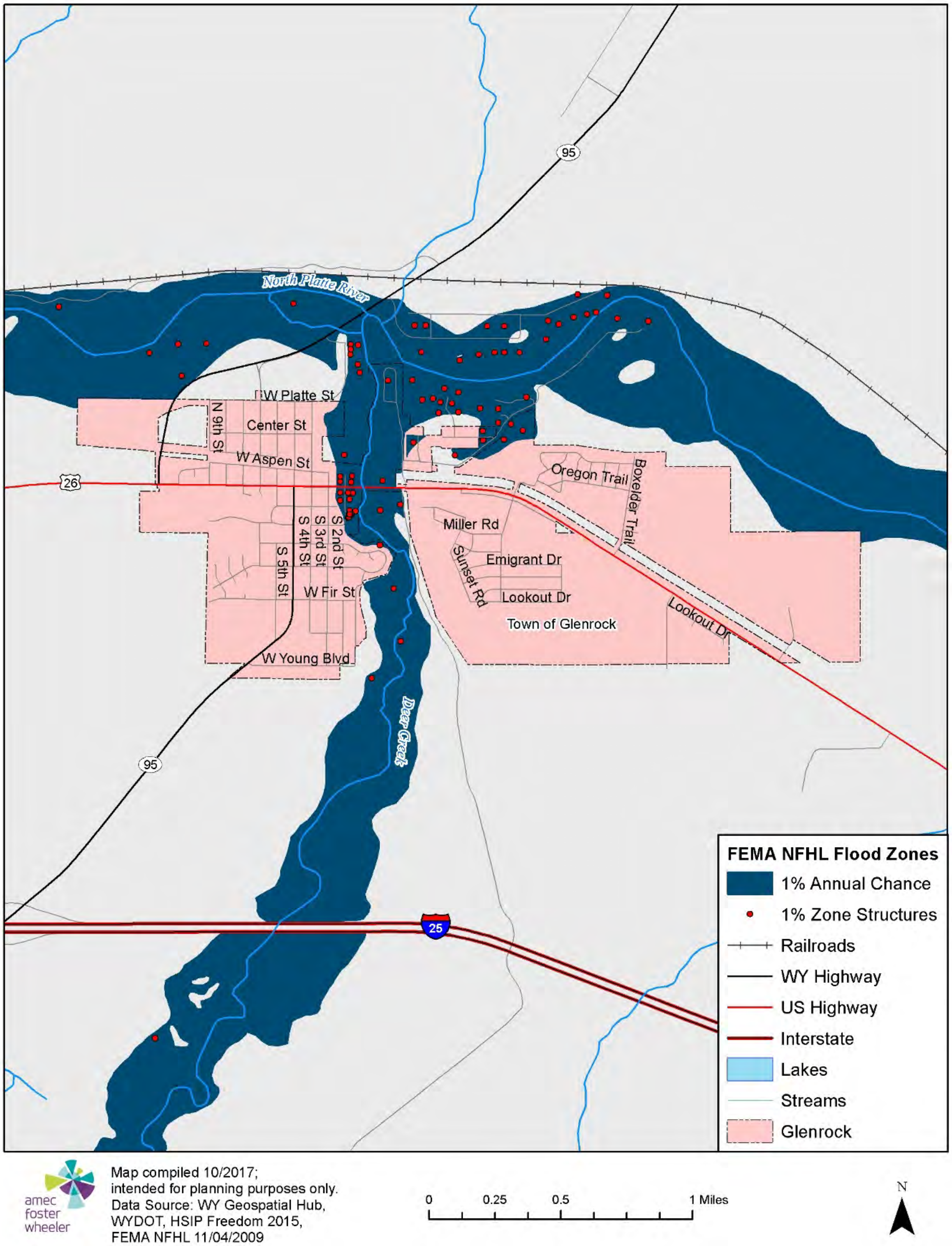


Figure 4-20 Lost Springs Flood Hazards

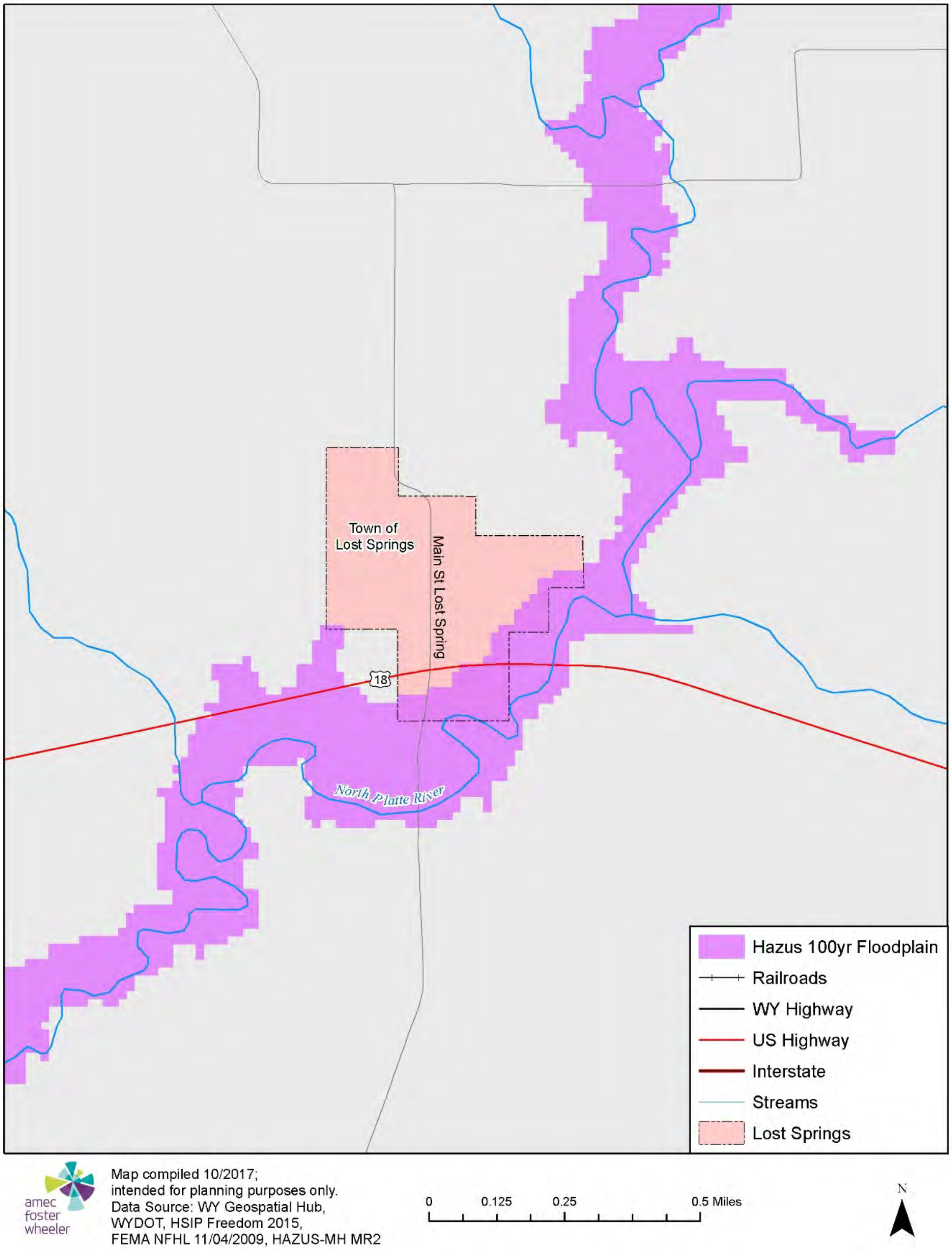
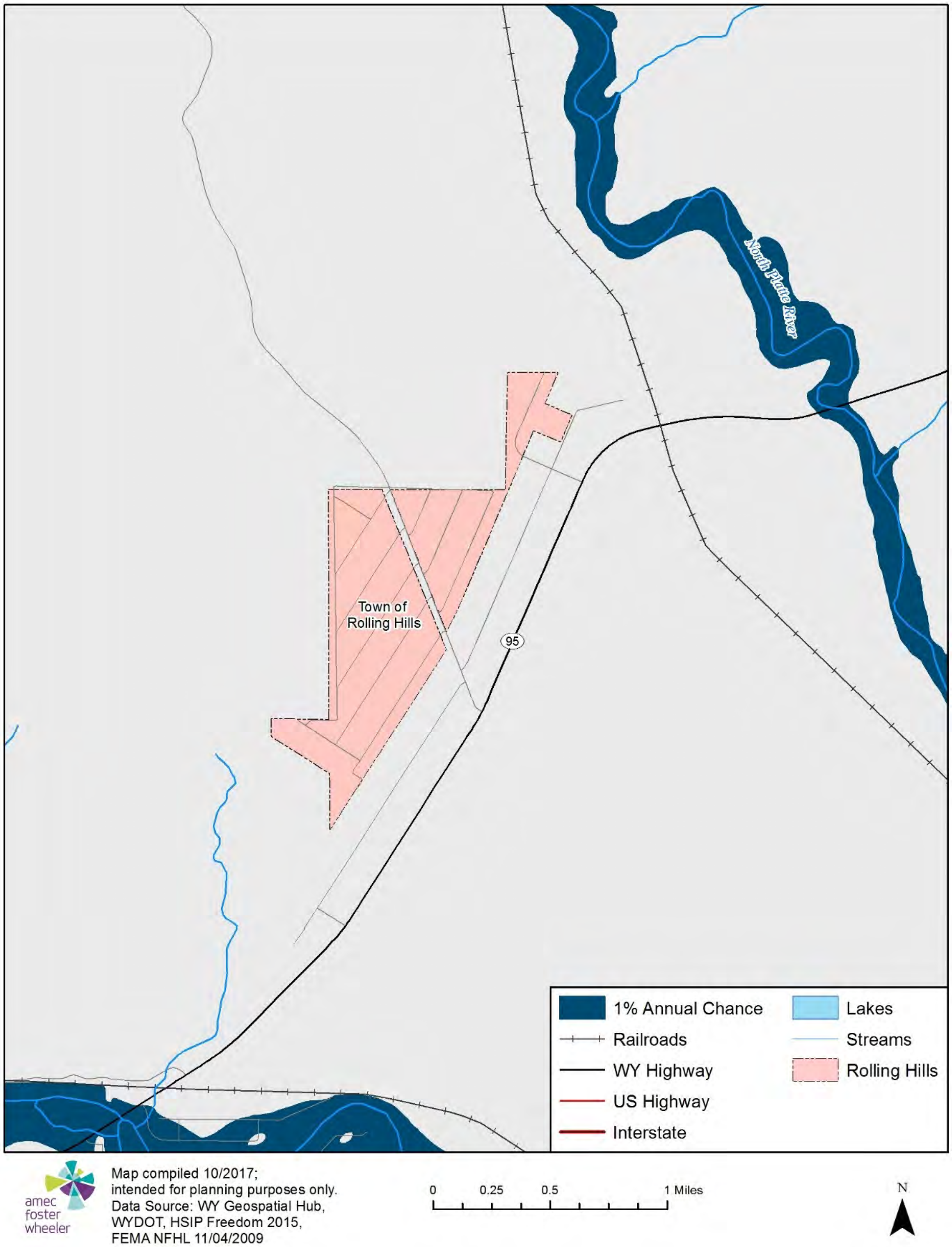


Figure 4-21 Rolling Hills Flood Hazards



Natrona County

Natrona County has suffered a total of $11,013,500 in property losses since the first recorded flood event, which took place in 1895. A major flood took place around mid-June of 1986, causing $2,250,000 in property damages. Smaller storms leading to flood also occurred in the mid-1990s.

Some notable floods have occurred in the last 18 or so years, however. For example, a July 2005 flash flood which originated as strong thunderstorms from the Bighorn Mountains hit Casper, shutting down portions of Interstate 25 and blocking areas around the city, ultimately causing damages to storage sheds and other properties (incurring $500,000 in damages). Another storm in August of the same year also caused heavy rainfall, leading to flash flooding. Basement flooding occurred in many houses in Casper, causing sinkholes as well. Property damages totaled $85,000. In July of 2007, Strong and severe thunderstorms spread south along the eastern slopes of the Bighorn Mountains. These storms produced long periods of hail and very heavy rain. Additional thunderstorms brought heavy rain to areas west and southwest of Casper, including the area near the Jackson Canyon fire burn scar. Property damage reached $105K. Later in the month, copious moisture was brought north into Wyoming in strong monsoonal flow. Rainfall estimated by radar to be three inches or more fell in a swath from Emigrant Gap to Bar Nunn. The heavy rain caused flash flooding along Poison Spider Road and other nearby roads as culverts could not handle the large volume of water. Portions of a ranch along Poison Spider Road were under several feet of water. A mobile home park south of Bar Nunn was flooded as water flowed from surrounding higher terrain. The lower floor of the rural Poison Spider Elementary School sustained flood damage as the water poured in through several doorways. Damages incurred were $585,000. Several storms in August were of similar nature, causing inundation in rural and urban areas alike. Natrona County International Airport was affected, as were portions of Interstate highways and personal properties. Overall, around $65,000 in damages were incurred.

The summer of 2009 brought about notable storms that caused flooding as well, both flash- and river-based. Damages were caused near Mountain View and Casper in July of that year, totaling $5,200,000. From 2013 onward, there are nine reported flood events across the county, often causing property damages that range from $40,000 to $200,000. The latest recorded event took place near Red Buttes Village in June 5, 2017, but no damages were reported.

Figure 4-22 through Figure 4-27 are maps of FEMA and HAZUS designated floodplains in Natrona County, overlaid by the parcels/infrastructure at risk of flooding (displayed as yellow or red dots, depending on the type of floodplain they intersect), if applicable. Natrona County is shown first with flooding only, then its jurisdictions with the parcels/structures on top (if present).

Figure 4-22 Natrona County Flood Hazards

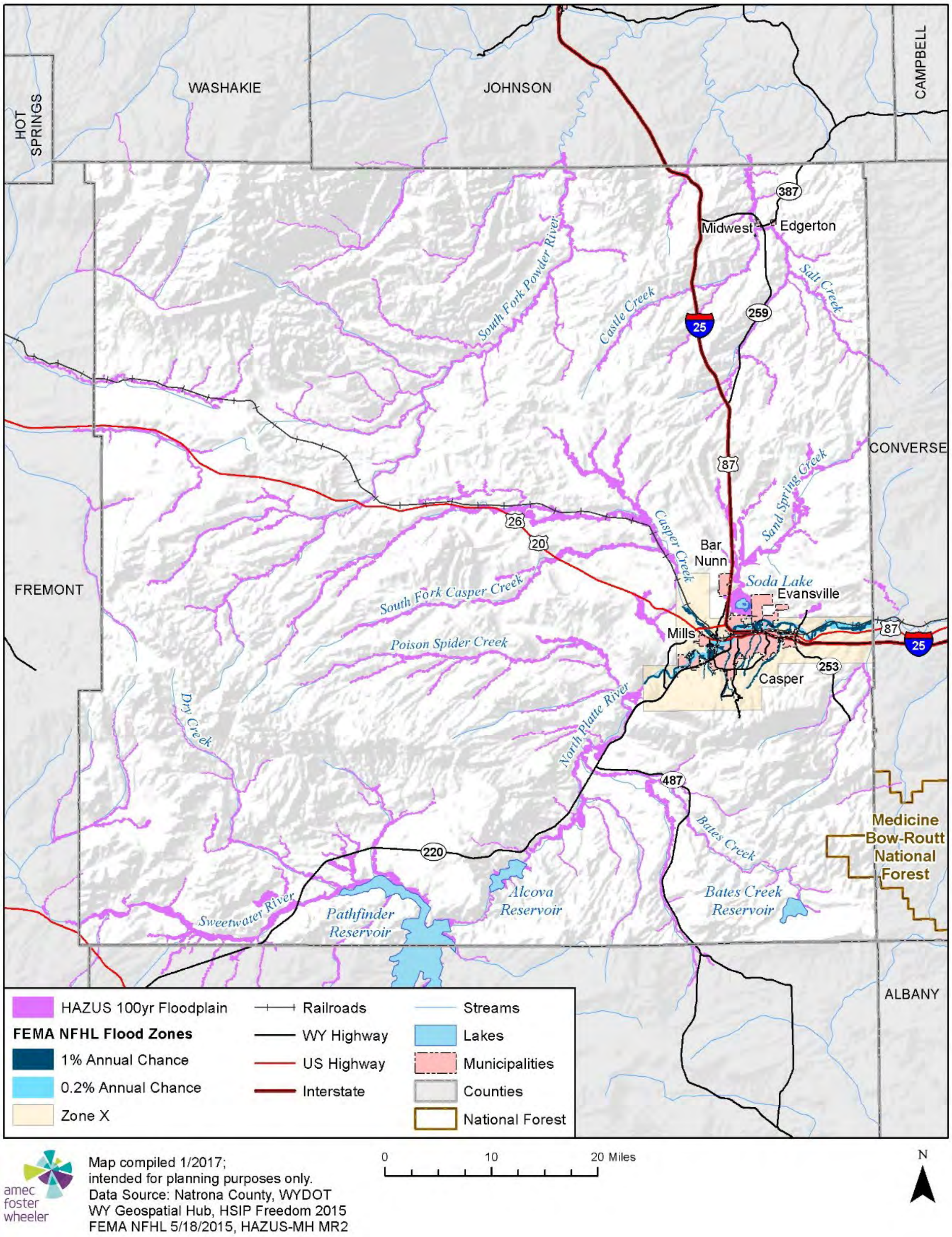


Figure 4-23 Bar Nunn Flood Hazards and Parcels/Structures at Risk

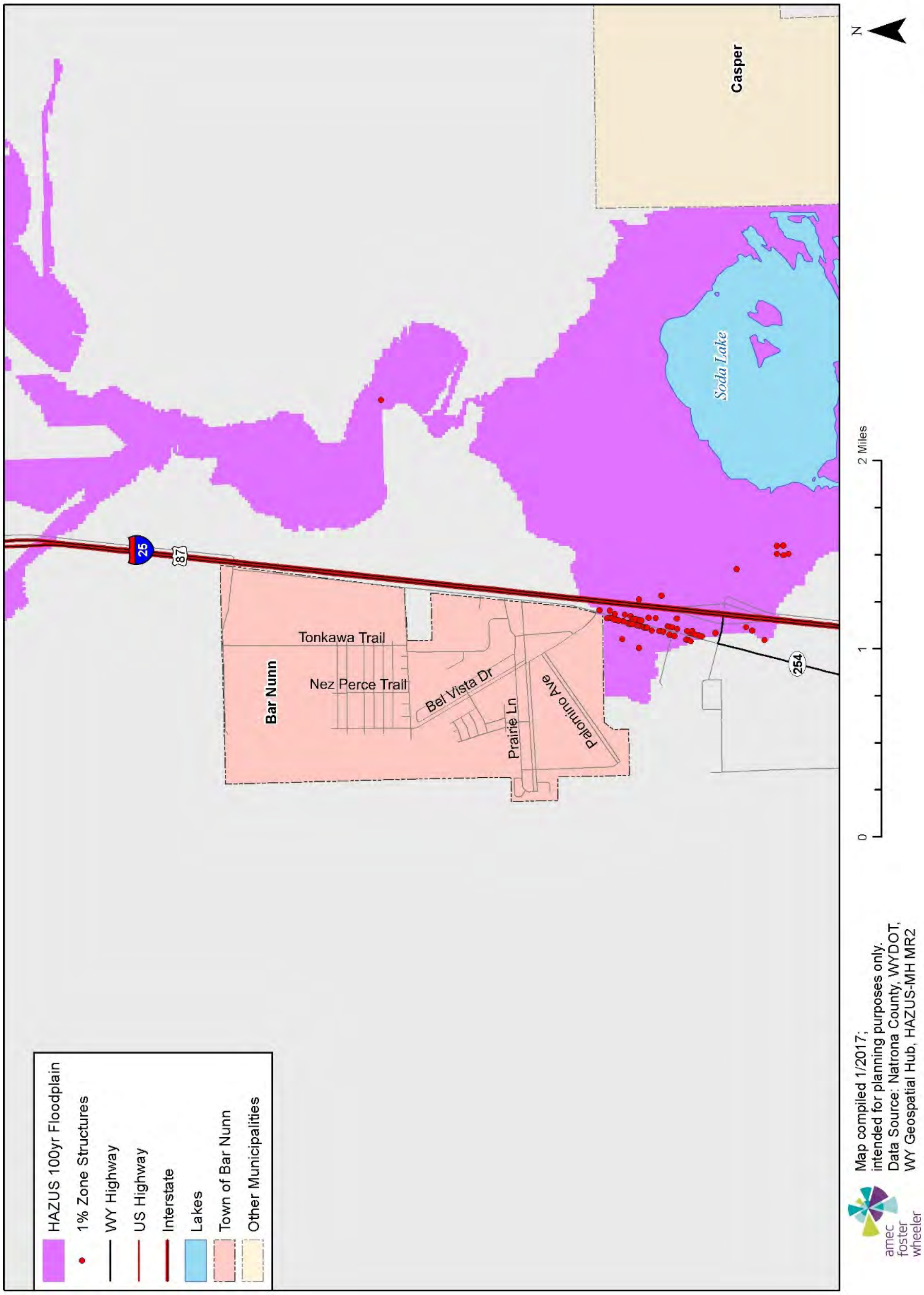


Figure 4-24 Casper Flood Hazards and Parcels/Structures at Risk

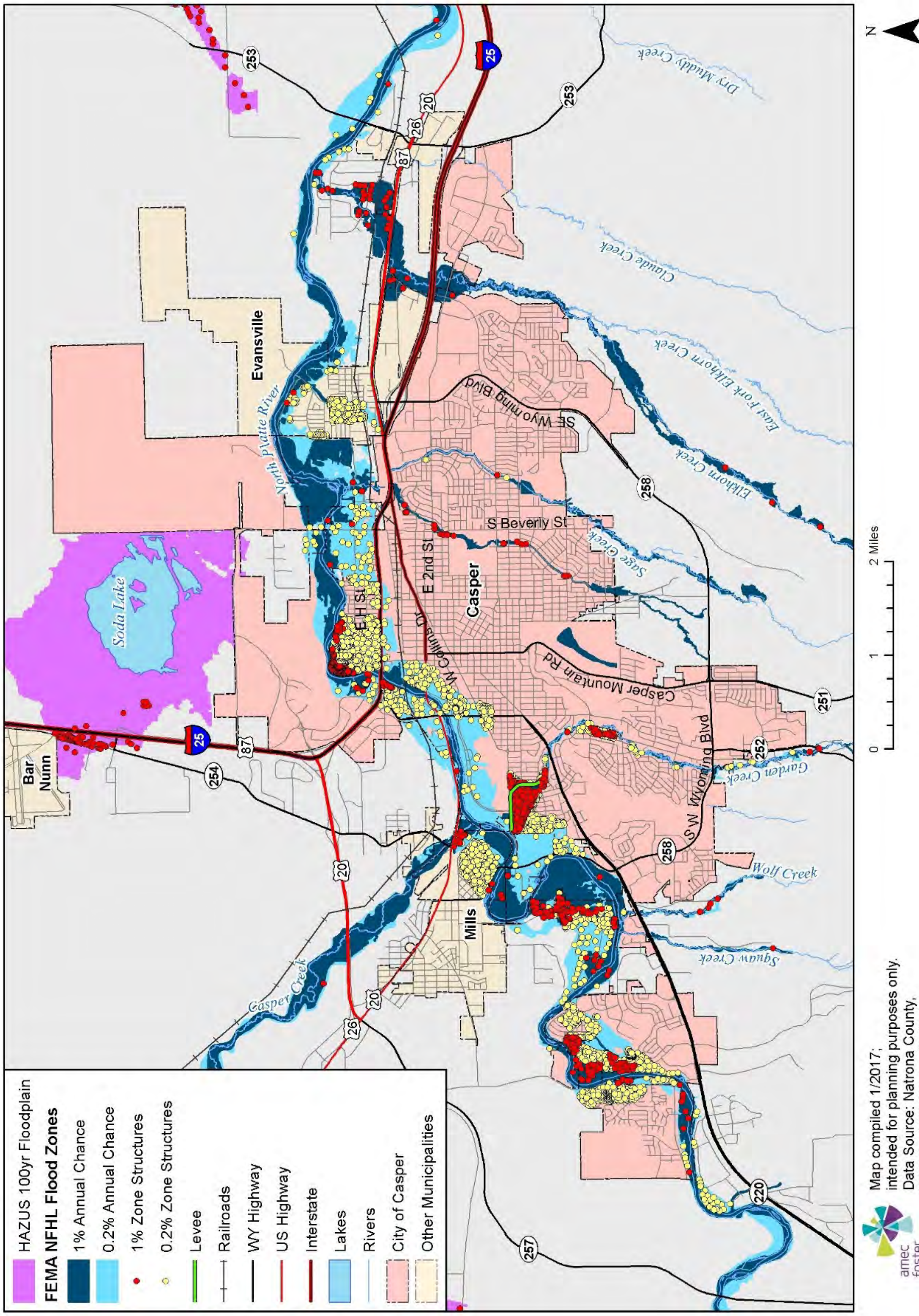


Figure 4-25 Evansville Flood Hazards and Parcels/Structures at Risk

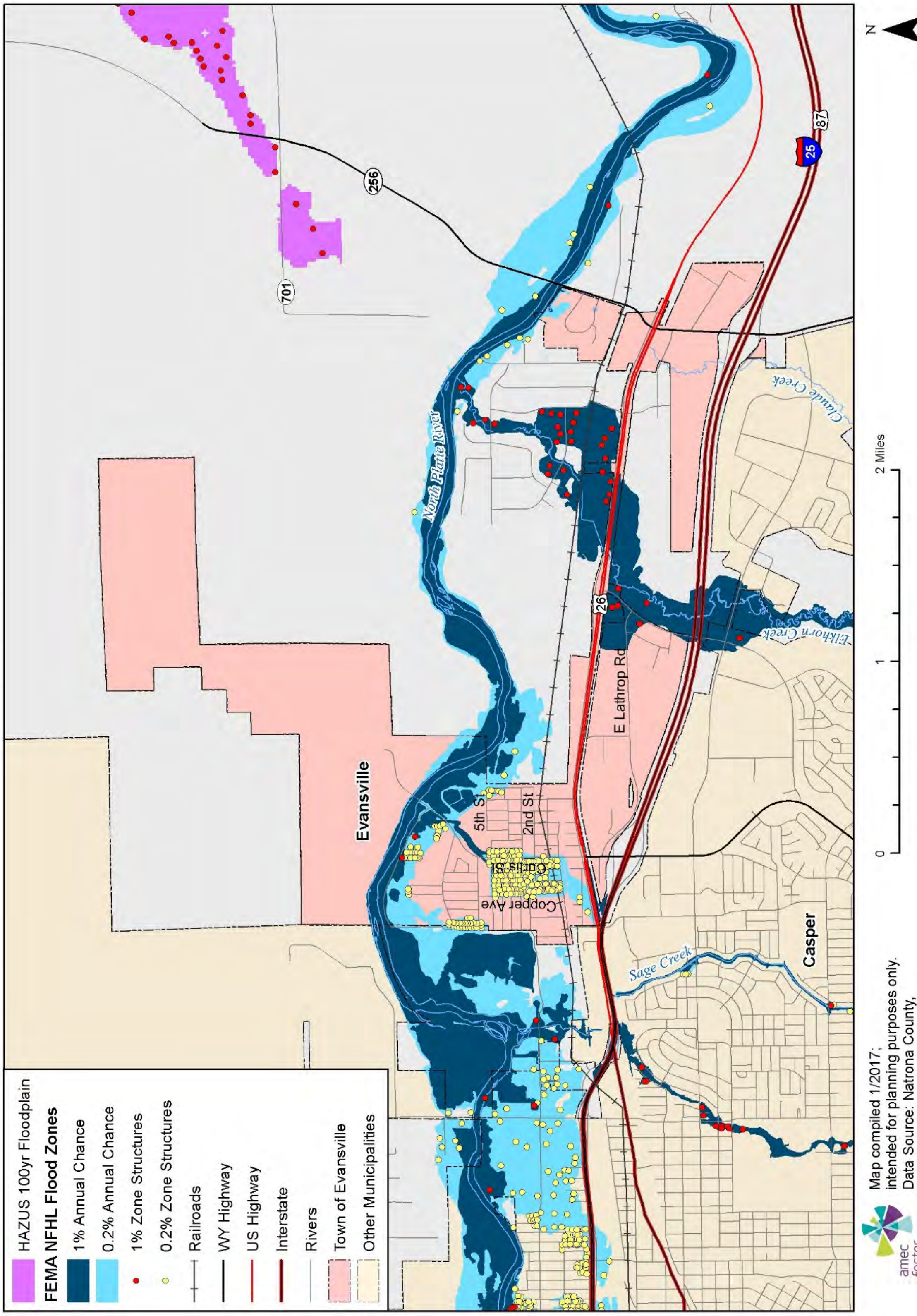


Figure 4-26 Midwest and Edgerton Flood Hazards

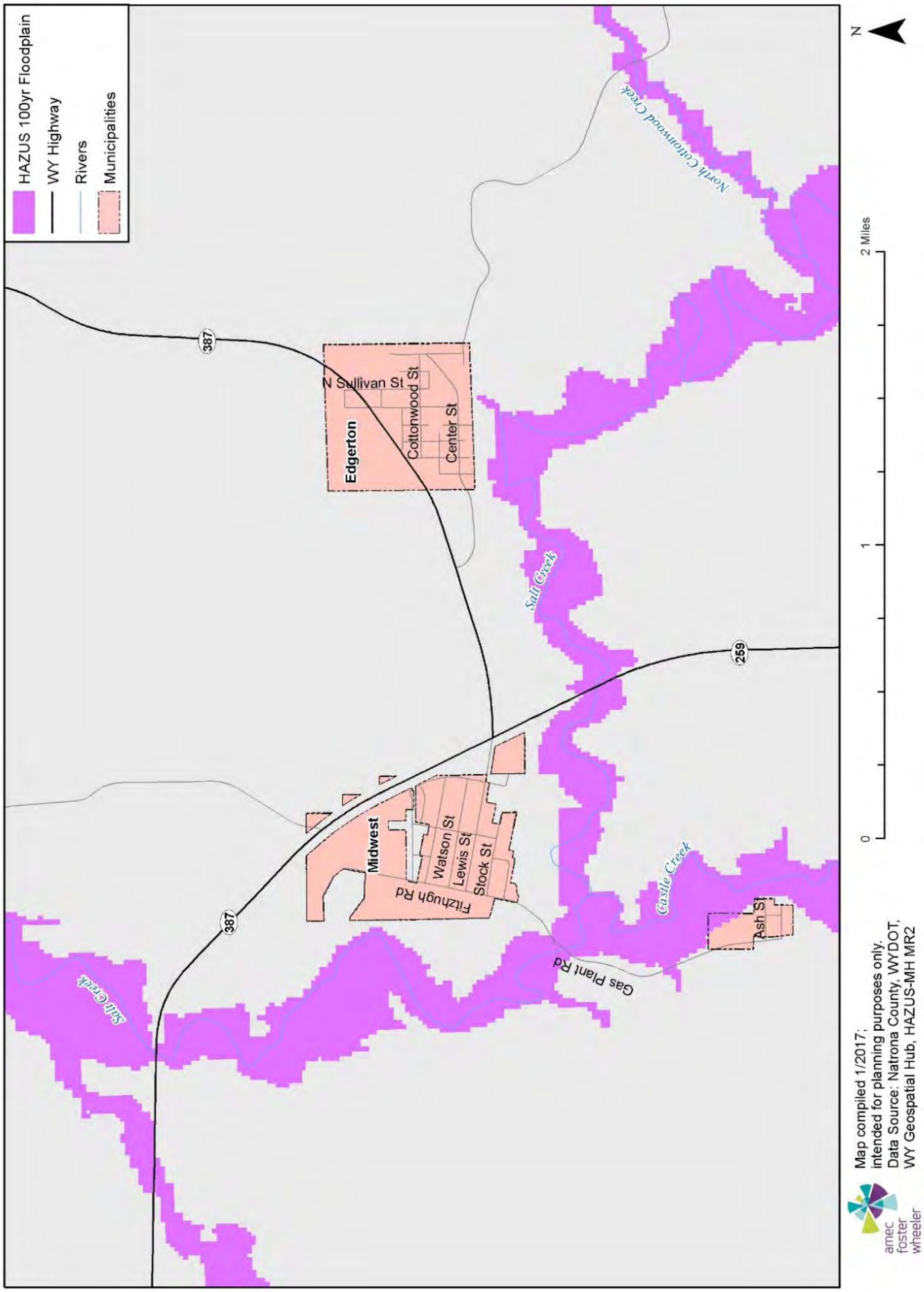
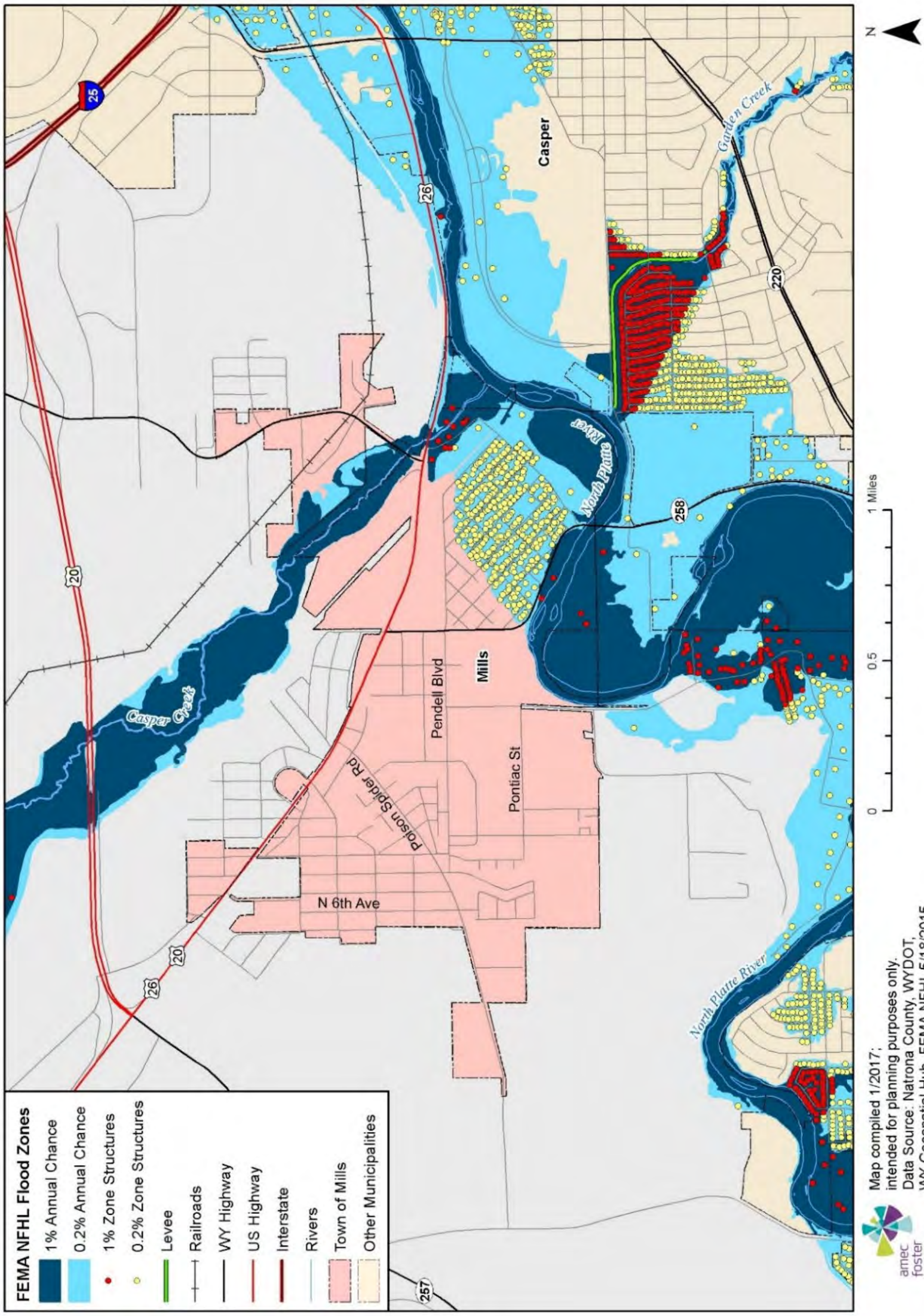


Figure 4-27 Mills Flood Hazards and Parcels/Structures at Risk



Niobrara County

Niobrara County has experienced multiple flooding events dating back to 1938. While not all have incurred property damages, many have. For example, an earlier flood on June 11, 1960 accrued a recorded $2,250 in damages, and another $2,250 in recorded crop losses (the highest crop damages incurred to date in Niobrara County).

A more recent event took place on June 4, 2015 and involved flash flooding of homes, businesses and a highway bridge in Lusk and surrounding areas, becoming the flood of record in the county due to high losses. Heavy rain of six inches sent the Niobrara River over its banks. The Niobrara County Emergency Management Coordinator reported that water covered approximately four city blocks and knocked out the town's drinking water system, resulting in a boil order from the Environmental Protection Agency (EPA). In addition to damaging and forcing closedowns on highways and roads, towns lost power, homes destroyed, and businesses received heavily damages, leading to both Governor and Presidential Disaster Declarations in early July. Overall, this flood caused around $1,500,000 in property damages.

Figure 4-28 through Figure 4-31 are maps of FEMA and HAZUS designated floodplains in Niobrara County, overlaid by the parcels/infrastructure at risk of flooding (displayed as yellow or red dots, depending on the type of floodplain they intersect), if applicable. Niobrara County is shown first with flooding only, then its jurisdictions with the parcels/structures on top (if present).

Figure 4-28 Niobrara County Flood Hazards

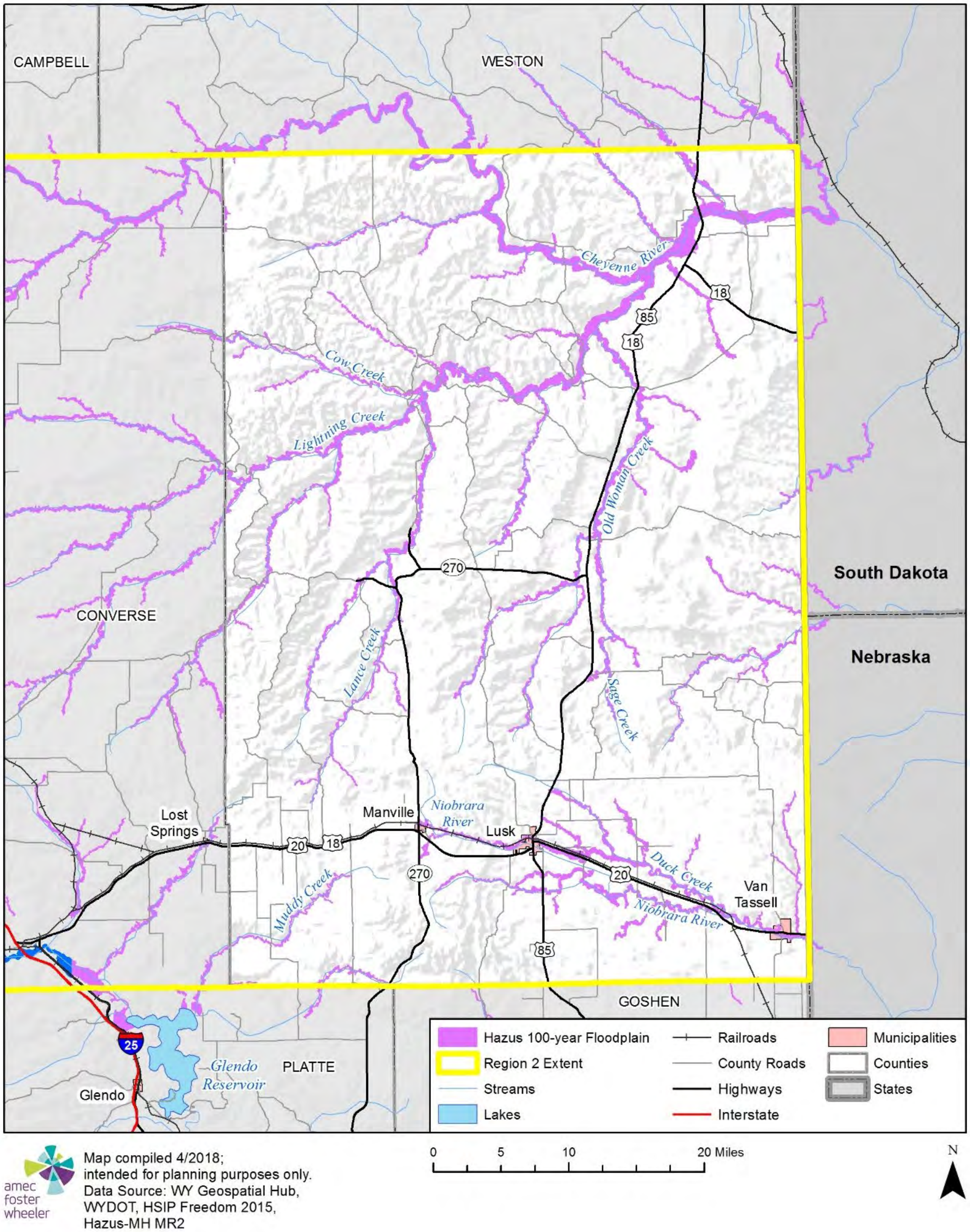


Figure 4-29 Manville Flood Hazards and Parcels/Structures at Risk

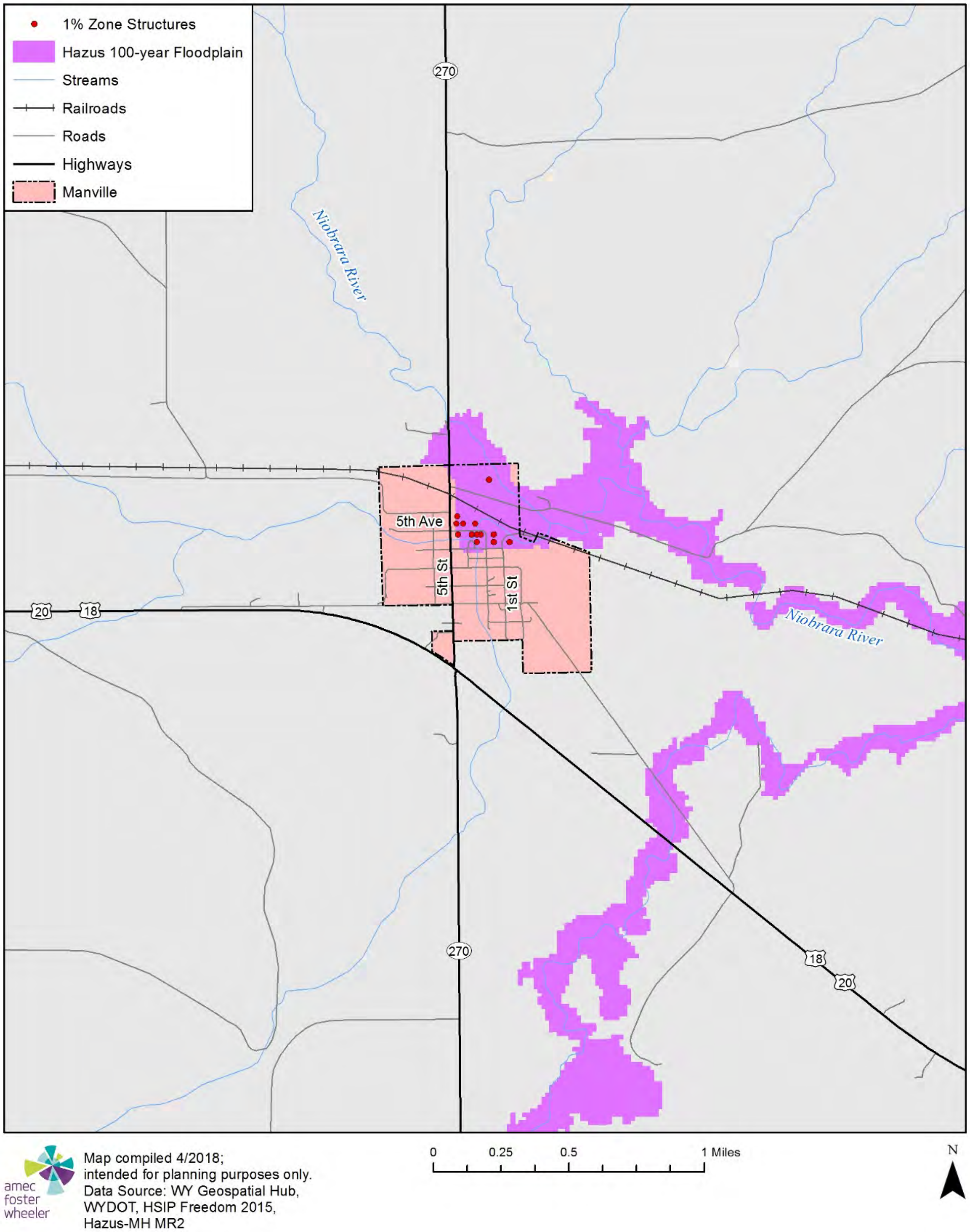
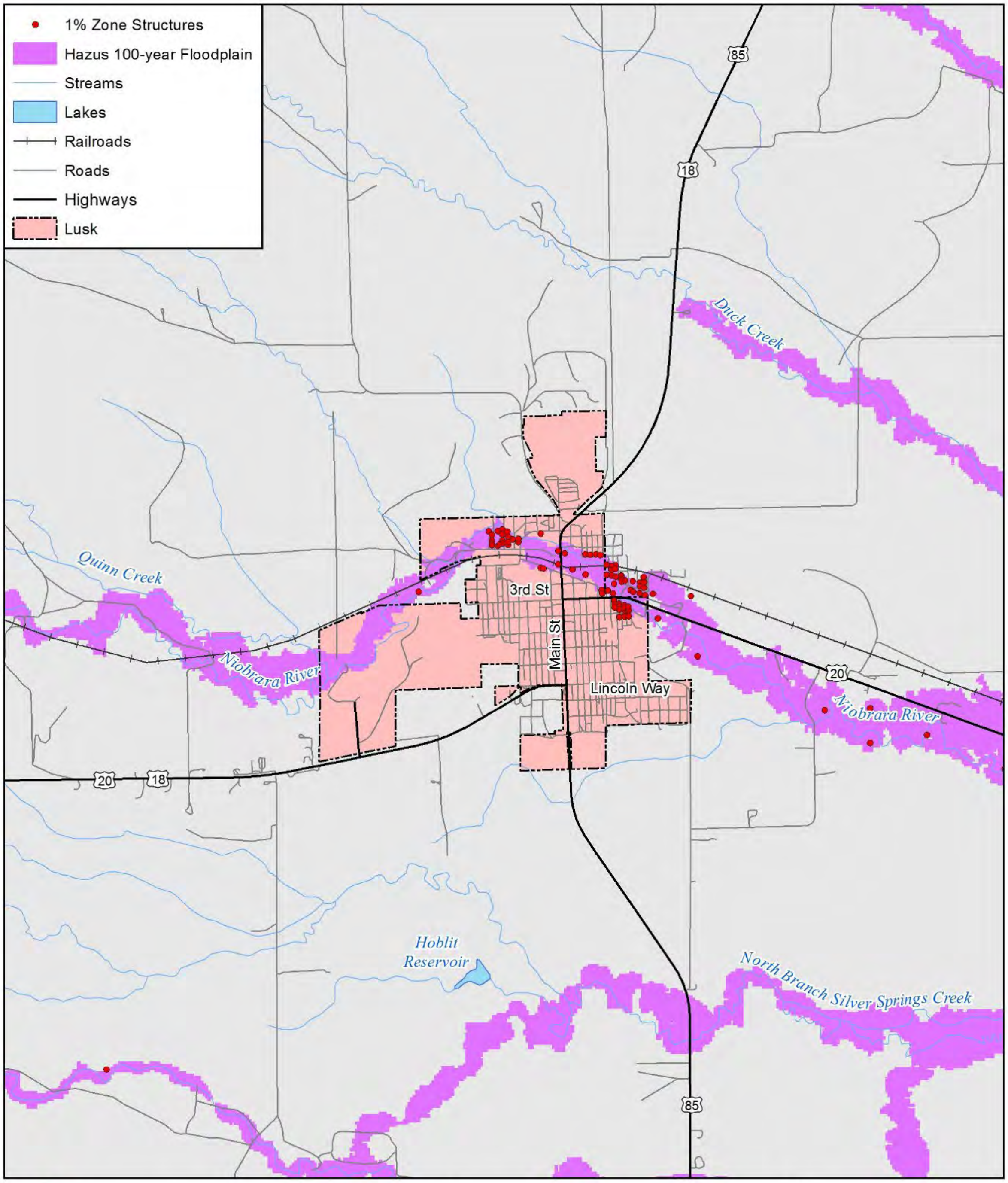


Figure 4-30 Lusk Flood Hazards and Parcels/Structures at Risk



Map compiled 4/2018;
intended for planning purposes only.
Data Source: WY Geospatial Hub,
WYDOT, HSIP Freedom 2015,
Hazus-MH MR2

0 0.5 1 2 Miles

N

Figure 4-31 Van Tassell Flood Hazards and Parcels/Structures at Risk

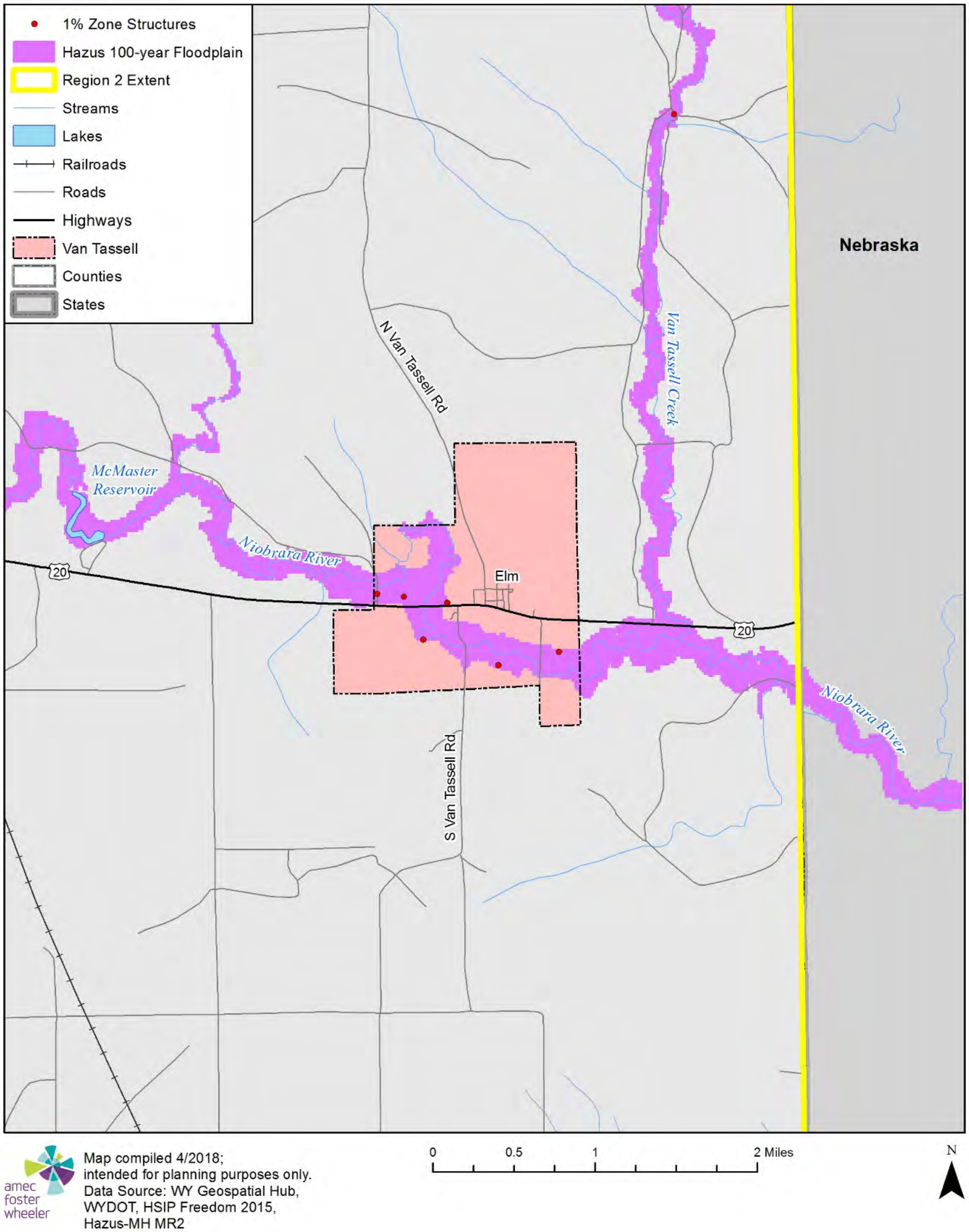


Table 4-32 Flood Occurrences per County

County	Events	Total Property Damage	Total Crop Damage	Period of Record
Converse	17	$1,181,500	$0	1941-2016
Natrona	41	$11,013,500	$0	1895-2017
Niobrara	17	$1,542,250	$2,250	1938-2015
TOTAL	**75**	**$13,737,250**	**$2,250**	**1895-2017**

Source: NCEI

Frequency/Likelihood of Occurrence and Spatial Coverage

Judging by the historical flood record for the Region, a flood of at least minimal magnitude occurs once or twice every year or two, on average, within the planning area. Most of these floods' extents were less than the 100-year flood; however, the chance of a 100-year flood occurring in any 100-year period is approximately 50%, or a chance that flooding will affect the region to some extent (spatially speaking). Using the guidelines outlined in Section 4.2, this yields a 10-100 % probability. This corresponds to a **likely** occurrence rating, meaning that a flood has a 10-100% chance of occurrence in the next year somewhere in the Region.

Potential Magnitude

Magnitude and severity can be described or evaluated in terms of a combination of the different levels of impact that a community sustains from a hazard event. Specific examples of negative impacts from flooding on Region 2 span a comprehensive range and are summarized as follows:

- Floods cause damage to private property that often creates financial hardship for individuals and families;
- Floods cause damage to public infrastructure resulting in increased public expenditures and demand for tax dollars;
- Floods cause loss of personal income for agricultural producers that experience flood damages;
- Floods cause emotional distress on individuals and families; and
- Floods can cause injury and death.

Floods present a risk to life and property, including buildings, their contents, and their use. Floods can affect crops and livestock. Floods can also affect lifeline utilities (e.g., water, sewerage, power), transportation, jobs, tourism, the environment, and the local and regional economies. The impact of a flood event can vary based on geographic location to waterways, soil content and ground cover, and construction. The extent of the damage of flooding ranges from very narrow to widespread based on the type of flooding and other circumstances such as previous rainfall, rate of precipitation accumulation, current conditions in the infrastructure and landscapes, the time of year, and emergency response preparedness.

The magnitude and severity of the flood hazard is usually determined by both the extent of impact it has on the overall geographic area, and by identifying the most catastrophic event in the previous flood history (as an example of the losses that could be incurred during such an event). Sometimes this "example" of a catastrophic event is referred to as the "event of record." The flood of record is almost always correlated to a peak discharge at a gage, because it usually also comes with the worst impacts in terms of property damage, loss of life, etc. The most damaging event in the Region is used to set the "event of record", in terms of injuries/deaths and/or property/agricultural damages.

An event of record could be the flood in summer of 2009 impacted Natrona County with over $5,000,000; nevertheless, an earlier flood in May of 1978 has been among the most damaging in the history of the region, inflicting roughly $15.5 million in damages, especially around Niobrara. However, given this event affected 12 counties in the Rocky Mountain region as a whole, it is difficult to calculate the event's damages for Region 2 alone. As such, a single "event of record" for Region 2 may not be clearly defined, given the various similarly damaging events.

The potential magnitude for a flood event in the Region is overall estimated to be **limited**. An event of limited magnitude can result in some injuries, a shutdown of critical facilities for over a week, and/or damages to more than 10% of the planning area (in terms of property and agricultural losses). This is consistent with the flood event history in the Region. The flood history indicates that damaging floods have occurred consistently in the planning area.

Vulnerability Assessment

Population

Vulnerable populations in Region 2 include residents living in known flood prone areas or near areas vulnerable to flash floods. Certain populations are particularly vulnerable. This may include the elderly and very young; those living in long-term care facilities; mobile homes; hospitals; low-income housing areas; temporary shelters; people who do not speak English well; tourists and visitors; and those with developmental, physical, or sensory disabilities. These populations may be more vulnerable to flooding due to limitations in mobility and accessibility, income, challenges in receiving and understanding warnings, or unfamiliarity with surroundings.

As part of this Plan's preparation, an estimate of the population exposed to flooding was created using a GIS overlay of existing Digital Flood Insurance Rate Maps (DFIRMs) on potentially flooded parcels. The flood-impacted population for each county in the region was then calculated by taking the number of residential units in the 100-year and 500-year floodplains and multiplying that number by the average household size based on the Census Bureau's estimate for the counties. The average household factor was 2.54 for Converse County, 2.44 for Natrona, and 2.24 for Niobrara. The results are displayed below in Table 4-33 below.

Table 4-33 Flood Vulnerable Population Estimates in Region 2

Type of Flood	Total # of Parcels	Vulnerable Population Estimate
100 yr. flood	1,544	2,751
500 yr. flood	3,401	6,231
TOTAL	**4,945**	**8,982**

Source: FEMA NFHL, HAZUS analysis, and Census Bureau average household estimates for 2012-2016

Property and Economic Losses

GIS analysis was used to estimate Region 2's potential property and economic losses. The county parcel layers were used as the basis for the inventory of developed parcels. GIS was used to create a centroid, or point, representing the center of each parcel polygon, which was overlaid on the best available floodplain layers. For the purposes of this analysis, the flood zone that intersected the centroid was assigned as the flood zone for the entire parcel (so either 1% or 0.2% annual chance flood). Another assumption with this model is that every parcel with an improvement value greater than zero was assumed to be developed in some way. Only improved parcels, and the value of those improvements, were analyzed and aggregated by jurisdiction, property type, and flood zone. The summarized results for the Region are shown below, followed by the summarized results for each community affected by flooding.

Table 4-34 and Table 4-35 show the count and improved value of all the parcels in the Region, broken up by each county and their jurisdictions, by flood zone. Only those parcels which fall within the 100-year/Hazus derived or 500-year floodplains are summarized. The tables also show loss estimate values which are calculated based upon the improved value and estimated contents value. The estimated contents value is 50% of the improved value for residential properties, 150% for industrial, and 100% for all other non-residential properties; the Total Exposure Value is the sum of the improved and estimated contents values; the potential loss estimate is 25% of the total value based on FEMA's depth-damage loss curves. For example, a two-foot flood generally results in about 25% damage to the structure (which translates to 25% of the structure's replacement value).

Table 4-34 Region 2 Hazus Flood Risk and FEMA 1% Annual Chance Flood Risk Summaries

Jurisdiction	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Converse	239	$46,981,829	$31,043,591	$78,025,420	$19,506,355	462
Natrona	1,131	$108,230,726	$70,102,695	$178,333,421	$44,583,355	2,161
Niobrara	174	$18,551,147	$16,866,250	$35,417,397	$8,854,349	128
TOTAL	**1,544**	**$173,763,702**	**$118,012,535**	**$291,776,237**	**$72,944,059**	**2,751**

Table 4-35 Region 2 FEMA 0.2% Annual Chance Flood Risk Summaries

Jurisdiction	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Converse	274	$43,265,330	$28,188,399	$71,453,729	$17,863,432	551
Natrona	3,127	$327,118,206	$215,701,005	$542,819,211	$135,704,803	5,680
Niobrara	--	--	--	--	--	--
TOTAL	**3,401**	**$370,383,536**	**$243,889,404**	**$614,272,940**	**$153,568,235**	**6,232**

Table 4-36 Converse County FEMA 1%/Hazus and 0.2% Annual Chance Flood Risk Summary

1% Annual Chance Flood Risk

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Unincorporated	Agricultural	46	$13,907,736	$13,907,736	$27,815,472	$6,953,868	--
	Commercial	4	$4,945,256	$2,472,628	$7,417,884	$1,854,471	--
	Residential	106	$20,515,693	$10,257,846	$30,773,539	$7,693,385	269
	Total	**156**	**$39,368,685**	**$26,638,210**	**$66,006,895**	**$16,501,724**	**269**
Douglas	Commercial	5	$1,020,034	$1,020,034	$2,040,068	$510,017	--
	Residential	51	$4,552,469	$2,276,234	$6,828,703	$1,707,176	130
	Total	**56**	**$5,572,503**	**$3,296,268**	**$8,868,771**	**$2,217,193**	**130**
Glenrock	Commercial	2	$177,586	$177,586	$355,172	$88,793	--
	Residential	25	$1,863,055	$931,527	$2,794,582	$698,646	64
	Total	**27**	**$2,040,641**	**$1,109,113**	**$3,149,754**	**$787,439**	**64**
Grand Total		**239**	**$46,981,829**	**$31,043,591**	**$78,025,420**	**$19,506,355**	**462**

0.2% Annual Chance Flood Risk

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Unincorporated	Commercial	1	$59,828	$59,828	$119,656	$29,914	--
	Total	**1**	**$59,828**	**$59,828**	**$119,656**	**$29,914**	--
Douglas	Commercial	50	$11,902,160	$11,902,160	$23,804,320	$5,951,080	--
	Exempt	5	$1,013,168	$1,013,168	$2,026,336	$506,584	--
	Industrial	1	$68,156	$102,234	$170,390	$42,598	--
	Residential	217	$30,222,018	$15,111,009	$45,333,027	$11,333,257	551
	Total	**273**	**$43,205,502**	**$28,128,571**	**$71,334,073**	**$17,833,518**	**551**
Grand Total		**274**	**$43,265,330**	**$28,188,399**	**$71,453,729**	**$17,863,432**	**551**

Table 4-37 Natrona County FEMA 1%/Hazus and 0.2% Annual Chance Flood Risk Summary

1% Annual Chance Flood Risk

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Casper	Commercial	84	$5,051,721	$5,051,721	$10,103,442	$2,525,861	--
	Exempt	18	$0	$0	$0	$0	--
	Res Vacant Land	2	$0	$0	$0	$0	--
	Residential	565	$50,281,259	$25,140,630	$75,421,889	$18,855,472	1,379
	Total	**669**	**$55,332,980**	**$30,192,351**	**$85,525,331**	**$21,381,333**	**1,379**
Evansville	Commercial	3	$1,758,803	$1,758,803	$3,517,606	$879,402	--
	Exempt	1	$0	$0	$0	$0	--
	Residential	1	$214,208	$107,104	$321,312	$80,328	2
	Total	**5**	**$1,973,011**	**$1,865,907**	**$3,838,918**	**$959,730**	**2**
Mills	Commercial	8	$763,194	$763,194	$1,526,388	$381,597	--
	Exempt	3	$0	$0	$0	$0	--
	Residential	5	$76,673	$38,337	$115,010	$28,752	12
	Total	**16**	**$839,867**	**$801,531**	**$1,641,398**	**$410,349**	**12**
Unincorporated	Com Vacant Land	5	$0	$0	$0	$0	--
	Commercial	73	$5,117,428	$5,117,428	$10,234,856	$2,558,714	--
	Exempt	3	$0	$0	$0	$0	--
	Industrial	9	$9,198,301	$13,797,452	$22,995,753	$5,748,938	--
	Multi-Use	10	$886,915	$886,915	$1,773,830	$443,458	--
	Res Vacant Land	26	$0	$0	$0	$0	--
	Residential	315	$34,882,224	$17,441,112	$52,323,336	$13,080,834	769
	Total	**441**	**$50,084,868**	**$37,242,907**	**$87,327,775**	**$21,831,944**	**769**
Grand Total		**1,131**	**$108,230,726**	**$70,102,695**	**$178,333,421**	**$44,583,355**	**2,161**

0.2% Annual Chance Flood Risk

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Casper	Com Vacant Land	8	$0	$0	$0	$0	--
	Commercial	256	$69,544,805	$69,544,805	$139,089,610	$34,772,403	--
	Exempt	108	$1,095,930	$1,095,930	$2,191,860	$547,965	--
	Industrial	5	$2,107,754	$3,161,631	$5,269,385	$1,317,346	--
	Multi-Use	13	$2,978,567	$2,978,567	$5,957,134	$1,489,284	--
	Res Vacant Land	89	$0	$0	$0	$0	--
	Residential	1,593	$164,544,092	$82,272,046	$246,816,138	$61,704,035	3,887
	Total	**2,072**	**$240,271,148**	**$159,052,979**	**$399,324,127**	**$99,831,032**	**3,887**
Evansville	Commercial	3	$355,402	$355,402	$710,804	$177,701	--
	Exempt	4	$0	$0	$0	$0	--
	Res Vacant Land	29	$0	$0	$0	$0	--
	Residential	239	$23,417,500	$11,708,750	$35,126,250	$8,781,563	583
	Vacant Land	2	$1,245	$1,245	$2,490	$623	

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
	Total	**277**	**$23,774,147**	**$12,065,397**	**$35,839,544**	**$8,959,886**	**583**
Mills	Com Vacant Land	21	$0	$0	$0	$0	--
	Commercial	21	$1,388,874	$1,388,874	$2,777,748	$694,437	--
	Exempt	7	$0	$0	$0	$0	--
	Industrial	1	$3,912,380	$5,868,570	$9,780,950	$2,445,238	--
	Res Vacant Land	62	$0	$0	$0	$0	--
	Residential	267	$9,870,584	$4,935,292	$14,805,876	$3,701,469	651
	Total	**379**	**$15,171,838**	**$12,192,736**	**$27,364,574**	**$6,841,144**	**651**
Unincorporated	Com Vacant Land	2	$0	$0	$0	$0	--
	Commercial	155	$11,089,932	$11,089,932	$22,179,864	$5,544,966	--
	Exempt	1	$0	$0	$0	$0	--
	Industrial	3	$2,694,324	$4,041,486	$6,735,810	$1,683,953	--
	Multi-Use	4	$400,133	$400,133	$800,266	$200,067	--
	Res Vacant Land	5	$0	$0	$0	$0	--
	Residential	229	$33,716,684	$16,858,342	$50,575,026	$12,643,757	559
	Total	**399**	**$47,901,073**	**$32,389,893**	**$80,290,966**	**$20,072,742**	**559**
Grand Total		**3,127**	**$327,118,206**	**$215,701,005**	**$542,819,211**	**$135,704,803**	**5,680**

Table 4-38 Niobrara County FEMA 1%/Hazus Annual Chance Flood Risk Summary

1% Annual Chance Flood Risk

Jurisdiction	Property Type	Parcel Count	Improved Value	Content Value	Total Exposure	Potential Loss	Population
Lusk	Commercial	3	$65,326	$65,326	$130,652	$32,663	--
	Exempt	1	$21,174	$21,174	$42,348	$10,587	--
	Ind. Vacant Land	2	$16,545	$16,545	$33,090	$8,273	--
	Industrial	1	$41,900	$62,850	$104,750	$26,188	--
	Res Vacant Land	6	$42,285	$42,285	$84,570	$21,143	--
	Residential	32	$1,456,790	$728,395	$2,185,185	$546,296	72
	Com Vacant Land	1	$12,500	$12,500	$25,000	$6,250	--
	Total	**46**	**$1,656,520**	**$949,075**	**$2,605,595**	**$651,399**	**72**
Manville	Residential	5	$180,032	$90,016	$270,048	$67,512	11
	Res Vacant Land	8	$30,242	$30,242	$60,484	$15,121	--
	Total	**13**	**$210,274**	**$120,258**	**$330,532**	**$82,633**	**11**
Unincorporated	Agricultural	73	$14,168,147	$14,168,147	$28,336,294	$7,084,074	--
	Com Vacant Land	2	$14,897	$14,897	$29,794	$7,449	--
	Commercial	5	$574,269	$574,269	$1,148,538	$287,135	--
	Ind Vacant Land	4	$77,468	$77,468	$154,936	$38,734	--
	Res Vacant Land	6	$23,647	$23,647	$47,294	$11,824	--
	Residential	19	$1,632,334	$816,167	$2,448,501	$612,125	43
	Total	**109**	**$16,490,762**	**$15,674,595**	**$32,165,357**	**$8,041,339**	**43**
Van Tassell	Residential	1	$142,539	$71,270	$213,809	$53,452	2
	Agricultural	3	$43,387	$43,387	$86,774	$21,694	--
	Res Vacant Land	2	$7,665	$7,665	$15,330	$3,833	--
	Total	**6**	**$193,591**	**$122,322**	**$315,913**	**$78,978**	**2**

Jurisdiction	Property Type	Parcel Count	Improved Value	Content Value	Total Exposure	Potential Loss	Population
Grand Total		**174**	**18,551,147**	**16,866,250**	**35,417,397**	**8,854,349**	**128**

Niobrara County does not have FEMA mapped floodplains in a digital format, so 0.2% annual chance floodplain losses were not calculated in this plan.

Based on this analysis, the Region 2 planning area has significant assets at risk to the 100-year and greater floods. There are 1,544 improved parcels within the 100-year floodplain (1% annual chance), for a total improved value of $173,763,702. There are 3,401 improved parcels within the 500-year floodplain (0.2% annual chance), for a total improved value of $370,383,536. Overall, Region 2 counties potentially face over $226 million in potential losses from flooding both the 100-year and 500-year floodplain estimations. Approximately $72.94 million of that total is based on damage estimates from the 1% annual chance flood alone, with the remaining $153.57 million in damages resulting from the 0.2% annual chance flood.

NFIP Claims Analysis

Another method of examining the magnitude and severity of flooding in the Region is to examine the historic damage losses and payments from the National Flood Insurance Program, or NFIP. This information is not comprehensive, because it only reflects the communities which participate in the NFIP and have made claims, but it is a useful overview of flood damages in the region. The information below represents the composite of unincorporated and community-specific policies, claims and payments. According to statistics from the National Flood Insurance Program (https://www.fema.gov/policy-claim-statistics-flood-insurance) there have been a total of 60 flood insurance claims filed between 1/1/1978 and 03/31/2018 in the Region. The total of the payments made on these claims was $137,694.55. As of 02/07/2018, however, there were 290 flood insurance policies in force in the Region, for a total coverage of $66,208,100. More details on National Flood Insurance Program participation can be found within the county annexes.

Most of Niobrara County is neither participating nor has effective FEMA Flood Insurance Rate Maps (with the exception of the Town of Lusk). As such, there are no NFIP policies available for most jurisdictions in the county, including unincorporated areas. Certain communities of Converse and Natrona Counties are also not mapped or part of the NFIP (indicated by “N/A” in Table 4-39 below).

Table 4-39 NFIP Policy and Insurance Claim Data for Region 2

Location	Policies	Coverage "Insurance in Force"	# of Claims "Closed Paid Losses"	Paid Losses "$ of closed paid losses"	Repetitive Losses	Substantial Damage claims	# of Policies in A Zones	# of Policies in Non A Zones
Converse County	17	$4,750,400	1	$2,032.60	--	--	2	15
Glenrock	4	$675,700	4	$7,350.78	--	--	2	2
Douglas	10	$2,729,000	--	--	--	--	0	10
Rolling Hills	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lost Springs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Natrona County	42	$12,919,500	1	$2,725.67	--	--	0	42
Casper	211	$43,728,500	20	$125,585.50	--	--	4	207
Mills	4	$875,000	--	--	--	--	0	4
Evansville	2	$530,000	--	--	--	--	0	2
Bar Nunn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Midwest	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Edgerton	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Niobrara County	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manville	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lusk	5	$828,300	N/A	N/A	N/A	N/A	0	5
Van Tassell	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	**295**	**$67,036,400**	**26**	**$137,695**	**0**	**0**	**8**	**287**

Source: FEMA Policy and Claim Statistics https://bsa.nfipstat.fema.gov/reports/1040.htm#56 , State of Wyoming Department of Homeland Security, NFIP Coordinator - current as of 2/07/2018

The only communities in the Region currently eligible for enrollment in the National Flood Insurance Program's Community Rating System (CRS) are Casper in Natrona County and Douglas in Converse County. The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions. For more details please visit the CRS document accessible here: https://www.fema.gov/media-library/assets/documents/15846

Critical Facilities and Community Assets

GIS analysis of flood hazards in Region 2 indicates that there are 48 critical facilities and/or community assets that are potentially exposed to flood hazards. There are 19 facilities in the 100-year floodplain (including the Hazus-derived floodplains) and 29 in the 500-year floodplain. The majority of these facilities are microwave service towers. Table 4-40 and Table 4-41 below summarize the facilities that are potentially at risk in the 1% and 0.2% annual chance floods. One limitation to the HSIP dataset, however, is a lack of water facilities (water and wastewater), for example. Gaining access to this type of information would enhance the results of the critical facility risk analysis in future endeavors.

Table 4-40 Critical Facilities within the Hazus Flood Zones 1% Chance FEMA Flood Hazard and Hazus Flood Zones

Source	County	Jurisdiction	Facility Type	Count
Hazus 100-year	CONVERSE	Unincorporated	Microwave Service Towers	1
	NATRONA	Unincorporated	Electric Substations	3
			Power Plants	1
	NIOBRARA	Lusk	Electric Substations	1
			Microwave Service Towers	2
1% Annual Chance FEMA	CONVERSE	Unincorporated	Electric Substations	1
			EPA FRS Power Plants	1
			Fire Stations	1
			Microwave Service Towers	1
			Paging Transmission Towers	1
			Power Plants	1
	NATRONA	Casper	Microwave Service Towers	1
			WWTP	1
		Unincorporated	Microwave Service Towers	2
			Natural Gas Plants	1
GRAND TOTAL				**19**

Table 4-41 Critical Facilities within the 0.2% Chance FEMA Flood Zone

County	Jurisdiction	Facility Type	Count
CONVERSE	Douglas	AM Transmission Towers	1
		Nursing Homes	1
		Public Schools	1
NATRONA	Casper	Day Care Facilities	3
		EMS Stations	1
		Fire Stations	1
		Local Law Enforcement	3
		Microwave Service Towers	12
		Paging Transmission Towers	1
		Public Schools	1
	Evansville	Day Care Facilities	1
		Microwave Service Towers	1
	Mills	Public Schools	1
	Natrona	Paging Transmission Towers	1
GRAND TOTAL			**29**

Natural, Historic, and Cultural Resources

Natural resources are generally resistant to flooding, except where natural landscapes and soil compositions have been altered for human development or after periods of previous disasters such as drought and fire. Wetlands, for example, exist because of natural flooding incidents. Areas that are no longer wetlands may suffer from oversaturation of water, as will areas that are particularly impacted by drought. Areas recently suffering from wildfire damage may erode because of flooding (as has been the case in previous floods in Natrona and Converse Counties), which could permanently alter an ecological system.

Tourism and outdoor recreation is an important part of the Region's economy as well. If part of the planning area were significantly damaged by flooding, tourism and outdoor recreation could potentially suffer.

Future Development

For NFIP participating communities, floodplain management practices implemented through local floodplain management ordinances are designed to mitigate the flood risk to new development in floodplains. The lack of comprehensive flood hazard mapping in Niobrara County, for example, makes floodplain management challenging in some areas of the County. No major growth or development in the Region is expected to significantly alter the general area flood risk, but good planning, zoning, and general hazard mitigation practices are always necessary to prevent future development from being heavily impacted by flooding.

Summary

Overall, flooding is a **medium** to significant hazard in parts of the region, particularly in Natrona and Converse Counties. The Region floods, on average, once or twice every year or two, having damaged homes, infrastructure (roads, railroads, bridges, culverts), and causing general property and sometimes agricultural losses in the past. Flood risk varies by jurisdiction and this risk is detailed further in the county annexes. Table 4-42 below summarizes the specific hazard risks by county.

Table 4-42 Flood Hazard Risk Summary in Region 2, by County

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Limited	Likely	Limited	Medium
Natrona	Significant	Likely	Significant	High
Niobrara	Limited	Likely	Limited	Medium

4.2.7 Hail

Hazard/Problem Description

Hail causes more than a billion dollars of property damage nationally each year. Damaging hail events occur sporadically throughout Region 2, usually associated with severe summer storms and wind events. Hailstones form when a super-cooled droplet collects a layer of ice and continues to grow, sustained by an updraft. Once the hailstone cannot be held up any longer by the updraft, it falls to the ground. Hail up to 3.5 inches in diameter has been recorded by the NCEI in the Region. Most of this damage is to crops, but hail can also decimate structural sidings, shatter windows, peel paint, and severely damage automobiles and equipment not protected or stored inside.

Geographical Area Affected

Hail can strike anywhere in the Region, and when they do occur hail storms can impact a Significant portion of the Region.

Past Occurrences

A comprehensive history of damaging hailstorms historically affecting the counties in Region 2 is included in Table 4-42. The data was derived from the monthly Storm Data reports generated and released by the National Oceanic and Atmospheric Administration's (NOAA) National Climate Center.

NOAA records any hail events with hailstones that are 0.75 inch or larger in diameter, or any hail of a smaller diameter which causes property and/or crop damage, or casualties. According to the NOAA definition, there have been 371 separate hail incidents in the region since 1950, or an average of 5.54 incidents per year. However, only fourteen of those incidents resulted in damage or injuries, for a total of two injuries, $320,500 of property damage, and no reported crop damage. No deaths have been associated with these storms in the region during this timeframe. Most public and personal property damage from hail is insured under private property insurance or crop insurance policies, serviced by multiple insurance providers; it is very difficult to get a true cumulative estimate of damage costs caused by hail events. Nationwide, most hail-related injuries are suffered by people caught unsheltered when hail begins to fall. Most hail-related injuries are minor and go unreported. The figures and tables below display past occurrences of hail in the Region.

Table 4-43 Summary Hail History, Region 2 (1950-2016)

County	Events	Deaths	Injuries	Property Damage	Crop Damage	Total Damage
Converse	104	0	1	$100,000	$0	$100,000
Natrona	126	0	1	$125,000	$0	$125,000
Niobrara	141	0	0	$95,500	$0	$95,500
Total:	**371**	**0**	**2**	**$320,500**	**$0**	**$320,500**

Source: NOAA

Figure 4-32 was created by Western Water Assessment based on their analysis of NCEI data; shows the number of hail events in Wyoming per county from 1955-2017.

Figure 4-32 Hail Events in Wyoming, 1955-2017

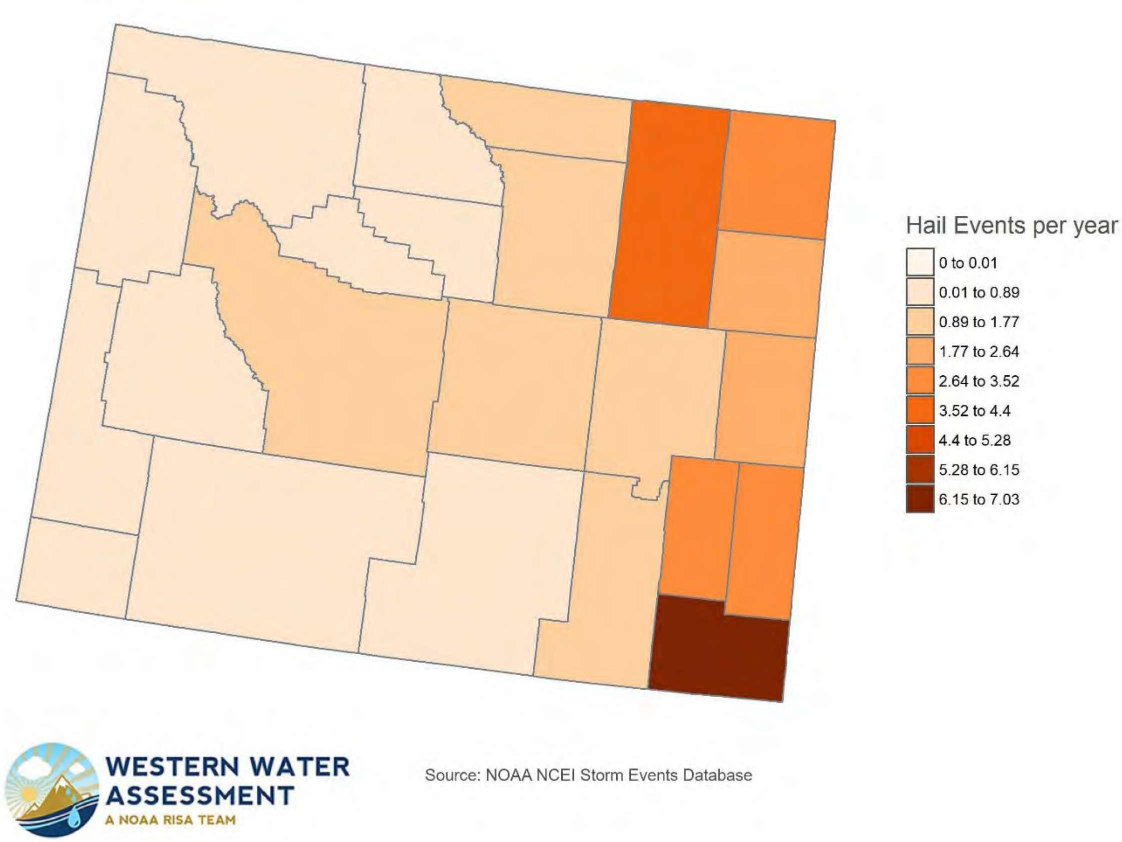


Figure 4-33 Region 2 Hail Events

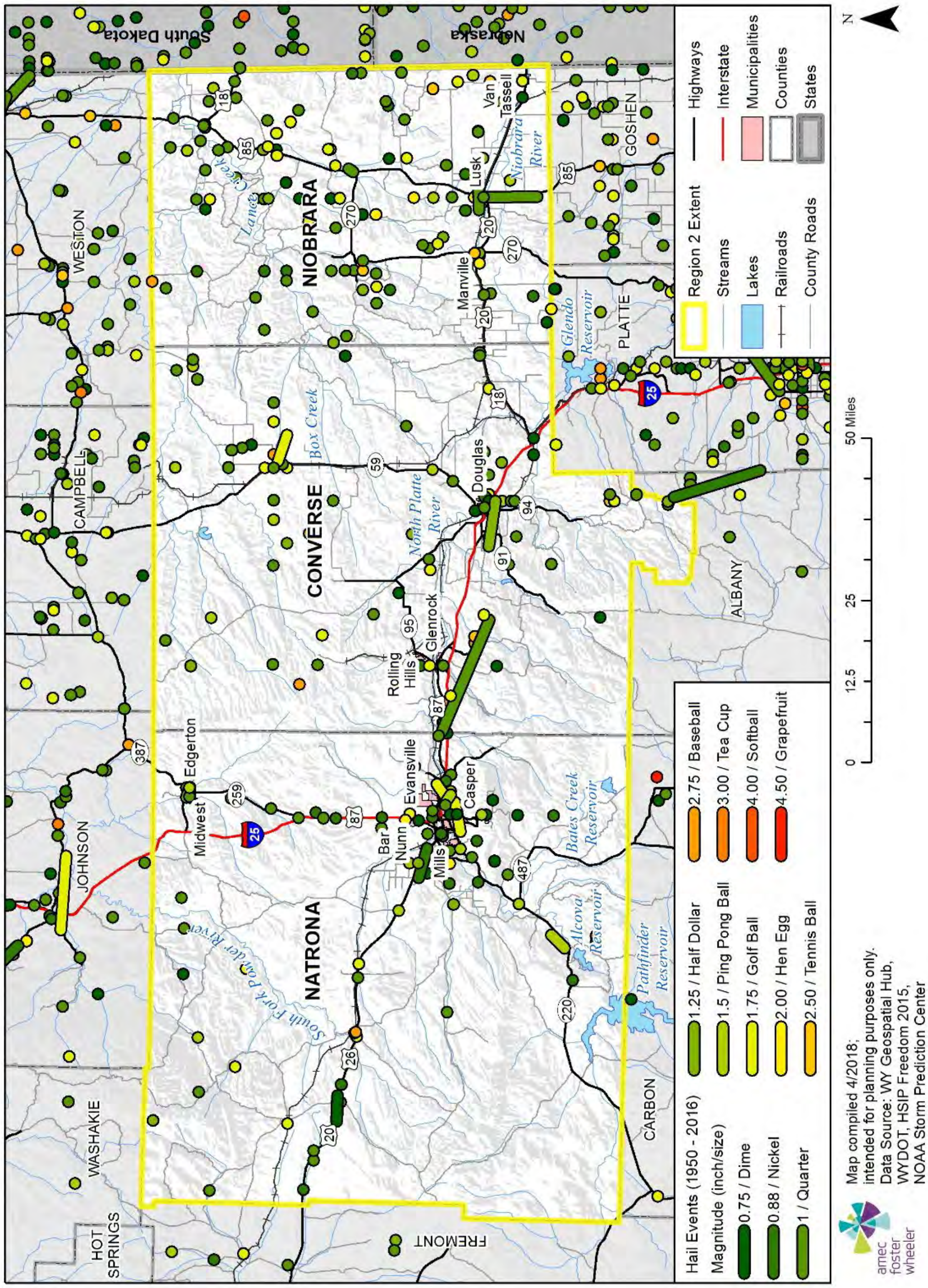
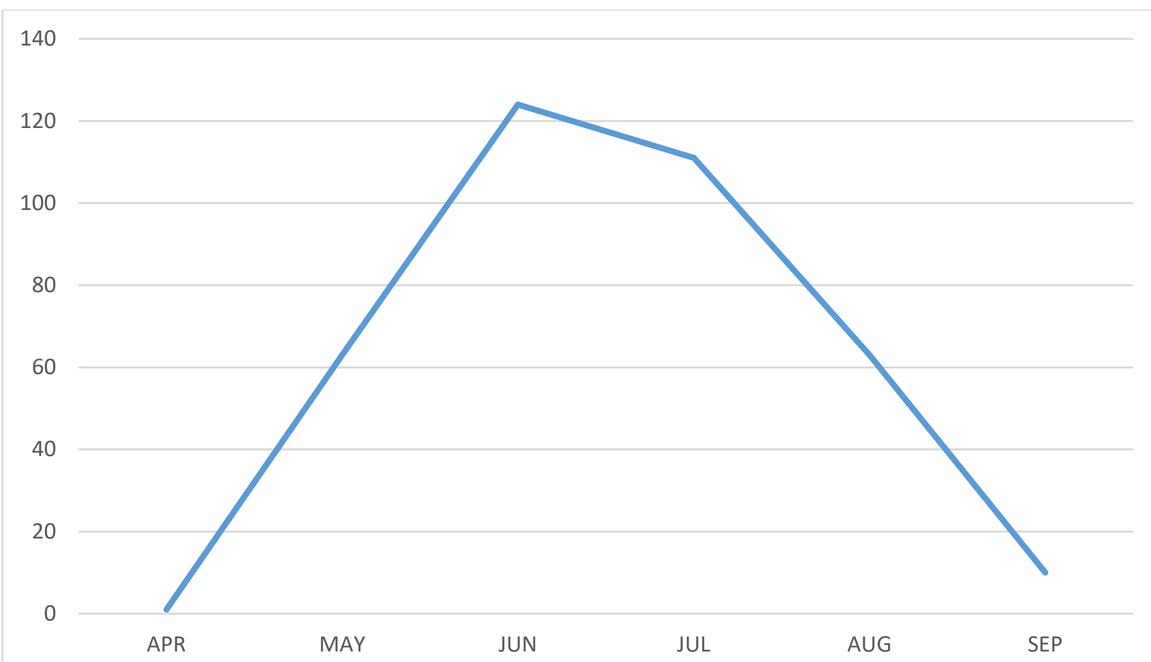


Table 4-44 Region 2 History with Damaging Hail

County	Date	Hail Size	Deaths	Injuries	Property Damage	Crop Damage
Natrona	2000-07-20	1.75	0	1	$110,000	$0
Converse	1989-08-18	0.75	0	1	$50,000	$0
Niobrara	1992-07-12	1.75	0	0	$50,000	$0
Converse	1996-08-15	1.75	0	0	$30,000	$0
Niobrara	1996-08-28	3.5	0	0	$10,000	$0
Niobrara	1996-08-28	1.75	0	0	$10,000	$0
Niobrara	1996-08-28	1.25	0	0	$10,000	$0
Niobrara	1996-08-28	1.75	0	0	$10,000	$0
Converse	1998-07-01	2.75	0	0	$10,000	$0
Converse	2009-07-12	1.25	0	0	$10,000	$0
Natrona	2013-06-22	2.75	0	0	$10,000	$0
Niobrara	1992-07-23	1.75	0	0	$5,000	$0
Niobrara	1990-07-04	0.75	0	0	$500	$0
Niobrara	1992-07-23	1.75	0	0	$5,000	$0

Source: NOAA

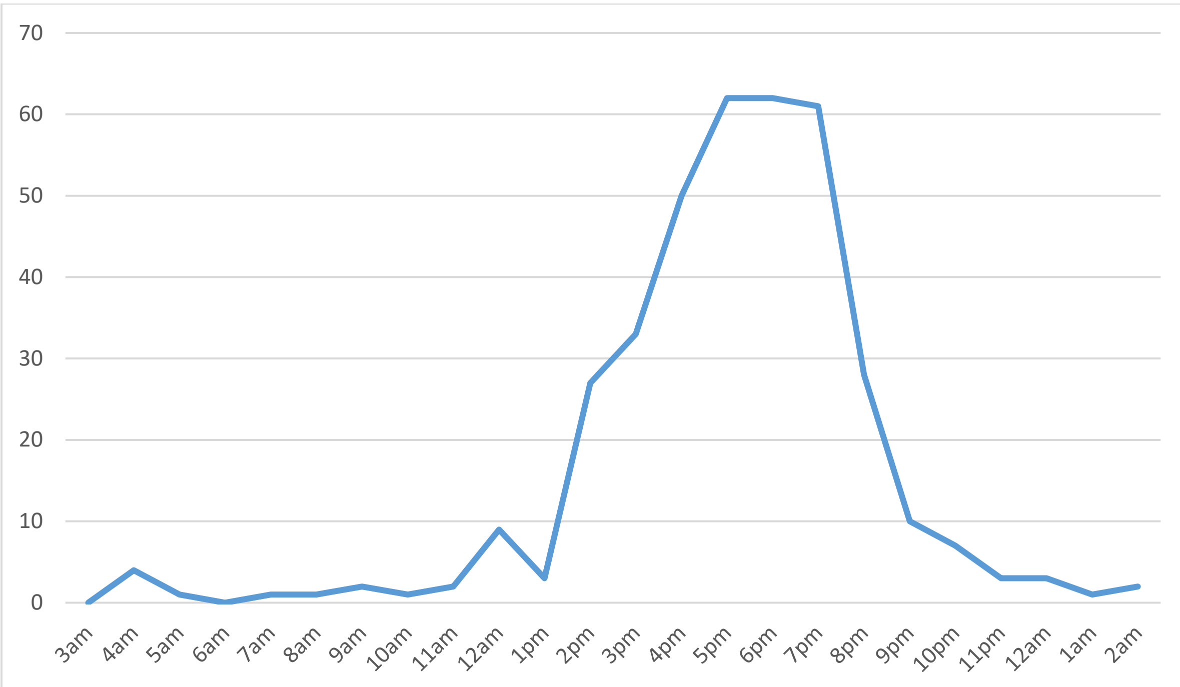
Figure 4-34 Number of Region 2 Hail Events by Month, 1950-2016



Source: NOAA

Hail events in Region 2 are most common during the months of May through August, most often between 1 pm and 10 pm Hail with a diameter less than two inches is most common, although hail up to 3.5 inches has been recorded in the Region. While most historical hail storms in the Region don't result in major damage, recordable damage to property and crops could be in the hundreds of thousands of dollars, while extreme events could result in millions of dollars of damage. Insured loss related to hail storms could be in the millions, depending on the location and parameters of the storm.

Figure 4-35 Number of Region 2 Hail Events by Time of Day, 1950-2016



Source: NOAA

Frequency/Likelihood of Occurrence

Based on available historical NOAA data, the Region has experienced 14 separate damaging hail events between 1950 and 2016, which is roughly one incident every 4-5 years. Thus, the Region is **Likely** to suffer damaging hail storms in the future.

Potential Magnitude

Most public and personal property damage from hail is insured under private property insurance or crop insurance policies, serviced by multiple insurance providers; it is very difficult to get a true cumulative estimate of damage costs caused by hail events. Data collection regarding dollar damage to public and personal property holds significant gaps for this reason. There have been no FEMA disaster or state declarations for the counties in the Region related to damaging hail, and no USDA disaster declarations as a result of hail damage were found. Agricultural losses and claims met by crop insurance carriers due to hail damage are difficult to determine. Since most hail damage is insured, the overall impact long-term for most of the Region is **Negligible**.

Vulnerability Assessment

Hail can strike anywhere in the region, and all structures are vulnerable. Hail can damage roofs, shingles, windows, siding, unsheltered vehicles and any other property unprotected from the storm. People without shelter can also be injured by exposure to hail storms, though there is very little historical reference for this occurring in the Region. Most injuries caused by hail are minor, and go unreported. Higher levels of property damage are expected in more urban areas, and higher levels of crop damage would be expected in rural areas with more farmland.

Future Development

Hail can strike anywhere in the Region, so any growth or new development in the counties will increase exposure to hail damage. Insurance will be an important tool to offset the potentially substantial dollar losses associated with hail.

Summary

The counties in Region 2 will continue to experience on a regular basis. Hail damage to property is expected to be highest in the municipalities; much of the damage to both property and crops is covered under insurance policies.

Table 4-45 Hail Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Significant	Likely	Limited	Medium
Natrona	Significant	Likely	Limited	Medium
Niobrara	Significant	Likely	Limited	Medium

4.2.8 Hazardous Materials

Hazard Description

Generally, a hazardous material is a substance or combination of substances which, because of quantity, concentration, or physical, chemical, or infectious characteristics, may either (1) cause or significantly contribute to, an increase in mortality or an increase in serious, irreversible, or incapacitating reversible, illness; or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, disposed of, or otherwise managed. Hazardous material incidents can occur while a hazardous substance is stored at a fixed facility, or while the substance is being transported.

The U.S. Department of Transportation, U.S. Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) all have responsibilities regarding hazardous materials and waste.

The U.S. Department of Transportation has identified the following classes of hazardous materials:

- Explosives
- Compressed gases: flammable, non-flammable compressed, poisonous
- Flammable liquids: flammable (flashpoint below 141 degrees Fahrenheit) combustible (flashpoint from 141 - 200 degrees)
- Flammable solids: spontaneously combustible, dangerous when wet
- Oxidizers and organic peroxides
- Toxic materials: poisonous material, infectious agents
- Radioactive material
- Corrosive material: destruction of human skin, corrodes steel

The counties in Region 2 are home to several gas plants, refineries and mines, and numerous pipelines, highways, and rail lines run across the Region, creating a likely potential for hazardous materials releases.

Geographical Area Affected

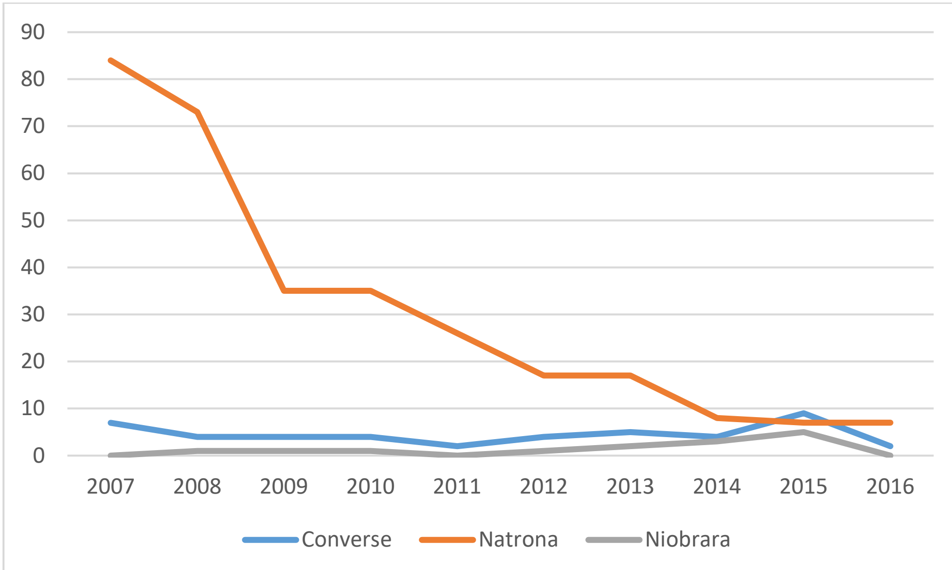
Hazmat incidents can occur at a fixed facility or during transportation. Hazardous materials facilities are identified and mapped by the counties they reside in, along with the types of materials stored there; facilities generally reside in and around communities. Some facilities contain extremely hazardous substances; these facilities are required to generate Risk Management Plans (RMPs), and resubmit these plans every five years. RMP facility information can be found within individual jurisdiction annexes.

In transit, hazardous materials generally follow major transportation routes where possible (including road, rail and pipelines), creating a risk area immediately adjacent to these routes.

Past Occurrences

There are a variety of mechanisms to get an idea of the number and types of historical hazardous materials spills in the Region. One such repository is the catalog of hazardous materials spill and accident reports at the National Response Center (NRC) as part of the Right to Know Network (RTK NET). The figure below shows a ten-year record for reported incidents in Region 2.

Figure 4-36 Hazardous Materials Spills/ Accidents Reported to the NRC Region 2: 2007-2016



Source: http://www.rtk.net/#rmp

The data shows that from 2007 through 2016, the number of NRC-reported incidents in Converse and Niobrara Counties stayed fairly consistent, averaging 4.5 per year in Converse and 1.2 per year in Niobrara. Natrona County, however, saw a steep drop in the number of incidents, falling from 84 per year in 2007 to only 7 per year in 2015 and 2016, a 92% reduction. This led to a Region-wide reduction of 90% in the number of NRC-reported incidents Region. Since 2012, the Region has averaged 18.2 incidents per year, which means that all counties can reasonably expect multiple hazardous materials responses annually. The county data is further broken down in the table below:

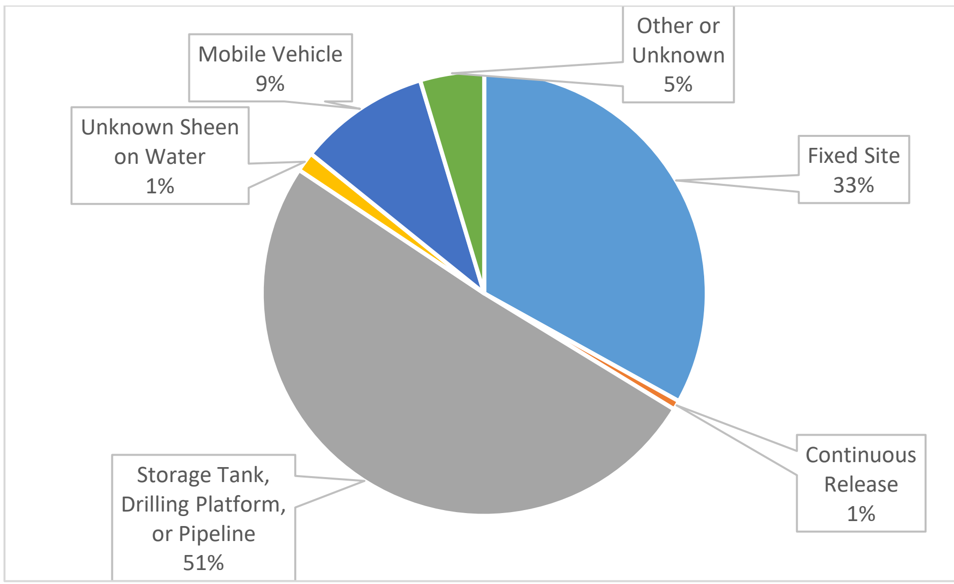
Table 4-46 NRC-Reported Incidents by County: 2007-2016

Year	Converse	Natrona	Niobrara	Total
2007	7	84	0	91
2008	4	73	1	78
2009	4	35	1	40
2010	4	35	1	40
2011	2	26	0	28
2012	4	17	1	22
2013	5	17	2	24
2014	4	8	3	15
2015	9	7	5	21
2016	2	7	0	9
Ten-Year Total	45	309	14	368

Source: http://www.rtk.net/#rmp

The NRC also tracks incidents by type. The following figure shows the percentage of each type of incident over the 10-year period between January 2007 and December 2016. Fixed sites and storage tanks make up 84% of all incidents in Region 2; this is mainly due to the large number of facilities in Natrona County. In Converse and Niobrara Counties, motor vehicle incidents account for 48% of spills.

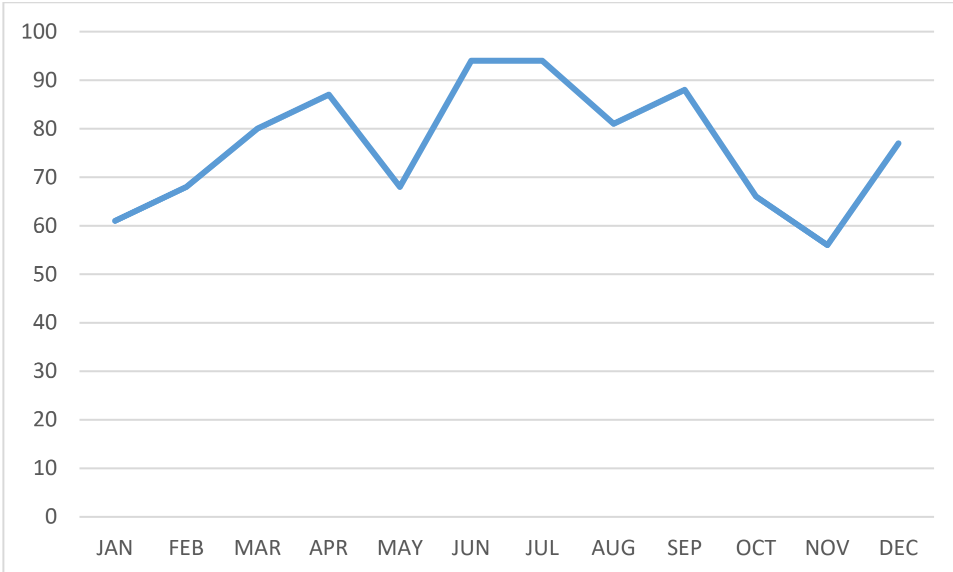
Figure 4-37 Hazmat Incidents Reported to the NRC, Region 2: 2007-2016



Source: http://www.rtk.net/#rmp

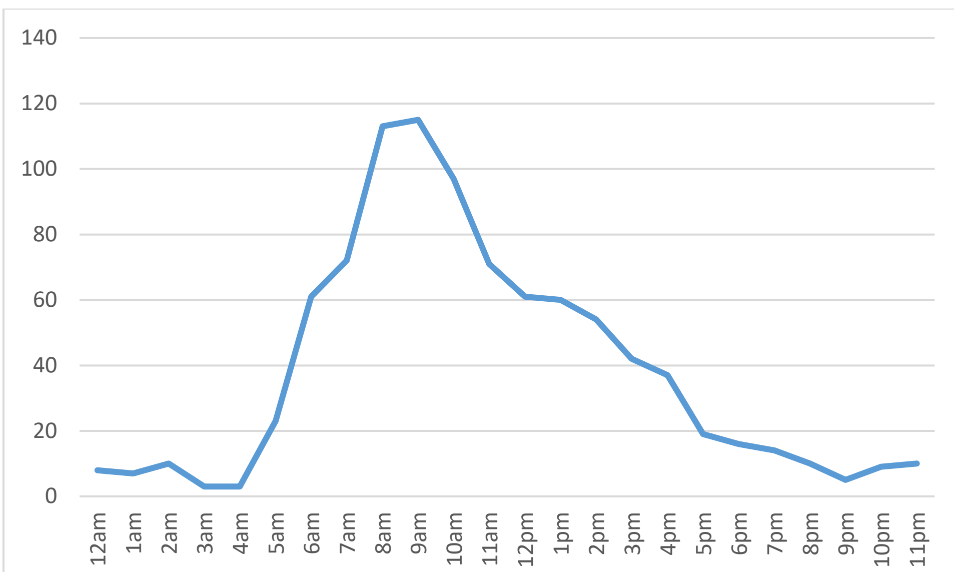
An analysis of NRC-reported incidents from 2000 through 2016 shows that hazardous materials incidents occur year-round, with a slight increase in the warmer months. Similarly, hazardous materials incidents can happen at any time of day, but are far more common between the hours of 5:00am and 6:00pm, peaking historically in the 9 AM hour.

Figure 4-38 Region 2 Hazardous Materials Incidents by Month: 2000-2016



Source: http://www.rtk.net/#rmp

Figure 4-39 Region 2 Hazardous Materials Incidents by Time of Day: 2000-2016



Source: http://www.rtk.net/#rmp

In addition to local first responders, eight Regional Emergency Response Teams (RERT) across the State of Wyoming respond to a variety of incidents, including those incidents involving hazardous materials. The Region 2 RERT is located in Casper, in Natrona County. The following table shows records of Region 2 RERT mission assignments pertaining to hazardous materials releases, according the 2016 Wyoming State Hazard Mitigation Plan.

Table 4-47 Region 2 RERT Mission Assignments, Hazardous Materials: 2004-2015

Type	Number
Fixed Facility	5
Truck/Highway	16
Rail	0
Pipeline	0
Aircraft	2
Orphan Drum	1
Total	**24**

Source: 2016 Wyoming State Hazard Mitigation Plan

Frequency/Likelihood of Occurrence

The Region experiences multiple hazardous materials incidents each year, with various degrees of impact; there is effectively a 100% chance that the Region will see a hazardous materials incident in any given year. Hazardous material spills and releases, both from fixed facilities and during transport, will continue to occur in each county in Region 2 annually.

Potential Magnitude

Impacts that could occur from hazardous waste spills or releases include:

- Injury
- Loss of life (human, livestock, fish and wildlife)
- Evacuations
- Property damage
- Air pollution
- Surface or ground water pollution/contamination
- Interruption of commerce and transportation

Numerous factors go into the ultimate impacts of a hazardous materials release, including method of release, the type of material, location of release, weather conditions, and time of day. This makes it difficult to nail down precise impacts. Materials found in Region 2 will have at least one of the impacts listed above, and probably more.

Vulnerability Assessment

Region 2 has energy pipelines, railroad tracks which carry many types of hazardous materials, and both state and Interstate highways running through its boundaries. A variety of hazardous materials originating in the Region or elsewhere are transported along these routes, and could be vulnerable to accidental spills. Consequences can vary depending on whether the spill affects a populated area vs an unpopulated but environmentally sensitive area.

The Right-to-Know Network lists 46 licensed hazardous waste handlers in Region 2, as broken down in Table 4-48. There are 12 Risk Management Plan (RMP) facilities located in Region 2, as noted in Table 4-49. Note that while Natrona County has a larger number of facilities overall, it has fewer RMP facilities than Converse County. Some of these sites are discussed in more detail in the Annexes.

Table 4-48 Hazardous Materials Handlers in Region 2

County	Treatment, Storage or Disposal	Large Quantity Generator	Transporter	Total
Converse	0	1	9	10
Natrona	1	7	23	31
Niobrara	0	0	5	5
Total	**1**	**8**	**37**	**46**

Source: http://www.rtknet.org/db/erns

Table 4-49 RMP Facilities in Region 2

County	Community	Number of Facilities
Converse	Douglas	6
Converse	Glenrock	2
Natrona	Casper	2
Natrona	Evansville	1
Natrona	Midwest	1
Niobrara	County	0
Total		**12**

Source: http://www.rtknet.org/db/erns

No specific hazardous materials routes or route restrictions are designated in Region 2. Any routes used to carry hazardous materials introduce an element of risk of materials release to the area immediately adjacent to them.

Potential losses can vary greatly for hazardous material incidents. For even a small incident, there are cleanup and disposal costs. In a larger scale incident, cleanup can be extensive and protracted. There can be deaths or injuries requiring doctor's visits and hospitalization, disabling chronic injuries, soil and water contamination can occur, necessitating costly remediation. Evacuations can disrupt home and business activities. Large-scale incidents can easily reach $1 million or more in direct damages.

Future Development

Stationary facilities with hazardous materials are identified and mapped throughout the Region. Transportation routes are also identified. Special care should be taken to cross-reference any new development areas with identified sources for potential hazardous materials incidents. The downturn in oil and gas has resulted in lower growth and loss of tax revenues throughout the Region.

Summary

Table 4-50 Hazardous Materials Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Significant	Highly Likely	Limited	Medium
Natrona	Significant	Highly Likely	Limited	Medium
Niobrara	Limited	Likely	Limited	Low

4.2.9 High Winds and Downbursts

Hazard Description

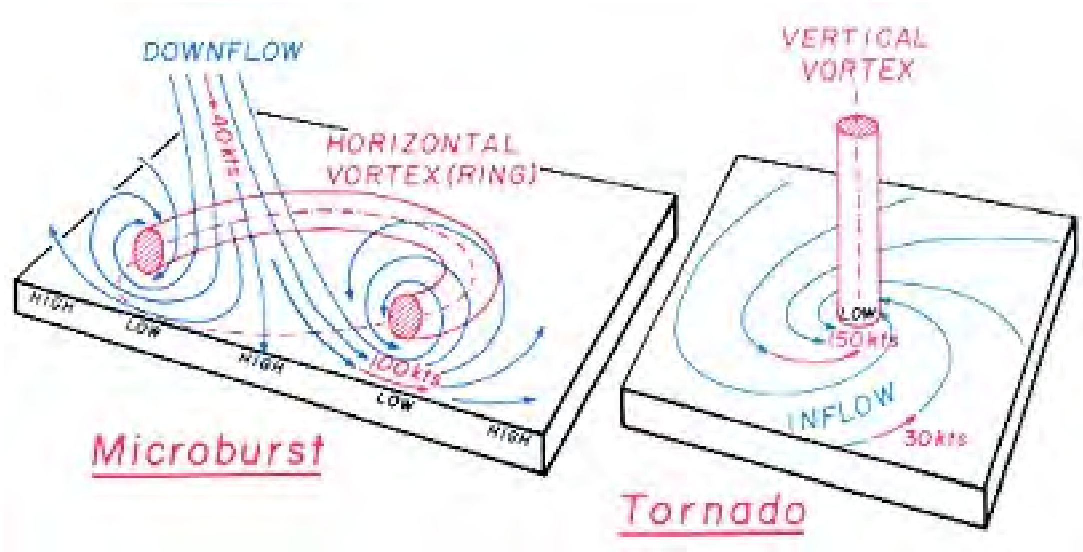
Wind is a nearly constant presence in Wyoming, and can often be overlooked as a hazard. Wyoming's wind is also becoming a positive economic factor, as renewable wind energy is developed around the state.

This profile examines the hazard that high winds present including downbursts, a subcategory of high winds. A downburst is a strong down draft which causes damaging winds on or near the ground. Downbursts are much more frequent than tornadoes, and for every one tornado there are approximately 10 downburst damage reports. Downbursts can be associated with either a heavy precipitation or non-precipitation thunderstorm (dry or wet downbursts), and often occur in the dissipating stage of a thunderstorm. Microbursts and macrobursts are categories of downbursts, classified by length of duration, velocity of wind, and radius of impact.

Microbursts generally last between five and 15 minutes, and impact an area less than three miles wide. Macrobursts can last up to 30 minutes with winds up to 130 miles per hour, and can impact areas larger than three miles in radius. Microbursts and macrobursts may induce dangerous wind shears, which can adversely affect aircraft performance, cause property damage and loss of life.

A downburst can occur when cold air begins to descend from the middle and upper levels of a thunderstorm (falling at speeds of less than 20 miles an hour). As the colder air strikes the Earth's surface, it begins to 'roll' outward. As this rolling effect happens, the air expands causing further cooling and having the effect of pulling the shaft of air above it at higher and higher speeds.

Figure 4-40 Schema of Microburst and Tornado



Source: www.erh.noaa.gov

Downbursts can be mistaken for tornadoes by those that experience them since damages and event characteristics are similar. Tornado winds can range from 40 mph to over 300 mph. Downbursts can exceed winds of 165 mph and can be accompanied by a loud roaring sound. Both downbursts and tornadoes can flatten trees, cause damage to homes and upend vehicles. In some instances, aerial surveying is the best method to determine what kind of event has taken place. In the following photograph, trees are blown down in a straight line - a very strong indication of a downburst as opposed to a tornado.

Figure 4-41 Aerial Image of Downburst Damage

Source: T. Fujita

Geographical Area Affected

High winds are common throughout the planning area. Figure 4-42 and Figure 4-43 were created by Western Water Assessment based on their analysis of NCEI data; they show the number of high wind and thunderstorm wind events in Wyoming per county from 1996-2017. Note that while the number of wind events reported in the counties of Region 2 appear to be relatively moderate, the residents of the area are used to high winds and may be less likely to report them as an "event" compared to other parts of the country.

Figure 4-42 High Wind Events in Wyoming, 1996-2017

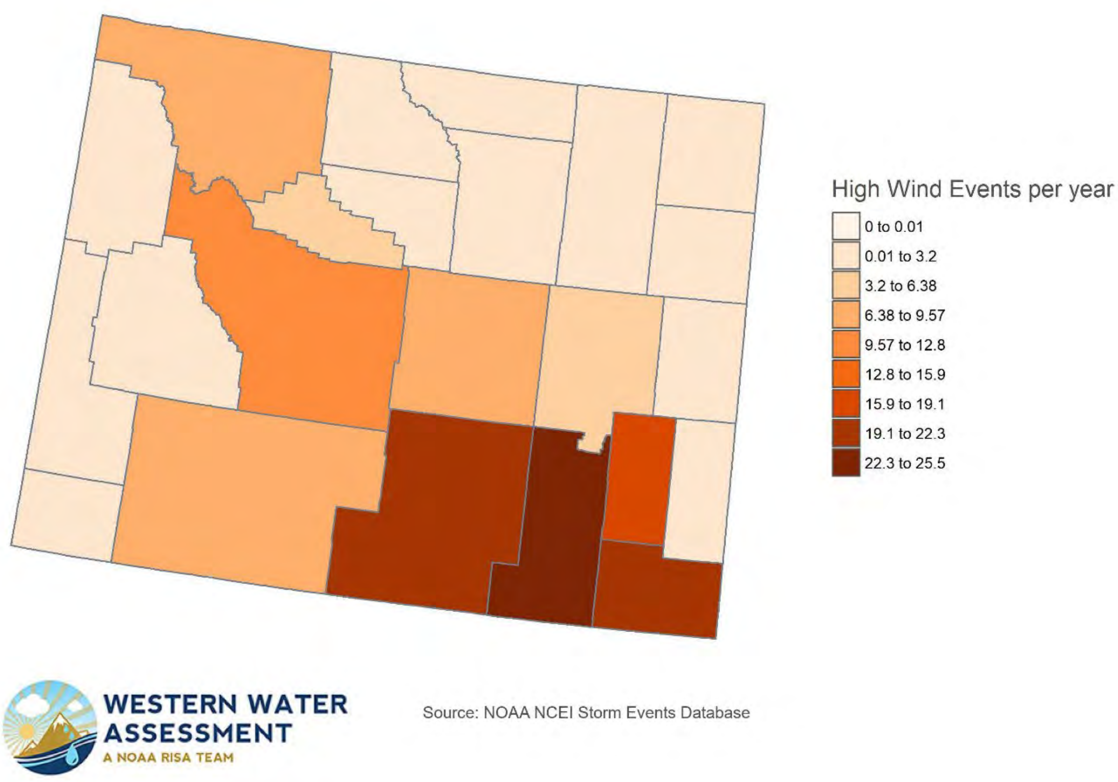
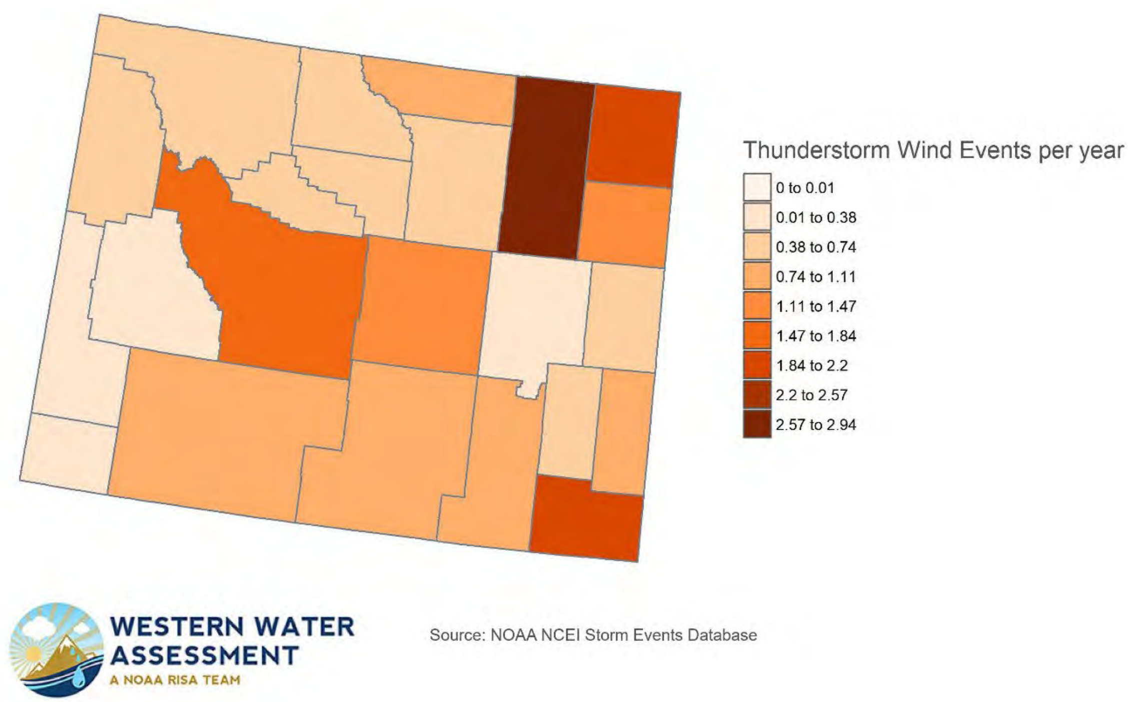


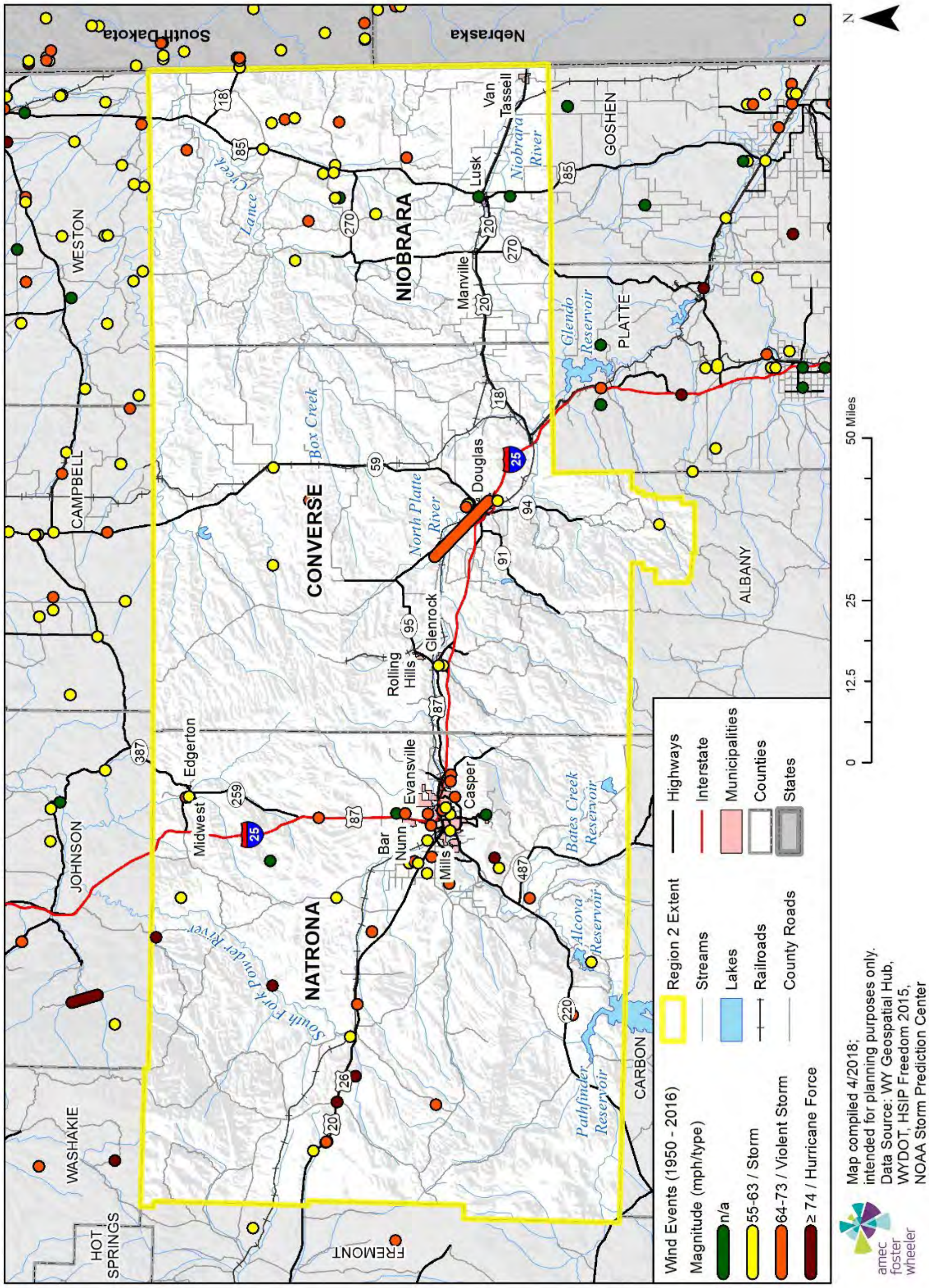
Figure 4-43 Thunderstorm Wind Events in Wyoming, 1996-2017



Past Occurrences

In the counties in Region 2, most documented wind events causing damage typically range between 50 and 65 knots; max wind speeds of up to 71 knots have been recorded. It should be noted that the data is limited by what the NCEI is able to record, and what equipment was in place at the time, and that the timespan of available records for each county differs.

Figure 4-44 NCEI-Recorded Wind Events, 1950-2016



Source: NOAA

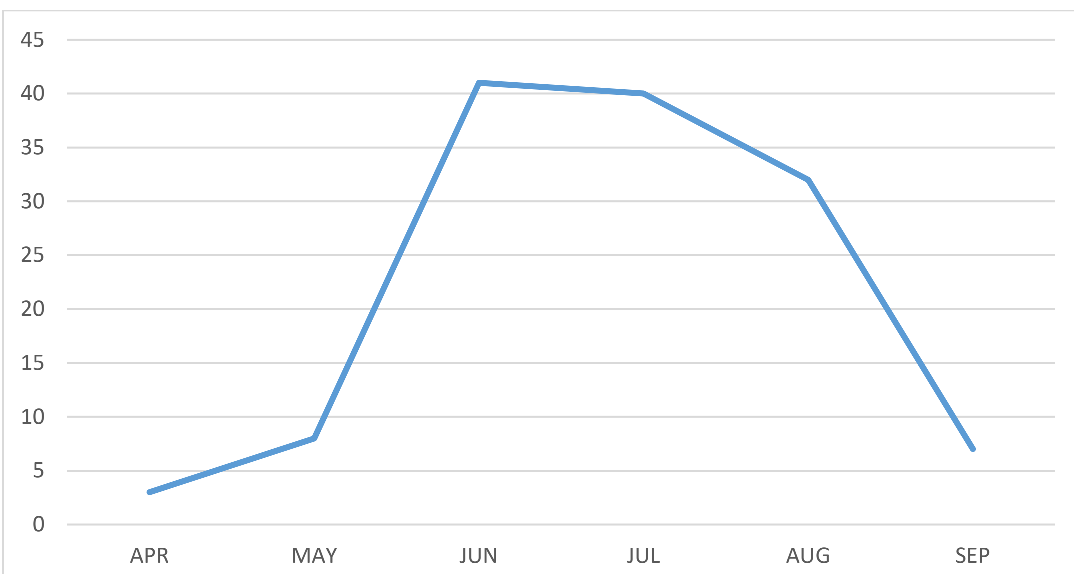
Table 4-51 Summary of Recorded Wind Weather Events and Impacts

Total Number of Wind Events*	Total Property Damage	Total Crop Damage	Total Fatalities	Total Injuries	Average Recorded Wind Speed	Max Recorded Wind Speed
Region 2 (1950-2016)						
131	$270,500	$0	0	0	51.5 knots	71 knots
Converse County (1950-2016)						
19	$60,000	$0	0	0	52.4 knots	71 knots
Natrona County (1950-2016)						
93	$145,500	$0	0	0	52.9 knots	70 knots
Niobrara County (1950-2016)						
19	$65,000	$0	0	0	43.3 knots	61 knots

Source: NCEI
*It's important to note that more than one event may be associated with a single storm

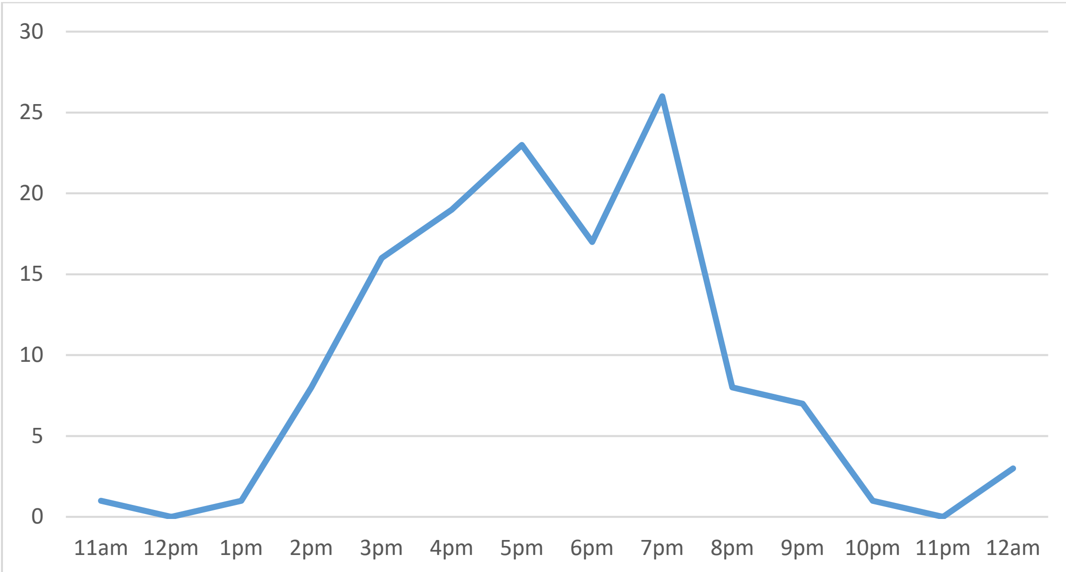
While high winds can occur anytime, they are most common in the Region during the months of June, July and August, between 2:00 and 10:00 pm.

Figure 4-45 Number of Region 2 High Wind Events by Month, 1950-2016



Source: NOAA

Figure 4-46 Number of Region 2 High Wind Events by Time of Day, 1950-2016



Source: NOAA

Frequency/Likelihood of Occurrence

NOAA records 131 confirmed and documented high wind incidents specifically impacting the Region, or zones tied to the Region since 1950; it should be noted that as technology has improved, the number of incidents recorded in more recent years have gone up dramatically.

Total recorded data for Region 2 since 1950 averages to 1.96 recorded incidents per year. This trend is expected to continue, and the region can expect high wind incidents every year for the foreseeable future.

Potential Magnitude

The 2016 Wyoming State Hazard Mitigation Plan cites SHELDUS and NCEI data to record 199 total damaging wind events between 1960-2015 in Region 2, with $273,165 in damage and two injuries recorded in Converse County from 58 events; $703,250 in damage, fourteen injuries and one death recorded in Natrona County from 84 events; and $266,326 and five injuries in damage recorded in Niobrara County from 57events during this timeframe.

Per NCEI, the most damaging event in the Region caused $50,000 damage to property; NCEI does not record any crop damage in the Region due to high winds. These incidents can be used as worst-case scenarios, though more damage could occur with the right combination of factors.

The following maps show annual average wind speeds across the US and across Wyoming (Figure 4-47 and Figure 4-48). The blue box corresponds to the planning area. Wyoming has some of the highest annual average wind speeds in the nation. While the threat varies across the planning area, all parts of the Region are susceptible to damaging wind events.

Figure 4-47 Annual Average Wind Speed – United States

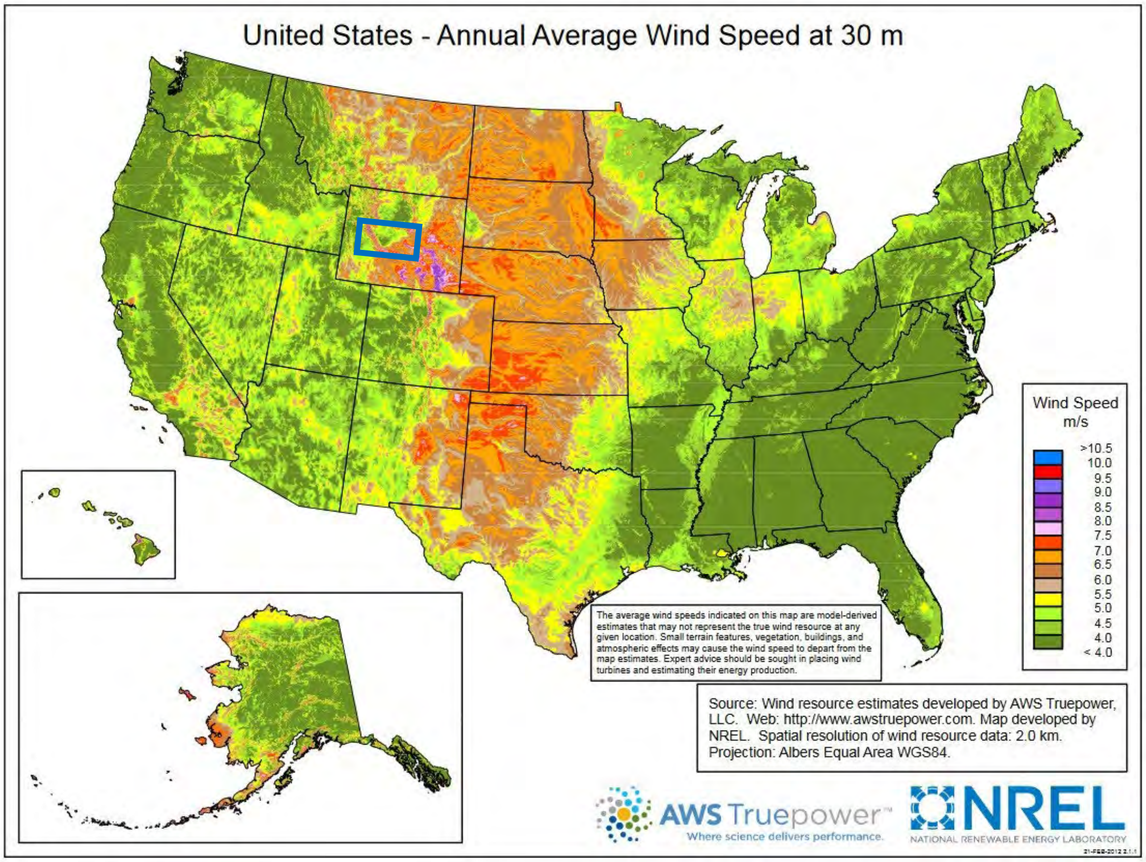
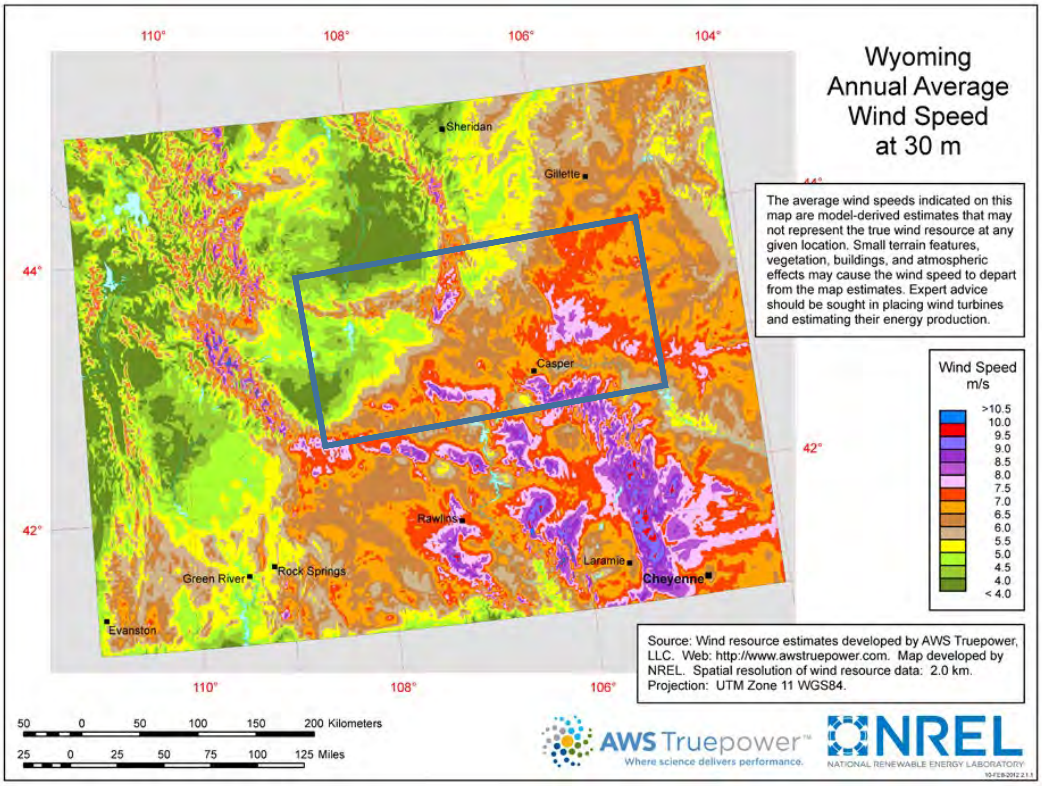


Figure 4-48 Annual Average Wind Speed – Wyoming



Vulnerability Assessment

Vulnerability as it relates to location is mostly random, as damaging winds have occurred everywhere in the Region. Damage from high winds is often described in regional or broad areas, but downburst damage will impact a small area most generally less than three miles in diameter. Because state or presidential emergency or disaster declarations have not been necessary in the aftermath of wind events in the Region, and because damage to personal property is dealt with by numerous private insurance companies, it is difficult to estimate actual monetary impacts that have occurred due to damaging winds. See section on Potential Losses for loss estimates based on reported damage.

Specific vulnerabilities from high wind events include damage to poorly constructed buildings, building collapse and damage, flying debris, semi rollovers and car accidents, and downed power lines and electric system damage. Cascading hazards caused by high winds can include power loss; depending on the time of year, winds can also exacerbate snow and blizzards by creating deep snow drifts over roads and affecting the normal flow of traffic. Damages recorded by the NCEI for the county include downed power lines, torn off roofs and building damage, and downed tree limbs and debris.

Future Development

Historical data demonstrates that the most critical area of the state for high wind hazards is the eastern one third, including much of Region 2. Future residential or commercial buildings built to code should be able to withstand wind speeds of at least 150 miles per hour.

Summary

Many areas of the United States are prone to damaging wind events, and while the counties of Region 2 may not be counted in a high category for occurrences across the nation, it does have a history of such episodes which should be anticipated for the future. Primary damage is structural and utility-borne. Although minimal deaths and injuries have been reported, the frequency of occurrence is due consideration, as well as the hazard to rural citizens and town populations from falling trees, power poles, and flying debris.

Photos and scattered reports document property damage (including damage to private utilities) occurring as a result of wind events, yet cumulative losses due to wind damage have been negligible.

Table 4-52 High Winds and Downbursts Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Significant	Likely	Negligible	Medium
Natrona	Significant	Likely	Negligible	Medium
Niobrara	Significant	Likely	Negligible	Medium

4.2.10 Landslide/Rockfall/Debris Flow

Hazard/Problem Description

A landslide is a general term for a variety of mass movement processes that generate a downslope movement of soil, rock, and vegetation under gravitational influence. Landslides are a serious geologic hazard common to almost every state in the United States. It is estimated that nationally they cause up to $2 billion in damages and from 25 to 50 deaths annually. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth material to landslide include: saturation by water, erosion or construction, alternate freezing or thawing, earthquake shaking, and volcanic eruptions.

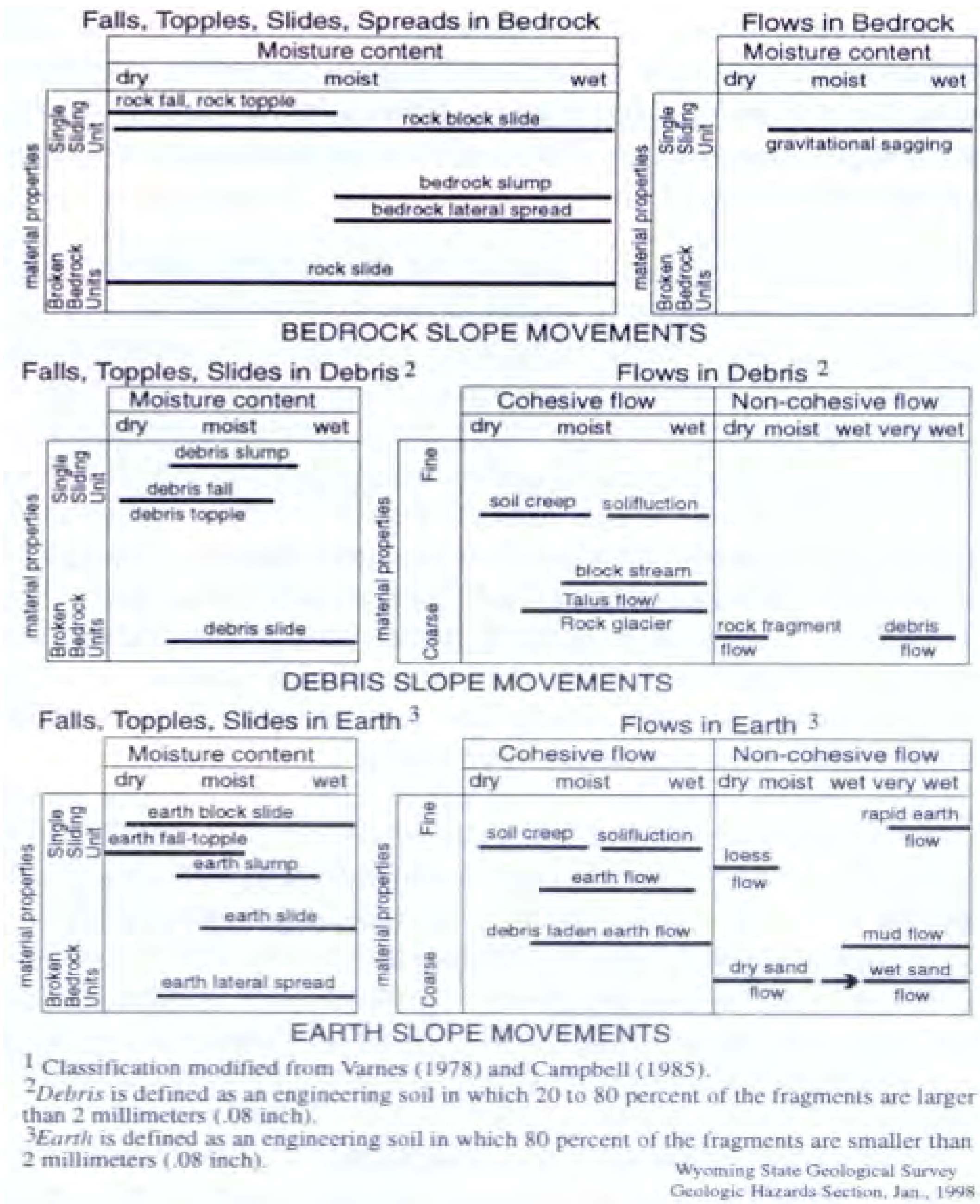
Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Generally, significant landslides follow periods of above-average precipitation over an extended period followed by several days of intense rainfall. It is on these days of intense rainfall that slides are most likely to occur.

Areas that are generally prone to landslide hazards include existing old landslides; the bases of steep slopes; the bases of drainage channels; and developed hillsides where leach-field septic systems are used. Landslides are often a secondary hazard related to other natural disasters. Landslide triggering rainstorms often produce damaging floods. Earthquakes often induce landslides that can cause additional damage.

Slope failures typically damage or destroy portions of roads and railroads, homes and public buildings, sewer and water lines, and other utility lines. Even small-scale landslides are expensive due to clean up costs that may include debris clearance from streets, drains, streams and reservoirs; new or renewed support for road and rail embankments and slopes; minor vehicle and building damage; personal injury; and livestock, timber, crop and fencing losses and damaged utility systems.

The most common geologic hazard in Wyoming is landslides. According to the State Hazard Mitigation Plan, Wyoming has among the highest landslide densities in the country. There are many types of landslides that pose a risk to Wyoming. In order to properly describe landslide type, the Geologic Hazards Section developed a landslide classification modified from Varnes (1978) and Campbell (1985). As can be seen in Figure 4-49, there are five basic types of landslides that occur in three types of material. Falls, topples, slides, lateral spreads, and flows can occur in bedrock, debris, or earth. While individual landslide types can occur in nature, most landslides are complex, or composed of combinations of basic types of landslides.

Figure 4-49 Wyoming Landslide Classifications



Rockfall

A rockfall is the falling of a detached mass of rock from a cliff or down a very steep slope. Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Rockfalls are caused by the loss of support from underneath through erosion or triggered by ice wedging, root growth, or ground shaking. Changes to an area or slope such as cutting and filling activities can also increase the risk of rockfall. Rocks in a rockfall can be of any dimension, from the size of baseballs to houses. Rockfall occurs most frequently in mountains or other steep areas during the early spring when there is abundant moisture and repeated freezing and thawing. Rockfalls are a serious geological hazard that can threaten human life, impact transportation corridors and communication systems and result in other property damage.

The Spring season is considered the landslide and rockfall season in Wyoming, as the snow melts and saturates soils and temperatures begin to enter into freeze and thaw cycles. Rockfall and landslides are influenced by seasonal patterns, precipitation and temperature patterns. Earthquakes could trigger rockfalls and landslides as well.

Debris Flow

Debris flows, sometimes referred to as mudslides, mudflows, lahars, or debris avalanches, are common types of fast-moving landslides. They are a combination of fast moving water and a great volume of sediment and debris that surges down slope with tremendous force. Similar to a flash flood these flows generally occur during periods of intense rainfall or rapid snowmelt and may occur with little warning. They usually start on steep hillsides as shallow landslides that liquefy and accelerate to speeds that are typically about 10 miles per hour, but can exceed 35 miles per hour. Figure 4-50 describes identifying characteristics of debris flows. The consistency of debris flow ranges from watery mud to thick, rocky mud that can carry large items such as boulders, trees, and cars. Debris flows from many different sources can combine in channels, and their destructive power may be greatly increased. When the flows reach level ground, the debris spreads over a broad area, sometimes accumulating in thick deposits that can wreak havoc in developed areas. The National Flood Insurance Program covers mudflows but it does not cover landslides.

Figure 4-50 Field Evidence of Debris Flow

Geographical Area Affected

The Wyoming Department of Transportation Geology Program has documented 248 landslide sites across the state that are impacting roads, including areas repaired, mitigation projects in process. Figure 4-51 below shows mapped landslides in the Region. Note the relatively high concentration of landslide deposits in Natrona County, particularly near the City of Casper. Natrona County is the second most populous county in the state, it is also the most vulnerable county in the Region to landslides.

Natrona County Landslide Areas

In Natrona County the primary areas of concern are landslide deposits near the north side of Casper Mountain where homes are located, along Hwy 220, and the Wolf Creek drainage. Unincorporated areas are also at risk of landslides and would be the most affected by the hazard in the county. The Towns of Mills and Bar Nunn are not affected by landslides based on available mapping.

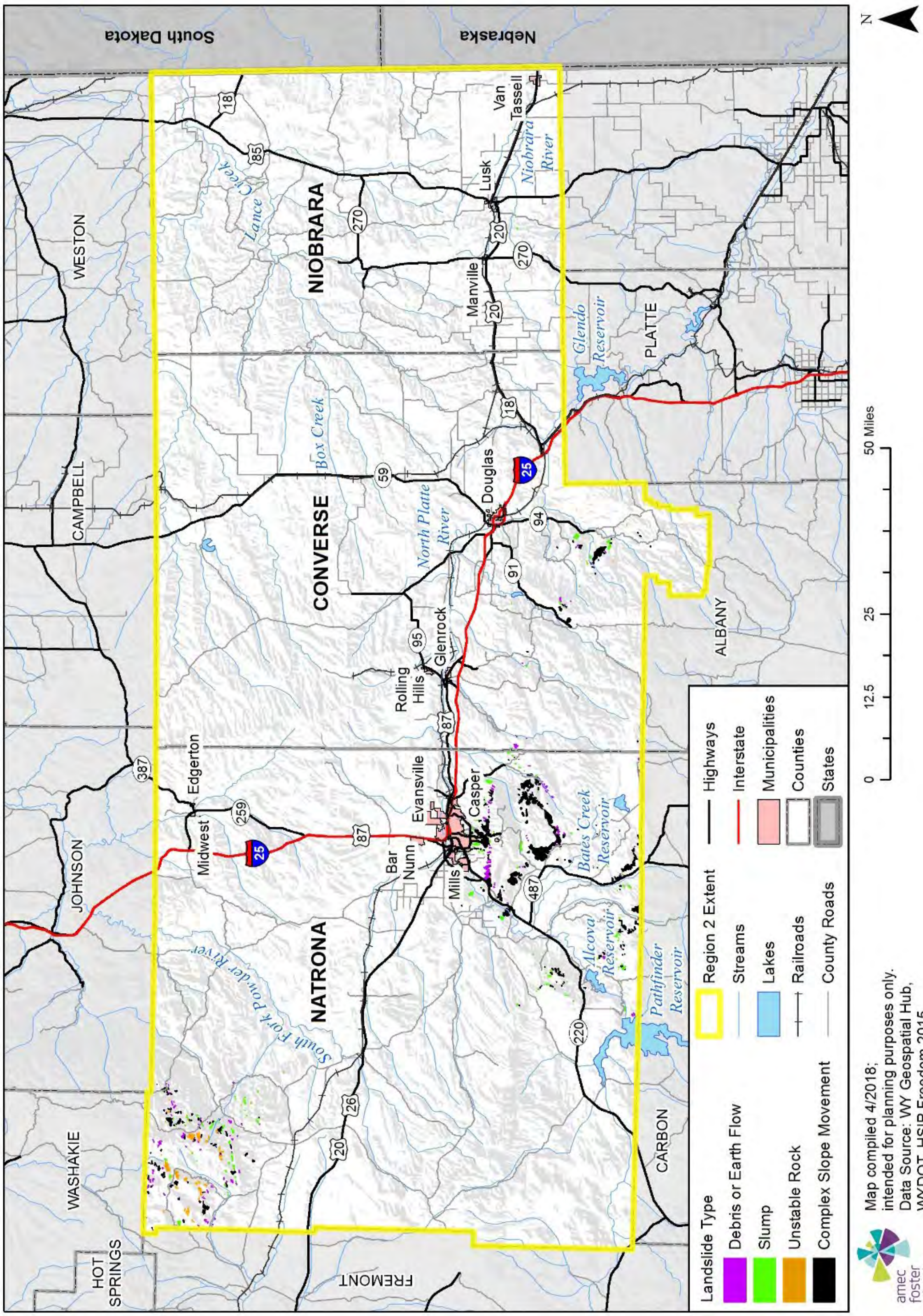
Converse County Landslide Areas

Overall, landslide susceptibility is minimal across Converse County as the geologic conditions do not make the county susceptible to landslides. Results from GIS analysis indicate that there are no properties or critical infrastructure located in areas prone to landslides. The county is not completely immune to landslides, however; transportation networks are most exposed to landslide and debris flow incidents in the county. Transportation infrastructure that would likely be impacted by one of these incidents include the east-west portion of Interstate 25 that goes through Glenrock and Rolling Hills, Highway 18 that runs north through Lost Springs and the north-south portion of State Highway 59 that passes through Douglas and Bill. Although the overall vulnerability to populations is low, the loss of transportation networks could have an impact on the County's overall infrastructure, including revenue and emergency response capabilities. The HMPC notes in the 2018 Converse County HMP Update that land subsidence especially in the City of Glenrock is more of a concern than landslides or debris flow. Mine and land subsidence hazards are profiled in more detail in Section 4.2.12 of this Plan.

Niobrara County Landslide Areas

There is one small landslide hazard area present in the southern portion of Niobrara County. Landslides on the Silver Springs Quadrangle have been examined by the Wyoming State Geological Survey and Niobrara County Emergency Management. Overall, there are no landslide areas that could have a significant effect on property, populations, or cultural and/or historic landmarks in the county.

Figure 4-51 Region 2 Landslide Areas



Past Occurrences

Although limited information is available on previous occurrences of geologic hazards that have caused a particular high amount of damage or incurred some other cost or unique impact, landslides, debris flows, and rockfalls occur regularly in Wyoming and the Region. According to the 2016 Wyoming State Mitigation Plan, between 1960 and 2015 there have been two landslide events that have taken place in the Region; both occurred in Natrona County. The total property damage from those events was $100,500. In the 2017 Natrona County Hazard Mitigation Plan, the HMPC reported debris flows in spring of 2013 on the Sheepherder Hill burn scar after wildfires in the area. They also reported debris flows on Alcova Lake Shore Drive, and associated rockfall risk.

Neither the State HMP nor the Converse County or Niobrara Counties noted significant landslide events taking place in the past.

Frequency/Likelihood of Occurrence

The probability of a landslide causing damage in the Region is difficult to determine because of the poor availability of historic data. Typically, there is a landslide/rockfall ‘season’ that coincides with increased freeze-thaw cycles and wetter weather in the spring and early summer. Heavy periods of precipitation or significant development could also have an effect on slope stability. However, given it is reasonable to assume that damaging events have between a 10 and 100% chance of occurrence in the next year or a recurrence interval of 10 years or less it can be assumed landslides, rockfalls or debris flows are **likely** to occur in the Region.

Potential Magnitude

There are three measures of future landslide impacts – historic dollar damages, estimated yearly damages, and building exposure values. There are not enough current data to estimate historic or yearly dollar damages. In general terms, landslides can threaten human life, impact transportation corridors and communication systems, and cause damage to property and other infrastructure. Actual losses can range from mere inconvenience to high maintenance costs where very slow or small-scale destructive slides are involved. The potential magnitude of landslides, rockfall and debris flows in the Region is **limited**, as events would typically be isolated in most counties. However, even a small isolated event has potential to close state or U.S. highways in the Region that can result in long detours for days or weeks. With the added cost of detours, and the potential for life safety impacts, some landslides could have greater costs.

Vulnerability Assessment

Population

The overall vulnerability of population is **low**. The general population is not overly vulnerable to landslides, but rockfall can cause serious injury or death. There are areas prone to rockfall on Interstate 25, Highway 18, and State Highway 59.

General Property

During the 2018 development of this Regional Plan, a GIS analysis of exposure to landslide hazard areas was performed. The greatest risk to general property is in Natrona County as shown in Table 4-53, which summarizes landslide exposure in the county, based on an intersect of improved parcels with landslide hazard areas. Based on this analysis, there are 133 buildings and a total exposure of $61,442,113 located in the landslide hazard zones in Natrona County.

Table 4-53 Landslide Exposure in Natrona County

Jurisdiction	Property Type	Building Count	Improved Value	Est. Content Value	Total Exposure	Population
City of Casper	Commercial	1	$5,629,648	$5,629,648	$11,259,296	
	Residential	2	$541,281	$270,641	$811,922	5
	Total	**3**	**$6,170,929**	**$5,900,289**	**$12,071,218**	**5**
Unincorporated	Commercial	2	$110,197	$110,197	$220,394	
	Exempt	1	$0	$0	$0	
	Res Vacant Land	2	$0	$0	$0	
	Residential	125	$32,767,001	$16,383,501	$49,150,502	305
	Sub Total	**130**	**$32,877,198**	**$16,493,698**	**$49,370,896**	**288**
	Grand Total	**133**	**$39,048,127**	**$22,393,986**	**$61,442,113**	**293**

Source: Natrona County; WYDOT; WY Geospatial Hub; HSIP Freedom 2015; WGS

Essential Infrastructure, Facilities, and Other Important Community Assets

Transportation networks are the most exposed aspect of the Region to rockfall, landslide and debris flow incidents. Residents and visitors alike are impacted by landslides when roads are damaged by landslides. This includes Highways 487 and 220 near Casper in Natrona County and Interstate 25 cross through Glenrock and Rolling Hills, Highway 18 running north through Lost Springs, and State Highway 59 passing through Douglas and Bill in Converse County. The loss of transportation networks could potentially cause secondary damage to the overall Region's infrastructure, including revenue, transportation availability, emergency response mechanisms and other essential capabilities by preventing the means of these resources from activating or moving between locations.

Natrona County HMP identifies two critical facilities located in the unincorporated area of the County that are potentially at risk to landslides.

Table 4-54 Critical Facilities at Risk to Landslides in Natrona County

Landslide Type	Jurisdiction	Critical Facility Type	Name
Complex Slope Movement	Unincorporated	EPA FRS Location	BROKEN WRENCH LLC
Debris or Earth Flow	Unincorporated	EPA FRS Location	KINDER ENTERPRISES INCORPORATED

Future Development

The severity of landslide problems is directly related to the extent of human activity in hazard areas. Human activities such as property development and road construction can also exacerbate the occurrence of landslides. Landslide areas tend to be picturesque and often within mountainous locations and therefore attract development. Development in landslide areas frequently consists of vacation homes and represents a potential risk for injury, loss of life and property.

Summary

Overall, landslides, rockfalls and debris flows range from **low** to **high** significance hazards in the region. Landslides have the potential for direct property impacts including residential structures but more likely infrastructure corridors including roads and highways, power line corridors, and gas lines.

Table 4-55 Landslide Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Limited	Unlikely	Limited	Low
Natrona	Limited	Occasional	Limited	Medium
Niobrara	Limited	Unlikely	Limited	Low

4.2.11 Lightning

Hazard/Problem Description

Lightning is a danger across Wyoming. Lightning is a sudden electrical discharge released from the atmosphere that follows a course from cloud to ground, cloud to cloud, or cloud to surrounding air, with light illuminating its path. Lightning's unpredictable nature causes it to be one of the most feared weather elements.

Anyone that is caught in an exposed area during a thunderstorm could be at risk to a lightning strike. In Wyoming, outdoor enthusiasts venturing to high and exposed areas should be especially cautious because rapid thunderstorm development with associated lightning can place even the most experienced persons in jeopardy without warning. Lightning strikes can cause power outages. Lightning is also the leading cause of wildland fires in Wyoming, and is indirectly responsible for millions of dollars' worth of fire damage.

Geographical Area Affected

All the region is susceptible to lightning impacts, particularly the higher elevation mountainous areas.

Past Occurrences

Vaisala's National Lightning Detection Network (NLDN) recorded 347,035 cloud to ground lightning flashes in Wyoming in 2015; they also record an average of 279,632 cloud to ground lightning flashes per year between 2006 and 2015 for the state. This ranks Wyoming 39th nationally for flashes per square mile, averaging 2.9 cloud to ground lightning flashes per square mile, per year.

Nationally, Wyoming ranks 36th in number of lightning fatalities, 33rd in injuries, and 40th in property damage from 1959 to 1994 according to the National Oceanic and Atmospheric Administration, National Severe Storms Laboratory (NOAA, NSSL). Wyoming is number one in the nation in lightning deaths per capita according to the National Weather Service in Salt Lake City. According to the NCEI, lightning has been responsible for 8 deaths, 75 injuries, over $1 million in property damage and $91,000 in crop damage in Wyoming between 1996 and 2015.

The 2016 Wyoming State Hazard Mitigation Plan lists loss-causing lightning events from 1960-2015, collected from SHELDUS and NCEI events databases. 26 incidents are recorded for the counties in Region 2, resulting in a total of 3 injuries, 3 deaths, and a total of $748,849 in property and crop damage; these incidents are listed in Table 4-56.

Table 4-56 Region 2 Lightning History 1960– 2015

County	Number of Events	Injuries	Fatalities	Property Damage	Crop Damage	Total Damage
Converse	9	0	3	$ 347,339	$ 5,000	$ 352,339
Natrona	13	3	0	$ 362,771	$ 0	$ 362,771
Niobrara	4	0	0	$ 30,739	$ 3,000	$ 33,739
Total	**26**	**3**	**3**	**$ 740,849**	**$ 8,000**	**$ 748,849**

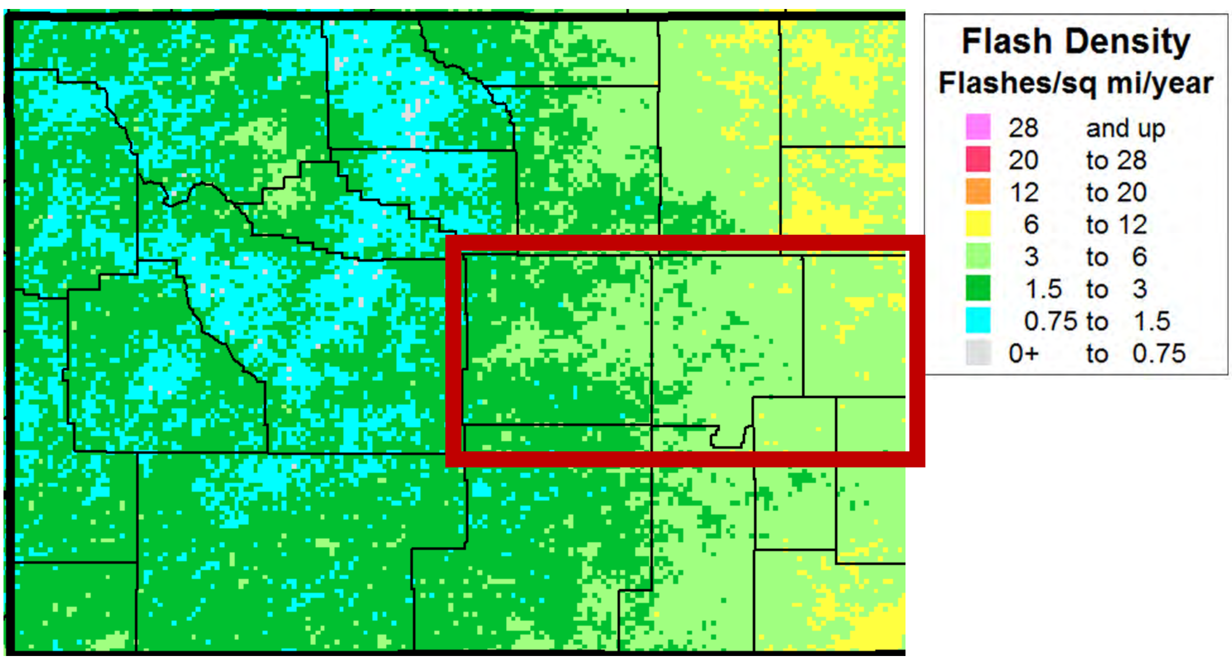
Source: 2016 Wyoming State Hazard Mitigation Plan

All three lightning fatalities since 1960 occurred in Converse County. On July 24, 1973, a 17-year-old boy and the horse he was riding were killed by lightning on a ranch just north of Douglas. The following month, on August 27, 1973, lightning struck a tree which a man was leaning against, killing him instantly. And on July 7, 1976, a cowboy was killed by lightning (circumstances unknown). There have been no recorded fatalities from lightning in Region 2 since 1976.

Frequency/Likelihood of Occurrence

Nationwide, lightning strikes are routinely monitored by Vaisala, Inc. with accuracies to within a 0.625-mile (1 kilometer) resolution. The Wyoming annual lightning strike frequency is depicted in Figure 4-52 for the period of 2005 through 2014. Clearly the eastern plains have more than three times the cloud to ground lightning strikes as the western half of the state. Region 2's flash density varies considerably, ranging from 0.75 to 6 flashes per square mile per year in much of Natrona County, to 3 to 12 flashes per square mile per year in Niobrara Counties. Despite annual variation, the locations of maximum and minimum strikes do not change much from year to year. A warming climate may also affect the frequency of lighting; in 2014 researchers at the University of Berkeley conducted a study that found that for every one-degree Celsius rise in the average global temperature, there will be a 12% increase in the amount of lightning strikes. (Source: Science Magazine, http://www.sciencemag.org/content/346/6211/851.abstract;)

Figure 4-52 Average annual lightning flash density (flashes/sq. mi./year) 2005-2014 over Wyoming.



Source: Illustration courtesy of Vaisala Inc.

U.S. statistics show that one in 345,000 lightning flashes results in a death and one in 114,000 results in an injury nationwide. According to meteorologists at Vaisala, Inc., the odds for an American being hit by lightning sometime in the course of an 80-year lifespan is about 1 in 3,000. Any persons caught in the open without cover during a lightning storm are vulnerable to strikes.

Although lightning strikes occur with high frequency throughout Region 2, Table 4-56 shows that strikes resulting in injuries or reportable damage are somewhat less-common. Based on this data, the chance of a loss or injury-causing lightning strike in any given year ranges from around 7% in Niobrara County, to 16% in Converse County, to 23% in Natrona County. Note that while Niobrara County has the highest number of lightning strikes, it has the lowest number of strikes that cause damage or injuries.

Potential Magnitude

Lightning can cause deaths, injuries, and property damage, including damage to buildings, communications systems, power lines, and electrical systems. It also causes forest, brush and structural fires. Damage from lightning occurs in four ways:

- Electrocution, severe electrical shock, and burns of humans and animals
- Vaporization of materials in the path of the strike
- Fire caused by the high temperatures associated with lightning
- Power surges that can damage electrical and electronic equipment

When people are struck by lightning, the result is deep burns at the point of contact (usually on the head, neck and shoulders). Approximately 70% of lightning survivors experience residual effects such as vision and hearing loss or neuropsychiatric issues. These effects may develop slowly and only become apparent much later. Death occurs in 20% of lightning strike victims.

Lightning strikes cause intense but localized damage. In contrast to other hazards, lightning does not cause widespread disruptions with the community. Structural fires, localized damage to buildings, damage to electronics and electrical appliances, and electrical power and communications outages are typical consequences of a lightning strike. Additionally, indirect fatalities may result via electrocution when a person steps from a vehicle into standing water that was previously “charged” by a live power-line that was knocked loose by a lightning strike.

The indirect social and economic impacts of lightning damage are typically associated with the loss of electrical power. Since society relies heavily on electric power, any disruption in the supply, even for a short time period, can have significant consequences. Wildfires can also be an indirect result of a lightning strike.

Past events in Region 2 indicate that the potential magnitude of lightning events will likely be limited—isolated deaths and/or injuries may occur; major or long-term property damage that threatens structural stability due to structural damage or fires; and/or interruption of essential facilities and services for 24-72 hours due to structural damage or utility outages.

Vulnerability Assessment

Population

Anyone who is outside during a thunderstorm is at risk of being struck by lightning. Aspects of the population who rely on constant, uninterrupted electrical supplies may have a greater, indirect vulnerability to lightning. As a group, the elderly or disabled, especially those with home health care services relying on rely heavily on an uninterrupted source of electricity. Resident populations in nursing homes, Community Based Residential Facilities, or other special needs housing may also be vulnerable if electrical outages are prolonged. If they do not have a back-up power source, rural residents and agricultural operations reliant on electricity for heating, cooling, and water supplies are also especially vulnerable to power outages.

According to the Vaisala Group and National Lightning Detection Network, Wyoming ranked 37th among the 50 U.S. states, Puerto Rico, and Washington D.C. for overall lightning deaths between 1959 and 2009. This would suggest that lightning is not a major hazard for Wyoming. However, the state had the second highest per capita fatality rate within that same time period at 1.27 deaths per million people.

Nationwide, 85% of lightning victims are children and young men ages 10-35 engaged in outdoor recreation or work. Outdoor recreation is a major economic contributor to Region 2. People may often find themselves outside and need to be especially watchful of the weather during the summer months when afternoon thunderstorms are more common.

General Property

According to the event details collected in the NCEI database, the majority of reported damages from lightning are fires to private structures, damage to chimneys or steeples, or small grass fires. Property is more vulnerable to lightning than population because of the exposure ratios. Buildings remain exposed. Mitigation techniques such as choice of building materials or landscaping help reduce the vulnerability of these properties, but there is not data available to segment these properties out of the overall vulnerability assessment.

Essential Infrastructure, Facilities, and Other Important Community Assets

Some essential infrastructures and facilities can be impacted by lightning. Emergency responders, hospitals, government services, schools, and other important community assets are not more vulnerable to lightning than the general vulnerabilities established for property and population. Some aspects of infrastructure are constructed of materials and/or located in places that increase their vulnerability to lightning. Sometimes, communications and infrastructure are interrupted by lightning strikes. These events raise the vulnerability of the essential functions by delaying response times, hindering interagency communication efforts, or endangering or damaging communication networks.

Natural, Historic and Cultural Resources

There are no indications that cultural or historic resources are more vulnerable to lightning than as previously accounted for as general structures. Natural resources may be vulnerable to indirect impacts of lightning, such as wild fires caused by lightning strikes. The presence of large areas of water, or of wide, open spaces in natural habitats may increase the danger of lightning strikes to trees, people, or structures, but these vulnerabilities are not directly related to natural resources. Campgrounds are areas where lightning strikes have more dangerous impacts, so populations utilizing the campgrounds may have a higher vulnerability.

Finally, lightning can also have many cascading impacts, including power failure and ignition of wildfires.

Future Development

Any development built above ground will be susceptible to lightning strikes. Buildings should be built with grounding when possible to prevent the ignition of structure fires.

Summary

Lightning is an annual occurrence in Region 2, although strikes with recorded damage or injuries are much rarer. Anything that can conduct electricity and is exposed is vulnerable to lightning strikes and their effects. Future impacts from lightning are difficult to determine because of the erratic nature of storms, though it is reasonable to assume that impacts to people, infrastructure and the natural environment will continue into the foreseeable future.

Table 4-57 Lightning Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Significant	Occasional	Limited	Low
Natrona	Significant	Likely	Limited	Medium
Niobrara	Significant	Likely	Limited	Medium

4.2.12 Mine and Land Subsidence

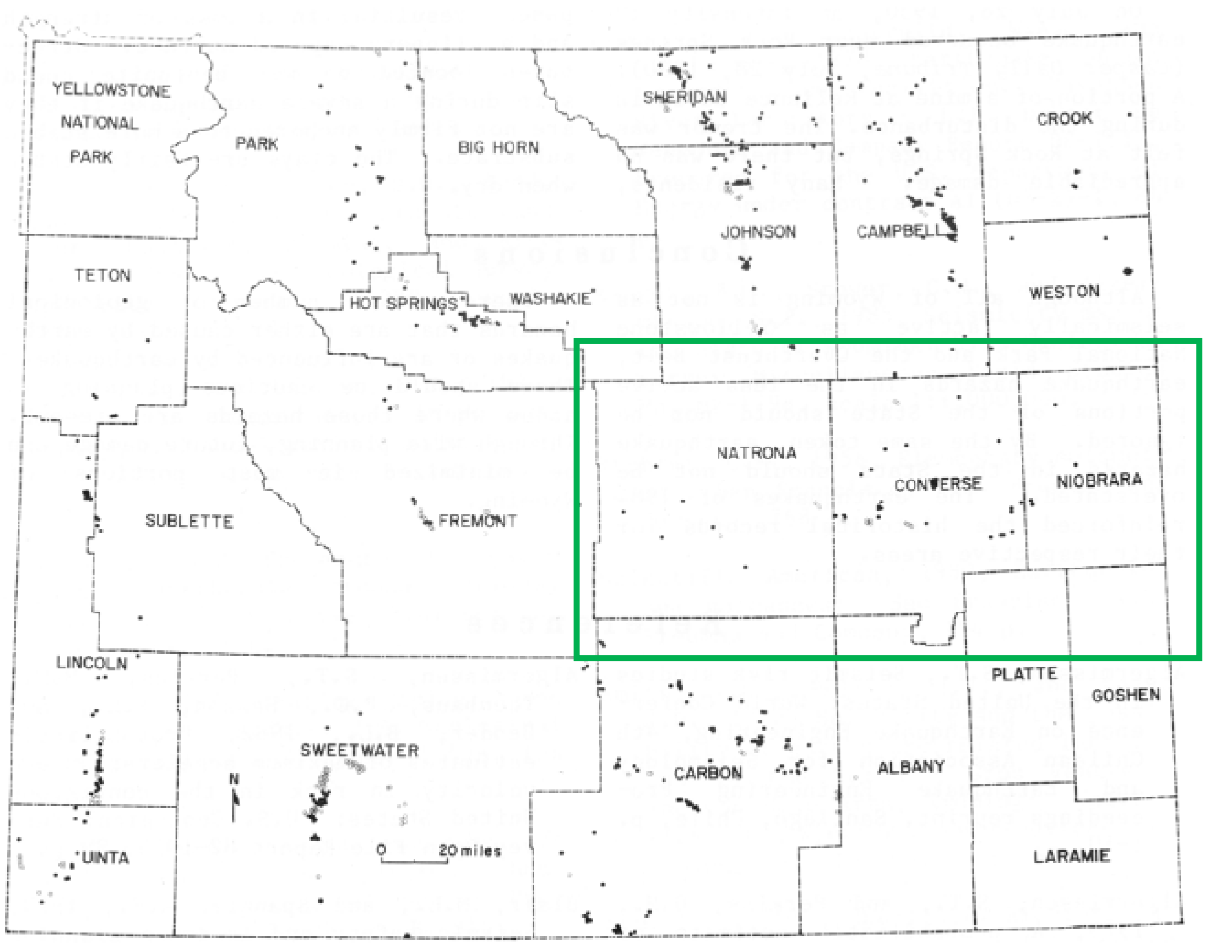
Hazard/Problem Description

Underground coal mining began in Wyoming during the 1860s. Many of the early coal mines were not designed and constructed well. Many were also shallow, and often had minimal ground support in the form of mine timbers. As a result, the underground pillars can fail. If enough pillars fail, the caprock in the mine will collapse. The effect of the collapse reaches the surface in some cases. If that happens, a subsidence pit, a sinkhole, or a trough forms. Mine subsidence is hence generally defined as the movement of the ground surface as a result of readjustments of the overburden, due to collapse or failure of the underground mine or land workings. Not all subsidence from mining is due to poor design, however. Most underground mines eventually have roof failures due to lack of maintenance and continuous loading of the unsupported rock layers overhead. In some cases, the pillars were pulled as mining retreated from an area. In other cases where fires occurred in the mines, the result is a loss of strength in the pillars and caprock.

Geographical Area Affected

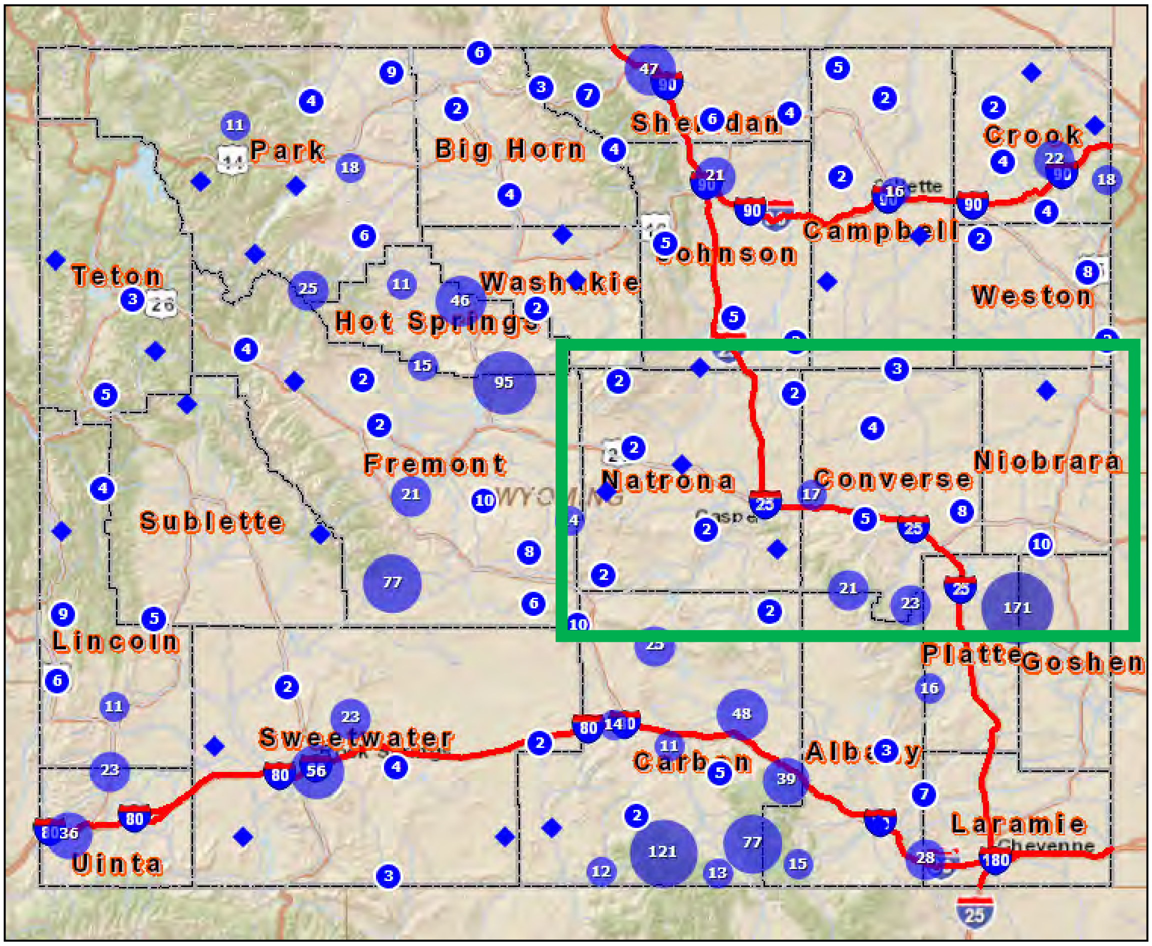
A map showing documented subsidence in Wyoming is provided in Figure 4-53. Figure 4-54 shows abandoned mine sites that are likely to suffer from subsidence issues. Gray dots and polygons from the immediate figure below represent mined-out areas with subsidence; Region 2 is highlighted with a green rectangle.

Figure 4-53 Mine Subsidence in Wyoming



Solid gray polygons represent mined-out areas where subsidence occurs. Region 2 falls within the green rectangle.
Source: 2016 Wyoming Multi-Hazard Mitigation Plan

Figure 4-54 Abandoned Mine Sites with Subsidence-Prone Underground Workings



Region 2 falls within the green rectangle.
Source: 2016 Wyoming Multi-Hazard Mitigation Plan

While the geographical extent of the hazard is **limited**, there are several abandoned mine sites with subsidence-prone underground workings in Converse County, especially in the southern areas bordering Albany and Platte Counties. Natrona also has a fair amount of these mine sites, spread throughout the county. Niobrara has the least number of mines, with most located towards the southern tip of the county, near the edge with Goshen County.

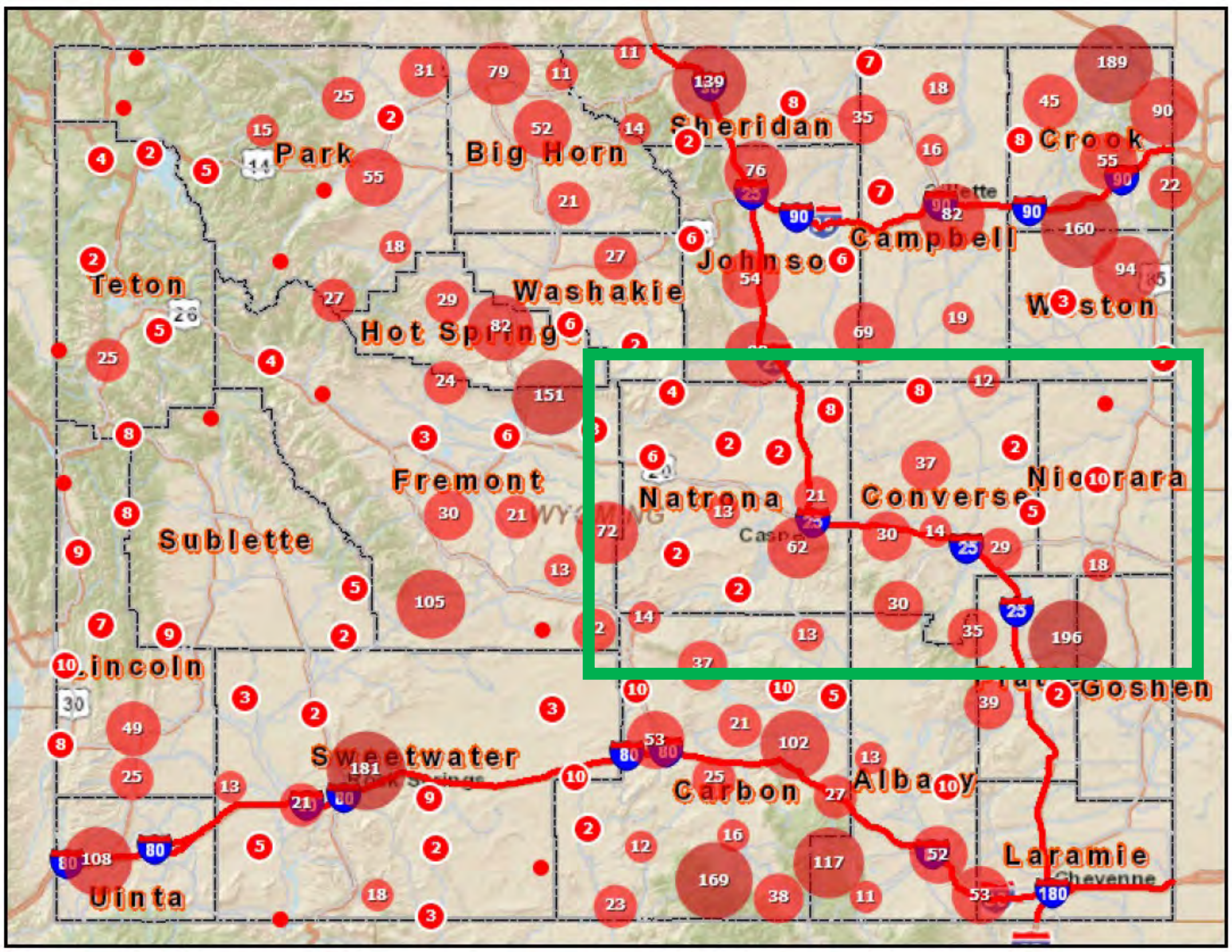
Past Occurrences

The 2016 Wyoming Hazard Mitigation Plan addresses mine subsidence, given it does occur occasionally throughout the state. Over the past several years, the Wyoming Abandoned Mine Lands (AML) Program at the Wyoming Department of Environmental Quality (DEQ) has funded a few large subsidence mitigation projects annually. This is in addition to a large number of traditional mine reclamation projects on both coal and non-coal mine sites, along with smaller projects aimed at protecting individual homeowners. Recent mine and land subsidence mitigation projects have focused on protecting critical infrastructure.

Glenrock in Converse County, has been noted to be especially vulnerable to subsidence, and an HMPC member indicated that over 60% of the Town could be impacted. Though federal reclamation programs have been instituted, the mines surrounding the Glenrock community are subsiding and additionally prone to flooding. Neither Natrona or Niobrara Counties have reported major mine/land subsidence issues in recent times, however.

Figure 4-55 displays the number of mined-out areas and mine subsidence events throughout the Region (enclosed within the green rectangle). Though all counties in the Region show some mine subsidence occurrences, the events may have taken place many years back and not reflect present-day risk potential.

Figure 4-55 Mined-out Areas and Mine Subsidence Cases in Wyoming



Source: 2016 Wyoming Multi-Hazard Mitigation Plan

Frequency/Likelihood of Occurrence

Although many areas of the state have already implemented mitigation projects designed to reduce or remove the impacts from underground mining and subsidence, subsidence may still occur in some areas. This hazard is rated **occasional** (between a 1% and 10% probability of occurrence in the next year). The potential for future damage from this hazard could additionally be reduced by mass adoption of a recent state effort, which created an assistance program for mine subsidence threats: the Wyoming Mine Subsidence Insurance Program. This program can help everyday citizens protect their home and business investments, given the insurance is affordable and addresses this specific hazard.

Potential Magnitude

Many mines in the Region have already been identified and mitigation work undertaken in the past, to remove the threat posed to the surrounding area; many identified mines that remain unmitigated pose little to no threat to infrastructure or property in the surrounding area. Any identified or unidentified mines located under or around buildings, roads, pipelines, or other critical infrastructure can pose higher risk to the surrounding area, including collapse, flooding, and unsettling of the ground. These risks vary by mine and area, though, but overall the potential magnitude/severity of this hazard to the Region is **negligible**.

Vulnerability Assessment

There has been property and infrastructure damage associated with mine subsidence in Wyoming communities before. The dollar amounts of the damage are not readily available. Underground coal fires can also occur in abandoned mines.

The dollar impact attributed to these types of events is difficult to predict. An indirect measure of the impacts is the existing cost of mitigating the hazards. The AML Program has spent $303.4 million through 2013, mitigating the effects of mine subsidence alone, as part of the abandoned mine reclamation program. If any of the above mines are found to be un-reclaimed and appear to pose a hazard to the public, the Abandoned Mine Lands Program at the Wyoming Department of Environmental Quality should be contacted (Wyoming Hazard Mitigation Plan 2016).

While hundreds of mine subsidence events have taken place across the Region in the last decades, vulnerability to the hazard is generally **low** due to minimal or no damages incurred by the jurisdictions or the individual populations. However, this risk should be further investigated when siting future development, especially in the Glenrock (Converse County) area, where occurrences have been known to take place several times before.

Future Development

Mine subsidence occurs throughout the Region in both populated and unpopulated areas. Development in locations where mine subsidence occurs certainly have the potential to impact individual homes or neighborhoods. While it is believed that all mined out areas in Wyoming have been mapped, it is unknown if all locations of potential subsidence have been located appropriately. The uncertainty regarding the locations of more potential subsidence areas means there is the possibility that development may occur in a subsidence-prone location without the knowledge of contractors or developers. Given this fact, there is no way to determine with certainty the likelihood that development will occur in a subsidence-prone location. Therefore, putting a risk factor to this hazard, as it relates to development within Wyoming's borders, is rather complicated.

Businesses seeking to lay pipelines, electrical transmission lines, develop a well site, or build another type of business structure in an area subject to subsidence hazards are typically referred to the AML during the environmental review process. This contact helps ensure new, developing infrastructure can be routed around problem areas, or if more efficient and possible, the area can be mitigated for subsidence hazards before structures or individuals are exposed to the hazard.

Overall, the risk of mine subsidence across Region 2 is **low**.

Summary

Table 4-58 Mine and Land Subsidence Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Significant	Occasional	Negligible	Low
Natrona	Limited	Occasional	Negligible	Low
Niobrara	Limited	Unlikely	Negligible	Low

4.2.13 Severe Winter Weather

Hazard/Problem Description

The National Weather Service defines a storm as "any disturbed state of the atmosphere, especially affecting the Earth's surface, and strongly implying destructive and otherwise unpleasant weather." Winter storms occur during the winter months and produce snow, ice, freezing rain, sleet, and/or cold temperatures. Winter storms are an annual occurrence in climates where precipitation may freeze and are not always considered a disaster or hazard. Disasters occur when the severe storms impact the operations of the affected community by damaging property, stalling the delivery of critical services, or causing injuries or deaths among the population.

Winter storm watches and warnings may be helpful for determining the difference between a seasonal winter storm and a severe winter storm. Warnings are issued if the storm is producing or suspected of producing heavy snow or significant ice accumulations. Watches are usually issued 24 to 36 hours in advance for storms capable of producing those conditions, though criteria may vary between locations. Winter Weather Advisories are issued when a low-pressure system produces a combination of winter weather that presents a hazard but does not meet warning criteria. (Source: National Weather Association Online Glossary, http://www.weather.gov/glossary/)

Heavy snow can immobilize the counties in Region 2, isolating communities, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse roofs and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow removal, damage repair, and business losses can have a tremendous impact on cities and towns. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days until damages are repaired. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Some winter storms are accompanied by strong winds, creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chills. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Blowing snow can reduce visibilities to only a few feet in areas where there are no trees or buildings. Serious vehicle accidents can result with injuries and deaths.

Winter storms in the counties of the Region, including strong winds and blizzard conditions, may cause localized power and phone outages, closures of streets, highways, schools, businesses, and non-essential government operations, and increase the likelihood of winter-weather related injury or death. People may be stranded in vehicles or other locations not suited to sheltering operations or isolated from essential services. A winter storm can escalate, creating life threatening situations when emergency response is limited by severe winter conditions. Other issues associated with severe winter storms include the threat of physical overexertion that may lead to heart attacks or strokes. Snow removal costs can pose significant budget impacts, as can repairing the associated damages caused by downed power lines, trees, structural damages, etc. Heavy snowfall during winter can also lead to flooding or landslides during the spring if the area snowpack melts too quickly.

Extreme cold often accompanies a winter storm, or is left in its wake. It is most likely to occur in the winter months of December, January, and February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities. Extreme cold temperatures can destroy crops and cause utility outages, leaving people without water or power until the utility companies are able to restore service.

What constitutes extremely cold temperatures varies across different areas of the United States, based on normal climate temperatures for the time of year. In Wyoming, cold temperatures are normal during the winter. When temperatures drop at least 20 degrees below normal winter lows, the cold is considered extreme and begins to impact the daily operations of the county. Extreme cold/wind chill impacts plants, animals and water supplies.

The effects of extremely cold temperatures are amplified by strong to high winds that can accompany winter storms. Wind-chill measures how wind and cold feel on exposed skin and is not a direct measurement of temperature. As wind increases, heat is carried away from the body faster, driving down the body temperature, which in turn causes the constriction of blood vessels, and increases the likelihood of severe injury or death to exposed persons. Animals are also affected by wind-chill however cars, buildings, and other objects are not.

In 2001, the NWS implemented an updated Wind-Chill Temperature index. This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 4-56 National Weather Service Wind-Chill Chart

NWS Windchill Chart

Temperature (°F)

Wind (mph) / Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

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

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

Effective 11/01/01

Source: National Weather Service

Geographical Area Affected

Winter storms are a yearly feature of the Wyoming climate and may occur anywhere in the state. Generally, severe winter storms and extreme cold events are considered regional, which implies the storms impact multiple counties simultaneously, often for extended time periods. It is possible for the geographic extent of the hazard to vary significantly within a single county - a regional storm may directly impact only a small portion of the planning area while still extending over a large portion of the surrounding area. However, even in these instances, while the percent of the planning area directly affected ranges from less than 10% to 100% depending on the specific circumstances, if any portion of the planning area is impacted by the storm then the entire planning area suffers indirect impacts. Therefore, they are considered to have an extensive geographic impact rating.

Past Occurrences

NCEI data on winter storms and extreme cold events in Region 2 extends from January 1996 through December 2017; during that period, the counties in Region 2 experienced 244 winter weather incidents, including blizzards, extreme cold, heavy snow, ice storms, winter storms and winter weather. There has been only 1 recorded injury and no recorded fatalities associated with these incidents; the single reported injury was a firefighter who was struck by a sliding car. Total reported property damages in the Region amounted to $3,019,000, with no reported crop damage. $3,000,000 of this property damage occurred in a single storm on October 3, 2013. From NCEI records: *"Natrona County was hardest hit with over a foot of snow in most parts of the County, including 16.2 inches at the Casper Airport and up to 22 inches in the foothill areas of Casper Mountain. The heavy, wet snow fell on trees that still had full foliage and caused branches and in some cases whole trees to fall. Many of these landed on power lines and caused widespread power outages. Around 14,000 customers were without power at the peak of the storm. Several warming shelters were established along the I-25 corridor to help those without heat. The heavy snow also brought many road closures to central Wyoming. In Casper, snowfall of 16.2 inches was the tenth highest storm total since records began in 1937 and held a liquid water content of 2.14 inches. The highest snowfall amounts fell in the higher elevations with over two feet of snow recorded in the higher elevations of the Wind River, Bighorn, and Absaroka ranges, as well as Casper Mountain. The highest amount was at the Reno Hill SNOTEL where 34 inches of snow was recorded."*

Table 4-59 Winter Weather Events Summary 1996-2017

County	Winter Storms	Ice Storms	Extreme Cold	Injuries/ Fatalities	Property Damage	Crop Damage	Total Damage
Converse	48	0	8	0 / 0	$0	$0	$0
Natrona	159	0	1	1 / 0	$3,019,000	$0	$3,019,000
Niobrara	27	1	1	0 / 0	$0	$0	$0

Source: NCEI. The "Winter Storm" column includes events labelled as blizzards, heavy snow, winter storm or winter weather.

The most significant blizzard in Wyoming's history occurred from January 2, 1949 to February 20, 1949. Snowfall in parts of eastern and southeastern Wyoming measured up to 30 inches, with drifts 20 to 30 feet high. Seventeen people perished, along with 55,000 head of cattle and over 105,000 sheep. Total economic loss was more than $9 million dollars. In 2009 dollars, the loss would be over $81 million.

The most extreme cold event on record in Wyoming occurred in March 1975, when zero-degree temperatures combined with 40-50 mph winds caused livestock losses worth $12,312,872 (adjusted to 2016). Another cold wave in December 1983 brought low temperatures between -20°F and -40°F, resulting in $6,650,688 in damages, primarily from freezing water pipes.

In late January 1996, record low temperatures were recorded for many areas, with 38 below zero recorded in Worland on the morning of January 31st. Low temperatures in the western Bighorn Mountains dropped to between ten below zero and 45 below zero during this time across the State of Wyoming. On the 1st, strong winds lowered wind chill temperatures to as low as 60 below zero in some locations. Some young livestock were frozen. The cold also froze many pipes and caused some water lines to break or leak. A number of schools and events were cancelled across the state during this time. About forty residences were without natural gas in the Big Horn Basin on the 3rd due to the cold causing a valve malfunction. Many accidents occurred on the 1st due to poor visibility. One person froze to death just north of Buffalo, WY early on the 2nd after walking for help after his car broke down.

On December 30th, 2014, northerly flow following the passage of an Arctic cold front brought brutally cold temperatures and dangerous wind chills to much of western and central Wyoming. The Daniel cooperative observer recorded a low temperature of -48F on the morning of Wednesday, December 31st. In addition, many locations across Fremont, Hot Springs, Lincoln, Sweetwater and Washakie counties saw temperatures of -30F to -35F. Wind chill temperatures of -30F were common.

The following table shows regional temperature profiles based on data from the Western Regional Climate Center for sensor locations in each county. The record low for the Region is -43°F in Douglas in 1919.

Table 4-60 Region 2 Temperature Summaries

County	Station	Winter[1] Average Minimum Temperature	Summer[1] Average Maximum Temperature	Highest Recorded Maximum Temperature	Lowest Recorded Minimum Temperature	# Days >90°F/ Year	# Days <32°F/ Year
Converse	Douglas	13° F	83.7° F	106° F 7/25/1931	-43° F 12/09/1919	26	180
Natrona	Casper WSO AP	14.8° F	84.1° F	104° F 7/12/1954	-41° F 12/21/1990	30	180
Niobrara	Lusk 2	12.7° F	82.4° F	105° F 7/27/1931	-38° F 1/14/1972	25	190

Source: Western Regional Climate Center, www.wrcc.dri.edu/
[1]Winter: December, January, February; Summer: June, July, August

Frequency/Likelihood of Occurrence

Winter storms and extreme cold are an annual occurrence in Wyoming, often occurring multiple times each winter, and affecting entire regions in their size and scope. Since 1996, the Region has averaged around 10 days with a recorded severe winter weather incident per year.

It is important to note that the lack of specific historical accounts on extreme cold temperatures does not necessarily indicate a low frequency of occurrence. Residents of Wyoming are used to cold weather, and may be less likely to report events that might be considered extreme in other areas.

Potential Magnitude

The damages caused by severe winter storms, blizzards and extreme cold vary and are dependent on several factors: the duration of the storm; the geographic extent; the time of year; meteorological factors such as wind, moisture content of the snow, ground and air temperatures; and the advance warning of the storm. Impacts from the storm dictate the magnitude of the event, emphasizing that the amount snow may not always directly correlate to how bad the storm is. Damaged power lines and dangerous or impassable roadways may forestall the delivery of critical services such as medical and emergency assistance, the delivery of food supplies and medications, or even the provision of basic utilities such as heat and running water. When events happen with a long warning time, it is possible to pre-mitigate the effects of insufficient supply levels or to pre-test emergency generators, which may prevent some of the previously described impacts from occurring. Unanticipated storms increase the number of people stranded, both in cars and at public locations, which may increase the number of injuries and deaths attributed to the event (often caused by exposure) and place uneven and unanticipated strains on public sheltering capacities. The weight of the snow, driven by the water content of the fall, increases the potential for damages caused to structures and trees. Lighter snow caused by extreme cold increases the damages caused to livestock, agriculture and landscaping due to freezing conditions. Winter storms which go through periods of thaw and freeze prolong dangerous icy conditions, increasing the likelihood of frozen and damaged water pipes, impassable or dangerous roadways, damaged communication lines, or more extensive damages to infrastructure and structures caused by seeping water freezing under roofs, porches, patios, inside sidings, or causing damage to vehicles. Extreme cold can also impact livestock and even crops if the event occurs during certain times of the year.

Winter storms usually cover a significant part of the state, and as such are easier to describe regionally than on a county by county basis.

Vulnerability Assessment

Population

The threat to public safety is typically the greatest concern during severe winter storms. While virtually all aspects of the population are vulnerable to severe winter weather, there are segments of the population that are more vulnerable to the potential indirect impacts of a severe winter storm than others, particularly the loss of electrical power. As a group, the elderly or disabled, especially those with home health care services that rely heavily on an uninterrupted source of electricity. Resident populations in nursing homes or other special needs housing may also be vulnerable if electrical outages are prolonged. If they do not have a back-up power source, rural residents and agricultural operations reliant on electricity for heating and water supplies are also especially vulnerable to power outages.

Extreme cold/wind chill pose the greatest danger to outdoor laborers, such as highway crews, police and fire personnel, and construction. The elderly, children, people in poor physical health, and the homeless are also vulnerable to exposure. Overall, the population has a medium exposure to severe cold.

Severe winter weather also increases the vulnerability of the commuting population. While there is no way to quantify which of these accidents occur during severe winter storms versus regular winter storms, the numbers indicate that winter driving conditions raise the vulnerability of the commuting population.

General Property

Property vulnerabilities to severe weather include damage caused by high winds, ice, or snow pack and subsequently melting snow. Vehicles may be damaged by the same factors, or temporarily un-useable due to the driving conditions created by severe winter weather. Contents of homes, storage units, warehouses and storefronts may be damaged if the structures are compromised or fail due to the weather, or during potential flooding caused by melting snow. Very wet snow packs down densely and is very heavy. This may create strains on structures, causing partial or entire collapses of walls, roofs, or windows. This is impacted both by architecture and construction material, and should be assessed on a building-by-building basis. These records are probably tracked via insurance or other private vendors. Crops, livestock and other agricultural operations are also highly vulnerable to severe winter storms.

Extreme cold/wind chill presents a minimal risk to the structures of Region 2. Property damage occurs occasionally when water pipes freeze and break. Homes without adequate insulation or heating may put owners at a higher risk for damages or cold-related injury. In cases of periods of prolonged cold, water pipes may freeze and burst in poorly insulated or unheated buildings. Vehicles may not start or stall once started due to the cold temperatures and the risks of carbon monoxide poisoning or structure fires increases as individuals attempt to warm cars in garages and use space heaters. Stalled vehicles, or those that fail to start, may result in minor economic loss if individuals are unable to commute between work, school, and home. Driving conditions may deteriorate if extreme cold/wind chill prolongs icy road conditions, which will impact commutes and emergency response times as well. Landscaping and agricultural products may be damaged or destroyed by unseasonable occurrences of extreme cold/wind chill, causing plants to freeze and die; this may increase the indirect vulnerabilities to severe cold by causing greater economic costs and losses for the year. The overall vulnerability of general property is low.

Essential Infrastructure, Facilities, and Other Important Community Assets

The physical structures which comprise essential infrastructure are as vulnerable as those outlined in the General Property subsection of this profile. Severe winter weather may also disrupt the availability of services from essential infrastructure, including utility delivery (gas, electric and water), telephone service, emergency response personnel capabilities, road plowing, and childcare availability. Severe winter storms may even halt the operation of an area for periods of time, making the vulnerability of the counties even higher.

Like general property, extreme cold/wind chill events have a limited impact on the physical property of essential infrastructures and facilities. Communications lines such as fiber optic cables can freeze. There may be incidents of delayed emergency response due to stalled vehicles, delays in dispatching due to frozen communications lines, or an increased volume in calls. Hospitals may see an increase in cold-related injuries directly or injuries associated as secondary effects of the cold (traffic accidents, broken bones or severe cuts due to slips, etc.) and a prolonged extreme cold/wind chill event may impact hospital personnel capabilities. Personnel working in the cold, such as firefighters, EMTs, police officers and construction workers, have a higher vulnerability due to exposure times, and response capabilities may be hindered. Human services programs that care for at-risk individuals and families may be stressed, but usually can still adequately provide services through the duration of the extreme cold/wind chill event. Unusually high volumes of individuals seeking shelter or food may overwhelm some facilities if the event is prolonged. There may be an increased number of displaced individuals or families due to flooding caused by ruptured pipes, which may strain local aid organizations such as the Red Cross. Older venues or historical properties suffer the same vulnerabilities associated with private and general properties that are older, with the added vulnerability of damaging historic and often irreplaceable property in the process. If the event is extremely extended and impacts multiple other counties and states, which in turn impacts the availability of mutual assistance, the risk factors may increase. The overall vulnerability of essential infrastructure and community assets is medium.

As mentioned previously, ice or heavy accumulations of snow, particularly with blowing and drifting, can temporarily impact the roadway system. These accumulations also require vast amounts of overtime for county highway and local streets departments to remove snow and melt ice. Ice storms or high winds in winter storms can cause extensive loss of overhead utility lines due to buildup either on the lines or on adjacent trees that either collapse due to the weight or blow down onto the utility lines. Services such as telephone, electricity, and cable TV are frequently affected by winter storms. The overall vulnerability of essential infrastructure is medium.

Natural, Historic and Cultural Resources

Natural resources may be damaged by the severe winter weather, including broken trees and death of unsheltered wildlife. Unseasonable storms may damage or kill plant and wildlife, which may impact natural food chains until the next growing season. Historical areas may be more vulnerable to severe winter storms due to construction and age of structures. Cultural resources generally experience the same vulnerabilities outlined in General Property, in addition to lost revenue impacts due to transportation impacts. The overall vulnerability of these resources is medium.

Future Development

Where building codes are applicable, future residential or commercial buildings built to code should be able to withstand snow loads from severe winter storms. Future power outages or delays in power delivery to future developments may be mitigated by construction considerations such as buried power lines. Future development will also require future considerations for snow removal capacity including equipment, personnel, and logistical support. Adequate planning will help establish the cost-effective balance.

Due to the relative prevalence of cold incidents across the Region, it is common practice to build infrastructure with the appropriate safeguards to protect it from extreme cold incidents. This practice will continue as infrastructure is built to face the realities of living in Wyoming.

Public education efforts may help minimize the risks to future populations by increasing knowledge of appropriate mitigation behaviors, clothing, sheltering capacities, and decision making regarding snow totals, icy roads, driving conditions, and outdoor activities (all of which are contributors to decreased public safety during severe winter storms). New establishments or increased populations who are particularly vulnerable to severe winter storms (such as those with health concerns or those who live in communities that may be isolated for extended periods of time due to the hazard) should be encouraged to maintain at least a 72-hour self-sufficiency as recommended by FEMA. Encouraging contingency planning for businesses may help alleviate future economic losses caused by such hazards while simultaneously limiting the population exposed to the hazards during commuting or commerce-driven activities.

Summary

Residents of the Region are generally well-adapted to severe winters and cold temperatures. Nevertheless, Severe Winter Storms are generally a high significance hazard in the Region due to the widespread nature, severity, and potential impacts to life and property.

Table 4-61 Winter Weather Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Significant	Highly Likely	Limited	High
Natrona	Significant	Highly Likely	Limited	High
Niobrara	Significant	Highly Likely	Limited	High

4.2.14 Tornado

Hazard/Problem Description

A tornado is a swirling column of air extending from a thunderstorm to the ground. Maximum winds in tornadoes are often confined to extremely small areas, and vary tremendously over very short distances, even within the funnel itself. Tornadoes can have wind speeds from 40 mph to over 300 mph, the majority displaying wind speeds of 112 mph or less. Erratic and unpredictable, they can move forward at up to 70 miles per hour, pause, slow down and change directions. Most have a narrow path, less than 100 yards wide and a couple of miles long. However, damage paths from major tornadoes can be more than a mile wide and 50 miles long.

Based on national statistics for 1970 – 1980, for every person killed by a tornado, 25 people were injured and 1,000 people received some sort of emergency care. Tales of complete destruction of one house next to a structure that is totally unscathed are well documented. Within a building, flying debris or missiles are generally stopped by interior walls. However, if a building has no partitions or has any glass, brick or other debris blown into the interior, the tornado winds can be life threatening. In order to examine tornado activity and the potential impact on the Region and its residents, it is important to understand how tornadoes are rated.

Rating a Tornado

In 1971, Dr. T. Theodore Fujita of the University of Chicago devised a six-category scale to classify U.S. tornadoes into intensity categories, F0 through F5. These categories are based upon the estimated maximum winds occurring within the funnel. The Fujita Tornado Scale (or the "F Scale") became the definitive scale for estimating wind speeds within tornadoes based upon the damage done to buildings and structures. It is used extensively by the National Weather Service in investigating tornadoes, and by engineers in correlating damage to building structures and techniques with different wind speeds caused by tornadoes.

Table 4-62 Fujita Scale Description

F-Scale Number	Intensity Phrase	Wind Speed	Type of Damage Done
F0	Gale tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages signboards.
F1	Moderate tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.

F-Scale Number	Intensity Phrase	Wind Speed	Type of Damage Done
F3	Severe tornado	158-206 mph	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.

Source: NOAA

Changes to Tornado Rating Scale

Devastating tornadoes in Jarrell, Texas on May 1997 and Moore/Oklahoma City on May 1999 demonstrated to that the wind estimates in the original F-scale may be too high. From 2000 to 2004, the Wind Science and Engineering Research Center at Texas Tech University, in cooperation with numerous expert meteorologists, civil engineers and the National Weather Service (NWS), developed an Enhanced Fujita Scale, or EF-scale. In addition to improving the ranking process, it was essential to the development team that the new EF-scale support and be consistent with the original F-scale. The EF-scale documentation includes additional enhanced descriptions of damage to multiple types of structures and vegetation with photographs, a PC-based expert system, and enhanced training materials.

In February 2007, the Enhanced Fujita scale replaced the original Fujita scale in all tornado damage surveys in the United States. The following table compares the estimated winds in the original F-scale with the operational EF-scale that is currently in use by the NWS.

Table 4-63 The Enhanced Fujita Tornado Scale

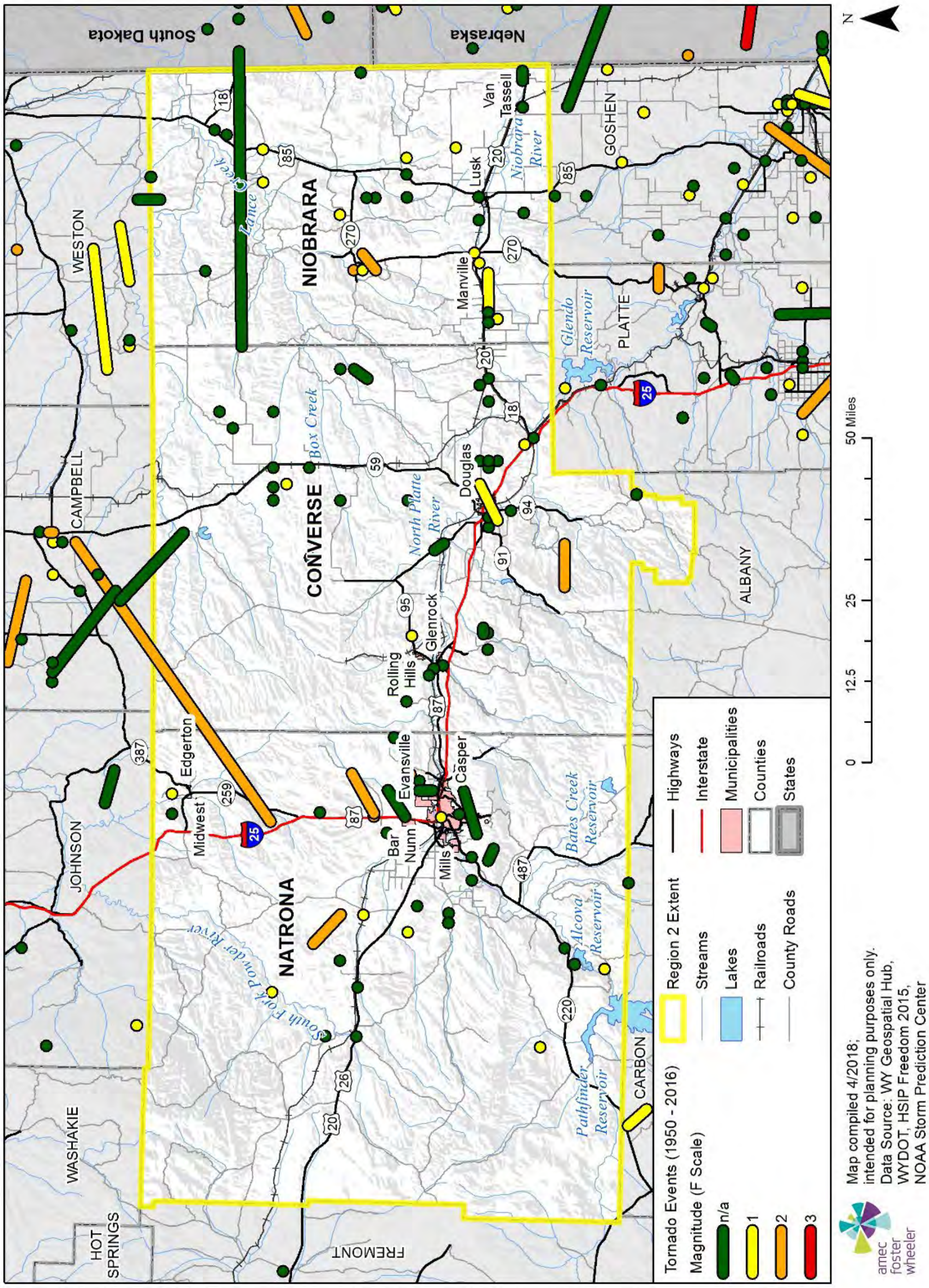
Fujita Scale			Operational EF-Scale	
F Number Fastest	Fastest 1/4 – mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85
1	73-112	79-117	1	86-110
2	113-157	118-161	2	111-135
3	158-207	162-209	3	136-165
4	208-260	210-261	4	166-200
5	261-318	262-317	5	Over 200

Source: NOAA

Geographical Areas Affected

The entire area of the Region is susceptible to tornadoes. While some areas may have seen more tornadoes than others, this is more of a statistical anomaly than a causal result.

Figure 4-57 Region 2 Tornadoes



Past Occurrences

Tornado statistics, especially prior to the 1970s, must be viewed as incomplete since many twisters occurred without being witnessed. Wyoming's open rangelands experience little if any damage from these storms, so many go unreported. Many documented tornadoes occurring in the counties in Region 2 are given low ratings on the Fujita Scale (F0s and F1s) simply because these tornadoes are often formed over open land and result in little or no damage.

Since 1950, there have been 101 tornadoes between the three counties of Region 2, as documented by the National Climatic Data Center. These tornadoes resulted in 18 injuries, no fatalities, and $2,640,600 in total recorded property damage in the Region.

Table 4-64 Tornado History by County, Region 2 (1950-2016)

County	Total Incidents	Magnitude	Damage-Causing Incidents	Fatalities	Injuries	Property Damage
Converse	34	0-2	8	0	5	$205,150
Natrona	33	0-2	12	0	8	$655,300
Niobrara	34	0-2	17	0	5	$1,780,150
Total	**101**	**0-2**	**37**	**0**	**18**	**$2,640,600**

Source: NOAA

NCEI data allows for examination and statistical analysis of tornadoes occurring in the Region. The majority of the historical tornadoes in the Region were rated F0 or EF0; the most powerful tornado recorded across the counties in Region 2 was rated as an EF2.

Table 4-65 History of Damage-Causing Tornadoes, Region 2 (1950-2016)

County	Date	Magnitude	Fatalities	Injuries	Property Damage	Crop Damage
Niobrara	1982-06-05	2	0	3	$500,000	$0
Niobrara	1984-06-13	2	0	1	$500,000	$0
Niobrara	1978-07-28	2	0	0	$500,000	$0
Natrona	1987-06-18	2	0	0	$500,000	$0
Natrona	1962-06-11	2	0	4	$50,000	$0
Converse	1982-06-05	1	0	3	$50,000	$0
Niobrara	1960-05-24	1	0	1	$50,000	$0
Converse	1965-06-14	1	0	1	$50,000	$0
Natrona	1978-07-20	2	0	1	$50,000	$0
Converse	1982-06-05	2	0	1	$50,000	$0
Natrona	1962-06-15	1	0	0	$50,000	$0
Niobrara	1962-07-17	1	0	0	$50,000	$0
Niobrara	1976-04-12	1	0	0	$50,000	$0
Niobrara	1979-08-01	0	0	0	$50,000	$0
Converse	1984-06-13	1	0	0	$50,000	$0
Niobrara	1984-06-13	1	0	0	$50,000	$0
Niobrara	1953-06-11	1	0	0	$5,000	$0
Niobrara	1960-06-26	1	0	0	$5,000	$0
Niobrara	1977-05-09	1	0	0	$5,000	$0
Niobrara	1983-06-20	0	0	0	$5,000	$0
Converse	1984-06-13	0	0	0	$5,000	$0
Niobrara	1985-07-26	0	0	0	$5,000	$0
Niobrara	1985-07-26	0	0	0	$5,000	$0
Natrona	1988-07-07	1	0	0	$5,000	$0
Niobrara	1950-06-07	1	0	0	$50	$0
Niobrara	1952-05-08	1	0	0	$50	$0
Converse	1955-07-25	0	0	0	$50	$0
Natrona	1962-06-12	1	0	0	$50	$0
Natrona	1968-09-02	0	0	0	$50	$0
Natrona	1969-05-15	0	0	0	$50	$0
Natrona	1974-08-09	1	0	0	$50	$0
Natrona	1975-05-08	1	0	0	$50	$0
Converse	1977-06-20	1	0	0	$50	$0
Converse	1982-06-05	0	0	0	$50	$0
Natrona	1982-06-05	0	0	0	$50	$0
Niobrara	1983-06-20	1	0	0	$50	$0
Natrona	1971-05-29	2	0	3	$0	$0
TOTALS			**0**	**18**	**$2,640,600**	**$0**

Source: NOAA

Figure 4-58 was created by Western Water Assessment based on their analysis of NCEI data; shows the number of tornado events in Wyoming per county from 1950-2017.

Figure 4-58 Tornado Events in Wyoming, 1950-2017

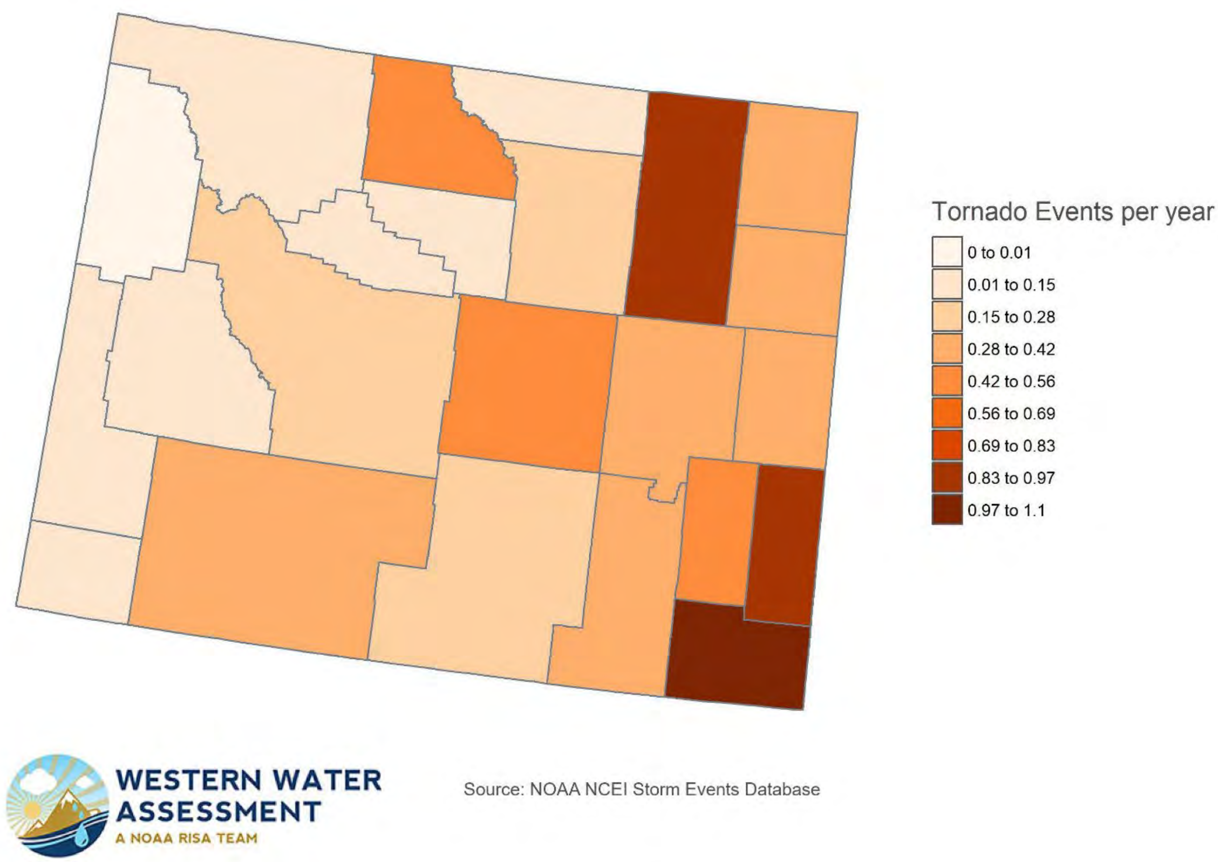
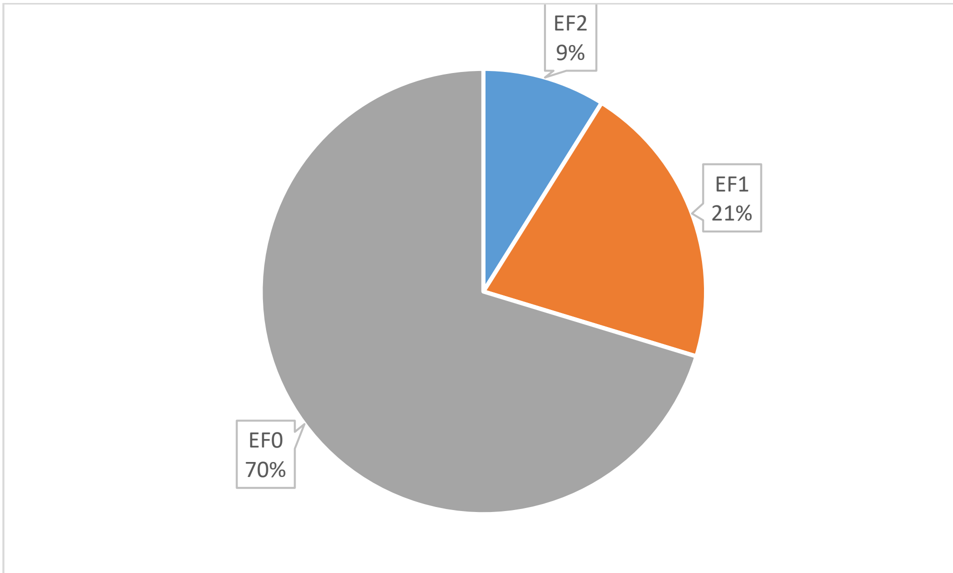


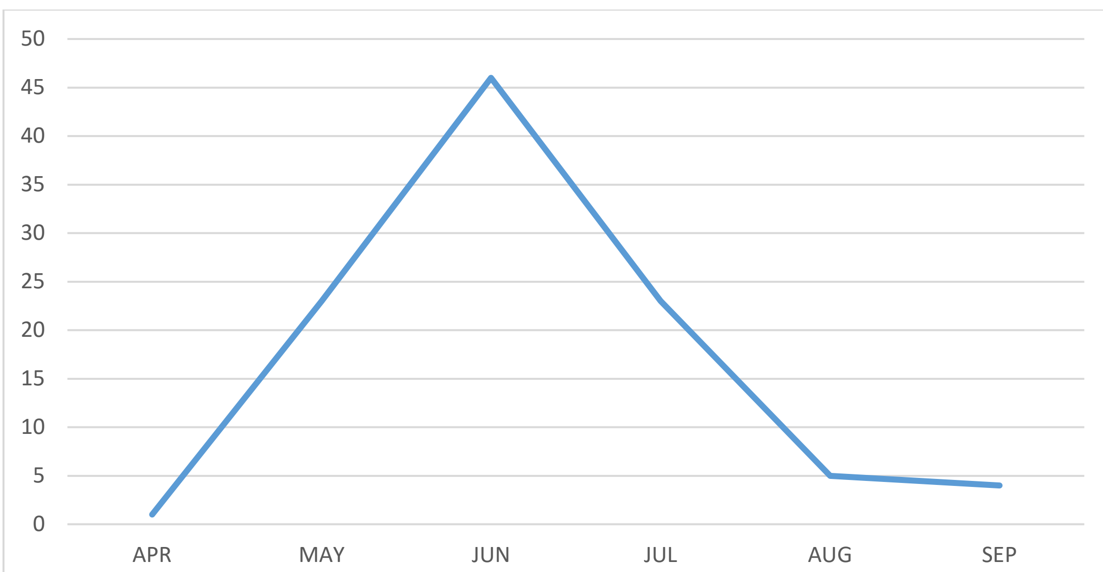
Figure 4-59 EF-Scale Tornadoes by Rating – Region 2



Source: NOAA

The data also allows for the development of profiles on historical time periods of tornadoes. Figure 4-60 and Figure 4-61 give historical perspective on the time of year and time of day that tornadoes in the region have occurred.

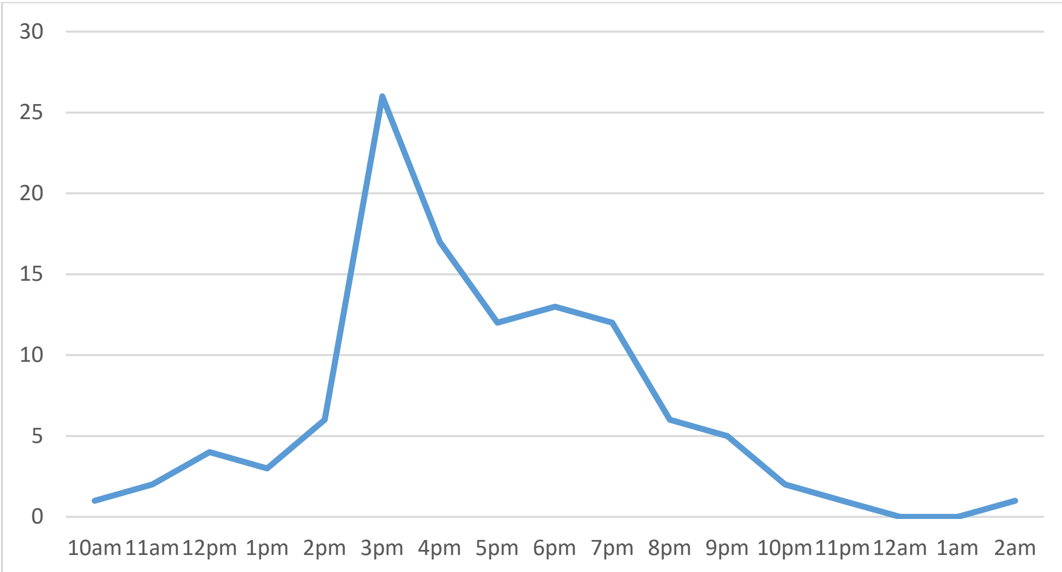
Figure 4-60 Region 2 Historical Tornadoes by Month: 1950-2016



Source: NOAA

Historically, tornadoes occur in the spring/summer months between April and September, with the highest number of tornadoes occurring in June.

Figure 4-61 Historical Tornadoes by Time of Day: 1950-2016



Source: NOAA

Historical tornadoes in Region 2 occurred mainly between 10am and midnight, with prime hours being 3:00 pm to 9:00 pm.

Most tornadoes recorded in the Region cause no recorded injuries, no recorded fatalities, and little to no damage to property ($0 - $5,000 range). Of the 101 tornadoes that have been recorded by NOAA in Region 2 from 1950 to 2016, 37 (37%) have caused recorded property damage or injuries, and none have caused recorded crop damage.

Frequency/Likelihood of Occurrence

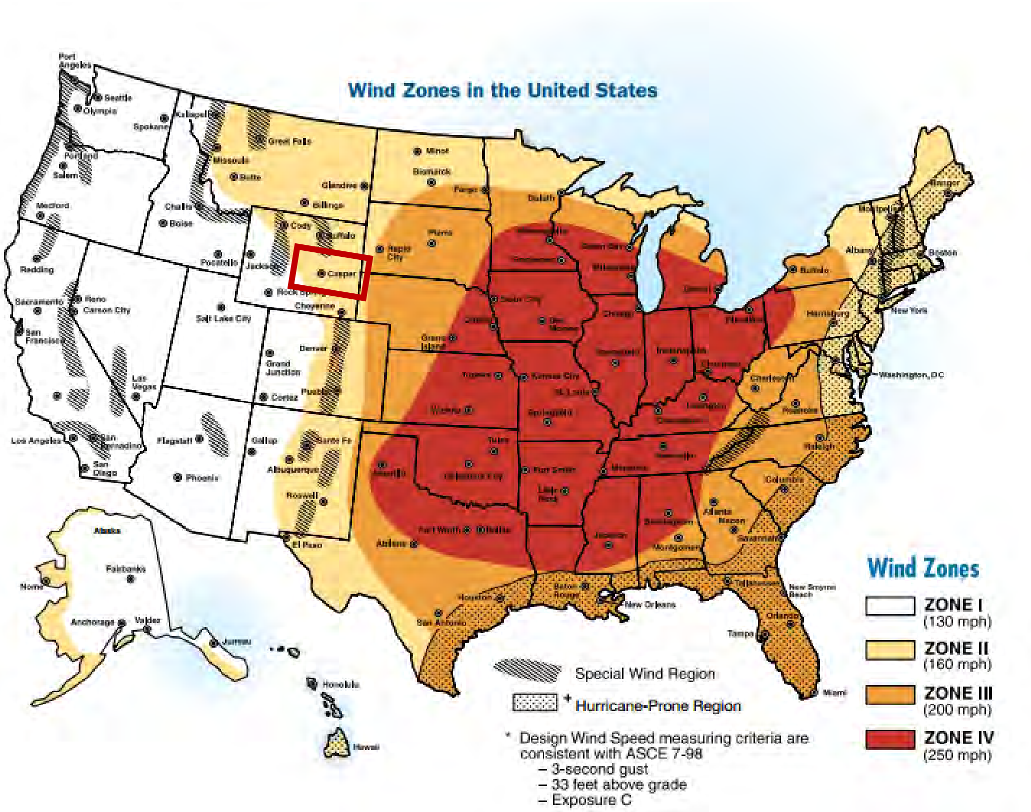
There were 101 tornadoes in the Region recorded between 1950 and 2016; of those, 37 resulted in damage or injuries. Each of the three counties in Region 2 experience a tornado roughly every two years. The frequency of damaging tornadoes varies from one every 8.4 years in Converse County, to one every 5.6 years in Natrona County, to one every 3.9 years in Niobrara.

On average, Region 2 experienced 1.5 recorded tornadoes per year, and experienced a damaging tornado every 1.8 years; this trend will likely continue into the future.

Potential Magnitude

The National Weather Service considers tornadoes to be among nature's most violent storms. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Tornadic winds can cause people and autos to become airborne, can tear homes to shreds, and can turn broken glass and other debris into lethal missiles. Even weaker tornados can cause major damage. The wind zone map shown below indicates the potential magnitude of wind speeds. Most of Region 2 is located in Zone II, which can expect winds up to 160 mph.

Figure 4-62 Wind Zones in the United States



Source: FEMA

According to NCEI records, the storm of record for Region 2 occurred on June 5, 1982, when a severe thunderstorm complex spawned five tornadoes across all three counties in the planning area. All told, the five tornadoes destroyed two mobile homes and a barn, and damaged several other structures as well as several cars, and injuring seven individuals; total property damage was over $300,000.

Though the strength of a tornado often dictates the impacts, it is important to remember that the location (rural or urban) of a tornado is just as important when assessing these risks, and that location is a random factor.

Vulnerability Assessment

Because of its rural composition, people or property within the county have not been historically impacted during past tornado incidents. While the F-Scale ratings of historical tornadoes in the counties in the Region are low, those ratings are partially based on recorded damage; recorded damage may have been much more substantial if these tornadic events had impacted one of the many communities in the Region, rather than timber, outlying range, and farm acreage.

Tornadoes occur at random throughout the Region; all structures, critical facilities, essential services, and populations are considered vulnerable.

Future Development

Any future development that is exposed and above ground will be vulnerable to a direct or indirect hit by a tornado. Generally, most areas in the Region lack building codes. In areas where building codes are not in place and enforced, buildings may not be built to withstand tornado-force winds.

Summary

Historically, the impacts to the counties and the Region from tornadoes has been low; however, depending on a tornado's size, intensity and path, it can cause severe impacts to people, property and infrastructure.

Table 4-66 Tornado Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Significant	Occasional	Limited	Medium
Natrona	Significant	Occasional	Limited	Medium
Niobrara	Significant	Occasional	Limited	Medium

4.2.15 Wildland Fire

Hazard/Problem Description

Wildland Fire is defined as a highly destructive fire or any instance of uncontrolled burning in grasslands, brush or woodlands. Wildfire has encroached into urban interface situations as more people move closer to forest settings. As defined by the National Interagency Fire Center (NIFC), a "wildland fire" is any non-structure fire, other than prescribed fire, that occurs in the wildland. The term "wildland/urban interface" or WUI is widely used within the wildland fire management community to describe any area where man-made buildings are constructed close to or within a boundary of natural terrain and fuel, where high potential for wildland fires exists. "Aspect" refers to the direction in which a slope faces. "Fuel" consists of combustible material, including vegetation, such as grass, leaves, ground litter, plants, shrubs, and trees that feed a fire.

Wildfires can occur at any time of the year, but are most likely to occur during the spring, summer or fall. Thunderstorms that contain lightning frequently start wildfires, but they can also be caused by humans. Wyoming's semi-arid climate and rural character make the state vulnerable to catastrophic wildland fires, which comprise more than 50% of all fires in Wyoming.

As the population and the wildland/urban interface in Wyoming increases, the risk of wildland fire becomes more significant. The past 100 years of wildland fire suppression has led to heavy vegetation growth and thus has greatly increased the potential fuel-load for a wildfire to burn. As the wildland/urban interface has grown into these densely packed forests, the potential for catastrophic wildland fires has increased as well. Fires have historically played a natural role on western landscapes. For example, some species of trees occupy sites following fire until replaced by more shade-tolerant species. In some cases regeneration of vegetation can be enhanced by fire. Fires may have positive or negative effects, or both, depending upon the resources at risk in the fire area.

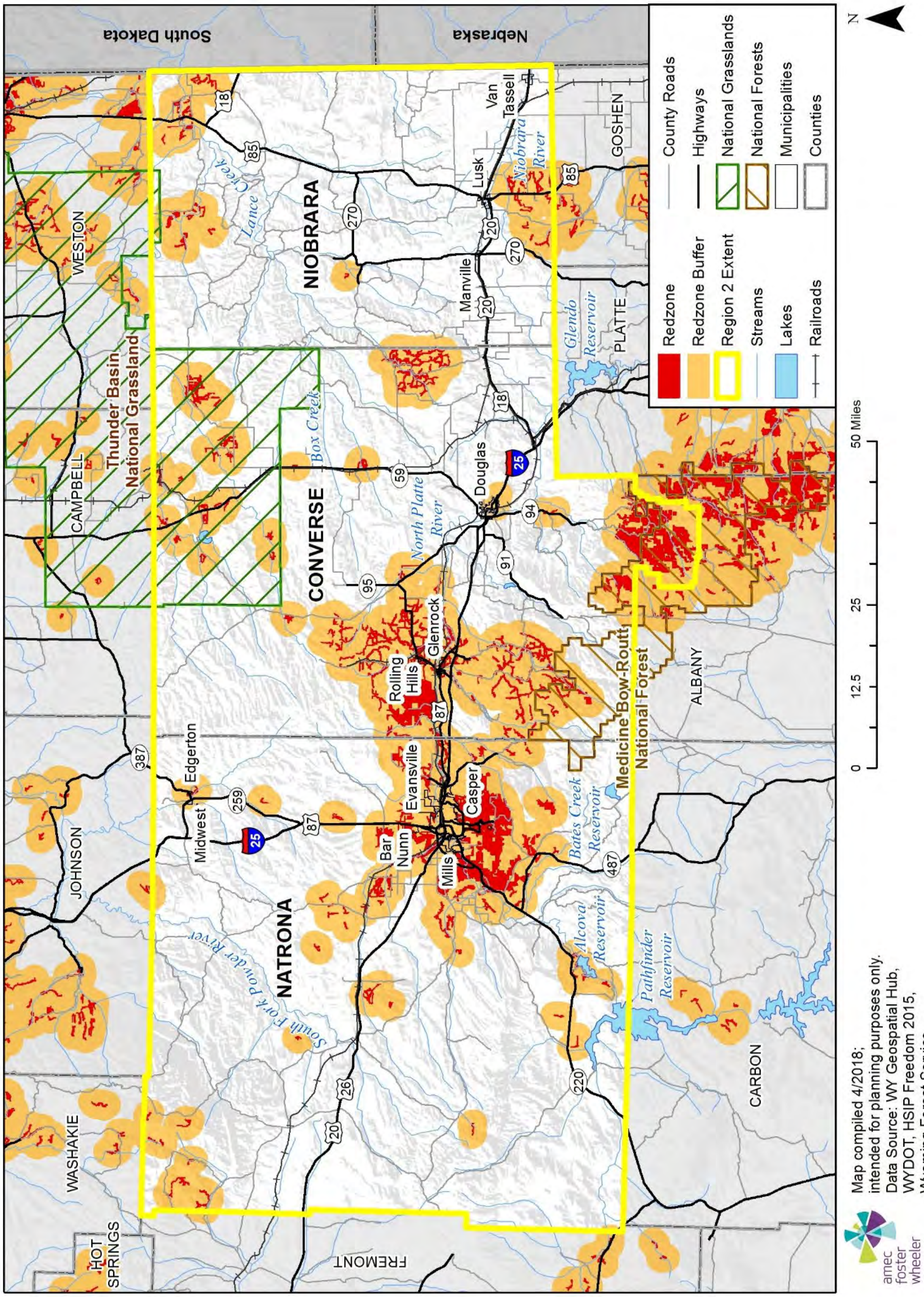
Geographical Area Affected

Certain areas of the counties in Region 2, because of their semi-arid climate and availability of fuel, are vulnerable to catastrophic wildland fires. Historically, over 50% of all wildfires in Wyoming involve wildland areas. A major portion of the Region is susceptible to wildfires, with the exception of areas above the tree line. According to the methodology for characterizing spatial extent, a **significant** portion of the planning area is affected by wildfires.

The wildland and wildland-urban interface areas are of most concern and are shown in Figure 4-63, based on the Wildland Urban Interface Hazard Assessment. This assessment was produced by a joint venture of the Wyoming State Forestry Division, USFS, BLM, NPS, and other interested parties. This Geographic Information System (GIS)-based mapping effort builds on the Front Range Redzone Project in Colorado. The Assessment seeks to map fire hazard incorporating population density against slope, aspect, and fuel conditions. With the mapping analysis evaluating areas of varying wildfire vulnerability, the final output results in a Risk, Hazard, and Value (RHV) map displaying areas of concern (called Redzones) for catastrophic wildland fires. According to the Redzones analysis, the following areas seem to be at highest risk, based on wildfire-prone vulnerable characteristics:

- Converse County has characteristics that indicate that a Catastrophic Fire is possible, especially surrounding the Towns of Rolling Hills and Glenrock
- The southern tip of Converse, along the boundary with Albany County, could also experience wildland fires
- Parts of Natrona County towards the southeast, including Casper, Mills, Bar Nunn, and Evansville
- All areas in or near forest lands, such as near the Medicine Bow-Routt National Forest and Thunder Basin National Grassland

Figure 4-63 Region 2 Wildland Fire Redzones

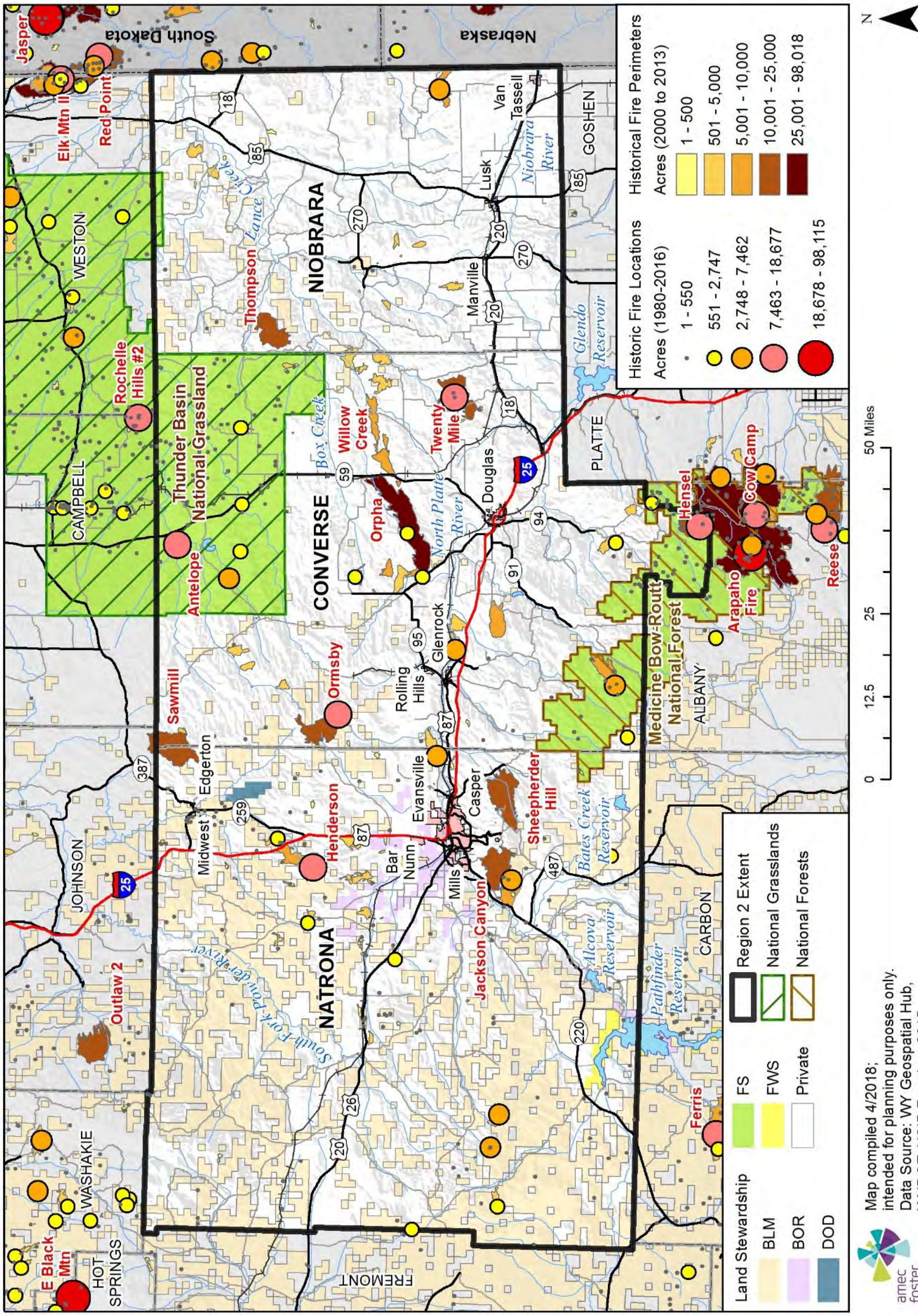


Past Occurrences

The Federal Wildland Occurrence Database was used to analyze fire history in Region 2. The database, maintained by the USGS and other agencies, includes perimeter and point GIS layers for fires on public lands throughout the United States. The data includes fires dating back to 1980. The National Park Service, Bureau of Land Management, and U.S. Forest Service reports include fires of 10 acres and greater. The database is limited to fires on federal lands. Some fires may be missing altogether or have missing or incorrect attribute data. Some fire information may be lacking because historical records were lost or damaged, fires were too small for the minimum cutoffs, documentation was inadequate, or fire perimeters have not yet been incorporated into the database. Also, agencies are at different stages of participation. For these reasons, the data should be used cautiously for statistical or analytical purposes.

The following figure shows wildfires that have affected the area based on the Federal Wildland Occurrence Database. Some of the largest recorded fires occurred in central Converse County, southeast Natrona, edge between northeast Natrona and northwest Converse, southern top of Converse County (on the boundary with Albany County), and northwest Niobrara. Some of the more significant fires are discussed by county in the following section.

Figure 4-64 Region 2 Wildland Fire Occurrences 1980-2016



Converse County

Converse County has had 29 recorded fires of over 1,000 acres in size since 1980; a portion of the wildfires occurred in heavily vegetated area such as the Medicine Bow Routt National Forest and the Thunder Basin National Grasslands.

The largest fire in the county (Boner) took place in 2006, and was deemed as a natural-sourcing wildfire that burned almost 54,000 acres. 2006 was the year with the most fires in the database, with six large scale events recorded. Orpha, which happened in 2010, burned 25,093 acres and is the second largest single wildfire in the county since 1980; it was human-caused. In total there have been 212,920 acres affected by wildfires in the County. The table below describes Converse County wildfires that burned 1,000 or more acres between 1980 and 2016, sorted by size.

Table 4-67 Wildfires over 1,000 acres in Converse County: 1980-2016

Fire Name	Acres Burned	Cause	Year
Boner	53,930	Natural	2006
Orpha	25,093	Human	2010
Hensel	14,855	Natural	2002
Twenty Mile	11,083	Natural	2006
Ormsby	11,042	Natural	2000
Thompson	10,464	--	2011
Antelope	10,000	Human	1999
Walker	10,000	Human	1999
Henry’s	9,500	Natural	1996
Willow Creek	9,239	--	2010
Little boxelder	5,882	Natural	2012
Carson	5,670	Human	2011
Douglas	5,199	--	2000
Russells Camp	4,905	Natural	2012
Bixby	3,030	Human	2005
Converse 3	2,955	--	2011
Walker Creek	2,764	--	2006
Harshman	2,128	Natural	2000
Cheyenne River	2,000	Natural	2006
Converse 8	1,964	--	2011
Ugly	1,827	Natural	2000
Olmstead D	1,520	Natural	1996
Elk Mountain	1,322	--	2006
Converse 7	1,184	--	2011
Ross #1	1,160	Natural	1996
Lance Creek	1,116	Natural	2006
Sand Creek	1,044	Natural	2012
Lake Creek	1,034	Natural	2003
Wagonhound	1,010	Human	2015

Source: Federal Wildland Occurrence Data.
A double dash symbol means the cause of the fire is not available in the database.

Natrona County

Historically, most significant fires in Natrona County have occurred in the southeastern parts, south of Casper. Natrona has had a total of 21 fires of over 1,000 acres in size since 1980, with 122,146 burned acres (see Table 4-68).

The largest fire in the county occurred in 2006, burning 16,503 acres. It was the Sawmill fire. The second most damaging fire, Sheepherder Hill, burned 15,556 acres. While 13 wildfires were natural-caused, 7 were caused by human actions and one records its cause as both human/natural-derived. The table below describes Natrona County wildfires that burned 1,000 or more acres between 1980 and 2016.

Table 4-68 Wildfires over 1,000 acres in Natrona County: 1980-2016

Fire Name	Acres	Cause	Year
Sherwood	2,000	Natural	1980
Goat Mtn	6,661	Natural	1985
Mudsprings	2,266	Human	1991
Ormsby	1,667	Natural	1995
Geary D. 2	14,700	Natural	1996
Cole Creek	9,290	Human	1996
Lawn Creek	1,033	Human	1998
Henderson	8,390	Natural	2000
Deadhorse	5,900	Natural	2000
33 Mile	2,514	Natural	2000
Hemmingway	1,069	Natural	2000
Casper Creek	1,354	Natural	2001
Sage Hen	1,271	Natural	2005
Sawmill	16,503	Natural	2006
Jackson Canyon	11,765	Natural	2006
Poison Spider	3,166	Natural	2006
Geary Dome	2,879	Human	2010
205 Fire	2,573	Human	2011
Arapahoe	2,073	Human	2011
Sheepherder Hill	15,556	Human/Natural	2012
Station AKA Cole	9,516	Human	2015

Source: Federal Wildland Occurrence Data.

Niobrara County

Large fires in Niobrara have taken place in the northwest and southeast of the county, but smaller ones have burned through the northeast (near the Cheyenne River), about 4 miles northwest of Manville, and sporadically throughout.

The most damaging fire in Niobrara occurred in 2002, burning 5,025 acres (Tollman Fire). Three additional fires of over 1,000 acres took place in the county, however: one in 2007 and two in 2011. A total of 10,523 acres have been affected by these four major wildfires in Niobrara. Table 4-69 below summarizes these large wildfire occurrences.

Table 4-69 Wildfires over 1,000 acres in Niobrara County: 1980-2016

Fire Name	Cause	Year	Total Acres Burned
Tollman	Natural	2002	5,025
Smith	--	2011	2,201
77 Hill	--	2007	1,751
Cheyenne River	--	2011	1,546

Source: Federal Wildland Occurrence Data.

Frequency/Likelihood of Occurrence

Wildfires are **likely** to occur in the Region each year. It is important to note that the risk of wildfires occurring may increase during times of drought, especially prolonged droughts such as the statewide Wyoming drought which began around 2000 and did not end until 2004.

Potential Magnitude

The counties' individual risk to wildfire ranges from **significant** to **critical**, given around 25% to 75% of property could be severely damaged during an event, and facilities and services likely to become unavailable between 1 and 7 days. In addition, wildfire can have significant economic impacts as they often coincide with the busy tourist season in the summer months. These natural hazards coupled with the predictions by the Redzone fire assessments discussed previously (including a careful study of the historical prevalence of wildfires throughout the five counties), makes the overall potential for magnitude of wildfires significant. More specific consequences based on parcel analysis are discussed by county in the next section, Vulnerability Assessment. It is important to note that, while only a small number of built environments (e.g., infrastructure in the towns and cities) might be affected from wildfires, agricultural lands and other amenities valuable to the Region can still be greatly damaged, in turn affecting other aspects and sectors of the economy in the Region.

Vulnerability Assessment

GIS tools are designed to collect, store, analyze, manipulate, and display/represent spatial data. In the case of a Wildland Urban Interface Hazard Assessment, wildfire hazard vulnerability is determined by comparing values such as slope, aspect, vegetation, and housing density, which then produce datasets such as the Redzone layer incorporated for this Plan's fire analyses. The following is from the *Wyoming Wildland Urban Interface Hazard Assessment Methodology*—a report written by the Wyoming State Forestry Division:

"The Wildland Urban Interface Hazard Assessment uses three main layers to determine fire danger—Risk, Hazard, and Values. The following lists include the data used to create each of the three layers.

1) Risk – Probability of Ignition
   a. Lightning Strike density

    b. Road density
    c. Historic fire density
2) Hazard – Vegetative and topological features affecting intensity and rate of spread
    a. Slope
    b. Aspect
    c. Fuels – Interpreted from GAP Vegetation information.
3) Values – Natural or man-made components of the ecosystem on which a value can be placed
    a. Housing Density – Life and property
4) Non-flammable areas Mask – a mask was created to aid in the analysis for areas that will not carry fire such as water and rock areas. These areas show in the final assessment as a zero value for hazard."

The statewide Wildland Urban Interface Hazard Assessment and its resultant outputs serve two primary purposes: assisting in prioritizing and planning mitigation projects, and creating a communications tool to which agencies can relate common information and data. With the mapping analysis evaluating areas of varying wildfire vulnerability, the final output will result in a Risk, Hazard, and Value (RHV) map displaying areas of concern (called Redzones) for catastrophic wildland fires.

To estimate vulnerability from wildfire hazards, a common approach is to determine the value of structures and buildings/parcels that are located within Redzones. Wildland fire building exposure values are the values of buildings that can be potentially damaged by wildland fire in an area. For this Plan, a vulnerability assessment based on the Redzone fire hazard zones and parcel data was conducted, to determine potential losses to property and assets in each community (broken up by attributes such as property type, estimated content values, and total exposure to wildfire hazards). In addition, the population affected under this Redzone fire hazard analysis was also estimated, based on average household sizes for each county. The potential number of people who would be at risk of wildfire are summarized for each of the county exposure tables (Table 4-70 through Table 4-72). An explanation of the population exposure to the hazard follows the section below.

General Property Exposure

The total exposure value for Region 2 totals $1,066,987,604, according to the Redzone analysis. The tables below summarize the counties' wildfire exposure by jurisdiction.

Converse County

According to the Redzone and parcel data analysis, Converse County's potential exposure was determined to be $143,511,121

Table 4-70 Converse County Property Exposure based on the Redzone Fire Hazard

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Population
Douglas	Commercial	1	$1,169,266	$1,169,266	$2,338,532	--
	Exempt	1	$374,388	$374,388	$748,776	--
	Total	**2**	**$1,543,654**	**$1,543,654**	**$3,087,308**	--
Glenrock	Industrial	1	$594,938	$892,407	$1,487,345	--
	Residential	65	$9,049,914	$4,524,957	$13,574,871	160.55
	Total	**66**	**$9,644,852**	**$5,417,364**	**$15,062,216**	**161**
Rolling Hills	Commercial	1	$11,204	$11,204	$22,408	--
	Residential	146	$26,025,440	$13,012,720	$39,038,160	360.62
	Total	**147**	**$26,036,644**	**$13,023,924**	**$39,060,568**	**361**
Unincorporated	Agricultural	38	$8,084,185	$8,084,185	$16,168,371	--
	Commercial	11	$2,737,195	$2,737,195	$5,474,390	--
	Exempt	2	$1,286,071	$1,286,071	$2,572,141	--
	Residential	287	$41,390,752	$20,695,376	$62,086,128	708.89
	Total	**338**	**$53,498,203**	**$32,802,827**	**$86,301,030**	**709**
	GRAND TOTAL	**553**	**$90,723,352**	**$52,787,769**	**$143,511,121**	**1,230**

Natrona County

Natrona County's losses were calculated in Table 4-71.

Table 4-71 Natrona County Property Exposure based on the Redzone Fire Hazard

Jurisdiction	Property Type	Building Count	Improved Value	Est. Content Value	Total Exposure	Population
Bar Nunn	Com Vacant Land	1	$0	$0	$0	--
	Commercial	1	$140,946	$140,946	$281,892	--
	Industrial	1	$722,100	$1,083,150	$1,805,250	--
	Res Vacant Land	31	$0	$0	$0	--
	Residential	488	$89,692,660	$44,846,330	$134,538,990	1,191
	Total	**522**	**$90,555,706**	**$46,070,426**	**$136,626,132**	**1,191**
Casper	Commercial	3	$6,696,169	$6,696,169	$13,392,338	--
	Exempt	11	$0	$0	$0	--
	Industrial	1	$1,522,792	$2,284,188	$3,806,980	--
	Multi-Use	1	$122,248	$122,248	$244,496	--
	Res Vacant Land	2	$0	$0	$0	--
	Residential	1,238	$234,695,278	$117,347,639	$352,042,917	3,021
	Total	**1,256**	**$243,036,487**	**$126,450,244**	**$369,486,731**	**3,021**
Edgerton	Commercial	12	$1,216,719	$1,216,719	$2,433,438	--
	Residential	26	$772,204	$386,102	$1,158,306	63
	Total	**38**	**$1,988,923**	**$1,602,821**	**$3,591,744**	**63**
Unincorporated	Agricultural	2	$0	$0	$0	--
	Com Vacant Land	1	$0	$0	$0	--
	Commercial	143	$8,204,804	$8,204,804	$16,409,608	--
	Exempt	38	$0	$0	$0	--
	Industrial	3	$791,863	$1,187,795	$1,979,658	--
	Multi-Use	7	$849,714	$849,714	$1,699,428	--
	Res Vacant Land	86	$0	$0	$0	--
	Residential	1,981	$270,064,587	$135,032,294	$405,096,881	4,834
	Vacant Land	3	$226,986	$226,986	$453,972	--
	Total	**2,264**	**$280,137,954**	**$145,501,592**	**$425,639,546**	**4,834**
	GRAND TOTAL	**4,080**	**$615,719,070**	**$319,625,083**	**$935,344,153**	**9,109**

Niobrara County

According to the Redzone and parcel data analysis, Niobrara County's losses were determined to amount to the values specified in Table 4-72.

Table 4-72 Niobrara County Property Exposure based on the Redzone Fire Hazard

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Population
Unincorporated	Agricultural	8	$1,275,543	$1,275,543	$2,551,086	--
	Commercial	1	$8,720	$8,720	$17,440	--
	Duplex	1	$154,929	$77,465	$232,394	2
	Industrial	1	$488,474	$732,711	$1,221,185	--
	Residential	5	$1,036,026	$518,013	$1,554,039	11
	Total	**16**	**$2,963,692**	**$2,612,452**	**$5,576,144**	**13**
	GRAND TOTAL	**16**	**$2,963,692**	**$2,612,452**	**$5,576,144**	**13**

Any flammable materials are vulnerable during a wildfire, including structures and personal property. The vulnerability of general property increases as the distance of the property to wildfire-prone areas decreases, and is particularly high for structures located in the WUI. These structures receive an even higher level of vulnerability if the properties surrounding them are not properly mitigated for fire. Appropriate mitigation techniques include using non-flammable materials such as concrete for construction, leaving appropriate spaces between buildings and vegetation areas filled with non-flammable materials (such as decorative rock or stone), and clearing of underbrush and trees.

Population Exposure

The most exposed populations, as recorded in the three tables above, are those living in the wildland-urban interface (WUI) zones, where residential properties are directly intruding into traditional wildland areas. The exposure of the population in these zones increases with the exposure of the corresponding general property. Other exposed (at-risk) population groups include children, the elderly, or those with breathing conditions who may be particularly affected by high levels of smoke.

Population at-risk estimates were calculated by taking the number of populated property units (i.e., parcels) falling within the Redzone fire hazard layer, and multiplying that number by the average household size for each county, based on the Census Bureau's estimates. The average household factor was 2.54 for Converse, 2.44 for Natrona, and 2.24 for Niobrara. It is important to note that many of these structures may include seasonal homes that could be vacant, although the likelihood of them being occupied during fire season is higher. The summary of all the parcels/populated property units, their values, estimated content, total exposure to the hazard, and finally exposed (vulnerable) populations is provided in Table 4-73 below.

Table 4-73 Region 2 Property and Population Exposure based on the Redzone Fire Hazard Analysis

County	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Population
Converse	553	$90,723,352	$52,787,769	$143,511,121	1,230
Natrona	4,080	$615,719,070	$319,625,083	$935,344,153	9,109
Niobrara	16	$2,963,692	$2,612,452	$5,576,144	13
Total	**4,649**	**$709,406,114**	**$375,025,303**	**$1,084,431,418**	**10,352**

Critical Infrastructure, Facilities, and Other Important Community Assets

To assess critical facilities at risk in the planning area, the inventory of critical and essential facilities and infrastructure was analyzed. Spatial analysis was carried out to determine which facilities would be damaged from wildfires, based again on the Redzone fire hazard layer. Table 4-74 and Table 4-75 provide a summary of the critical facilities within the Redzone hazard zones, by county and jurisdiction. Note that Niobrara County does not have any critical facilities falling within Redzone areas, and as such only tables of Converse and Natrona Counties are provided.

Table 4-74 Converse County Critical Facility Exposure within the Redzone

Jurisdiction	Facility Type	Facility Count
Rolling Hills	Electric Substations	4
	EPA FRS Power Plants	2
	Fire Stations	2
	Microwave Service Towers	4
	Power Plants	2
Unincorporated	Microwave Service Towers	2
TOTAL		**16**

Table 4-75 Natrona County Critical Facility Exposure within the Redzone

Jurisdiction	Facility Type	Facility Count
Casper	Day Care Facilities	1
Edgerton	Cellular Towers	1
Unincorporated	AM Transmission Towers	1
	BRS & EBS Transmitters	3
	Cellular Towers	1
	EMS Stations	1
	Fire Stations	1
	FM Transmission Towers	9
	Microwave Service Stations	23
	Paging Transmission Towers	2
	Power Plants	1
	TV Analog Station Transmitters	4
	TV Digital Transmitters	4
TOTAL		**52**

Facilities in the Region such as those summarized in the tables above may be exposed directly or indirectly to wildfire. Direct exposures are similar to those of General Property, and vulnerabilities increase as the infrastructure or facilities and capabilities move into the WUI zones. Communication infrastructure and lines passing through susceptible areas such as forests are more exposed than those located in cities and more urbanized areas. The indirect vulnerability of response capabilities increases seasonally and with the number of occurrences. Though the populations making up the response capability systems are not directly exposed to all fire events, the response of some of the personnel to an event lessens the capabilities overall for responses to other emergency situations. If there is a large increase in the number of simultaneous wildland fires, even small ones, the response capability of the Region could easily be compromised.

Overall, there are a total of 68 critical facilities found in Region 2. While Niobrara did not contain any of these facilities within the Redzone areas, Converse has 16 facilities and Natrona 52 (primarily microwave service towers).

Table 4-76 Summary of Region 2 Critical Facilities within the Redzone, by County

County	Facility Type	Facility Count
Converse	Electric Substations	4
	EPA FRS Power Plants	2
	Fire Stations	2
	Microwave Service Towers	6
	Power Plants	2
Natrona	Day Care Facilities	1
	Cellular Towers	2
	AM Transmission Towers	1
	BRS & EBS Transmitters	3
	EMS Stations	1
	Fire Stations	1
	FM Transmission Towers	9
	Microwave Service Towers	23
	Paging Transmission Towers	2
	Power Plants	1
	TV Analog Station Transmitters	4
	TV Digital Transmitters	4
GRAND TOTAL		**68**

Natural, Historic and Cultural Resources

A portion of the Region (particularly Converse County) includes National Forest and Grassland, which contains many natural and cultural resources potentially at risk. Wildfires in open spaces and forests may also have a regional impact on summer tourism and other economic sectors.

Wildfire can have negative impacts where significant areas of sagebrush are burned within crucial mule deer winter range and sage-grouse breeding and winter habitats, for example. Nevertheless, natural resources and spaces can actually benefit from wildland fire, to encourage a healthy ecological redevelopment of areas impacted by pests or other such deterrents to the environment's native species growth.

Historic and cultural resources exhibit a vulnerability rating similar to those in general property. However, vulnerability ratings increase the closer into the WUI a particular property is, and the less mitigated the landscaping surrounding the property is. In addition, older buildings may be exempt from internal fire mitigation such as sprinklers and fire suppression technology, which may increase the vulnerability of the resource. The way in which the building or property was constructed (e.g., based on weakened or less reliable materials) can also play a part when it comes to vulnerability to fire. Examples of units of exempt nature may include historic buildings in downtown and tourist areas, such as museums or restaurants, especially those constructed with wooden materials that can burn rapidly or have their structural grounds significantly damaged during a wildfire.

Future Development

The wildland/urban interface (WUI) is a very popular building location, as shown by national and statewide trends. More and more homes are being built in the interface. Overall, Wyoming has less developed WUI than most western states. Throughout Wyoming there remains potential for future home construction in undeveloped, forested private lands adjacent to fire-prone public lands. Building homes in these high-risk areas would put lives and property in the path of wildfires. Regulating growth in these areas will be a delicate balance between protecting private property rights and promoting public safety. Should the region begin to experience this type of WUI growth, local government may wish to consider: regulation of subdivision entrance/exit roads and bridges for the safety of property owners and fire personnel; reviewing building plans pertaining to land on slopes greater than 25% (in consideration of access for fire protection of structures); and reviewing water supply requirements set forth to include ponds, access by fire apparatuses, pumps, and backup generators. Such standards serve to protect residents and property, as well as enable emergency services personnel and government/public resources during a wildfire.

Summary

Wildfires occur within the region on a frequent, almost annual basis. Based on GIS analysis of the Redzone and property values, the Region has over $1 billion in building/parcel value potentially at risk to wildland fires (as summarized on Table 4-77, under the Total Exposure column). Though it is not likely that the areas at risk will simultaneously face a destructive event, this figure provides the upper end of what could be affected and is currently exposed. Overall, wildfire is a **high** significance hazard to the entire Region 2, based on the reported analyses as well as input from the HMPC. County ratings are noted in the table below for each county.

Table 4-77 Wildfire Hazard Risk Summary

County	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Converse	Significant	Highly Likely	Critical	High
Natrona	Significant	Likely	Critical	High
Niobrara	Medium	Likely	Significant	High

CHAPTER 5 MITIGATION STRATEGY

Requirement §201.6(c)(3): [The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

5.1 Mitigation Strategy: Overview

This section describes the mitigation strategy process and mitigation action plan for the Region 2 Hazard Mitigation Plan. It describes how the participating jurisdictions in the Region meet the following requirements from the 10-step planning process:

- Planning Step 6: Set Goals
- Planning Step 7: Review Possible Activities
- Planning Step 8: Draft an Action Plan

The results of the planning process, the risk assessment, the goal setting, the identification of mitigation actions and the work of each county's HMPC led to this mitigation strategy and action plan. Section 5.2 identifies the goals of this plan; Section 5.4 describes the mitigation action plan.

5.2 Goals and Objectives

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

Up to this point in the planning process, each county's HMPC has organized resources, assessed hazards and risks, and documented mitigation capabilities. The resulting goals and mitigation actions were developed and updated based on these tasks. During the 2018 development of this plan, a meeting was held with each county HMPC designed to achieve a collaborative mitigation strategy as described further throughout this section.

During the planning workshops held in 2018, the counties reviewed the results of the hazard identification, vulnerability assessment, capability assessment and the goals from previous county-level hazard mitigation plans as well as the State of Wyoming Mitigation Plan (2016). The analysis of the risk assessment identified areas where improvements could be made and provided the framework for the counties to review planning goals (in some instances objectives) to base the development of new or updated mitigation strategies for the counties in the Region.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation; cost, schedule, and means of implementation are not considered. Goals are defined before considering how to accomplish them to not be dependent on the means of achievement. Goal statements form the basis for objectives (where applicable) and actions that will be used to achieve the goals. When used, objectives are more specific and measurable than goals, and are used to define strategies to attain goals. They are sometimes developed in mitigation planning as an intermediate step between goals and mitigation actions or projects.

The update and validation of goals for each county in the region was initiated through a facilitated discussion at each county planning workshop held in 2018. The HMPC members were provided a PowerPoint presentation that explained goals, objectives and actions and provided examples of each. Existing goals and related plan goals were noted in the PowerPoint, including the State of Wyoming Mitigation Plan. This review was to ensure that the Regional Plan's mitigation goals were aligned and integrated with existing plans and policies.

Based on the risk assessment update, each county identified, updated, or developed specific goals which provide the direction for reducing future hazard-related losses within the counties and regional planning area. During the planning process for the 2018 Regional Plan, all three counties determined the existing number and intent of goals and objectives continue to be appropriate and no revisions or additions were necessary.

The updated goals and objectives (where applicable) for each county in the Region are noted below.

Converse County

Converse County reviewed and validated the following goals during the planning process.

Goal 1: Strengthen public infrastructure.

Goal 2: Improve local mitigation capabilities.

Goal 3: Reduce economic losses due to hazard events.

Goal 4: Reduce local costs of response and recovery.

Natrona County

Natrona County reviewed and validated the following goals and objectives during the planning process.

Goal 1: Continue to implement actions to mitigate the effect of hazards through education, ordinances and resolutions, and proper project analysis, to enhance life safety and reduce property losses.

> *Objective 1.1:* The County and jurisdictions will participate in activities and support mitigation projects that enhance the protection of citizens from hazards.
>
> *Objective 1.2:* The County and jurisdictions will create public awareness campaigns to educate citizens of the possible hazards associated with all hazards that affect the planning area.

Goal 2: Continue coordination among all entities of Natrona County to assess all hazards and take various actions to reduce or eliminate the risk factors of those hazards.

> *Objective 2.1:* The County and jurisdictions will participate and support projects that ensure emergency services are properly equipped and trained to provide the level of service the community deserves.
>
> *Objective 2.2:* Continue multi-jurisdictional collaboration on hazard mitigation projects to the benefit of all jurisdictions.

Goal 3: Reduce the economic impact on the local economy caused by the effects of hazards in the communities.

> *Objective 3.1:* Communities working together shall develop policies for hazard prone areas that either limit development or provide additional mitigation measures within those areas.

Niobrara County

Niobrara County reviewed and validated the following goals during the planning process.

Goal 1: Mitigate natural hazards to reduce potential injury and loss of life, and property damage in the Town of Lusk.

Goal 2: Mitigate natural hazards to reduce potential injury and loss of life, and property damage in the Town of Manville.

Goal 3: Mitigate natural hazards to reduce potential injury and loss of life, and property damage in the Town of Van Tassell.

Goal 4: Mitigate natural hazards to reduce potential injury and loss of life, and property damage in Niobrara County.

5.3 Identification and Analysis of Mitigation Actions

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

The next step in the mitigation strategy is to identify and analyze a comprehensive range of specific mitigation actions and projects to reduce the effects of each hazard on new and existing buildings and infrastructure. During the 2018 Regional Plan development, each county Hazard Mitigation Planning Committee (HMPC) analyzed viable mitigation options by hazard that supported the identified goals. The HMPCs were provided with the following list of categories of mitigation actions, which originate from the Community Rating System:

- **Plan and Regulations (Prevention)**: Administrative or regulatory actions or processes that influence the way land and buildings are developed and built.
- **Property protection**: Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area.
- **Structural and infrastructure projects**: Actions that involve the construction of structures to reduce the impact of a hazard.
- **Natural resource protection**: Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
- **Public information/education and awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.
- **Emergency services**: Actions that protect people and property during and immediately after a disaster or hazard event.

To identify and select mitigation actions to support the mitigation goals, each hazard identified and profiled in Chapter 4 was evaluated at the planning workshop. At the county workshops a handout was provided showing existing mitigation actions identified in its previous plan, as well as examples of potential mitigation action alternatives for each of the above categories and for each of the identified hazards. Another reference document titled "Mitigation Ideas" developed by FEMA was also made available. This document lists the common alternatives for mitigation by hazard. The counties were asked to consider both future and existing buildings in considering possible mitigation actions. A facilitated discussion then took place to examine and analyze the options. Appendix A includes each county specific handout given at the planning workshops.

The mitigation strategy is based on existing local authorities, policies, programs, and resources, as well as the ability to expand on and improve these existing tools. As part of the Regional Plan development the county planning teams reviewed existing capabilities for reducing long-term vulnerability to hazards. Those capabilities are noted by jurisdiction in the county annexes and can be assessed to identify gaps to be addressed and strengths to enhance through new mitigation actions. For instance, gaps in design or enforcement of existing regulations can be addressed through additional personnel or a change in procedure or policy.

Based upon the capability assessment and key issues identified in the risk assessment, the counties came to consensus on proposed mitigation actions for each hazard for their jurisdictions. Certain hazards' impacts were best reduced through multi-hazard actions. A lead for each new action was identified to provide additional details on the project in order to be captured in the plan. Final action strategies are discussed in Section 5.4 and detailed within the respective annexes.

5.3.1 Prioritization Process

Once the mitigation actions were identified, the county planning teams discussed FEMA's recommended prioritization criteria, STAPLEE, to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. STAPLEE is an acronym for the following:

- Social: Does the measure treat people fairly? (e.g., different groups, different generations)
- Technical: Is the action technically feasible? Does it solve the problem?
- Administrative: Are there adequate staffing, funding, and other capabilities to implement the project?
- Political: Who are the stakeholders? Will there be adequate political and public support for the project?
- Legal: Does the jurisdiction have the legal authority to implement the action? Is it legal?
- Economic: Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- Environmental: Does the action comply with environmental regulations? Will there be negative environmental consequences from the action?

Other criteria used to assist in evaluating the priority of a mitigation action included:

- Does the action address hazards or areas with the highest risk?
- Does the action protect lives?
- Does the action protect infrastructure, community assets or critical facilities?
- Does the action meet multiple objectives?

During the planning workshops, the counties used the above criteria to determine which of the new identified actions were most likely to be implemented and effective. The results of the evaluation process produced prioritized mitigation actions for implementation within the planning area, or evaluated existing actions already laid out in county hazard mitigation plans.

Each mitigation action developed for this plan contains a brief description of the proposed project and it's benefits, the entity with primary responsibility for implementation, a cost estimate, a priority level and a schedule for implementation. Development of these project details further informed the determination of a high, medium, or low priority for each. During the plan update some of the mitigation actions were identified to be carried forward from the Converse, Natrona, and Niobrara Counties' existing hazard mitigation plans. More information on the priority levels on these actions were revisited and, in some cases, modified to reflect current priorities based on the STAPLEE principles.

5.4 Mitigation Action Plan

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

This section outlines the development of the mitigation action plan. The action plan consists of the specific projects, or actions designed to meet the identified goals within the plan. Over time the implementation of these projects will be tracked as a measure of demonstrated progress on meeting the plan's goals.

5.4.1 Progress on Previous Mitigation Actions

The mitigation actions in Converse, Natrona, and Niobrara Counties' previous hazard mitigation plans provided the basis for the updates of mitigation action strategies. As part of the update process these three counties reviewed the previously identified actions to assess progress on implementation. These reviews were completed through a discussion during the planning workshop to capture information on each action, including if the action was completed or to be deferred to future planning efforts. Actions that were not completed were discussed for continued relevance and were either continued in the plan or in some cases recommended for deletion.

The counties and participating jurisdictions have been successful in implementing actions identified in their respective plans' Mitigation Strategy, thus, working steadily towards meeting each plan's goals. Progress on mitigation actions previously identified in these planning mechanisms are detailed in the mitigation action strategy in the county annexes. These action plans were also shared amongst the regional plan participants to showcase progress and stimulate ideas amongst the respective county planning committees. Reasons that some actions have not been completed include low priority, lack of funding, or lack of administrative resources. Refer to the county annexes for more details on the progress of implementation.

5.4.2 New Mitigation Actions

One of the takeaways from the public survey was that the public is interested in being provided information on hazards that pose a risk to where they live. In response to this, each county revisited their action strategy to ensure this concern was adequately addressed in existing actions, adding a new mitigation measure when needed. Mitigation actions for each county can be found in their respective annexes.

5.4.3 Continued Compliance with NFIP

Given the significance of the flood hazard in the planning area and as required by the DMA, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP). Counties and jurisdictions that participate in the NFIP will continue to make every effort to remain in good standing with the program. The table below summarizes the NFIP mapping and participation status for applicable jurisdictions in the Region.

Table 5.1 NFIP Participation Status Summary

Jurisdiction	Effective Map Status	Date Joined	Comments
Converse County			
City of Douglas	10/17/78	10/17/78	Participating
Town of Glenrock	11/15/85	11/15/85	Participating
Town of Lost Springs	n/a	n/a	Not participating - never mapped
Town of Rolling Hills	8/08/08		Not participating
Converse County	4/5/88	4/5/88	Participating
Natrona County			
City of Casper	09/15/77	09/15/77	Participating
Town of Bar Nunn	n/a	n/a	Not participating – never mapped
City of Edgerton	n/a	n/a	Not participating – never mapped
Town of Evansville	07/17/78	07/17/78	Participating
Town of Midwest	n/a	n/a	Not participating – never mapped
Town of Mills	12/01/86	12/01/86	Participating
Natrona County	08/15/78	08/15/78	Participating
Niobrara County			
Town of Manville	n/a	n/a	Not participating – never mapped
Town of Lusk	03/18/86	03/18/86	Participating
Town of Van Tassell	n/a	n/a	Not participating – never mapped
Niobrara County	n/a	n/a	Not participating – never mapped

Unincorporated Niobrara County is not mapped and does not participate in the NFIP, resulting in residents unable to purchase flood insurance. In June 2015, the county was impacted by a flood event that according to the HMPC cost the county $3 million. As a result of this regional planning process, the county determined to keep the existing mitigation action of encouraging property owners to purchase flood insurance.

Continued compliance with the NFIP includes continuing to adopt floodplain maps when updated and implementing, maintaining and updating floodplain ordinances. Actions related to continued compliance include:

- Continued designation of a local floodplain manager whose responsibilities include reviewing floodplain development permits to ensure compliance with the local floodplain management ordinances and rules;
- Suggest changes to improve enforcement of and compliance with regulations and programs;
- Participate in Flood Insurance Rate Map updates by adopting new maps or amendments to maps;
- Utilize Digital Flood Insurance Rate maps in conjunction with GIS to improve floodplain management, such as improved risk assessment and tracking of floodplain permits;
- Promote and disperse information on the benefits of flood insurance.

Also to be considered are flood mitigation actions contained in this Regional Plan that support the ongoing efforts by participating counties to minimize the risk and vulnerability of the community to the flood hazard and to enhance their overall floodplain management program.

5.4.4 Mitigation Action Plan

The action plan presents the recommendations developed by the county planning teams, outlining how each county and the Region can reduce the risk and vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses. The mitigation actions developed by the counties are detailed in the county annexes. These details include the action description, hazard(s) mitigated, lead and partner agencies responsible for initiating implementation, costs, and timeline. Many of the action items included in this plan are a collaborative effort among local, state and federal agencies and stakeholders in the planning area.

Further, it should be clarified that the actions included in this mitigation strategy are subject to further review and refinement; alternatives analyses; and reprioritization due to funding availability and/or other criteria. The counties are not obligated by this document to implement any or all of these projects. Rather, this mitigation strategy represents the desires of the community to mitigate the risks and vulnerabilities from identified hazards. The counties also realize that new needs and priorities may arise as a result of a disaster or other circumstances and reserve the right to support new actions, as necessary, as long as they conform to their overall goals as listed in this plan.

Where feasible, it is recommended that mitigation be integrated and implemented through existing planning mechanisms. Specific related mechanisms are noted in the county annexes. Chapter 6 also discusses incorporating the plan into existing planning mechanisms, and how each county will address continued public involvement.

CHAPTER 6 PLAN ADOPTION, IMPLEMENTATION AND MAINTENANCE

Requirement §201.6(c)(4): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally approved by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, county commissioner, Tribal Council).

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. This chapter provides an overview of the overall strategy for plan implementation and maintenance and outlines the method and schedule for monitoring, updating, and evaluating the regional plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

6.1 Formal Adoption

The purpose of formally adopting this plan is to secure buy-in from participating jurisdictions, raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes Planning Step 9 of the 10-step planning process: Adopt the Plan. The governing board for each participating jurisdiction has adopted this local hazard mitigation plan by passing a resolution. A copy of the generic resolution and the executed copies are included in Appendix B, Plan Adoption. This plan will be updated and re-adopted every five years in concurrence with the required DMA local and tribal plan update requirements.

6.2 Implementation

Once adopted, the plan faces the truest test of its worth: continued implementation. While this plan contains many worthwhile actions, each county and jurisdiction will need to decide which action(s) to undertake or continue. Two factors will help with making that decision: the priority assigned the actions in the planning process and funding availability. Low or no-cost actions most easily demonstrate progress toward successful plan implementation.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. Implementation will be accomplished by adhering to the schedules identified for each action and through constant, pervasive, and energetic efforts to network and highlight the benefits to the counties, communities and stakeholders. This effort is achieved through the routine actions of monitoring meeting agendas for hazard mitigation related initiatives, coordinating on the topic at meetings, and promoting a safe, sustainable community. Additional mitigation strategies could include consistent and ongoing enforcement of existing policies and vigilant review of programs for coordination and multi-objective opportunities.

Simultaneous to these efforts, it is important to maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the more costly recommended actions. This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements. When funding does become available, the Region and its counties will be in a position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, state and federal earmarked funds, benefit assessments, and other grant programs, including those that can serve or support multi-objective applications.

6.2.1 Role of Hazard Mitigation Planning Committee in Implementation and Maintenance

With adoption of this plan, the Region, its counties, and its municipalities will be responsible for the plan implementation and maintenance. Each county, led by their Emergency Management Coordinators, will reconvene their HMPC for plan implementation and maintenance. This HMPC will be the same committee (in form and function, if not actual individuals) that developed this HMP and will also be responsible for the next formal update to the plan in five years.

The county-level HMPCs will:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high-priority, low/no-cost recommended actions;
- Ensure hazard mitigation remains a consideration for community decision makers;
- Maintain a vigilant monitoring of multi-objective cost-share opportunities to help the community implement the plan’s recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Report on plan progress and recommended changes to county and municipal officials; and
- Inform and solicit input from the public.

Each HMPC will not have any powers over respective county staff; it will be purely an advisory body. The primary duty is to see the plan successfully carried out and to report to the county commissioners, municipal boards, and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on county websites (and others as appropriate).

6.3 Plan Maintenance

Plan maintenance implies an ongoing effort to monitor and evaluate plan implementation and to update the plan as progress, roadblocks, or changing circumstances are recognized. The regulation at 44 CFR§201.6(d)(3) requires that a local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five years in order to continue to be eligible for mitigation project grant funding.

6.3.1 Maintenance Schedule

The Emergency Management Coordinators are responsible for initiating plan reviews and consulting with the heads of participating departments in their own counties. In order to monitor progress and update the mitigation strategies identified in the action plan, each county and their standing HMPC will conduct an annual review of this plan and/or following a hazard event. An annual mitigation action progress report will be prepared by the Emergency Management Coordinators based on the HMPC input and kept on file to assist with for future updates. The annual review will be conducted by re-convening each HMPC in November of each year.

This plan will be updated, approved and adopted within a five-year cycle as per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000 unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule. The Region and its counties will inquire with WOHS and FEMA for funds to assist with the update. It is recommended to begin seeking funds in 2020 as most applicable grants have multiple years to expend the funds. Funding sources may include the Emergency Management Performance Grants, Pre-Disaster Mitigation, Hazard Mitigation Grant Program (if a presidential disaster has been declared), and Flood Mitigation Assistance grant funds. The next plan update should be completed and reapproved by WOHS and FEMA Region VIII within five years of the FEMA final approval date. The planning process to prepare the update should begin no later than 12 months prior to that date.

6.3.2 Maintenance Evaluation Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions;
- Increased vulnerability as a result of new or altered hazards
- Increased vulnerability as a result of new development.

Updates to this plan will:

- Consider changes in vulnerability due to action implementation;
- Document success stories where mitigation efforts have proven effective;

- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Incorporate new data or studies on hazards and risks;
- Incorporate new capabilities or changes in capabilities;
- Incorporate growth and development-related changes to infrastructure inventories; and
- Incorporate new action recommendations or changes in action prioritization.

To best evaluate any changes in vulnerability as a result of plan implementation, each county and municipality will adhere to the following process:

- A representative from the responsible office identified in each mitigation measure will be responsible for tracking and reporting on an annual basis to the department lead on action status and provide input on whether the action, as implemented, meets the defined objectives and is likely to be successful in reducing vulnerabilities.
- If the action does not meet identified objectives, the lead will determine what additional measures may be implemented, and an assigned individual will be responsible for defining action scope, implementing the action, monitoring success of the action, and making any required modifications to the plan.

Changes will be made to the plan to accommodate for actions that were not successful or were not considered feasible after a review of their consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring and update of this plan to determine feasibility of future implementation. Updating of the plan will be by written changes and submissions, as each HMPC deems appropriate and necessary, and as approved by the respective participating agencies. In keeping with the five-year update process, the HMPC will convene public meetings to solicit public input on the plan and its routine maintenance and the final product will be adopted by the governing council of each participating jurisdiction.

6.3.3 Incorporation into Existing Planning Mechanisms

Another important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into other county plans and mechanisms. Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. As described in each county annex capability assessment, the counties already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. Where applicable, these existing mechanisms could include:

- County or community comprehensive plans

- County or community land development codes
- County or community emergency operations plans
- Threat and Hazard Identification and Risk Assessments (THIRA)
- Community Wildfire Protection Plans (CWPP)
- Transportation plans
- Capital improvement plans and budgets
- Recovery planning efforts
- Watershed planning efforts
- Wildfire planning efforts on adjacent public lands
- Master planning efforts
- River corridor planning efforts
- Other plans, regulations, and practices with a mitigation aspect

The county annexes note, where applicable, how the previous versions of the hazard mitigation plan have been incorporated into existing planning mechanisms in the past five years. Each annex notes specific opportunities to integrate the mitigation plan into other mechanisms in the future.

HMPC members involved in these other planning mechanisms will be responsible for integrating the findings and recommendations of this plan with these other plans, programs, etc., as appropriate. As described in Section 6.2 Implementation, incorporation into existing planning mechanisms will be done through the process of:

- Monitoring other planning/program agendas;
- Attending other planning/program meetings;
- Participating in other planning processes;
- Ensuring that the related planning process cross-references the hazard mitigation plan, where appropriate, and
- Monitoring community budget meetings for other community or tribal program opportunities.

The successful implementation of this mitigation strategy will require constant and vigilant review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community.

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

6.3.4 Continued Public Involvement

Continued public involvement is imperative to the overall success of the plan's implementation. The update process provides an opportunity to solicit participation from new and existing stakeholders and to publicize success stories from the plan implementation and seek additional public comment. The plan maintenance and update process will include continued public and stakeholder involvement and input through attendance at designated committee meetings, web postings, press releases to local media, and through public hearings.

When each HMPC reconvenes for the update, they will coordinate with all stakeholders participating in the planning process – including those that joined the committee since the planning process began – to update and revise the plan. Public notice will be posted and public participation will be invited, at a minimum, through available website postings and press releases to the local media outlets, primarily newspapers, or through public surveys. As part of this effort, at least one public meeting will be held, or alternately a public survey, and public comments will be solicited on the plan update draft.

WYOMING REGION 2
REGIONAL HAZARD MITIGATION PLAN
CONVERSE COUNTY PLANNING ANNEX

Converse County, Wyoming
Hazard Mitigation Plan
2018 Update




CONVERSE County WY

wood.

Converse County
Hazard Mitigation Plan
2018 Update

Developed by Converse County

with professional planning assistance from

Wood Environment & Infrastructure Solutions, Inc.
Hazard Mitigation and Emergency Management

TABLE OF CONTENTS

Chapters

Appendixes

1 INTRODUCTION

1.1 Purpose

Converse County including the municipalities of Douglas, Glenrock, Lost Springs, and Rolling Hills prepared this multi-jurisdictional hazard mitigation plan update to guide hazard mitigation planning and to better protect the people and property of the planning area from the effects of hazard events. This plan demonstrates the County's commitment to reducing risks from hazards, and serves as a tool to help decision makers direct mitigation activities and resources. This plan also maintains the planning area's eligibility for certain federal disaster assistance under the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance (HMA) grant programs.

1.2 Background and Scope

This plan builds upon years of mitigation planning and project implementation by Converse County and its communities. This Hazard Mitigation Plan underwent a comprehensive update in 2018 and replaces the 2011 Converse County Hazard Mitigation Plan.

Each year in the United States, disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters, because additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally-mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of $4 in avoided future losses in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council 2005).

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals and objectives are set, and appropriate actions to lessen impacts are identified, prioritized, and implemented. This plan documents the planning region's hazard mitigation planning process, identifies relevant hazards and risks, and identifies the strategy that each participating County and jurisdiction will use to decrease vulnerability and increase resiliency and sustainability.

This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the *Federal Register* on February 26, 2002 (44 CFR §201.6) and finalized on October 31, 2007 (hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act (DMA). While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). Because the planning area is subject to many kinds of hazards, access to these programs is vital.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to the community and its property owners by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruption. The planning area has been affected by hazards in the past and is thus committed to reducing future disaster impacts and maintaining eligibility for federal funding.

1.3 Plan Organization

The Converse County Hazard Mitigation Plan is organized in alignment with the DMA planning requirements and the FEMA plan review crosswalk as follows:

- Chapter 1: Introduction
- Chapter 2: Community Profile
- Chapter 3: Planning Process
- Chapter 4: Risk Assessment
- Chapter 5: Mitigation Strategy
- Chapter 6: Plan Adoption, Implementation, and Maintenance
- Appendices

2 Community Profile

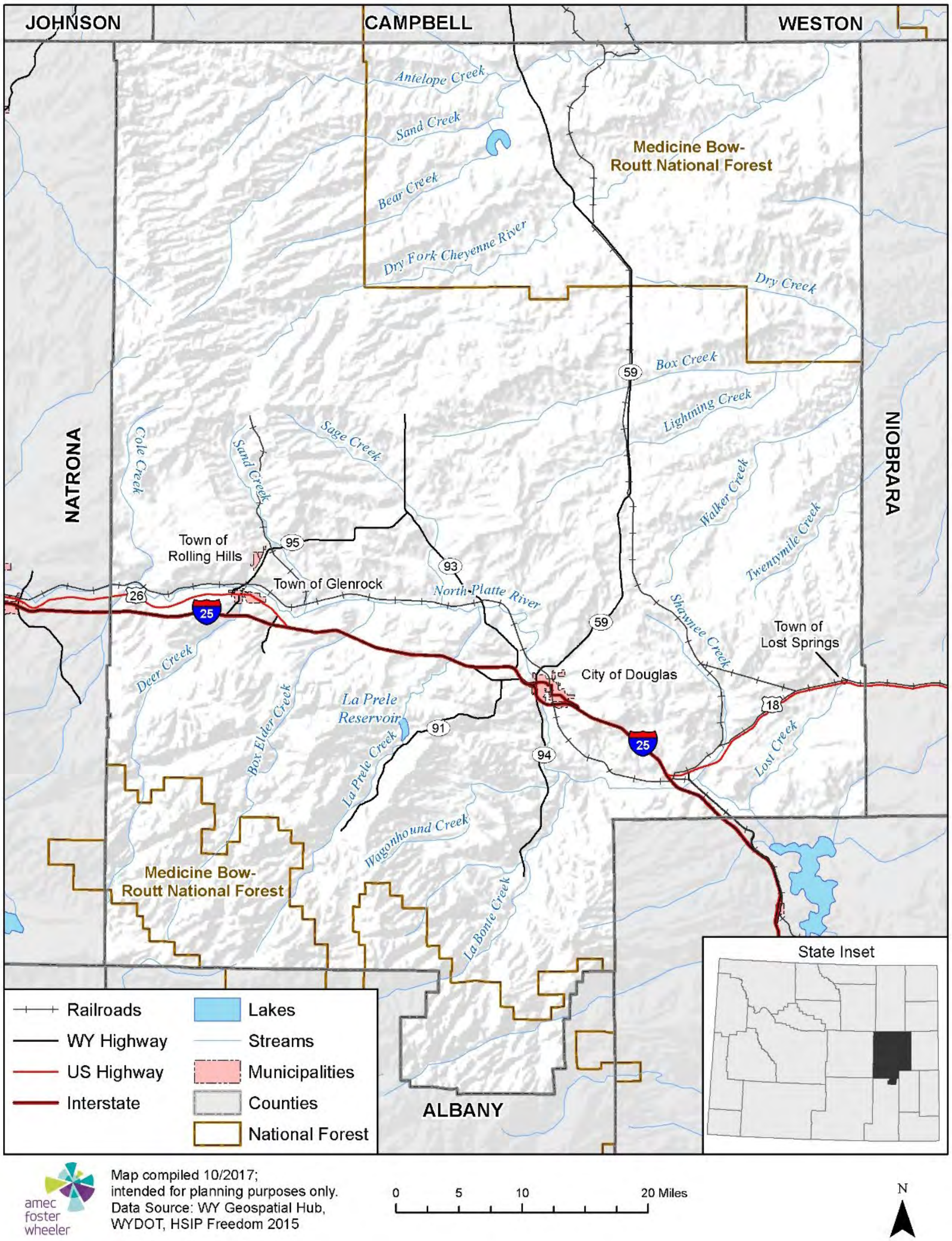
2.1 Geography and Climate

The two dominant natural features in Converse County are the Laramie Mountain Range and North Platte River. The Laramie Mountains cut across the southwest corner of the county. The North Platte flows across the county from northwest to southeast and through the center of Douglas, the county seat.

Elevations across Converse County range from just over 4,400 feet above sea level in the northeastern corner of the county to 9,165 feet at Twin Peaks in the southwestern, forested area of the county. Lands drain into both the Cheyenne and North Platte Rivers. The surface is characterized by rolling hills, canyons, and breaks in the north half of the county, and steeper, timbered mountain slopes in the southwest. Precipitation at Douglas is 12.6 inches annually, with most of the precipitation coming between April and September. Underlying the surface are oil and gas producing basins. Air and water quality in the county are generally quite good.

Interstate 25 bisects the county, running east-west to the west of Douglas, then turning north-south at Douglas. U.S. Highways 18 and 20 exit the southeast corner of the county in an easterly direction, serving Lost Springs and Shawnee. State highway 59 runs north-south connecting Douglas to Gillette in neighboring Campbell County. Highway 93/95 forms a loop from I-25 that largely parallels the North Platte and accesses Glenrock, Rolling Hills, and Orpha. The Burlington Northern and Santa Fe Railroad (BNSF) enters the county from the north and runs roughly parallel to State Highway 59. The BNSF carries coal mined in the Powder River Basin to the north, to all parts of the country. These tracks intersect with the east-west Union Pacific Railroad (UPRR) at Douglas. The UPRR closely follows the North Platte west of Douglas and State Highways 18 and 20 east of Douglas. Douglas has a general aviation airport south of town, but does not have commercial air service. Commercial air service is available in Casper, 50 miles west of Douglas.

Figure 2.1: Converse County Base Map



2.2 History

Converse County was established in 1888 from portions of Albany and Laramie Counties. The county is named after Wyoming pioneer, Amasa R. Converse. The county is approximately

170 miles east-west and 92 miles north-south and encompasses 4,253 square miles. Converse County is located in east central Wyoming. Open range is the dominant land use with timbered mountain slopes located along the southwest boundary. Land ownership in the county is private, state, and federal. Neighboring counties include Albany, Campbell, Johnson, Natrona, Niobrara, Platte, and Weston.

2.3 Population

The population for the County in according to the Census in 2010 was 13,833, which is a 13% increase from the 2000 census population of 12,052. The population is 95.1 % white. Population growth in the county has been faster than the state and faster than the nation. The population density based on the 2010 census was 3.2 people per square mile. County residents live in one of the incorporated communities, Douglas, Glenrock, Lost Springs, or Rolling Hills, or one of the unincorporated communities of Bill, Esterbrook, Orpha, Orin, and Shawnee, or in unincorporated areas of the county. The highest concentration of population is in the City of Douglas, population 5,932; Douglas serves as the County seat. The town of Glenrock has a population of 2,576, Rolling Hills, 440, and Lost Springs, 4, according to the U.S. Census Bureau (Source: http://factfinder.census.gov).

Table 2.1: Planning Area Population

	2010 Census	2011 Census Estimate	2012 Census Estimate	2013 Census Estimate	2014 Census Estimate	2015 Census Estimate	2016 Census Estimate	% Change 2010-2016
Converse County	13,833	13,596	13,779	13,934	13,991	14,101	14,223	2.9%
City of Douglas	6,120	6,002	6,117	6,209	6,272	6,371	6,478	5.7%
Town of Glenrock	2,498	2,534	2,548	2,583	2,576	2,593	2,607	4.3%
Town of Lost Springs	4	5	6	6	5	5	4	0%
Town of Rolling Hills	440	496	581	534	522	487	383	-12.9%

Source: U.S. Census Bureau

2.4 Economy

In 2005, retail trade represented the largest number of firms in the county's economic profile. This was followed by construction; other services; mining; accommodation and food services; health care and social assistance; and professional, scientific and technical services. Mining, utilities, construction, and healthcare represented the largest employers with each of these industries having at least one firm that employed 100 or more individuals. Mining is the only industry in the county that has a firm employing 250 or more people. The government share of total employment (local, state, and federal) in 2006 was 18%. Job growth over the past 36 years has outpaced both state and national rates. (Source: Socioeconomic Profile of Converse County, Headwaters Economics, February 2009)

The median family income for 2010 as estimated by Housing and Urban Development was $66,400, slightly higher than the statewide figure of $66,100. The unemployment rate in the county was 5.8% in 2009. The total number of housing units in the county increased from 5,669 to 6,134 for the period 2000 to 2010. (Source: Wyoming Housing Database Partnership, Final Report, August 31, 2010) The home ownership rate across the County in 2009 was 74%. (Source: http://quickfacts.census.gov)

2.5 Mitigation Capabilities

The Wyoming State Multi-Hazard Mitigation Plan summarizes existing mitigation capabilities of each county and some of their incorporated cities. The information was derived from county websites and through completed worksheets from the County Coordinators. The table below presents a summary of Converse County's mitigation capabilities that are highlighted in the 2016 Wyoming State Mitigation Plan and in some cases updated with 2017 information. Opportunities to expand on these capabilities were discuss during the 2017-2018 update process as part of the updated mitigation strategy in Chapter 5 and implementation and incorporation through related planning efforts in Chapter 6.

Table 2.2: Summary of Mitigation Capabilities

Building Codes	Comprehensive Planning	Floodplain Management	GIS & Planning	Land Use Regulations	Other
County does not have building codes City of Douglas and Town of Glenrock have building codes	2015 Converse County Land Use Plan includes the incorporated cities and towns. Includes a lot of references to preserving natural areas, wetlands etc.	RiskMAP FIRM: 11/4/09 2009 Flood Damage Ordinance	Planning and Zoning Commission	2015 Subdivision Regulations requires storm sewer improvements	Natural Resource Planning board; manages multiple uses of federal and state land Converse Area New Development Organization = Economic Development

Source: Wyoming Multi-Hazard Mitigation Plan 2016

As part of the mitigation planning process, communities were asked to provide data on their capabilities related to hazard mitigation and emergency management. Those results are included in the table below. It should be noted that Lost Springs has a population of 4, without much in the way of official community capability.

Table 2.3: Capability Assessment

	Converse County	Douglas	Glenrock	Rolling Hills	Lost Springs
Planning Capabilities	**Yes/No**				
Comprehensive Plan	No	Yes		7/14/2009	

	Converse County	Douglas	Glenrock	Rolling Hills	Lost Springs
Capital Improvement Plan	No	7/2018		No	N/A
Local Emergency Plan	N/A	No	No	No	No
County Emergency Plan	9/1/2015	N/A	N/A	N/A	N/A
Local Recovery Plan	No	No		No	No
County Recovery Plan	No	N/A	N/A	N/A	N/A
Local Mitigation Plan	N/A	No	No	No	No
County Mitigation Plan	2011	Yes	Yes	Yes	Yes
Local Mitigation Plan (PDM)	No	No	No	No	No
County Mitigation Plan (PDM)	No	No	No	No	No
Debris Management Plan	No	No	No	No	No
Economic Development Plan	No	6/2014		No	No
Transportation Plan	No	6/2014		No	No
Land-use Plan	2015	6/2014		No	No
Flood Mitigation Assistance (FMA) Plan	2009	Yes		No	No
Watershed Plan	No	6/2004		No	No
Firewise or other fire mitigation plan	2005			No	No
Critical Facilities Plan (Mitigation/Response/Recovery)	No	No		No	No
Policies/Ordinance					
Zoning Ordinance	No	Yes		Yes	
Building Code	No	Yes		No	
Floodplain Ordinance	2009	Yes	Yes	No	
Subdivision Ordinance	2015	Yes		No	
Tree Trimming Ordinance	N/A	Yes		No	No
Nuisance Ordinance	N/A	Yes		Yes	
Storm Water Ordinance	N/A	Yes		No	
Drainage Ordinance	N/A	Yes		No	
Site Plan Review Requirements	No	Yes		No	No
Historic Preservation Ordinance	No	Yes		Yes	No
Landscape Ordinance	No	Yes		No	No
Program					
Zoning/Land Use Restrictions	Yes	Yes	Yes	Yes	Yes
Codes Building Site/Design	No	Yes		No	
National Flood Insurance Program (NFIP)	Yes	Yes	Yes	No	No
NFIP Community Rating System (CRS) Participating Community	No	Yes Class 8	No	No	No
Hazard Awareness Program	No	No	No	No	
National Weather Service (NWS) Storm Ready	No	No	No	No	No
ISO Fire Rating	No	Yes – 5		No	
Economic Development Program	No	Yes	Yes	No	
Land Use Program	No	Yes	Yes	No	
Public Education/Awareness	No	Yes	Yes	No	
Property Acquisition	No	Yes	Yes	No	
Planning/Zoning Boards	Yes	Yes	Yes	Yes	
Stream Maintenance Program	No	Yes		No	
Tree Trimming Program	No	Yes		No	
Engineering Studies for Streams (Local/County/Regional)	No	No		No	
Mutual Aid Agreements	Yes	Yes		No	
Studies/Reports/Maps					
Hazard Analysis/Risk Assessment (Local)	N/A	Yes	No	Yes	No

	Converse County	Douglas	Glenrock	Rolling Hills	Lost Springs
Hazard Analysis/Risk Assessment (County)	Yes	Yes	Yes	Yes	Yes
Flood Insurance Maps	Yes	Yes			No
FEMA Flood Insurance Study (Detailed)	Yes	Yes	Yes		No
Evacuation Route Map	No	Yes		No	No
Critical Facilities Inventory	No	No		Yes	No
Vulnerable Population Inventory	No	Yes		No	No
Land Use Map	Yes	Yes	Yes	No	No
Staff/Department					
Building Code Official	Yes	Yes	Yes	Yes	
Building Inspector	No	Yes	Yes	No	
Mapping Specialist (GIS)	Yes	Yes		No	
Engineer	No	Yes		Yes	
Development Planner	No	Yes	Yes	No	
Public Works Official	Yes	Yes	Yes	Yes	
Emergency Management Coordinator	Yes	Yes	Yes	Yes	Yes
NFIP Floodplain Administrator	Yes	Yes	Yes	N/A	N/A
Bomb and/or Arson Squad	No	No	No	No	No
Emergency Response Team	Yes	Yes	Yes	Yes	Yes
Hazardous Materials Expert	No	No	No	No	No
Local Emergency Planning Committee	Yes	Yes	Yes	Yes	Yes
Sanitation Department	No	Yes	Yes	No	
Transportation Department	Yes	Yes		No	
Economic Development Department	No	No	Yes	No	
Housing Department	No	Yes		No	
Historic Preservation	No	Yes		Yes	
American Red Cross	Yes	No	No	No	
Salvation Army	No	No	No	No	
Environmental Organization	Yes	Yes		No	
Homeowner Associations	Yes	No		No	
Neighborhood Associations	No	No		No	
Chamber of Commerce	N/A	Yes	Yes	Yes	
Community Organizations (Lions, Kiwanis, etc.	Yes	Yes	Yes	No	
Financial Resources					
Apply for Community Development Block Grants	Yes	Yes		No	
Fund projects through Capital Improvements funding	Yes	Yes		Yes	
Authority to levy taxes for specific purposes	Yes	Yes		Yes	
Fees for water, sewer, gas, or electric services	No	Yes		Yes	
Impact fees for new development	No	Yes		Yes	
Incur debt through general obligation bonds	Yes	Yes			
Incur debt through special tax bonds	Yes	Yes			
Incur debt through private activities	No	No			
Withhold spending in hazard prone areas	Yes	Yes		Yes	

3 PLANNING PROCESS

Requirements §201.6(b) and §201.6(c)(1): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

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

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.]

3.1 Background on Mitigation Planning in Converse County

This Multi-Hazard Mitigation Plan is an update of the 2011 Plan for Converse County. The County, with Converse County Emergency Management as the lead agency, recognized the need and importance of this plan and was responsible for initiating its development. The County contracted with Wood (formerly Wood) in 2017 to facilitate and develop the plan.

The Emergency Management Coordinator led Hazard Mitigation Planning Committees (HMPCs) working in concert with the hazard mitigation planning consultant. As the planning consultant, Wood's role was to:

- Provide guidance on a planning organization for the entire planning area representative of the participants;
- Meet all of the DMA requirements as established by federal regulations, following FEMA's most recent planning guidance;
- Facilitate the entire planning process;
- Identify the data requirements that the participating counties and municipalities could provide, and conduct the research and documentation necessary to augment that data;
- Develop and help facilitate the public input process;
- Produce the draft and final plan documents; and
- Ensure acceptance of the final Plan by WOHS and FEMA Region VIII

The remainder of this chapter provides a narrative description of the steps taken to prepare the hazard mitigation plan (HMP).

3.2 Local Government Participation

The Disaster Mitigation Act (DMA) planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the Hazard Mitigation Planning Committee (HMPC),
- Detail areas within the planning area where the risk differs from that facing the entire area,
- Identify specific projects to be eligible for funding, and
- Have the governing board formally adopt the plan.

For the Converse County Multi-Hazard Mitigation Plan's HMPC, "participation" meant:

- Attending and participating in HMPC meetings;
- Providing available data requested by the HMPC coordinator/Wood;
- Providing/updating the hazard profile and vulnerability details specific to jurisdictions;
- Developing/updating the local mitigation strategy (action items and progress);
- Advertising and assisting with the public input process;
- Reviewing and commenting on plan drafts; and
- Coordinating the formal adoption of the plan by the governing boards.

In the interest of completing a robust process that would ultimately result in FEMA approval the County and participating municipalities met all of these participation requirements. In most cases one or more representatives for each agency attended the HMPC meetings and also brought together department staff to help collect data, identify mitigation actions and implementation strategies, and review and provide data on plan drafts. Appendix B provides additional information and documentation of the planning process.

3.3 The 10-Step Planning Process

Wood established the planning process for the Converse County Hazard Mitigation Plan using the DMA planning requirements and FEMA's associated guidance. This guidance is structured around a four-phase process:

1) Organize Resources
2) Assess Risks
3) Develop the Mitigation Plan
4) Implement the Plan and Monitor Progress

Into this four-phase process, Wood integrated a more detailed 10-step planning process used for FEMA's Community Rating System (CRS) and Flood Mitigation Assistance (FMA) programs. Thus, the modified 10-step process used for this plan meets the requirements of six major programs: FEMA's Hazard Mitigation Grant Program, Pre-Disaster Mitigation program, Community Rating System (CRS), Flood Mitigation Assistance Program, Severe Repetitive Loss program, and new flood control projects authorized by the U.S. Army Corps of Engineers. FEMA's March 2013 *Local Mitigation Planning Handbook* recommends a nine step process within the four phase process. **Table 3.1** summarizes the four-phase DMA process, the detailed CRS planning steps and work plan used to develop the plan, the nine handbook planning tasks from FEMA's 2013 *Local Mitigation Planning Handbook*, and where the results are captured in the Plan. The sections that follow describe each planning step in more detail.

Table 3.1. Mitigation Planning Process

FEMA 4 Phase Guidance	Community Rating System (CRS) Planning Steps (Activity 510) and Wood Work Plan Tasks	FEMA Local Mitigation Planning Handbook Tasks (44 CFR Part 201)	Location in Plan
Phase I: Organize Resources	Task 1. Organize Resources	1: Determine the Planning Area and Resources	Chapters 1, 2 and 3
		2: Build the Planning Team 44 CFR 201.6(c)(1)	Chapter 3, Section 3.3.1
	Task 2. Involve the public	3: Create an Outreach Strategy y 44 CFR 201.6(b)(1)	Chapter 3, Section 3.3.1
	Task 3. Coordinate with Other Agencies	4: Review Community Capabilities 44 CFR 201.6(b)(2) & (3)	Chapter 3, Section 3.3.1 and Chapter 4, Section 4.4
Phase II: Assess Risks	Task 4. Assess the hazard	5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) & (iii)	Chapter 4, Sections 4.1-4.3
	Task 5. Assess the problem		Chapter 4, Sections 4.1-4.3
Phase III: Develop the Mitigation Strategy	Task 6. Set goals	6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii)	Chapter 5, Section 5.2
	Task 7. Review possible activities		Chapter 5, Section 5.3
	Task 8. Draft an action plan		Chapter 5, Section 5.4
Phase IV: Adopt and Implement the Plan	Task 9. Adopt the plan	8: Review and Adopt the Plan	Chapter 6, Appendix C
	Task 10. Implement, evaluate, revise	7: Keep the Plan Current	Chapter 7
		9: Create a Safe and Resilient Community 44 CFR 201.6(c)(4)	Chapter 7

3.3.1 Phase 1: Organize Resources

Planning Task 1: Organize the Planning Effort

With the County's commitment to update the Plan, Wood worked with County Emergency Management to establish the framework and organization for the process. Organizational efforts were initiated with each jurisdiction to inform and educate the plan participants of the purpose and need for the update and continued participation. During the update of this plan, the planning process was directed through a Hazard Mitigation Planning Committee comprised of Converse County and participating jurisdictions. The planning consultant held an initial conference call to discuss the organizational aspects of the planning process with the county Emergency Management Coordinator. Using FEMA planning guidance, representatives for the county's HMPC base membership was established, with additional invitations extended as appropriate to other federal, state, tribal, and local stakeholders and the public throughout the planning process.

Wood and the County's Emergency Management Coordinator identified key county, municipal, and other local government and initial stakeholder representatives. An email was sent to invite them to participate as members of the HMPC and to attend a series of planning workshops. Representatives from the following County and municipal departments participated on the county or jurisdictional-level HMPC during the development of the 2018 plan update.

Table 3.2. HMPC Members by Jurisdiction

Jurisdictions	Position	Department
Converse County	Coordinator; Admin Assistant	Emergency Management
	Secretary	Rural Fire Department
	Sheriff; Undersheriff; Deputy	Sheriff's Office
	Coordinator	Converse County Firewise
	Public Health Response	Converse County Public Health
	PSC Manager	Joint Communications
City of Douglas	Chief; Assistant Chief; Prevention Coordinator	Fire Department
	Lieutenant	Police Department
	Supervisor	City Supervisor
	Director	Community Development
Town of Glenrock	President; Captain	Fire Department
	Director	Community Development
	Administrator	Glenrock Health Center
Town of Lost Springs	Mayor	City of Lost Springs
Town of Rolling Hills	Councilperson	Town Council
	Chief Water Operator	Water Department
Stakeholders	**Position**	**Department**
		WY Public Health Department
	State Hazard Mitigation Officer	WYOHS
	AMS; District Maintenance Engineer	WYDOT
	Disaster Program Manager	Red Cross of Casper
	Director; Ops Chief	RERT II
	Secretary	La Prele Irrigation
	Compliance	Sinclair Transportation Co.

	Supervisor	Tallgrass Energy
	Disaster POC	Natrona-Converse-Niobrara VW Extension
	Maintenance Director; Buildings and Grounds	CCSD 1 & 2
	Paramedic	Memorial Hospital of Converse County
	Communications Manager	Converse County Joint Comms Center
	Administrator; Safety Director	Mountain Lodge Douglas Care Center

When sending invitations to participate in the hazard mitigation planning process, jurisdictions were requested to send at least one participant, and then go back to their communities and work with other jurisdictional agencies as appropriate to participate in plan development. A list of all persons and agencies invited as part of the LEPC is included in the appendices. The planning process officially began with a kick-off meeting/webinar held on September 14, 2017 in combination with a meeting of the Converse County Local Emergency Planning Commission (LEPC). The meeting covered the scope of work, project schedule and an introduction to the DMA planning requirements. The meeting was also an opportunity to revisit the list of hazards analyzed in the plan. A summary of this meeting is included in Appendix A.

During the planning process, the HMPC communicated through face-to-face meetings, email, and telephone conversations. Draft documents were also shared by email. The complete draft was posted on the County website so that the HMPC members and the public could easily access and review them.

The HMPC held three primary planning meetings during the planning period (September 2017-January 2018). The first meeting focused on kicking off the process and was held remotely over Skype. The second meeting focused on discussing the draft hazard analysis and risk assessment, adding local perspective to the draft document. The third meeting focused on developing mitigation strategies. Agendas for each of the meetings are included in Appendix A.

Planning Task 2: Involve the Public

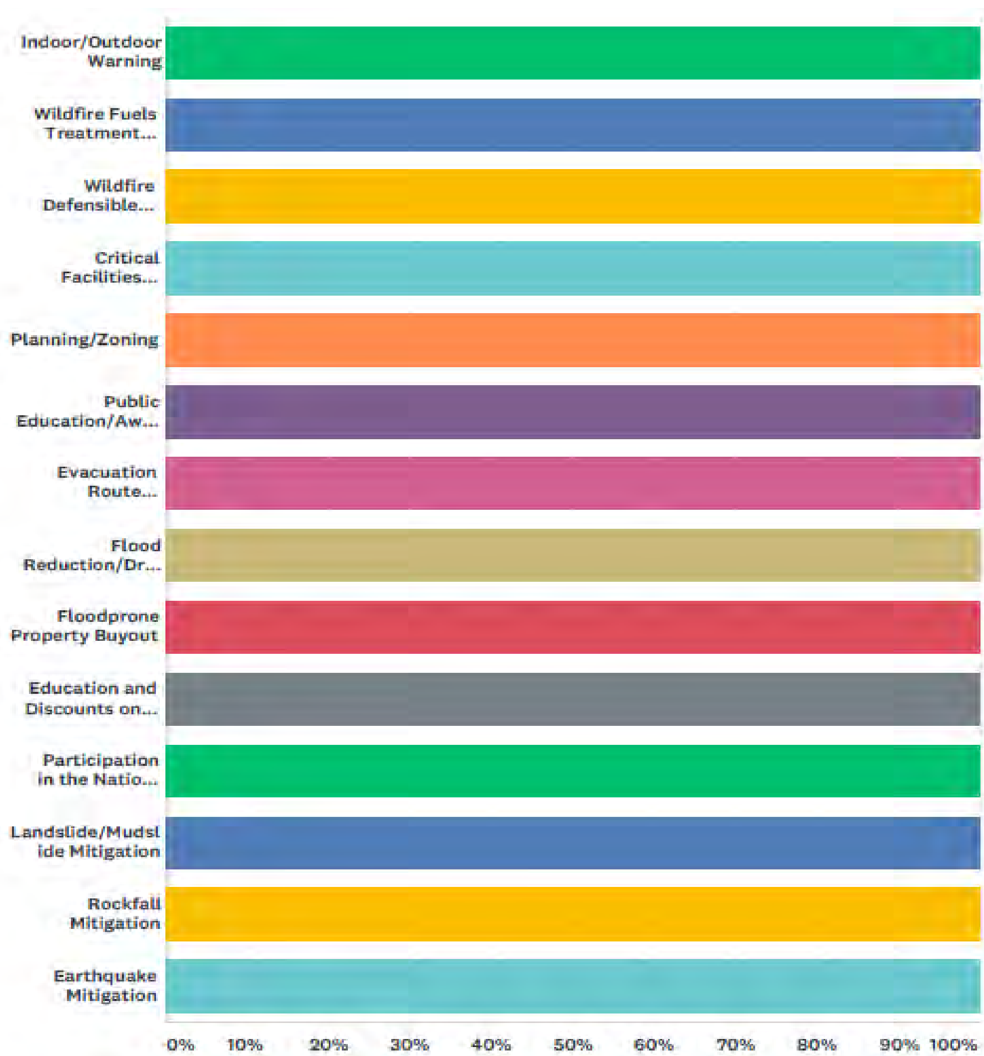
The 2017-2018 planning process was an open one, with the public informed and involved early in the process. Mitigation planning was primarily accomplished at HMPC meetings, which in some cases such as the kickoff meeting included members of the public and local business and industry. Additional public involvement was accomplished through a public survey.

Public Survey

During the planning process and drafting stage, a public survey was developed as a tool to gather public input. The survey was for the public to provide feedback to the county planning teams on topics related to hazard concerns and reducing hazard impacts. The survey provided an opportunity for public input during the planning process, prior to finalization of the plan update. The survey gathered public feedback on concerns about wildfires, floods, winter storms and other hazards and solicited input on strategies to reduce their impacts. The survey was released as both an online tool and a hardcopy form in September 2017 and closed in February 2018. The County provided links to the public survey by distributing it using social media, email, and posting the link on websites. 172 responses were received and shared with the county planning committees to inform the process.

The survey included a question on ranking hazard significance. The results generally track with the significance levels noted in Chapter 4 of this plan, with hail, winter storm, wildfire, and wind as being the four most significant. The following graph is a display of the results from Question 5. Question 5 read: *The following types of mitigation actions may be considered in this plan. Please indicate all the types of mitigation actions that you think should have the highest priority in the Multi-Hazard Mitigation Plan. These results will be considered during the planning process.* The results indicate that all categories of actions were equally popular with the public, each category receiving a 100% rating on the Priority scale. Additional results of the survey are included in Appendix A Planning Process Documentation.

Figure 3.1. Mitigation Action Survey - Results from Question 5



Prior to finalizing, a draft of the plan was made available to the public for review and comment. The plan was placed on the county's web page and a press release and social media were used to announce the public comment period. A feedback form was provided to collect specific comments.

Planning Task 3: Coordinate with Other Departments and Agencies

Early in the planning process, the HMPC determined that data collection, mitigation strategy development, and plan approval would be greatly enhanced by inviting state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation activities or their role in land stewardship in the county, representatives from state, federal, and local businesses were invited to participate on the HMPC in 2017 and are noted in **Table 3.2**.

Many of these stakeholders participated in the process by attending HMPC meetings or providing data and information that was used to update hazard profiles in the plan. Stakeholders were also given an opportunity to review and comment on the draft plan.

Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is an important aspect to mitigation planning. Hazard mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability from natural hazards. The County uses a variety of comprehensive planning mechanisms, such as development master plans and ordinances, to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this plan establishes a credible and comprehensive plan that ties into and supports other community programs. The development of this plan incorporated information from the following existing plans, studies, reports, and initiatives identified in the table (below). (Note - the actions in the mitigation action strategy in Chapter 5 identify the related planning mechanism, where applicable, with each detailed action description).

Table 3.3. Key Plans, Studies and Reports

Resource	How Incorporated or Referenced
Converse County Community Wildfire Protection Plan (CWPP)	• Incorporated into Risk and Vulnerability Assessment and Mitigation Strategy
Wyoming State Hazard Mitigation Plan (2016)	• Informed data sources and information gathering and goals update
Converse County Together Now and Tomorrow	• Referenced for development trends
2010 City of Douglas Development Plan	• Referenced for development trends
2010 Wyoming Irrigation Systems Report	• Informed dam failure analysis and risk assessment
Basic Seismological Characterization for Converse County, WY (WSGS)	• Informed earthquake analysis and risk assessment

Resource	How Incorporated or Referenced
Swelling Clays Map of the Conterminous United States (1989)	• Informed earthquake analysis and risk assessment
FEMA Flood Insurance Study (2009)	• Informed flood analysis and risk assessment
Wyoming Vehicle Miles Report (2015)	• Informed hazardous materials analysis and risk assessment
2016 Wildland Fire Management Annual Operating Plan	• Informed wildfire analysis and risk assessment
Mountain Community Wildfire Protection Plan (2005)	• Informed wildfire analysis and risk assessment
Wyoming Wildland Urban Interface Hazard Assessment Methodology	• Informed wildfire analysis and risk assessment
Socioeconomic Profile of Converse County (2009)	• Informed community profile
Wyoming Housing Database Partnership Final Report (2010)	• Informed community profile
	•

Documents were reviewed and cited, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment, and capability assessment.

2011 Mitigation Plan Inclusion in Other Planning Mechanisms

The 2011 Converse County HMP was integrated or cross referenced into some other planning mechanisms in the County. The risk assessment portion of the 2011 plan was integrated into the other planning mechanisms listed in Table 3.4. The Table lists the jurisdiction and what planning mechanism into which the 2011 HMP was integrated. In some cases, communities have deferred this step for future planning mechanisms, as discussed in the Chapter 6 Plan Adoption, Implementation and Maintenance.

Table 3.4. 2011 Hazard Mitigation Plan Inclusion in Other Planning Mechanisms

Jurisdiction	Planning Mechanism
Converse County	Not reported
City of Douglas	• FEMA regulations used in Unified Land Development Code • 2012 Building Code adopted • Mitigation Plan informed Capital Improvement Plan and Infrastructure Plan • Hazard analysis informed 2014 Douglas Master Plan
Town of Glenrock	Plan was not implemented through other mechanisms
Town of Lost Springs	Not reported
Town of Rolling Hills	Not reported

3.3.2 Phase 2: Assess Risks

Planning Tasks 4 and 5: Identify the Hazards and Assess the Risks

Wood led the HMPC in research efforts to identify and document all the hazards that have, or could, impact the planning area. The existing hazard mitigation plan and Wyoming State Hazard Mitigation Plan provided a basis for most of the hazard profiles. Where data permitted, Geographic Information Systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities. Sophisticated analyses for dam failure, flood, landslide and wildfire hazards were performed by Wood that included an analysis of flood risk based on the recent Digital Flood Insurance Rate Maps (DFIRMs).

Also included in the 2018 plan is a capability review and documentation of the planning area's current capabilities to mitigate risk and vulnerability from natural hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the HMPC can assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. The results of this review are captured in Chapter 2. A more detailed description of the risk assessment process and the results are included in Chapter 4.

3.3.3 Phase 3: Develop the Mitigation Plan

Planning Tasks 6 and 7: Set Goals and Review Possible Activities

Wood facilitated discussion sessions with the HMPC that described the purpose and the process of developing planning goals, a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This process was used to update and enhance the mitigation action plan, which is the essence of the planning process and one of the most important outcomes of this effort. The Action Plan and the process used to identify and prioritize mitigation actions are described in greater detail in **Chapter 5 Mitigation Strategy**.

Planning Task 8: Draft an Action Plan

Based on input from the HMPC regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7, Wood produced a complete first draft of the updated Plan. This complete draft was shared for HMPC review and comment. Other agencies were invited to comment on this draft as well. HMPC and agency comments were integrated into the second draft, which was advertised and distributed to collect public input and comments. Wood integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for the Wyoming Office of Homeland Security and FEMA Region VIII to review and approve, contingent upon final re-adoption by the governing boards of each participating jurisdiction.

3.3.4 Phase 4: Implement the Plan and Monitor Progress

Planning Task 9: Adopt the Plan

In order to secure buy-in and officially implement the plan, the plan was adopted by the governing boards of each participating jurisdiction. Since the adoption process follows the FEMA plan review and approval, copies of the adoption resolution will be included electronically in **Appendix D Records of Adoption**.

Planning Task 10: Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. Up to this point in the planning process, all of the HMPC's efforts have been directed at researching data, coordinating input from participating entities, and developing/updating appropriate mitigation actions. Each recommended action includes key descriptors, such as a lead agency and possible funding sources, to help initiate implementation. Progress on the implementation of specific actions identified in the plan is captured in a discussion and the mitigation action plan summary table in **Chapter 5 Mitigation Strategy.** An overall implementation strategy is described in **Chapter 6 Plan Adoption, Implementation and Maintenance**.

Finally, there are numerous organizations within the Converse County planning area whose goals and interests interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is paramount to the ongoing success of this plan and mitigation in Converse County, and is addressed further in Chapter 6. A plan update and maintenance schedule and a strategy for continued public involvement are also included in Chapter 6.

4 HAZARD ANALYSIS AND RISK ASSESSMENT

44 CFR Requirement 201.6(c)(2): [The plan shall include] a risk assessment that provides the factual basis for activities proposed in the strategy to reduce the losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

As defined by the Federal Emergency Management Agency (FEMA), risk is a combination of hazard, vulnerability, and exposure. "It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage."

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction's potential risk to natural hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment builds upon the methodology described in the 2013 FEMA Local Mitigation Planning Handbook, which recommends a four-step process for conducting a risk assessment:

1) Describe Hazards
2) Identify Community Assets
3) Analyze Risks
4) Summarize Vulnerability

Data collected through this process has been incorporated into the following sections of this chapter:

Section 4.1 Hazard Identification identifies the hazards that threaten the planning area and describes why some hazards have been omitted from further consideration.

Section 4.2 Hazard Profiles discusses the threat to the planning area and describes previous occurrences of hazard events, the likelihood of future occurrences, and the County's vulnerability to hazard events.

4.1 Hazard Identification

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type…of all natural hazards that can affect the jurisdiction.

The Hazard Mitigation Planning Committee (HMPC) conducted a hazard identification study to determine the hazards that threaten the planning area.

4.1.1 Results and Methodology

Using existing hazards data, plans from participating jurisdictions, and input gained through planning and public meetings, the HMPC agreed upon a list of hazards that could affect the County. Hazards data from FEMA, the Wyoming Office of Homeland Security (including the 2016 State of Wyoming Multi-Hazard Mitigation Plan), the National Oceanic and Atmospheric Administration, the Spatial Hazard Events and Losses Database for the United States (SHELDUS), and many other sources were examined to assess the significance of these hazards to the planning area. The hazards evaluated in this plan include those that have occurred historically or have the potential to cause significant human and/or monetary losses in the future.

The final list of natural hazards identified and investigated for the 2017 Converse County Multi-Hazard Mitigation Plan includes:

- Dam Failure
- Drought
- Earthquake
- Expansive Soils
- Flood
- Hazardous Materials
- High Winds and Downbursts
- Landslide/Rockfall/Debris Flow
- Severe Thunderstorms (includes Hail and Lightning)
- Tornado
- Severe Winter Weather
- Wildfire

Members of the HMPC used a hazards worksheet to rate the significance of hazards that could potentially affect the County. Significance was measured in general terms, focusing on key criteria such as the likelihood of the event, past occurrences, spatial extent, and damage and casualty potential. Table 4.1 represents the worksheet used to identify and rate the hazards, and is a composite that includes input from all the participating jurisdictions. Note that the significance of the hazard may vary from jurisdiction to jurisdiction. Jurisdictional variation is summarized in significance tables at the end of each hazard profile.

Table 4.1: Converse County Hazard Significance Summary Table

Hazard	Spatial Extent	Magnitude/ Severity	Probability of Future Occurrence	Overall Significance
Dam Failure	Limited	Limited	Unlikely	Low
Drought	Extensive	Limited	Likely	High
Earthquake	Significant	Critical	Occasional	High
Expansive Soils	Significant	Limited	Likely	Low
Flood/Flash Flood	Significant	Limited	Likely	Medium
Hazardous Materials	Limited	Limited	Highly Likely	Medium
Landslide/Mudslide/Rockfall	Limited	Limited	Likely	Medium
Thunderstorm (including Lightning and Hail)	Extensive	Limited	Highly Likely	Medium
Tornado/Wind	Negligible	Limited	Highly Likely	Low
Wildland Fire	Extensive	Critical	Highly Likely	High
Winter Weather	Extensive	Limited	Highly Likely	Medium

Geographic Extent

Negligible: Less than 10 percent of planning area or isolated single-point occurrences

Limited: 10 to 25 percent of the planning area or limited single-point occurrences

Significant: 25 to 75 percent of planning area or frequent single-point occurrences

Extensive: 75 to 100 percent of planning area or consistent single-point occurrences

Potential Magnitude/Severity

Negligible: Less than 10 percent of property is severely damaged, facilities and services are unavailable for less than 24 hours, injuries and illnesses are treatable with first aid or within the response capability of the jurisdiction.

Limited: 10 to 25 percent of property is severely damaged, facilities and services are unavailable between 1 and 7 days, injuries and illnesses require sophisticated medical support that does not strain the response capability of the jurisdiction, or results in very few permanent disabilities.

Critical: 25 to 50 percent of property is severely damaged, facilities and services are unavailable or severely hindered for 1 to 2 weeks, injuries and illnesses overwhelm medical support for a brief period of time, or result in many permanent disabilities and a few deaths.

Catastrophic: More than 50 percent of property is severely damaged, facilities and services are unavailable or hindered for more than 2 weeks, the medical response system is overwhelmed for an extended period of time or many deaths occur.

Probability of Future Occurrences

Unlikely: Less than 1 percent probability of occurrence in the next year, or has a recurrence interval of greater than every 100 years.

Occasional: Between a 1 and 10 percent probability of occurrence in the next year, or has a recurrence interval of 11 to 100 years.

Likely: Between 10 and 90 percent probability of occurrence in the next year, or has a recurrence interval of 1 to 10 years

Highly Likely: Between 90 and 100 percent probability of occurrence in the next year, or has a recurrence interval of less than 1 year.

Overall Significance

Low: Two or more of the criteria fall in the lower classifications or the event has a minimal impact on the planning area. This rating is also sometimes used for hazards with a minimal or unknown record of occurrences/impacts or for hazards with minimal mitigation potential.

Medium: The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is also sometimes utilized for hazards with a high impact rating but an extremely low occurrence rating.

High: The criteria consistently fall along the high ranges of the classification and the event exerts significant and frequent impacts on the planning area. This rating is also sometimes utilized for hazards with a high psychological impact or for hazards that the jurisdiction identifies as particularly relevant.

Hazards Considered but Not Profiled

There are several other hazards identified in the Wyoming State Hazard Mitigation Plan that could affect the county but are not profiled further for mitigation purposes due to very low probability or minimal vulnerability. These hazards include liquefaction, mine subsidence, snow avalanche, space weather, and windblown deposits. There has been little, if any, reported damage from liquefaction throughout the state, and the geologic characteristics of the County do not indicate any risk for Converse County. There is a high-level discussion of liquefaction included in Section 4.3.3 Earthquake. The Wyoming State HMP notes that liquefaction is generally isolated to the counties in the northwest corner of the state. Avalanche conditions may exist in the Laramie Range south of Douglas and Glenrock. Thousands of acres, as well as numerous well-maintained campgrounds, are managed by the U.S. Forest Service, including the land surrounding Laramie Peak (10,272 feet) in the Southern region of the County. These areas are susceptible to minor avalanche hazards, but the risk does not affect built areas. There are mines present in Glenrock that pose a threat to the community. However, because the hazard is isolated to a few specific areas and is not significant for the county at large, the issue is discussed in Section 4.3.8 Landslide/Rockfall/Debris Flow. Windblown deposits have not caused issues in the past and would likely have nuisance impacts if ancient deposits are re-mobilized. Regarding volcanism, the county and region is potentially vulnerable to an eruption of the Yellowstone Caldera due to its proximity to Yellowstone National Park. A large-scale eruption would have catastrophic global impacts. Because of the overly long expected occurrence of frequency (greater than 10,000 years) for explosive volcanism at Yellowstone, and the fact that a good response or mitigation plan is not possible for an event of this magnitude, it was not analyzed in this document.

During planning meetings, two additional hazards were discussed. Terrorism is the use of force or violence against persons or property for purposes of intimidation, coercion, or ransom. Terrorists often use threats to create fear among the public, try to convince citizens that their government is powerless to prevent terrorism, and to get immediate publicity for their causes. Converse County is not immune to the threat of terrorism, though no recorded terrorist attacks have taken place in the county or its jurisdictions. Terrorism is more of a prevention and response activity than a mitigation activity, and is not profiled further in this plan.

In August 2017, a total solar eclipse occurred over Wyoming, making many of its communities popular destinations for eclipse viewing. Converse County was included in the path of totality. The planning committee noted the logistical issues raised by the estimated 536,000 extra cars on the road, bringing more than a million people into the state. Converse County estimated that 30,000 people traveling southbound on Interstate 25 to Colorado. The State of Wyoming and Converse County had been preparing for this event, and visitors were told to ensure they had food and water, and that they had enough fuel; these warnings helped the incident run smoothly. The planning committee noted that while rare, this high volume of traffic could be repeated by two other potential scenarios, a breach in the LaPrele Dam that would affect Interstate 25, or some sort of expansive event in Casper that would push the city's 50,000 residents along the interstate for evacuation. Because high traffic is a cascading hazard, it was not profiled separately under this plan.

4.1.2 Disaster Declaration History

As part of the hazard identification process, the HMPC researched past events that triggered federal and/or state emergency or disaster declarations in the planning area. Federal and/or state disaster declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments' capacities are exceeded, a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), and/or the Small Business Administration (SBA). FEMA also issues emergency declarations, which are more limited in scope and without the long-term federal recovery programs of major disaster declarations. The quantity and types of damage are the determining factors.

A USDA declaration will result in the implementation of the Emergency Loan Program through the Farm Services Agency. This program enables eligible farmers and ranchers in the affected county as well as contiguous counties to apply for low interest loans. A USDA declaration will automatically follow a major disaster declaration for counties designated major disaster areas and those that are contiguous to declared counties, including those that are across state lines. As part of an agreement with the USDA, the SBA offers low interest loans for eligible businesses that suffer economic losses in declared and contiguous counties that have been declared by the USDA. These loans are referred to as Economic Injury Disaster Loans.

Table 4.2 provides information on federal emergencies and disasters declared in Wyoming between 1963 and 2017. Those that affected Converse County are indicated by an asterisk. Fire management assistance declarations that affected Converse County are also included.

Table 4.2: Major Disaster Declarations in Wyoming: 1963 – 2017

Event/ Hazard	Year	Declaration Type
Heavy rains, flooding	1963	Presidential – Major Disaster Declaration
Drought	1977	Presidential - Emergency Declaration
Severe storms, flooding, mudslides*	1978	Presidential – Major Disaster Declaration
Severe storms, tornadoes	1979	Presidential – Major Disaster Declaration
Severe storms, hail, flooding	1985	Presidential – Major Disaster Declaration
Methane gas seepage	1987	Presidential - Emergency Declaration
Severe winter storm	1999	Presidential – Major Disaster Declaration
Winter storm	2000	Presidential – Major Disaster Declaration

Event/ Hazard	Year	Declaration Type
Hensel Fire	2002	Fire Mgmt Assistance Declaration
Reese Mountain Fire	2002	Fire Mgmt Assistance Declaration
Commissary Ridge Fire	2002	Fire Mgmt Assistance Declaration
Tongue River Fire	2003	Fire Mgmt Assistance Declaration
Tornado	2005	Presidential – Major Disaster Declaration
Drought*	2006	USDA Declaration
Thorn Divide Fire Complex	2006	Fire Mgmt Assistance Declaration
Jackson Canyon Fire	2006	Fire Mgmt Assistance Declaration
Drought*	2007	USDA Declaration
Little Goose Fire	2007	Fire Mgmt Assistance Declaration
Drought*	2009	USDA Declaration
Severe freeze	2009	USDA Declaration
Flooding	2010	Presidential – Major Disaster Declaration
Severe Storms, Flooding, and Landslides	2011	Presidential-Major Disaster Declaration
Arapahoe Fire	2012	Fire Mgmt Assistance Declaration
Squirrel Creek Fire	2012	Fire Mgmt Assistance Declaration
Oil Creek Fire	2012	Fire Mgmt Assistance Declaration
Sheep Herder Hill Fire	2012	Fire Mgmt Assistance Declaration
Severe Storms and Flooding	2015	Presidential-Major Disaster Declaration
Station Fire	2015	Fire Mgmt Assistance Declaration
Lava Mountain Fire	2016	Fire Mgmt Assistance Declaration
Tokawana Fire	2016	Fire Mgmt Assistance Declaration
Severe Winter Storm and Straight-line Winds	2017	Presidential- Major Disaster Declaration
Flooding	2017	Presidential- Major Disaster Declaration

4.2 Asset Summary

4.2.1 Assets Exposure

As a starting point for analyzing the Planning Area's vulnerability to identified hazards, the HMPC used a variety of data to define a baseline against which all disaster impacts could be compared. If a catastrophic disaster was to occur in the Planning Area, this section describes significant assets exposed or at risk in the Planning Area. Data used in this baseline assessment included:

- Total assets at risk;
- Critical facility inventory;
- Cultural, historical, and natural resources; and
- Population growth and land use/development trends.

Total Assets at Risk

Parcel and 2017 tax year data were provided by the Converse County Assessor's Office. This data presents an inventory of the total exposure of developed properties within the county. It is important to note that depending on the nature and type of hazard event or disaster, it is generally the value of the infrastructure or improvements to the land that is of concern or at risk. Generally, the land itself is not a total loss, but may see a reduction in value. Thus, the parcel analysis excludes land value.

Parcel Exposure and Preparations for Analysis

Parcel and assessor data was obtained through the county website. This information provided the basis for building exposure and property types. The focus of the analysis was on "improved" or developed parcels. These parcels were identified based on an improvement value greater than zero. Property Types were included in the assessor data and were used to identify occupancy type as shown in the following table, which includes summations of total improved value for the various property types. For the purposes of this plan 'improved' includes parcels that have an improvement value greater than zero. The table below shows a summary of the total improved property inventory grouped by jurisdiction. Contents values were estimated as a percentage of building value based on their property type, using FEMA/HAZUS estimated content replacement values. This includes 100% of the structure value for non-residential structures, 150% for industrial structures, and 50% for residential structures.

Table 4.3: Converse County Total Exposure by Jurisdictions

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure
Douglas	Commercial	303	$98,535,775	$98,535,775	$197,071,549
	Exempt	38	$13,925,588	$13,925,588	$27,851,176
	Industrial	5	$634,267	$951,401	$1,585,668
	Residential	2,039	$282,323,554	$141,161,777	$423,485,331
	Total	**2,385**	**$395,419,184**	**$254,574,540**	**$649,993,724**
Glenrock	Commercial	110	$18,425,428	$18,425,428	$36,850,856
	Exempt	6	$1,824,941	$1,824,941	$3,649,882
	Industrial	4	$917,073	$1,375,610	$2,292,683
	Residential	905	$111,947,324	$55,973,662	$167,920,986
	Total	**1,025**	**$133,114,766**	**$77,599,641**	**$210,714,407**
Lost Springs	Commercial	2	$127,815	$127,815	$255,630
	Residential	2	$6,114	$3,057	$9,171
	Total	**4**	**$133,929**	**$130,872**	**$264,801**
Rolling Hills	Commercial	2	$27,751	$27,751	$55,502
	Residential	155	$27,809,122	$13,904,561	$41,713,683
	Total	**157**	**$27,836,873**	**$13,932,312**	**$41,769,185**
Unincorporated	Agricultural	531	$126,701,465	$126,701,465	$253,402,930
	Commercial	104	$28,623,361	$28,623,361	$57,246,722
	Exempt	8	$2,191,630	$2,191,630	$4,383,259
	Industrial	18	$87,118,301	$130,677,452	$217,795,753
	Residential	1,533	$263,656,134	$131,828,067	$395,484,202
	Total	**2,194**	**$508,290,891**	**$420,021,974**	**$928,312,865**
	Grand Total	**5,765**	**$1,064,795,643**	**$766,259,339**	**$1,831,054,983**

Source: Wood analysis based on Assessor's Office data 2017

Critical Facility Inventory

For the purposes of this plan, a critical facility is defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. FEMA's HAZUS-MH loss estimation software uses the following three categories of critical assets:

- *Essential facilities* are those that if damaged would have devastating impacts on disaster response and/or recovery;
- *High potential loss facilities* are those that would have a high loss or impact on the community;
- *Transportation and lifeline facilities* are a third category of critical assets, consisting of transportation systems and utilities.

Examples of each are provided in Table 4.4. Critical facilities data was provided by Converse County Planning; supplemental data from HAZUS was used to capture wastewater facilities; Homeland Security Infrastructure Program (HSIP) data was used for communications, emergency operations centers and urgent care facilities. Each jurisdiction identified assets on a data collection guide worksheet which may capture additional facilities and additional details not within the GIS database. For a list of assets and vulnerabilities within specific jurisdictions, please refer to Appendix D.

Table 4.4: Critical Facilities Types and Examples

Essential Facilities	High Potential Loss Facilities	Transportation and Lifeline Facilities
Medical Facility	Assisted Living	Air Facility
Fire Department	College/University	Non-Union Communication
Hospital	Community Support	Union Communications
Law Enforcement	Day Cares	Electrical Facility
Local EOC	EPA FRS Location	
Medical Facility	EPA Regulated Facility	
Special Medical Facility	National Shelter System Facility	
Urgent Care Facility	Nursing Home	
	Power Plant	
	Public Health Department	
	School	
	Substation	
	Tier II	

Table 4.5: Summary of Critical Facilities in Converse County by Jurisdiction

Jurisdiction	Critical Facility Type	Facility Count
Douglas	Essential Facility	4
	High Potential Loss Facility	7
	Transportation and Lifeline Facilities	12
	Total	**23**
Glenrock	Essential Facility	2
	High Potential Loss Facility	4
	Total	**6**
Unincorporated	High Potential Loss Facility	10
	Transportation and Lifeline Facilities	131
	Total	**141**
Grand Total		**170**

Source: Converse County GIS, HSIP and HAZUS

Cultural, Historical, and Natural Resources

Assessing the County's vulnerability to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant more protection due to their unique and irreplaceable nature and contribution to the overall economy.
- In the event of a disaster, an accurate inventory of natural, historical and cultural resources allows for more prudent care in the disaster's immediate aftermath when the potential for additional impacts is higher.

- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, for example, wetlands and riparian habitat which help absorb and attenuate floodwaters and thus support overall mitigation objectives.

Cultural and Historical Resources

Converse County has a large stock of historically significant homes, public buildings, and landmarks. The **National Register of Historic Places** is the nation's official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the U.S. Department of the Interior National Park Service.

Table 4.6: Converse County Historical Resources

City	Name	Address
Bill	Dorr Ranch	Approx. 5 mi. NE. of Woody Creek & Steinle Rds.
Douglas	Christ Episcopal Church and Rectory	4th and Center Sts.
	College Inn Bar	103 N. 2nd St.
	US Post Office--Douglas Main	129 N. Third St.
	Douglas City Hall	130 S. Third St.
	LaPrele Work Center	SW of Douglas, Medicine Bow NF
	Fremont, Elkhorn & Missouri Valley Railroad Passenger Depot	100 Walnut St.
	Braehead Ranch	69 Moss Agate Rd.
	Jenne Block	301 Center St.
	North Douglas Historic District	Roughly bounded by Second St., Clay St. Sixth St., and Center St.
	Morton Mansion	425 Center St.
	Officer's Club, Douglas Prisoner of War	115 S. Riverbend Dr.
	Hotel LaBonte	206 Walnut St.
Glenrock	Hotel Higgins	416 W. Birch
	Glenrock Buffalo Jump	Address Restricted
	Sage Creek Station (48CO104)	Address Restricted
	Commerce Block	Fourth and Birch Sts.
	Huxtable Ranch Headquarters District	1351 Box Elder Rd
Orpha	Fort Fetterman	7 mi. N of I-25 on Orpha Rd.
Unincorporated County	Antelope Creek Crossing (48CO171 and 48CO165)	Address Restricted
	Stinking Water Gulch Segment, Bozeman Trail (48CO165)	Address Restricted
	Ross Flat Segment, Bozeman Trail (48C0165)	Address Restricted

City	Name	Address
	Holdup Hollow Segment, Bozeman Trail (48CO165)	Address Restricted

Source: National Register of Historic Places, 2015

It should be noted that these lists change periodically, and they may not include those currently in the nomination process and not yet listed. Additionally, as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, if the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for this regulation.

Many cultural and historical resources in the County are vulnerable to several hazards due to the nature of their construction. Some of these risks include earthquakes, wildfires or high winds damaging historic buildings.

Natural Resources

Natural resources are important to include in benefit/cost analyses for future projects and may be used to leverage additional funding for mitigation projects that also contribute to community goals for protecting sensitive natural resources. Awareness of natural assets can lead to opportunities for meeting multiple objectives. For instance, protecting wetlands areas protects sensitive habitat as well as reducing the force of and storing floodwaters.

Natural and Beneficial Functions

Floodplains can have natural and beneficial functions. Wetlands function as natural sponges that trap and slowly release surface water, rain, snowmelt, groundwater and flood waters. Trees, root mats, and other wetland vegetation also slow the speed of floodwaters and distribute them more slowly over the floodplain. This combined water storage and braking action lowers flood heights and reduces erosion. Wetlands within and downstream of urban areas are particularly valuable, counteracting the greatly increased rate and volume of surface water runoff from pavement and buildings. The holding capacity of wetlands helps control floods and prevents water logging of crops. Preserving and restoring wetlands, together with other water retention, can often provide the level of flood control otherwise provided by expensive dredge operations and levees.

Special Status Species

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e., endangered species) in the Planning Area. The US Fish and Wildlife Service maintains a list of threatened and endangered species in nationwide. State and federal laws protect the habitat of these species through the environmental review process. Several additional species are of special concern or candidates to make the protected list.

Table 4.7 summarizes Converse County's special status animal species in the Fish and Wildlife Service database.

Table 4.7: Threatened and Endangered Animals in Converse County

Name	Scientific Name	Status
Bald eagle	Haliaeetus leucocephalus	Recovery
Ute ladies' tresses	Spiranthes diluvialis	Threatened
Gray wolf	Canis lupis	Recovery
Preble's meadow jumping mouse	Zapus hudsonius preblei	Threatened

Source: US Fish and Wildlife Service

Population, Growth and Development Trends

As part of the planning process, the HMPC looked at changes in growth and development, both past and future, and examined these changes in the context of hazard-prone areas, and how the changes in growth and development affect loss estimates and vulnerability.

The US Census Bureau estimated population of Converse County for July 1, 2016 was 14,191, representing an 2.6% increase in population since 2010 (estimated at 13,827).

Development Trends

Converse County Planning and Zoning Department recently published the Converse County Together Now and Tomorrow plan to provide a unified guide for all governmental entities in Converse County regarding land use and public investment decisions to address the balance of community health, safety, welfare, and individual rights. As described in the 2010 City of Douglas Development plan, the population of Wyoming generally, is a rapidly aging one. This translates into a diminishing skilled workforce, which will require different housing options and goods and services, particularly in healthcare.

Converse County, the State of Wyoming, and the Rocky Mountain Region have been greatly influenced by energy resource exploration and development activities in the past. The economy of Converse County is tied to the availability and management of natural resources. The 2015 Converse County Land Use Plan emphasizes the relationship between population trends and the role of energy resources. The increase and intensity of the development of energy related resources has created an influx of population that does not distribute itself evenly over the County. Energy development areas, such as oil and gas fields, coal mines, or uranium mines are dispersed throughout the County but most of the workers live in or near the incorporated towns. At the same time, conservation of these resources, open spaces, and working landscapes also impacts the economy by attracting tourism, new residents, and entrepreneurs who value access to vast areas for outdoor pursuit and the quality of life associated with a clean environment and abundant wildlife.

4.3 Hazard Profiles

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the…location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

The hazards identified in Section 4.1 Identifying Hazards are profiled individually in this section. Much of the profile information came from the same sources used to initially identify the hazards.

Profile Methodology

Each hazard is profiled in a similar format that is described below:

Hazard Description

This subsection gives a description of the hazard and associated problems, followed by details on the hazard specific to the County.

Geographical Area Affected

This subsection discusses which areas of the County are most likely to be affected by a hazard event.

Limited: Less than 10 percent of the planning area

Significant: 10 to 50 percent of the planning area

Extensive: 50 to 100 percent of the planning area

Past Occurrences

This subsection contains information on historic incidents, including impacts where known. Information provided by the HMPC is included here along with information from other data sources, including the National Climatic Data Center (NCDC) and SHELDUS where available.

SHELDUS is a county-level data set for the United States that tracks 18 types of natural hazard events along with associated property and crop losses, injuries, and fatalities. In 2014 this formerly free database transitioned into a fee-based service. Due to this and the availability of similar data in NCDC databases it was not used as a resource during the 2017 plan update except for when the data was already available.

When available, tables showing county-specific data from the NCDC and SHELDUS databases may be found in each hazard profile.

Likelihood of Occurrence

The frequency of past events is used in this section to gauge the likelihood of future occurrences. Based on historical data, the likelihood of future occurrences is categorized into one of the following classifications:

- **Highly Likely**—Near 100 percent chance of occurrence in next year, or happens every year.
- **Likely**—Between 10 and 100 percent chance of occurrence in next year, or has a recurrence interval of 10 years or less.
- **Occasional**—Between 1 and 10 percent chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
- **Unlikely**—Less than 1 percent chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

The frequency, or chance of occurrence, was calculated where possible based on existing data. Frequency was determined by dividing the number of events observed by the number of years and multiplying by 100. Stated mathematically, the methodology for calculating the probability of future occurrences is:

$$\frac{\text{\# of known events}}{\text{years of historic record}} \times 100$$

This gives the percent chance of the event happening in any given year. An example would be three droughts occurring over a 30-year period which equates to 10 percent chance of that hazard occurring any given year.

Potential Magnitude

This subsection discusses the potential magnitude of impacts, or extent, from a hazard event. Magnitude classifications are as follows:

- **Catastrophic**—More than 50 percent of property severely damaged, and/or facilities are inoperable or closed for more than 30 days. More than 50 percent agricultural losses. Multiple fatalities and injuries. Critical indirect impacts.
- **Critical**—25 to 50 percent of property severely damaged, and/or facilities are inoperable or closed for at least 2 weeks. 10-50 percent agricultural losses. Injuries and/or illnesses result in permanent disability and some fatalities. Moderate indirect impacts.
- **Limited**—10 to 25 percent of area affected. Some injuries, complete shutdown of critical facilities for more than one week, more than 10 percent of property is severely damaged.
- **Negligible**—Less than 10 percent of area affected. Minor injuries, minimal quality-of-life impact, shutdown of critical facilities and services for 24 hours or less, less than 10 percent of property is severely damaged.

Vulnerability Assessment

Vulnerability is the measurement of exposed structures, critical facilities or populations relative to the risk of the hazard. For most hazards, vulnerability is a best-estimate. Some hazards, such as flood, affect specific areas so that exposure can be quantified, and vulnerability assessments result in a more specific approximation. Other hazards, such as tornados, are random and unpredictable in location and duration that only approximate methods can be applied.

The following vulnerability assessment sections evaluate natural hazards based on the degree to which they impact people, property, critical facilities, and natural resources. Analysis is primarily driven by the availability and relevancy of GIS capabilities, combined with anecdotal information provided by HMPC members, the National Climatic Data Center storm events catalog, and other online media resources. The vulnerability assessment of some hazards is extensive and replete with quantitative analysis, while other assessments reflect a high-level interpretation of the anticipated risk.

Future Development

This section describes how the hazard could impact future development.

Summary

This section summarizes risk according to the area affected, likelihood, and magnitude of impacts. If the hazard has impacts on specific towns or cities in the County they are noted here, where applicable.

4.3.1 Dam Failure

Hazard Description

Dams are man-made structures built for a variety of uses, including flood protection, power, agriculture, water supply, and recreation. Dams typically are constructed of earth, rock, concrete, or mine tailings. Dams and reservoirs serve a very important role for Wyoming residents and industry. While dam failures are rare, should a complete or partial failure occur it creates a significant hazard for those downstream.

Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, which can affect life and property. Two factors that influence the potential severity of a full or partial dam failure are the amount of water impounded and the density, type, and value of development and infrastructure located downstream.

Dam failure occurs when the retention function of the dam is compromised, in part or in its entirety. Damage to a dam structure that may result in a failure may be caused by many sources:

- Prolonged periods of rainfall and flooding, which result in overtopping
- Earthquake

- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage or piping or rodent activity
- Improper design
- Age
- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway
- Vandalism or terrorism

A dam failure is not the only type of emergency associated with dams. Spillway discharges that are large enough to cause flooding in downstream areas or flooding upstream of dams due to backwater effects or high pool levels are both considered dam emergencies and may cause significant property damage and loss of life.[1]

Dam failures can be classified into four classifications: overtopping, foundation failure, structural failure, and other unforeseen failures. Overtopping failures result from the uncontrolled flow of water over, around, and adjacent to the dam. Earthen dams are most susceptible to this type of failure. Hydraulic failures account for approximately 28% of all dam failures. Foundation and structural failures are usually tied to seepage through the foundation of the main structure of the dam. Deformation of the foundation or settling of the embankment can also result in dam failure. Structural failures account for approximately 28% of all dam failures, and foundation problems account for another 25%. Earthquakes or sabotage account for 12% of all dam failures, while inadequate design and construction account for the remaining 7% of failures.

Dam failures result in a unique source of flash flooding, when a large amount of previously detained water is suddenly released into a previously dry area due to a failure in some way of the dam. Dams are classified into three classes. The State of Wyoming has adopted FEMA's risk classifications as set forth in FEMA's *Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams*. These guidelines define High Hazard (Class I) dams as those rated based on an expected loss of human life, should the dam fail, and Significant Hazard (Class II) dams as those rated based on expected significant damage, but not loss of human life. Significant damage refers to structural damage where humans live, work, or recreate; or public or private facilities exclusive of unpaved roads and picnic areas. Damage refers to making the structures inhabitable or inoperable.

Geographical Area Affected

In 1981, the U.S. Army Corps of Engineers completed an inspection program for nonfederal dams under the National Dam Inspection Act (P.L. 92-367). This was a four-year work effort and included compiling an inventory of about 50,000 dams and conducting a review of each state's

[1] US Army Corps of Engineers *Flood Emergency Plans: Guidelines for Corps Dams*. Hydrologic Engineering Center, (June 1980) p 4.

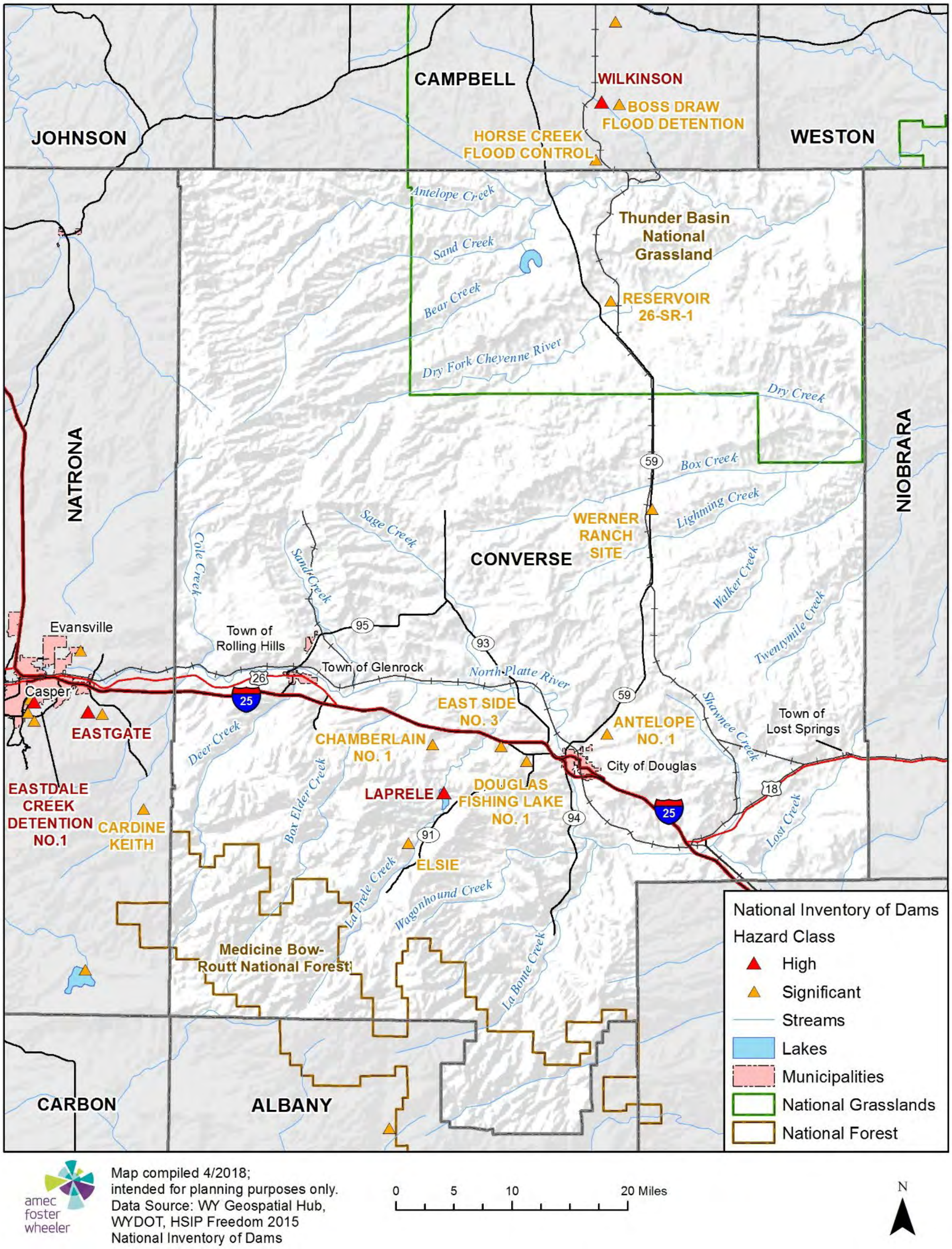
capabilities, practices, and regulations regarding design, construction, operation, and maintenance of dams. Part of the inspection included evaluating the dams and assigning a hazard potential based on the effects downstream should one of the dams fail. The dams were rated (1) High, (2) Significant, and (3) Low hazard. The Corps of Engineers based the hazard potential designation on such items as acre-feet capacity of the dam, distance from nearest community downstream, population density of the community, and age of the dam**.**

There were 1,458 dams in Wyoming that were reviewed by the Corps of Engineers. Of that number 38 were rated high hazard, 56 were rated significant hazard, and the remaining 1,364 were rated low hazard. The Wyoming State Engineers Office inspects dams over 20 feet high or with a storage capacity of 50 acre-feet or more, although smaller dams are also inspected in highly populated areas. According to the WSEO web site[2], the WSEO regulates 1,515 dams. As a part of the regulatory process the WSEO inspects these dams once every five years. Of these dams, 84 are rated high hazard, 106 are rated significant hazard, and 1,325 are rated low hazard.

Figure 4-1 shows the dams affecting Converse County. Seven dams are classified as Significant Hazard (Class II) and one is classified as High hazard (Class I). Table 4.8 below provides details of the High and Significant Hazard Dams.

[2] http://seo.wyo.gov/home

Figure 4-1: Locations of High and Significant Dams Affecting Converse County



Map compiled 4/2018; intended for planning purposes only. Data Source: WY Geospatial Hub, WYDOT, HSIP Freedom 2015 National Inventory of Dams

Table 4.8: High and Significant Hazard Dams Affecting Converse County

Dam Name	Owner	River	Hazard Class	Nearest City	Distance to City	Maximum Capacity
Antelope No. 1	Art C. Sims	Antelope Creek N.	S	Douglas	3	202
Chamberlain No. 1	LaPrele Irrigation District	LaPrele Creek	S	Douglas	16	727
Douglas Fishing Lake No. 1	Wyoming Game and Fish Commission	Six Mile Creek	S	Douglas	4	193
East Side No. 3	LaPrele Irrigation District	Five Mile Creek	S	Douglas	6	200
Elsie	Elsie Deininger	Moss Agate Creek	S	Douglas	28	51
LaPrele	LaPrele Irrigation District	LaPrele CR, TR N Platte River	H	Douglas	14	26850
Reservoir 26-SR-1	Thunder Basin Coal Company		S	Wright		
Werner Ranch	J.P. Werner & Sons, Inc.	Werner Draw	S	Unnamed Ranch	15	113

Source: National Inventory of Dams

Of these eight dams of concern, LaPrele Dam is the only one that is classified as high hazard. LaPrele Dam is a 135-foot tall zoned concrete dam operated by LaPrele Irrigation District for irrigation. The dam is located on LaPrele Creek, roughly 14 miles southwest of Douglas near Ayres natural bridge. The dam was originally constructed in 1909 under the Carey Act, in which the federal government gave land to Western states with the intention that the land would be use for irrigation that would promote settlement. By the 1970s the dam had denigrated significantly, and was not fully functioning; only holding half of the 20,000 acre of water capacity, which was not enough to irrigate the crops of the area. The dam was then modified in 1980, which was quite the feat and lead to the American Society of Civil Engineers to award the LaPrele Irrigation District, the Panhandle Eastern Pipeline Company and the DMJM-Phillips-Reister-Haley Inc. engineering firm the "Outstanding Civil Engineering Achievement of 1979." Today the LaPrele dam holds irrigates 14,612 acres of land, according to the 2010 Wyoming Irrigation Systems Report by the Wyoming Water Development Commission.

Past Occurrences

There have been many dam failures in Wyoming, some of which have caused the loss of life and damage to property. According to the Wyoming State Hazard Mitigation Plan (2008) there has been one documented dam failure in Converse County. On July 22, 1983, a dam linked to the LaPrele Range Drainage Basin collapsed as a result of heavy rains. A wall of water, 10-15 feet, high inundated a nearby ranch southwest of Douglas near the LaPrele Reservoir. No damage information is available from that incident and HMPC members have confirmed that the impact of the failure was isolated to the single ranch.

Likelihood of Future Occurrences

Based on the past occurrences a dam fails in the county on average every 36 years, which equates to an **occasional** rating. The structural integrity of dams depends on regular inspections and maintenance, which do not always happen. Additionally, many of the dam failures in Wyoming and other Rocky Mountain states occurred because of snow melt flooding that exceeded the capacity and strength of levees and dams. The County's dams will continue to be tested by snow melt, heavy rains, and other types of floods nearly every year. Thus, dam failures could possibly threaten Converse County.

Potential Magnitude of Impacts

Potential impacts could include injury and loss of life, property damage, damage to infrastructure, drinking water contamination, loss of crops and livestock, evacuations and sheltering and associated costs, interruption of commerce and transportation, search and rescue, and clean-up costs. In addition, dam failure and associated flooding can cause damage to and loss of irrigation structures such as head gates and ditches. Loss or damage to water structures negatively impacts agricultural producers of crops and livestock, and can be costly to repair.

The severity and magnitude of a given dam failure will vary on a county basis and case-by-case basis. This information is considered sensitive and is not detailed due to Homeland Security concerns. Emergency management coordinators have access to inundation maps contained in the emergency action plans for the High Hazard dams in the State. High Hazard (Class I) dams, by definition, would merit a magnitude/severity rating of **catastrophic**, whereas Significant Hazard (Class II) dams rate as **critical** and Low Hazard dams fall into the **limited** rating. The magnitude/severity rating for the hazard in the County is considered mostly **critical**, mostly due to the number of Class I dams that could impact highly populated communities such as Douglas.

Vulnerability Assessment

If the LaPrele Dam were to fail, the impacts would be catastrophic. Areas inundated include the Natural Bridger Park recreation area, the City of Douglas, nearby unincorporated areas, rural ranches, and I-25. The failure could result in hundreds of millions of dollars of damage in downstream communities, although the probability of such an event is low. One specific concern regarding the dam raised by the HMPC is the excessive amounts of traffic it might generate through Converse County if inundation areas had to be evacuated; the 2017 solar eclipse showed high volume traffic impacts when an incident can be planned for, and an unexpected dam failure that doesn't provide adequate warning time to evacuees on the interstate to prepare for the trip could compound the initial problem of high traffic volume.

Another concern is the aging of the dams. Of the 1,548 dams in the State inventory, 860 or 56% were constructed before 1965 and are over fifty years old. Of the 8 dams that affect Converse County, four were constructed before 1965 and are over fifty years old; however, two of these dams were modified in the last 40 years.

Future Development

As communities or unincorporated areas grow, previously lower-classified dams may pose greater risks, which could elevate their hazard classification. Inundation maps and emergency action plans should be consulted in the planning of new development, where applicable. Growth rates in the region do not indicate that risk is increasing substantially.

Summary

Overall, dam failure significance ranges from high to low dependent upon location in the County. The probability of such an event is low, but impacts could be significant depending upon the dam involved and where it occurred in the region.

Table 4.9: Converse County Dam Failure Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Douglas	Significant	Significant	Unlikely	Medium
Glenrock	Limited	Limited	Unlikely	Low
Rolling Hills	Limited	Limited	Unlikely	Low
Lost Springs	Limited	Limited	Unlikely	Low
Converse County	Limited	Significant	Unlikely	Medium

4.3.2 Drought

Hazard Description

Drought is described as a protracted period of deficient precipitation resulting in extensive damage to vegetation. Of all the natural weather-related disasters, drought is by far the costliest to society; it indirectly kills more people and animals than the combined effects of hurricanes, floods, tornadoes, blizzards, and wildfires. Unlike other disasters that quickly come and go, drought's long-term unrelenting destruction has been responsible in the past for mass migrations and lost civilizations. The 1980 and 1988 droughts in the US resulted in approximately 17,500 heat-related deaths and an economic cost of over $100 billion. Drought occurs in four stages and is defined as a function of its magnitude (dryness), duration, and regional extent. Severity, the most commonly used term for measuring drought, is a combination of magnitude and duration.

The first stage of drought is known as a meteorological drought. The conditions at this stage include any precipitation shortfall of 75% of normal for three months or longer. The second stage is known as agricultural drought. Soil moisture is deficient to the point where plants are stressed and biomass (yield) is reduced. The third stage is the hydrological drought. Reduced stream flow (inflow) to reservoirs and lakes is the most obvious sign that a serious drought is in progress. The fourth stage is the socioeconomic drought. This final stage refers to the situation that occurs when physical water shortage begins to affect people.

As these stages evolve over time, the impacts to the economy, society, and environment converge into an emergency. Without reservoir water to irrigate farms, food supplies are in jeopardy. Without spring rains for the prairie grasslands, open range grazing is compromised. Without groundwater for municipalities, the hardships to communities result in increases in mental and physical stress as well as conflicts over the use of whatever limited water is available. Without water, wetlands disappear. The quality of any remaining water decreases due to its higher salinity concentration. There is also an increased risk of fires, and air quality degrades because of increased soil erosion due to strong winds and blowing dust.

Geographical Area Affected

Droughts are often regional events, impacting multiple counties and states simultaneously; therefore, it is reasonable to assume that a drought will impact the entire county at the same time. According to the Wyoming State Climate Office, Wyoming is the 5th driest state in the U.S. Drought can be a normal occurrence in Wyoming due to the State's natural climate. Based on this information, the geographic extent rating for drought in Converse County is extensive.

The North Platte is the main water source, of which the State of Nebraska has significant primacy/water rights.

Past Occurrences

The county has experienced several multi-year droughts over the past several decades. The most severe statewide drought in recent history started in 1999, but began in earnest in the spring of 2000 and lingered through 2004. 2005 was a wetter year, technically signifying the end of the drought period. Dry conditions returned in the following years and became especially severe between 2006 and 2007. According to the Wyoming State Climate Office, "conditions eased somewhat in mid-2008, but a near decade with warm temperatures and relatively little precipitation has left [Wyoming] very vulnerable" (http://www.wrds.uwyo.edu/sco/drought/drought.html). Another particularly intense but short drought occurred in 2012.

The 1999-2004 drought is considered by many to be the most severe in collective memory. According to instrument records, since 1895 there have been only seven multi-year (three years or longer) statewide droughts. Based on deficit precipitation totals (negative departures from the long-term average), they are ranked statewide.

Table 4.10: Significant Multi-Year Wyoming Droughts of the Modern Instrumented Era

Years	Average Annual Precipitation (inches)	Percent of 1985-2006 Average Annual Precipitation (13.04")
1952-1956	10.65	81.69%
1900-1903	10.76	82.52%
1999-2004	11.07	84.89%
1987-1990	11.12	85.28%
1958-1964	11.67	89.49%
1974-1977	11.77	90.26%
1931-1936	11.79	90.41%

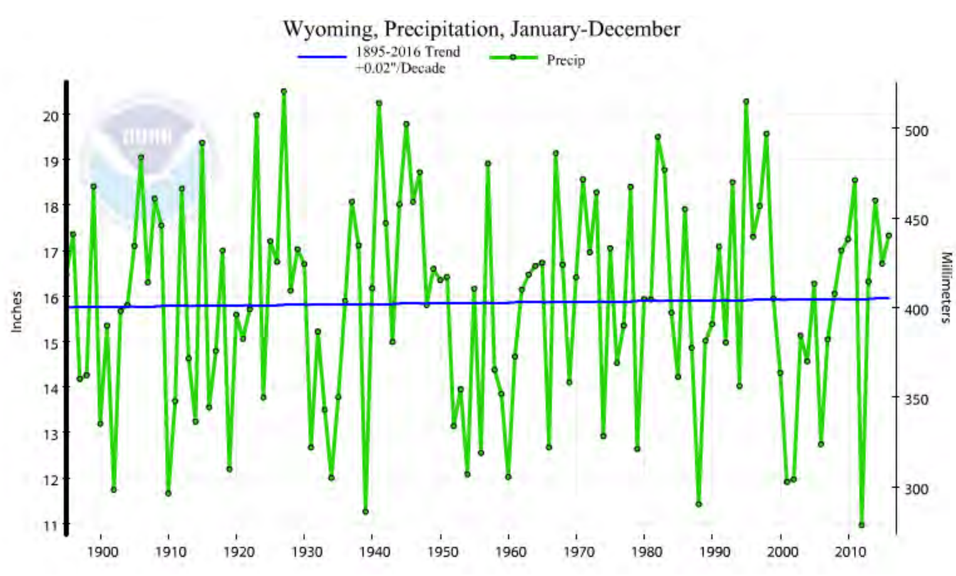
Source: Wyoming Climate Atlas

Widespread droughts in Wyoming, as determined from stream flow records, were most notable during three periods: 1929-1942, 1948-1962, and 1976-1982.

Converse County was listed in three USDA drought disaster declarations in 2006, 2007 and 2009. Converse County was included as a contiguous county for a 2016 USDA drought declaration.

Wyoming's precipitation records from 1895-2016 reveals that, for the first half of the 20th century (except for the Dust Bowl years of the 1930s), there was generally a surplus of moisture. These trends are displayed in the following figures. During the second half of the 20th century and into the 21st century there was an increasing trend of increased periods of drought.

Figure 4-2: Wyoming Annual Precipitation: 1895-2016

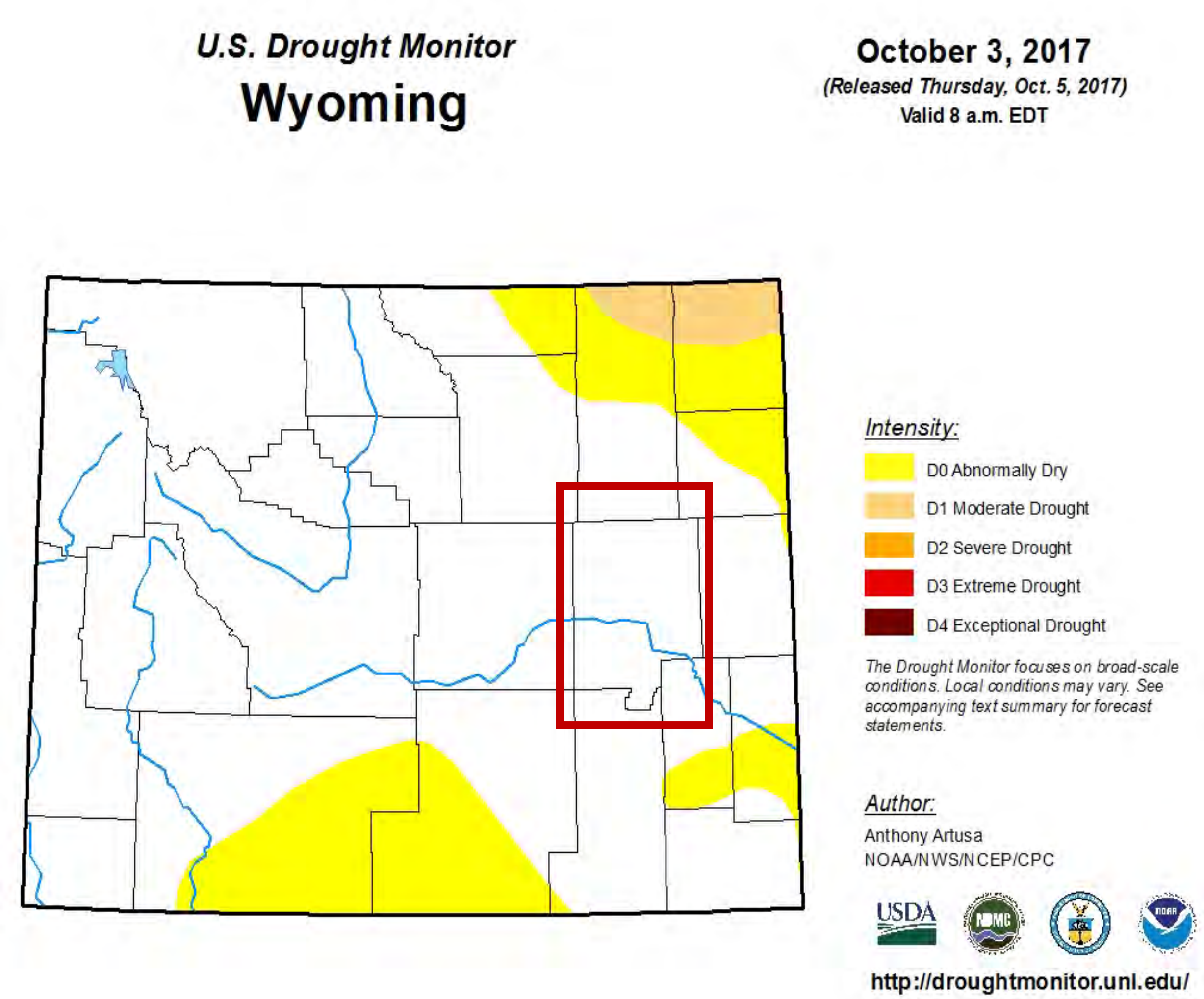


Source: https://www.ncdc.noaa.gov/cag/global/time-series/

The U.S. Drought Monitor provides a general summary of current drought conditions. The U.S. Department of Agriculture (USDA), the National Oceanic and Atmospheric Administration (NOAA), and the National Drought Mitigation Center (University of Nebraska-Lincoln) collaborate on this weekly product, which is released each Thursday. Multiple drought indicators, including various indices, outlooks, field reports, and news accounts are reviewed and synthesized. In addition, numerous experts from other agencies and offices across the country are consulted. The result is the consensus assessment presented on the USDM map. The image is color-coded for four levels of drought intensity. An additional category, "Abnormally Dry," is used to show areas that might be moving into a drought, as well as those that have recently come out of one. The dominant type of drought is also indicated (i.e. agricultural and/or hydrological).

As of October 3, 2017, no drought conditions are identified in Converse County; the HMPC noted that statewide, areas of drought were receding.

Figure 4-3: U.S. Drought Monitor



Another useful resource to determine the impacts of drought is the Drought Impact Reporter (DIR), launched by the National Drought Mitigation Center in July 2005 as the nation's first comprehensive database of drought impacts. The Drought Impact Reporter is an interactive web-based mapping tool designed to compile and display impact information across the United States in near real-time from a variety of sources such as media, government agencies, and the public.

Information within the Drought Impact Reporter is collected from a variety of sources including the media, government agencies and reports, and citizen observers. Each of these sources provides different types of information at different spatial and temporal scales.

A search of the database for Converse County from 2007 to 2016 (which includes the most recent severe droughts) shows a total of 177 reported impacts. The most reported impacts (53) are in the Agricultural category, followed by Plants and Wildlife (32) and Fire (32). The following table shows total impacts by category for the county.

Table 4.11 Converse County Drought Impact Reporter Summary 2007-2016

Category	Total Number of Impacts Recorded
Agriculture	53
Plants and Wildlife	32
Society and Public Health	8
Water Supply and Quality	21
Fire	32
Relief, Response and Restrictions	27
Tourism and Recreation	4
Total	**177**

Source: http://droughtreporter.unl.edu/map/

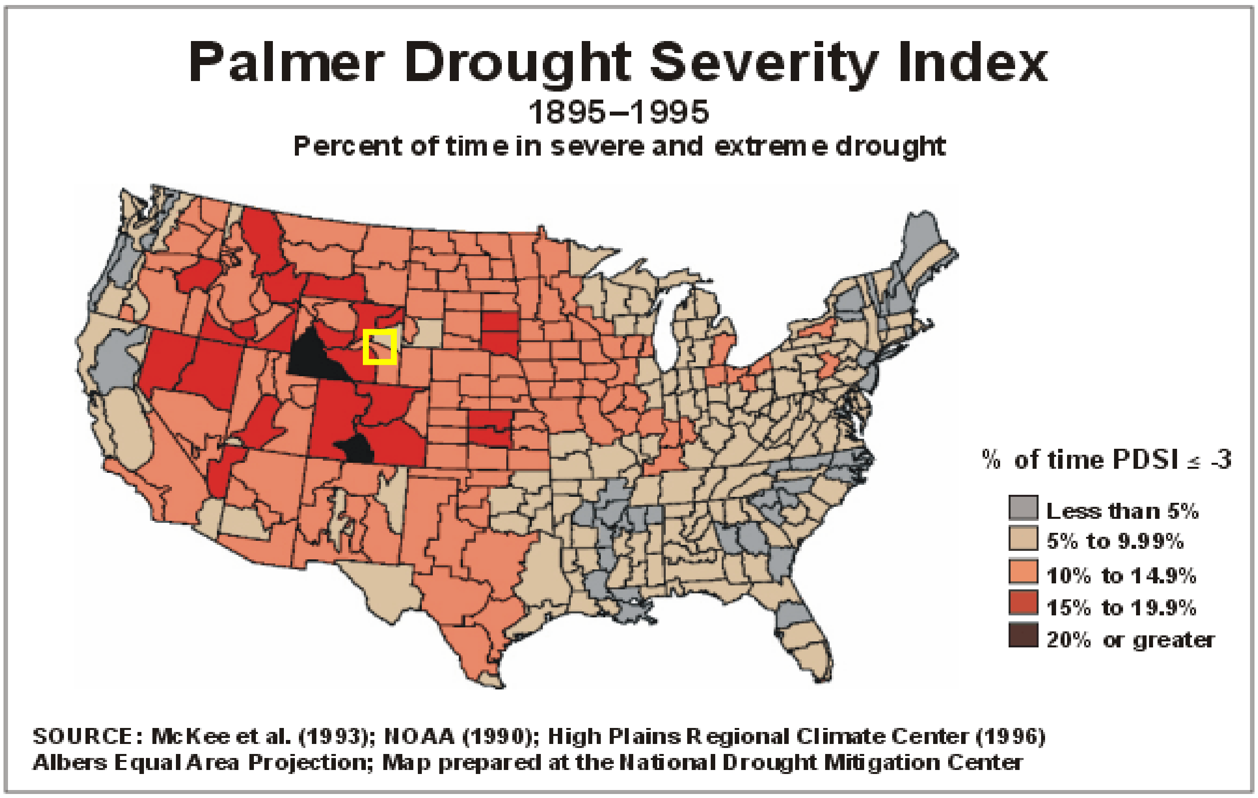
Drought effects associated with agriculture include damage to crop quality; income loss for farmers due to reduced crop yields; reduced productivity of cropland; reduced productivity of rangeland; forced reduction of foundation stock; and closure/limitation of public lands to grazing, among others. The Relief, Response & Recovery category refers to drought effects associated with disaster declarations, aid programs, requests for disaster declaration or aid, water restrictions, or fire restrictions. Specific recorded impacts include reports on reduced yields, fire danger, water availability and impacts to livestock and wildlife. HMPC members have noted that the most significant impacts of drought for the county are those associated with wildfire and agriculture. In the past, there have been issues with crops coming to maturity and overall agricultural production during dry years.

The 1999-2004 drought had significant impacts on agriculture and other industries in Converse County. The worst-case year was 2002, with a negative dollar impact of $308,171,390 statewide. If it is assumed that the drought impact is equally distributed across the state, which it is not, the potential drought impact in Converse County for 2002 would have been approximately $13,400,000. The total impact statewide for the 1999-2004 drought has been $903,649,936. If it is assumed that the drought impact is equally distributed across the state, which it is not, then the potential drought impact in Converse County would be over $39 million for the five-year period in 2002 dollars. Using a 4% annual inflation rate, this would put the losses for Converse County for this five-year event at approximately $56 million in 2010 dollars.

Likelihood of Future Occurrence

The Palmer Drought Severity Index indicates that Converse County experienced severe or extreme drought conditions between 10% and 19% of the time between 1895 and 1995. This is consistent with the data in the Past Occurrences subsection which suggests that severe multi-year droughts have occurred roughly every ten years since the mid-20th century. Based on the historic record, Wyoming experienced major drought conditions for 36 years out of a 115-year period (based on the total number of years in each of the seven droughts). This yields a 31% chance that Wyoming will be in a drought in any given year. An occurrence interval of roughly once every ten years corresponds to a **likely** frequency of occurrence.

Figure 4-4: Palmer Drought Severity Index for the Continental U.S.: 1895-1995



Converse County indicated by yellow outline

Potential Magnitude

To calculate a magnitude and severity rating for comparison with other hazards, and to assist in assessing the overall impact of the hazard on the planning area, information from the event of record is used. In some cases, the event of record represents an anticipated worst-case scenario, and in others, it reflects a common occurrence. Based upon information in the past occurrences discussion the drought of 1999-2004 is as significant, if not more significant than any other droughts in the last 100 years for the entire state. Data derived from the Wyoming Climate Atlas indicates that the most significant droughts in the last century, in terms of precipitation deficit, were in 1952-1956 and 1999-2004. To determine which drought period had the most significant impact on Wyoming, crop production and livestock inventory data for the two periods were compared. 1957 and 2005 were wetter years, with annual statewide precipitation totals above the 1895-2015 average. Those two years were used as endpoints for the droughts that started in 1952 and 1999 respectively. In both cases, the years following saw a return to drier conditions. Because of this, the most recent drought impacts were also calculated for 2005 and 2006, and are included in summary tables. The following tables show peak decline (%) in production during drought compared to the 5-year pre-drought production average for various commodities.

A comparison of peak commodity production changes in the late 1940s and early 1950s, and peak commodity production changes between 1994 and 2004 indicate that drought impacts to the Wyoming agricultural community were greater in the 1999-2004 drought than in the 1952-1956 drought. Except for dry beans, all commodities in the worst years of the 1999-2004 drought showed a greater percentage decline in production than in the 1952-1956 drought. As a result, the 1999-2004 drought will be used as the drought of historic record to calculate dollar impacts.

Table 4.12: Peak Commodity Production Changes from Pre-Drought (1947-1951) to Drought (1952-1956)

Commodity	5-Year Pre-Drought Production Average (1947-1951)	Units	Lowest Production During Drought (1952-1956)	Year of Lowest Production (1952-1956)	Percent Change
Winter Wheat	5,072	1,000 bu.	2,346	1954	-54%
Spring Wheat	1,579	1,000 bu.	600	1954	-62%
Barley	4,414	1,000 bu.	2,700	1956	-39%
Oats	4,577	1,000 bu.	2,470	1954	-46%
Dry Beans	1,009	1,000 cwt.	589	1955	-42%
Sugarbeets	413	1,000 tons	421	1955	+2%
Corn	227	1,000 bu.	161	1953	-29%
Alfalfa Hay	490	1,000 tons	675	1954	+38%
Other Hay	674	1,000 tons	442	1954	-34%
Cattle/ Calves Inventory	1,050	1,000 head	1,096	1954	+4%

Source: Wyoming Climate Atlas

Table 4.13: Peak Commodity Production Changes from Pre-Drought (1994-1998) to Drought (1999-2004)

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	Lowest Production During Drought (1999-2006)	Year of Lowest Production (1999-2006)	Percent Change
Winter Wheat	6,029	1,000 bu.	2375	2002	-61%
Spring Wheat	648	1,000 bu.	96	2002	-84%
Barley	8,383	1,000 bu.	4680	2002	-44%
Oats	1,648	1,000 bu.	600	2005	-64%
Dry Beans	691	1,000 cwt.	514	2001	-26%
Sugarbeets	1,151	1,000 tons	659	2002	-43%
Corn	6,328	1,000 bu.	4165	2002	-34%
Alfalfa Hay	1,581	1,000 tons	1150	2002	-27%
Other Hay	817	1,000 tons	450	2002	-45%
Cattle/ Calves Inventory	1,536	1,000 head	1300	2004	-16%

Source: Wyoming Climate Atlas

In the future, the state could expect similar impacts to the 1999-2004 drought (based on the event of record). Post-2006 data shows that significant losses were experienced in the agricultural industry following the 1999-2004 drought. Even when a drought technically ceases, the impacts can continue. It may take years for the Wyoming agricultural industry to fully recover from the effects of any given drought.

Economic Impacts

Agricultural dollar impacts can also be used to show the effects of drought. Data was obtained from the U.S. Department of Agriculture (USDA) Quick Stats database (https://quickstats.nass.usda.gov).

The data below represent changes in production value for crops and changes in inventory value for cattle and calves. As such, the data should be considered impact value versus loss value. For example, with cattle and calves (Table 4.9 through Table 4.17) inventory, the inventory has decreased during the drought. Therefore, the value of inventory on hand has decreased. The inventory decreased, however, because of the sale of the cattle and calves. The sales resulted in an increase in cash receipts to the farming and ranching community. The net result, however, is a decrease in inventory value, which is a negative drought impact.

Table 4.14: 1999 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	1999 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	6,105	$2.12/bu	+ 161,120
Spring Wheat	648	1,000 bu.	264	$2.54/bu	- 976,376
Barley	8,383	1,000 bu.	7,310	$3.03/bu	- 3,251,190
Oats	1,648	1,000 bu.	1,539	$1.45/bu	- 158,050
Dry Bean	691	1,000 cwt.	788	$16.00/cwt	+ 1,555,200
Sugar Beet	1,150	1,000 tons	1,205	$39.00/ton	+ 2,145,000
Corn	6,328	1,000 bu.	6,136	$1.94/bu	- 372,480
Alfalfa Hay	1,581	1,000 tons	1,782	$67.00/ton	+ 13,467,000
Other Hay	817	1,000 tons	1,008	$60.00/ton	+ 11,436,000
Cattle/Calves Inventory	1,536	1,000 head	1,580	$770.00/head	+ 33,880,000
TOTAL					+$57,886,224

Table 4.15: 2000 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2000 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	4,080	$2.70/bu	- 5,262,300
Spring Wheat	648	1,000 bu.	232	$2.70/bu	- 1,124,280
Barley	8,383	1,000 bu.	7,885	$3.08/bu	- 1,533,840
Oats	1,648	1,000 bu.	1,156	$1.55/bu	- 252,650
Dry Bean	691	1,000 cwt.	762	$16.80/cwt	+ 1,196,160
Sugar Beet	1,150	1,000 tons	1,556	$32.50/ton	+ 195,000
Corn	6,328	1,000 bu.	7,656	$2.02/bu	+ 2,682,560
Alfalfa Hay	1,581	1,000 tons	1,449	$85.00/ton	- 11,220,000
Other Hay	817	1,000 tons	650	$80.00/ton	- 13,392,000
Cattle/Calves Inventory	1,536	1,000 head	1,550	$780.00/head	+$10,920,000
TOTAL					-$17,791,350

Table 4.16: 2001 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2001 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	2,880	$2.70/bu	- 8,502,300
Spring Wheat	648	1,000 bu.	168	$2.90/bu	- 1,393,160
Barley	8383	1,000 bu.	6,970	$3.32/bu	- 4,691,160
Oats	1,648	1,000 bu.	1,344	$1.65/bu	- 501,600
Dry Bean	691	1,000 cwt.	514	$23.00/cwt	- 4,066,400
Sugar Beet	1,150	1,000 tons	794	$39.70/ton	- 14,133,200
Corn	6,328	1,000 bu.	6,375	$2.30/bu	+ 108,100
Alfalfa Hay	1,581	1,000 tons	1,276	$110.00/ton	- 33,550,000
Other Hay	817	1,000 tons	605	$105.00/ton	- 22,302,000
Cattle/Calves Inventory	1,536	1,000 head	1,470	$780.00/head	- 51,480,000
TOTAL					-$140,511,720

Table 4.17: 2002 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2002 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	2,375	$3.70/bu	- $ 13,519,800
Spring Wheat	648	1,000 bu.	96	$3.90/bu	- $ 2,154,360
Barley	8,383	1,000 bu.	4,680	$3.23/bu	- $ 11,960,690
Oats	1,648	1,000 bu.	750	$2.20/bu	- $ 1,975,600
Dry Bean	691	1,000 cwt.	624	$18.30/cwt	- $ 1,222,440
Sugar Beet	1,150	1,000 tons	659	$42.30/ton	- $ 20,769,300
Corn	6,328	1,000 bu.	4,165	$2.60/bu	- $ 5,623,800
Alfalfa Hay	1,581	1,000 tons	1,150	$111.00/ton	- $ 47,841,000
Other Hay	817	1,000 tons	450	$106.00/ton	- $ 38,944,400
Cattle/Calves Inventory	1,536	1,000 head	1,320	$760.00/head	- $164,160,000
TOTAL					-$308,171,390

Table 4.18: 2003 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2003 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	3,915	$3.40/bu	-$7,187,600
Spring Wheat	648	1,000 bu.	180	$3.15/bu	-$1,474,200
Barley	8,383	1,000 bu.	6,975	$3.46/bu	-$4,871,680
Oats	1,648	1,000 bu.	1,104	$1.80/bu	-$979,200
Dry Bean	691	1,000 cwt.	645	$17.40/cwt	-$800,400
Sugar Beet	1,150	1,000 tons	752	$41.20/ton	-$16,397,600
Corn	6,328	1,000 bu.	6,450	$2.50/bu	$305,000
Alfalfa Hay	1,581	1,000 tons	1,625	$80.00/ton	$3,520,000
Other Hay	817	1,000 tons	770	$73.00/ton	-$3,431,000
Cattle/Calves Inventory	1,536	1,000 head	1,350	$890.00/head	-$165,540,000
TOTAL					-$196,856,680

Table 4.19: 2004 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2004 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	3,510	$3.20/bu	-$8,060,800
Spring Wheat	648	1,000 bu.	240	$3.25/bu	-$1,326,000
Barley	8,383	1,000 bu.	7,050	$3.41/bu	-$4,545,530
Oats	1,648	1,000 bu.	795	$1.55/bu	-$1,322,150
Dry Bean	691	1,000 cwt.	541	$25.90/cwt	-$3,885,000
Sugar Beet	1,150	1,000 tons	812	$41.70/ton	-$14,094,600
Corn	6,328	1,000 bu.	6,550	$2.48/bu	$550,560
Alfalfa Hay	1,581	1,000 tons	1,305	$74.50/ton	-$20,562,000
Other Hay	817	1,000 tons	756	$69.50/ton	-$4,239,500
Cattle/Calves Inventory	1,536	1,000 head	1,300	$1,020.00/head	-$240,720,000
TOTAL					-$298,205,020

Table 4.20: 2005 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2005 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	4,350	$3.50/bu	-$5,876,500
Spring Wheat	648	1,000 bu.	315	$3.19/bu	-$1,062,270
Barley	8,383	1,000 bu.	5,580	$3.28/bu	-$9,193,840
Oats	1,648	1,000 bu.	600	$1.60/bu	-$1,676,800
Dry Bean	691	1,000 cwt.	776	$18.70/cwt	$1,589,500
Sugar Beet	1,150	1,000 tons	801	$42.80/ton	-$14,937,200
Corn	6,328	1,000 bu.	6,860	$2.45/bu	$1,303,400
Alfalfa Hay	1,581	1,000 tons	1,560	$75.00/ton	-$1,575,000
Other Hay	817	1,000 tons	756	$72.00/ton	-$4,392,000
Cattle/Calves Inventory	1,536	1,000 head	1,400	$1,140.00/head	-$155,040,000
TOTAL					-$190,860,710

Table 4.21: 2006 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2006 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	36,45	$4.58/bu	-$10,918,720
Spring Wheat	648	1,000 bu.	234	$3.80/bu	-$1,573,200
Barley	8,383	1,000 bu.	4,845	$3.32/bu	-$11,746,160
Oats	1,648	1,000 bu.	684	$2.15/bu	-$2,072,600
Dry Bean	691	1,000 cwt.	590	$22.00/cwt	-$2,222,000
Sugar Beet	1,150	1,000 tons	798	$46.80/ton	-$16,473,600
Corn	6,328	1,000 bu.	5,805	$2.64/bu	-$1,380,720
Alfalfa Hay	1,581	1,000 tons	1,400	$101.00/ton	-$18,281,000
Other Hay	817	1,000 tons	715	$103.00/ton	-$10,506,000
Cattle/Calves Inventory	1,536	1,000 head	1,400	$1,010.00/head	-$137,360,000
TOTAL					-$212,534,000

Table 4.22: Production and Inventory Value Impact for Worst Year of Drought

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	Worst Yearly Production of Drought	Year	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6,029	1,000 bu.	2,375	2002	$3.70/bu	-$13,519,800
Spring Wheat	648	1,000 bu.	96	2002	$3.90/bu	-$2,152,800
Barley	8,383	1,000 bu.	4,505	2007	$3.62/bu	-$14,038,360
Oats	1,648	1,000 bu.	376	2007	$2.82/bu	-$3,587,040
Dry Bean	691	1,000 cwt.	514	2001	$23.00/cwt	-$4,071,000
Sugar Beet	1,150	1,000 tons	658	2007	$40.20/ton	-$19,778,400
Corn	6,328	1,000 bu.	4,165	2002	$2.60/bu	-$5,623,800
Alfalfa Hay	1,581	1,000 tons	1,150	2002	$111.00/ton	-$47,841,000
Other Hay	817	1,000 tons	450	2002	$106.00/ton	-$38,902,000
Cattle/Calves Inventory	1,536	1,000 head	1,300	2004	$1,020/head	-$240,720,000
TOTAL						-$390,234,200

Table 4.23 Converse County Economic Impact from Drought

	Size (Sq Mi)	Ratio	Negative Dollar Impact (2002)	Total Drought impact 1999-2004
Wyoming	97,818		$308,171,390	$903,649,936
Converse	4,265	4.4%	$13,559,541	$39,760,597

Additionally, drought can exacerbate the risk of wildfires; increase the cost of municipal water usage; and deplete water resources used for recreation, affecting the local economy.

Vulnerability Assessment

The vulnerability of the people, buildings, and economy of Converse County to drought is very difficult to quantify. Typically, people and structures are not directly vulnerable to drought, though secondary or indirect impacts may eventually increase vulnerability ratings. However, some areas are more vulnerable overall than others and, therefore, benefit from adequate mitigation planning and implementation. For Converse County, the agricultural sector is the most vulnerable to drought and will benefit the most from mitigation efforts. Economic resources tied to agricultural production are extremely vulnerable to drought. Outdoor recreation, which is important to Converse County's economy, is also vulnerable to drought. Fishing, hunting, snowmobiling and skiing are some of the activities that could be affected by drought. The geographic extent of the hazard is considered extensive. The probability of future occurrences is considered **likely**, and the potential magnitude/severity is **critical**. In addition, the HMPC considers the hazard to have an overall impact rating of **high** for the County.

Future Development

Future development in Converse County is not anticipated to change vulnerability to drought significantly.

Summary

Drought is considered a high significance hazard for Converse County due to the potential for extensive economic and environmental impacts. Drought can be widespread and pervasive for several years.

Table 4.24: Drought Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Douglas	Extensive	Critical	Likely	High
Glenrock	Extensive	Critical	Likely	High
Rolling Hills	Extensive	Critical	Likely	High
Lost Springs	Extensive	Critical	Likely	High
Converse County	Extensive	Critical	Likely	High

4.3.3 Earthquake

Hazard Description

An earthquake is generally defined as a sudden motion or trembling in the Earth caused by the abrupt release of strain accumulated within or along the edge of the earth's tectonic plates. The most common types of earthquakes are caused by movements along faults and by volcanic forces, although they can also result from explosions, cavern collapse, and other minor causes not related to slowly accumulated strains.

The amount of energy released during an earthquake is usually expressed as a Moment magnitude (which succeeds the Richter magnitude) and is measured directly from the earthquake as recorded on seismographs. Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface as felt by humans or resulting damage to structures and defined in the Modified Mercalli scale (see Table 4.25). Seismic shaking is typically the greatest cause of losses to structures during earthquakes.

Table 4.25: Modified Mercalli Intensity (MMI) Scale

MMI	Felt Intensity	Acceleration (%g) (PGA)
I	Not felt except by a very few people under special conditions. Detected mostly by instruments.	<0.17
II	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.	0.17 – 1.4
III	Felt noticeably indoors. Standing automobiles may rock slightly.	0.17 – 1.4
IV	Felt by many people indoors, by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.	1.4 – 3.9
V	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned.	3.9 – 9.2
VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.	9.2 – 18
VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction.	18 – 34
VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, great in poorly built structures. Heavy furniture is overturned.	34 – 65
IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.	65 – 124
X	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Considerable landslides occur on steep slopes.	>124
XI	Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.	>124
XII	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.	>124

Source: USGS. http://earthquake.usgs.gov/learn/topics/mercalli.php; Modified Mercalli Intensity and peak ground acceleration (PGA) (Wald, et al 1999).

Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, communication, and transportation lines. Other damaging effects of earthquakes include surface rupture, fissuring, ground settlement, and permanent horizontal and vertical shifting of the ground. Secondary impacts can include landslides, seiches, liquefaction, fires, and dam failure. The combination of widespread primary and secondary effects from large earthquakes make this hazard potentially devastating.

Part of what makes earthquakes so destructive is that they generally occur without warning. The main shock of an earthquake can usually be measured in seconds, and rarely lasts for more than a minute. Aftershocks can occur within the days, weeks, and even months following a major earthquake.

By studying the geologic characteristics of faults, geoscientists can often determine when the fault last moved and estimate the magnitude of the earthquake that produced the last movement. Because the occurrence of earthquakes is relatively infrequent in Converse County and the historical earthquake record is short, accurate estimations of magnitude, timing, or location of future dangerous earthquakes in the County are difficult to estimate.

Liquefaction

During an earthquake, near surface (within 30 feet), relatively young (less than 10,000 years old), water-saturated sands and silts may act as a viscous fluid. This event is known as liquefaction (quicksand is a result of liquefaction). Liquefaction occurs when water-saturated materials are exposed to seismic waves. These seismic waves may compact the material (i.e. silts and sands), increasing the interior pore water pressure within the material mass.

When the pore pressure rises to about the pressure of the weight of the overlying materials, liquefaction occurs. If the liquefaction occurs near the surface, the soil bearing strength for buildings, roads, and other structures may be lost. Buildings can tip on their side, or in some cases sink. Roads can shift and become unstable to drive on. If the liquefied zone is buried beneath more competent material, cracks may form in the overlying material, and the water and sand from the liquefied zone can eject through the cracks as slurry.

Geographical Area Affected

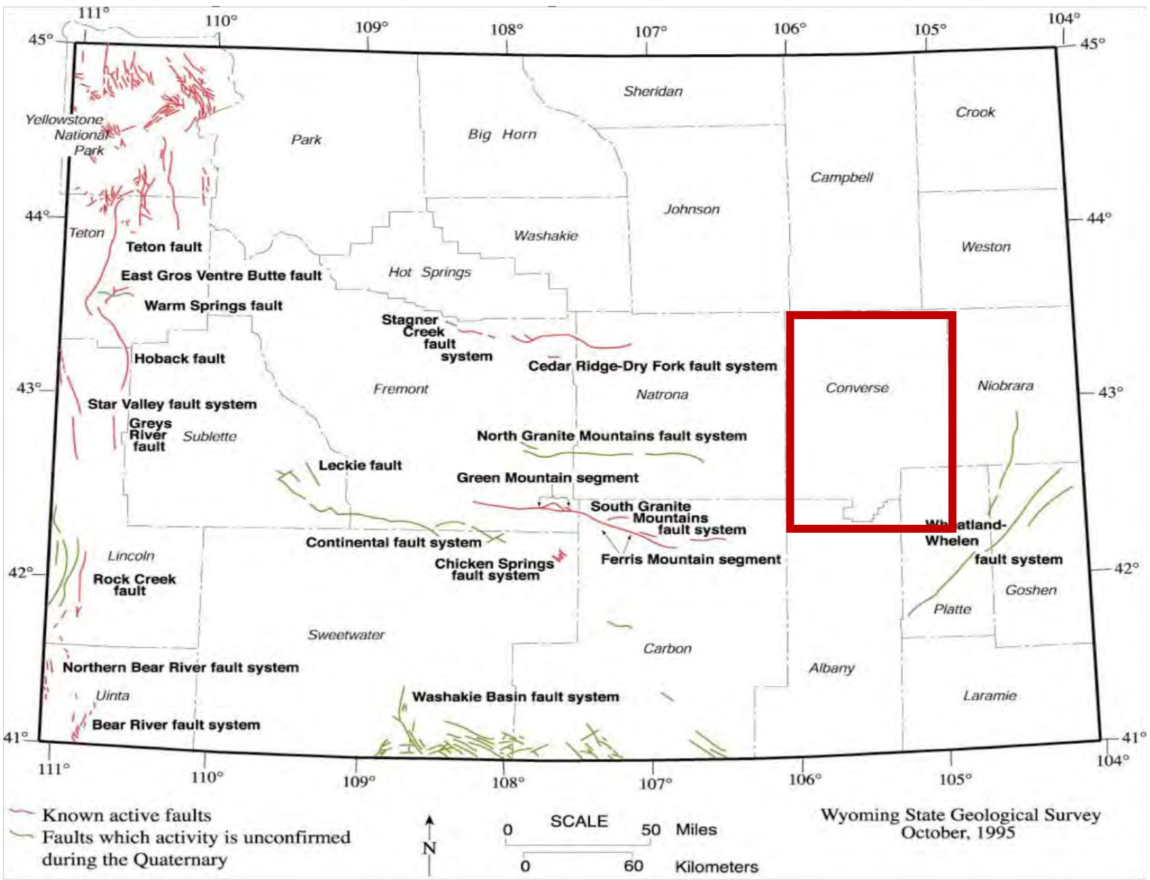
Most Wyoming earthquakes outside of Yellowstone National Park occur as a result of movement on faults. If the fault has moved within the Quaternary geological period, or last 1.6 million years, the fault is considered to be active. Active faults can be exposed at the surface or deeply buried with no significant surface expression. Historically, no earthquakes in Wyoming have been associated with exposed active faults. The exposed active faults, however, have the potential to generate the largest earthquakes. As a result, it is necessary to understand both exposed and buried active faults to generate a realistic seismological characterization of the state.

There are approximately 80 Quaternary faults mapped in Wyoming, with 26 considered active (Source: www.wsgs.wyo.gov). In central Wyoming, the Stagner Creek fault system and the South Granite Mountain fault system are both considered potentially active and capable of generating magnitude 6.5 to 6.75 earthquakes.

There are no known active fault systems located within the boundaries of Converse County. However, there are a few significant faults in the surrounding counties. A fault system called the Cedar Ridge/Dry Fork fault system is present in the northwestern corner of Natrona County. The 35-mile long Cedar Ridge fault comprises the western portion of the fault system, and the 15-mile long Dry Fork fault makes up the eastern portion.

There is also no compelling reason to believe that the Cedar Ridge fault system is active. Based upon its fault rupture length of 35 miles, however, if the fault did activate it could potentially generate a maximum magnitude 7.1 earthquake (Wong et al., 2001). Although there is no compelling reason to believe that the Dry Fork fault system is active, if it did activate as an isolated system, it could potentially generate a magnitude 6.7 earthquake. This is based upon a postulated fault rupture length of 15 miles (Wong et al., 2001).

Figure 4-5: Exposed Known or Suspected Active Faults in Wyoming

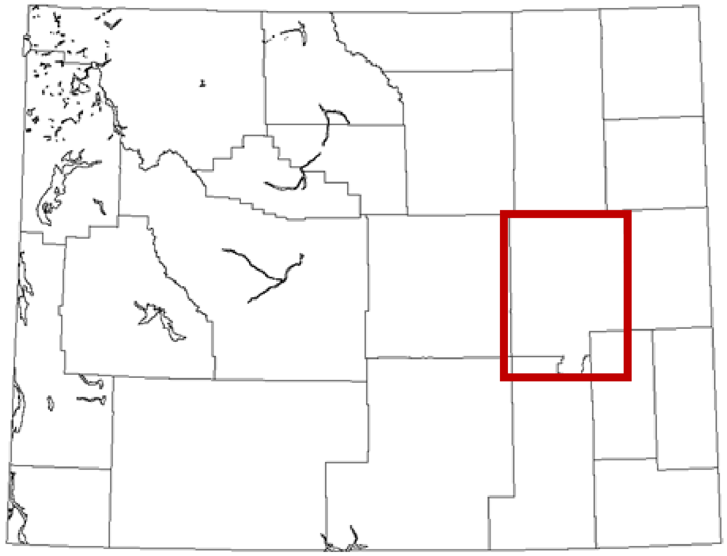


Source: Wyoming Geological Survey

The Wyoming Multi-Hazard Mitigation plan estimates that an earthquake of 6.5 magnitude is possible anywhere in the state.

Figure 4-6 shows areas in Wyoming that could experience liquefaction during an intense earthquake. Areas shown have sands and coarse silts that are less than 10,000 years in age and are within 30 feet of the surface. None of these areas are identified in Converse County.

Figure 4-6: Wyoming Liquefaction Coverage



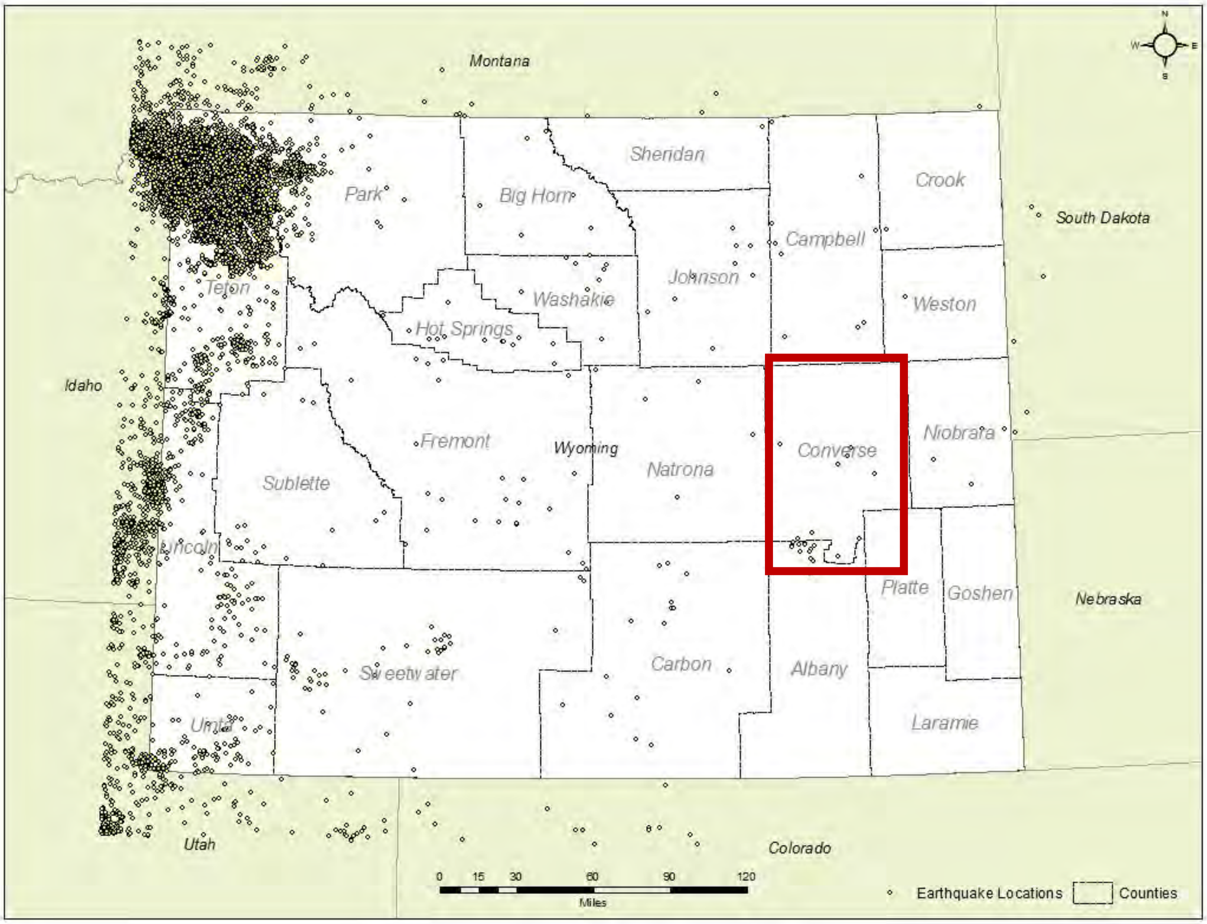
Converse County outlined in red
Source: Wyoming Geological Survey

Past Occurrences

Prior to the 1950s, most earthquakes were detected and located by personal reports. After the Hebgen Lake earthquake in 1959 near Yellowstone Park, monitoring in Wyoming started to improve and earthquakes were more commonly located by seismometers.

Since 1871, the state has logged some 47,000 earthquakes, with most of the events taking place in the western third of the state (see Figure 4-7). Of these historic earthquakes, most occurrences in Converse County were concentrated in the southern portion of the county, around the Albany County border.

Figure 4-7: Wyoming Historic Earthquake Occurrences Statewide Since 1963- 2010



Source: Wyoming Geological Survey - Wyoming Earthquake Hazard and Risk Analysis: HAZUS-MH Loss Estimations for 16 Earthquake Scenarios Report

Historically, earthquakes have occurred in every county in Wyoming. The first was reported in Yellowstone National Park in 1871. Even if the epicenter of an earthquake is not located within Converse County, the effects of the earthquake may still be felt in the County. According to the Wyoming State Geological Survey, there are no known active or suspected active faults in Converse County. However, there have been multiple earthquakes with magnitudes greater than 3.0 recorded in or near Converse County. The most recent event was a 3.8 earthquake on August 29, 2004 with the epicenter approximately 11 miles northwest of Douglas. There was no reported damage, but the earthquake was felt throughout the city and even on nearby highways. Members from the HMPC commented on this event, remarking that this quake occurred in the middle of vacant land and there was no damage reported because there weren't any structures or infrastructure near the epicenter.

Table 4.26 presents a more comprehensive list of Converse County's Earthquake history. The data is derived from the Wyoming State Geological Survey report titled "Basic Seismological

Characterization for Converse County, Wyoming" in September of 2002. The document includes a history of magnitude 3.0 or greater earthquakes recorded in Converse County. Many of the earthquakes noted above have originated in the Laramie mountain range in southern Converse County and northern Albany County.

Table 4.26: Historic Earthquake Occurrences in Converse County

Date	Location	Magnitude/Intensity	Comments
April 14, 1947	LaPrele Creek, southwest of Douglas	Intensity V	The earthquake was felt by everyone in a ranch house and by a few outdoors. Windows were rattled, chairs were moved, and buildings shook
April 21, 1952	7 miles north-northeast of Esterbrook	Intensity IV	Felt by several people in the area and was reportedly felt 40 miles to the southwest of Esterbrook
September 2, 1952	7 miles north-northeast of Esterbrook	N/A	Small magnitude event; no damage reported
January 5, 1957	7 miles north-northeast of Esterbrook	Intensity III	No damage reported
March 31, 1964	7 miles north-northeast of Esterbrook	Intensity IV	No damage reported
November 15, 1983	15 miles northeast of Casper in western Converse County	Magnitude 3.0, Intensity III	No damage reported
October 18, 1984	4 miles west of Toltec in norther Albany County. 21 miles south of Esterbrook	Magnitude 5.5	Felt in Wyoming, South Dakota, Nebraska, Colorado, Utah, Montana, and Kansas. It cracked buildings and shook items from shelves in grocery stores in Douglas.
December 5, 1984	Laramie Range in southern Converse County	Magnitude 2.9	No damage reported
June 30, 1993	15 miles north of Douglas	Magnitude 3.0	No damage reported
July 23, 1993	Southern Converse County; 13 miles north-northwest of Tolec in northern Albany County	Magnitude 3.7, Intensity IV	The event was felt as far away as Laramie
December 13, 1993	8 miles east of Toltec	Magnitude 3.5	No damage reported
October 19, 1996	15 miles northeast of Casper in western Converse County	Magnitude 4.2	No damage reported

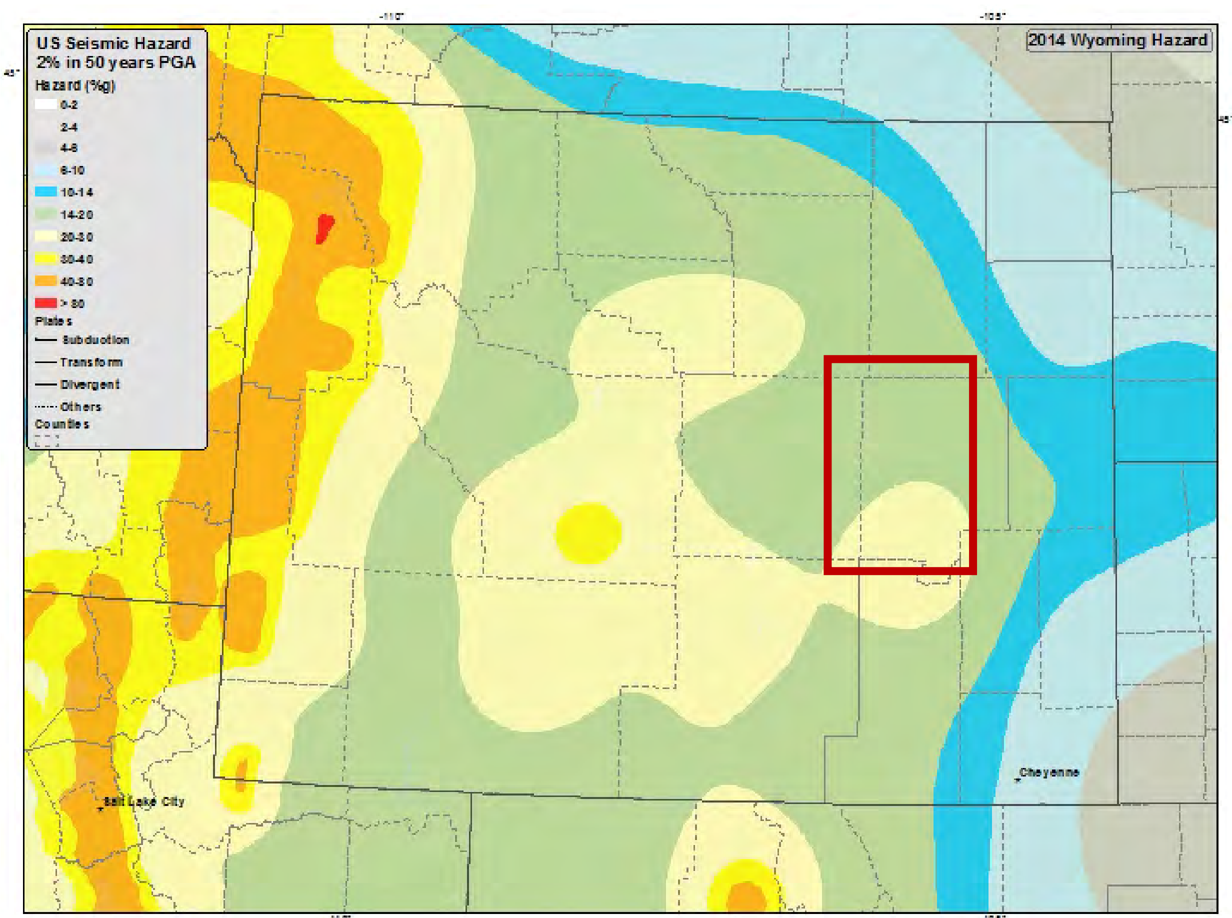
Source: Wyoming State Geological Survey

Frequency/Likelihood of Future Occurrence

Based on past occurrences the region is likely to experience one magnitude 2.5 or greater earthquake approximately every ten to fifteen years; based on past occurrences, the earthquakes are likely to cause little to no damage. To determine the likelihood of damaging earthquakes the

U.S. Geological Survey (USGS) publishes probabilistic acceleration maps for 500-, 1000-, and 2,500-year time frames. The maps show what accelerations may be met or exceeded in those time frames by expressing the probability that the accelerations will be met or exceeded in a shorter time frame. For example, a 10% probability that acceleration may be met or exceeded in 50 years is roughly equivalent to a 100% probability of exceedance in 500 years. The 2,500-year (2% probability of exceedance in 50 years) map is shown in the figure below. The International Building Code uses a 2,500-year map as the basis for building design. The maps reflect current perceptions on seismicity in Wyoming based on available science. In many areas of Wyoming, ground accelerations shown on the USGS maps can be increased further due to local soil conditions. For example, if fairly soft, saturated sediments are present at the surface, and seismic waves are passed through them, surface ground accelerations will usually be greater than would be experienced if only bedrock was present. In this case, the ground accelerations shown on the USGS maps would underestimate the local hazard, as they are based upon accelerations that would be expected if firm soil or rock were present at the surface.

Figure 4-8: 2500-year probabilistic acceleration map (2% probability of exceedance in 50 years) – Converse County Highlighted by Red Rectangle



As the historic record is limited, it is nearly impossible to determine when a 2,500-year event last occurred in the county. Because of the uncertainty involved, and based upon the fact that the new International Building Code utilizes 2,500-year events for building design, it is suggested that the 2,500-year probabilistic maps be used for regional and county analyses. This conservative approach is in the interest of public safety.

Potential Magnitude

Limited damages have been documented in the County from historic earthquakes. Because of the limited historic record, however, it is possible to underestimate the seismic hazard in the County if historic earthquakes are used as the sole basis for analysis. Earthquake and ground motion probability maps give a more reasonable estimate of damage potential in areas with or without exposed active faults at the surface. USGS earthquake probability maps that are used in support of the modern building codes suggest a scenario that would result in moderate damage to buildings and their contents, with damage increasing from the northwest to the east.

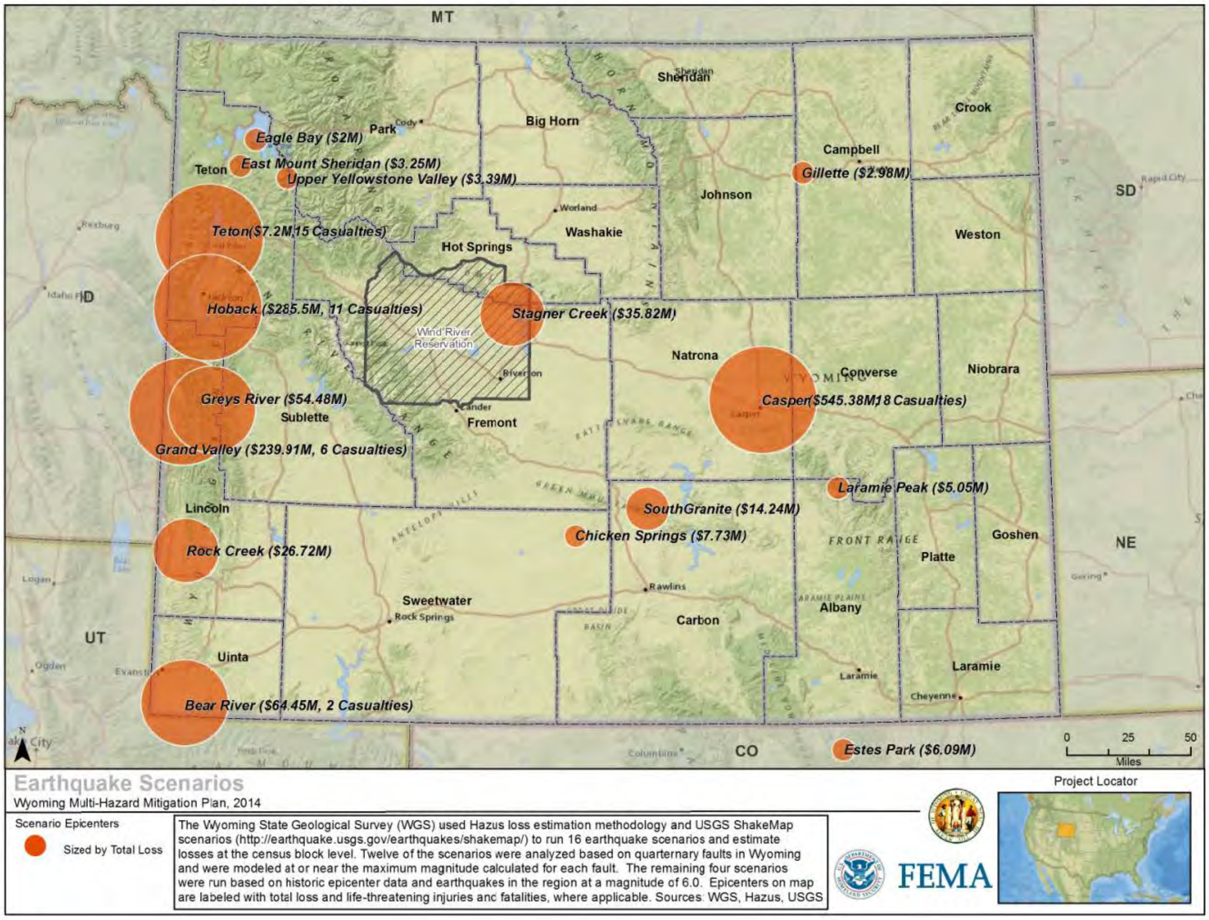
Vulnerability Assessment

HAZUS (Hazards U.S.) is a nationally standardized, GIS-based, risk assessment and loss estimation computer program that was originally designed in 1997 to provide the user with an estimate of the type, extent, and cost of damages and losses that may occur during and following an earthquake. It was developed for the FEMA by the National Institute of Building Sciences (NIBS). There have been many versions of HAZUS generated by FEMA, with HAZUS-MH (HAZUS - Multi-Hazard) being the most recent release.

The study included information regarding the likelihood of damage to local and regional infrastructure, including fire stations, police stations, sheriffs' departments, schools, and hospitals. The scenarios reflect anticipated functionality of each infrastructure system immediately following the scenario earthquake, on day seven following the earthquake and one month after the earthquake. Additional information provided includes anticipated households displaced or seeking temporary shelter, electrical outages anticipated, number of households without potable water, debris generated by the scenario and economic losses resulting from three categories: buildings, transportation and utilities.

The following figure shows epicenter locations of the scenarios, sized by total loss. Epicenters on map are labeled with total loss and if applicable, life-threatening injuries and fatalities.

Figure 4-9: HAZUS-MH Earthquake Scenarios for Wyoming, 2011



Source: Wyoming Multi-Hazard Mitigation Plan, 2014

Probabilistic Scenario

A 2,500-year probabilistic HAZUS earthquake scenario was performed as part of this mitigation plan development and the results can be referenced below in. This scenario considers worst-case ground shaking from a variety of seismic sources. The following table lists total loss, loss ratio (total loss/total building inventory value), and ranges of casualties within severity levels. HAZUS provides casualty estimates for 2 a.m., 2 p.m., and 5 p.m. to represent periods of the day that different sectors of the community are at their peak occupancy loads. The casualty ranges represent the lowest to highest casualties within these times of day. Casualty severity levels are described as follows:

- Level 1: Injuries will require medical attention but hospitalization is not needed
- Level 2: Injuries will require hospitalization but are not considered life-threatening

- Level 3: Injuries will require hospitalization and can become life-threatening if not promptly treated
- Level 4: Victims are killed by the earthquake

Table 4.27: HAZUS-MH Earthquake Loss Estimation 2,500-Year Scenario Results

Type of Impact	Impacts to County
Total Buildings Damaged	Slight: 1,268 Moderate: 725 Extensive: 156 Complete: 12
Building and Income Related Losses	$70.98M 60% of damage related to residential structures 19% of loss due to business interruption
Total Economic Losses (includes building, income and lifeline losses)	$89.71M
Casualties (based on 2 a.m. time of occurrence)	Without requiring hospitalization: 8 Requiring hospitalization: 1 Life threatening: 0 Fatalities: 0
Casualties (based on 2 p.m. time of occurrence)	Without requiring hospitalization: 14 Requiring hospitalization: 2 Life threatening: 0 Fatalities: 1
Casualties (based on 5 p.m. time of occurrence)	Without requiring hospitalization: 10 Requiring hospitalization: 2 Life threatening: 0 Fatalities: 0
Damage to Transportation and Utility Systems and Essential Facilities	Some damage to utility pipeline systems, 1 Hospital, 14 Schools, 4 Police Stations, and 3 Fire Stations all damaged with >50% functionality on day 1
Displaced Households	30
Shelter Requirements	17

Source: Hazus-MH 4.0

The total damage figure by itself does not reflect the percentage of building damage, since small damage to many valuable buildings may result in a higher total damage figure than may be found in a county with fewer, less expensive buildings, with a higher percentage of damage.

Liquefaction Vulnerability

There have been little, if any, reported damages from liquefaction in Wyoming. Given that ground motions associated with Intensity VIII or larger are usually needed to trigger liquefaction, and that only small areas of the region would experience that level of shaking during the 2% event (2% probability of exceedance in 50 years), liquefaction would be a rare occurrence in the County. The 2016 Wyoming State Hazard Mitigation Plan notes that Converse County has $0 in exposure to liquefaction.

Future Development

Future development in the county is not anticipated to significantly affect vulnerability to earthquakes, but will result in a slight increase in exposure of the population and building stock

Summary

Converse County is at moderate risk due to the closer proximity of potentially active faults within and near the County and the history of having experienced one of the strongest earthquakes in central Wyoming. It is estimated that if a worst-case event occurred in Converse County, $268 million in combined capital stock and income losses could occur. Though the probability is low, WSGS studies indicate the possibility of a 6.5 magnitude could occur anywhere in the state.

Table 4.28: Earthquake Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Douglas	Significant	Critical	Occasional	Medium
Glenrock	Significant	Critical	Occasional	Medium
Rolling Hills	Significant	Critical	Occasional	Medium
Lost Springs	Significant	Critical	Occasional	Medium
Converse County	Significant	Critical	Occasional	Medium

4.3.4 Expansive Soils

Hazard Description

Soils and swelling bedrock contain clay which causes the material to increase in volume when exposed to moisture and shrink as it dries. They are also commonly known as expansive, shrinking and swelling, bentonitic, heaving, or unstable soils and bedrock. In general, the term refers to both soil and bedrock contents although the occurrence of the two materials may occur concurrently or separately. The difference between the materials is that swelling soil contains clay, while swelling bedrock contains claystone.[3]

The clay materials in swelling soils are capable of absorbing great quantities of water and expanding 10 percent or more as the clay becomes wet. The force of expansion is capable of exerting pressures of 15,000 pounds per square foot or greater on foundations, slabs, and other confining structures.[4] The amount of swelling (or potential volume of expansion) is linked to five main factors: the type of mineral content, the concentration of swelling clay, the density of the materials, moisture changes in the environment, and the restraining pressure exerted by materials

[3] Colorado Geological Survey Department of Natural Resources, *A Guide to Swelling Soils for Colorado Homebuyers and Homeowners*. (Denver, Colorado.) 1997. p 15-16.
[4] Ibid., p 17.

on top of the swelling soil. Each of these factors impact how much swelling an area will experience, but may be modified, for better or worse, by development actions in the area.

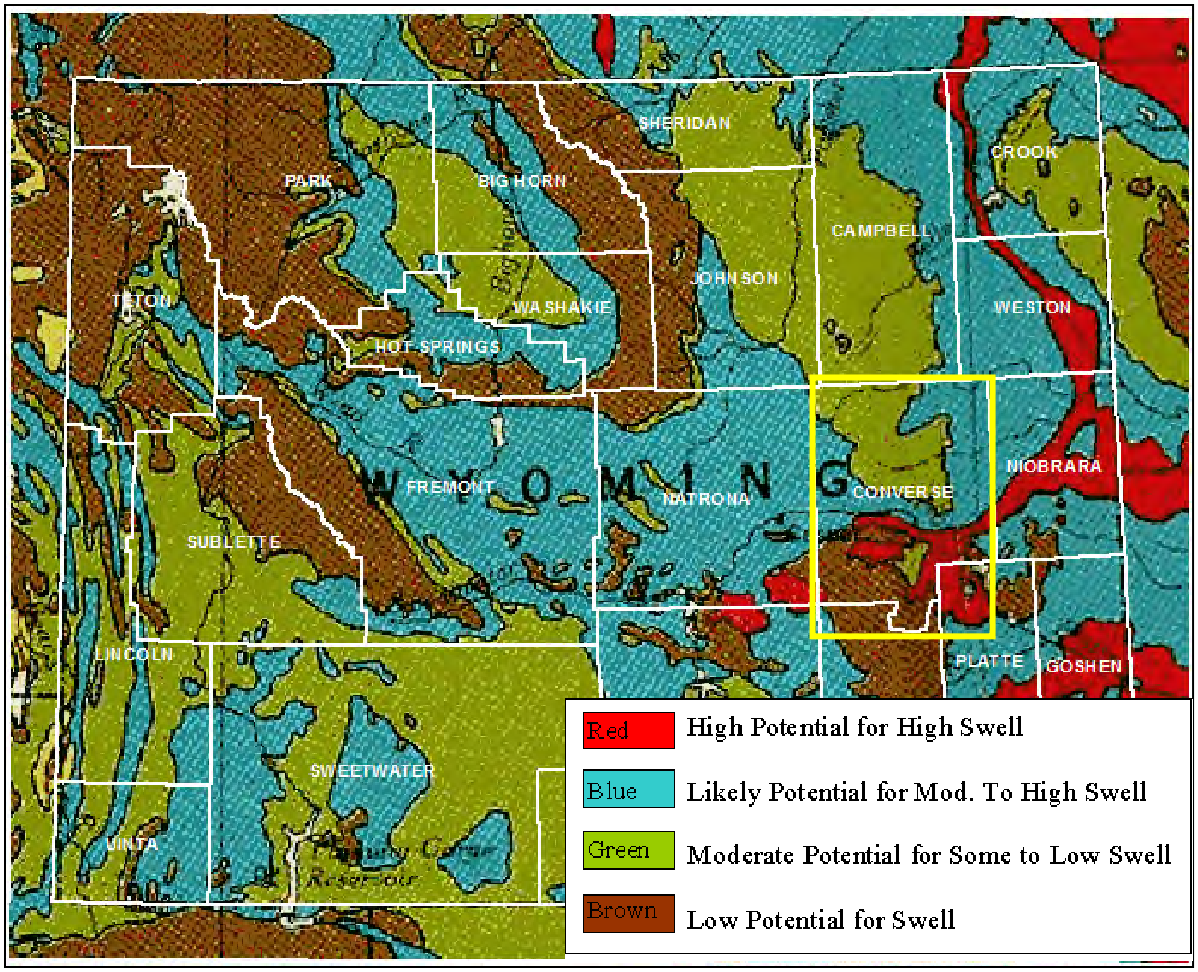
- **Low**—this soils class includes sands and silts with relatively low amounts of clay minerals. Sandy clays may also have low expansion potential, if the clay is kaolinite. Kaolinite is a common clay mineral.
- **Moderate**—this class includes silty clay and clay textured soils, if the clay is kaolinite, and includes heavy silts, light sandy clays, and silty clays with mixed clay minerals.
- **High**—this class includes clays and clay with mixed montmorillonite, a clay mineral which expands and contracts more than kaolinite.

Geographical Area Affected

Expansive soils are known to be present in Converse County. The figures below illustrate possible expansive soils locations in Wyoming. Figure 4-10 is based on select geologic formations from the Love and Christiansen 1985 Geologic Map of Wyoming. Most of land coverage in the county falls under the category of moderate potential for swelling, with a significant portion of land (primarily in the southern area) considered to be low potential for swelling. Areas of concern are located in the central/south-eastern County where a belt of high potential soil flows through the County from the north-east.

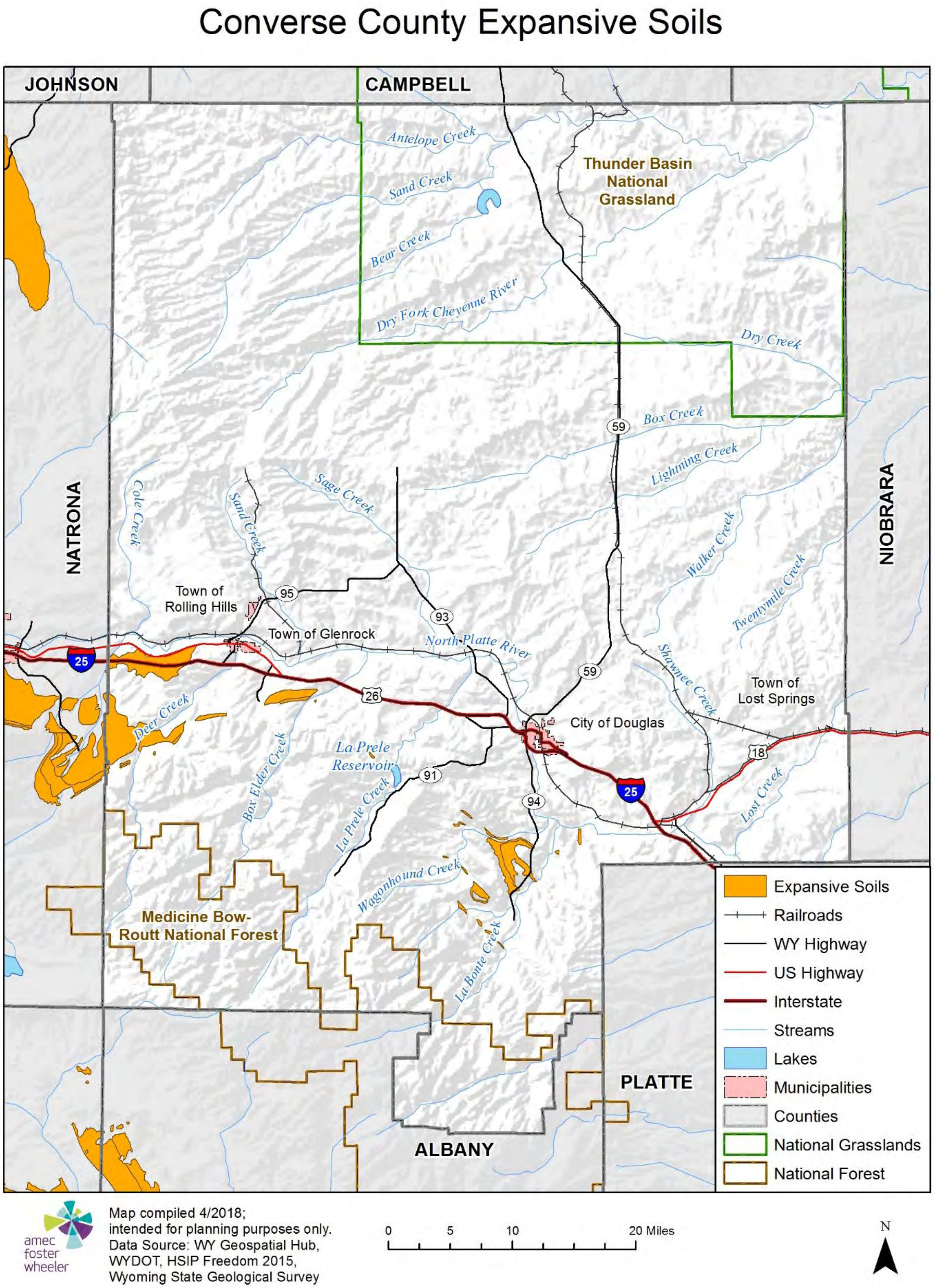
Figure 4-11 is based on data from the Wyoming State Geological Survey which displays much of Converse County at risk to expansive soils. Those formations selected have characteristics that could lead to expansive soils where they outcrop. Deposits of calcium montmorillonite can also contribute to swelling problems, but these areas have not been completely mapped. Based on the figures below, expansive soils are estimated to affect a **limited** portion of the planning area.

Figure 4-10: Expansive Soil Potential in Wyoming



Source: The map above is based upon "Swelling Clays Map of the Conterminous United States" by W. Olive, A. Chleborad, C. Frahme, J. Shlocker, R. Schneider and R. Schuster. It was published in 1989 as Map I-1940 in the USGS Miscellaneous Investigations Series. Land areas were assigned to map soil categories based upon the type of bedrock that exists beneath them as shown on a geologic map. In most areas, where soils are produced "in situ", this method of assignment was reasonable. However, some areas are underlain by soils which have been transported by wind, water or ice. The map soil categories would not apply for these locations.

Figure 4-11: Expansive Soil Potential in Wyoming



Past Occurrences

Very little data exists on expansive soil problems and damages in Wyoming. Studies on the issue have not been performed and no database exists to catalog occurrences. The 2016 State of Wyoming Multi-Hazard Mitigation Plan does not list specific events in Converse County.

Likelihood of Occurrence

Expansive soils will be a **likely** problem for the Converse County.

Potential Magnitude

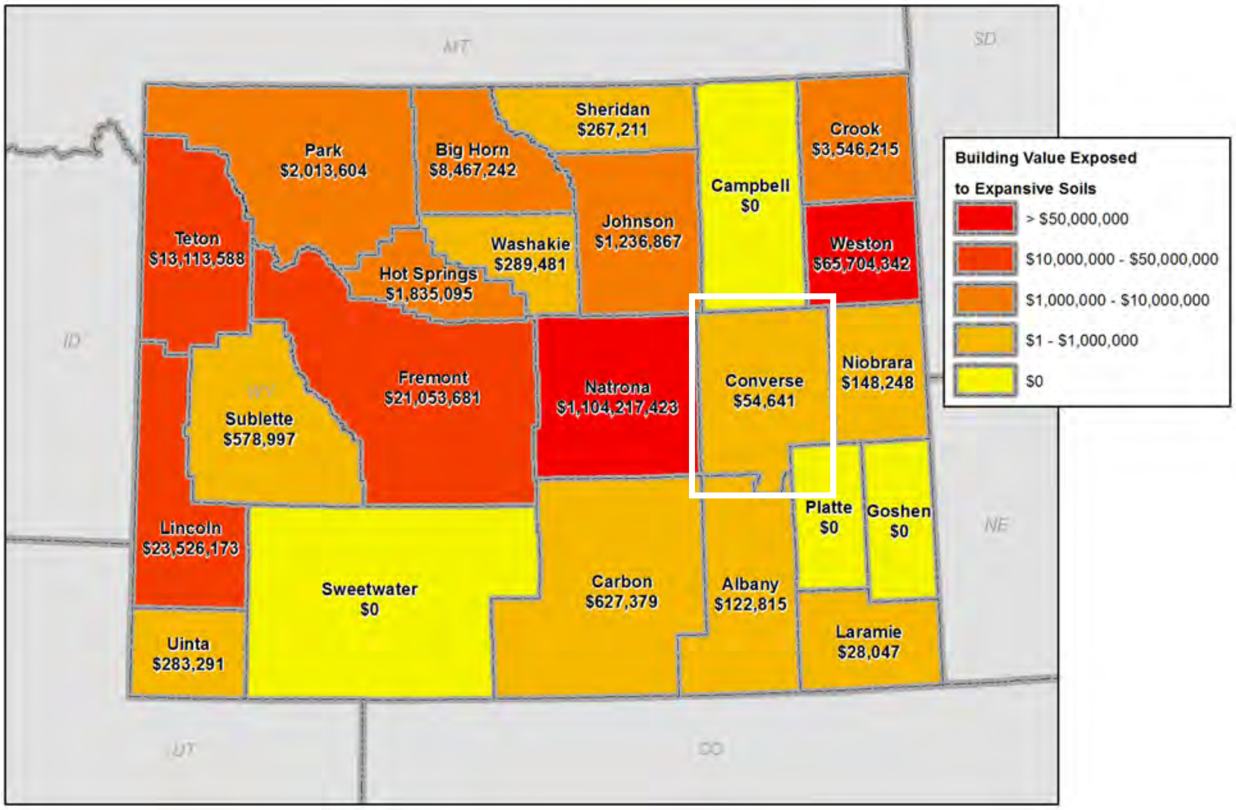
The potential magnitude of expansive soils events and damages is estimated to be **significant** in Converse County. No impacts related to expansive soils have been reported thus far. Because damages from expansive soils tend to happen over an extended period, it is difficult to estimate the potential severity of a problem. Many deposits of expansive soils do not inflict damage over large areas. Instead, these deposits can often create localized damage to individual structures and supply lines, such as roads, railways, bridges and power lines.

Vulnerability Assessment

According to the Wyoming State Multi-Hazard Mitigation Plan there are two measurements used for calculating future impacts: historic dollar damages and building exposure values. There are not enough current data to accurately estimate historic damages.

The Wyoming State Geological Survey (WSGS) calculated the building exposure values for buildings that may occur within the areas of expansive soils. All expansive soils mapped have been digitized and the expansive soil layer was then digitally crossed with the Census block building values. In the event of an expansive soil boundary dissecting a census block, the proportional value of the buildings in the census block will be assigned to the expansive soil. IN a case where a census block is within an expansive soil, the combined values of all the buildings in the census block are assigned. The values derived by county are shown in the map below. These damage estimates assume an instantaneous event, which would damage all the property of suspected expansive areas at one time. This scenario is extremely unlikely, meaning that the exposed damage estimates most likely are vastly overstated. It is far more likely that damage from these soils will be individual events, which will cause damage to a small number of buildings or road segments over time. Converse County has a moderately low value of exposed buildings, ranking 20th out of 23 Wyoming counties; four counties statewide have zero building exposure.

Figure 4-12: Wyoming Exposure to Shrinking/Swelling Soils by County



Source: State of Wyoming Multi-Hazard Mitigation Plan
White box denotes Converse County boundary

Summary

Overall, expansive soils are a medium significance hazard for the County.

Table 4.29: Expansive Soil Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Douglas	Limited	Limited	Likely	Low
Glenrock	Limited	Limited	Likely	Low
Rolling Hills	Limited	Limited	Likely	Low
Lost Springs	Limited	Limited	Likely	Low
Converse County	Limited	Limited	Likely	Low

4.3.5 Flood

Hazard Description

Floods can and have caused significant damage in Converse County. They have caused millions of dollars in damage in just a few hours or days. A flood, as defined by the National Flood Insurance Program, is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from: overflow of waters; unusual and rapid accumulation or runoff of surface waters from any source; or, a mudflow. Floods can be slow or fast rising, but generally develop over a period of many hours or days. Causes of flooding relevant to the County include:

- Rain in a general storm system
- Rain in a localized intense thunderstorm
- Melting snow
- Rain or melting snow
- Urban stormwater drainage
- Ice Jams
- Dam failure
- Levee Failure
- Rain on fire damaged watersheds

The area adjacent to a river channel is its floodplain. In its common usage, "floodplain" most often refers to that area that is inundated by the 100-year flood, the flood that has a 1 percent chance in any given year of being equaled or exceeded. The 100-year flood is the national standard to which communities regulate their floodplains through the National Flood Insurance Program.

Converse County is susceptible to multiple types of floods including riverine flooding, flash floods, slow rise floods, ice jams and possibly dam or levee failure.

Riverine flooding is defined as when a watercourse exceeds its "bank-full" capacity and is usually the most common type of flood event. Riverine flooding generally occurs because of prolonged rainfall, or rainfall that is combined with soils already saturated from previous rain events. Slow rise floods associated with snowmelt and sustained precipitation usually are preceded with adequate warning, though the event can last several days.

Floods can also occur with little or no warning and can reach full peak in only a few minutes. Such floods are called flash floods. A flash flood usually results from intense storms dropping large amounts of rain within a brief period. Flash floods, by their nature, occur very suddenly but usually dissipate within hours. Even flash floods are usually preceded with warning from the National Weather Service in terms of flash flood advisories, watches, and warnings.

Floods can occur for reasons other than precipitation or rapidly melting snow. They can also occur because of ice jams, which have occurred in Washakie and Big Horn Counties. An ice jam is a stationary accumulation of ice that restricts flow. Ice jams can cause considerable increases in upstream water levels, while at the same time downstream water levels may drop. Types of ice jams include freeze up jams, breakup jams, or combinations of both. These types of floods can be slow or fast rising, but generally develop over a period of many hours or days.

Levee failure can also cause a flash flood and is a risk in the planning area. A levee is an earthen embankment constructed along the banks of rivers, canals and coastlines to protect adjacent lands from flooding by reinforcing the banks. By confining the flow, levees can also increase the speed of the water. Levees can be natural or man-made. A natural levee is formed when sediment settles on the river bank, raising the level of the land around the river. To construct a man-made levee, workers pile dirt or concrete along the river banks, creating an embankment. This embankment is flat at the top, and slopes at an angle down to the water. For added strength, sandbags are sometimes placed over dirt embankments. Natural disasters such as Hurricane Katrina demonstrate that, although levees can provide strong flood protection, they are not failsafe. Levees can *reduce* the risk to individuals and structures behind them; but they do not eliminate risk entirely. Levees are designed to protect against a specific flood level; severe weather could create a higher flood level that the levee cannot withstand. Levees can fail by either overtopping or breaching. Overtopping occurs when floodwaters exceed the height of a levee and flow over its crown. As the water passes over the top, it may erode the levee, worsening the flooding and potentially causing an opening, or breach, in the levee. A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning. Unfortunately, in the rare occurrence when a levee system fails or is overtopped, severe flooding can occur due to increased elevation differences associated with levees and the increased water velocity that is created. It is also important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure. In 2011, Emergency Management Coordinator Lt. Stewart Anderson reported "crews had constructed a levee of sorts" on the North Platte River in preparation for flooding.

The potential for flooding can also change and increase through various land use changes and changes to land surface. A change in the built environment can create localized flooding problems inside and outside of natural floodplains by altering or confining watersheds or natural drainage channels. These changes are commonly created by human activities. Flooding in the communities in the County could be exacerbated by inadequate drainage and channel systems that would not stand up to the 1% annual chance flood. Inadequate culverts and drainage systems can cause flooded roads and flood adjacent properties.

Increased flooding can also be can also be created by other events such as wildfires. Wildfires create hydrophobic soils, a hardening or "glazing" of the earth's surface that prevents rainfall from being absorbed into the ground, thereby increasing runoff; erosion, and downstream sedimentation of channels.

Geographical Area Affected

All areas within the planning area have the potential for flooding. The extent of the flooding varies based on the location in the county. The North Platte River is the main source of flooding in Converse County, although many of its tributaries have the potential to flood as well. Converse County is located downstream of several reservoirs that dam the North Platte River, notably Seminoe and Pathfinder Reservoirs. According to a 2009 FEMA Flood Insurance Study, the primary cause of flooding in the North Platte River near Douglas is runoff from the drainage area below the reservoirs, particularly from drainages entering the North Platte from the south.

The North Platte River basin is located in the southeast corner of the state. The river flows north into Wyoming from Colorado. The Sweetwater River, one of the North Platte's major tributaries, flows in from the west. The North Platte River Basin covers roughly 22,000 square miles in Wyoming, about one quarter of the state. The headwaters flow from the mountains surrounding North Park, Colorado, as well as the Medicine Bow and Sierra Madre and other, minor ranges of southeast Wyoming.

Most of Converse County is situated within five watersheds: The Antelope in the northwest corner, the Dry Fork Cheyenne in the north-central region, the Lightning in the northeast, the Middle North Platte-Casper in the central/south east (including Rolling Hills and Glenrock), and the Glendo Reservoir Watershed in the central/south west (encompassing Douglas and Lost Springs) (EPA, 2011). The County has a relatively low population density (2.8 persons per square mile), which makes the danger to human health and life from flooding in the County quite low. The towns of Douglas and Glenrock, which lie along the North Platte River and its tributaries, account for most of the documented flood risk in the County.

Figure 4-12 shows the Converse County flood hazards, followed by Figure 4-14 through Figure 4-18, showing flood hazards by jurisdiction.

GIS analysis is based on the statewide layers for communities in Wyoming, and covers both the 1% and 0.2% annual Chance Flood Hazard zones. Moderate flood hazard areas, labeled Zone B or Zone X (shaded) are also shown on the FIRM, and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood. The areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood, are labeled Zone C or Zone X (unshaded).

The maps were generated primarily using FEMA NFIP data. However, FEMA flood data is not completely comprehensive, especially in the unincorporated areas of Converse County. Therefore, a HAZUS 1% annual chance flood model was used to determine the potential extent of flooding otherwise not depicted. When relevant, the maps differentiate the sources of the flood layer information.

An HMPC member from the City of Douglas supplied an additional GIS layer that suggests a variance in city boundary. The primary difference in extent is seen in the western area of the jurisdiction, as evident by the Douglas Boundary 2 in the figure below. Though this discrepancy is visually significant, the added area from the layer is either green space or other undeveloped land, and therefore it does not change parcel numbers or building count exposure results.

Figure 4-13: City of Douglas Boundary Variance

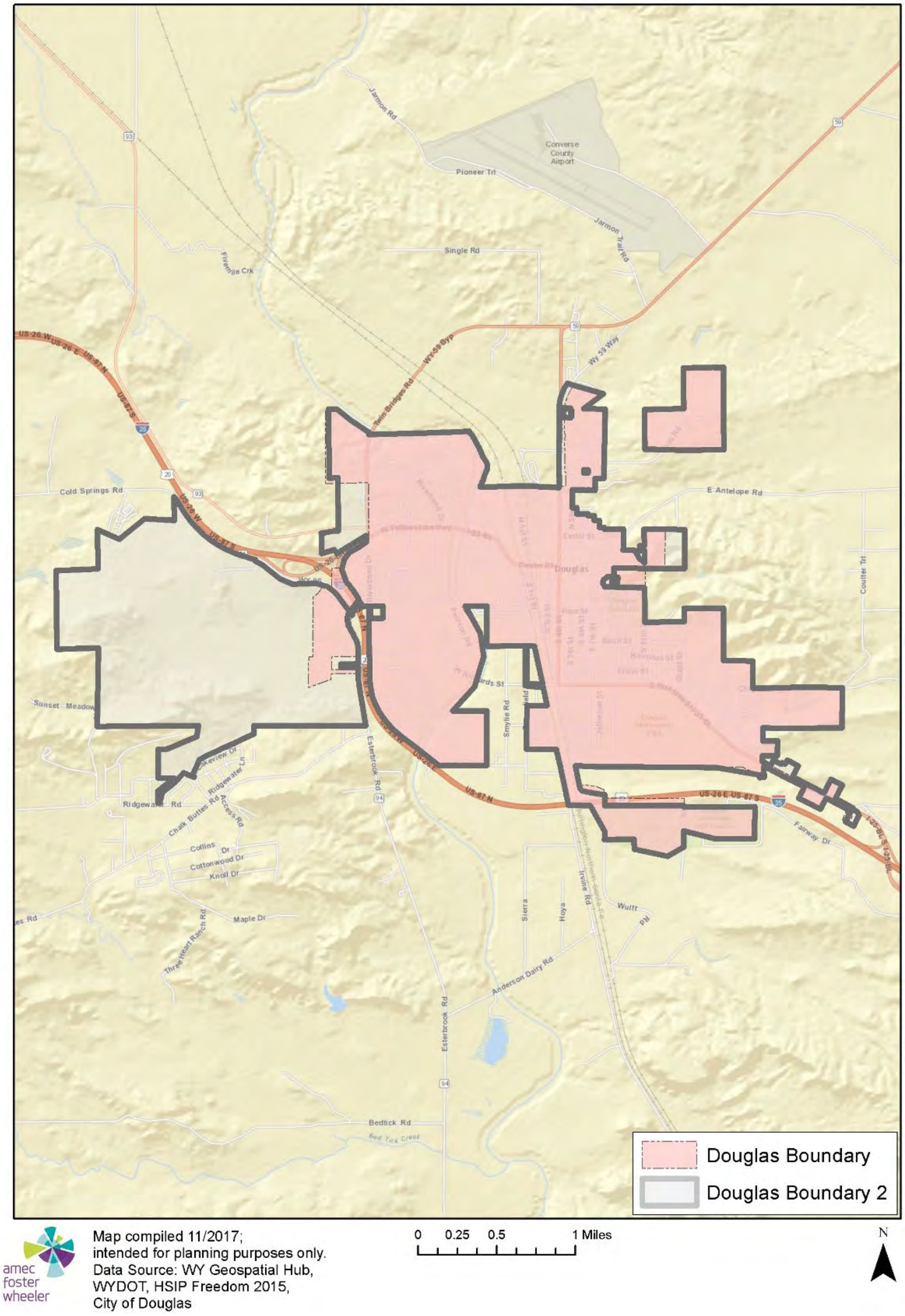


Figure 4-14: Converse County FEMA and HAZUS Flood Hazards

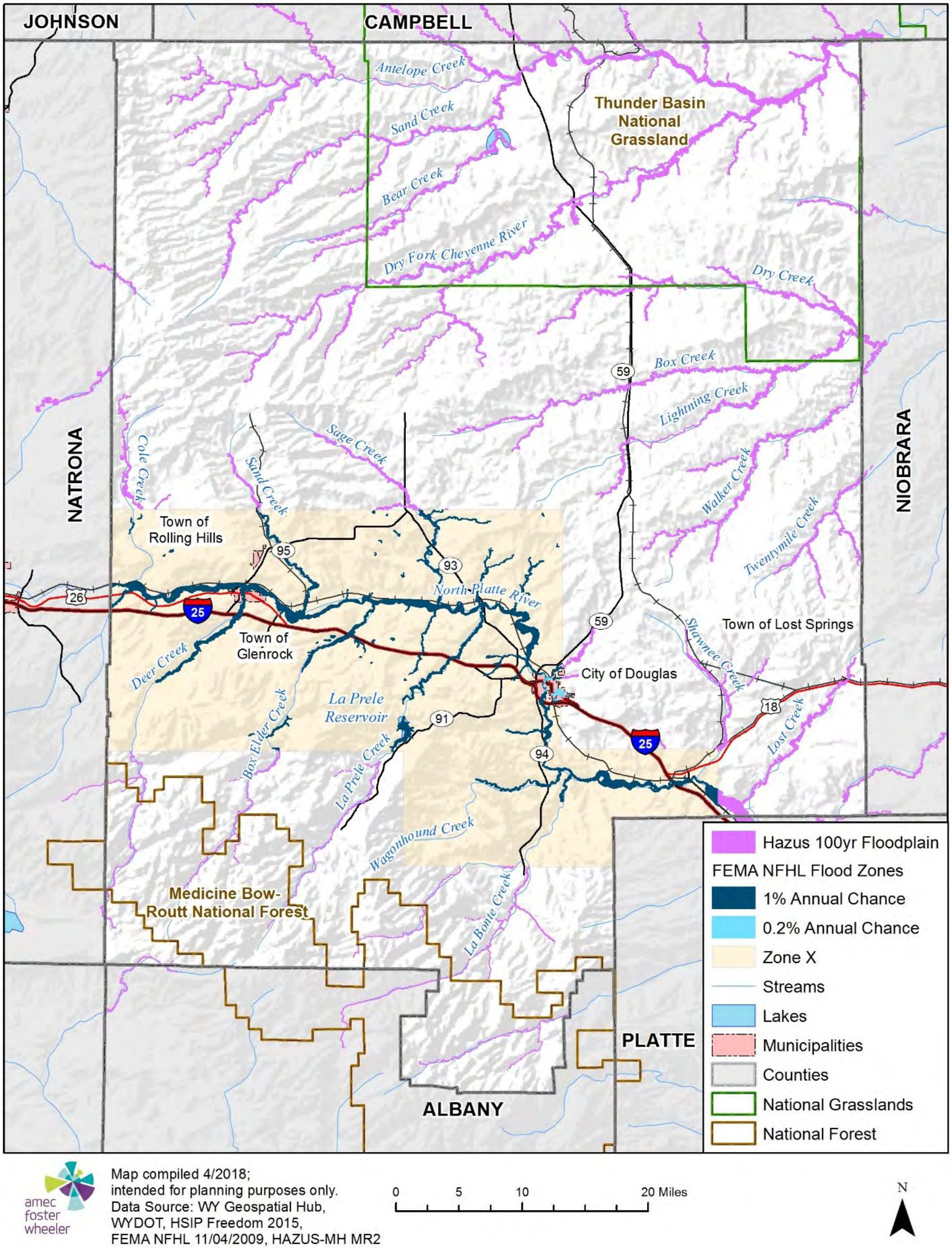


Figure 4-15: Douglas 1% and 0.2% Annual Chance Flood Hazards

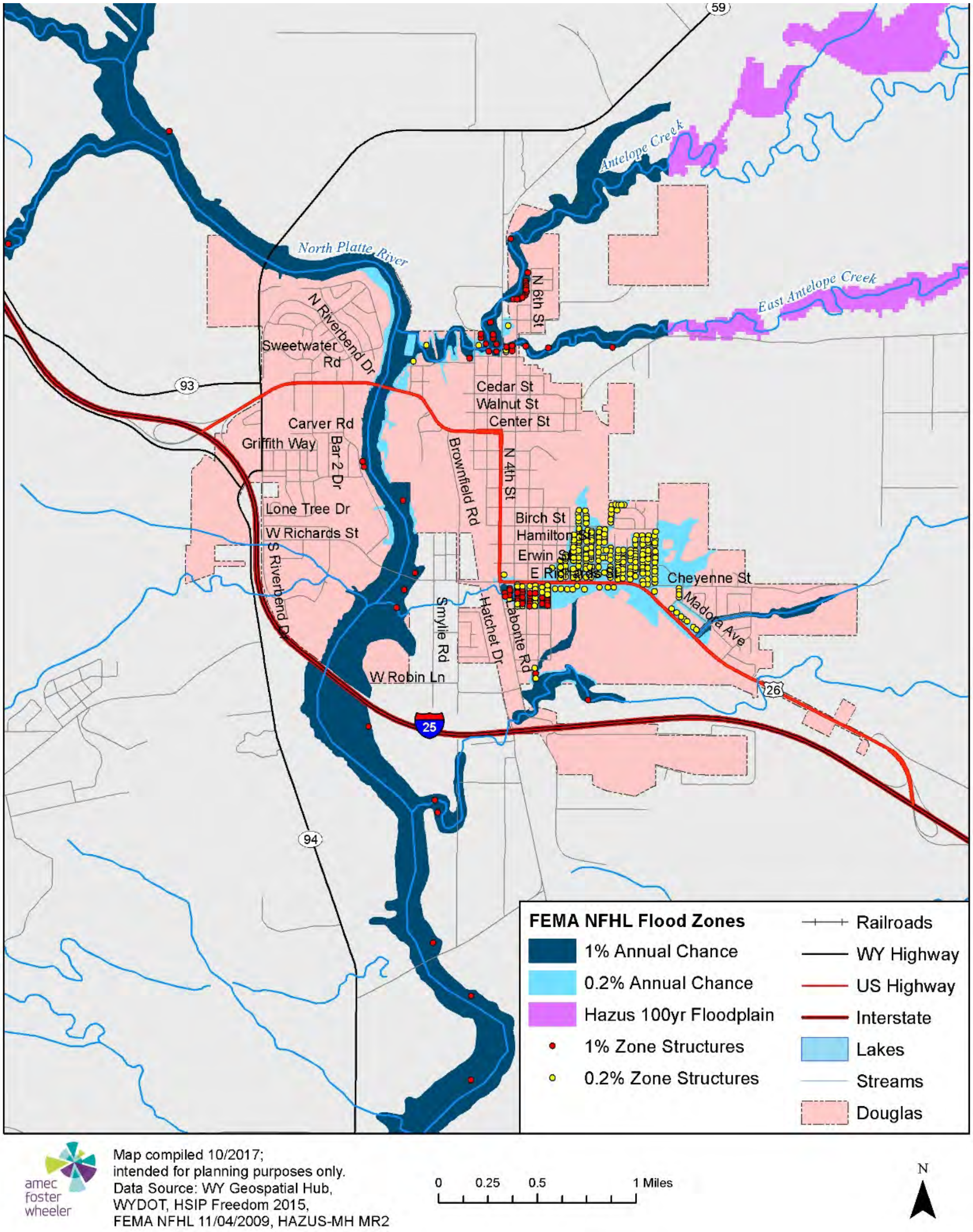


Figure 4-16: Glenrock 1% Annual Chance Flood Hazards

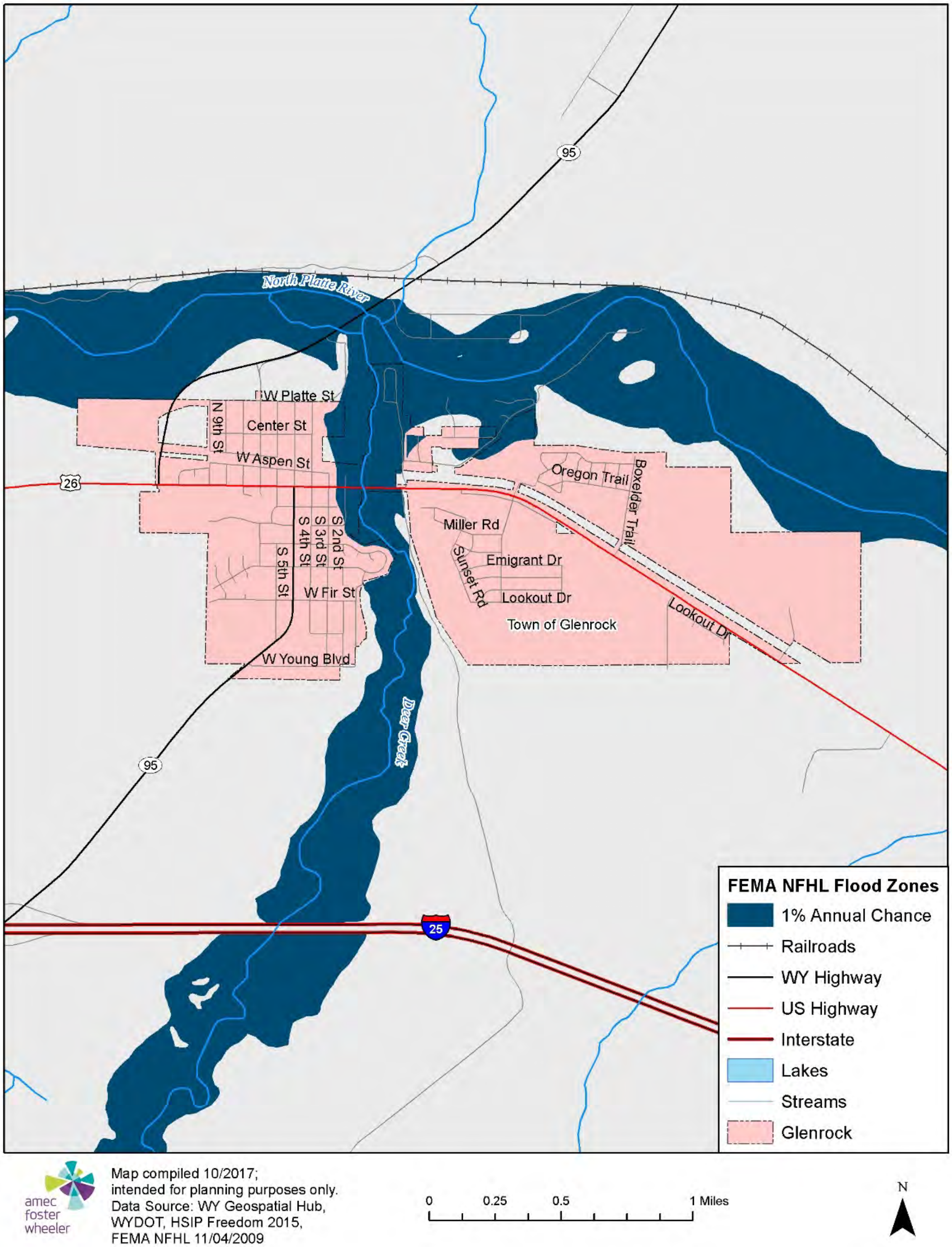


Figure 4-17: Lost Springs HAZUS 1% Annual Chance Flood Hazards

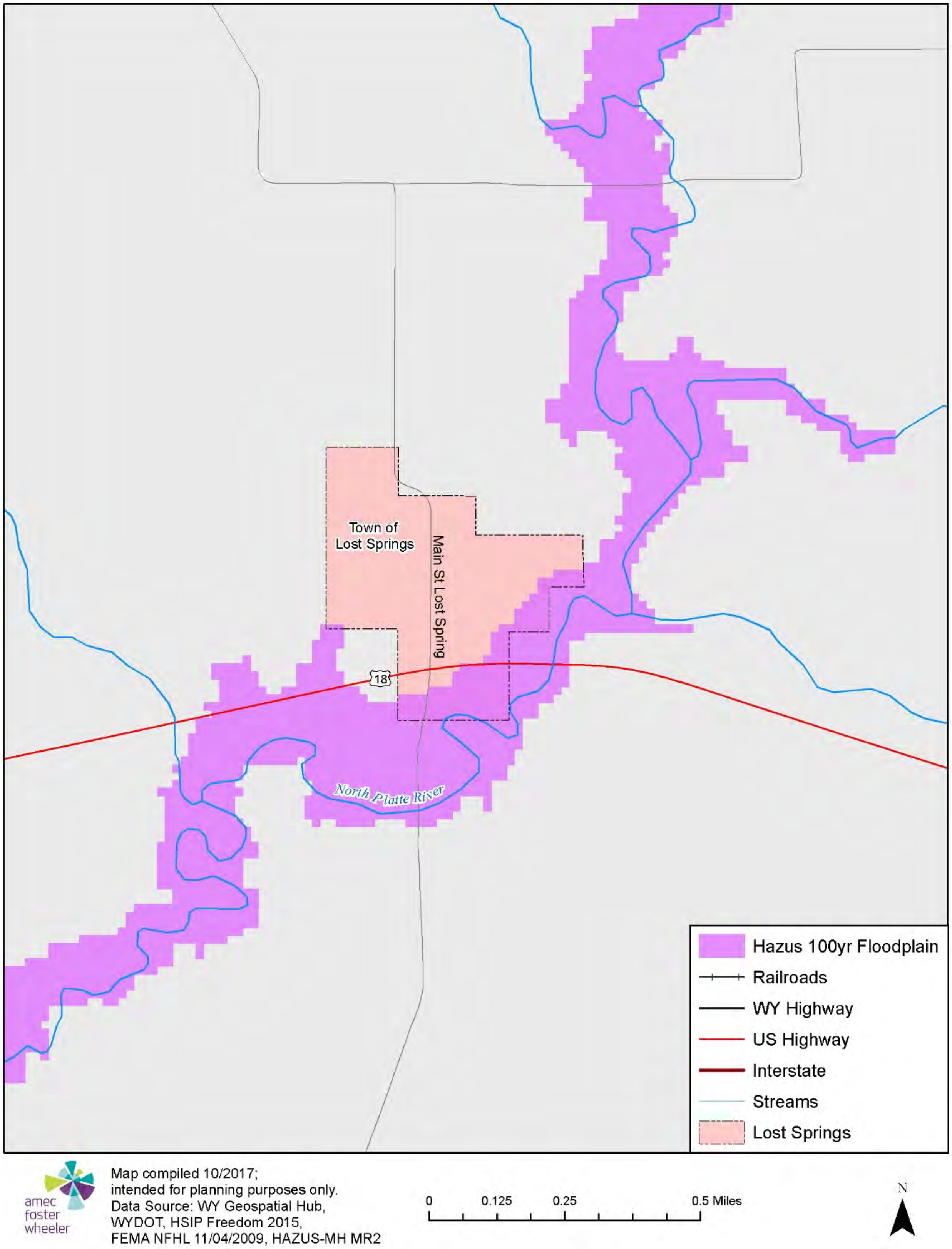
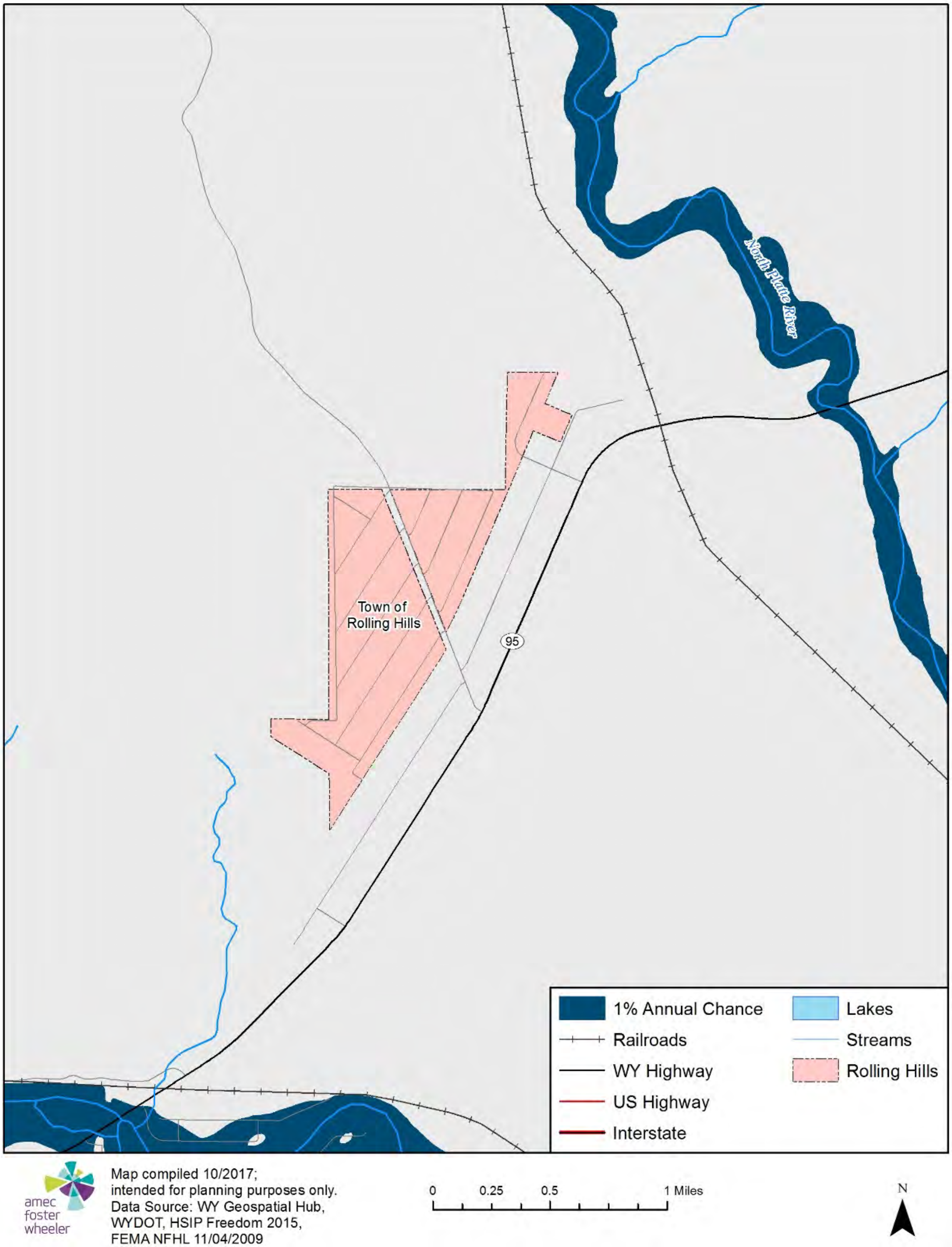


Figure 4-18: Rolling Hills 1% Annual Chance Flood Hazards



Past Occurrences

A brief history of significant floods is presented below. NCDC data is available for floods and flash flooding in Converse County. The table below outlines occurrences and associated damages.

Table 4.30: Flood Occurrences in Converse County, 1965-2017

Date	Type of Event	Damages	Comments
May 14, 1965	Flood	$175,000 of damages ($50K in Glenrock and $125K in the County)	16,000 cfs eight miles downstream of Glenrock and 23,800 cfs at Orin. This flood considered a 50-year (2% chance) event.
June 16, 1965	Flash Flood	$2,250	A flash flood near Bill killed one coal miner on Antelope Creek.
June 12, 1970	Flood	$1 million	Northeast residential area flooded, municipal park severely damaged, trailer court, croplands, bridges, fences, and farm buildings damaged
May, 1978	Flood	$15.5 million.	Severe thunderstorm produced 4.5 inches of rain overnight. Major impacts to infrastructure (roads, bridges, powerlines). Severe damage to homes, property, crops, and livestock.
July 22, 1983	Flood	-	Runoff collapsed a dam. See Section 4.3.5 Flood History for more information.
August, 1, 1984	Flood	$2,250	A thunderstorm dumped two inches of rain in 30 minutes. Rain flooded basements of several houses, a car, and several businesses.
May, 1991	Flash Flood		A storm produced 4.5 to 11 inches of rain in 48 hours. Erosion and major damage to irrigation pumps and canals, fences, and fields. Estimated to be a 100-year event.
July 1, 1998	Flash Flood	$2,000	A storm produced 6 inches of rainfall 50 miles northwest of Douglas. Water covered many rural roads in the area.
July, 2008	Flash Flood	-	LaPrele Creek flooding as flow of water increased from 2,000 cfs to 12,000 cfs in a few hours. Sandbagging occurred at three homes in the Orin area.
June, 2010	Flood	-	Rapid snowmelt prompted sandbagging efforts in Douglas around structures in low-lying areas.
August 9, 2013	Flash Flood	-	Slow moving thunderstorms across Converse County produced rainfall estimates of one to three inches in a two-hour period. The heavy rainfall resulted in flash flooding. Water and debris were flowing across Highway 59 north of Bill.
May 7, 2016	Flash Flood	-	Rain on snowmelt produced flash flooding in southwest Converse County. Flash flooding was reported on Esterbrook and Cold Springs Road. Two to three feet of water was reported at the Deer Creek RV park. Natural Bridge Park was closed due to rising flood waters. Flooding was reported along the Deer Creek, Boxelder, and LaPrele drainages.

Source: National Center for Climatic Data

Likelihood of Occurrence

The available flood history indicates that damaging floods occur infrequently in Converse County. Documented flood history for Converse County extends back to 1937 as described previously. This record shows about 12 floods or high-flow events in the last 52 years, which translates to one event every four years or so, or about a 25% chance any given year. Note that not all of these floods caused damage to property. Most of these floods have taken place in the summer months of June, July, and August. This corresponds to a **Likely** occurrence rating, meaning that a flood has a 10-100 percent chance of occurrence in the next year somewhere in the County.

Potential Magnitude

Magnitude and severity can be described or evaluated in terms of a combination of the various levels of impact that a community sustains from a hazard event. Specific examples of negative impacts from flooding on the County span a comprehensive range and are summarized as follows:

- Floods cause damage to private property that often creates financial hardship for individuals and families;
- Floods cause damage to public infrastructure resulting in increased public expenditures and demand for tax dollars;
- Floods cause loss of personal income for agricultural producers that experience flood damages;
- Floods cause loss of income to businesses relying on recreational uses of regional waterways;
- Floods cause emotional distress on individuals and families; and
- Floods can cause injury and death.

Floods present a risk to life and property, including buildings, their contents, and their use. Floods can affect crops and livestock. Floods can also affect lifeline utilities (e.g., water, sewerage, and power), transportation, jobs, tourism, the environment, and the local and regional economies. The impact of a flood event can vary based on geographic location to waterways, soil content and ground cover, and construction. The extent of the damage of flooding ranges from very narrow to widespread based on the type of flooding and other circumstances such as previous rainfall, rate of precipitation accumulation, and the time of year.

The magnitude and severity of the flood hazard is usually determined by not only the extent of impact it has on the overall geographic area, but also by identifying the most catastrophic event in the previous flood history. Sometimes it is referred to as the “event of record.” The flood of record is almost always correlated to a peak discharge at a gage, but that event may not have caused the worst historic flood impact in terms of property damage, loss of life, etc.

One method of examining the magnitude and severity of flooding in the planning area is to examine the damage losses and payments from the National Flood Insurance Program. This information is not comprehensive, because it only reflects the communities which participate in the NFIP, but it is a useful overview of flood damages in the planning area. The information below represents the composite of unincorporated and community-specific policies, claims and payments. There were no repetitive losses or substantial damage claims reported.

Table 4.31: Converse County NFIP Statistics

Jurisdiction	Policies	Coverage	# of Claims	Paid Losses
Douglas	7	$2,189,000	2	$0
Glenrock	5	$862,700	4	$7,350
County	15	$4,423,100	1	$2,032
Total	**27**	**$7,474,800**	**7**	**$9,382**

Source: FEMA Policy and Claim Statistics http://www.fema.gov/policy-claim-statistics-flood-insurance

Converse County, Douglas, and Glenrock all participate in the NFIP. Converse has participated since 1988, Douglas since 1978, and Glenrock since 1985. As of August 2017, there were 27 flood insurance policies in Converse County with an insured value of $7,474,800. Douglas has the most insurance policies (primarily single-family), but Glenrock is the only jurisdiction where NFIP insurance claims have been made for flood damages. In recent years, there have been no substantial damage claims (claims in excess of 50% of the structure value).

The potential magnitude for a flood event in the planning area is generally **limited**. An event of limited magnitude would result in some injuries, a complete shutdown of critical facilities for over a week, and damages to more than 10% of the planning area. This is consistent with the flood event history in the County. The flood history indicates that damaging floods have occurred consistently in the County. Fortunately, there has been no loss of life or any significant injury caused by floods in the county.

Vulnerability Assessment

The vulnerability assessment of flood risk in Converse County is highly comprehensive. Supported by extensive geospatial analysis, the following section describes the potential impacts of flood for the County's people, properties, critical facilities, and natural resources.

Vulnerable populations in the County include residents living in known flooding areas or near areas vulnerable to flash floods. Certain populations are particularly vulnerable. This may include the elderly and very young; those living in long-term care facilities; mobile homes; hospitals; low-income housing areas; temporary shelters; people who do not speak English well; tourists and visitors; and those with developmental, physical, or sensory disabilities. These populations may be more vulnerable to flooding due to limitations of movement, fiscal income, challenges in receiving and understanding warnings, or unfamiliarity with surroundings.

As part of this plan's preparation, an estimate of the population exposed to flooding was created using a GIS overlay of existing DFIRMs on potentially flooded parcels. The flood-impacted population for each jurisdiction in the county was then calculated by taking the number of Residential parcel units in the 1% annual chance and 0.2% annual chance floodplains and multiplying that number by the average household size based on the Census Bureau's estimate for the county. GIS analysis was used to estimate Converse County's potential property and economic losses. The parcel layer was used as the basis for the inventory of developed parcels. Parcel boundaries with assessor attributes merged into the layer were converted into centroids to represent building locations. For the purposes of this analysis, the flood zone that intersected the parcel centroids were assigned the flood zone for the entire parcel. In some cases, there are parcels in multiple flood zones, such as Zone A and X500. Another assumption with this model is that every parcel with an improvement value greater than zero was assumed to be developed in some way. Only improved parcels, and the value of those improvements, were analyzed and aggregated by jurisdiction, property type and flood zone. The summarized results for the planning area are shown below

Table 4.32 through Table 4.34 show the count and improved value of parcels in the planning area, broken out by each jurisdiction, that fall in a floodplain, by FEMA DFIRM 1% annual chance flood and 0.2% annual chance flood and Hazus 1% annual chance. The tables also show loss estimate values which are calculated based upon the improved value and estimated contents value. The estimated contents value for a Residential Property is 50% of the improved value (150% for Industrial and 100% all other non-residential properties); the total exposure is the sum of the improved and estimated contents values; the loss estimate is 25% of the total value based on FEMA's depth-damage loss curves. For example, a two-foot flood generally results in about 25% damage to the structure (which translates to 25% of the structure's replacement value).

Based on this analysis, the planning area has significant assets at risk to the 100-year and greater floods. There are 239 structures within the FEMA and Hazus 100-year floodplain (1% annual chance) for a total improved value of $47M. There are 274 structures within the 500-year floodplain (0.2% annual chance) for a total value of $42M. Overall, Converse County potentially faces almost $19 million in losses from flooding.

Table 4.32: Converse County FEMA/Hazus 1% Annual Chance Flood Hazards

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Unincorporated	Agricultural	46	$13,907,736	$13,907,736	$27,815,472	$6,953,868	0
	Commercial	4	$4,945,256	$2,472,628	$7,417,884	$1,854,471	0
	Residential	106	$20,515,693	$10,257,846	$30,773,539	$7,693,385	269
	Total	**156**	**$39,368,685**	**$26,638,210**	**$66,006,895**	**$16,501,724**	**269**

Source: FEMA NFHL, HAZUS-MH MR2, Wood analysis based on Assessor's Office data 2017

Table 4.33: Douglas FEMA 1% Annual Chance Flood Hazards

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Douglas	Commercial	5	$1,020,034	$1,020,034	$2,040,068	$510,017	0
	Residential	51	$4,552,469	$2,276,234	$6,828,703	$1,707,176	130
	Total	**56**	**$5,572,503**	**$3,296,268**	**$8,868,771**	**$2,217,193**	**130**

Source: FEMA NFHL, Wood analysis based on Assessor's Office data 2017

Table 4.34: Glenrock 1% FEMA Annual Chance Flood Hazards

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Glenrock	Commercial	2	$177,586	$177,586	$355,172	$88,793	0
	Residential	25	$1,863,055	$931,527	$2,794,582	$698,646	64
	Total	**27**	**$2,040,641**	**$1,109,113**	**$3,149,754**	**$787,439**	**64**

Source: FEMA NFHL, Wood analysis based on Assessor's Office data 2017

As demonstrated in Table 4.36 and Table 4.37, there are $17.9 million in damages resulting from the 0.2% annual chance flood. The City of Douglas and the Unincorporated County are the only areas with 0.2% annual chance flood areas, with a total of 274 buildings impacted.

Table 4.35: Douglas 0.2% Annual Chance Flood Hazards

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Douglas	Commercial	50	$11,902,160	$11,902,160	$23,804,320	$5,951,080	0
	Exempt	5	$1,013,168	$1,013,168	$2,026,336	$506,584	0
	Industrial	1	$68,156	$102,234	$170,390	$42,598	0
	Residential	217	$30,222,018	$15,111,009	$45,333,027	$11,333,257	551
	Total	**273**	**$43,205,502**	**$28,128,571**	**$71,334,073**	**$17,833,518**	**551**

Source: FEMA NFHL, Wood analysis based on Assessor's Office data 2017

Table 4.36: Converse County 0.2% Annual Chance Flood Hazards

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Unincorporated	Commercial	1	$59,828	$59,828	$119,656	$29,914	0
	Total	**1**	**$59,828**	**$59,828**	**$119,656**	**$29,914**	**0**

Source: FEMA NFHL, Wood analysis based on Assessor's Office data 2017

GIS analysis of flood hazards in Converse County indicates that there are 41 critical facilities and/or community assets that are potentially exposed to 1% and 0.2% annual chance flood hazards. There are 40 facilities in the 100-year floodplain and 1 in the 500-year. Beyond the unincorporated county, Douglas is the only jurisdiction in the county with critical facilities (3) located within the floodplain. The tables below summarize the facilities that are potentially at risk.

Table 4.37: Critical Facilities within FEMA/Hazus 1% Annual Chance Flood Hazards

Jurisdiction	Critical Facility Type	Facility Count
Douglas (FEMA)	Transportation and Lifeline Facilities	3
Unincorporated (FEMA)	High Potential Loss Facility	1
	Transportation and Lifeline Facilities	25
Unincorporated (Hazus)	Transportation and Lifeline Facilities	11
	Total	**40**

Source: Converse County GIS, HSIP, FEMA, HAZUS

Table 4.38: Critical Facilities within 0.2% Chance FEMA Flood Zone

Jurisdiction	Critical Facility Type	Facility Count
Douglas	High Potential Loss Facility	1
	Total	**1**

Source: Converse County GIS, HSIP, FEMA, HAZUS

Natural resources are generally resistant to flooding except where natural landscapes and soil compositions have been altered for human development or after periods of previous disasters such as drought and fire. Wetlands, for example, exist because of natural flooding incidents. Areas that are no longer wetlands may suffer from oversaturation of water, as will areas that are particularly impacted by drought. Areas recently suffering from wildfire damage may erode because of flooding, which can permanently alter an ecological system.

Tourism and outdoor recreation is an important part of the County's economy. If part of the planning area were damaged by flooding, tourism and outdoor recreation could potentially suffer.

Future Development

For NFIP participating communities, floodplain management practices implemented through local floodplain management ordinances should mitigate the flood risk to new development in floodplains.

Summary

Overall, flooding presents a **medium risk** for Converse County. Flooding has damaged homes, infrastructure (roads and bridges), and caused agricultural losses in the planning area in the past. Flood risk varies by jurisdiction.

Table 4.39: Flood Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Douglas	Significant	Critical	Likely	Medium
Glenrock	Limited	Limited	Likely	Medium
Rolling Hills	Limited	Limited	Likely	Medium

Lost Springs	Limited	Limited	Likely	Medium
Converse County	Significant	Critical	Likely	Medium

4.3.6 Hazardous Materials

Hazard Description

Generally, a hazardous material is a substance or combination of substances which, because of quantity, concentration, or physical, chemical, or infectious characteristics, may either (1) cause or significantly contribute to, an increase in mortality or an increase in serious, irreversible, or incapacitating reversible, illness; or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, disposed of, or otherwise managed. Hazardous material incidents can occur while a hazardous substance is stored at a fixed facility, or while the substance is being transported.

The U.S. Department of Transportation, U.S. Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) all have responsibilities regarding hazardous materials and waste.

The U.S. Department of Transportation has identified the following classes of hazardous materials:

- Explosives
- Compressed gases: flammable, non-flammable compressed, poisonous
- Flammable liquids: flammable (flashpoint below 141 degrees Fahrenheit) combustible (flashpoint from 141 - 200 degrees)
- Flammable solids: spontaneously combustible, dangerous when wet
- Oxidizers and organic peroxides
- Toxic materials: poisonous material, infectious agents
- Radioactive material
- Corrosive material: destruction of human skin, corrodes steel

Geographical Areas Affected

Hazmat incidents can occur at a fixed facility or during transportation. Hazardous materials facilities are identified and mapped by the counties they reside in, along with the types of materials stored there. Some facilities contain extremely hazardous substances; these facilities are required to generate Risk Management Plans (RMPs), and resubmit these plans every five years.

Hazardous materials routes are also present in the County. Interstate 25 goes directly through the county and the Glenrock metropolitan area. Major rail lines run through the county as well, and can convey hazardous materials. Generally, any infrastructure or populations located within a half mile of a hazardous materials route or fixed facility can be considered at elevated risk for impacts from a hazmat incident.

A 2017 commodity flow study conducted by the University of Wyoming Department of Civil and Architectural Engineering examined HAZMAT traffic from four different study locations. Using data from the 2015 Wyoming Vehicle Miles Report a monthly average daily traffic (MADT) was calculated for each of the study locations. HAZMAT truck percentages are based on the percentage of HAZMAT trucks counted during field data collection. Using the estimated number of HAZMAT trucks per day, the study went on to calculate the potential range of hazardous materials transported by different truck body configurations (straight truck, truck-trailer, and multi-trailer).

Total min amount = MADT ×% of trucks × % of HAZMAT trucks × body config. × min capacity
Total max amount = MADT ×% of trucks × % of HAZMAT trucks × body config. × max capacity

The study was conducted in Natrona County, and data was collected from four different locations along I-25 and Highway 220. Three out of four sites are not relevant to Converse County; however, one of the observation points was located along I-25, east of Casper. Though the assessment is focused in Natrona County, it can be presumed that the results can be extrapolated because the transport of hazardous materials is in close proximity to the survey point and the flow of materials will likely pass along I-25 through western Converse County. Table 4.40 displays the minimum and maximum amount of hazardous materials transported along this route.

Table 4.40 HAZMAT Traffic Assessment in Converse County

Study Location	Monthly Average Daily Traffic	% of Truck	% of HAZMAT Trucks	Monthly Average Number of HAZMAT trucks per day	Total Amount (US gallons/day) Min/Max
I-25 East of Casper MP 182.06	8,188	17.9%	12.7%	186	1,131,353/2,061,772

The estimated minimum/maximum amounts of the transported HAZMATs was 1,131,353/2,061,772 US gallons/day for I-25 south of Casper. It should be noted that these numbers were estimated without taking seasonal variation into account due to lack of seasonal factors for HAZMAT transportation in Wyoming.

Data analysis showed that the most common HAZMAT class being transported is class 3, which is flammable liquids. Accordingly, it would indicate that the most likely HAZMAT incident could happen would involve a class 3 HAZMAT of flammable liquids. Flammable liquids (Class 3) HAZMAT has the highest percentage among the transported HAZMAT classes. It represents 78.5% from the survey location, averaged for both directions.

According to data from the Environmental Protection Agency posted by the Right to Know Network (www.rtknet.org), there are six RMP 73 facilities in the Douglas area and two in Glenrock. There have been four 5-year accidents, three of which were associated with the Douglas Gas Plant. These accidents caused one injury and no reported property damage. No additional information about toxic or flammable chemicals in processes was provided.

The State of Wyoming had 63 RMP facilities as of October 24, 2009. (www.rtknet.org). The amount of property damage from 5-year accidents across the state at that time was $73,598,500.

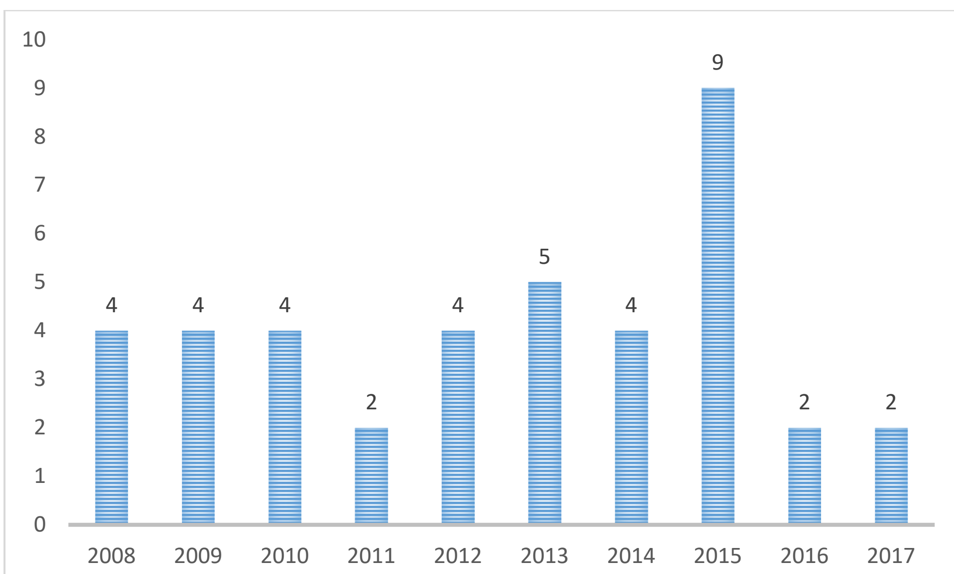
As a rough measure, this figure divides out to $1,168,222 per facility. Converse County has seven RMP facilities so applying this per facility figure to the seven facilities in Converse County would produce a damage estimate of $9,345,777 in property damage over a five-year period. Of course, the facilities in the county may not have this level or spills or releases but just one very serious event could cost in the millions of dollars when clean-up, property and resource damage, and interruption of production and commerce are factored in.

Past Occurrences

There are a variety of mechanisms to get an idea of the number and types of historical hazardous materials spills in Converse County. One such repository is the catalog of hazardous materials spill and accident reports at the National Response Center (NRC) as part of the Right to Know Network (RTK NET). The figure below shows a ten-year record for reported incidents in Converse County.

Converse County has seen a relatively stable rate of occurrence of hazardous material incidents. There have been 40 hazardous materials incidents recorded between 2008 and 2017. Between 2007 and 2017, the average number of events per year was four. The following figure shows trends in hazardous material spill occurrences by year. 2015 recorded the highest number of incidents (15), while there were only two accidents noted for 2017, 2016 and 2011.

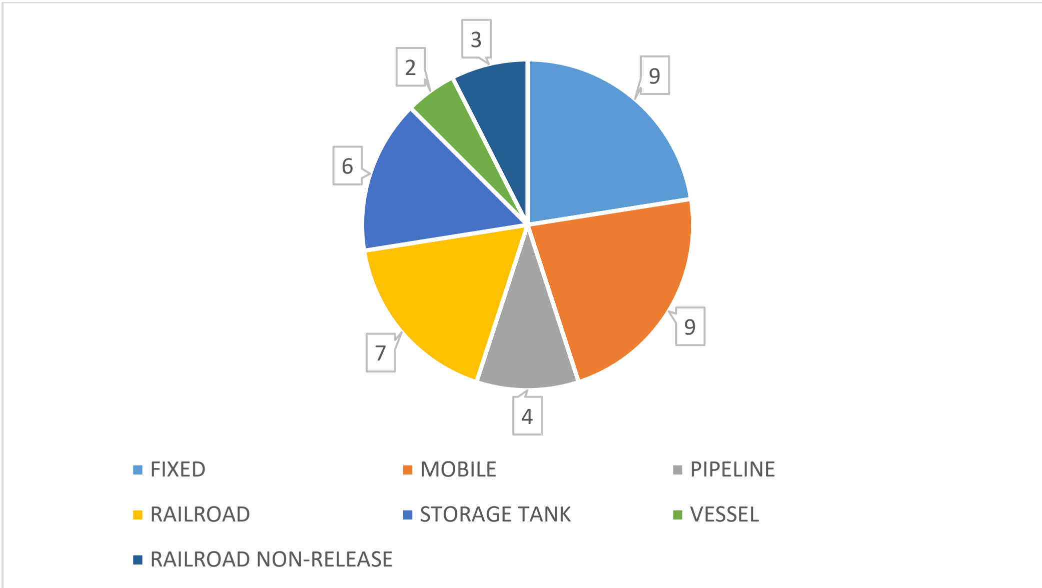
Figure 4-19: Hazardous Materials Spills/Accidents Reported to the NRC 2008-2017



Source: National Response Center

According to the NRC site, the incident types with the highest rates of reports were fixed-site incidents (9) and mobile incidents (9); together, incidents of these types made up 45% of total incidents reported.

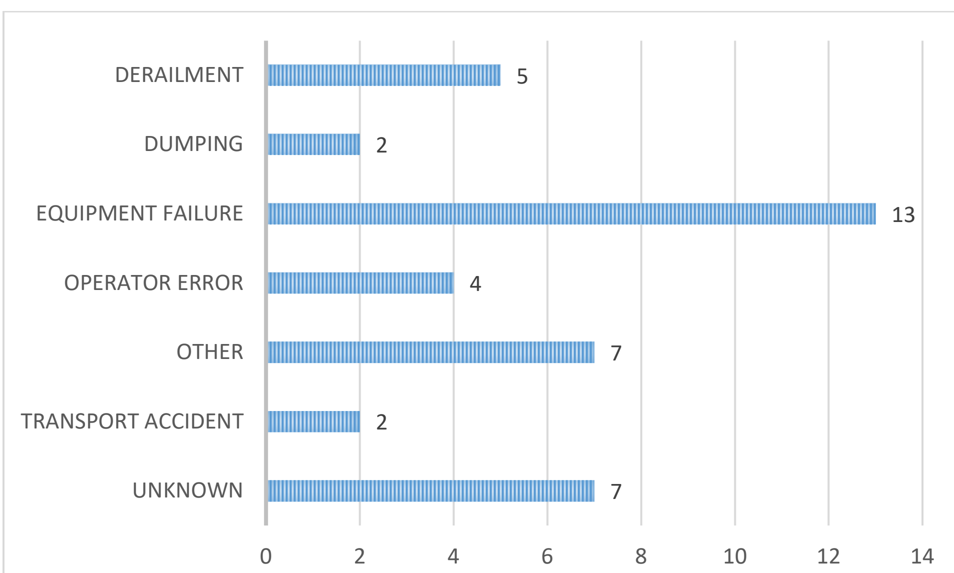
Figure 4-20: Hazardous Materials Spills/Accidents by Type 2008-2017



Source: National Response Center

Equipment failure was by far the most prevalent cause for hazardous materials spills and accidents in Converse County. Operator error, derailment, transport accident, and dumping were also responsible for spills reported in the County. The figure below shows incidents by cause in the County between 2008 and 2017.

Figure 4-21: Hazardous Materials Spills/Accidents by Cause 2008-2017



Source: National Response Center

According to the data, the City of Douglas experienced the highest number of incidents with 20, followed by Bill and Glenrock, both with 5. McKinley/Ammon, Rolling Hills, and Shawnee also experienced hazardous materials incidents, but at a much lower rate. These numbers are detailed in Table 4.41 below.

Table 4.41: Hazardous Materials Incidents by Community 2008-2017

Nearest City	Incidents
Bill	5
Douglas	20
Glenrock	5
Mckinley/Ammon	1
Rolling Hills	1
Shawnee	4
Unidentified	4
Total	40

Source: National Response Center

In addition to local first responders, eight Regional Emergency Response Teams across the State of Wyoming respond to a variety of incidents, including those incidents involving hazardous materials. Converse County is serviced by the Region 2 RERT, located in Casper. The following table shows records of Region 2 RERT mission assignments pertaining to hazardous materials releases, according the 2016 Wyoming State Hazard Mitigation Plan. It should be noted that this data is *regional*, not county-specific.

Table 4.42: Region 2 RERT Mission Assignments – Hazardous Materials: 2004-2015

Type	Number
Fixed Facility	5
Truck/Highway	16
Rail	-
Pipeline	-
Aircraft	2
Orphan Drum	1
Total	24

Source: 2016 Wyoming State Hazard Mitigation Plan

Likelihood of Future Occurrence

According to National Response Center data, Converse County experiences multiple hazardous materials incidents each year; there is a 100% chance that the County will experience a hazardous materials incident in any given year.

Potential Magnitude

Impacts that could occur from hazardous waste spills or releases include:

- Injury
- Loss of life (human, livestock, fish and wildlife)
- Evacuations

- Property damage
- Air pollution
- Surface or ground water pollution/contamination
- Interruption of commerce and transportation

Numerous factors go into the ultimate impacts of a hazardous materials release, including method of release, the type of material, location of release, weather conditions, and time of day. This makes it difficult to nail down precise impacts. Hazardous materials found in the County will have at least one of the impacts listed above, and probably more.

Historical data doesn't provide much to go on, as NRC data doesn't record any fatalities, injuries or economic impacts from hazardous materials incidents in the last ten years.

Vulnerability Assessment

Converse County and many of the municipalities have energy pipelines, Interstate and state highways, and railroad tracks which carry many types of hazardous materials. A variety of hazardous materials originating in the County or elsewhere are transported along these routes, and could be vulnerable to accidental spills. Consequences can vary depending on whether the spill affects a populated area vs an unpopulated but environmentally sensitive area.

Because of the volatility of some hazardous materials and the increased risk they pose to the facility and the surrounding area, the 1990 Clean Air Act requires facilities that use extremely hazardous substances to develop a Risk Management Plan (RMP). These plans help local fire, police and emergency response personnel prepare for and respond to chemical emergencies. There are eight RMP facilities located in Converse County, as noted in the following table.

Table 4.43: RMP Facilities in Converse County

Community	Number of Facilities
Douglas	6
Glenrock	2
Rolling Hills	0
Lost Springs	0
Total	**8**

Source: http://www.rtknet.org

Potential losses can vary greatly for hazardous material incidents. For even a small incident, there are cleanup and disposal costs. In a larger scale incident, cleanup can be extensive and protracted. There can be deaths or injuries requiring doctor's visits and hospitalization, disabling chronic injuries, soil and water contamination can occur, necessitating costly remediation. Evacuations can disrupt home and business activities. Large-scale incidents can easily reach $1 million or more in direct damages.

Future Development

Fixed facilities with hazardous materials are identified and mapped. Transportation routes are also identified. Considerations should be given to hazardous materials when new development is planned to ensure that high concentrations of vulnerable populations are not located nearby (e.g. schools and nursing homes). If an uptick in oil and gas development and extraction occurs, this could result in greater exposure for transportation incidents.

Summary

Converse County is at **moderate** risk to hazardous materials spills. Due to proprietary restrictions, it is difficult to monitor the transportation of hazardous materials. Loss estimations indicate that the seven facilities in Converse County would produce a damage estimate of $9,345,777 in property damage over a five-year period. With 40 hazardous materials incidents occurring between 2008 and 2017, it should be expected that there would be four events each year.

Table 4.44: Hazardous Materials Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Douglas	Significant	Limited	Highly Likely	Medium
Glenrock	Significant	Limited	Highly Likely	Medium
Rolling Hills	Negligible	Limited	Likely	Medium
Lost Springs	Negligible	Limited	Likely	Medium
Converse County	Negligible	Limited	Likely	Medium

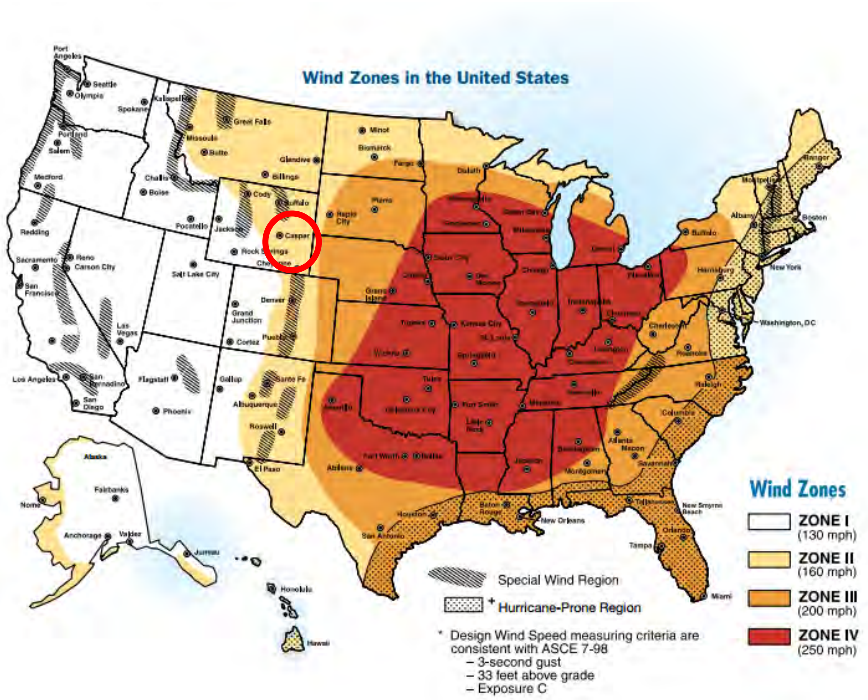
4.3.7 High Winds and Downbursts

Hazard Description

Wind, because of its constant presence in Wyoming, can be overlooked as a hazard. Upon analysis, wind can be a damage-inducing hazard and warrants review in the County. Wyoming’s wind is also becoming an economic factor as renewable wind energy is developed around the state.

The wind zone map shown below indicates the potential magnitude of wind speeds. Most of the Planning area is in Zone II, which could expect winds up to 160 mph.

Figure 4-22: Wind Zones in the United States

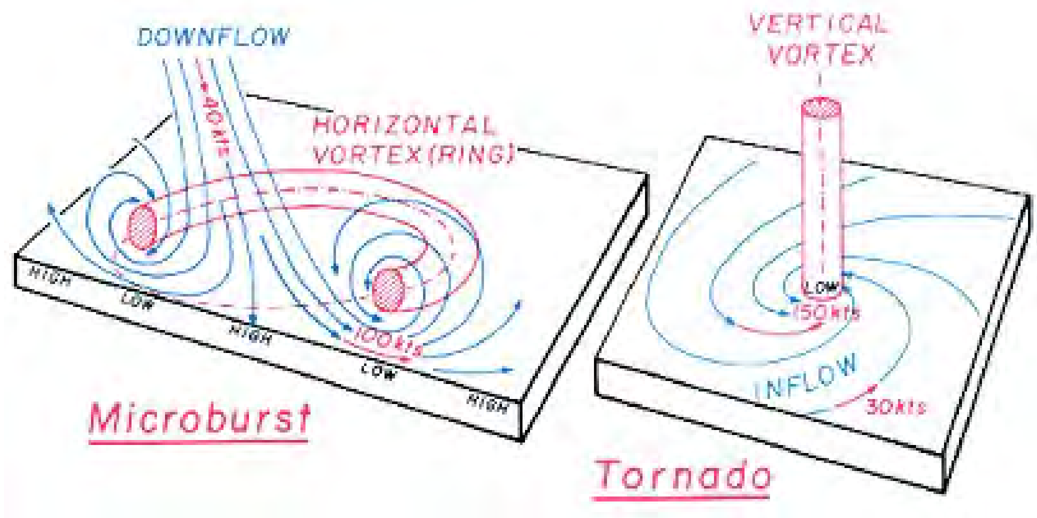


This profile examines the hazard that high winds present including downbursts, a subcategory of high winds. A downburst is a strong down draft which causes damaging winds on or near the ground. Downbursts are much more frequent than tornadoes, and for everyone tornado there are approximately 10 downburst damage reports. Downbursts can be associated with either a heavy precipitation or non-precipitation thunderstorm (dry or wet downbursts), and often occur in the dissipation stage of a thunderstorm. Microbursts and macrobursts are categories of downbursts, classified by length of duration, velocity of wind, and radius of impact.

Microbursts generally last between five and 15 minutes, and impact an area less than three miles wide. Macrobursts can last up to 30 minutes with winds up to 130 miles per hour, and can impact areas larger than three miles in radius. Microbursts and macrobursts may induce dangerous wind shears, which can adversely affect aircraft performance, cause property damage and loss of life.

A downburst can occur when cold air begins to descend from the middle and upper levels of a thunderstorm (falling at speeds of less than 20 miles an hour). As the colder air strikes the Earth's surface, it begins to ‘roll’ outward. As this rolling effect happens, the air expands causing further cooling and having the effect of pulling the shaft of air above it at higher and higher speeds.

Figure 4-23: Schema of Microburst and Tornado



Source: www.erh.noaa.gov

Downbursts can be mistaken for tornadoes by those that experience them since damages and event characteristics are similar. Tornado winds can range from 40 mph to over 300 mph. Downbursts can exceed winds of 165 mph and can be accompanied by a loud roaring sound. Both downbursts and tornadoes can flatten trees, cause damage to homes and upend vehicles. In some instances, aerial surveying is the best method to determine what kind of event has taken place.

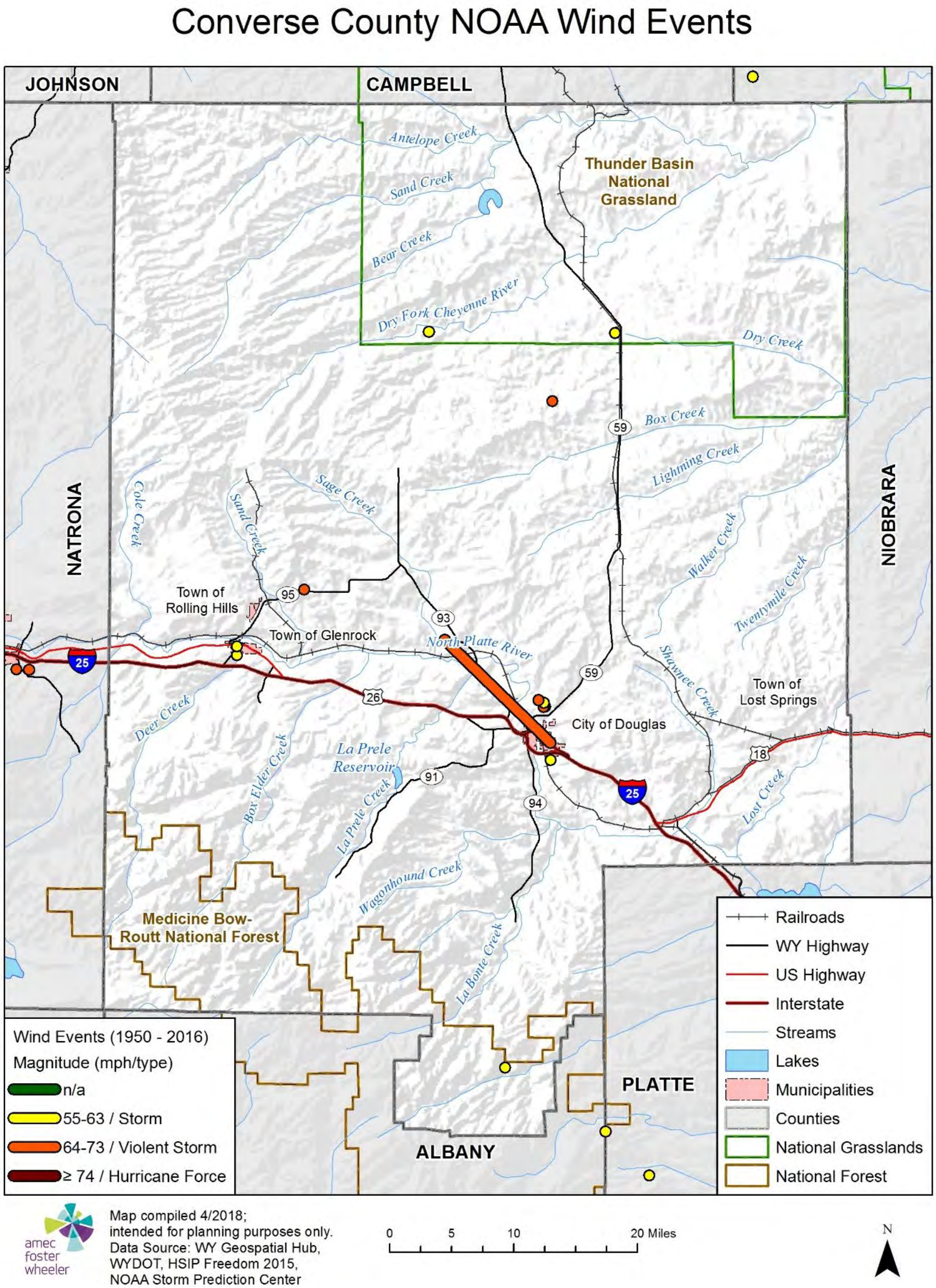
In the photograph below, trees are blown down in a straight line - a very strong indication of a downburst as opposed to a tornado.

Figure 4-24: Aerial Image of Downburst Damage

Source: T. Fujita

Geographical Area Affected

Figure 4-25: Historical High Wind Events in Converse County



Winds are not limited to a single geographic area in the County, and can impact anywhere in the planning area.

Past Occurrences

In the County, most documented wind events causing damage typically range between 50-59 mph; max wind speeds of up to 85 mph have been recorded. It should be noted that the data is limited by what the NCDC is able to record, and what equipment was in place at the time.

High winds are so common in Converse County, and therefore record of occurrence is inconsistent. HMPC members noted a high wind event in 2014 that resulted in tress falling and shingles flying off roofs across the county. Additionally, on October 25, 2017, the winds were so strong that a pickup truck was blown over.

According to the numbers generated by NCDC (detailed in Table 4.45), there has been 98 high wind events in the region, however, none of these events caused any property or crop damage, nor any fatalities/injuries. Though no property damage was reported by NCDC, wind frequently causes damage to structures in Converse County by spreading and catalyzing fire. Additionally, high winds pose a threat to traffic along I-25.

Table 4.45: Summary of Wind Weather Events and Impacts in Converse County 1996-2015

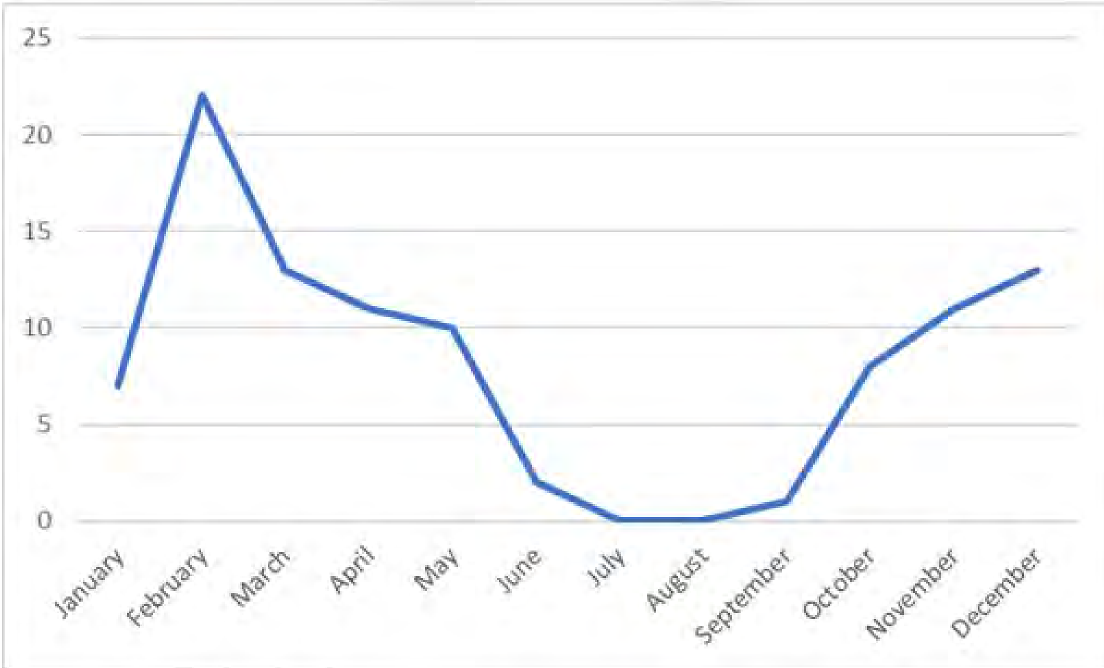
MPH	# of Events	Total Property Damage	Total Crop Damage	Total Fatalities	Total Injuries
30-39	0	0	0	0	0
40-49	35	0	0	0	0
50-59	31	0	0	0	0
60-69	19	0	0	0	0
70-79	12	0	0	0	0
>80	1	0	0	0	0
Total	98	0	0	0	0

Source: National Climatic Data Center

Likelihood of Future Occurrences

NCDC records 98 confirmed and documented high wind incidents specifically impacting the County since 1996. This means that the region averages about five high wind incidents per year. Based on this data, incidence of recorded events appears to spike between October to February.

Figure 4-26: High Wind Events by Month for Converse County 1996-2017



Source: NCDC

Vulnerability Assessment

Vulnerability as it relates to location is mostly random, as damaging winds have occurred everywhere in the County. Damage from high winds is often described in regional or broad areas, but downburst damage will impact a small area most generally less than three miles in diameter. Because state or presidential emergency or disaster declarations have not been necessary in the aftermath of wind events in the County, and because damage to personal property is dealt with by numerous private insurance companies, it is difficult to estimate actual monetary impacts that have occurred due to damaging winds. See section on Potential Losses for loss estimates based on reported damage.

Specific vulnerabilities from high wind events include damage to poorly constructed buildings, building collapse and damage, flying debris, semi rollovers and car accidents, and downed power lines and electric system damage. Cascading hazards caused by high winds can include power loss and hazardous materials spills; depending on the time of year, winds can also exacerbate snow and blizzards by creating deep snow drifts over roads and affecting the normal flow of traffic.

The 2016 Wyoming State Hazard Mitigation Plan lists wind events by county over a period of 55.5 years. Converse County has 84 recorded events, which results in a 100% chance each year, and a Highly Likely probability. According to NCDC recorded events, the annual occurrence rate for significant, high wind in Converse County is about 5 times per year, though none of the previously recorded events had any associated damages.

Future Development

During the construction period buildings are vulnerable to wind, and construction materials can become airborne if not properly secured. Future residential or commercial buildings built to code should be able to withstand wind speeds of at least 150 miles per hour.

Summary

Many areas of the United States are prone to damaging wind events, and while Converse County may not be counted in a high category for occurrences across the nation, it does have a history of such episodes which should be anticipated for the future. Primary damage is structural and utility-borne. Although minimal deaths and injuries have been reported, the frequency of occurrence is due consideration, as well as the hazard to rural citizens and town populations from falling trees, power poles, and flying debris.

Photos and scattered reports document property damage (including damage to private utilities) occurring because of wind events, yet cumulative losses due to wind damage have been negligible.

Table 4.46: High Winds and Downbursts Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Douglas	Extensive	Limited	Highly Likely	Medium
Glenrock	Extensive	Limited	Highly Likely	Medium
Rolling Hills	Extensive	Limited	Highly Likely	Medium
Lost Springs	Extensive	Limited	Highly Likely	Medium
Converse County	Extensive	Limited	Highly Likely	Medium

4.3.8 Landslide/Rockfall/Debris Flow

Hazard Description

A landslide is a general term for a variety of mass movement processes that generate a downslope movement of soil, rock, and vegetation under gravitational influence. Landslides are a serious geologic hazard common to almost every state in the United States. It is estimated that nationally they cause up to $2 billion in damages and from 25 to 50 deaths annually. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth material to landslide include: saturation by water, erosion or construction, alternate freezing or thawing, earthquake shaking, and volcanic eruptions.

Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Generally significant land sliding follows periods of above-average precipitation over an extended period, followed by several days of intense rainfall. It is on these days of intense rainfall that slides are most likely.

Areas that are generally prone to landslide hazards include existing old landslides; the bases of steep slopes; the bases of drainage channels; and developed hillsides where leach-field septic systems are used. Landslides are often a secondary hazard related to other natural disasters. Landslide triggering rainstorms often produce damaging floods. Earthquakes often induce landslides that can cause additional damage.

Slope failures typically damage or destroy portions of roads and railroads, sewer and water lines, homes and public buildings, and other utility lines. Even small-scale landslides are expensive due to clean up costs that may include debris clearance from streets, drains, streams and reservoirs; new or renewed support for road and rail embankments and slopes; minor vehicle and building damage; personal injury; and livestock, timber, crop and fencing losses and damaged utility systems.

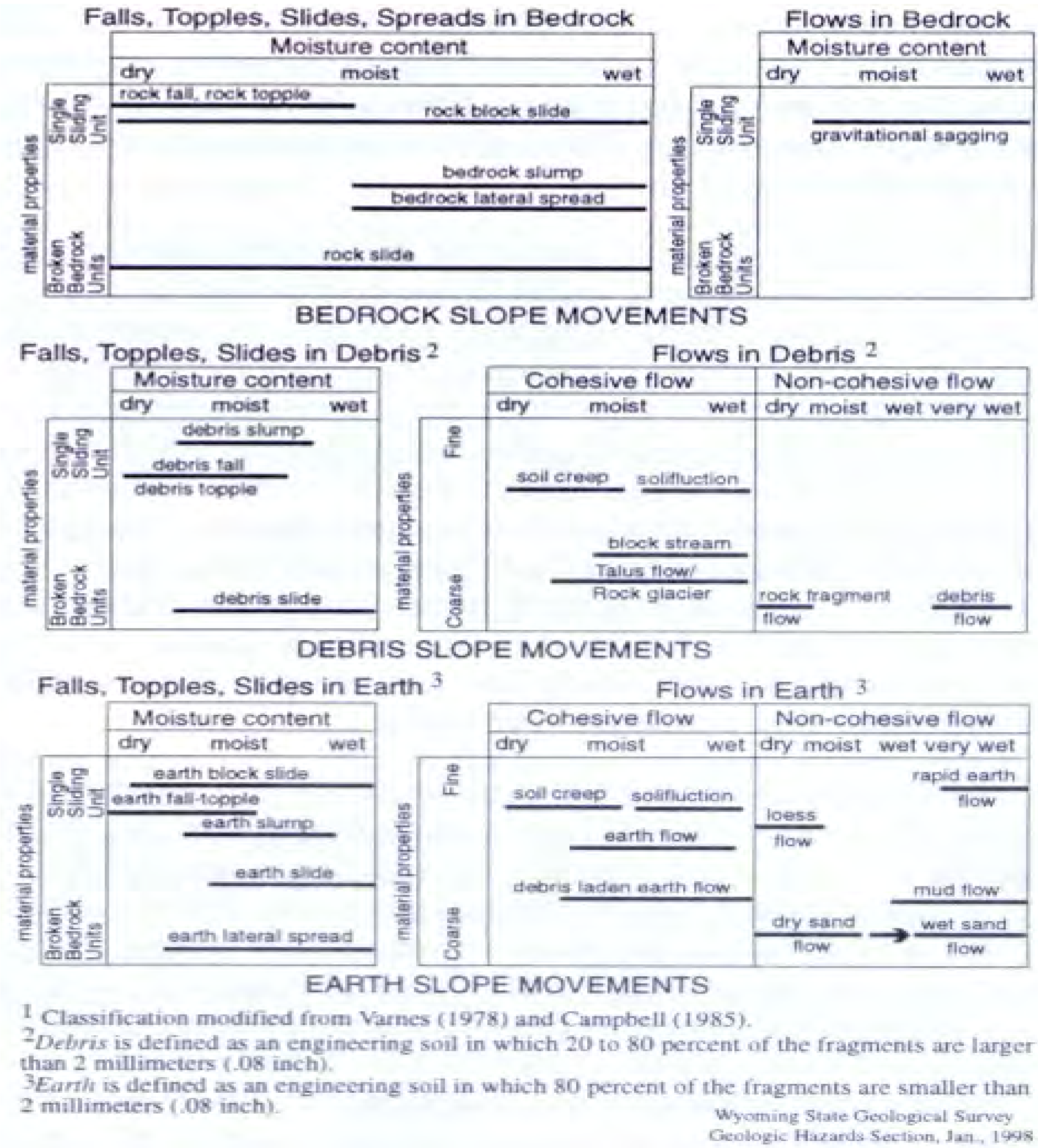
There are many types of landslides present in Wyoming. To properly describe landslide type, the Geologic Hazards Section developed a landslide classification modified from Varnes (1978) and Campbell (1985). As can be seen in Figure 4-25, there are five basic types of landslides that occur in three types of material. Falls, topples, slides, lateral spreads, and flows can occur in bedrock, debris, or earth. While individual landslide types can occur in nature, most landslides are complex, or composed of combinations of basic types of landslides.

Rockfall

A rockfall is the falling of a detached mass of rock from a cliff or down a very steep slope. Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Rockfalls are caused by the loss of support from underneath through erosion or triggered by ice wedging, root growth, or ground shaking. Changes to an area or slope such as cutting and filling activities can also increase the risk of a rockfall. Rocks in a rockfall can be of any dimension, from the size of baseballs to houses. Rockfall occurs most frequently in mountains or other steep areas during the early spring when there is abundant moisture and repeated freezing and thawing. Rockfalls are a serious geological hazard that can threaten human life, impact transportation corridors and communication systems and result in other property damage.

Spring is typically the landslide/rockfall season in Wyoming as snow melts and saturates soils and temperatures enter freeze/thaw cycles. Rockfall and landslides are influenced by seasonal patterns, precipitation and temperature patterns. Earthquakes could trigger rockfalls and landslides too.

Figure 4-27: Wyoming Landslide Classifications



Debris Flow

Debris flows, sometimes referred to as mudslides, mudflows, lahars, or debris avalanches, are common types of fast-moving landslides. They are a combination of fast moving water and a great volume of sediment and debris that surges down slope with tremendous force. These flows generally occur during periods of intense rainfall or rapid snowmelt and may occur with little onset warning, similar to a flash flood. They usually start on steep hillsides as shallow landslides that liquefy and accelerate to speeds that are typically about 10 miles per hour, but can exceed 35 miles per hour. Figure 4-26 describes identifying characteristics of debris flows. The consistency of debris flow ranges from watery mud to thick, rocky mud that can carry large items such as boulders, trees, and cars. Debris flows from many various sources can combine in channels, and their destructive power may be greatly increased. When the flows reach flatter ground, the debris spreads over a broad area, sometimes accumulating in thick deposits that can wreak havoc in developed areas. Mudflows are covered under the National Flood Insurance Program, however landslides are not.

Figure 4-28: Field Evidence of Debris Flow

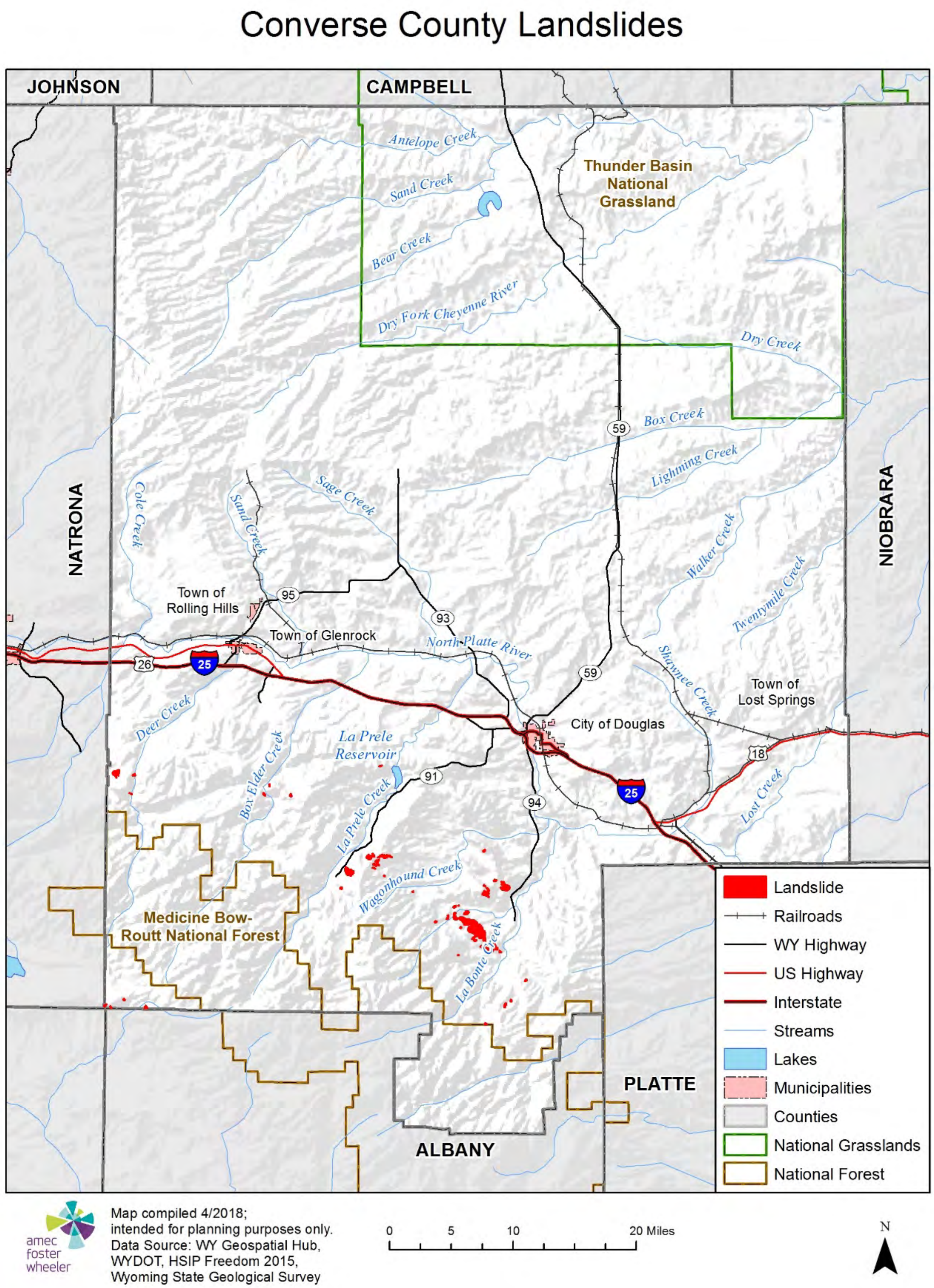
Geographical Area Affected

Landslides are one of the most common geologic hazards in Wyoming. However, the geologic conditions of Converse County do not make the area susceptible to landslides, however, subsidence is a concern noted by the HMPC. The issue of subsidence is more significant than the existing mapping data indicates. Glenrock is especially vulnerable to subsidence, and an HMPC member indicated that over 60% of the City is impacted. One pertinent issue facing Glenrock is subsidence as it relates to the mines. Though federal reclamation programs have been instituted, the mines surrounding the Glenrock community are subsiding and prone to flooding. AML Wyoming is now in the area, with one company responsible for roads and another responsible for buildings.

Past Occurrences

Since landslides, debris flows, and rockfalls occur regularly in Wyoming, previous occurrences are limited to those that caused a high amount of damage or incurred some other cost or unique impact.

Figure 4-29: Historical Landslides in Converse County



Likelihood of Occurrence

The probability of a landslide causing damage in the County is difficult to determine because of the poor historic data. However, given it is reasonable to assume that damaging events have between 10 and 100 percent chance of occurrence in next year, or a recurrence interval of 10 years or less. Therefore, landslides, rockfalls or debris flows are **likely** to occur. Heavy periods of precipitation or significant development could influence slope stability. Typically, there is a landslide/rockfall 'season' that coincides with increased freeze-thaw cycles and wetter weather in the spring and early summer.

Potential Magnitude

There are three measures of future landslide impacts – historic dollar damages, estimated yearly damages, and building exposure values. There are not enough current data to estimate historic or yearly dollar damages. In general terms, landslides can threaten human life, impact transportation corridors and communication systems, and cause damage to property and other infrastructure. Actual losses can range from mere inconvenience to high maintenance costs where very slow or small-scale destructive slides are involved. The potential magnitude of landslides, rockfall and debris flows in the County would be **limited**. However even a small isolated event has potential to close state or US highways in the region that can result in long detours for days or weeks. With the added cost of detours, and the potential for life safety impacts, some landslides could have greater costs.

Vulnerability Assessment

Wood used GIS to conduct an analysis on potential landslide risk areas in the county. Analysis results indicated that no properties or critical infrastructure intersected map risked areas, meaning no built infrastructure was in areas prone to landslide. Because landslide susceptibility is minimal across the County, the overall vulnerability of population is low. Geologic hazards do not pose a threat to human life in Converse County, however, land subsidence is a significant issue, especially in Glenrock. Current mapping does not accurately reflect subsidence conditions, though HMPC members have noted the high rate of structures located near subsiding land.

Transportation networks are the most exposed aspect of the Planning area to landslide and debris flow incidents. Residents and visitors alike are impacted by landslides when roads are damaged by landslides. This includes Interstate 25, cutting east-west across the County through Glenrock and Rolling Hills, Highway 18, running north through Lost Springs, and State Highway 59, running north-south through Douglas and Bill. The loss of transportation networks could potentially cause secondary damage to the overall County's infrastructure, including revenue, transportation availability, emergency response mechanisms and other essential capabilities by preventing the means of these resources from activating or moving between locations.

Future Development

The severity of landslide problems is directly related to the extent of human activity in hazard areas. Human activities such as property development and road construction can also exacerbate the occurrence of landslides. Future development should be done carefully to prevent landslide damage to property or people. Adverse effects can be mitigated by early recognition and avoiding incompatible land uses in these areas or by corrective engineering. Improving mapping and information on landslide hazards and incorporating this information into the development review process could prevent siting of structures and infrastructure in identified hazard areas.

Summary

Overall, landslides, rockfalls and debris flows range from **low** to **medium** significance hazards in the County. Landslides have the potential for direct property impacts including residential structures but more likely infrastructure corridors including roads and highways, power line corridors, and gas lines.

Table 4.47: Landslide Hazard Risk Summary

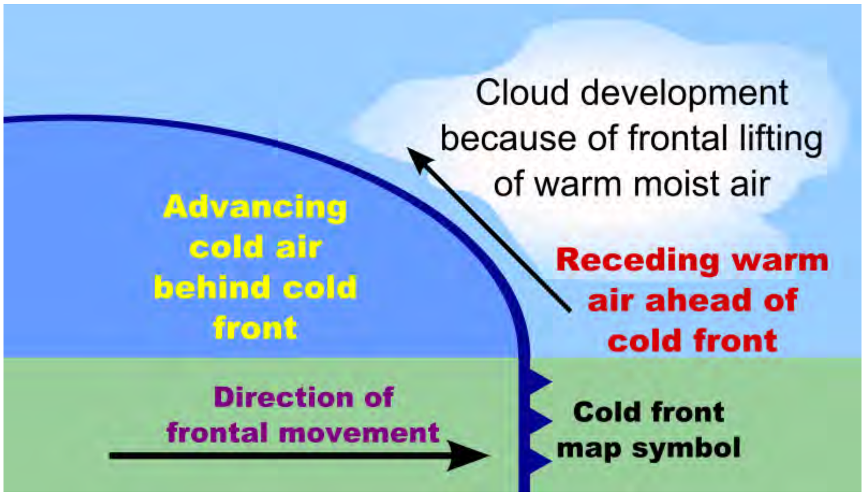
	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Douglas	Negligible	Negligible	Unlikely	Low
Glenrock	Significant	Limited	Occasional	Medium
Rolling Hills	Negligible	Negligible	Unlikely	Low
Lost Springs	Negligible	Negligible	Unlikely	Low
Converse County	Negligible	Negligible	Unlikely	Low

4.3.9 Severe Thunderstorms (includes Hail and Lightning)

Hazard Description

Severe thunderstorms in Converse County are generally characterized by heavy rain, often accompanied by strong winds and sometimes lightning and hail. Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. According to the National Weather Service, a thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. This chapter profiles several sub-hazards that can impact the County in diverse ways – monsoon, hail and lightning. Flooding because of the monsoon is addressed in the Flood profile.

Figure 4-30: Formation of a Thunderstorm



Source: NASA. http://rst.gsfc.nasa.gov/Sect14/Sect14_1c.html

Thunderstorms result from the rapid upward movement of warm, moist air. They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that can reach heights of greater than 35,000 feet. As the rising air reaches its dew point, water droplets and ice form and begin falling the long distance through the clouds towards earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of air that spreads out at Earth's surface and causes strong winds associated with thunderstorms.

The term monsoon generally refers to a seasonal wind shift, or monsoon circulation, that produces a radical change in moisture conditions in a given area or region.

- The movement northward from winter to summer of the huge upper level subtropical high-pressure system, specifically known as the Bermuda High, and
- The intense heating of the Mojave Desert creates rising air and surface low pressure, called a thermal low.

These two features then combine to create a strong southerly flow that helps bring in moisture (i.e., from the Gulf of Mexico, the Gulf of California, and the Pacific Ocean) that lifts and forms thunderstorms when it encounters Wyoming.

Hail

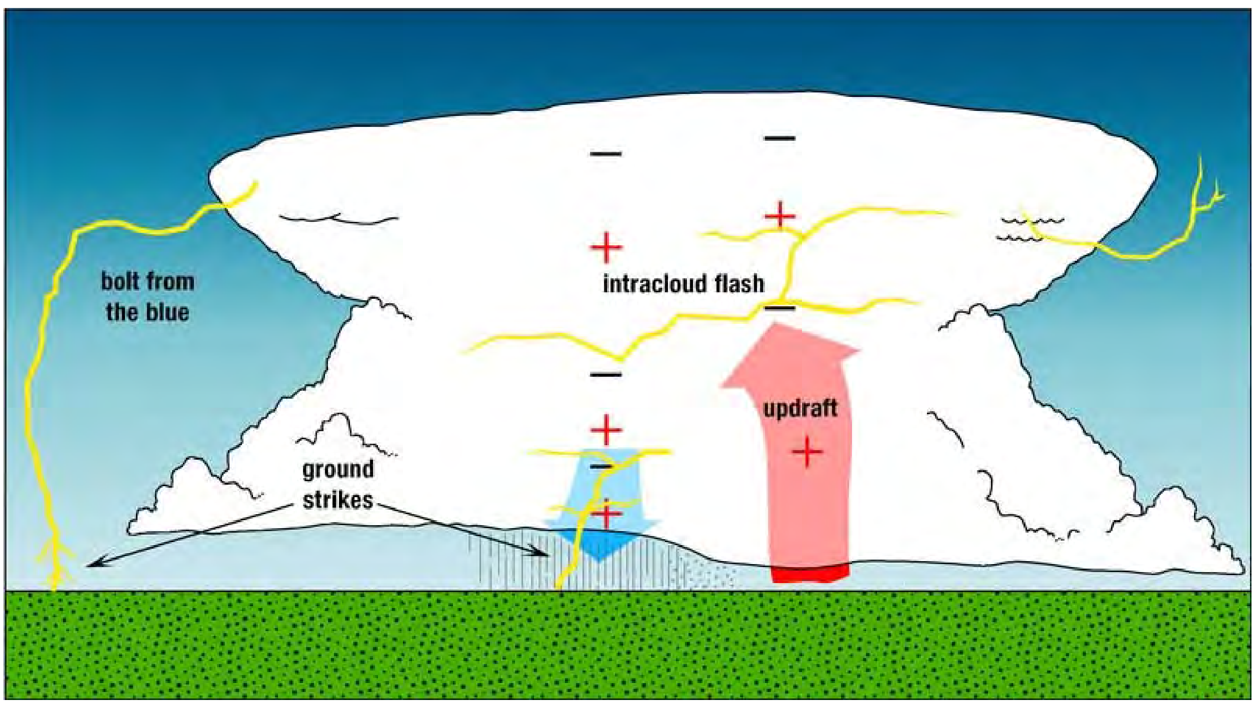
Hail is formed when water droplets freeze and thaw as they are thrown high into the upper atmosphere by the violent internal forces of thunderstorms. Hail is sometimes associated with severe storms within Converse County. Hailstones are usually less than two inches in diameter and can fall at speeds of 120 miles per hour (mph). Severe hailstorms can be quite destructive, causing damage to roofs, buildings, automobiles, vegetation, and crops.

Lightning

Lightning is defined as any and all of the various forms of visible electrical discharge caused by thunderstorms. Thunderstorms and lightning are usually (but not always) accompanied by rain. Cloud-to-ground lightning can kill or injure people by direct or indirect means. Objects can be struck directly, which may result in an explosion, burn, or destruction. Damage may also be indirect, when the current passes through or near an object, which generally results in less damage.

Cloud-to-ground lightning is the most damaging and dangerous type of lightning. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a large minority of flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat. Positive lightning also has a longer duration, so fires are more easily ignited. And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

Figure 4-31: Cloud to Ground Lightning



Source: National Weather Service

Geographical Area Affected

Thunderstorms are generally expansive in size. The entire county is susceptible to any of the effects of a severe thunderstorm, including monsoon, hail and lightning. The typical thunderstorm is 15 miles in diameter, and lasts 30 minutes. Thunderstorms generally move from west to east across the county.

Extent

The National Weather Service classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. The table below indicates the hailstone measurements utilized by the National Weather Service.

Table 4.48: Hailstone Measurements

Average Diameter	Corresponding Household Object
.25 inch	Pea
.5 inch	Marble/Mothball
.75 inch	Dime/Penny
.875 inch	Nickel
1.0 inch	Quarter
1.5 inch	Ping-pong ball
1.75 inch	Golf-Ball
2.0 inch	Hen Egg
2.5 inch	Tennis Ball
2.75 inch	Baseball
3.00 inch	Teacup
4.00 inch	Grapefruit
4.5 inch	Softball

Source: National Weather Service

Damaging hail events occur sporadically throughout the County, usually associated with severe summer storms and wind events. Hail up to 3 inches in diameter has been recorded by the NCDC in Converse County

Lightning is measured by the Lightning Activity Level (LAL) scale, created by the National Weather Service to define lightning activity into a specific categorical scale. The LAL is a common parameter that is part of fire weather forecasts nationwide. The LAL is reproduced below and the planning area is susceptible to all levels:

Table 4.49: Lightning Activity Level Scale

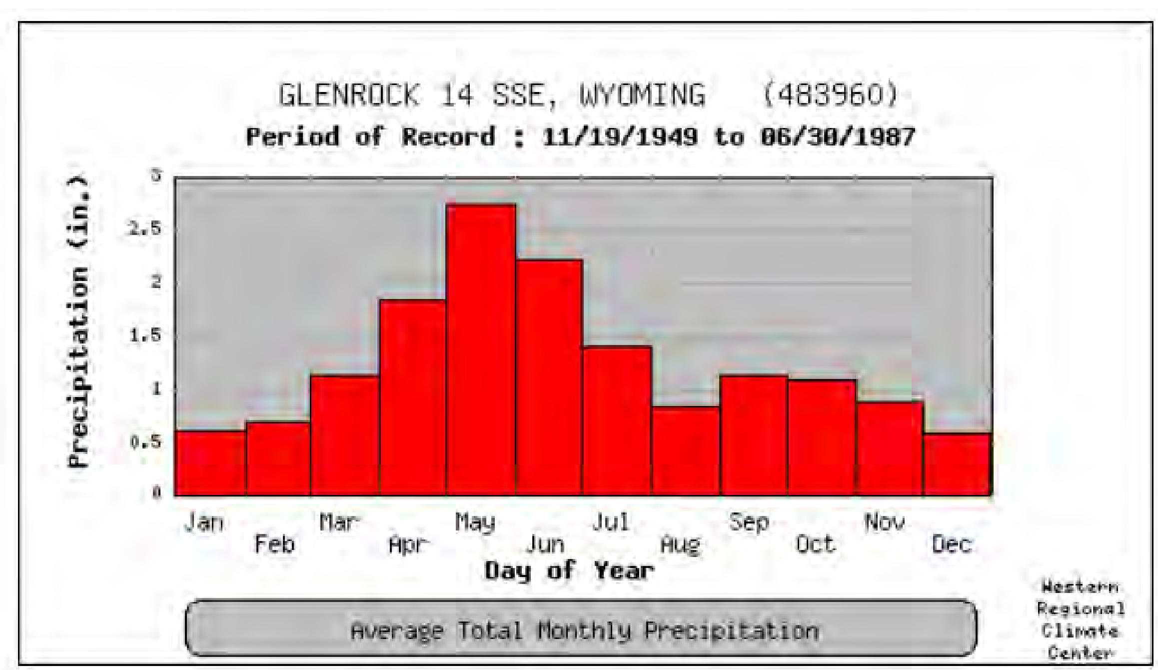
Level	Description
LAL 1	No thunderstorms
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 clouds to ground strikes in a five-minute period
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 clouds to ground strikes in a five-minute period.
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 clouds to ground strikes in a five-minute period.
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 clouds to ground strikes in a five-minute period.
LAL 6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag warning.

Source: National Weather Service. Converse County is at risk to experience lightning in any of these categories.

Previous Occurrences

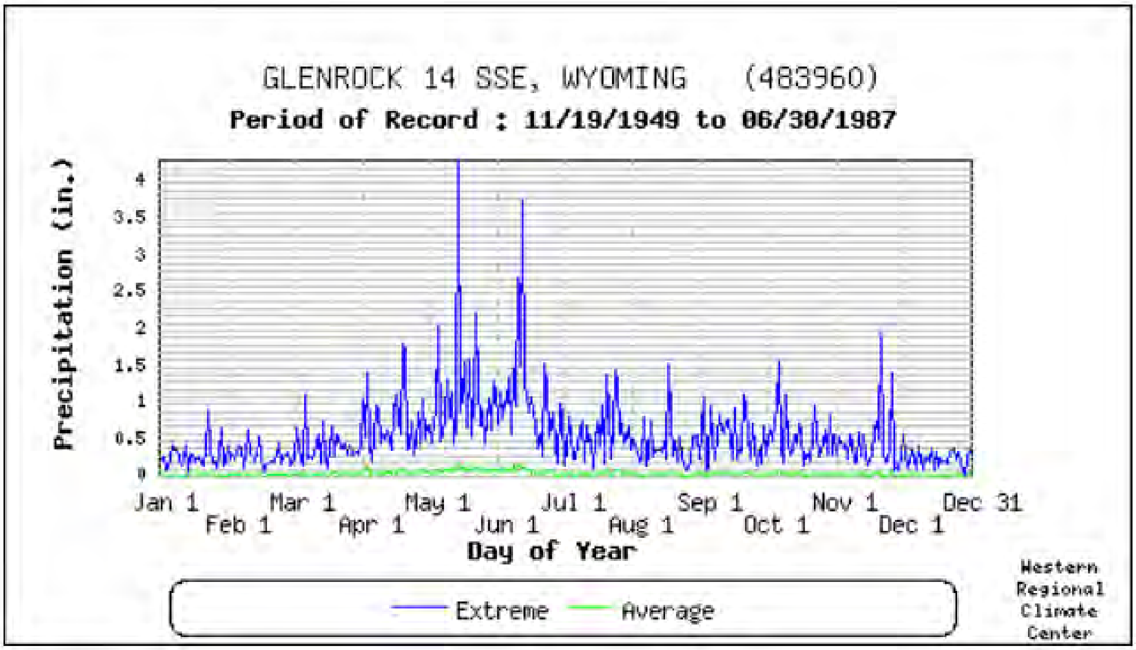
Average monthly precipitation totals for Converse County are shown in Figure 4-29. Precipitation extremes for the County are shown in Figure 4-30. Many of these extremes have occurred between April and July.

Figure 4-32: Converse County Monthly Average Total Precipitation (Glenrock Coop Station)



Source: Western Regional Climate Center

Figure 4-33: Converse County Daily Precipitation Ave. & Extremes (Glenrock Coop Station)



Source: Western Regional Climate Center

Heavy rain, thunderstorms, lightning, and hail in the County are many in number and occur on a yearly basis. The NCDC has not recorded a heavy rain incident between 1960 and 2015.

Hail

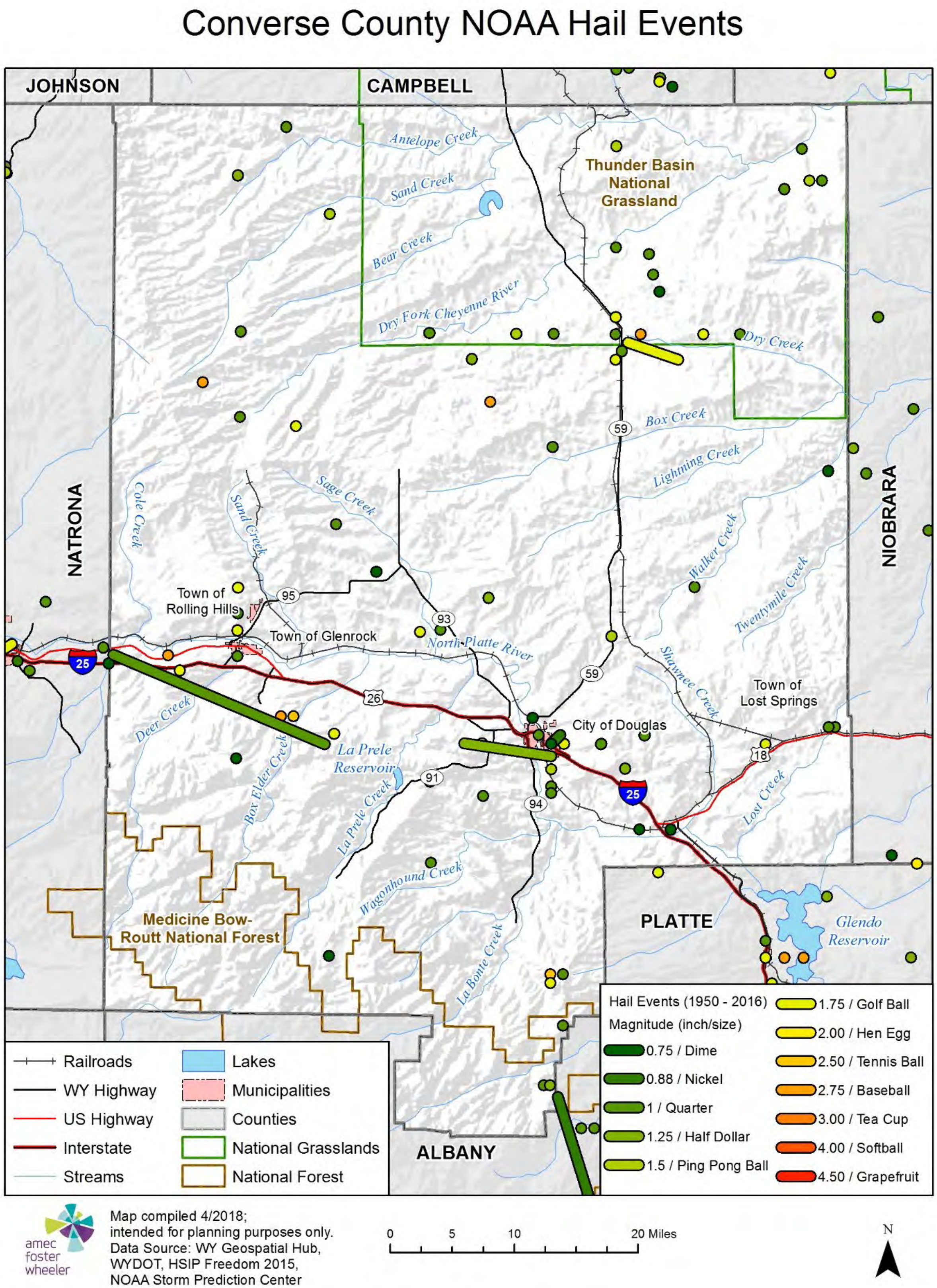
NCDC records any hail events with hailstones that are .75 inch or larger in diameter, or any hail of a smaller diameter which causes property and/or crop damage, or casualties. According to the NCDC definition, there have been 90 separate hail incidents in the County since 1985. The cumulative hail incidents had a total recorded property damage of $60,000. No deaths and one injury have been associated with these storms in the region during this timeframe. Statewide, four injuries have been reported since 1985. Most hail-related injuries are minor and go unreported.

Table 4.50: Converse County Hail History with Impacts 1955-2015

Location	Date	Time	Hail Size	Deaths	Injuries	Property Damage	Crop Damage
Unincorporated	8/18/1989	6:45pm	0.75 in	0	1	$0	0
Douglas	8/15/1996	3:20pm	1.75 in	0	0	$30,000	0
Glenrock	8/19/1997	4:20am	1.75 in	0	0	$2,000	0
Glenrock	8/29/1997	3:30pm	1.75 in	0	0	$2,000	0
Douglas	7/1/1998	10:00pm	2.75 in	0	0	$7,000	0
Bill	7/1/1998	10:34pm	1.75 in	0	0	$4,000	0
Douglas	7/12/2009	5:30pm	1.25 in	0	0	$15,000	0

Source: National Climactic Data Center

Figure 4-34: Historical Hail Events in Converse County



Historically, seven of the 103 NCDC recorded incidents had some level of recorded impact. While most storms don't have much impact, history shows a few outliers, summarized below:

August 19, 1997—A few golf ball sized hailstones accompanied by a large amount of pea size stones caused $2,000 worth of property damage to structures in Glenrock.

July 1, 1998—A storm produced golf ball to baseball size hail, which covered the ground, on several ranches 40 miles northwest of Douglas. Additionally, this same storm produced golf ball size hail in the eastern portion of the County, seven miles east of Bill.

July 12, 2009—The County's costliest hail event occurred when a couple of severe thunderstorms produced large hail and some flooding in Douglas. Strong wind gusts were also reported, with trees damaged or down, and some car windows broken.

Beyond the data supplied by NCDC, members of the HMPC provided anecdotal reports of recent hail events. Not listed in NCDC was hail storms in '96 (Glenrock), August '07 (entire County), and June '17 (entire County).

Lightning

Vaisala's National Lightning Detection Network (NLDN) recorded 347,035 clouds to ground lightning flashes in Wyoming in 2015; they also record an average of 279,632 cloud to ground lightning flashes per year between 2006 and 2015 for the state. This ranks Wyoming 39th nationally for flashes per square mile, averaging 2.9 cloud to ground lightning flashes per square mile, per year.

Nationally, Wyoming ranks 36th in number of lightning fatalities, 33rd in injuries, and 40th in property damage from 1959 to 1994 according to the National Oceanic and Atmospheric Administration, National Severe Storms Laboratory (NOAA, NSSL). Wyoming is number one in the nation in lightning deaths per capita according to the National Weather Service in Salt Lake City. According to the NCDC, lightning has been responsible for 8 deaths, 75 injuries, over $1 million in property damage and $91,000 in crop damage in Wyoming between 1996 and 2015.

According to the National Climatic Data Center, there has only been one lightning event in Converse County between 1950 and 2017. This event occurred in Orin on July 21, 1997 and did not cause any property or crop damage. There were no injuries or fatalities associated with this incident. Table 4.51 presents the details below.

Table 4.51: Converse County Lightning History 1969– 2015

Location	Date	Begin Time	Fatalities	Injuries	Property Damage	Crop Damage
Orin	7/21/1997	3:30pm	0	0	0	$5,000

On May 8, 2006, a lightning strike caused a fire near Orin. The fire burned 500 acres of grass on a ranch, causing $5,000 of crop damage.

Though no fatalities have been reported by NCDC, livestock fatalities are common in Converse County. There have been numerous instances where lighting caused death to cattle and herds of sheep. Other effects include damaged or destroyed wells, as well as to lightning blowing out the power grid. Additionally, with wildfire being a major concern in Converse County, lightning is especially relevant and annually, many tree fires are ignited from lightning strikes. According to the Federal Wildfire Occurrence data obtained through the USGS, of the 209 wildfires occurring in Converse County between 1989 and 2016, 174 fires were ignited due to natural causes. In this instance, natural fire causes involve fires caused without direct human intervention, such as lightning, earthquake, wind, and the like. The data does not distinguish any further specifics.

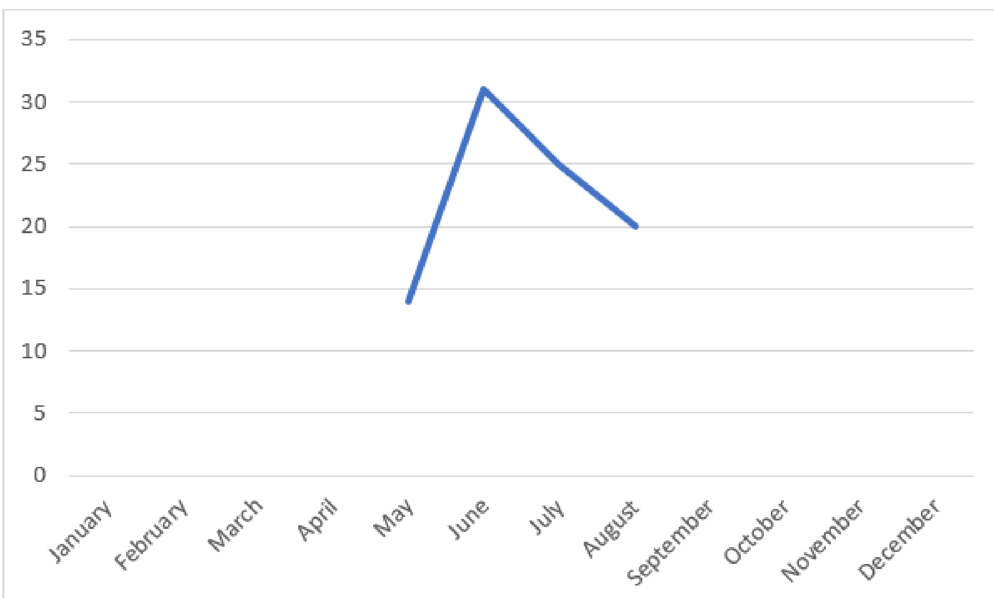
Likelihood of Occurrence

Hail

With 90 hail events recorded by the NCDC over 32 years, hail is estimated to occur almost three times per year in Converse County.

Figure 4-35 displays the month that hail events occur. Hail has only been recorded to occur from April to September. The highest number of events occur in June and July.

Figure 4-35: Month of Occurrence - Hail Events in Converse County 1985 to 2016



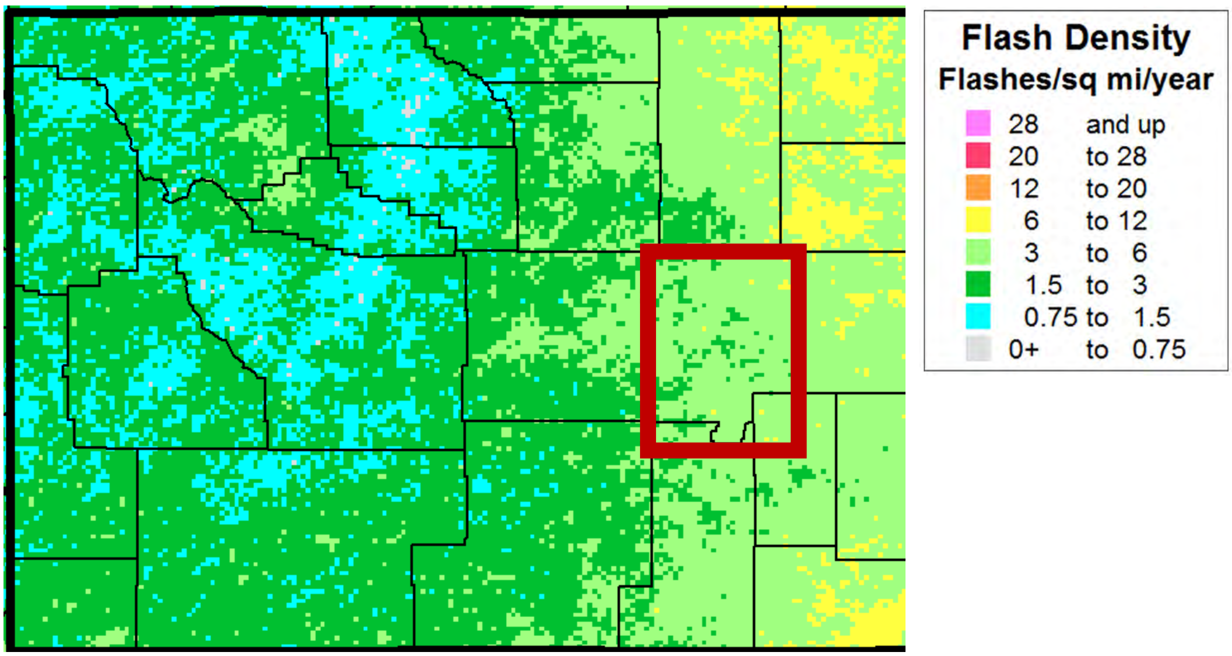
Source: National Climactic Data Center

Lightning

Nationwide, lightning strikes are routinely monitored by Vaisala, Inc. with accuracies to within a 0.625-mile (1 kilometer) resolution. The Wyoming annual lightning strike frequency is depicted in Figure 10.1 for the period of 2005 through 2014. Clearly the eastern plains have more than three times the cloud to ground lightning strikes as the western half of the state. Despite annual variation, the locations of maximum and minimum strikes do not change much from year to year. A warming climate may also affect the frequency of lighting; in 2014 researchers at the University of Berkeley conducted a study that found that for everyone degree Celsius rise in the average global temperature, there will be a 12 percent increase in the amount of lightning strikes.

(Source: Science Magazine, http://www.sciencemag.org/content/346/6211/851.abstract;)

Figure 4-36: Average annual lightning flash density (flashes/sq. mi/year) 2005-2014 over Wyoming.



Source: Illustration courtesy of Vaisala Inc.

U.S. statistics show that one in 345,000 lightning flashes results in a death and one in 114,000 results in an injury nationwide. According to meteorologists at Vaisala, Inc., the odds for an American being hit by lightning sometime during an 80-year lifespan is about 1 in 3,000.

Vulnerability Assessment

Exposure is the greatest danger to people from severe thunderstorms. People can be hit by lightning, pelted by hail, and caught in rising waters. Serious injury and loss of human life is rarely associated with hailstorms.

While national data shows that lightning causes more injuries and deaths than any other natural hazard except extreme heat, there doesn't seem to be any trend in the data to indicate that one segment of the population is at a disproportionately high risk of being directly affected. Anyone who is outside during a thunderstorm is at risk of being struck by lightning. Aspects of the population who rely on constant, uninterrupted electrical supplies may have a greater, indirect vulnerability to lightning. As a group, the elderly or disabled, especially those with home health care services relying on rely heavily on an uninterrupted source of electricity. Resident populations in nursing homes, residential facilities, or other special needs housing may also be vulnerable if electrical outages are prolonged. If they do not have a back-up power source, rural residents and agricultural operations reliant on electricity for heating, cooling, and water supplies are also especially vulnerable to power outages.

Economic impact of severe thunderstorms is typically short term. Lightning can cause power outages and fires. Hail can destroy exposed property; an example is car lots, where entire inventories can be damaged. Generally, long-term economic impacts center more on hazards that cascade from a severe thunderstorm, including wildfires ignited by lightning and flooding.

The Converse County Planning Area experiences a rainy season in the summer. These summer storms can include significant precipitation, winds, and hail. According to historical hazard data, severe weather is an annual occurrence in Converse County. Damage and disaster declarations related to severe weather have occurred and will continue to occur in the future. Heavy rain and thunderstorms are the most frequent type of severe weather occurrences in the County. Utility outages, downing of trees, debris blocking streets and damage to property can be a direct result of these storm events. Given the nature of these types of storms, the entire County is potentially at risk. The HMPC specifically noted that wells often get hit by lightning, and that lightning is a prevalent cause of wildfire. Rolling Hills noted a lightning strike to the town water tank which drained stored water.

There are no indications that cultural or historic resources are more vulnerable to lightning than as previously accounted for as general structures. Natural resources may be vulnerable to indirect impacts of lightning, such as wild fires caused by lightning strikes. The presence of large areas of water, or of wide, open spaces in natural habitats may increase the danger of lightning strikes to trees, people, or structures, but these vulnerabilities are not directly related to natural resources. Campgrounds are areas where lightning strikes have more dangerous impacts, so populations utilizing the campgrounds may have a higher vulnerability.

Lightning doesn’t just strike unprotected people, as the HMPC reported that lightning causes the death of unprotected livestock. Lightning can also have many cascading impacts, including power failure and ignition of wildfires.

Future Development

As the County population increases, more people and property will be exposed to lightning and hail risk. While hail events occur at a regional scale and impact large areas at a time, it is difficult to quantify where specific lightning impacts will occur due to the random nature of lightning strikes.

Summary

Converse County experiences heavy rains and severe thunderstorms during the spring and summer on an annual basis. Both global and regional climate patterns determine the potential severity of these storms from year to year. The entire planning area is equally at risk; it is a matter of chance as to which drainage area a slow-moving storm might linger over. Based on historical information, the primary effect of these storms has not resulted in significant injury or damage to people or property. Hail damage to property is expected to be highest in the municipalities; much of the damage to both property and crops is covered under insurance policies. The most significant threat associated with lightning is the threat of igniting a wildfire. Given the lightning statistics for Wyoming, the County remains at **moderate** risk and is vulnerable to the effects of lightning.

Table 4.52 Severe Thunderstorms Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Douglas	Limited	Limited	Highly Likely	Medium
Glenrock	Limited	Limited	Highly Likely	Medium
Rolling Hills	Limited	Limited	Highly Likely	Medium
Lost Springs	Limited	Limited	Highly Likely	Medium
Converse County	Limited	Limited	Highly Likely	Medium

4.3.10 Tornado

Hazard Description

A tornado is a swirling column of air extending from a thunderstorm to the ground. Maximum winds in tornadoes are often confined to extremely small areas, and vary tremendously over very short distances, even within the funnel itself. Tornadoes can have wind speeds from 40 mph to over 300 mph, the majority displaying wind speeds of 112 mph or less. Erratic and unpredictable, they can move forward at up to 70 miles per hour, pause, slow down and change directions. Most have a narrow path, less than 100 yards wide and a couple of miles long. However, damage paths from major tornadoes can be more than a mile wide and 50 miles long.

Based on national statistics for 1970 – 1980, for every person killed by a tornado, 25 people were injured and 1,000 people received some sort of emergency care. Tales of complete destruction of one house next to a structure that is totally unscathed are well documented. Within a building, flying debris or missiles are generally stopped by interior walls. However, if a building has no partitions or has any glass, brick or other debris blown into the interior, the tornado winds can be life threatening. To examine tornado activity and the potential impact on Converse County and its residents, it is important to understand how tornadoes are rated.

Rating a Tornado

In 1971, Dr. T. Theodore Fujita of the University of Chicago devised a six-category scale to classify U.S. tornadoes into intensity categories, F0 through F5. These categories are based upon the estimated maximum winds occurring within the funnel. The Fujita Tornado Scale (or the "F Scale") became the definitive scale for estimating wind speeds within tornadoes based upon the damage done to buildings and structures. It is used extensively by the National Weather Service in investigating tornadoes, and by engineers in correlating damage to building structures and techniques with different wind speeds caused by tornadoes.

Table 4.53: Fujita Scale Description

F-Scale Number	Intensity Phrase	Wind Speed	Type of Damage Done
F0	Gale tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages signboards.
F1	Moderate tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe tornado	158-206 mph	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.

Recent Changes to Tornado Rating Scale

Devastating tornadoes in Jarrell, Texas on May 1997 and Moore/Oklahoma City on May 1999 demonstrated that wind estimates in the original F-scale may be too high. From 2000 to 2004, the Wind Science and Engineering Research Center at Texas Tech University, in cooperation with numerous expert meteorologists, civil engineers and the National Weather Service (NWS), developed an Enhanced Fujita Scale, or EF-scale. In addition to improving the ranking process, it was essential to the development team that the new EF-scale support and be consistent with the original F-scale. The EF-scale documentation includes additional enhanced descriptions of damage to multiple types of structures and vegetation with photographs, a PC-based expert system, and enhanced training materials.

In February 2007, the Enhanced Fujita scale replaced the original Fujita scale in all tornado damage surveys in the United States. The following table compares the estimated winds in the original F-scale with the operational EF-scale that is currently in use by the NWS.

Table 4.54: The Enhanced Fujita Tornado Scale

	Fujita Scale		Operational EF-Scale	
F Number Fastest	Fastest 1/4 – mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85
1	73-112	79-117	1	86-110
2	113-157	118-161	2	111-135
3	158-207	162-209	3	136-165
4	208-260	210-261	4	166-200
5	261-318	262-317	5	Over 200

Geographical Areas Affected

The entire area of the Converse County is susceptible to tornadoes. While some areas may see more tornadoes than others, this is more of a statistical anomaly than a causal result. The average tornado in the United States is 500 feet across and travels five miles.

Past Occurrences

Tornado statistics, especially prior to the 1970s, must be viewed as incomplete since many twisters have occurred without being witnessed. Wyoming's open rangelands experience little if any damage from these storms, so many go unreported. Many documented tornadoes occurring in Converse County are given low ratings on the Fujita Scale (F0s and F1s) simply because these tornadoes are often formed over open land and result in little or no damage.

Since 1955 there have been 41 tornadoes recorded for Converse County by the National Climatic Data Center. From 1950-2016, there were five injuries, no fatalities, and $105,090 in total recorded property damage in the County. A full accounting of those tornadoes can be found in the following table.

Table 4.55: Tornado History 1950-2016, Converse County

Location	Date	Time	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Converse Co.	7/25/1955	1530	-	0	0	$30	0
Converse Co.	6/14/1965	1700	F1	0	1	$25,000	0
Converse Co.	5/9/1977	2300	F1	0	0	$2,500	0
Converse Co.	6/20/1977	1845	F1	0	0	$30	0
Converse Co.	5/16/1978	1915	-	0	0	0	0
Converse Co.	5/16/1978	2100	-	0	0	0	0

Location	Date	Time	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Converse Co.	5/18/1978	1800	-	0	0	0	0
Converse Co.	5/18/1978	1800	-	0	0	0	0
Converse Co.	5/18/1978	1800	-	0	0	0	0
Converse Co.	5/18/1978	1800	-	0	0	0	0
Converse Co.	5/27/1978	1214	-	0	0	0	0
Converse Co.	7/27/1979	2020	F0	0	0	0	0
Converse Co.	7/27/1979	2020	F0	0	0	0	0
Converse Co.	7/27/1979	2020	F0	0	0	0	0
Converse Co.	7/27/1979	2235	F0	0	0	0	0
Converse Co.	7/25/1980	1630	-	0	0	0	0
Converse Co.	6/5/1982	1904	F0	0	0	$30	0
Converse Co.	6/5/1982	1925	F2	0	1	$25,000	0
Converse Co.	6/5/1982	1945	F1	0	3	$25,000	0
Converse Co.	6/13/1984	1640	F0	0	0	0	0
Converse Co.	6/13/1984	1645	F1	0	0	$25,000	0
Converse Co.	6/13/1984	1755	F0	0	0	0	0
Converse Co.	6/13/1984	1800	F0	0	0	$2,500	0
Converse Co.	6/18/1984	1330	F0	0	0	0	0
Converse Co.	7/16/1989	1621	F0	0	0	0	0
Converse Co.	7/16/1989	1715	F0	0	0	0	0
Converse Co.	5/13/1990	1520	F0	0	0	0	0
Converse Co.	5/11/1991	1754	F0	0	0	0	0
Converse Co.	7/29/1997	1450	F0	0	0	0	0
Converse Co.	7/29/1997	1454	F0	0	0	0	0
Converse Co.	7/29/1997	1500	F0	0	0	0	0
Converse Co.	7/29/1997	1558	F0	0	0	0	0
Converse Co.	5/5/1998	1512	F0	0	0	0	0
Converse Co.	6/13/1998	1040	F0	0	0	0	0
Converse Co.	6/12/1999	1549	F0	0	0	0	0
Converse Co.	6/12/1999	1611	F0	0	0	0	0
Converse Co.	9/3/1999	1551	F0	0	0	0	0
Converse Co.	8/12/2005	1805	F0	0	0	0	0
Converse Co.	7/3/2006	1634	F0	0	0	0	0
Converse Co.	6/20/2010	1620	EF0	0	0	0	0
Converse Co.	6/16/2015	1403	EF0	0	0	0	0
Totals:				0	5	$105,090	0

Source: National Climatic Data Center

The NCDC data allows for examination and statistical analysis of tornadoes occurring in the county. Of the tornadoes in Converse County, twenty-six were rated F0 or EF0 (63%), 5 tornadoes were rated F1 or EF1 (12%), and 10 tornadoes did not receive a rating (24%).

Figure 4-37: Historical Tornadoes in Converse County

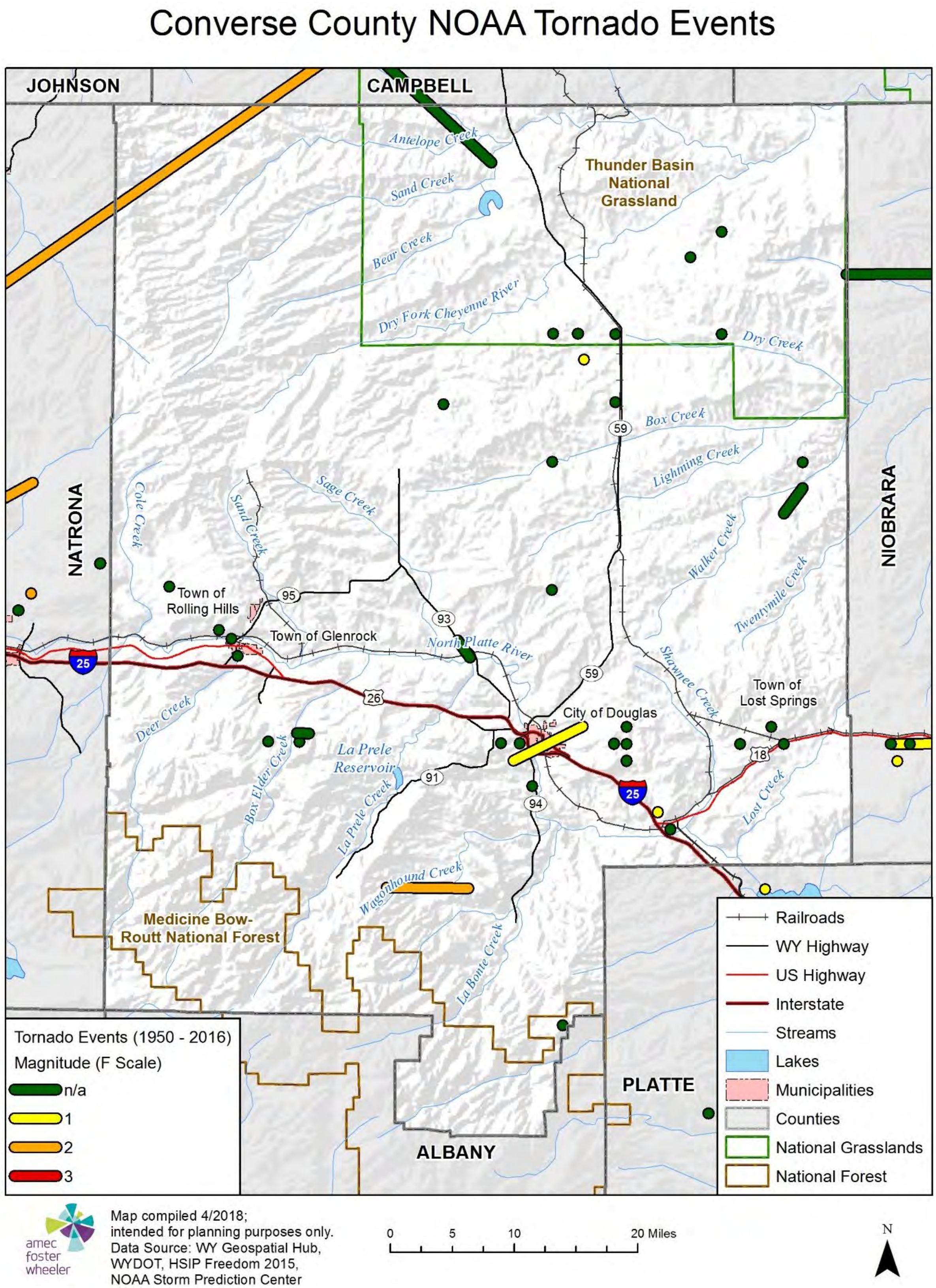
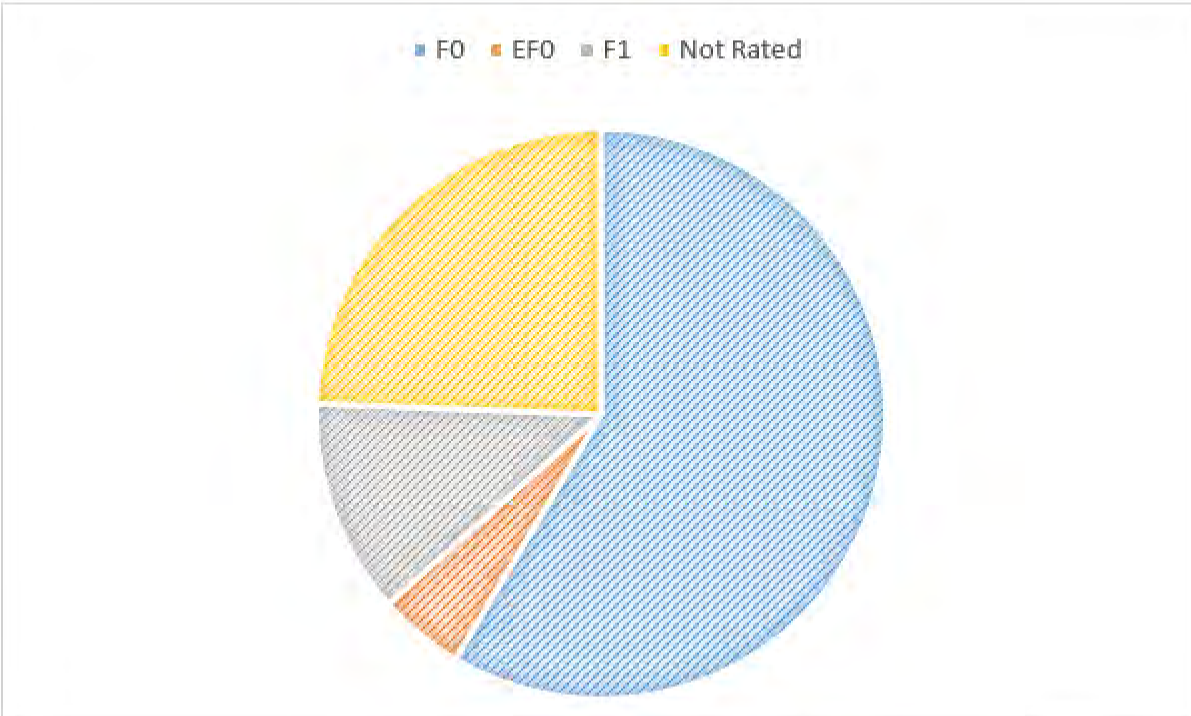


Figure 4-38: Converse County Tornados by Rating: 1950-2016



The data also allows for the development of profiles on historical time periods of tornadoes. Figure 4-33 and Figure 4-40 give historical perspective on the time of year and time of day that tornadoes in the planning area have occurred.

Figure 4-39: Converse County Historical Tornadoes by Month: 1950-2016

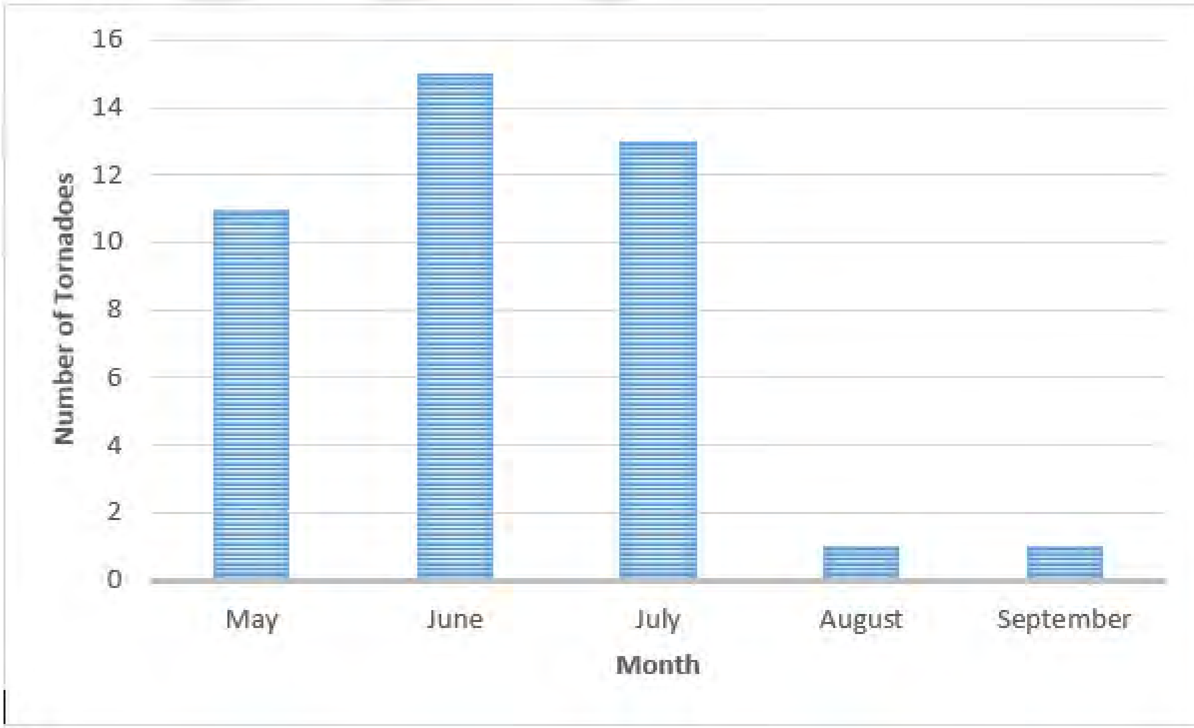
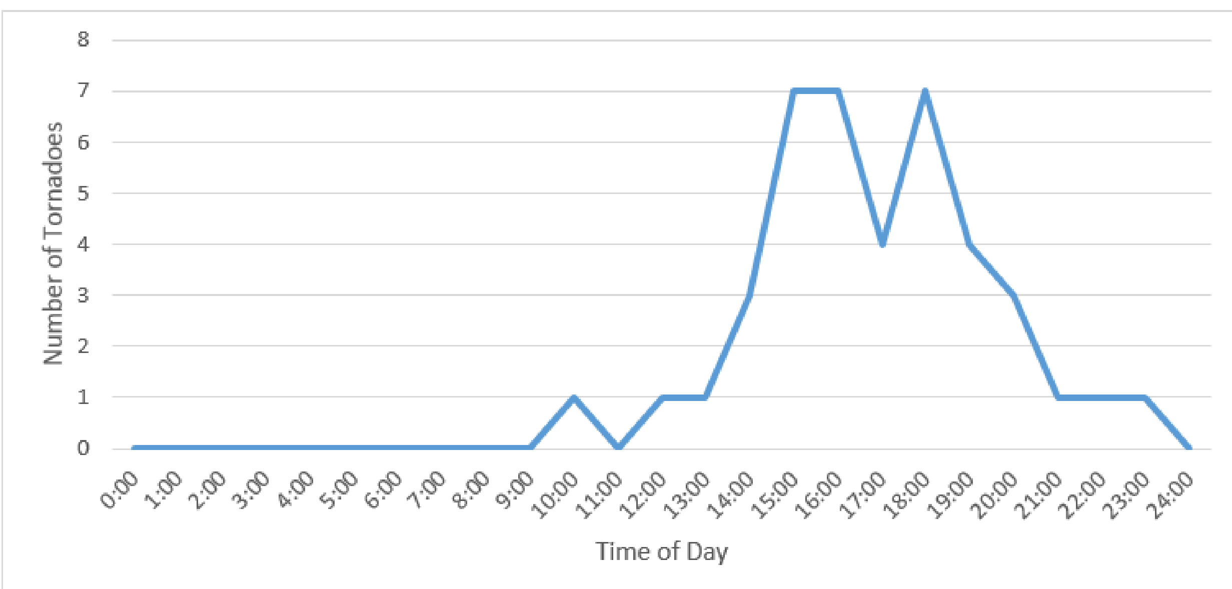


Figure 4-40: Historical Tornadoes by Time of Day: 1950-2016



Most tornadoes recorded in Converse County cause no recorded injuries, no recorded fatalities, and little to no damage to property ($2,500 - $25,000 range). Of the 35 tornadoes that have been recorded by the NCDC in Converse County from 1950 to 2016, six have caused property damage and none have caused crop damage.

Likelihood of Occurrence

On average, Converse County experiences a tornado every 1.6 years. Recorded tornadoes in the County occurred during the months of May through September; most of the tornadoes occurred between 11 a.m. and 11 p.m. Historical ratings vary between F0 and F2 on the F-scale; after the advent of the EF-scale, the planning area has experienced four EF-0 tornadoes. An average tornado occurs in June in the evening, is rated EF-0 or EF-1, and causes less than $25,000 worth of damage to property, though it mostly strikes rural areas causing no damage. This is due more to chance than any environmental factor, however, as inhabited areas are statistically equally at risk of a tornado strike; the potential for injuries, fatalities and damage in these areas is much greater.

NCDC has recorded five injuries and no fatalities attributed to these tornadoes. Cumulatively, the storms have caused $105,090 in recorded property damage, and no recorded crop damage.

Potential Magnitude of Impacts

The National Weather Service considers tornadoes to be among nature's most violent storms. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Tornadic winds can cause people and autos to become airborne, rip ordinary homes to shreds, and turn broken glass and other debris into lethal missiles. Even weaker tornados can cause large economic damages.

According to NCDC records, the three most significant storms of record for Converse County occurred in 1965, and 1982. These three storms each caused $25,000 in property damage, with at least one injury per event.

Though the strength of the tornado often dictates the impacts, it is important to remember that the location (rural or urban) of the tornado is just as important when assessing these risks. Impacts can vary depending on multiple factors, including the size and strength of a tornado, and its path.

Vulnerability Assessment

Because of its rural composition, people or property within the county have not had a history of being severely impacted during past tornado incidents. While the F-Scale ratings of historical tornadoes in the counties in the planning area are low, those ratings are partially based on recorded damage. Recorded damage may have been much more substantial if these tornadic events had impacted one of the many communities in the planning area, rather than timber, outlying range, and farm acreage.

Tornadoes occur at random locations throughout the jurisdiction; for that reason, all structures, critical facilities, essential services, and populations are considered vulnerable.

Future Development

Any future development that is exposed and above ground will be vulnerable to a direct or indirect hit by a tornado. In areas where building codes are not in place and enforced, buildings may not be built to withstand tornado-force winds. Safe room installation in unprotected development can provide an additional safety measure.

Summary

Tornadoes are a credible threat, and will continue to occur in Converse County. While the County has been relatively lucky in its tornado history in its past, it is not immune to the threat of a much larger and more ferocious tornado. Depending on a tornado's size, ferocity and path, it can cause devastating damage to people, property and infrastructure.

Table 4.56: Tornado Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Douglas	Negligible	Limited	Highly Likely	Low
Glenrock	Negligible	Limited	Highly Likely	Low
Rolling Hills	Negligible	Limited	Highly Likely	Low
Lost Springs	Negligible	Limited	Highly Likely	Low
Converse County	Negligible	Limited	Highly Likely	Low

4.3.11 Severe Winter Weather

Hazard Description

The National Weather Service defines a storm as "any disturbed state of the atmosphere, especially affecting the Earth's surface, and strongly implying destructive and otherwise unpleasant weather." Winter storms occur during the winter months and produce snow, ice, freezing rain, sleet, and/or cold temperatures. Winter storms are an annual occurrence in climates where precipitation may freeze and are not always considered a disaster or hazard. Disasters occur when the severe storms impact the operations of the affected community by damaging property, stalling the delivery of critical services, or causing injuries or deaths among the population.

Winter storm watches and warnings may be helpful for determining the difference between a seasonal winter storm and a severe winter storm. Warnings are issued if the storm is producing or suspected of producing heavy snow or significant ice accumulations. Watches are usually issued 24 to 36 hours in advance for storms capable of producing those conditions, though criteria may vary between locations. Winter Weather Advisories are issued when a low-pressure system produces a combination of winter weather that presents a hazard but does not meet warning criteria.[5]

Heavy snow can immobilize the planning region, isolating communities, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse roofs and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow removal, damage repair, and business losses can have a tremendous impact on cities and towns. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days until damages are repaired. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Some winter storms are accompanied by strong winds, creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chills. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Blowing snow can reduce visibilities to only a few feet in areas where there are no trees or buildings. Serious vehicle accidents can result with injuries and deaths.

Winter storms in the County, including strong winds and blizzard conditions, may cause localized power and phone outages, closures of streets, highways, schools, businesses, and non-essential government operations, and increase the likelihood of winter-weather related injury or death. People may be stranded in vehicles or other locations not suited to sheltering operations or isolated from essential services. A winter storm can escalate, creating life threatening situations when emergency response is limited by severe winter conditions. Converse County is prepared with the delivery of extra oxygen as a preventative measure if a large storm is forecasted. The dialysis center also has a generator hookup and contract with a generator company after previous occurrences. All fire stations have backup generators to ensure doors can be opened. Other issues associated with severe winter storms include the threat of physical overexertion that may lead to heart attacks or strokes. Snow removal costs can pose significant budget impacts, as can repairing the associated damages caused by downed power lines, trees, structural damages, etc. Heavy snowfall during winter can also lead to flooding or landslides during the spring if the area snowpack melts too quickly.

Extreme cold often accompanies a winter storm or is left in its wake. It is most likely to occur in the winter months of December, January, and February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities. Extreme cold temperatures

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[5] This information is drawn from the National Weather Association Online Glossary, which may be accessed at http://www.weather.gov/glossary/

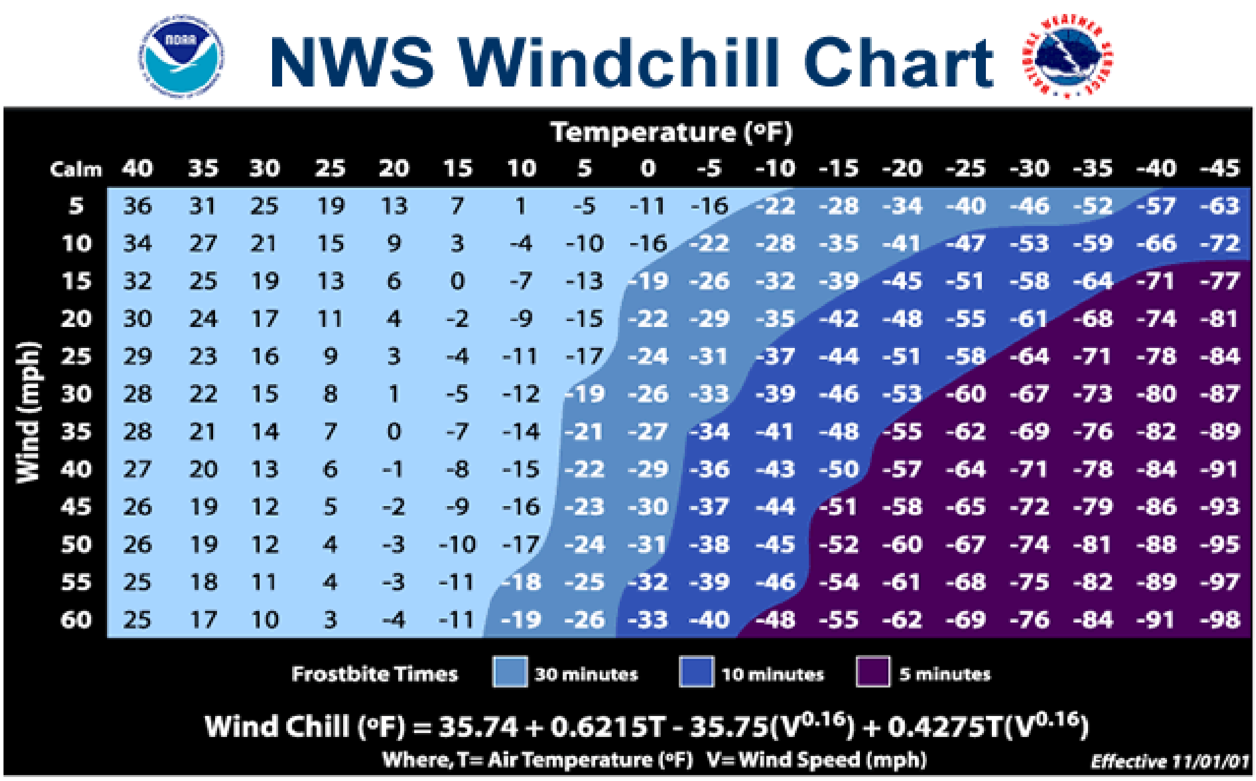
can destroy crops and cause utility outages, leaving people without water or power until the utility companies are able to restore service.

What constitutes extremely cold temperatures varies across different areas of the United States, based on normal climate temperatures for the time of year. When temperatures drop at least 20 degrees below normal winter lows, the cold is considered extreme and begins to impact the daily operations of the county. Extreme cold/wind chill impacts inanimate objects, plants, animals and water supplies.

The effects of extremely cold temperatures are amplified by strong to high winds that can accompany winter storms. Wind-chill measures how wind and cold feel on exposed skin and is not a direct measurement of temperature. As wind increases, heat is carried away from the body faster, driving down the body temperature, which in turn causes the constriction of blood vessels, and increases the likelihood of severe injury or death to exposed persons. Animals are also affected by wind-chill however cars, buildings, and other objects are not.

In 2001, the NWS implemented an updated Wind-Chill Temperature index. This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 4-41: National Weather Service Wind-Chill Chart


NWS Windchill Chart

Temperature (°F)

Wind (mph) \ Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

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

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

Effective 11/01/01

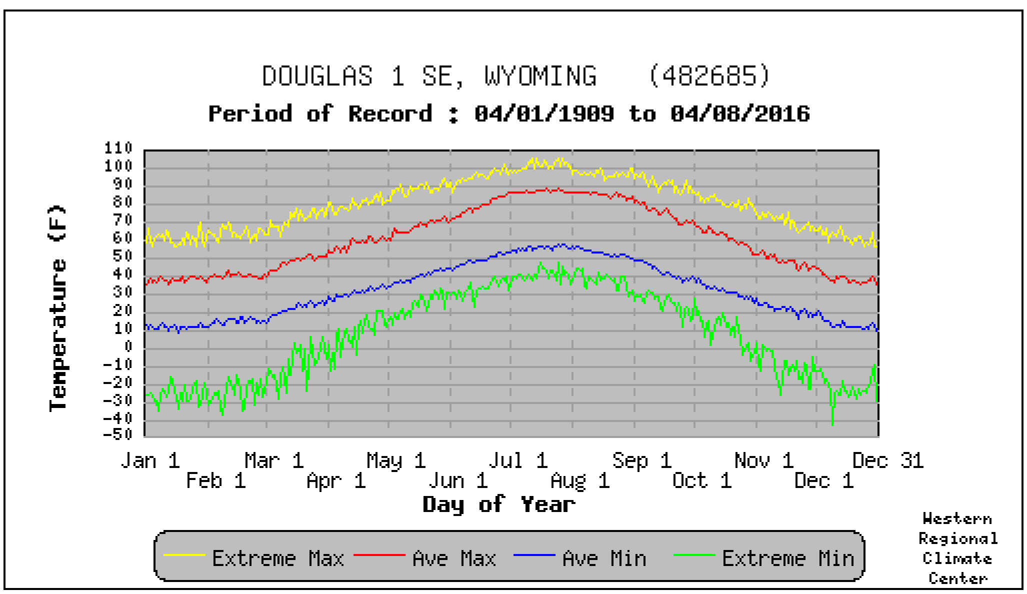
Geographical Area Affected

Winter storms are a yearly feature of the Wyoming climate and may occur anywhere in the state. Generally, severe winter storm events are considered regional, which implies the storms impact multiple counties simultaneously, often for extended time periods. It is possible for the geographic extent of the hazard to vary significantly within a single county - a regional storm may directly impact only a small portion of the planning area while still extending over a large portion of the surrounding area. However, even in these instances, the impacts and effects of a regional hazard are still felt within the planning area. Therefore, while the percent of the planning area directly affected ranges from less than 10% to 100% depending on the specific circumstances, if any portion of the planning area is impacted by the storm, then the entire planning area suffers indirect impacts. Sheltering of stranded travelers on I-25 can be an issue, even from storms affecting Colorado. Glenrock and Douglas can quickly be overwhelmed with shelter needs when I-25 is closed to Casper.

Past Occurrences

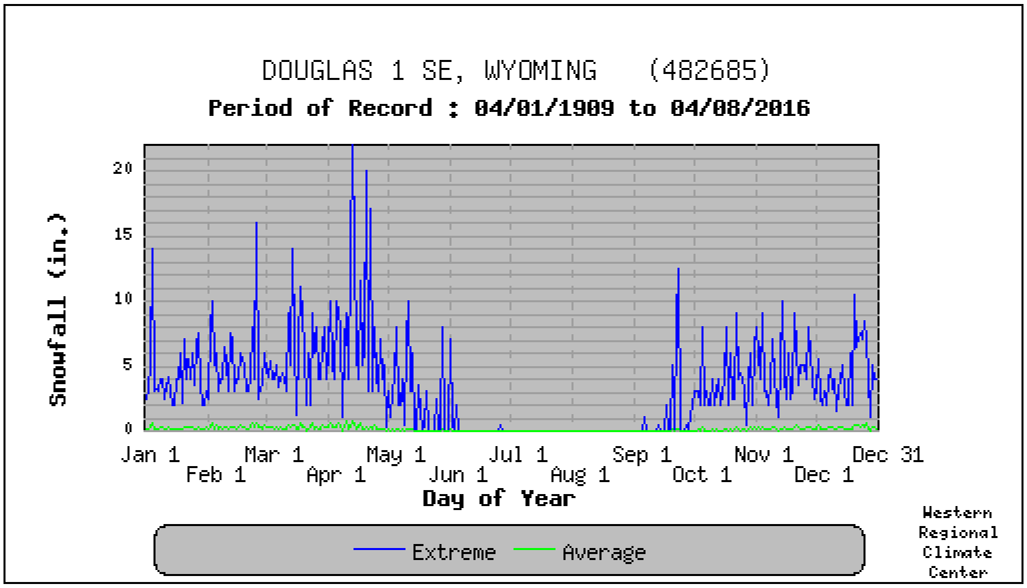
Monthly temperature extremes and averages for Converse County are shown in the following figure. Monthly snowfall extremes and averages for the County are also shown.

Figure 4-42: Converse County Daily Temperature Average and Extremes (Douglas Coop Station)



Source: Western Regional Climate Center

Figure 4-43: Converse County Daily Snowfall Average and Extremes (Casper Coop Station)



Source: Western Regional Climate Center

The winter storm history in Converse County extends from 2009 to January 2017. The County has experienced 96 winter storm incidents during this timeframe. No winter storms in the County caused recorded damage, fatalities, or injuries.

Table 4.57: Summary of NCDC Winter Weather Events in Converse County 2009- 2016

Year	# of Winter Storm Events	# of Blizzard Events	# of Cold/Wind Chill Events	# of Heavy Snow Events	Total Events
2009	1	0	0	4	5
2010	1	1	1	6	9
2011	2	0	0	9	11
2012	0	0	0	0	0
2013	19	1	0	0	20
2014	5	0	0	6	11
2015	7	0	0	0	7
2016	26	0	0	0	26
2017	7	0	0	0	7
Totals	68	2	1	25	96

Source: National Climate Data Center

On October 3, 2013, a potent early season winter storm moved into Wyoming and continued through much of Friday, October 4. Snow began in the higher elevations of western Wyoming early Thursday morning. Rain across the lower elevations changed to snow during the afternoon and evening hours of Thursday as colder air moved across Wyoming from west to east. Wind gusts to 50 mph created blizzard conditions in some areas where visibilities were reduced to near zero and snow drifts of two to eight feet. Several roads and highways were closed, including Interstate 25 from north of Cheyenne to Douglas and Interstate 25 from west of Cheyenne to Rawlins. Total snow accumulations ranged from six to 24 inches. Several warming shelters were established Friday along the I-25 corridor to help those without heat.

Likelihood of Occurrence

Winter storms are an annual occurrence in Wyoming, often occurring multiple times each winter, and affecting entire regions in their size and scope.

Potential Magnitude

The damages caused by severe winter storms and blizzards very and are dependent on several factors: the duration of the storm; the geographic extent; the time of year; meteorological factors such as wind, moisture content of the snow, ground and air temperatures; and the advance warning of the storm. Impacts from the storm dictate the magnitude of the event, emphasizing that the amount snow may not always directly correlate to how bad the storm is. Damaged power lines and dangerous or impassable roadways may forestall the delivery of critical services such as medical and emergency assistance, the delivery of food supplies and medications, or even the provision of basic utilities such as heat and running water. When events happen with a long warning time, it is possible to pre-mitigate the effects of insufficient supply levels or to pre-test emergency generators, which may prevent some of the previously described impacts from occurring. Unanticipated storms increase the number of people stranded, both in cars and at public locations, which may increase the number of injuries and deaths attributed to the event (often caused by exposure) and place uneven and unanticipated strains on public sheltering capacities. The weight of the snow, driven by the water content of the fall, increases the potential for damages caused to structures and trees. Lighter snow caused by extreme cold increases the damages caused to livestock, agriculture and landscaping due to freezing conditions. Winter storms which go through periods of thaw and freeze prolong dangerous icy conditions, increasing the likelihood of frozen and damaged water pipes, impassable or dangerous roadways, damaged communication lines, or more extensive damages to infrastructure and structures caused by seeping water freezing under roofs, porches, patios, inside sidings, or causing damage to vehicles.

Winter storms usually cover a significant part of the State, and as such are easier to describe regionally than on a county by county basis.

Vulnerability Assessment

The threat to public safety is typically the greatest concern during severe winter storms. While virtually all aspects of the population are vulnerable to severe winter weather, there are segments of the population that are more vulnerable to the potential indirect impacts of a severe winter storm than others, particularly the loss of electrical power. As a group, the elderly or disabled, especially those with home health care services that rely heavily on an uninterrupted source of electricity.

Resident populations in nursing homes or other special needs housing may also be vulnerable if electrical outages are prolonged. If they do not have a back-up power source, rural residents and agricultural operations reliant on electricity for heating and water supplies are also especially vulnerable to power outages.

Severe winter weather also increases the vulnerability of the commuting population. While there is no way to quantify which of these accidents occur during severe winter storms versus regular winter storms, the numbers indicate that winter driving conditions raise the vulnerability of the commuting population.

Property vulnerabilities to severe weather include damage caused by high winds, ice, or snow pack and subsequently melting snow. Vehicles may be damaged by the same factors, or temporarily un-useable due to the driving conditions created by severe winter weather. Contents of homes, storage units, warehouses and storefronts may be damaged if the structures are compromised or fail due to the weather, or during potential flooding caused by melting snow. Very wet snow packs down densely and is very heavy. This may create strains on structures, causing partial or entire collapses of walls, roofs, or windows.   This is impacted both by architecture and construction material, and should be assessed on a building-by-building basis. These records are probably tracked via insurance or other private vendors. Crops, livestock and other agricultural operations are also highly vulnerable to severe winter storms.

The physical structures which comprise essential infrastructure are as vulnerable as those outlined in the General Property subsection of this profile. Severe winter weather may also disrupt the availability of services from essential infrastructure, including utility delivery (gas, electric and water), telephone service, emergency response personnel capabilities, road plowing, and childcare availability. Severe winter storms may even halt the operation of an area for periods of time, making the vulnerability of the counties even higher.

As mentioned previously, ice or heavy accumulations of snow, particularly with blowing and drifting, can temporarily impact the roadway system. These accumulations also require vast amounts of overtime for county and local highway and streets departments to remove snow and melt ice. Ice storms or high winds in winter storms can cause extensive loss of overhead utility lines due to buildup either on the lines or on adjacent trees that either collapse due to the weight or blow down onto the utility lines. Services such as telephone, electricity, and cable TV are frequently affected by winter storms. The overall vulnerability of essential infrastructure is medium.

Natural resources may be damaged by the severe winter weather, including broken trees and death of unsheltered wildlife. Unseasonable storms may damage or kill plant and wildlife, which may impact natural food chains until the next growing season. Historical areas may be more vulnerable to severe winter storms due to construction and age of structures. Cultural resources generally experience the same vulnerabilities outlined in General Property, in addition to lost revenue impacts due to transportation impacts. The overall vulnerability of these resources is medium.

Future Development

Where building codes are applicable, future residential or commercial buildings built to code should be able to withstand snow loads from severe winter storms. Future power outages or delays in power delivery to future developments may be mitigated by construction considerations such as buried power lines. Future development will also require future considerations for snow removal capacity including equipment, personnel, and logistical support. Adequate planning will help establish the cost-effective balance.

Public education efforts may help minimize the risks to future populations by increasing knowledge of appropriate mitigation behaviors, clothing, sheltering capacities, and decision making regarding snow totals, icy roads, driving conditions, and outdoor activities (all of which are contributors to decreased public safety during severe winter storms). New establishments or increased populations who are particularly vulnerable to severe winter storms (such as those with health concerns or those who live in communities that may be isolated for extended periods of time due to the hazard) should be encouraged to maintain at least a 72-hour self-sufficiency as recommended by FEMA. Encouraging contingency planning for businesses may help alleviate future economic losses caused by such hazards while simultaneously limiting the population exposed to the hazards during commuting or commerce-driven activities.

Summary

Winter Storms are a **medium** significance hazard in the County. While the percent of the planning area directly affected ranges depending on the specific circumstances, if any area near Converse County is impacted by the storm, then the entire County suffers indirect impacts. Sheltering of stranded travelers on I-25 can be an issue, even from storms affecting Colorado. Glenrock and Douglas can quickly be overwhelmed with shelter needs when I-25 is closed to Casper.

Table 4.58: Winter Storm Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Douglas	Significant	Limited	Highly Likely	Medium
Glenrock	Significant	Limited	Highly Likely	Medium
Rolling Hills	Significant	Limited	Highly Likely	Medium
Lost Springs	Significant	Limited	Highly Likely	Medium
Converse County	Significant	Limited	Highly Likely	Medium

4.3.12 Wildfire

Hazard Description

Wildfire is defined as a highly destructive fire or any instance of uncontrolled burning in grasslands, brush or woodlands. Wildfire has encroached into urban interface situations as more people move closer to forest settings. As defined by the National Interagency Fire Center (NIFC), a “wildland fire” is any non-structure fire, other than prescribed fire, that occurs in the wildland. The term “wildland/urban interface” or WUI is widely used within the wildland fire management community to describe any area where man-made buildings are constructed close to or within a boundary of natural terrain and fuel, where high potential for wildland fires exists. “Aspect” refers to the direction in which a slope faces. “Fuel” consists of combustible material, including vegetation, such as grass, leaves, ground litter, plants, shrubs, and trees that feed a fire.

Wildfires can occur at any time of the year, but are most likely to occur during the spring, summer or fall. Thunderstorms that contain lightning frequently start wildfires, but they can also be caused by humans. Wyoming’s semi-arid climate and rural character make the state vulnerable to catastrophic wildland fires, which comprise more than 50% of all fires in Wyoming.

As the population and the wildland/urban interface in Wyoming increases, the more significant the risk of wildland fire hazard. The past 100 years of wildland fire suppression has led to heavy vegetation growth and thus has greatly increased the potential fuel-load for a wildfire to burn. As the wildland/urban interface has grown into these densely packed forests, the potential for catastrophic wildland fires has increased as well. Fires have historically played a natural role on western landscapes. For example, some species of trees occupy sites following fire until replaced by more shade-tolerant species. In some cases, regeneration of vegetation can be enhanced by fire. Fires may have positive or negative effects, or both, depending upon the resources at risk in the fire area.

Geographical Area Affected

While brushfires could ignite anywhere across the county, the wildland and wildland-urban interface areas are of most concern and are shown in Figure 4-39 based on the Wildland Urban Interface Hazard Assessment. This assessment was produced by a joint venture of the Wyoming State Forestry Division, USFS, BLM, NPS, and other interested parties. This Geographic Information System (GIS)-based mapping effort builds on the Front Range Redzone Project in Colorado (the first fire-hazard mapping program of its kind). The Assessment maps fire hazard incorporating population density against slope, aspect, and fuels. With the mapping analysis evaluating areas of varying wildfire vulnerability, the final output results in a Risk, Hazard, and Value (RHV) map displaying areas of concern (Redzones) for catastrophic wildland fires. The following figure shows RedZone areas, based on available data.

Figure 4-44: Wildland Fire Redzones

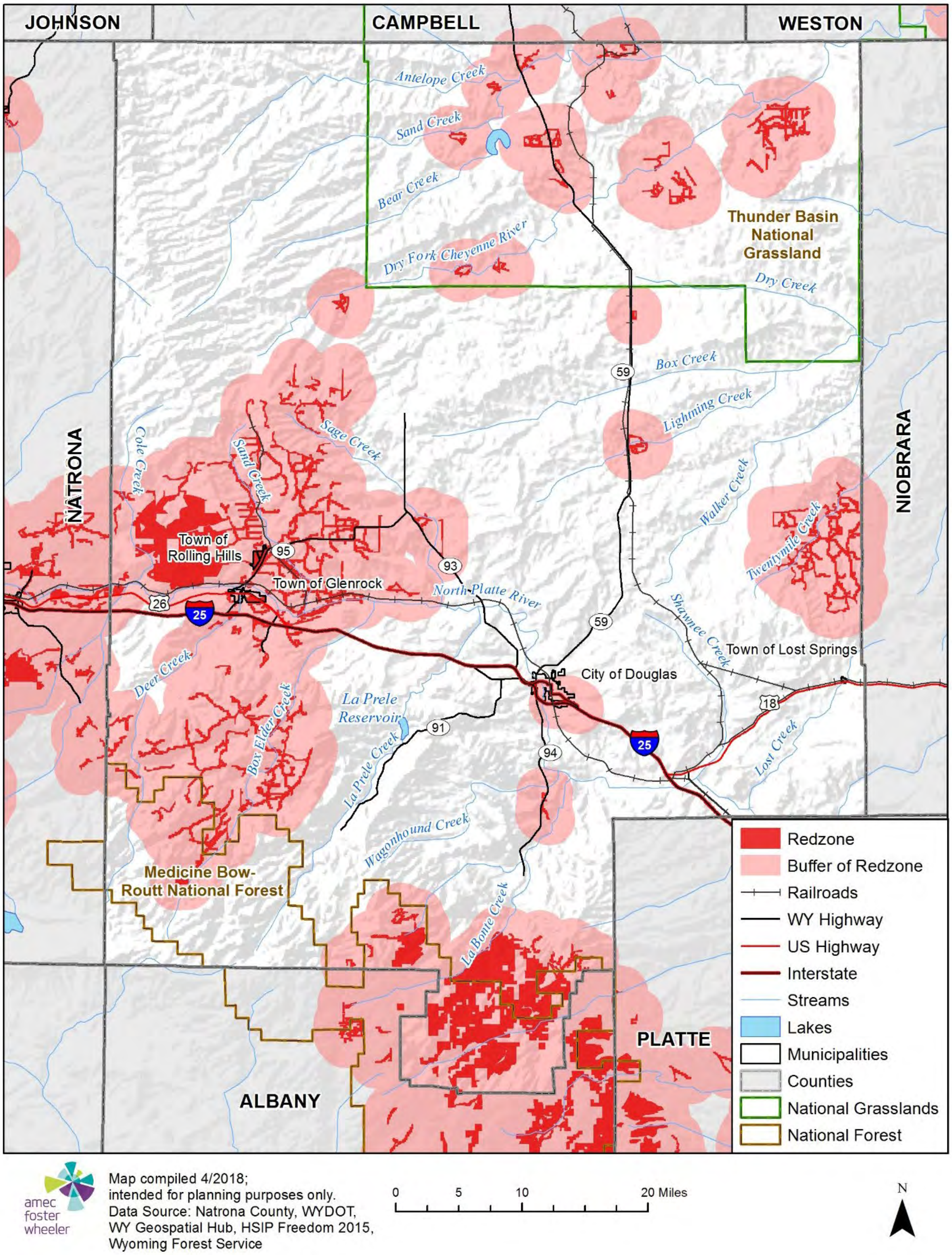
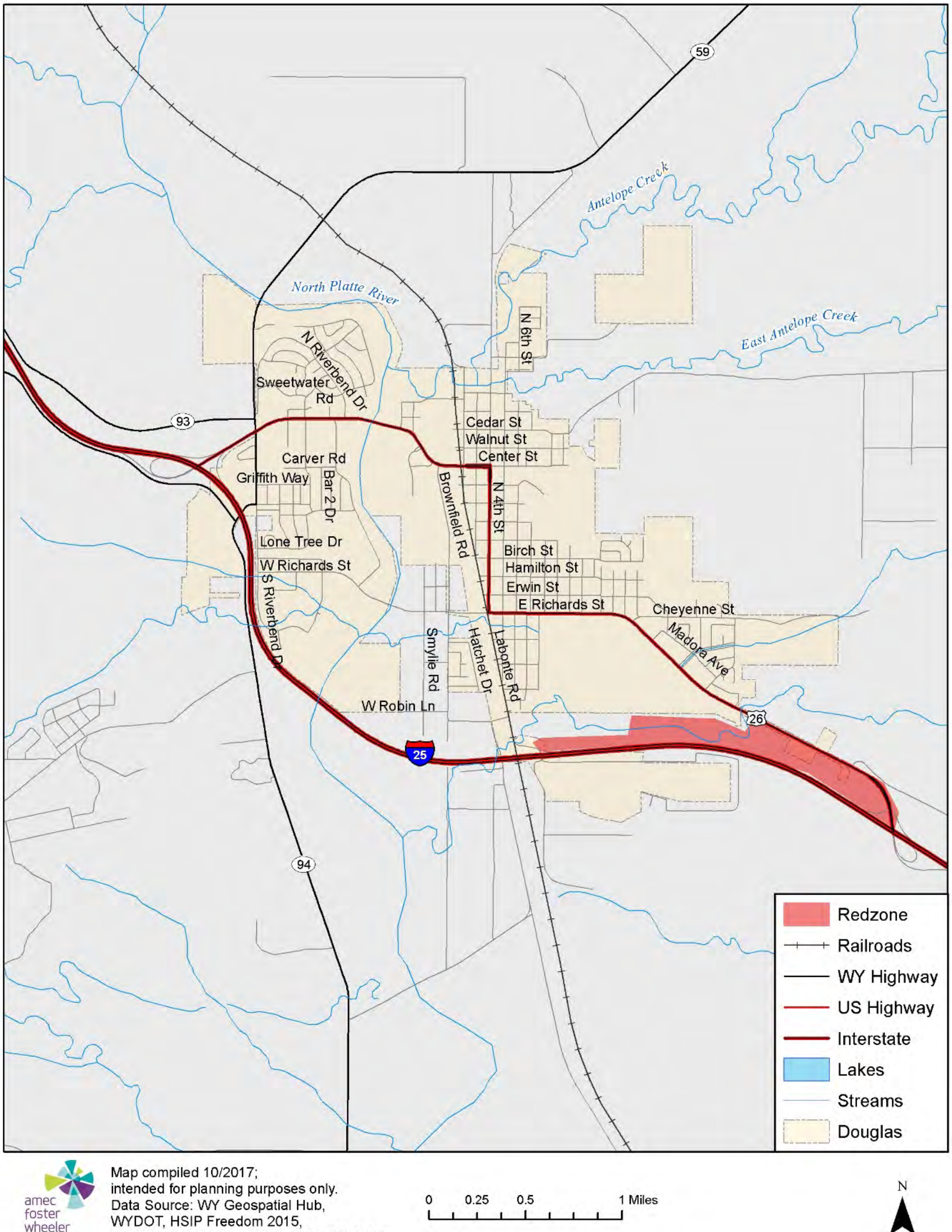


Figure 4-45: Douglas Wildland Fire Redzones



Map compiled 10/2017;
intended for planning purposes only.
Data Source: WY Geospatial Hub,
WYDOT, HSIP Freedom 2015,
WY Geospatial Hub, USGS: BLM, FS, NPS

Figure 4-46: Glenrock Wildland Fire Redzones

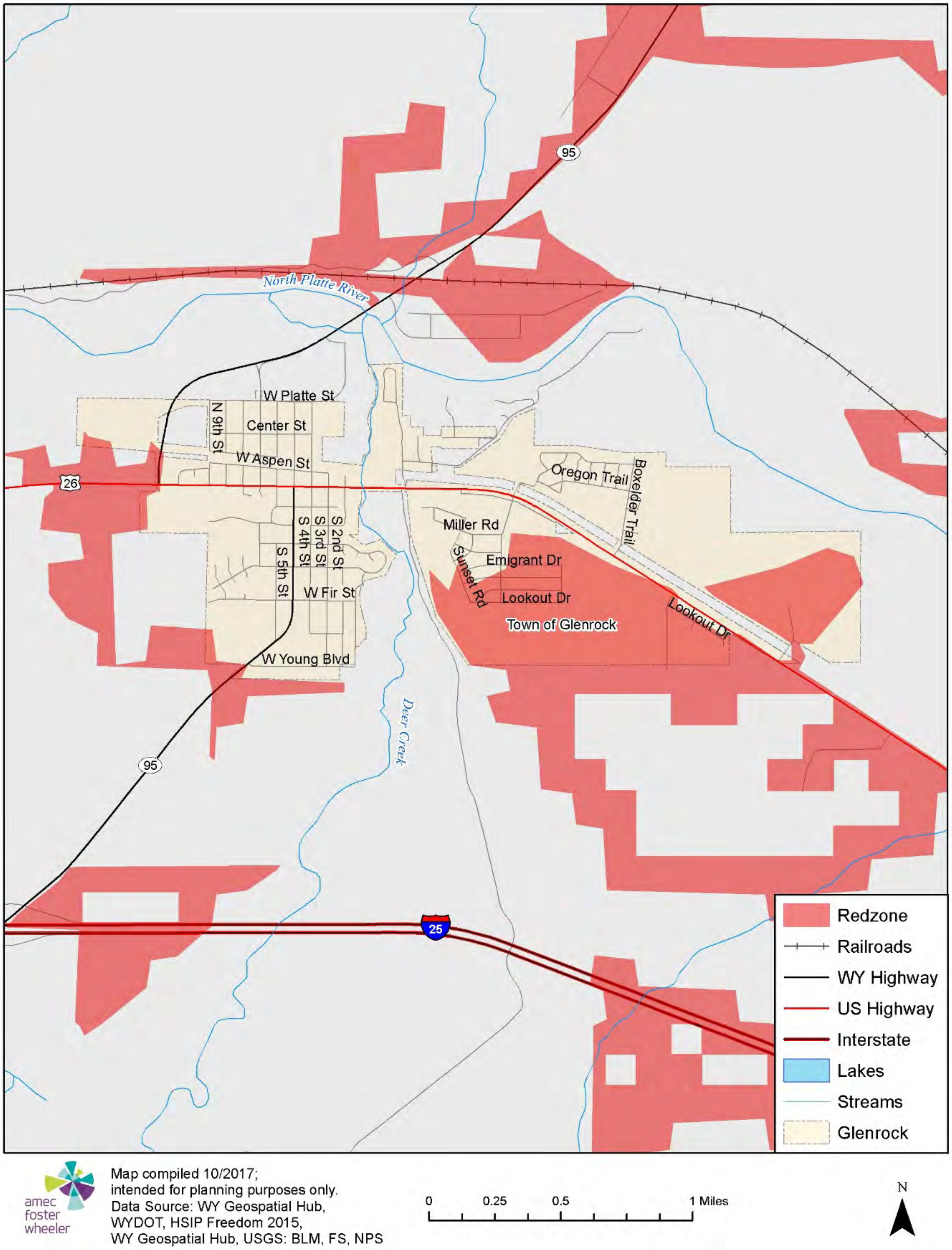
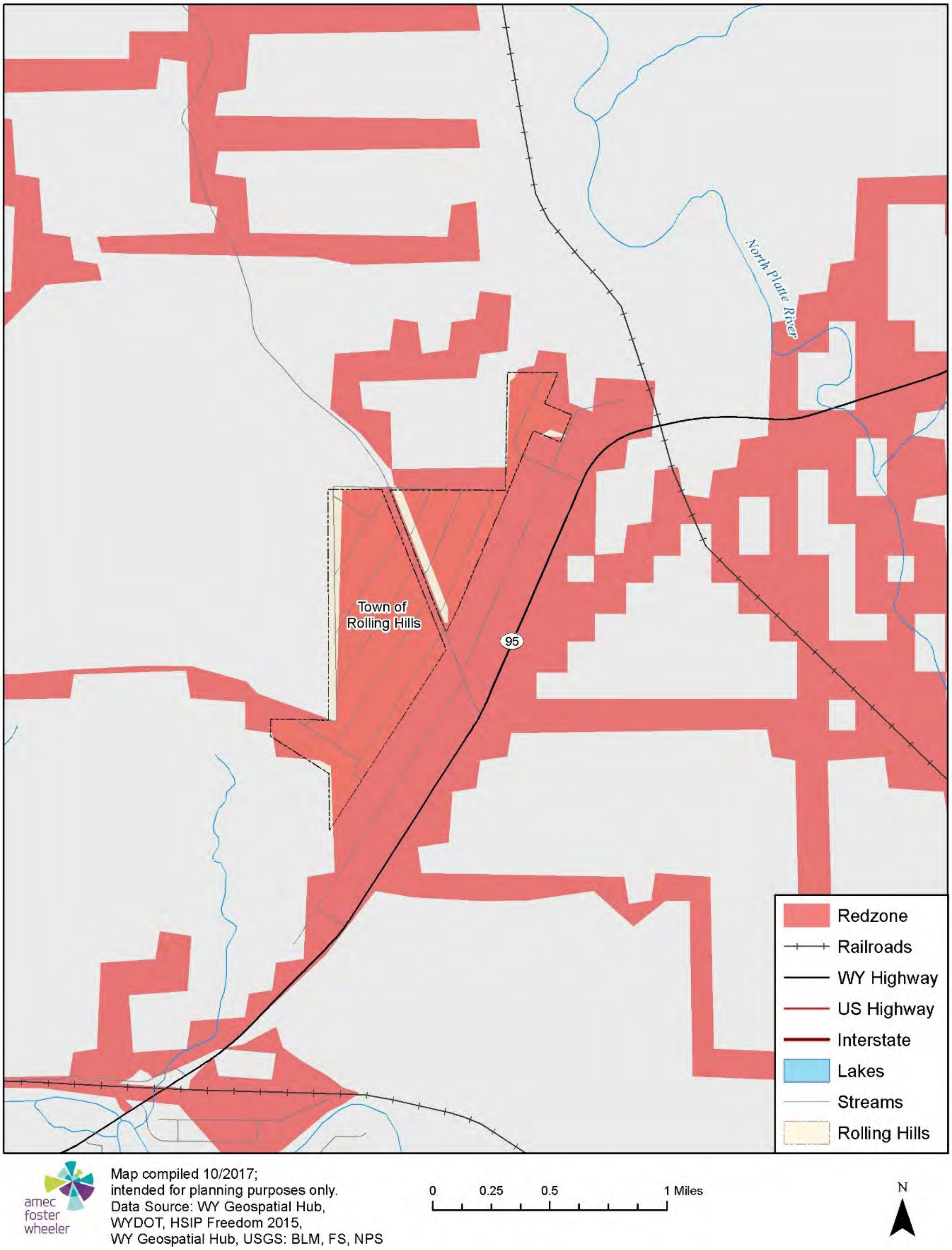


Figure 4-47: Rolling Hills Wildland Fire Redzones



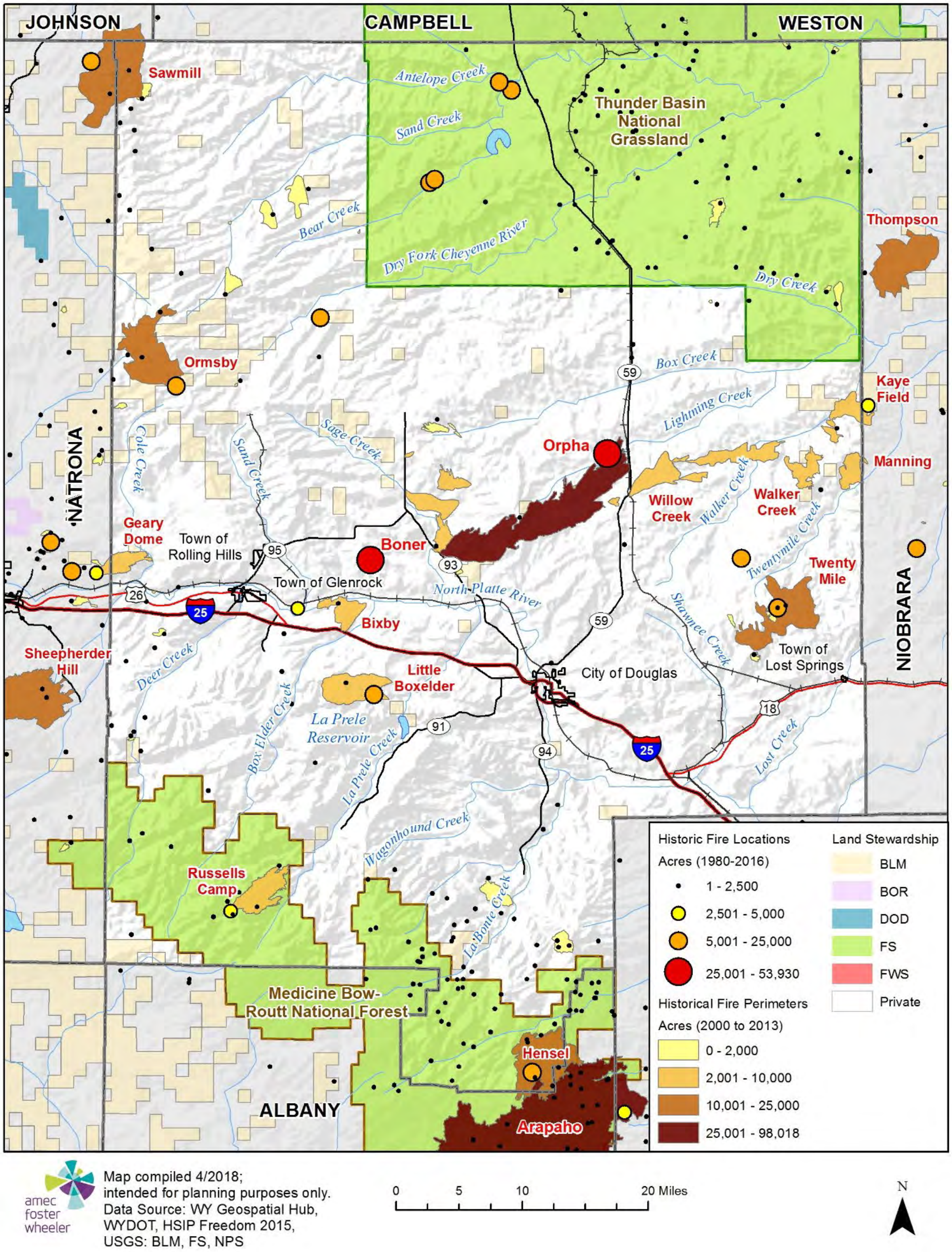
Past Occurrences

The Federal Wildland Occurrence Database was used to analyze fire history in Converse County.

The Federal Wildland Fire Occurrence database, maintained by the USGS and other agencies, includes perimeter and point GIS layers for fires on public lands throughout the United States. The data includes fires dating back to 1980. The Bureau of Land Management, and US Forest Service reports include fires of 10 acres and greater. The database is limited to fires on federal lands. Some fires may be missing altogether or have missing or incorrect attribute data. Some fires may be missing because historical records were lost or damaged, fires were too small for the minimum cutoffs, documentation was inadequate, or fire perimeters have not yet been incorporated into the database. Also, agencies are at different stages of participation. For these reasons, the data should be used cautiously for statistical or analytical purposes.

The following figure shows a map of wildfires that have affected the area based on the Federal Wildland Occurrence Database. Most of the recorded fires occurred in the eastern part of the county.

Figure 4-48: Wildland Fire Occurrences in Converse County 1935 - 2016



There have been several fires affecting over 1,000 acres, and many smaller fires throughout the county. According to the Federal Wildland Occurrence data, of the fires affecting over 1,000 acres, a total of 23 fires burned 208,354 acres. In total, there were 209 fires, affecting 223,628 acres between 1935 and 2015. The largest fire in the County occurred in 2006, when the Boner fire burned 53,930 acres north of Glenrock. The following table describes wildfires in Converse County that burned 1,000 or more acres between 1980 and 2016.

Table 4.59: Wildfires over 1,000 acres in Converse County: 1980-2015

Fire Name	Acres Burned	Cause	Year
Boner	53,930	Natural	2006
Orpha	25,093	Human	2010
Hensel	14,855	Natural	2002
Hensel	14,855	Natural	2002
Twenty Mile	11,083	Natural	2006
Ormsby	11,042	Natural	2000
Antelope	10,000	Human	1999
Walker	10,000	Human	1999
Antelope	10,000	Human	1999
Henry's	9,500	Natural	1996
Little boxelder	5,882	Natural	2012
Carson	5,670	Human	2011
Carson Fire	5,670	Human	2011
Russells Camp Fire	4,905	Natural	2012
Bixby	3,030	Human	2005
Harshman	2,128	Natural	2000
Cheyenne River	2,000	Natural	2006
Ugly	1,827	Natural	2000
Olmstead D	1,520	Natural	1996
Ross #1	1,160	Natural	1996
Lance Creek	1,116	Natural	2006
Sand Creek	1,044	Natural	2012
Lake Creek	1,034	Natural	2003
Wagonhound	1,010	Human	2015

Source: Federal Wildland Occurrence Database

NCDC tracks wildfire incidents, including damages, however, there are no crop or property damages reported for wildfire in Converse County. During the HMP Risk and Goals Meeting, it was noted that during the Orpha fire in 2010, a fire truck got stuck and 3 fire fighters were injured. Additionally, in 2014, the Box Elder Canyon Fire damaged critical facility infrastructure at the halfway point between Douglas and Glenrock. Since this event, the facility has been completely retrofitted and is now more resilient.

Likelihood of Occurrence

Wildfires are **highly likely** to occur in each county in Converse County each year, meaning that there is nearly a 100% chance of a fire happening in any given year. It is important to note that the risk of wildfires occurring may increase during times of drought, especially prolonged droughts such as the statewide Wyoming drought that began between 1999 and 2000 and the 1988 drought in northwestern Wyoming.

It is important to note that this probability is based on total fires; many fires recorded in Converse County are relatively small in size or cause relatively little property damage.

Potential Magnitude

Wildfires can have significant economic impacts as they often coincide with the busy tourist season in the summer months, as well as posing a threat to agriculture and farming. It is important to note that the magnitude of a wildfire can be intensified by drought; drought can also cause significant complications to firefighting operations. Additionally, the high winds of the County also exacerbate fire threat. Most of fires in Converse County have occurred in the unincorporated areas, and therefore there are minimal damages to property or crops. Though the best available data does not indicate any economic costs associated with wildfire in Converse County, anecdotal information emphasizes the inherent threat to people, property, and environment.

Vulnerability Assessment

The 2016 Wildland Fire Management Annual Operating Plan includes Converse County, Gosehn County, Natrona County, and Platte County, in conjunction with the USDI Bureau of Land Management (BLM) High Plains District & Wind River/Bighorn Basin District, USDA Forest Service (USFS) Medicine Bow/Routt National Forest and Thunder Basin National Grasslands, USDI US Fish & Wildlife Service (USFWS), National Park Service (NPS), Wyoming State Forestry Division (WSFD). The plan primarily focuses on implementation of the Wyoming Interagency Cooperative Fire Management Agreement, and addresses issues affecting cooperation, interagency working relationships and protocols, financial arrangements, and joint activities.

In 2005, Converse County developed the Mountain Community Wildfire Protection Plan (MCWPP) for communities identified as ―at risk of wildfire. These communities, all located within the Medicine Bow National Forest in the southern part of the County, were assessed for wildfire risk and mitigation strategies. The MCWPP used a Wildfire Hazard Information Extraction (WHINFOE) model to calculate the wildfire hazard rating for parcels in the WUI. Primary factors that determine the hazard rating for each site include topography, structure construction, access, utilities, landscape, and water supply. Results give the percent of structures at low, moderate, high, and very high risk; and the percent of structures at risk if the mitigation measures are enacted. The document also describes how cooperation is needed between rural fire districts, year-round residents, part-time residents, and neighboring fire response districts if they are to be prepared to respond as quickly and safely as possible in case of a wildland fire.

The most exposed population are those living in the wildland-urban interface (WUI) zones, where residential properties are directly intruding into traditional wildland areas. The exposure of the population in these zones increases with the exposure of the corresponding general property, examined in the section below. Other exposed groups include children, the elderly, or those with breathing conditions who may be exposed to high levels of smoke.

Population at-risk estimates were developed by multiplying the average household size from the U.S. Census for the county by the number of residential structures within the Redzone. These results are shown in the table below. It is important to note that many of these structures may include seasonal homes that could be vacant, although the likelihood of them being occupied during fire season is higher. Converse County's MCWPP focuses on the rural mountain communities of Esterbrook, Downey Park, Cold Springs, and Boxelder. Before modern settlement and the disruption of established fire patterns by grazing, timber harvesting, and fire suppression, these areas experienced regularly-occurring wildfires.

GIS is a tool that is used to compare, capture, input, output, store, manipulate, analyze, model, and display spatial data. In the case of the Wildland Urban Interface Hazard Assessment, wildfire hazard vulnerability is determined by comparing values such as slope, vegetation, housing density, and aspect. The following is from the *Wyoming Wildland Urban Interface Hazard Assessment Methodology*—a report written by the Wyoming State Forestry Division:

"The Wildland Urban Interface Hazard Assessment uses three main layers to determine fire danger—Risk, Hazard, and Values. The following lists include the data used to create each of the three layers.

1) Risk – Probability of Ignition
    a. Lightning Strike density
    b. Road density
    c. Historic fire density
2) Hazard – Vegetative and topological features affecting intensity and rate of spread
    a. Slope
    b. Aspect
    c. Fuels – Interpreted from GAP Vegetation information.
3) Values – Natural or man-made components of the ecosystem on which a value can be placed
    a. Housing Density – Life and property
4) Non-flammable areas Mask – a mask was created to aid in the analysis for areas that will not carry fire such as water and rock areas. These areas show in the final assessment as a zero value for hazard."

The statewide Wildland Urban Interface Hazard Assessment and its resultant outputs serve two primary purposes: assisting in prioritizing and planning mitigation projects and creating a communications tool to which agencies can relate to common information and data. With the mapping analysis evaluating areas of varying wildfire vulnerability, the final output will result in a Risk, Hazard, and Value (RHV) map displaying areas of concern (RedZones) for catastrophic wildland fires.

Another method of estimating vulnerability is to determine the value of structures that are located within RedZones, or wildland fire building exposure values. Wildland fire building exposure value is the value of buildings that can be potentially damaged by wildland fire in an area. The total building exposure value is $917,900,339 according to this analysis. The RedZone analysis also includes a buffer zone to exhibit potential areas at risk within two miles of the RedZone; since wildfires can spread rapidly, it is important to consider areas close to the RedZone boundary. According to the RedZone Buffer analysis, the total building exposure value is $143,511,121. The following table details exposure by jurisdiction and property type. For most communities in the RedZone, residential property presented by far the greatest amounts of exposure.

Table 4.60: RedZone Fire Hazard by Jurisdiction and Property Type

Jurisdiction	Property Type	Building Count	Improved Value	Est. Content Value	Total Exposure
Douglas	Commercial	1	$1,169,266	$1,169,266	$2,338,532
	Exempt	1	$374,388	$374,388	$748,776
	Total	**2**	**$1,543,654**	**$1,543,654**	**$3,087,308**
Glenrock	Industrial	1	$594,938	$892,407	$1,487,345
	Residential	65	$9,049,914	$4,524,957	$13,574,871
	Total	**66**	**$9,644,852**	**$5,417,364**	**$15,062,216**
Rolling Hills	Commercial	1	$11,204	$11,204	$22,408
	Residential	146	$26,025,440	$13,012,720	$39,038,160
	Total	**147**	**$26,036,644**	**$13,023,924**	**$39,060,568**
Unincorporated	Agricultural	38	$8,084,185	$8,084,185	$16,168,370
	Commercial	11	$2,737,195	$2,737,195	$5,474,390
	Exempt	2	$1,286,071	$1,286,071	$2,572,142
	Residential	287	$41,390,752	$20,695,376	$62,086,128
	Total	**338**	**$53,498,203**	**$32,802,827**	**$86,301,030**
	Grand Total	**553**	**$90,723,353**	**$52,787,769**	**$143,511,122**

Source: Wildland Urban Interface Hazard Assessment, Wood analysis based on Assessor's Office data 2017

Population counts were generated using the average household size figure provided by the US Census Bureau. Accordingly, Converse County has an average household size of 2.8. GIS analysis was used to estimate the total population located in the RedZone for each participating jurisdiction. The results are outlined in the table below, and indicate that there are 1,230 people total in the RedZone, of which, the majority are residents of the unincorporated areas (58%).

Table 4.61: RedZone Population by Jurisdiction

Jurisdiction	RedZone Population
Douglas	n/a
Glenrock	165
Rolling Hills	371
Unincorporated	729
Total	**1,265**

Source: Census, Wildland Urban Interface Hazard Assessment, Wood analysis based on Assessor's Office data 2017

Any flammable materials are vulnerable during a wildfire, including structures and personal property. The vulnerability of general property increases as the distance of the property to wildfire-prone areas decreases, and is particularly high for structures located in the WUI. These structures receive an even higher level of vulnerability if the properties surrounding them are not properly mitigated for fire. Appropriate mitigation techniques include using non-flammable materials such as concrete for construction, leaving appropriate spaces between buildings and vegetation areas filled with non-flammable materials (such as decorative rock or stone), and clearing of underbrush and trees.

Essential infrastructure, facilities, and other community assets may be exposed directly or indirectly to wildfire. Direct exposures are like those of General Property and increase as the infrastructure or facilities and capabilities moves into the WUI zone. Communications lines passing through susceptible areas such as forests are more exposed than those located in cities and other more urban areas. The indirect exposure of response capability increases seasonally and with the number of occurrences. Though the populations making up the response capability are not directly exposed to all fire events, the response of some of the personnel to an event lessens the capabilities overall for response to other emergency situations. If there is a significant increase in the number of simultaneous wildland fires, even small ones, the response capability of the county could easily be compromised.

The following table shows numbers of facilities that fall within the RedZones, along with the type of facility. Ten critical facilities reside in the RedZones, all in the unincorporated County.

Table 4.62: Critical Facilities within Redzone

Jurisdiction	Critical Facility Type	Facility Count
Unincorporated	High Potential Loss Facility	2
	Transportation and Lifeline Facilities	8
	Total	10

Source: Wildland Urban Interface Hazard Assessment, Converse County GIS, HSIP, HAZUS

Natural resources and natural areas may benefit from wildland fire, as at some level they must also be exposed to wildfire for a healthy ecological development of the area. Historic and cultural resources could include cabins in the WUI. In addition, older buildings may be exempt from internal fire mitigation such as sprinklers and fire suppression technology, which may increase the vulnerability of the resource.

Future Development

The wildland/urban interface (WUI) is a very popular building location, as shown by national and statewide trends. More and more homes are being built in the interface. Overall, Wyoming has less developed wildland urban interface than most western states. According to the 2016 Wyoming Hazard Mitigation Plan the areas of highest existing risk from wildfire (number of square miles of the wildland urban interface with homes now) mainly occur within Park, Teton and northern Lincoln Counties. Throughout Wyoming there remains potential for future home construction in undeveloped, forested private lands adjacent to fire-prone public lands. Building homes in these high-risk areas would put lives and property in the path of wildfires. Regulating growth in these areas will be a delicate balance between protecting private property rights and promoting public safety.

Summary

Wildfires occur within the county on generally an annual basis. Based on GIS analysis, the planning area has over $143 million in building and content value, as well as 1,230 people potentially at risk to wildland fires in the Redzone. Though it is not likely that the areas at risk will simultaneously face a completely destructive event, this figure provides the upper end of what could be affected.

Overall, wildfire is a **high** significance hazard in Converse County.

Table 4.63: Converse County Wildfire Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Douglas	Extensive	Critical	Likely	High
Glenrock	Extensive	Critical	Likely	High
Rolling Hills	Extensive	Critical	Likely	High
Lost Springs	Extensive	Critical	Likely	High
Converse County	Extensive	Critical	Likely	High

5 MITIGATION STRATEGY

Requirement §201.6(c)(3): [The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

5.1 Mitigation Strategy: Overview

This section describes the mitigation strategy process and mitigation action plan for the Converse County Hazard Mitigation Plan. It describes how the HMPC met the following requirements from the 10-step planning process:

- Planning Step 6: Set Goals
- Planning Step 7: Review Possible Activities
- Planning Step 8: Draft an Action Plan

The results of the planning process, the risk assessment, the goal setting, the identification of mitigation actions, and the hard work of the HMPC led to this mitigation strategy and action plan. **Section 5.2** identifies the goal of this plan and **Section 5.4** describes the mitigation action plan.

5.2 Goals and Objectives

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

Up to this point in the planning process, the HMPC had organized resources, assessed hazards and risks, and documented mitigation capabilities; the resulting goals and mitigation actions were developed and updated based on these tasks. During the original development as well as 2018 update of this plan, the County held a series of meetings designed to achieve a collaborative mitigation strategy as described further throughout this section.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for actions that will be used as means to achieve the goals.

The update of goals for Converse County was initiated through a facilitated discussion at two planning workshops held in November 2017 and January 2018. The HMPC members were provided a PowerPoint presentation that explained goals and actions, and listed examples of each. The plan goals from the 2011 plan were provided to allow HMPC members to provide suggestions for revisions. The updated goals for the 2018 Converse County Hazard Mitigation plan are listed below.

Goal 1: Strengthen public infrastructure.

Goal 2: Improve local mitigation capabilities.

Goal 3: Reduce economic losses due to hazard events.

Goal 4: Reduce local costs of response and recovery.

5.3 Identification and Analysis of Mitigation Actions

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

The next step in the mitigation strategy is to identify and analyze a comprehensive range of specific mitigation actions and projects to reduce the effects of each hazard on new and existing buildings and infrastructure. During the 2018 Plan update, the HMPC analyzed viable mitigation options by hazard that supported the identified goals. The HMPC was provided with the following list of categories of mitigation actions, which originate from the Community Rating System:

- **Prevention**: Administrative or regulatory actions or processes that influence the way land and buildings are developed and built.
- **Property protection**: Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area.
- **Structural**: Actions that involve the construction of structures to reduce the impact of a hazard.
- **Natural resource protection**: Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
- **Emergency services**: Actions that protect people and property during and immediately after a disaster or hazard event.
- **Public information/education and awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

In order to identify and select mitigation actions to support the mitigation goals, each hazard identified and profiled in Chapter 4 was evaluated. At the mitigation strategy meeting, the HMPC was also provided a matrix showing examples of potential mitigation action alternatives for each of the above categories, for each of the identified hazards. The HMPC was also provided a handout that explains the categories and provided further examples. Finally, another reference document titled "Mitigation Ideas" developed by FEMA was distributed. This document lists the common alternatives for mitigation by hazard grouped by the FEMA categories of Plans and Regulations, Structure and Infrastructure Projects, Education and Awareness, Natural Systems Protection and Emergency Services. The HMPC was asked to consider both future and existing buildings in considering possible mitigation actions. A facilitated discussion then took place to examine and analyze the options. Appendix B provides the matrix of alternatives considered. Jurisdictions were requested to return to their communities, discuss potential mitigation measures and add any new actions.

The mitigation strategy builds on existing local authorities, policies, programs, and resources, as well as the ability to expand on and improve these existing tools. Those capabilities are noted in Chapter 2 and can be assessed to identify gaps to address or strengths to enhance through new mitigation actions. For instance, gaps in design or enforcement of existing regulations could be addressed through additional personnel or a change in procedure or policy. Final action strategies are discussed in **Section 5.4**.

5.3.1 Prioritization Process

Once the mitigation actions were identified, the HMPC was provided FEMA's recommended prioritization criteria STAPLEE to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. STAPLEE is an acronym for the following:

- Social: Does the measure treat people fairly? (e.g., different groups, different generations)
- Technical: Is the action technically feasible? Does it solve the problem?
- Administrative: Are there adequate staffing, funding, and other capabilities to implement the project?
- Political: Who are the stakeholders? Will there be adequate political and public support for the project?
- Legal: Does the jurisdiction have the legal authority to implement the action? Is it legal?
- Economic: Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- Environmental: Does the action comply with environmental regulations? Will there be negative environmental consequences from the action?

Other criteria used to assist in evaluating the priority of a mitigation action includes:

- Does the action address hazards or areas with the highest risk?
- Does the action protect lives?
- Does the action protect infrastructure, community assets or critical facilities?

At the mitigation strategy meeting, the HMPC used STAPLEE to determine which of the actions were most likely to be implemented and effective. Keeping the STAPLEE criteria in mind, each member assigned a "high," "medium" or "low" level of priority to each action. The results of the

STAPLEE evaluation process produced prioritized mitigation actions for implementation within the planning area.

The process of identification and analysis of mitigation alternatives allowed the HMPC to come to consensus and to prioritize recommended mitigation actions for their jurisdictions. During the voting process, emphasis was placed on the importance of a benefit-cost review in determining project priority as this is a requirement of the Disaster Mitigation Act regulations; however, this was a planning level analysis as opposed to a quantitative analysis. Quantitative cost-benefit analysis will be considered in additional detail when seeking FEMA mitigation grant funding for eligible projects identified in this plan.

Each mitigation action developed for this plan contains a description of the problem and proposed project, the entity with primary responsibility for implementation, any other alternatives considered, a cost estimate, expected project benefits, potential funding sources, and a schedule for implementation. Development of these project details for each action led to the determination of a high, medium, or low priority for each. For mitigation actions carried forward from the previous Converse County Hazard Mitigation Plan, priority levels were revisited but in most cases remained unchanged. Wholesale changes to priorities across the county (for example changes to the financial, legal and/or political climates in the county) were not identified during this process.

5.4 Mitigation Action Plan

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

This section outlines the development of the updated mitigation action plan. The action plan consists of the specific projects, or actions, designed to meet the plan's goals. Over time the implementation of these projects will be tracked as a measure of demonstrated progress on meeting the plan's goals.

5.4.1 Progress on Previous Mitigation Actions

As part of the update process Converse County reviewed the previously identified actions in the 2011 plan to assess progress on implementation. These reviews were completed using a worksheet and follow up discussion to capture information on each action including if the action was completed or deferred to the future. Actions that were not completed were discussed for continued relevance and were either continued in this plan or in some cases recommended for deletion.

The County and the majority of their participating jurisdictions have been successful in implementing actions identified in this plan, thus, working steadily towards meeting the plan’s goals. Progress on mitigation actions previously identified in these planning mechanisms are detailed in the mitigation action strategy; see **Table 5.1** for more details on progress on implementation.

Table 5.1. 2011 Mitigation Action Status

2015 Action ID	Mitigation Action	2018 Status	Comment
1.2.1	Implement and enforce city ordinances to restrict where trucks are hauling	Continue in progress	Project is continuing. Douglas has designated a specific truck route.
1.3.1	Review and exercise Douglas evacuation plan	Continue in progress	The plan is being developed.
1.3.2	Conduct hazmat tabletop exercises in Glenrock for a yellow cake spill at junction of Highways 26 and 95	Continue in progress	Community is currently planning an exercise to test this scenario.
2.1.1	Put on severe weather spotter training for the public	Continue in progress	Classes have been offered over previous plan life cycle
2.2.1	Enforce building codes (to include use of hurricane clips)	Continue in progress	Douglas requires the use of hurricane clips; Glenrock has codes and enforces them. Glenrock re-prioritizes this mitigation strategy as "high priority."
3.1.1	Work with existing floodplain residents to elevate or flood-proof their structures. Obtain funding assistance and technical guidance	Continue in progress	The project is continuing as structures are altered or constructed; Douglas participates in the FEMA Community Rating System (CRS) program.
3.3.1	Continue to participate in National Flood Insurance Program (NFIP)	Continue in progress	All communities remain in good standing with the NFIP; Douglas participates in the FEMA CRS program.
3.3.2	Implement direction in Converse County Together for Now and Tomorrow (CCTNT) to steer development away from floodplains in Douglas and Glenrock or require mitigation	Continue in progress	Douglas follows FEMA guidelines; Glenrock enforces codes and ordinances.
3.4.1	Obtain funding to implement engineer's recommendation for drainage plans in West Plains subdivision	Continue in progress	The project should be complete by 2022.
3.4.3	Make stormwater system improvements identified in Glenrock.	Continue in progress	Glenrock has been making improvements; improvements will continue in updated plan.
4.1.1	Expand defensible space program begun by State Forestry Division to include more areas of the forested southern part of the County	Continue in progress	State Forestry continues to offer funding for debris removal
4.2.1	Improve access to rural water sources for fire trucks. Fit stock ponds, rural water tanks, etc. with valves compatible to fire apparatus	Continue in progress	this is an ongoing process
4.2.2	Implement communications interoperability for emergency responders via the use of cooperative infrastructure to meet all agencies' wireless communications needs	Continue in progress	Converse County Joint Communications brings Douglas and the County together for communications. Jurisdictions use other systems to supplement communication. County and communities continue to improve communications systems as appropriate.

2015 Action ID	Mitigation Action	2018 Status	Comment
4.2.3	Drill strategically-placed deep source water wells around rural areas for firefighting	Continue in progress	this is an ongoing process
4.3.4	Incorporate Firewise access requirements into county subdivision review for WUI areas	Continue in progress	
4.3.5	Assist addressing issues in Downey Park, Little Medicine, Boxelder Roads, driveways	Continue in progress	Process is continuing
4.4.1	Support hazard fuel reduction projects on all ownerships	Continue in progress	Hazard fuel reduction continues throughout the county
5.1.1	Review water restrictions and continue to implement water rationing measures in Douglas (regulatory) and Glenrock (voluntary) as necessary during drought situations	Continue in progress	Douglas has plan in place to manage water restrictions due to drought conditions. Glenrock has not implemented rationing measures, though water rate increases have been instrumental in customers cutting back on water usage.
6.1.2	Publish snow plowing priorities for county roads. Sign road locations where people are repeatedly stranded by snow	Continue in progress	Snow plow priorities have been recorded. Share and publicize this information with appropriate parties.
6.1.3	Enhance tree trimming program near utility lines and other vulnerable areas	Continue in progress	Utility companies maintain trees; Douglas offers and will continue to offer a cost share tree trimming program to residents.
6.1.4	Continue to work with WYDOT on location and timing of Interstate closures	Continue in progress	This is an ongoing process every winter season, and will continue
7.2.2	Obtain means of back-up power for Rolling Hills town hall.	Continue not started	Incomplete due to lack of funding.
7.3.1	Obtain emergency access easement to Dunham Road in Rolling Hills.	Continue not started	Incomplete due to lack of funding.
7.3.2	Develop plan to deliver potable water to Glenrock if water pipelines are compromised	Continue in progress	Public Works is developing a vulnerability assessment plan with Rural Water; part of the plan will address this strategy.

5.4.2 Deleted Mitigation Actions

As part of mitigation action development for the plan update, the HMPC review of the mitigation actions identified in the previous plan yielded a few actions that the group determined should not continue into the new plan and instead be deleted. **Table 5.2** shows these actions with an explanation for their removal.

Table 5.2. Deleted Mitigation Actions

2015 Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Hazard(s) Addressed	Lead Agency(ies)	2018 Status	Comment
1.1.1	Raise awareness and educate the public on sheltering in place, disaster/emergency supplies and plans, and evacuation	Unincorporated Converse County	Hazardous Materials	Converse County Emergency Management (Converse County Emergency Management Agency), Red Cross, Homeland Security	Delete	Replace with new action
1.1.2	Train and equip local emergency responders to enhance their ability to respond to HazMat incidents	Unincorporated Converse County	Hazardous Materials	Dept. of Justice, Dept. of Defense, Federal Emergency management Agency (FEMA), Wyoming Office of Homeland Security (WOHS)	Delete	Not a mitigation strategy; focuses on response
2.1.2	Educate the public on tornado awareness and what to do in case of a tornado	Unincorporated Converse County	Tornado	Converse County Emergency Management Agency, Red Cross, National Weather Service	Delete	Replace with new action
3.4.2	Engineer and construct a berm to protect the Deer Creek RV Park	Unincorporated Converse County	Flood	Converse County Emergency Management Agency	Delete	Not a priority
3.4.4	Monitor snowpack in Deer Creek and devise method to warn RV Park operator of floods	Unincorporated Converse County	Flood	Converse County Emergency Management Agency, NRCS	Delete	Warning accomplished by direct communication
3.4.5	Address debris collection on Coal Shadow Rd and Hwy 20/26 Deer Creek bridges	Unincorporated Converse County	Flood	Converse County Emergency Management Agency, County Road and Bridge	Delete	this is an ongoing process
4.1.2	Educate rural residents about the use of defensible space to protect property from wildland fire. Educate public on fire resistant construction materials.	Unincorporated Converse County	Wildland Fire	Converse County Emergency Management Agency, County Extension, Bureau of Land Management	Delete	Replace with new action
5.1.2	Educate residents on benefits of conserving water not just during drought. Include education on drought-tolerant plantings (crops & residential).	Unincorporated Converse County	Drought	Converse County Emergency Management Agency, University of WY, County Extension Office, Converse Conservation District (CCD)	Delete	Replace with new action

2015 Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Hazard(s) Addressed	Lead Agency(ies)	2018 Status	Comment
5.1.3	Develop or increase water storage capabilities for livestock industry	Unincorporated Converse County	Drought	Private land owners, CCD, Ag. Organizations	Delete	Not a priority
6.1.1	Educate the public on winter storm preparedness including emergency supplies	Unincorporated Converse County	Winter Storm	Converse County Emergency Management Agency< Red Cross, National Weather Service	Delete	Replace with new action
6.2.2	Obtain 2 snowmobiles for Search and Rescue.	Unincorporated Converse County	Winter Storm	County Sheriff, Converse County Emergency Management Agency	Delete	Not a mitigation strategy; focuses on response
7.1.1	Set up mobile command center as a dual console dispatch	Unincorporated Converse County	All	Converse County Emergency Management Agency	Delete	Not a mitigation strategy; focuses on response
7.1.2	Identify two additional areas outside the downtown core of Douglas to access into 911 if needed. Hardwire these locations ahead of time	Unincorporated Converse County	All	Converse County Emergency Management Agency and LEPC	Delete	Not a mitigation strategy; focuses on response
7.1.3	Install a 911 trunk in the Rolling Hills Fire Station.	Rolling Hills	All	Converse County Emergency Management Agency	Delete	Rolling Hills contracts out comms with GPD and GFD.
7.1.4	Develop and run a PSA educating people to listen to their car radios during a loss of power	County	All	Converse County Emergency Management Agency, Radio Station	Delete	Rolled up into larger public information campaign about different hazards Converse County is vulnerable to
7.1.5	Evaluate communications means for Lost Springs during a disaster	Lost Springs	All	Converse County Emergency Management Agency, Lost Springs	Delete	Not a mitigation strategy; focuses on response
7.2.1	Obtain back-up power for the radio station in Douglas	Unincorporated Converse County	All	Converse County Emergency Management Agency	Delete	Not a priority

5.4.3 Continued Compliance with NFIP

Given the significance of the flood hazard in the planning area and as required by DMA, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP). Unincorporated Converse County, Douglas and Glenrock participate in the NFIP; each jurisdiction will continue to make every effort to remain in good standing with the program. The table below summarizes the NFIP mapping and participation status for jurisdictions in the County.

Table 5.1 NFIP Participation Status Summary

Jurisdiction	Effective Map Status	Date Joined	Comments
Unincorporated County	11/04/09	04/05/88	
Douglas	11/04/09	10/17/78	Douglas is a CRS participant
Glenrock	11/04/09	11/15/85	
Lost Springs	N/A	N/A	Not mapped; not required to participate
Rolling Hills	N/A	N/A	Not mapped; not required to participate

The mitigation strategy reflects each participant's commitment to continue NFIP compliance and participation. Information related to specific floodplain management capabilities can be found in Chapter 2, Table 2.3. Specific efforts include continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance. Actions related to continued compliance include:

- Continued designation of a local floodplain manager whose responsibilities include reviewing floodplain development permits to ensure compliance with the local floodplain management ordinances and rules;
- Suggest changes to improve enforcement of and compliance with regulations and programs;
- Participate in Flood Insurance Rate Map updates by adopting new maps or amendments to maps;
- Utilize Digital Flood Insurance Rate maps in conjunction with GIS to improve floodplain management, such as improved risk assessment and tracking of floodplain permits;
- Promote and disperse information on the benefits of flood insurance.

Also to be considered are the flood mitigation actions contained in this plan that support the ongoing efforts by participating counties to minimize the risk and vulnerability of the community to the flood hazard, and to enhance their overall floodplain management program. It is also important to note that the City of Douglas is a participant in the Community Rating System which underscores the City's commitment to managing its floodplains above and beyond the FEMA minimum standards and keeping flood insurance affordable. Actions related to continued compliance in the CRS include:

- Assessing community flood problems
- Mapping and flood data
- Managing new development to minimize flood damage
- Implementing and updating the Flood Mitigation Assistance Plan

- Reducing flood losses to existing development
- Improving emergency preparedness and response
- Implementing public information and floodplain awareness activities

5.4.4 Mitigation Action Plan

The mitigation action plan presents the recommendations developed by the County planning team, outlining how each jurisdiction can reduce the risk and vulnerability of people, property, infrastructure, and natural resources to future disaster losses. The mitigation strategy is designed to be realistic based on the capabilities in the Unincorporated County and participating jurisdictions.

The actions are captured in **Table 5.3**, and include a description of the action, priority, hazards intended to be mitigated, the parties responsible for implementation, and an action identification number to make actions easier to track and reference in the future. Some mitigation actions are detailed further in the pages that follow. These details include the action description, hazard(s) mitigated, lead and partner agencies responsible for initiating implementation, costs, and timeline. Many of the action items included in this plan are a collaborative effort among local, state, and federal agencies and stakeholders in the planning area.

Further, it should be clarified that the actions included in this mitigation strategy are subject to further review and refinement; alternatives analyses; and reprioritization due to funding availability and/or other criteria. The jurisdictions are not obligated by this document to implement any or all of these projects. Rather, this mitigation strategy represents the desires of each community to mitigate the risks and vulnerabilities from identified hazards. The participating jurisdictions also realize that new needs and priorities may arise as a result of a disaster or other circumstances and reserves the right to support new actions, as necessary, as long as they conform to their overall goals, as listed in this plan.

Where feasible it is recommended that mitigation be integrated and implemented through existing planning mechanisms. Specific related mechanisms are noted in the table where applicable and also discussed in Chapter 6.

Table 5.3. Mitigation Action Strategy 2018-2022

Goal	Action ID	Mitigation Action	Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
1	1.1	Implement and enforce city ordinances to restrict where trucks are hauling	Douglas	Ensure hazardous chemicals transported away from critical facilities and population centers where possible, mitigating potential release impacts	Hazardous Materials	N/A	Elected officials, Law enforcement	Medium	2019
1	1.2	Steer development away from floodplains in Douglas and Glenrock or require mitigation activities consistent with each community's long term planning and flood regulations	Douglas, Glenrock	Reduced impacts from flooding hazards	Flood	N/A	Town and City Planning Departments	High	Ongoing
1	1.3	Enforce building codes (to include use of hurricane clips)	Douglas, Glenrock	Reduced vulnerability to impacts due to high winds, tornadic weather	Tornado; high winds and downbursts	N/A	Code enforcement officers, Douglas, Glenrock	Medium	Ongoing
1	1.4	Make stormwater system improvements identified in Glenrock per the Glenrock Stormwater Management Plan and Master Plan	Glenrock	Increased stormwater flow and reduced vulnerability to flash flooding	Flood	Glenrock, HMGP	Glenrock, FEMA	Medium	2022

Goal	Action ID	Mitigation Action	Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
1	1.5	Obtain means of back-up power for Rolling Hills town hall	Rolling Hills	Continued operations for Rolling Hills town hall during power loss	Dam failure; drought; earthquake; flood; hail; hazardous materials; landslide and subsidence; tornado and windstorm; wildland fire; winter storm	Rolling Hills, Converse County Emergency Management Agency	Rolling Hills, Converse County Emergency Management Agency	Medium	2021
1	1.6	Obtain emergency access easement to Dunham Road in Rolling Hills	Rolling Hills	Additional access to Rolling Hills	Dam failure; drought; earthquake; flood; hail; hazardous materials; landslide and subsidence; tornado and windstorm; wildland fire; winter storm	Rolling Hills, FEMA	Rolling Hills, Converse County Emergency Management Agency	Medium	2022
1	1.7	Remove debris from storm sewers, culverts and other impacted waterways to conserve the unimpeded flow of water	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Improved water flow and reduced risk of flash flooding	Flash Flood	Community funding; County funding	Public Works	High	2019

Goal	Action ID	Mitigation Action	Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
1	1.8	Develop an implementation plan and investigate funding availability and feasibility for saferooms in rural schools (White School, Moss Agate School, Dry Creek School and Walker Creek School)	Unincorporated Converse County	Safe space for schools during tornado or other severe weather incidents	Tornado; Severe Thunderstorm	County funds; staff time	Converse County Emergency Management; School Districts	Medium	2019

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
2	2.1	Continue to participate in National Flood Insurance Program (NFIP) with activities including continued designation of a floodplain manager, improving enforcement of and compliance with regulations and programs, participation in any new FIRM updates, using GIS to improve floodplain management, and promoting the benefits of flood insurance	Unincorporated Converse County, Douglas, Glenrock	Floodplain mitigation and reduced flood vulnerability	Flood	N/A	Converse County Emergency Management Agency, Douglas, Glenrock, Converse County	High	Ongoing
2	2.2	Enhance tree trimming program near utility lines and other vulnerable areas	Unincorporated Converse County, Douglas, Glenrock	Reduce vulnerability of utility lines to failure caused by tree limbs	Winter Storm; high winds and downbursts	County and municipalities	Town/city maintenance, County Road and Bridge	Medium	Ongoing
2	2.3	Review water restrictions and continue to implement water rationing measures in Douglas (regulatory) and Glenrock (voluntary) as necessary during drought situations	Douglas, Glenrock	Enforced and voluntary citizen water conservation during drought conditions	Drought	N/A	City of Douglas; Town of Glenrock	High	One year
2	2.4	Support hazard fuel reduction projects on all ownerships	Unincorporated Converse County	Reduced vulnerability to wildland fire due to reduction in available fuels	Wildland Fire	Bureau of Land Management, Forest Service, WDF	Converse County Emergency Management Agency, local fire departments	High	Ongoing

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
2	2.5	Incorporate Firewise access requirements into county subdivision review for WUI areas	Unincorporated Converse County	Reduced vulnerability to wildland fire due to reduction in available fuels and other fire mitigation measures	Wildland Fire	County staff	County Planning, Converse County Emergency Management Agency	Medium	2020
2	2.6	Continue programs across the County to subsidize water usage during winter months to prevent frozen pipes, and ensure these programs are publicized	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Mitigated impacts to homes and buildings due to freezing winter weather	Winter Weather			High	2019
2	2.7	Develop a public information campaign to increase public awareness of dam failure risk in the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce their risk to dam failure.	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Citizen awareness; personal hazard mitigation	Dam failure	County funds; community funds; staff time	County Emergency Management	High	2019
2	2.8	Continue 50/50 tree trimming program in Douglas and Glenrock to defray homeowner cost in preventive tree care	Douglas; Glenrock	Cooperative approach to reduce utility risk from overgrown trees	High Wind and Downburst; Severe Thunderstorm	Local funds	City of Douglas; Town of Glenrock	High	2019

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
2	2.9	Develop a public information campaign to increase public awareness of hazardous materials risk in the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce their risks during a hazmat incident.	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Citizen awareness; personal hazard mitigation	Hazardous Materials	County funds; community funds; staff time	County Emergency Management	High	2019
2	2.10	Develop a public information campaign to increase public awareness of drought risk in the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce their risk to drought.	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Citizen awareness; personal hazard mitigation; specific focus on drought tolerant plantings (crops/residential), benefits of water conservation	Drought	County funds; community funds; staff time	County Emergency Management	High	2019
2	2.11	Develop a public information campaign to increase public awareness of earthquake risk in the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce their risk to earthquake.	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Citizen awareness; personal hazard mitigation	Earthquake	County funds; community funds; staff time	County Emergency Management	High	2019

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
2	2.12	Develop a public information campaign to increase public awareness of expansive soils risk in the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce their risk to expansive soils.	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Citizen awareness; personal hazard mitigation	Expansive Soils	County funds; community funds; staff time	County Emergency Management	High	2019
2	2.13	Develop a public information campaign to increase public awareness of flood risk in the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce their risk to flood.	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Citizen awareness; personal hazard mitigation	Flood	County funds; community funds; staff time	County Emergency Management	High	2019
2	2.14	Develop a public information campaign to increase public awareness of high wind and downburst risk in the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce their risk to high winds and/or downbursts.	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Citizen awareness; personal hazard mitigation	High Wind and Downburst	County funds; community funds; staff time	County Emergency Management	High	2019

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
2	2.15	Develop a public information campaign to increase public awareness of risks associated with severe thunderstorms in the County (including hail and lightning), focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce their risk to severe thunderstorms.	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Citizen awareness; personal hazard mitigation	Severe Thunderstorm	County funds; community funds; staff time	County Emergency Management	High	2019
2	2.16	Develop a public information campaign to increase public awareness of tornado risk in the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce their risk to tornado.	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Citizen awareness; personal hazard mitigation	Tornado	County funds; community funds; staff time	County Emergency Management	High	2019
2	2.17	Develop a public information campaign to increase public awareness of winter weather risks in the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce their risk to winter weather.	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Citizen awareness; personal hazard mitigation	Winter Weather	County funds; community funds; staff time	County Emergency Management	High	2019

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
2	2.18	Develop a public information campaign to increase public awareness of wildfire risk in the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce their risk to wildfire.	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Citizen awareness; personal hazard mitigation; educate rural residents about the use of defensible space to protect property from wildland fire, and fire-resistant construction materials.	Wildfire	County funds; community funds; staff time	County Emergency Management	High	2019

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
3	3.1	Work with existing floodplain residents to elevate or flood-proof their structures. Obtain funding assistance and technical guidance	Unincorporated Converse County, Douglas	Reduced flooding impacts	Flood	HMGP, FEMA Funds	County Planning Dept., Town and City Planning Depts., Converse County Emergency Management Agency	Medium	2023
3	3.2	Obtain funding to implement engineer's recommendation for drainage plans in West Plains subdivision	Unincorporated Converse County, Douglas	Improved drainage in the Unincorporated Converse County and Douglas	Flood	HMGP, FEMA	Converse County Emergency Management Agency, Douglas, Converse County	High	2022
3	3.3	Expand defensible space program begun by State Forestry Division to include more areas of the forested southern part of the County	Unincorporated Converse County	Reduced vulnerability to wildland fire due to reduction in available fuels	Wildland Fire	State Disaster Preparedness grant, EMPA Grant, DRI, National Weather Service, E911 funds	WY Division of Forestry, Bureau of Land Management (Bureau of Land Management), Forest Service 9FS, Rural Fire Districts	High	2022

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
3	3.4	Maintain compliance with and participate in the National Flood Insurance Program (NFIP) and the Community Rating System (CRS) through continued management and enforcement of floodplain regulations, as well as continual assessment of flood problems, managing new development to mitigate flood damage, implementing and updating the FMA plan, improving emergency preparedness and response, and public awareness	Douglas	Floodplain mitigation and reduced flood vulnerability	Flood	N/A	Douglas	High	Ongoing

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
3	3.5	Participate in the Great Wyoming Shakeout Statewide Earthquake Drill; encourage schools to participate as well	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Reduced impacts of potential earthquake incidents	Earthquake	County funds; community funds; staff time	County Emergency Management	Medium	2019
3	3.6	Conduct annual cleanup and mowing of grasses and underbrush to reduce the potential impacts of grass and/or wildland fire	Lost Springs	Reduce fuel and create buffer around community buildings from grass fire risk	Wildfire	Community funds	Lost Springs	Medium	2019

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
4	4.1	Continue to work with WYDOT on location and timing of Interstate closures	Unincorporated Converse County	Coordinated road closures; reduced impacts of winter storms	Winter Storm	N/A	Converse County Emergency Management Agency, Wyoming Department of Transportation (WYDOT)	High	Ongoing
4	4.2	Publish snow plowing priorities for county roads. Sign road locations where people are repeatedly stranded by snow	Unincorporated Converse County	Increase public awareness and individual resilience; lessen impact of winter storms	Winter Storm	County Road and Bridge	County Road and Bridge, Converse County Emergency Management Agency	Medium	Ongoing

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
4	4.3	Review and exercise Douglas evacuation plan	Douglas	Increased capability to move people from Douglas quickly if necessary	Hazardous Materials	N/A	Converse County Emergency Management Agency, Douglas	Medium	2021
4	4.4	Conduct hazmat tabletop exercises in Glenrock for a yellow cake spill at junction of Highways 26 and 95	Glenrock	Improved ability to respond to hazmat incident; improved interagency coordination	Hazardous Materials	N/A	Converse County Emergency Management Agency, Douglas	Medium	2021

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
4	4.5	Develop plan to deliver potable water to Glenrock if water pipelines are compromised	Glenrock	Reduced vulnerability to infrastructure failure	Dam failure; drought; earthquake; flood; hail; hazardous materials; landslide and subsidence; tornado and windstorm; wildland fire; winter storm	Glenrock	Glenrock Public Works, Converse County Emergency Management Agency	Medium	2021
4	4.6	Implement communications interoperability for emergency responders via the use of cooperative infrastructure to meet all agencies' wireless communications needs	Unincorporated Converse County, Douglas, Glenrock, Rolling Hills	Improved coordination during incident	Wildland Fire	Unknown	PSMC Steering Committee	High	Five years
4	4.7	Put on severe weather spotter training for the public	Unincorporated Converse County	Increased awareness of severe weather occurrences; increased warning time	Tornado	National Weather Service	Converse County Emergency Management Agency, National Weather Service	High	Ongoing

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
4	4.8	Improve access to rural water sources for fire trucks. Fit stock ponds, rural water tanks, etc. with valves compatible to fire apparatus	Unincorporated Converse County	Improved access to water sources during fire response	Wildland Fire	Unknown	Private land owners	Medium	2023
4	4.9	Drill strategically-placed deep source water wells around rural areas for firefighting	Unincorporated Converse County	Improved access to water sources during fire response	Wildland Fire	State of Wyoming	Private land owners, Converse Co. Rural Fire Department	Low	2023
4	4.10	Implement the IPAWS system across the county	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Reduced impacts from hazards due to improved early warning system	All	Local funds	Joint Justice; County Emergency Management	High	2019

Goal	Action ID	Mitigation Action	Benefitting Jurisdiction(s)	Project Benefits	Hazard(s) Addressed	Potential Funding Sources	Lead Agency(ies)	Priority	Timeframe
4	4.11	Develop a public information campaign to increase public awareness of basic community preparedness in the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce their risk to identified hazards.	Unincorporated Converse County; Douglas; Glenrock; Lost Springs; Rolling Hills	Citizen awareness; personal hazard mitigation and preparedness	All	County funds; community funds; staff time	County Emergency Management	High	2019
4	4.12	Conduct soils testing for expansive soils in identified risk areas in Glenrock and Douglas	Glenrock; Douglas	Reduced risk to impacts in areas with identified expansive soils potential	Expansive Soils	Staff time	City of Douglas; Town of Glenrock	High	2019
4	4.13	Assist addressing issues in Downey Park, Little Medicine, Boxelder Roads, driveways	Unincorporated Converse County	Improved addressing in Unincorporated areas of the County, improving response time and efficiency	Wildland Fire	County, Subdivisions, Forest Service	WDF, Bureau of Land Management, FS, Co Road and Bridge, Subdivisions	High	Ongoing

6 PLAN ADOPTION, IMPLEMENTATION AND MAINTENANCE

Requirement §201.6(c)(4): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. This chapter provides an overview of the strategy for plan implementation and maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

6.1 Formal Adoption

The purpose of formally adopting this plan is to secure buy-in from participating jurisdictions, raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes Planning Step 9 of the 10-step planning process: Adopt the Plan. The governing board for each participating jurisdiction has adopted this local hazard mitigation plan by passing a resolution. A copy of the generic resolution and the executed copies are included in Appendix C, Plan Adoption. This plan will be updated and re-adopted every five years in concurrence with the required DMA local plan update requirements.

6.2 Implementation

Converse County has made demonstrated progress toward successful plan implementation since this plan's initial development. Continued implementation will be accomplished by adhering to the schedules identified for each action and through constant, pervasive, and energetic efforts to network and highlight the benefits to the counties, communities and stakeholders. This effort is achieved through the routine actions of monitoring meeting agendas for hazard mitigation related initiatives, coordinating on the topic at meetings, and promoting a safe, sustainable community. Additional mitigation strategies could include consistent and ongoing enforcement of existing policies and vigilant review of programs for coordination and multi-objective opportunities. **Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development.**

Simultaneous to these efforts, it is important to maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the costlier recommended actions. This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements. When funding does become available, the County and municipalities will be in a position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, state and federal earmarked funds, benefit assessments, and other grant programs, including those that can serve or support multi-objective applications.

6.2.1 Role of Hazard Mitigation Planning Committee in Implementation and Maintenance

With adoption of this plan, the County will be responsible for the plan implementation and maintenance. The County, led by Emergency Management, will reconvene its HMPC for plan implementation and maintenance. This HMPC will be the same committee (in form and function, if not actual individuals) that developed this HMP and will also be responsible for the next formal update to the plan in five years.

The County's HMPC will:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high-priority, low/no-cost recommended actions;
- Ensure hazard mitigation remains a consideration for community decision makers;
- Maintain a vigilant monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Report on plan progress and recommended changes to county and municipal officials; and
- Inform and solicit input from the public.

The HMPC will not have any powers over respective County staff; it will be purely an advisory body. The primary duty is to see the plan successfully carried out and to report to the county commissioners, municipal boards, and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on county websites (and others as appropriate).

6.3 Maintenance

Plan maintenance implies an ongoing effort to monitor and evaluate plan implementation and to update the plan as progress, roadblocks, or changing circumstances are recognized.

6.3.1 Maintenance Schedule

The emergency management coordinator is responsible for initiating plan reviews and consulting with the heads of participating departments in the County. In order to monitor progress and update the mitigation strategies identified in the action plan, the county and the standing HMPC will conduct an annual review of this plan and/or conduct a review following a hazard event. An annual mitigation action progress report may be prepared by the HMPC and kept on file to assist with for future updates.

This plan will be updated, approved and adopted within a five-year cycle as per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000 unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule. The County will inquire with WOHS and FEMA for funds to assist with the update. Funding sources may include Emergency Management Performance Grants, Pre- Disaster Mitigation, Hazard Mitigation Grant Program (if a presidential disaster has been declared), and Flood Mitigation Assistance grant funds. The next plan update should be completed and reapproved by WOHS and FEMA Region VIII within five years of the FEMA final approval date. The planning process to prepare the update should begin no later than 12 months prior to that date.

6.3.2 Maintenance Evaluation Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions;
- Increased vulnerability as a result of new or altered hazards
- Increased vulnerability as a result of new development.

Updates to this plan will:

- Consider changes in vulnerability due to action implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Incorporate new data or studies on hazards and risks;
- Incorporate new capabilities or changes in capabilities;
- Incorporate growth and development-related changes to infrastructure inventories; and
- Incorporate new action recommendations or changes in action prioritization.

In order to best evaluate any changes in vulnerability as a result of plan implementation, the County will adhere to the following process:

- A representative from the responsible office identified in each mitigation measure will be responsible for tracking and reporting on an annual basis to the department lead on action status and provide input on whether the action as implemented meets the defined objectives and is likely to be successful in reducing vulnerabilities.

Updating of the plan will be by written changes and submissions, as the HMPC deems appropriate and necessary, and as approved by the respective participating agencies. In keeping with the five-year update process, the HMPC will convene public meetings to solicit public input on the plan and its routine maintenance and the final product will be adopted by the governing council.

6.3.3 Incorporation into Existing Planning Mechanisms

Another important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into other existing plans and mechanisms. Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. As described in the capability assessment, the participating jurisdictions already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. Where applicable, these existing mechanisms could include:

- Converse County Land Use Plan 2015
- Community comprehensive plans
- County or community land development codes
- County or community emergency operations plans
- Threat and Hazard Identification and Risk Assessments (THIRA)
- Community Wildfire Protection Plans (CWPP)
- Transportation plans
- Capital improvement plans and budgets
- Recovery planning efforts
- Watershed planning efforts
- Wildfire planning efforts on adjacent public lands
- Other master planning efforts
- Other plans, regulations, and practices with a mitigation aspect

HMPC members involved in these other planning mechanisms will be responsible for integrating the findings and recommendations of this plan with these other plans, programs, etc., as appropriate. As an action step to ensure integration with other planning mechanisms the County Emergency Manager will discuss this topic at the annual meeting of the HMPC previously described in the Maintenance Schedule. The HMPC will discuss if there are opportunities to incorporate the plan into other planning mechanisms and who would be responsible for leveraging those opportunities. As described in Section 6.2, incorporation into existing planning mechanisms will be done through the process of:

- Monitoring other planning/program agendas;
- Attending other planning/program meetings;
- Participating in other planning processes;
- Ensuring that the related planning process cross-references the hazard mitigation plan, where appropriate, and

- Monitoring community budget meetings for other community program opportunities.

The successful implementation of this mitigation strategy will require constant and vigilant review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community.

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

6.3.4 Continued Public Involvement

Continued public involvement is imperative to the overall success of the plan's implementation. The update process provides an opportunity to solicit participation from new and existing stakeholders and to publicize success stories from the plan implementation and seek additional public comment. The plan maintenance and update process will include continued public and stakeholder involvement and input through attendance at designated committee meetings, web postings, press releases to local media, and through public hearings.

When the HMPC reconvenes for the update, they will coordinate with all stakeholders participating in the planning process—including those that joined the committee since the planning process began—to update and revise the plan. Public notice will be posted and public participation will be invited, at a minimum, through available website postings and press releases to the local media outlets, primarily newspapers, or through public surveys. As part of this effort, at least one public meeting will be held (or a public survey developed) and public comments will be solicited on the plan update draft.

APPENDIX A: PLANNING PROCESS DOCUMENTATION

1.

SIGN-IN SHEET
Converse County Hazard Mitigation Plan Update Project
Meeting #1 (Kickoff), & THIRA REVIEW, September 14, 2017, 1:00 – 3:00 PM
Webinar

Name	Email Address	Phone	Jurisdiction/ Department/ Organization/Affiliation	Title
Ken King	kking@casperwy.gov	267-9103	RERT II	Director
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Jeff Kastle	Jkastle@ccsd1.org	358-5671	" "	Maintenance
Rick Andrews	randrews@qeiwy.com	359-1756	Douglas Fire Dept	Fire Chief
Carlos Mesa	cmesa@mhccwyo.org	359 9093	MHCC, Douglas FD	
James Brown	jbrown@mhccwyo.org	359-3656	MHCC, ~~Do~~	Paramedic
Todd Matthews	tmatthews@cityofdouglas.org	~~358-3~~11	Douglas Police Dept.	Lieutenant
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Terri Sherman	terri.sherman@ccjcc.us	359-0049	Converse County Joint Communications Center	Comm's Manager
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Russ Dalgarn	russ.dalgarn@conversecounty.wy.gov	358-6880	CCEMA	Coordinator

SIGN-IN SHEET
Converse County Hazard Mitigation Plan Update Project
Meeting #2 Risk and Goals Meeting, October 24, 2017, 1:00 pm – 3:00 pm
Converse County Courthouse, Douglas, WY

Name	Email Address	Phone	Jurisdiction/ Department/ Organization/Affiliation	Title
Tonja Rothleutner	TRothleutner@hmsmt.com	358-3397	Mountain Lodge Douglas Care Center	Administrator AP, Safety
Hershel Wickett	Hummer-W@msn.com	307-436-8853	Glenrock Fire Dept.	President
Scott Cotton	Scotton1@uwyo.edu	3072359400	UW Extension Natrona-Converse-Niobrara	WY Disaster POC
Ken Kink	KKink@CASPERWY.GOV		REAT II	DIRECTOR
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Kasey Drummond	kdrummond@glenrock.org	307-436-9294 x5	Town of Glenrock	Com Dev Director
Kim Gullickson	conversefire mitigation@yahoo	307-351-1388	CC Firewise	Fuel Mitig Coord
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SIGN-IN SHEET
Converse County Hazard Mitigation Plan Update Project
Meeting #2 Risk and Goals Meeting, October 24, 2017, 1:00 pm – 3:00 pm
Converse County Courthouse, Douglas, WY

Name	Email Address	Phone	Jurisdiction/ Department/ Organization/Affiliation	Title
Nick Larramendy	nick.larramendy@wyo.gov		Public Health	P.H.RC
Jerome Flores	jflores@sinclairoil.com	(307) 320-6337	Sinclair Trans. Co	Safety & Reg. Corp
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Rick Andrews	randrews@ [illegible]	359-1756	Douglas Fire Dept	Fire chief
Amanda Horr	revseven1@hotmail.com	351-4414	CC Rural Fire	Secretary
Anna McClure	lapreleirrigationdistrict@gmail.com	359-2084	LaPrele Irrigation	Secretary
Todd Matthews	Tmatthews@cityofdouglas.org	358-3811	Douglas Police	Lieutenant
Shane McCloy	Smccloy@Converse2.org	307-554-0975	CCSD2	B+G Supervisor
Steve Martinez	Smartinez@cityofdouglas	307-358-9750	City of Douglas	Superintendent
Jim Ferko	Jvferko@[illegible].com	307-[illegible]-4957	Rolling Hills	Chief [illegible]

M N

SIGN-IN SHEET

Converse County Hazard Mitigation Plan Update Project

Meeting #3 (Mitigation Strategy), January 31, 2018, 12:00 – 3:00 PM

Name	Email Address	Phone	Jurisdiction/ Department/ Organization/Affiliation	Title
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Steve Martinez	smartinez@cityofdouglas	307-358-9750	City of Douglas	Supervisor

SIGN-IN SHEET
Converse County Hazard Mitigation Plan Update Project
Meeting #3 (Mitigation Strategy), January 31, 2018, 12:00 – 3:00 PM

Name	Email Address	Phone	Jurisdiction/ Department/ Organization/Affiliation	Title
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Rick Andrews	randrews@aeiwy.com	307-359-1756	Douglas Fire Dept	Fire Chief

amec foster wheeler

Meeting Objectives:

- Introduce the project
- Introduce purpose, process and requirements
- Formally kick off planning process
- Review hazards to address in the plan update
- Schedule future meetings, plan for stakeholder and public involvement
- Begin data collection effort

Meeting Objectives:

- Review purpose, process and requirements
- Review of Identified Hazards
- Vulnerability Assessment Overview by Hazard
- Capability Assessment
- Update Goals for the Mitigation Plan
- Update on Public Involvement Activities

Agenda

- Opening remarks and introductions
- Review of the planning process and requirements
- Update the mitigation strategy
- Discuss plan implementation and maintenance
- Next steps
- Regionalization
- Questions and Answers/Adjourn

Minutes from Converse County Mitigation Plan Update Initial Coordination Conference Call held on 8/10/2017

This document is a record of attendance and a summary of the topics discussed at the above meeting including the following:

1. Planning Area and Process
2. GIS Resources
3. Public Notification Process
4. Politically Sensitive Issues

The meeting began at 2:00 pm and concluded at 3:00 pm CST.

Attendees

Name	Title	Agency/Department
Russ Dalgarn	Emergency Management Coordinator	Converse County
Mary Schell	Administrative Assistant	Converse County
Kyle Karsjen	Senior Emergency Management Specialist	Amec Foster Wheeler
Jeff Brislawn	Hazard Mitigation Lead	Amec Foster Wheeler

Planning Process

Jurisdictions/Contacts to Invite and Invitations

The jurisdictions that will be invited to participate as official participants in the Converse County Multi-jurisdictional Hazard Mitigation Plan Update will include the following:

- Unincorporated Converse County
- City of Douglas
- Town of Glenrock
- Town of Rolling Hills
- Town of Lost Springs

Additional stakeholders may also be invited to include private businesses, community groups, and private non-profit entities.

The County will work on developing a contact list, including e-mail addresses where available Kyle will provide a blank spreadsheet to record the names and contact info for members of the Hazard Mitigation Planning Committee (HMPC). A list of potential HMPC members was included in the presentation.

Kyle will provide sample invite text to the County for the HMPC kickoff meeting. Once the county has sent out the initial invitation to participate in the process, Kyle will follow up with a calendar invite.

Project Schedule and Meeting Dates/Locations

Tentative meeting dates, times, and locations have been established as follows:

Converse County	Meeting 1 (Remote)	Meeting 2	Meeting 3
Date	September 13	Mid-October	Late November
Time	1-3 PM MST	TBD	TBD
Location	N/A	TBD	TBD

The county suggested 1-3 PM as a good time for the meetings; dates and locations for meetings 2 and 3 are still to be determined.

List of Hazards to Include/Naming of Hazards

For the purposes of the plan update, the list of hazards will mirror the hazards in the old plan. Those hazards are:

- Dam Failure
- Drought
- Earthquakes
- Floods
- Hail
- Hazardous Materials
- Landslides and Subsidence
- Tornadoes and Windstorms
- Wildland Fires
- Winter Storms

The Wyoming State Hazard Mitigation Plan includes the following additional hazards:

- Avalanche
- Expansive Soils
- Landslide
- Lightning
- Mine Subsidence

While these hazards may not receive a full profile in the plan, it is recommended to at least identify these hazards in the Converse County plan and explain why they didn't receive a full profile.

GIS Resources

A preliminary list of GIS needs will be provided. The County noted that there is not a full-time GIS person on staff, and that most of the County's GIS information is hosted online.

Public Notification Process

For the first public comment opportunity, Amec Foster Wheeler will facilitate development of a public survey. This survey will be distributed through a link to an online SurveyMonkey survey. Additionally, during the Kickoff meeting, Amec Foster Wheeler will ask the participating jurisdictions to identify locations such as city halls or post offices where hard copy surveys can be made available. Amec Foster Wheeler will also ask jurisdictions to identify other outreach tools that can be used to disseminate information on the availability of the public survey.

For the final public comment, the County website will be utilized to post the draft plan during the final public comment period. The Cities and school districts will be encouraged to include a link on their websites to the County website as well.

Amec Foster wheeler will provide sample text for two public notifications that the County will distribute through various media outlets such as the County website, Facebook, and Twitter. The first public notification release will provide the online survey link as well as locations where hard copy surveys can be completed. The second public notification release will provide information on the availability of the final draft for public review and comment.

Politically Sensitive Issues

The group discussed whether or not there were currently politically sensitive issues in Converse County. Zoning was mentioned as a possible issue.

Summary of Converse County Hazard Mitigation Plan Update
Kick-Off Meeting Conference Call/Webinar
Converse County Courthouse Meeting Room
107 N 5th Street, Douglas
September 14, 1:00 – 2:00 PM

Opening Remarks and Introductions

Kyle Karsjen, the project manager from Amec Foster Wheeler began the webinar presentation and asked everyone in the room to make sure they signed in to the meeting. Present on-site were 13 participants, documented in a sign-in sheet. A mix of people representing the County, municipalities, and stakeholders were present including:

Name	Title	Agency	Jurisdiction
Kevin King	Director	RERT II	RERT
Dan Grizwold	Ops Chief	RERT II	RERT
Jim Cobb	Maintenance Director	Converse County School #1	Converse County
Jeff Kastle	Maintenance	Converse County School #1	Converse County
Rick Andrews	Fire Chief	Douglas Fire Department	Douglas
Carlos Mesa		MHCC Douglas Fire Department	Douglas Converse County
James Brown	Paramedic	MHCC	Converse County
Todd Matthews	Lieutenant	Douglas Police Department	Douglas
Joe Perko	Chief Water Operator	Town of Rolling Hills	Rolling Hills
Terri Sherman	Communications Manager	Converse County Joint Communications Center	Converse County
Adam Alvarado	Deputy	Converse County Sheriff's Office	Converse County
Mary Schell	Admin Assistant	Emergency Management	Converse County
Russ Dalgarn	Coordinator	Emergency Management	Converse County

Mitigation, Mitigation Planning, and Disaster Mitigation Act (DMA) Requirements

A PowerPoint presentation was presented via Skype by Kyle Karsjen. The presentation described the importance of mitigation planning and the process thereof, including the 9 step planning process that will be followed to ensure compliance with the Disaster Mitigation Act of 2000. The plan is intended to identify hazards, assets at risk, and ways to reduce impacts through long-term, sustainable mitigation projects. The plan will also maintain eligibility for FEMA mitigation grant funding.

Objectives and Schedule for Plan Development

All municipalities within Converse County that participate in the plan will maintain or create eligibility for FEMA mitigation funds. The participating jurisdictions in the process are:

- Unincorporated Converse County
- City of Douglas
- Town of Glenrock
- Town of Rolling Hills
- Town of Lost Springs

This meeting is the first meeting of a committee formed to provide input to the plan update process. A definition of participation in the planning process was provided that includes:

- Attend and participate in planning meetings/workshops
- Provide available data requested of the County Emergency Management coordinator and Amec Foster Wheeler
- Provide input on local mitigation strategy (actions/projects)
- Advertise and assist with public input process
- Review and comment on plan drafts
- Coordinate formal adoption

It was discussed how each jurisdiction needs to commit to the above elements to receive full credit for participation in the plan.

Hazard Mitigation Planning Committee Organization and Roles

The Hazard Mitigation Planning Committee (HMPC) will include members of appropriate county departments, e.g., Building, Planning, Public Works, Police/Fire/Public Safety, and Emergency Management and include municipalities and special districts (fire and school).

Goals of the process include:

- Thoroughly update the plan per most current FEMA planning guidance
- Revisit and update risk assessment
- Update the mitigation strategies
- Note implementation progress of loss reduction activities

The plan will be developed over the next six months. There will be two planning workshops. The meetings will occur in late October and December. An email group has been developed for the HMPC for sharing information on upcoming meetings. Amec Foster Wheeler will be drafting the updated risk assessment in the next couple of months. A complete draft for FEMA review is targeted to be complete by mid-February 2018. The final approved plan is anticipated to be ready for adoption sometime in April 2017.

Review of Identified Hazards

A list of natural hazards was discussed, based on the hazards in the 2011 HMP, to start a discussion about what hazards should formally profiled and analyzed in the plan update. Kyle compared the list in the existing plan with hazard profiled in the State Hazard Mitigation Plan, and then the group had a quick discussion on any hazards to be added; the new plan will include expansive soils as the HMPC had indicated some recent history in the county. The hazards discussed to be profiled in the plan update included:

Converse HMP Hazards 2011	State HMP Hazards 2016	Recommended Converse Hazards List for 2017 Plan Update
	Avalanche	
Dam Failure	Dam Failure	Dam Failure
Drought	Drought	Drought
Earthquake	Earthquake	Earthquake
	Expansive Soil	Expansive Soil
Flood	Flood	Flood
Hail	Hail	Severe Thunderstorm (Lightning and Hail)
Hazardous Materials		Hazardous Materials

Landslide and Subsidence	Landslide	Landslide and Subsidence
	Lightning	
	Mine Subsidence	
Tornado and Wind	Tornado	Tornado and Wind
Wildland Fire	Wildfire	Wildland Fire
	Wind	
Winter Storm	Winter Storm	Winter Storm

Planning for Stakeholder and Public Involvement

The planning team was encouraged to involve the public and stakeholders in the planning process. Techniques discussed included:

- Develop an online survey
- Social media or email blasts
- Mentioning the planning efforts and 'piggybacking' at other public forums

A public survey has been developed; a hard copy of the survey will be sent to committee members so that they can see it. The public survey can be found at https://www.surveymonkey.com/r/ConverseCountyWY.

Jurisdictions are encouraged to provide the link to the survey to their citizens, using whatever platforms they normally use to share information. The survey will close November 17th.

Coordinating with Other Agencies / Related Planning Efforts / Recent Studies

A discussion was held on how to coordinate this planning process with other planning processes, agencies and departments in order to meet DMA planning requirements. The group identified that Glenrock, Rolling Hills and possibly Douglas were currently going through the process to develop a master plan. Kyle noted the importance of including hazard mitigation information in the master plan, as well as other plans and documents. The group also identified the WYOWARN network as a potential partner during the hazard mitigation process.

Next Steps/Next Meeting Timing

Amec Foster Wheeler HIRA update	Late October
HMPC meeting to discuss HIRA and Goals	Late October
HMPC meeting to update mitigation actions	Early December
First draft of HMP for HMPC review	Early January
HMPC comments by	Mid-January
Public/State review draft	Late January
Public comments due	Mid-February
Plan to FEMA	Mid-February

The group agreed to hold the next hazard mitigation meeting from 1-3 pm on October 25. The meeting will be held in the Converse County Courthouse in Douglas. An email group has been established to provide information.

Questions and Answers/Adjourn

The presentation concluded at 2:00 pm.

Summary of the Converse County Risk Assessment and Goals Meeting
2017 Hazard Mitigation Plan Update
October 25, 2017
1:00pm – 3:00 pm
Douglas City Hall
Douglas, WY

Introductions and Opening Remarks

Russ Dalgarn, emergency manager of Converse County began with calling the LEPC meeting to session. After reviewing the minutes from the last LEPC meeting and attending to some admin tasks, the LEPC meeting shifted to the agenda for the hazard mitigation planning committee. Kyle Karsjen of Amec Foster Wheeler, the consulting firm hired by the County to facilitate the plan update process, began with welcoming remarks. Kyle asked everyone around the room to introduce themselves. Twenty-six persons representing a mix of County agencies and the municipalities of Douglas, Glenrock, and Rolling Hills along with local stakeholders were present and documented on a sign in sheet. Representatives from the WYDOT, the Converse County Sheriff's Department, the LaPrele Irrigation District, Douglas Schools, Tallgrass Energy and the Red Cross were also present.

Last	First	Title	Agency
Larramendy	Nick	PHRC	Public Health
Flores	Jerome	Safety and Reg. Comp.	Sinclair Transportation Company
Wills	Travis		Converse County Rural Fire
Alvarado	Adam	Patrol Deputy	Sheriff's Office
Hughes	Nathan	Undersheriff	Sheriff's Office
Heger	John	Vista	Red Cross Casper
Pritchard	Amber	Vista	Red Cross Casper
Good	Kaleigh	Disaster Program Manager	Red Cross
Cobb	Jim	Maintenance Director	CCSD 1
Fenton	Bob	Supervisor	Tallgrass Energy
Sherman	Terri	Communications Manager	Converse County Joint Communications
Andrews	Rick	Chief	Douglas Fire Department
Horr	Amanda	Secretary	Converse County Rural Fire
McClure	Anna	Secretary	LaPrele Irrigation
Matthews	Todd	Lieutenant	Douglas Police
McCoy	Shane	B & G Supervisor	CCSD 2
Martinez	Steve	Supervisor	City of Douglas
Perko	Joe	Chief Water Operator	Rolling Hills
Rothlaetner	Tonja	Administrator AP, Safety	Mountain Lodge Douglas Care Center
Wickett	Hershel	President	Glenrock Fire Department
Cotton	Scott	Wyoming Disaster POC	Natrona-Converse-Niobrara VW Extension
King	Ken	Director	RERT II
Stoldt	Jacque	Councilperson	Town Rolling Hills
Drummond	Kasey	Community Development Director	Town of Glenrock
Gullickson	Kim	Firewise	Converse County
Chaffin	Clara	Community Development Director	City of Douglas
Schell	Mary	Administrative Assistant	Converse County Emergency Management
Dalgarn	Russ	Coordinator	Converse County Emergency Management
Pluss	Madi	Associate	Amec Foster Wheeler
Karsjen	Kyle	Project Manager	Amec Foster Wheeler

Review of Mitigation, Disaster Mitigation Act (DMA) Requirements, and the Planning Process

A PowerPoint presentation was presented by Kyle Karsjen and Madi Pluss, project manager and project associate from AMEC Foster Wheeler. Kyle outlined the nine-step planning process being followed and discussed the project status. The update of the 2011 Hazard Mitigation Plan (HMP) will allow the County and participating municipalities to remain eligible for FEMA mitigation grants.

Risk Assessment Presentation and Discussion

Kyle outlined the general risk assessment requirements before beginning a detailed discussion of each hazard. He presented details on each hazard that will be included in the draft updated risk assessment chapter. Refer to the PowerPoint presentation and draft Hazard Identification and Risk Assessment (HIRA - forthcoming) chapter for specific details on each hazard. Several valuable details were learned during the risk assessment conversation among participants. The group discussed several hazard incidents that have occurred in the county. Highlights of the discussion are noted by hazard in the table below.

Hazard or Topic	Meeting Discussion
Dam Failure	• Only one dam failure event to note has occurred in the County since 1983. The HMPC could not remember the exact instance or specific dam associated with the overtopping event, however, some quick online research indicates that the dam in question was related to the LaPrele Range Drainage Basin. HMPC members confirmed that the impact of the dam failure was isolated to one ranch.
Drought	• The most significant impacts of drought for Converse county are associated with wildfire and agriculture. HMPC members noted that in the past, there have been issues with crops coming to maturity and overall agricultural production during dry years. Discussion also focused on how drought exacerbates wildfire risk in already increasingly prone areas.
Earthquake	• The 3.8 earthquake of 2004 occurred in the middle of the unincorporated county. There weren't any structures of infrastructure near the epicenter which is why there was no damage reported. • An earthquake damaged the foundation of a city administration building and cracked the foundation.
Expansive Soils	• Structural cracks in Douglas schools. • Building code requires soil testing in both Douglas and Glenrock. • Rolling Hills identified sand dunes as an issue.
Hazardous Materials	• Challenging to fully monitor hazardous materials transportation due to proprietary restrictions on releasing information • On April 25, 2015, there was a well blowout east of Douglas • Highway 59 pipeline rupture in 2016 • In 2015 there was a gas plant blow up, 22 miles north of Douglas
Landslide (Subsidence)	• More of an issue than data indicates. The existing landslide susceptibility maps do not accurately reflect geologic conditions in various areas of the County. • Glenrock is especially vulnerable to subsidence, and an HMPC member indicated that over 60% of the City is impacted. One pertinent issue facing Glenrock is subsidence as it relates to the mines. Though federal reclamation programs have been

	instituted, the mines surrounding the Glenrock community are subsiding and prone to flooding. AML Wyoming is now in the area, with one company responsible for roads and another responsible for buildings.
Flood	• Estherbrook Road South of Douglas was washed out recently
Hail	• Notable hail events not listed in NCDC include '96 (Glenrock), as well as August '07 (entire county), and June '17 (entire county). • It was recommended to look at USDA farm claims to determine crop damages and losses resulting from hail storms in the county. • One HMPC member commented that in '07, the hailstorm left 3" holes in his hot tub.
Lightning	• Though no fatalities noted in NCDC, livestock fatalities are common in Converse County. There have been multiple instances where lightning caused death to cattle and herds of sheep. • Lightning also effects wells and has blown out the power grid on numerous occasions. • Wildfire is a major concern in Converse County, and annually, numerous tree fires are ignited from lightning. The HIRA chapter should utilize the HSIP data to determine the exact number of fires linked to lightning.
Tornado	• The HMPC noted an event in June 2017 where a small tornado, accompanied by hail, ripped off the roof of on old homestead cabin off of Cold Springs Rd.
Wind	• No property damage was reported by NCDC, though wind frequently causes damage to structures in Converse County by spreading and catalyzing fire. • In 2014, high winds resulted in trees falling and shingles flying off the roofs across the County. • On October 25, 2017 the winds were so strong that a pickup truck was blown over.
Winter Storms	• Interstate (I-25) is frequently closed in Converse County. Multiple gates along the roadway. Road is closed due to inclement driving conditions (snow and ice), however, road is also blocked when there is not enough sheltering capacity to contain travelers from nearby Counties. • Livestock can be frozen. • In 2014, the natural gas switch was frozen in Glenrock, and residents were without heat for over 20 hours. The problem has been remedied and should not be reoccurring. • Winter storms can also lead to increased home fires caused by electric blankets in mobile homes.
Wildfire	• Exacerbated by the high winds in the County. • Orpha- A fire truck got stuck and 3 fire fighters were injured. • 1 cabin lost in Esterbrook • Box Elder Canyon Fire '14, critical facility infrastructure at the ½ point between Douglas and Glenrock was damaged. However, it has been completely retrofitted and is now more resilient.

Capability Assessment Review

Kyle briefly reviewed highlights of existing capabilities in the county to mitigate hazards, including the emergency management program, jurisdiction Comprehensive Plans, and the county Community Wildfire Protection Plan.

Coordination and Integration with Other Plans

Kyle asked the group if other plans reference or integrate aspects of the HMP within the past five years. The group noted that the EOP mentions the HMP. An HMPC member commented that the County Hazard Mitigation Plan will be cross referenced by the Douglas Comprehensive Plan, which is currently undergoing review and update. The Glenrock Comprehensive Plan was updated in 2016 and is reviewed on a yearly basis. The CWPP is also being updated.

Plan Goals Update

Kyle presented a slide with the goals and objectives from the 2011 HMP. The update presents an opportunity to revisit the goals and adjust if necessary. The previous goals were tailored to individual hazard needs and Kyle suggested that the HMPC consider using the 2016 Wyoming State HMP goals as a template for the goals outlined in the updated Converse County plan. The committee agreed that the state goals were more comprehensive and aligned with the interests of the County and participating jurisdictions. Kyle offered to make any necessary changes to the language of the State goals, and the HMPC will have an opportunity to make any comments. The new Plan goals are:

Goal 1: Strengthen public infrastructure
Goal 2: Improve local mitigation capabilities
Goal 3: Reduce economic losses due to hazard events
Goal 4: Reduce local costs of response and recovery

Changes, if any, will be finalized at the next planning workshop.

Planning for Public Involvement

Kyle noted that public involvement will include advertisement of the draft updated plan for review and comment. The survey is currently available and can be easily shared via email or social media. The group noted that the survey is on the County website and has been shared through Facebook. So far 131 responses have been received. The PowerPoint included the current results, highlighting the public's perception of hazards in Converse County. Kyle requested that the group give the survey one more push before it closes. The survey can be found at:
https://www.surveymonkey.com/r/ConverseCountyWY.

Mitigation Action Strategy Update

Kyle noted the next step in the process is updating the hazard mitigation strategy. As a starting point the group will need to provide a status on the existing actions from the 2011 plan. A handout was provided which will be discussed further in the next meeting. Kyle encouraged the participating entities to review prior to the next meeting.

Plan Timeline/Next steps

Kyle summarized the next steps in the process.

- HMPC homework:
  - Review the handout on the mitigation strategy and note status of actions; return to kyle.karsjen@amecfw.com by **November 10th**
  - Return the data collection guide to kyle.karsjen@amecfw.com by **November 10th**
  - Provide any more information to inform the HIRA and review the draft HIRA once it is released (target is **November 8th** for release; review period will be at least two weeks)
  - Start formulating ideas for new mitigation projects based on hazard analysis and vulnerability assessment

The next and final HMPC planning meeting will be held in early January, and will focus on updating mitigation actions for the plan. Kyle emphasized that this is an important meeting and will form the basis for the mitigation action plan. A calendar update will be sent out to save the date. The meeting materials will also be shared electronically, including the presentation and worksheets.

Converse County Mitigation Strategy Meeting
2018 Hazard Mitigation Plan Update
January 31, 2018
12:00 – 3:00 PM
Converse County Courthouse, Douglas, WY

Introduction and Opening Remarks

Russ Dalgarn, emergency manager of Converse County began with calling the LEPC meeting to session. After reviewing the minutes from the last LEPC meeting and conducting LEPC business, the LEPC meeting shifted to the agenda for the hazard mitigation planning committee. Kyle Karsjen, project manager with Amec Foster Wheeler, began with welcoming remarks. Kyle asked everyone around the room to introduce themselves. Attendance was documented on the sign-in sheet and includes 24 persons from various departments in Douglas, Glenrock, Rolling Hills, and Lost Springs. Participants included Converse County Emergency management, Converse County Sheriff's Department, Converse County Public Health, Douglas Fire Department, Tallgrass Energy, Douglas Budget Newspaper, and WYDOT. Handout materials were provided.

Kyle and Madi Pluss of Amec Foster Wheeler presented the PowerPoint slide deck that outlined the meeting agenda and topics.

Review of the Planning Process

Kyle reviewed the planning process that has taken place so far. The process is currently in Phase III – Develop a Mitigation Plan and this meeting is the last formally facilitated meeting of the Hazard Mitigation Planning Committee (HMPC). Kyle noted the results of the online-public survey, that had 172 responses at the time of this meeting. Amongst other results, the primary findings of the survey relate to the public's belief on what is considered the highest natural threat to the community, as well as the perception of who should be responsible for hazard mitigation. Madi reviewed the findings of the process up to the point of the meeting, including the draft hazard identification and risk assessment. Two committee members asked questions about the FEMA grant application process. There was a discussion about how funding is determined, distributed, and the responsibilities of the County.

Plan Goals

Madi reviewed the mitigation goals with some modifications that were suggested at the previous meeting. The group did not express any need to alter the goals. The revised goals will be included in the updated plan for review by the HMPC, during which there will be opportunity for final review and comment.

Review of Possible Mitigation Activities and Alternatives

Madi presented information on typical mitigation activities and alternatives, and referred to handouts with further details and guidance. Madi outlined potential project criteria and action requirements, including the requirements of the Disaster Mitigation Act of 2000. Each hazard must have at least one true mitigation action (not preparedness) pertaining to them. Another reference document titled “Mitigation Ideas” developed by FEMA was suggested at the meeting, which can be found online at https://www.fema.gov/media-library/assets/documents/30627.

This reference discusses the common alternatives and best practices for mitigation by hazard.

Action Prioritization

The group was provided with decision-making tools to consider when prioritizing the actions. This including FEMA’s recommended criteria, STAPLE/E (which considers social, technical, administrative, political, legal, economic, and environmental constraints and benefits). Other criteria used to recommend what actions might be more important, more effective, or more likely to be implemented than another included:

- Does action protect lives?
- Does action address hazards or areas with the highest risk?
- Does action protect critical facilities, infrastructure or community assets?
- Does action meet multiple objectives (Multiple Objective Management)?

Actions continuing from the 2011 plan will need to be reviewed for relative priority (high, medium, low). Any new actions developed will also need a relative prioritization based on these criteria.

Review of progress on 2011 Plan actions and identification of new actions

At the last meeting, jurisdictions were provided a handout with the mitigation action table from the 2011 plan. Kyle reminded the committee to report action statuses if it had not already done so. Half of the participating jurisdictions had already submitted their comments, and some actions were determined to still be relevant and should continue in the updated plan. Others were recommended to be deleted; some progress details were still outstanding. Action priorities were revisited and modified in some cases. Completed and deleted actions will be moved to separate tables in the updated plan. The continuing, deferred and new actions will be grouped together in an updated action strategy table.

Kyle introduced an exercise to initiate a discussion about new actions. Using hazard summaries compiled from the draft risk assessment, Kyle wrote the hazards on a white board and asked the committee to brainstorm potential actions for each hazard. The FEMA “Mitigation Ideas” document provided additional support. Most relevant and feasible mitigation actions associated with each hazard were already in place, but the committee encouraged the continuation of these strategies. The table below presents the various mitigation action ideas sorted by hazard, as discussed by the HMPC.

Hazard	Ideas for Mitigation Actions
Dam failure	• Public education
Drought	• Public information/education • Water restrictions • Citizen drought projects • Fire breaks—Douglas
Earthquake	• Building codes • Continuing utilization of International Building Code
Expansive Soil	• Engineering reports • Restrict structural development • Restrict irrigation • Educate contractors • No finished basements
Hazardous Materials	• Pipeline education for First Responders • Public education on regulated pipelines
High Wind/Downburst	• Infrastructure projects • Tree pruning • Bury powerlines
Landslide	• Support AML projects
Thunderstorm (lightning and hail)	• Insurance • Saferoom construction • Public education • Lightning rods • Storm spotters
Tornado	• Saferoom construction • Public education • Warning systems • Storm spotters
Wildfire	• Fuel management • Tie to CWPP • Update CWPP • FireWise
Winter Weather	• Sheltering • Public education • Snow fencing • Snow road/closure and danger warnings

Next Steps

Kyle provided a new action worksheet for participants to flesh out the details of proposed actions. He then walked through the worksheet and showed the committee members how to fill out each section using a Tornado Shelter Room mock idea. New action worksheets are due to kyle.karsjen@amecfw.com by February 23rd. These will be compiled by Madi into the mitigation action table and shared with the committee for further refinement and prioritization when the draft plan is made available for review.

The meeting adjourned at 3:00 PM.

Converse County
Hazard Risk Assessment Summaries

Dam Failure

Overall, dam failure significance ranges from **high to low** dependent upon location in the County. The probability of such an event is low, but impacts could be significant depending upon the dam involved and where it occurred in the region.

Drought

Drought is considered a **high** significance hazard for Converse County due to the potential for extensive economic and environmental impacts. Drought can be widespread and pervasive for several years.

Earthquake

Converse County is at **moderate** risk due to the closer proximity of potentially active faults within and near the County and the history of having experienced one of the strongest earthquakes in central Wyoming. It is estimated that if a worst-case event occurred in Converse County, $268 million in combined capital stock and income losses could occur. Though the probability is low, WSGS studies indicate the possibility of a 6.5 magnitude could occur anywhere in the state.

Expansive Soils

Overall, expansive soils are a **medium** significance hazard for the County. Expansive soils are estimated to affect a limited portion of the planning area. Most land coverage Converse County falls under the category of moderate potential for swelling, with a significant portion of land (primarily in the southern area) considered to be low potential for swelling. Areas of concern are located in the central/south-eastern County where a belt of high potential soil flows through the County from the north-east.

Flood

Overall, flooding presents a **medium** risk for Converse County. Flooding has damaged homes, infrastructure (roads and bridges), and caused agricultural losses in the planning area in the past. Flood risk varies by jurisdiction.

Hazardous Materials

Converse County is at **moderate** risk to hazardous materials spills. Due to proprietary restrictions, it is difficult to monitor the transportation of hazardous materials. Loss estimations indicate that the seven facilities in Converse County would produce a damage estimate of $9,345,777 in property damage over a five-year period. With 40 hazardous materials incidents occurring between 2008 and 2017, it should be expected that there would be four events each year.

High Winds and Downbursts

Many areas of the United States are prone to damaging wind events, and while Converse County may not be counted in a high category for occurrences across the nation, it does have a history of such episodes which should be anticipated for the future, resulting in a **moderate** significance rating for this hazard. Primary damage is structural and utility-borne. Although minimal deaths and injuries have been reported, the frequency of occurrence is due consideration, as well as the hazard to rural citizens and town populations from falling trees, power poles, and flying debris.

Landslide, Debris Flow, Rockfall

Overall, landslides, rockfalls and debris flows range from **low** to **medium** significance hazards in the County. Landslides have the potential for direct property impacts including residential structures but more likely infrastructure corridors including roads and highways, power line corridors, and gas lines.

Severe Thunderstorms (including Hail and Lightning)

Converse County experiences heavy rains and severe thunderstorms during the spring and summer on an annual basis. Both global and regional climate patterns determine the potential severity of these storms from year to year. The entire planning area is equally at risk; it is a matter of chance as to which drainage area a slow-moving storm might linger over. Based on historical information, the primary effect of these storms has not resulted in significant injury or damage to people or property. Hail damage to property is expected to be highest in the municipalities; much of the damage to both property and crops is covered under insurance policies. The most salient threat associated with lightning is the threat of igniting a wildfire. Given the lightning statistics for Wyoming, the County remains at **moderate** risk and is vulnerable to the effects of lightning.

Tornado

Though risk is **low**, tornadoes are a credible threat, and will continue to occur in Converse County. While the County has been relatively lucky in its tornado history in its past, it is not immune to the threat of a much larger and more ferocious tornado. Depending on a tornado's size, ferocity and path, it can cause devastating damage to people, property and infrastructure.

Severe Winter Weather

Winter Storms are a **medium** significance hazard in the County. While the percent of the planning area directly affected ranges depending on the specific circumstances, if any area near Converse County is impacted by the storm, then the entire County suffers indirect impacts. Sheltering of stranded travelers on I-25 can be an issue, even from storms affecting Colorado. Glenrock and Douglas can quickly be overwhelmed with shelter needs when I-25 is closed to Casper.

Wildfire

Wildfires occur within the county on generally an annual basis. Based on GIS analysis, the planning area has over $143 million in building and content value, as well as 1,230 people potentially at risk to wildland fires in the Redzone. Though it is not likely that the areas at risk will simultaneously face a completely destructive event, this figure provides the upper end of what could be affected.

Overall, wildfire is a **high** significance hazard in Converse County.

Example Mitigation Actions by FEMA categories with Hazards Identified in the Converse County Hazard Mitigation Plan 2018

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Landslides/ Debris Flows/ Rockfalls; soil hazards; subsidence	Weather Extremes (Tornado, hail, lightning, wind, temps, drought)	Earth quakes	Wildfires	Severe Winter Storm
PLANS and REGULATIONS								
Building codes and enforcement		■	■	■	■	■	■	■
Comprehensive Watershed Tax		■						
Density controls	■	■	■	■			■	
Design review standards		■	■	■		■	■	
Easements		■	■	■			■	
Environmental review standards		■	■	■		■	■	
Floodplain development regulations	■	■	■					
Hazard mapping	■	■	■	■			■	
Floodplain zoning	■	■	■					
Forest fire fuel reduction							■	
Housing/landlord codes			■		■			
Slide-prone area/grading/hillside development regulations				■			■	
Manufactured home guidelines/regulations		■			■	■		
Minimize hazardous materials waste generation			■					
Multi-Jurisdiction Cooperation within watershed	■	■						
Open space preservation	■	■		■			■	
Performance standards	■	■		■	■	■	■	■
Periodically contain/remove wastes for disposal			■					
Pesticide/herbicide management regulations			■					
Special use permits	■	■	■	■			■	
Stormwater management regulations		■	■					
Subdivision and development regulations	■	■	■	■		■	■	
Surge protectors and lightning protection					■			

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Landslides/ Debris Flows/ Rockfalls; soil hazards; subsidence	Weather Extremes (Tornado, hail, lightning, wind, temps, drought)	Earth quakes	Wildfires	Severe Winter Storm
Tree Management					■		■	■
Transfer of development rights		■		■			■	
Utility location			■	■	■			■
STRUCTURE AND INFRASTRUCTRE PROJECTS								
Acquisition of hazard prone structures	■	■		■			■	
Facility inspections/reporting	■	■	■			■		
Construction of barriers around structures	■	■	■					
Elevation of structures	■	■						
Relocation out of hazard areas	■	■	■	■			■	
Structural retrofits (e.g., reinforcement, floodproofing, bracing, etc.)		■	■	■	■	■	■	■
Channel maintenance		■		■				
Dams/reservoirs (including maintenance)	■	■						
Isolate hazardous materials waste storage sties			■					
Levees and floodwalls (including maintenance)		■						
Safe room/shelter					■	■		■
Secondary containment system			■					
Site reclamation/restoration/revegetation		■		■				
Snow fences								■
Water supply augmentation					■			
Debris Control		■		■				
Defensible Space							■	
Stream stabilization		■		■				
EDUCATION AND AWARENESS								
Flood Insurance	■	■						
Hazard information centers	■	■	■	■	■	■	■	■

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Landslides/ Debris Flows/ Rockfalls; soil hazards; subsidence	Weather Extremes (Tornado, hail, lightning, wind, temps, drought)	Earth quakes	Wildfires	Severe Winter Storm
Public education and outreach programs	■	■	■	■	■	■	■	■
Real estate disclosure	■	■	■	■	■	■	■	■
Crop Insurance					■	■		
Lightning detectors in public areas					■			
NATURAL SYSTEMS PROTECTION								
Best Management Practices (BMPs)		■	■	■	■		■	
Forest and vegetation management	■	■		■	■		■	■
Hydrological Monitoring	■	■	■	■	■			
Sediment and erosion control regulations	■	■	■	■				
Stream corridor restoration		■		■				
Stream dumping regulations		■	■					
Urban forestry and landscape management		■		■	■		■	■
Wetlands development regulations		■	■	■			■	
EMERGENCY SERVICES								
Critical facilities protection	■	■	■	■	■	■	■	■
Emergency response services	■	■	■	■	■	■	■	■
Facility employee safety training programs	■	■	■	■	■	■	■	■
Hazard threat recognition	■	■	■	■	■	■	■	■
Hazard warning systems (community sirens, NOAA weather radio)	■	■	■	■	■	■	■	■
Health and safety maintenance	■	■	■	■	■	■	■	■
Post-disaster mitigation	■	■	■	■	■	■	■	■
Evacuation planning	■	■	■	■			■	

Mitigation Action Selection and Prioritization Criteria

Does the proposed action protect lives?

Does the proposed action address hazards or areas with the highest risk?

Does the proposed action protect critical facilities, infrastructure, or community assets?

Does the proposed action meet multiple objectives (multi-objective management)?

STAPLE/E

Developed by FEMA, this method of applying evaluation criteria enables the planning team to consider in a systematic way the social, technical, administrative, political, legal, economic, and environmental opportunities and constraints of implementing a particular mitigation action. For each action, the HMPC should ask, and consider the answers to, the following questions:

Social

Does the measure treat people fairly (different groups, different generations)?

Technical

Will it work? (Does it solve the problem? Is it feasible?)

Administrative

Is there capacity to implement and manage project?

Political

Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support it?

Legal

Does your organization have the authority to implement? Is it legal? Are there liability implications?

Economic

Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development? Does it reduce direct property losses or indirect economic losses?

Environmental

Does it comply with environmental regulations or have adverse environmental impacts?

Name of Jurisdiction:

Completed by:

Phone #:

Email:

How was mitigation plan incorporated into other planning mechanisms over the last 5 years? If incorporation did not occur, please just state that…there is no "grade" given for this. It is simply to inform the plan maintenance section.

How will mitigation plan be incorporated into other planning mechanisms going forward? For example, mitigation actions could be reviewed when planning future capital improvement / infrastructure projects and/or risk assessment could be reviewed when determining future growth areas.

Indicate plans / planning process below that hazard mitigation plan will be incorporated into:

☐ Comprehensive Plan

☐ Capital Improvement Plan

☐ City / County Infrastructure Plan

☐ School Infrastructure Plan

☐ School Emergency Plan

☐ Other (please specify) ______________________________

Converse County Hazard Mitigation Committee (HMPC),

The link to the online survey is now active and included below. Each jurisdiction is encouraged to share the survey broadly through whatever channels possible (email lists, social media, post link on web etc.). Please document how this is distributed (an email, screenshot or a link to a website) and forward to kyle.karsjen@amecfw.com.

Here is some text that can be used with the notice about the survey link:

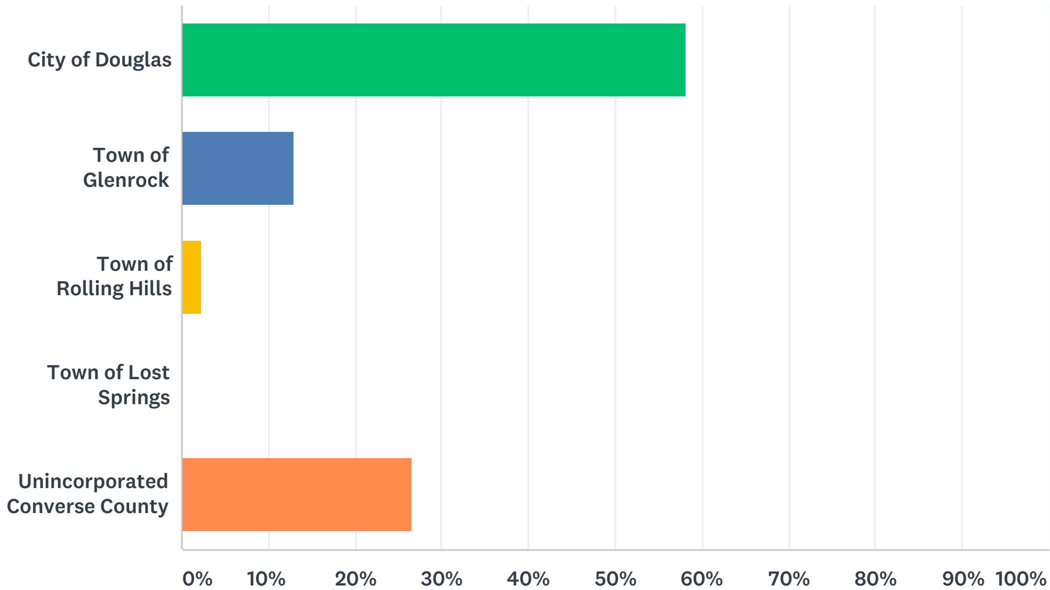
Converse County Hazard Mitigation Plan Update 2017 Public Survey

Provide feedback to the multi-jurisdictional Hazard Mitigation Planning Committee to inform the update of the Converse County Hazard Mitigation Plan. The survey is intended to gather public feedback on concerns about floods, wildfires, winter storms and other hazards and strategies to reduce their impacts. Take a quick survey and let your concerns and ideas be heard. Please complete the survey by **October 24, 2017**.

Click the link below to start the survey:
https://www.surveymonkey.com/r/ConverseCountyWY

Q1 Indicate the jurisdiction you reside in:

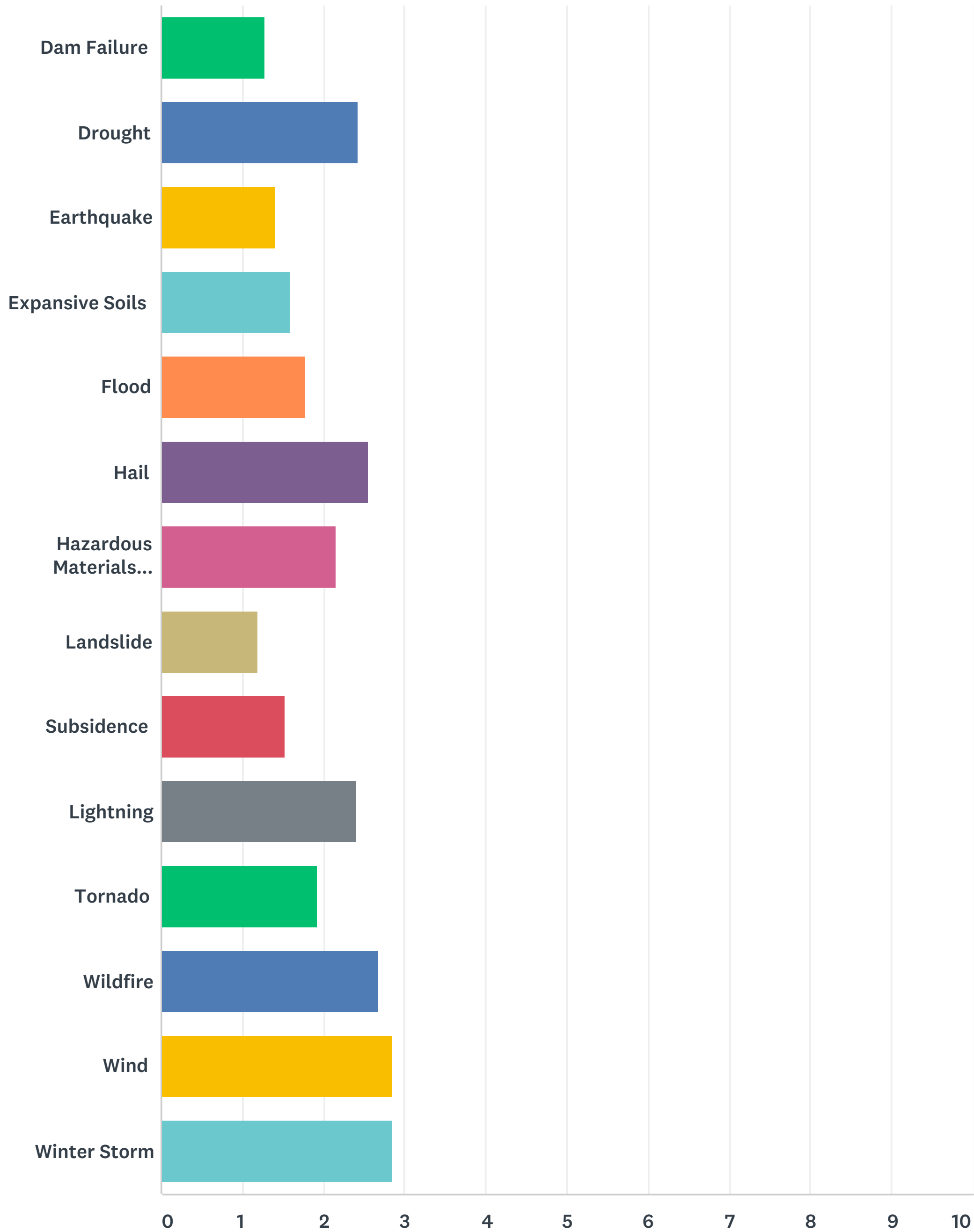
Answered: 170 Skipped: 2



ANSWER CHOICES	RESPONSES	
City of Douglas	58.24%	99
Town of Glenrock	12.94%	22
Town of Rolling Hills	2.35%	4
Town of Lost Springs	0.00%	0
Unincorporated Converse County	26.47%	45
TOTAL		170

Q2 The hazards addressed in the Multi-Jurisdictional Hazard Mitigation Plan are listed below. Please indicate the level of significance in your county that you perceive for each hazard. Please rate these hazards 1 through 3 as follows: 1=low, 2=moderate, 3=high.

Answered: 172 Skipped: 0



	1 = LOW	2 = MODERATE	3 = HIGH	TOTAL	WEIGHTED AVERAGE
Dam Failure	77.33% 133	16.86% 29	5.81% 10	 172	 1.28

Drought	10.47% 18	37.21% 64	52.33% 90	172	2.42
Earthquake	62.94% 107	34.12% 58	2.94% 5	170	1.40
Expansive Soils	47.37% 81	45.61% 78	7.02% 12	171	1.60
Flood	35.09% 60	52.05% 89	12.87% 22	171	1.78
Hail	2.96% 5	39.05% 66	57.99% 98	169	2.55
Hazardous Materials Incident	24.42% 42	36.05% 62	39.53% 68	172	2.15
Landslide	82.56% 142	15.12% 26	2.33% 4	172	1.20
Subsidence	58.28% 95	31.90% 52	9.82% 16	163	1.52
Lightning	6.98% 12	45.35% 78	47.67% 82	172	2.41
Tornado	23.98% 41	60.23% 103	15.79% 27	171	1.92
Wildfire	5.23% 9	22.09% 38	72.67% 125	172	2.67
Wind	0.58% 1	14.04% 24	85.38% 146	171	2.85
Winter Storm	0.58% 1	15.12% 26	84.30% 145	172	2.84

Q3 Do you have information on specific hazard issues/problem areas that you would like the planning committee to consider? Please note the jurisdiction in your response.

Answered: 81 Skipped: 91

Q4 Please comment on any other pre-disaster strategies that the planning committee should consider for reducing future losses caused by natural disasters.

Answered: 64 Skipped: 108

Q5 The following types of mitigation action items may be considered in the multi-jurisdictional plan. Please identify the types of mitigation action items that you think should have the highest priority in the plan.

Answered: 168 Skipped: 4

	PRIORITY ACTION	TOTAL
Indoor/Outdoor Warning	100.00% 110	110

Wildfire Fuels Treatment Projects	100.00% 94	94
Wildfire Defensible Space Projects	100.00% 97	97
Critical Facilities Protection	100.00% 80	80
Planning/Zoning	100.00% 48	48
Public Education/Awareness	100.00% 109	109
Evacuation Route Development	100.00% 81	81
Flood Reduction/Drainage Improvement	100.00% 44	44
Floodprone Property Buyout	100.00% 17	17
Education and Discounts on Flood Insurance	100.00% 48	48
Participation in the National Flood Insurance Program	100.00% 38	38
Landslide/Mudslide Mitigation	100.00% 9	9
Rockfall Mitigation	100.00% 10	10
Earthquake Mitigation	100.00% 25	25

Q6 Please provide your name and email address if you would like to be added to a distribution list for upcoming activities related to the planning process:

Answered: 50 Skipped: 122

Q7 How did you hear about this survey?

Answered: 125   Skipped: 47

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Wyo Game & FIsh Game Warden Glenrock Wyo Game & FIsh	home work	 Boydglenrock@ yahoo.com Wy Game & FIsh PO Box 384 Glenrock WY 82637 United States of America
Wyo Independent Living Rehabilitation Wyo Independent Living Rehabilitation	work	305 West 1st Street Casper Wy 82601
Wyo Office of Homeland Security Senior Planner/Exercise Officer Wyo Office of Homeland Security	 work	 lynn.budd@wyo .gov 5500 Bishop Blvd Cheyenne WY 82002 United States of America

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Appendix B ADOPTION RESOLUTION

Note to Reviewers: When this plan has been reviewed and approved pending adoption by FEMA Region VIII, the adoption resolutions will be signed by the participating jurisdictions and added to this appendix. A model resolution is provided below:

Resolution # ______

Adopting the Converse County Hazard Mitigation Plan

WHEREAS Converse County has historically experienced severe damage from natural and human-caused hazards such as flooding, wildfire, earthquake, drought, thunderstorms/high winds, and hazardous materials incidents on many occasions in the past century, resulting in loss of property and life, economic hardship, and threats to public health and safety;

WHEREAS Converse County has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its All Hazard Mitigation Plan under the requirements of 44 CFR 201.7;

WHEREAS the Plan specifically addresses hazard mitigation strategies and plan maintenance procedures for Converse County;

WHEREAS the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural and human caused hazards that impact Converse County, with the effect of protecting people and property from loss associated with those hazards;

WHEREAS, adoption of this plan will make Converse County eligible for funding to alleviate the impacts of future hazards,

NOW THEREFORE BE IT RESOLVED by the [insert appropriate official titles] of Converse County that:

1) The Plan is hereby adopted as an official plan of Converse County.
2) The respective officials identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them.
3) Future revisions and Plan maintenance required by 44 CFR 201.7 and FEMA, are hereby adopted as a part of this resolution for a period of five (5) years from the date of this resolution.
4) An annual report on the progress of the implementation elements of the Plan shall be presented to the [insert appropriate official titles such as Mayor, Town Council, Board of Supervisors, etc.] by [insert date] of each calendar year.
5) Converse County will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 44 CFR 13.11 (c); and will amend our Plan whenever necessary to reflect applicable changes in Tribe, State or Federal laws and statutes as required in 44 CFR 13.11. (d).

PASSED by Converse County, this ___ day of ____ (month), _____(year).

____

Certifying Official

WYOMING REGION 2

REGIONAL HAZARD MITIGATION PLAN

NIOBRARA COUNTY PLANNING ANNEX

REGION 2 HAZARD MITIGATION PLAN NIOBRARA COUNTY ANNEX

1 Mitigation Planning and Niobrara County Planning Team

This annex has been created during the development of the 2017-2018 Region 2 Hazard Mitigation Plan (referred to as the Main Plan or Base Plan herein). This County Annex builds upon previous versions of the Niobrara County Multi-Hazard Mitigation Plan completed in 2015. The plan is the result of a collaborative effort between Niobrara County Government, municipal governments, citizens, public agencies, non-profit organizations and the private sector. The following jurisdictions participated in the planning process:

- Town of Manville
- Town of Lusk
- Town of Van Tassell
- Unincorporated Niobrara County

More details on the planning process followed and how the counties, municipalities and stakeholders participated can be referenced in Chapter 3 of the Base Plan, as well as how the public was involved during the 2018 update.

2 Geography and Climate

Niobrara County covers about 2,626 square miles of land in east-central Wyoming, sharing a border with the counties of Converse, Weston, Goshen, and Platte in Wyoming, and bordering Nebraska and South Dakota to the east. The county lies southeast of the Thunder Basin National Grassland in Wyoming, and west of the Black Hills National Forest in South Dakota. The Oglala National Grassland also slightly touches the county boundary towards the east-central portion. Elevations range from a low of 3,186 feet, to a high of 5,236 feet.

The Cheyenne River originates in Converse County, but is the most influential in Niobrara (in terms of drainage), flowing through the northeast and out of Wyoming into the Missouri River in South Dakota. Other large rivers and streams in the county include the Niobrara River and Duck Creek in the southeast, Old Woman Creek flowing into the Cheyenne River, and Lightning Creek. Major watersheds in the county include the Lance, Niobrara Headwaters, Upper Cheyenne, Angostura Reservoir, Lightning, Middle North Platte-Scotts Bluff, Glendo Reservoir, and Hat.

No Interstate highways cross through Niobrara. However, major roadways present include U.S. highway 18, 85, and 20, and State Road 270 which runs in a central to west fashion, then southward to exit the county close to the boundary between Platte and Goshen Counties. A large part of Niobrara remains only traversable via local (smaller) roadways, and railroad systems.

The tables below summarize the land use types present in Niobrara County as of 2006, and the land ownership statistics current as of 2016 (from Headwaters Economics reports). There are a total of 1,681,886 acres of land in the county, most of which is grassland and shrubland, and owned by private parties.

Table 2-1 Niobrara County Land Types

Land Type	Acres	Percent of Total
Total Acres	1,681,886	---
Forest	3,707	0.2%
Grassland	1,597,792	95.0%
Shrubland	50,457	3.0%
Mixed Cropland	6,178	0.4%
Water	0	0.0%
Urban	0	0.0%
Other	14,333	0.9%

Source: NASA MODIS Land Cover Type Yearly L3 Global 1km MOD12Q1, 2006.

Table 2-2 Niobrara County Land Ownership (2016)

Land Ownership	Acres	Percent of Total
Total Acres	1,681,886	--
Private Lands	1,395,243	83.0%
Conservation Easement	0	0.0%
Federal Lands	124,710	7.4%
Forest Service	982	0.1%
BLM	123,728	7.4%
National Park Service	0	0.0%
Military	0	0.0%
Other Federal	0	0.0%
State Lands	161,676	9.6%
*State Trust Lands**	161,676	9.6%
Other State	0	0.0%
Tribal Lands	0	0.0%
City, County, Other	256	0.0%

Source: U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS)

The climate of Niobrara County is semi-arid. Precipitation in the form of rain is about 14 inches per year, but in terms of snow it can get around 52 inches. Winter temperature lows are about 12 degrees Fahrenheit, and summers often reach 89 degrees.

3 Population Trends

As of the July 2017 United States Census estimates, there were a total of 2,397 people living in Niobrara County. The population has decreased slightly, as for the 2010 U.S. Census the population was 2,484. There are 0.9 people per square mile. The county seat is the Town of Lusk, which is also the most populated incorporated jurisdiction.

Table 3-1 Niobrara County Population Distribution

Jurisdiction	2017 Estimated Population	% of County Total
Niobrara County	2,397	--
Town of Manville	88	3.67%
Town of Lusk	1,543	64.37%
Town of Van Tassell	14	0.58%

Source: US Census Bureau

Table 3-2 Niobrara County Population Change, 2010-2017

Jurisdiction	2010 Census	2011	2012	2013	2014	2015	2016	2017	% change
Niobrara County	2,484	2,483	2,476	2,544	2,489	2,496	2,470	2,397	-3.50%
Town of Manville	95	95	93	95	93	93	92	88	-7.37%
Town of Lusk	1,567	1,569	1,576	1,624	1,593	1,598	1,583	1,543	-1.53%
Town of Van Tassell	15	15	15	15	15	15	14	14	-6.67%

Source: US Census Bureau

Select Census demographic and social characteristics for Niobrara County are shown in the table below. The county's median age is 39.2 years old. The table also indicates some populations that may have special needs or prove vulnerable, such as the elderly or children under 5 years of age. About 13.8% of the total 65 years and below population (i.e., workforce-aged adults) have a disability. Households contain an average of 2.24 persons. 3.2% of homes speak a language other than English.

Table 3-3. Niobrara County Demographic Profile

Population	
Population estimates, July 1, 2017, (V2017)	2,397
Age and Sex	
Persons under 5 years, percent	5.80%
Persons under 18 years, percent	17.20%
Persons 65 years and over, percent	21.90%
Race and Hispanic Origin	
White alone, percent	94.30%
Black or African American alone, percent	0.90%
American Indian and Alaska Native alone, percent	1.60%
Asian alone, percent	0.50%
Native Hawaiian and Other Pacific Islander alone, percent	0.00%
Two or More Races, percent	2.70%
Hispanic or Latino, percent	3.60%
White alone, not Hispanic or Latino, percent	91.40%
Population Characteristics	
Veterans, 2012-2016	185
Foreign born persons, percent, 2012-2016	0.30%
Housing	
Housing units, July 1, 2017, (V2017)	1,370
Median value of owner-occupied housing units, 2012-2016	$155,200
Median gross rent, 2012-2016	$627
Families & Living Arrangements	
Households, 2012-2016	981
Persons per household, 2012-2016	2.24
Living in same house 1 year ago, percent of persons age 1 year+, 2012-2016	86.30%
Language other than English spoken at home, percent of persons age 5 years+, 2012-2016	3.20%
Education	
High school graduate or higher, percent of persons age 25 years+, 2012-2016	88.90%
Bachelor's degree or higher, percent of persons age 25 years+, 2012-2016	19.00%
Health	
With a disability, under age 65 years, percent, 2012-2016	13.80%
Persons without health insurance, under age 65 years, percent	16.00%
Economy	
In civilian labor force, total, percent of population age 16 years+, 2012-2016	52.30%
Total retail sales per capita, 2012	$11,712
Transportation	
Mean travel time to work (minutes), workers age 16 years+, 2012-2016	13.6
Income and Poverty	
Median household income (in 2016 dollars), 2012-2016	$40,640
Per capita income in past 12 months (in 2016 dollars), 2012-2016	$23,356
Persons in poverty, percent	14.30%
Geography	
Population per square mile, 2010	0.9
Land area in square miles, 2010	2,626.04

Source: U.S. Census Bureau www.census.gov/

*Hispanic or Latino is considered to be an ethnicity and not a race. People who identify themselves as Hispanic or Latino can belong to one or more races. Therefore, the total percentage can be greater than 100%.

4 Development Trends

From 1970-2016, there has been a general trend of population decrease in the county, with a population reduction of 524 people from 1970 to 2000 (going from 2,920 to 2,396), a slight increase of 88 people from 2000 to 2010 (going from 2,396 to 2,484), and then another decrease of 87 people from 2010 to 2017 (going from 2,484 to 2,397).

Niobrara County has not had any portion of its homes built in areas of Wildland-Urban Interface (WUI) as of the last decade. In terms of development trends, further, there has been very little done to build new residential, commercial, or industrial buildings.

A summary of housing statistics is provided below for the County of Niobrara, based on the most recent available figures.

Table 4-1 Niobrara County Housing Characteristics

Characteristic	# Units	% of Units	US Comparison
Total Housing Units	**1,281**	**100%**	**134,054,899**
Occupied	981	76.6%	117,716,237
Vacant	300	23.4%	16,338,662
For rent	28	2.2%	2,855,844
Rented, not occupied	0	0.0%	616,696
For sale only	0	0.0%	1,395,797
Sold, not occupied	10	0.8%	636,952
Seasonal, recreational, occasional use	111	8.7%	5,368,085
For migrant workers	0	0.0%	35,398
Other vacant	151	11.8%	5,429,890
Year Built	--	--	--
Built 2014 or later	11	0.9%	525,051
Built 2010 to 2013	4	0.3%	2,573,002
Built 2000 to 2009	80	6.2%	19,705,347
Built 1990 to 1999	65	5.1%	18,762,073
Built 1980 to 1989	79	6.2%	18,355,676
Built 1970 to 1979	106	8.3%	20,901,765
Built 1940 to 1969	425	33.2%	35,773,834
Median year structure built	1949	--	1977

Source: U.S. Department of Commerce; Census Bureau, American Community Survey

5 Economy

In 2016, Niobrara County had 1,788 total jobs, where an estimated 547 were non-services related, 476 were in government sectors, and 799 in service industries. In particular, farming, mining (including fossil fuels), and retail trade jobs were popular, while accommodation and food services, transportation and warehousing, construction, health care and social services, and real estate, rental, and leasing also contributed largely to the local economies. The three industry sectors with the largest addition of new jobs from 2001 to 2016 were government (with 142 new jobs), health care and social assistance (with 29 new jobs), and finance and insurance (with 24 new jobs).

Niobrara County's unemployment rate has fluctuated from a 3.7% in 2000, to 4.6% in 2010, to the current 2.8% as of 2017. The lowest monthly unemployment rate was found in December of 2017. A total of 741 proprietors (self-employed individuals) were reported in 2016, which is a growth in jobs of this type since the year 2000. The table below summarizes the county's economic statistics based on the latest U.S. Census.

Table 5-1. Niobrara County Basic Economic Profile

Characteristic	Niobrara County
EMPLOYMENT	
Total Employment, 2016	1,788
Unemployment Rate, as of 2017 (US average: 4.4%)	2.8%
Per capita income, 2016 (US average is $50,280)	$45,992
Average earning per job, 2016 (US average: $59,598)	$38,291
Population % change, 1970-2016 (US ave: 58.6%)	-15.1%
Employment % change, 1970-2016 (US ave: 112.2%)	13.7%
Personal Income % change, 1970-2016 (US ave: 201.1%)	54.7%
Persons in poverty (US average is 15.1%)	13.6%
Families in poverty (US average is 11.0%)	12.4%
EMPLOYERS	
Total employer establishments, 2016	89
Total annual payroll, 2016 ($1000)	$11,851
Paid employees	413
Total Private	N/A
Non-Services	N/A
Natural Resources and Mining	4.5%
Ag., Forestry, Fishing, Hunting	1.8%
Mining	2.8%
Construction	N/A
Manufacturing (Incl. Forest Prod.)	N/A
Services	40.9%
Trade, Transportation, Utilities	16.2%
Information	N/A
Financial Activities	2.8%
Professional and Business	1.9%
Education and Health	8.0%
Leisure and Hospitality	N/A
Other Services	N/A
Unclassified	0.0%

Characteristic	Niobrara County
Government	13.1%
Federal Government	1.2%
State Government	11.9%
Local Government	N/A
Travel & Tourism related jobs as a percentage of total private employment	31.2%
HOUSEHOLD INCOME	
Total Households	981
Less than $10,000	8.2%
$10,000 to $14,999	5.8%
$15,000 to $24,999	17.2%
$25,000 to $34,999	14.0%
$35,000 to $49,999	10.9%
$50,000 to $74,999	19.0%
$75,000 to $99,999	10.6%
$100,000 to $149,999	10.3%
$150,000 to $199,999	1.1%
$200,000 or more	3.0%
Median household income	$40,640
Median monthly mortgage cost (US ave: $1,491)	$1,066
Median monthly rent (US ave: $949)	$627
Labor earnings	70.4%
Social Security	34.3%
Retirement income	18.5%
Supplemental Security Income	6.9%
Cash public assistance income	0.7%
Food Stamp/SNAP	8.9%

N/A = Not Applicable.
Source: U.S. Census Bureau www.census.gov/ ; Headwaters Economics,

Visitors traveling to and throughout Wyoming represent an important component of the state's, including Niobrara County's, economy. Travel originating in domestic and international markets generates valuable business sales, payroll, employment and tax receipts for the state as well as for local jurisdictions.

The Town of Lusk's website highlights how tourism contributes to their economy. Popular activities include attending parades, visiting museums and historic sites, engaging in dinosaur bone discovery, and general outdoor activities. They provide a list of frequented hospitalities, shopping, night life, and restaurants for those wanting to "get away" or who are visiting their community.

Other popular attractions in Niobrara County include the Medicine Bow-Routt National Forest and the Thunder Basin National Grassland. Common outdoor activities for visitors are hiking, animal hunting, and camping. Travel and tourism jobs alone make up 31.2% of the county's total private employment. Other important industries in the county, however, are the government sector, agriculture, and mining (including fossil fuels). (Sources: U.S. Census Bureau, 2018 Economic Profile System report by Headwaters Economics, Town of Lusk Tourism website.)

6 Hazard Identification and Risk Assessment

6.1 Identified Hazards

The HMPC reviewed the hazards from the 2015 Niobrara County Multi-Hazard Mitigation Plan for inclusion in this 2018 Regional hazard mitigation plan. The hazards list was compared with the hazards list found in the State of Wyoming's hazard mitigation plan, updated in 2016. Upon further review, the HMPC added: Expansive Soils, High Winds and Downbursts, and Mine/Land Subsidence to be more consistent with the State's plan and hazards in the Region. Furthermore, Extreme Temperatures were combined along with the Severe Winter Weather and Drought chapters as appropriate, while information contained in the Windstorms and Windblown Deposits chapters was considered as part of the Landslide/Rockfall/Debris Flow section, to supplement said hazards as they are similar in nature and risk posed. Blizzards (from Winter Storms and Blizzards) are covered as part of the Severe Winter Weather chapter in this document and the Region 2 Base Plan. Terrorism, while considered, was not included in the Region 2 Base Plan nor in this county annex. The following table notes the summary of hazard significance for each jurisdiction in the County based on a combination of geographic extent, potential magnitude/severity and frequency/probability of occurrence as defined below. Hazard significance is rated as High (H), Medium (M), or Low (L).

Table 6-1 Overall Hazard Significance Summary Table

Hazard	Niobrara County	Lusk	Manville	Van Tassell
Dam Failure	Low	Low	Low	Low
Drought	High	High	High	High
Earthquake	Low	Low	Low	Low
Expansive Soil	Low	Low	Low	Low
Flood	Low	Medium	Medium	Medium
Hail	Medium	Medium	Medium	Medium
Hazardous Materials	Low	Low	Low	Low
High Winds and Downbursts	Medium	Medium	Medium	Medium
Landslide/Rockfall/Debris Flow	Low	Low	Low	Low
Lightning	Medium	Medium	Medium	Medium
Mine and Land Subsidence	Low	Low	Low	Low
Severe Winter Weather	High	High	High	High
Tornado	Medium	Medium	Medium	Medium
Wildfire	High	Medium	Low	Low

Geographic Extent
Negligible: Less than 10 percent of planning area or isolated single-point occurrences
Limited: 10 to 25 percent of the planning area or limited single-point occurrences
Significant: 25 to 75 percent of planning area or frequent single-point occurrences
Extensive: 75 to 100 percent of planning area or consistent single-point occurrences

Potential Magnitude/Severity
Negligible: Less than 10 percent of property is severely damaged, facilities and services are unavailable for less than 24 hours, injuries and illnesses are treatable with first aid or within the response capability of the jurisdiction.
Limited: 10 to 25 percent of property is severely damaged, facilities and services are unavailable between 1 and 7 days, injuries and illnesses require sophisticated medical support that does not strain the response capability of the jurisdiction, or results in very few permanent disabilities.
Critical: 25 to 50 percent of property is severely damaged, facilities and services are unavailable or severely hindered for 1 to 2 weeks, injuries and illnesses overwhelm medical support for a brief period of time, or result in many permanent disabilities and a few deaths.
Catastrophic: More than 50 percent of property is severely damaged, facilities and services are unavailable or hindered for more than 2 weeks, the medical response system is overwhelmed for an extended period of time or many deaths occur.

Probability of Future Occurrences
Unlikely: Less than 1 percent probability of occurrence in the next year, or has a recurrence interval of greater than every 100 years.
Occasional: Between a 1 and 10 percent probability of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Likely: Between 10 and 90 percent probability of occurrence in the next year, or has a recurrence interval of 1 to 10 years
Highly Likely: Between 90 and 100 percent probability of occurrence in the next year, or has a recurrence interval of less than 1 year.

Overall Significance
Low: Two or more of the criteria fall in the lower classifications or the event has a minimal impact on the planning area. This rating is also sometimes used for hazards with a minimal or unknown record of occurrences/impacts or for hazards with minimal mitigation potential.
Medium: The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is also sometimes utilized for hazards with a high impact rating but an extremely low occurrence rating.
High: The criteria consistently fall along the high ranges of the classification and the event exerts significant and frequent impacts on the planning area. This rating is also sometimes utilized for hazards with a high psychological impact or for hazards that the jurisdiction identifies as particularly relevant.

6.1.1 Hazards Considered but Not Profiled

Though noted in other relevant plans such as the Wyoming State Multi-Hazard Mitigation Plan from 2016 and the Niobrara County Multi-Hazard Plan (2015), this plan does not further evaluate the following hazards:

- Avalanche
- Liquefaction
- Space weather
- Terrorism/Civil Disturbance
- Volcanism
- Windblown Deposits

It is important to be aware of the possibility of these events and the associated impacts for Niobrara County. However, the hazard identification described in Chapter 4 of the Base Plan omits these hazards due to the limited relevance in the regional context of this plan or not being sufficiently addressed in other planning mechanisms. Some of the above listed hazards are acknowledged to some degree under other hazard profiles, such as deposits carried by wind that could be part of a debris flow event.

6.2 Building Inventory and Assets

In addition to people, structures, and critical facilities and infrastructure, other important assets exist in Niobrara County that are potentially exposed to hazards identified in this plan. Table 6-2 summarizes the property inventory for the county and each participating jurisdiction, based on the improvement value, and includes the building count and value grouped by parcel type and jurisdiction. This as an assessment of the overall property exposed within the county and by jurisdiction.

Assets inventoried to determine vulnerability include people, structures, critical facilities, and natural, historic, or cultural resources. For the regional planning process, locally available GIS databases were utilized. Parcel and assessor data was obtained through sources such as the Wyoming Property Tax Division's Assessor's Portal. This information provided the basis for building exposure and property types. The focus of the analysis was on "improved," or developed, parcels. These parcels were identified based on an improvement value greater than zero. Abstract Codes were used to identify occupancy type as shown in the following table, which includes summations of total improved value for the various property types and jurisdictions, and the population exposed in each. Using GIS, building counts are estimated from either address point locations or centroid points which fall in the middle of each parcel.

Table 6-2 Niobrara County Building Inventory and Value by Jurisdiction

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Population
Lusk	Com Vacant Land	17	$347,753	$347,753	$695,506	
	Commercial	109	$16,848,294	$16,848,294	$33,696,588	
	Exempt	3	$70,768	$70,768	$141,536	
	Ind Vacant Land	6	$77,200	$77,200	$154,400	
	Industrial	4	$459,667	$689,501	$1,149,168	
	Res Vacant Land	95	$1,373,519	$1,373,519	$2,747,038	
	Residential	690	$57,929,453	$28,964,727	$86,894,180	1,546
	Total	**924**	**$77,106,654**	**$48,371,761**	**$125,478,415**	**1,546**
Manville	Agricultural	1	$6,424	$6,424	$12,848	
	Commercial	6	$272,478	$272,478	$544,956	
	Res Vacant Land	36	$137,708	$137,708	$275,416	
	Residential	81	$3,153,846	$1,576,923	$4,730,769	181
	Total	**124**	**$3,570,456**	**$1,993,533**	**$5,563,989**	**181**
Van Tassell	Agricultural	11	$522,710	$522,710	$1,045,420	
	Res Vacant Land	18	$25,700	$25,700	$51,400	
	Residential	15	$653,233	$326,617	$979,850	34
	Total	**44**	**$1,201,643**	**$875,027**	**$2,076,670**	**34**
Unincorporated	Agricultural	1,072	$154,860,256	$154,860,256	$309,720,512	
	Com Vacant Land	8	$53,595	$53,595	$107,190	
	Commercial	29	$2,967,205	$2,967,205	$5,934,410	
	Duplex	1	$154,929	$77,465	$232,394	2
	Ind. Vacant Land	9	$162,066	$162,066	$324,132	
	Industrial	4	$730,781	$1,096,172	$1,826,953	
	Multiple Unit	3	$514,416	$514,416	$1,028,832	
	Res Vacant Land	85	$3,046,850	$3,046,850	$6,093,700	
	Residential	140	$16,593,768	$8,296,884	$24,890,652	314
	Total	**1,351**	**$179,083,866**	**$171,074,908**	**$350,158,774**	**316**
Grand Total		**2,443**	**$260,962,619**	**$222,315,229**	**$483,277,848**	**2,077**

Source: Wyoming Property Tax Division

Total building exposure within Niobrara County based on the analysis of improved parcels is over $483 million, with over $260 million in improved value properties and over $222 million in estimated contents value. The unincorporated parts of the county have the greatest number of properties (based on the improved parcel counts) followed by the Town of Lusk.

Based on these exposure estimates, there are 2,076 individuals potentially at risk of the various hazards identified for Niobrara County. To calculate these population exposure summaries, a household occupancy average of 2.24 was used, based on the most current statistics from the U.S.

Census. Note that this method over-estimates the Census-estimated population. There might also be a seasonal influx of visitors during the summer months.

6.2.1 Critical Facilities, Infrastructure, and Other Important Community Assets

A critical facility (CF) may be defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. FEMA's HAZUS-MH loss estimation software uses the following three categories of critical assets. Essential facilities are those that, if damaged, would have devastating impacts on disaster response and/or recovery. High potential loss facilities are those that would have a high loss or impact on the community. Transportation and lifeline facilities are a third category of critical assets. Examples of each are provided below.

Essential Facilities	High Potential Loss Facilities	Transportation and Lifelines
• Hospitals and other medical facilities • Police stations • Fire station • Emergency Operations Centers	• Power plants • Dams and levees • Military installations • Hazardous material sites • Schools • Shelters • Day care centers • Nursing homes • Main government buildings	• Highways, bridges, tunnels • Railroads and facilities • Airports • Water treatment facilities • Natural gas and oil facilities and pipelines • Communications facilities

Table 6-3 summarizes critical facilities in Niobrara County, followed by Table 6-4 which examines the distribution of those critical facilities across each individual jurisdiction. Critical facilities were based on the Homeland Security Infrastructure Program (HSIP) Freedom GIS databases and supplemented with input by the HMPC.

Table 6-3 Niobrara County Critical Facility Summary

Facility Type	Facility Count
Cellular Towers	3
Day Care Facilities	1
Electric Substations	15
EMS Stations	1
Fire Stations	2
FM Transmission Towers	1
Hospitals	1
Local Law Enforcement	2
Microwave Service Towers	16
Paging Transmission Towers	1
Public Schools	4

Facility Type	Facility Count
TV Analog Station Transmitters	1
Total	**48**

Source: HSIP Freedom and HMPC

Table 6-4 Niobrara County Critical Facilities by Jurisdiction

Jurisdiction	Facility Type	Count
Lusk	Cellular Towers	2
	Day Care Facilities	1
	Electric Substations	1
	EMS Stations	1
	Fire Stations	1
	Hospitals	1
	Local Law Enforcement	2
	Microwave Service Towers	2
	Public Schools	3
	Total	**14**
Van Tassell	Fire Stations	1
	Total	**1**
Unincorporated	Cellular Towers	1
	Electric Substations	14
	FM Transmission Towers	1
	Microwave Service Towers	14
	Paging Transmission Towers	1
	Public Schools	1
	TV Analog Station Transmitters	1
	Total	**33**
	Grand Total	**48**

Source: HSIP Freedom and HMPC

6.2.2 Natural, Historic, and Cultural Assets

Assessing the vulnerability of Niobrara County to disasters also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant more protection due to their unique and irreplaceable nature as well as contribution to the overall economy.
- If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath when the potential for additional impacts are higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.

- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

Historic and Cultural Resources

By definition, a historic property not only includes buildings or other types of structures such as bridges and dams, but also prehistoric places such as Native American sites, roads, byways, historic landscapes, and many other features. Given the history of the County, five of these historic properties exist in the planning area.

Table 6-5 lists the properties in Niobrara County that are on the National Register of Historic Places, which is the Nation's official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.

Table 6-5 Niobrara County Historic Properties

City/Place	Historic Name
Lusk	C and H Refinery Historic District
	Lusk Water Tower
Mule Creek	Agate Basin Site
Riverview	DSD Bridge over Cheyenne River
Van Tassell	Site of Ferdinand Branstetter Post No. 1, American Legion

Sources: National Register of Historic Place Program, https://www.nps.gov/Nr/research/

Natural Resources

Natural resources are important to include in benefit-cost analyses for future projects and may be used to leverage additional funding for projects that also contribute to community goals for protecting sensitive natural resources. Awareness of natural assets can lead to opportunities for meeting multiple objectives. For instance, protecting wetlands areas protects sensitive habitat as well as attenuates and stores floodwaters.

Wetlands

Wetlands are a valuable natural resource for communities, due to their benefits to water quality, wildlife protection, recreation, and education, and play an important role in hazard mitigation. Wetlands reduce flood peaks and slowly release floodwaters to downstream areas. When surface runoff is dampened, the erosive powers of the water are greatly diminished. Furthermore, the reduction in the velocity of inflowing water as it passes through a wetland helps remove sediment being transported by the water. They also provide drought relief in water-scarce areas where the relationship between water storage and streamflow regulation are vital.

Endangered Species

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e. threatened and endangered species) in the planning area. An endangered species is any species of fish, plant life, or wildlife that is in danger of extinction throughout all or most of its range. A threatened species is a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Both endangered and threatened species are protected by law and any future hazard mitigation projects are subject to these laws. Candidate species are plants and animals that have been proposed as endangered or threatened but are not currently listed.

There are six federally-recognized endangered, threatened, or candidate species present in Niobrara County according to the U.S. Fish and Wildlife Service. These species are listed in Table 6-6.

Table 6-6 Endangered and Threatened Species in Niobrara County

Common Name	Scientific Name	Type of Species	Status
Bald eagle	Haliaeetus leucocephalus	Birds	Recovery
Gray wolf	Canis lupus	Mammals	Recovery
Least tern	Sterna antillarum	Birds	Endangered
Piping Plover	Charadrius melodus	Birds	Threatened
Ute ladies'-tresses	Spiranthes diluvialis	Flowering Plants	Threatened
Western prairie fringed Orchid	Platanthera praeclara	Flowering Plants	Threatened

Source: http://www.fws.gov/endangered/

6.3 Vulnerability to Specific Hazards

This section provides vulnerability to specific hazards, where quantifiable, to summarize the information of the Region and/or provide more detail at the county and jurisdictional level. The results of detailed GIS analyses used to estimate potential for future losses are presented here, in addition to maps of hazard areas and details by jurisdiction and building type in Niobrara County. For a discussion of the methodology used to develop the loss estimates refer to Chapter 4 of the Base Plan. In many cases, Chapter 4 contains detailed information that differentiates the risk by county or city/town, thus such information is not duplicated here. For most of the weather-related hazards the overall risk does not vary significantly enough from the rest of the Region; the reader should refer to Chapter 4 for more details on the following hazard assessment section.

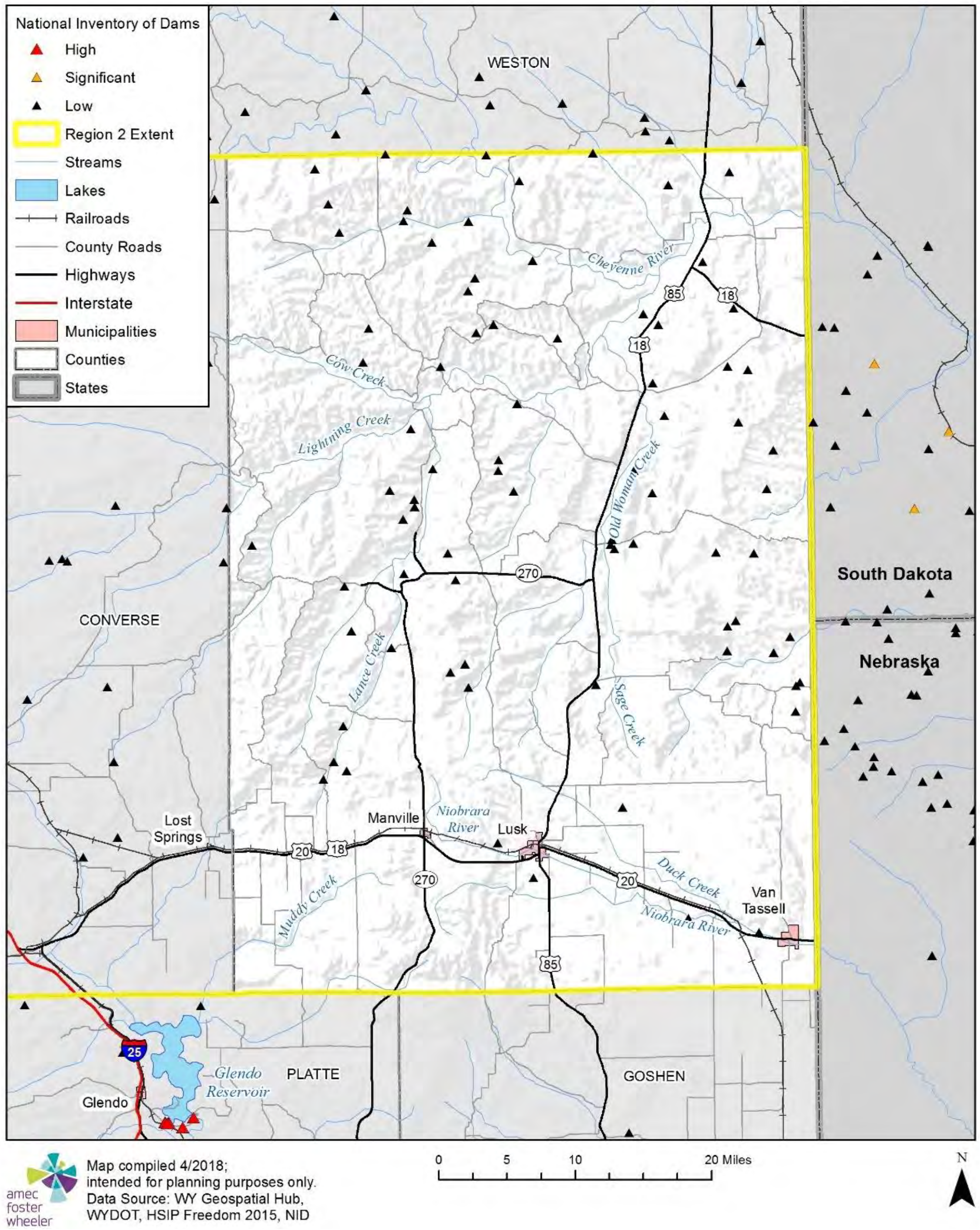
6.3.1 Dam Failure

There are no significant or high hazard dams located in Niobrara County. However, the Wyoming State HMP identifies two dam failure events that took place within Niobrara County, and the Niobrara County Multi-Hazard Mitigation Plan discusses an additional event. As such, the County Emergency Operations Plan, or EOP, also identifies three potentially-significant dams: Duel Reservoir on Cow Creek, Field Reservoir on Cottonwood Draw, and Pfister No. 2 Reservoir on Oat Creek. Historic dam failure events affecting Niobrara County are summarized below:

- On August 10, 1955 heavy rains caused several dams to break resulting in one ranch losing twenty-one heads of cattle.
- The Niobrara HMP identifies a dam failure event that occurred in July of 1969. Although the dam failure took place in nearby Platte County it had a substantial impact on Niobrara County. The dam break resulted in a wall of water that was 50 feet high that damaged crops, killed livestock and forced evacuations. Property damage was estimated to be over $1 million.
- The last dam failure event took place on July 21, 1973 and affected both Niobrara and Weston counites. Torrential rainfall accompanied by hail caused flash flooding to damage bridges, make roads impassable in some areas and result in several earthen dams to fail. Crop and property damaged was substantial with an estimated $225,000 in property damage.

The figure below shows the location of all the Low hazard dams in the county, with the surrounding Significant and High hazard dams falling outside of Niobrara.

Figure 6-1 Dams in Niobrara County and Surrounding Areas



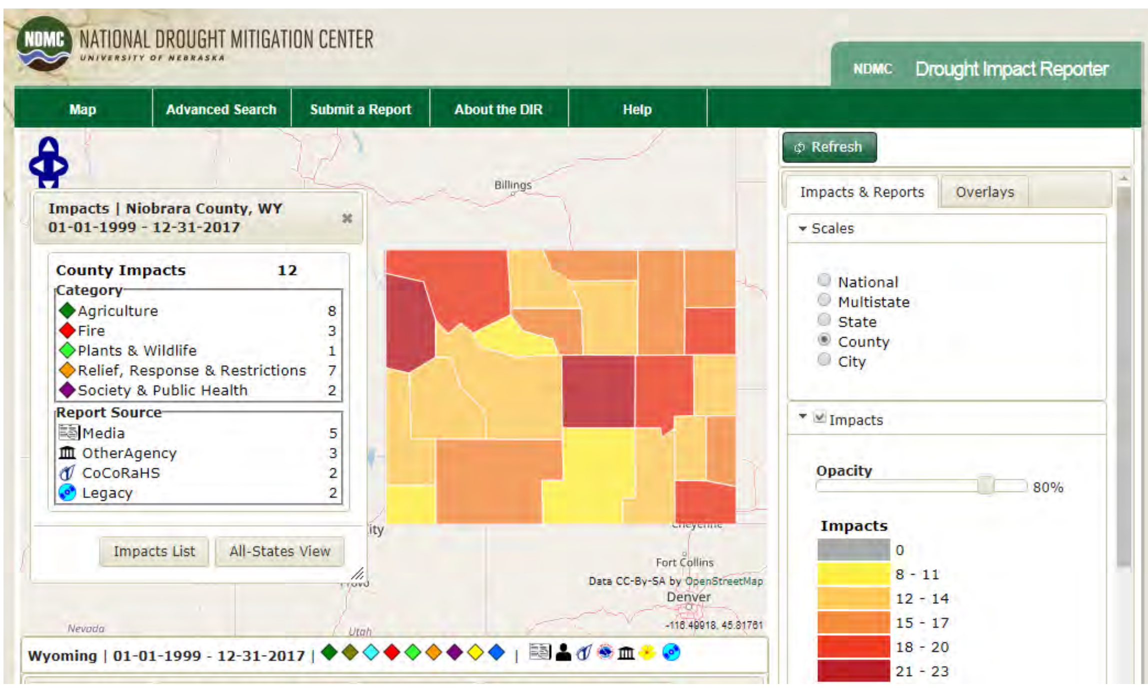
While no significant or high hazard dams are located in the county nor in close proximity (e.g. downstream from water bodies) to jurisdictions, there is always the possibility of structure failure-based flooding in the future. The overall risk of dam failure across Niobrara County and its jurisdictions is however **low**.

6.3.2 Drought

Drought is a high significance hazard across Niobrara County. Drought-related impacts to the local economy can be extensive, affecting agriculture, relief response efforts, and increasing fire danger, among others. The most affected sector in Niobrara County has been agriculture, but the county and jurisdictional agencies suffer from relief response efforts' increased management costs too, which prevent them from maintaining revenue flows during drought. Since 1999, Niobrara County has received twelve reports of countywide impacts to the various sectors due to drought. The overall significance of drought is again high throughout the county and its jurisdictions.

The figure below summarizes the number and type of reports that have been made at the county level, from 1999 to the end of 2017. These reports were submitted to indicate negative effects to the economic sectors and local industries due to drought events. Refer to Chapter 4 in the Base Plan for additional discussion of drought risk related to the region and the county.

Figure 6-2 County-Level Drought Reports in Niobrara County, 1999-2017



Source: NDMC

Table 6-8 below takes the impacts of drought on crop production (detailed in Table 4-16 of the Base Plan) and breaks out the agriculture losses specific to Niobrara County.

Table 6-7 Indemnities Paid for Commodities that Suffered from Drought in Niobrara County, 2007-2017

Commodity	Acres Damaged	Indemnity Amount
Forage Production	14,988	$422,739
Forage Seeding	318	$36,294
Oats	127	$3,009
Wheat	684	$69,028
TOTAL	**16,117**	**$531,070**

Source: USDA – Risk Management Agency

6.3.3 Earthquake

Niobrara County has experienced eleven notable seismic events since 1889 (though more may have taken place but not been recorded/reported). The earthquakes occurring in the county are not usually felt, nor do they cause any reportable damages or injure populations every time. Below are the known occurrence summaries; none of those events resulted in damages or injuries:

- The earliest recorded earthquake in Niobrara County occurred on October 8, 1889. The event was felt in Lusk, Manville, and Muskrat Canyon and traveled in a northeasterly direction (Case, 1993).
- Two earthquakes occurred in the Lusk area in the mid-1900s. On February 25, 1942, an intensity V earthquake, with an epicenter approximately 18 miles south of Lusk, caused no damage (Casper Tribune-Herald, February 27, 1942). On October 3, 1954, an intensity IV earthquake was reported near Guernsey, approximately 38 miles south-southwest of Lusk. Although the event was felt from Douglas to Wheatland, no damage was reported. Train traffic between Douglas and Wheatland was temporarily halted until it was determined that the tracks had not been damaged (Laramie Republican-Boomerang, October 4, 1954).
- In the 1960s, there were two earthquakes in the Lusk area. On March 28, 1964, there was an intensity V earthquake with an epicenter approximately 21 miles southeast of Lusk. No significant damage was reported (Casper Star-Tribune, March 29, 1964). On August 22, 1964, there was a magnitude 4.5, intensity V earthquake recorded with an epicenter approximately 17 miles northwest of Lusk. Much of the town was attending a concert in the town's new high school building. When the attendees felt the tremor, they thought that the furnace had blown up (Wyoming State Tribune, August 23, 1964). Fortunately, no significant damage was reported.
- In the 1990s, there were a few earthquakes in the Lusk area. On November 1, 1992, a magnitude 3.0, intensity V earthquake occurred just a few miles southeast of Lusk. Although the earthquake was felt throughout Lusk, little damage was reported (Casper Star-Tribune, November 4, 1992). In 1996, there were two earthquakes in the Lusk area. The first occurred on April 8, 1996. It was a magnitude 3.7, intensity III event, and was located approximately 26 miles northeast of Lusk. Although the earthquake was felt in Lusk, no damage was reported. Another earthquake occurred on May 3, 1996. This earthquake, which was located in southwestern corner of South Dakota, had a magnitude of 3.1. No damage was reported.

- Three events were reported in the 2000s, though none of the earthquakes caused damaged. A magnitude 3.1 earthquake was reported 19 miles outside of Lance Creek on August 22, 2008. County commissioners reported that an earthquake was felt in December of 2008 in Lusk and much of the County, but no damages were reported. Most recently, a magnitude 2.9 earthquake occurred 13 miles away from Van Tassell on March 10, 2011.

No active fault lines have been identified in the county, although the Wheatland-Whelen fault system exists (but is not confirmed as active).

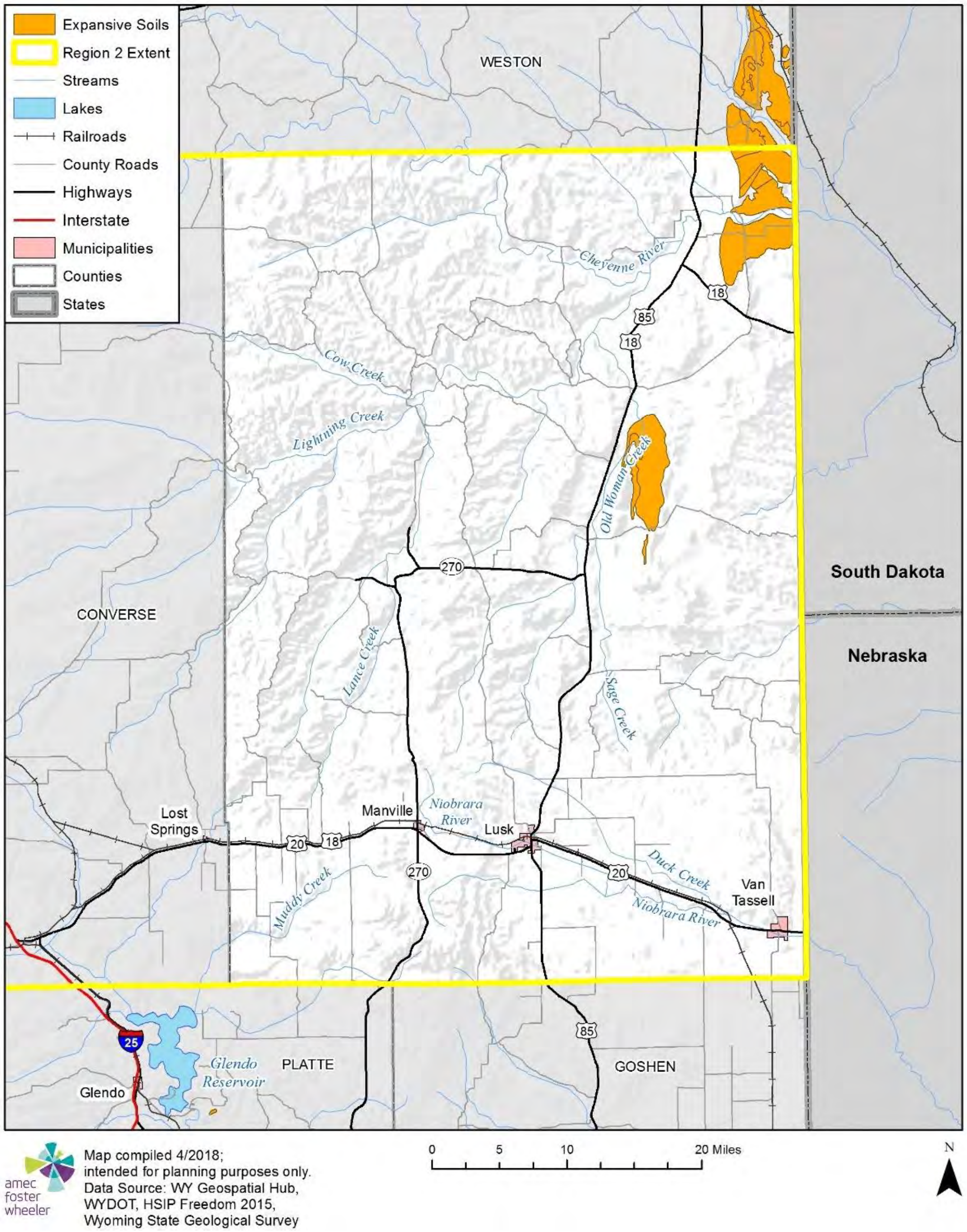
A HAZUS earthquake loss analysis was completed as part of the 2018 Plan development. The 2500-Year probabilistic scenario estimated about $4 million in economic losses (damages) in the county, but without any casualties. For more details on the past studies, refer to the Earthquake chapter of the Base Plan. Based on all the information available to date, earthquakes are a low significance hazard in the county.

6.3.4 Expansive Soils

State of Wyoming mapping data shows a small amount of expansive soils within Niobrara County, comprising only around 2% of the county's area; this is below the regional average of 13.5%. There were no known historic or current issues of expansive soils in Niobrara County, but based on the figure below there are areas where expansive soils are present. These areas are located along the northeast and central east in the county, running to the east of highways 18 and 85. Potential for swelling is predominantly low for the County, and associated impacts negligible. Chapter 4 of the Base Plan includes more information on the location of various soil types, probability of expansion, and exposed building values for both Niobrara County and the Region 2.

The figure below displays the areas known to be susceptible to expansive soils in Niobrara County.

Figure 6-3 Expansive Soils in Niobrara County



Based on recent GIS analysis of parcels, buildings, building improved values, building contents, population, and critical facilities in Niobrara County, it is estimated that there is some risk of exposure to expansive soils across unincorporated portions. The table below summarizes the findings of the analysis, including potential losses, population affected, and the type and number of parcels and facilities that could be affected by this hazard. Note that Niobrara County does not have any critical facilities at risk of expansive soils.

Table 6-8 Building/Structure and Population Exposure to Expansive Soils in Niobrara County

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Population
Unincorporated	Agricultural	27	$2,775,152	$2,775,152	$5,550,304	-
	Res. Vacant Land	1	$9,000	$9,000	$18,000	-
	Total	**28**	**$2,784,152**	**$2,784,152**	**$5,568,304**	**0**

Source: WY State Geological Survey, WY Assessor's Office, parcel analysis,

6.3.5 Flood

Niobrara County has a long history of flooding that has resulted in financial losses and property destruction. Recently, a large event took place on June 4, 2015 which involved flash flooding of homes, businesses and a highway bridge in Lusk and surrounding areas. Heavy rain of six inches sent the Niobrara River over its banks. The Niobrara County Emergency Management Coordinator reported that water covered approximately four city blocks and knocked out the town's drinking water system, resulting in a boil order from the Environmental Protection Agency (EPA). In addition to damaging and forcing closedowns on highways and roads, towns lost power, homes were destroyed, and businesses received heavily damages, leading to both Governor and Presidential Disaster Declarations in early July of that year. Sixteen other flooding events have been reported to NOAA's National Centers for Environmental Information (NCEI) system since 1938, totaling $1,542,250 in property damages and $2,250 in crop damages. Riverine sources of flooding in the county include the Cheyenne River, Niobrara River, Quinn Creek, and Van Tassell Creek. Niobrara County does not have any NFIP Repetitive Loss Facilities.

Table 6-9 summarizes significant flood events that occurred between 1938 and 2018 in Niobrara County, as reported to the NOAA NCEI system.

Table 6-9 Flood Events in Niobrara County, 1938-2018

Main Location	Date	Property Damage	Crop Damage
Cheyenne River	6/1/1938	--	--
--	6/7/1945	--	--
4 miles north of old Whitman Post Office	8/10/1955	--	--
South of Lusk	6/11/1960	$2,250	$2,250
Lusk and county-wide	6/1/1962	--	--
County wide	7/1/1973	--	--
state wide	5/1/1978	--	--
Lusk	7/1/1980	--	--
Niobrara River	Spring 1990	--	--
Niobrara River	Spring 1991	--	--
County wide	5/7/1995	--	--
Redbird	8/6/2006	$40,000	--
County wide	Spring 2008	--	--
Keeline, Lusk	9/29/2014	--	--
WEST LANCE CREEK	5/26/2015	--	--
KEELINE	6/3/2015	--	--
VAN TASSELL	6/4/2015	$1,500,000	--
TOTAL		**$1,542,250**	**$2,250**

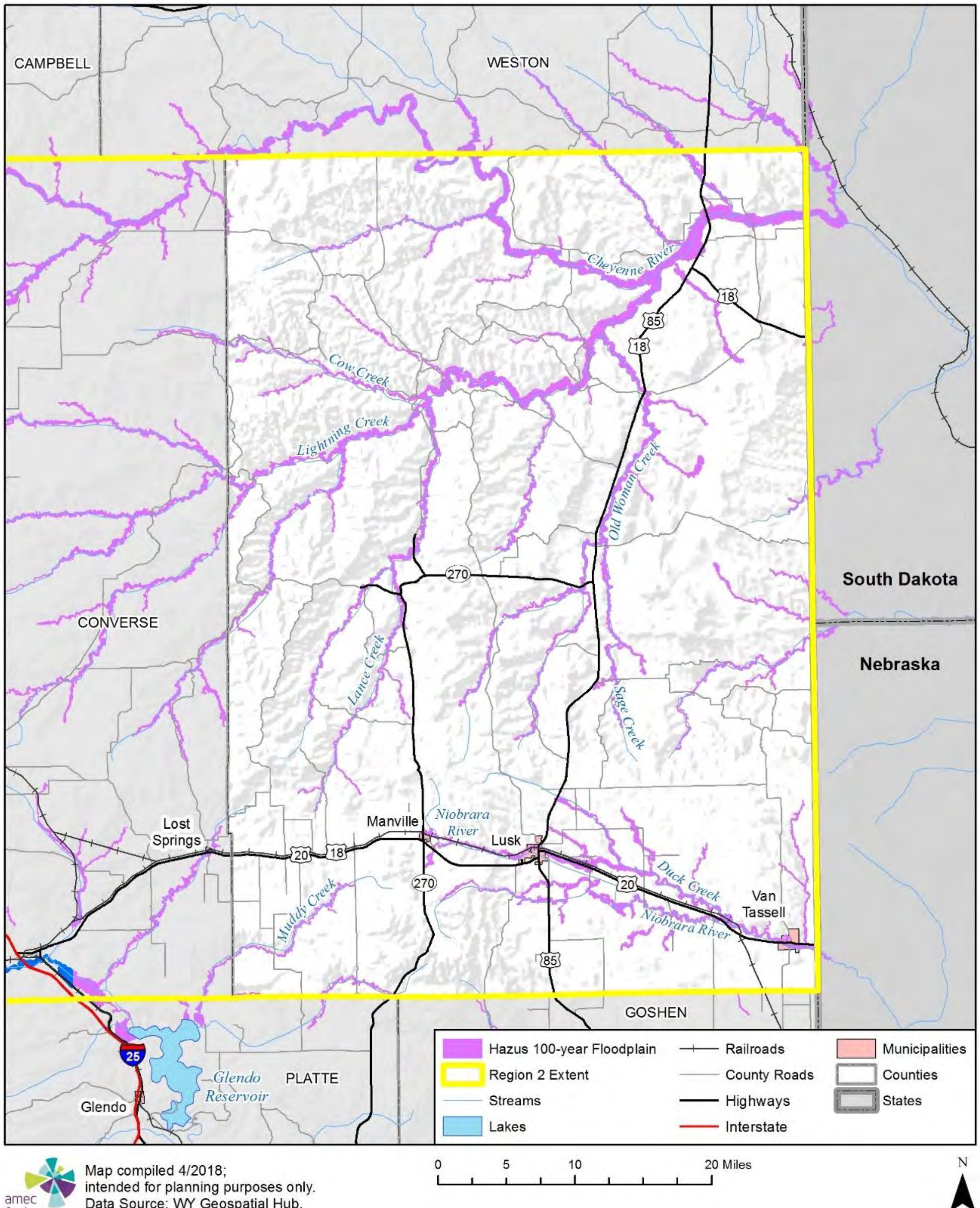
Source: NOAA NCEI

Based on GIS analysis, in the event of a 100-year flood (1% annual chance), the most impacted parcels and buildings would be in the unincorporated areas (62.6% of all the impacted parcels and buildings in the county), followed by the Town of Lusk (26.4%), the Town of Manville (7.4%), and finally the Town of Van Tassell (3.4%). This ratio changes when taking into consideration the improved value and content value of the properties at risk, as the unincorporated areas represent 90.8% of potential loss in the entire county (given higher value properties, more contents at risk, or other such factors). The total exposure value in Niobrara County to the 100-year floodplain is equal to $35,417,397, with $8.8 million of potential loss during a 100-year flood event. An estimated 128 people would face displacement during these floods, and 174 parcels/buildings would be at risk.

Niobrara County does not show risk to the 500-year flood event (0.2% annual chance flood), given the lack of flood studies at that level.

Below are maps of flood prone areas in Niobrara County and its jurisdictions, based on Hazus-derived (100-year) floodplains calculated for a 1% annual chance flood event. Tables highlighting general properties at risk, vulnerable critical facilities, exposure values, potential losses, and overall population vulnerable to flooding are included under the Base Plan.

Figure 6-4 Niobrara County 100-year and 500-year Flood Hazards



Map compiled 4/2018; intended for planning purposes only. Data Source: WY Geospatial Hub, WYDOT, HSIP Freedom 2015, Hazus-MH MR2

Figure 6-5 Town of Lusk Hazus-Derived (100-year) Flood Hazards

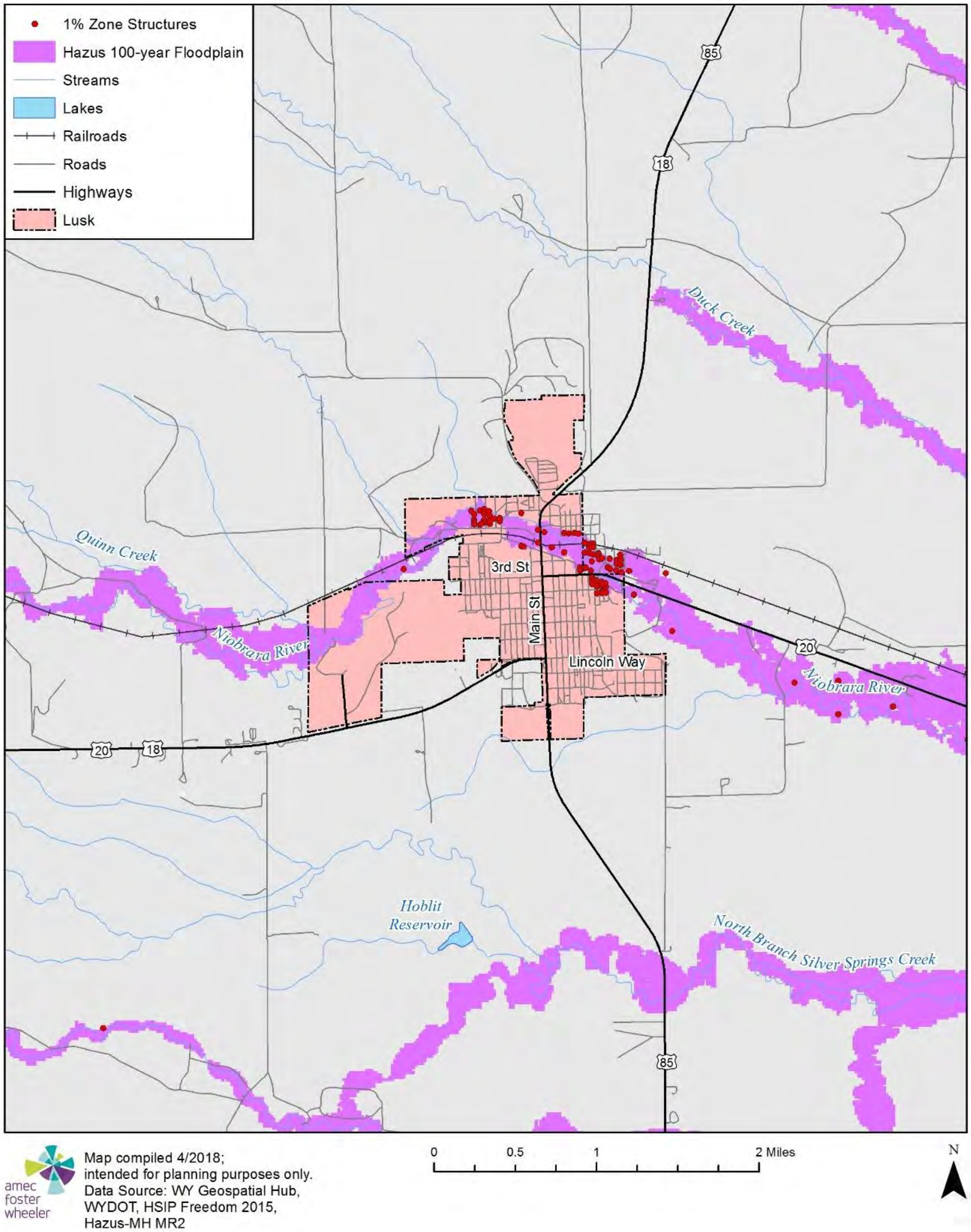


Figure 6-6 Town of Manville Hazus-Derived (100-year) Flood Hazards

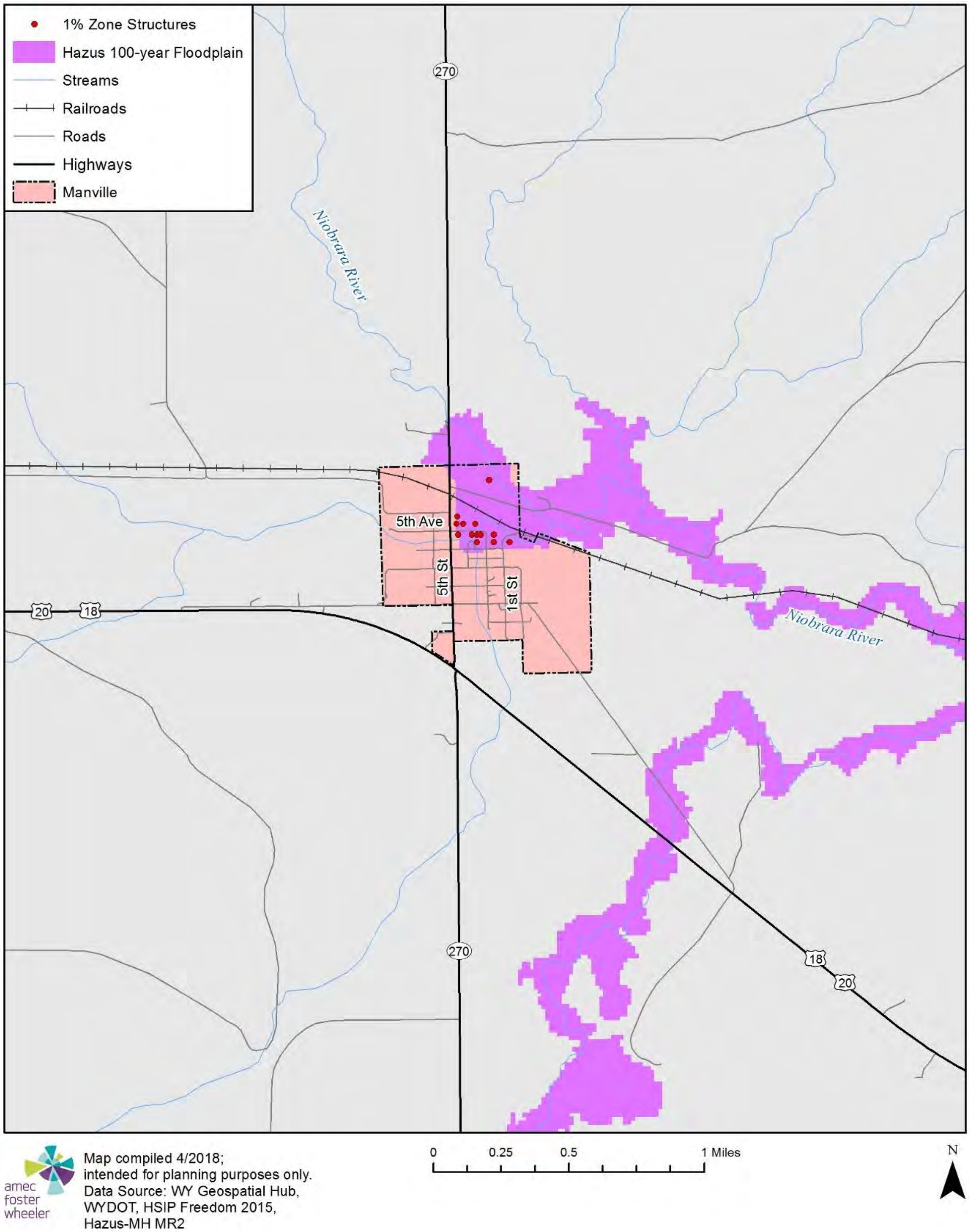
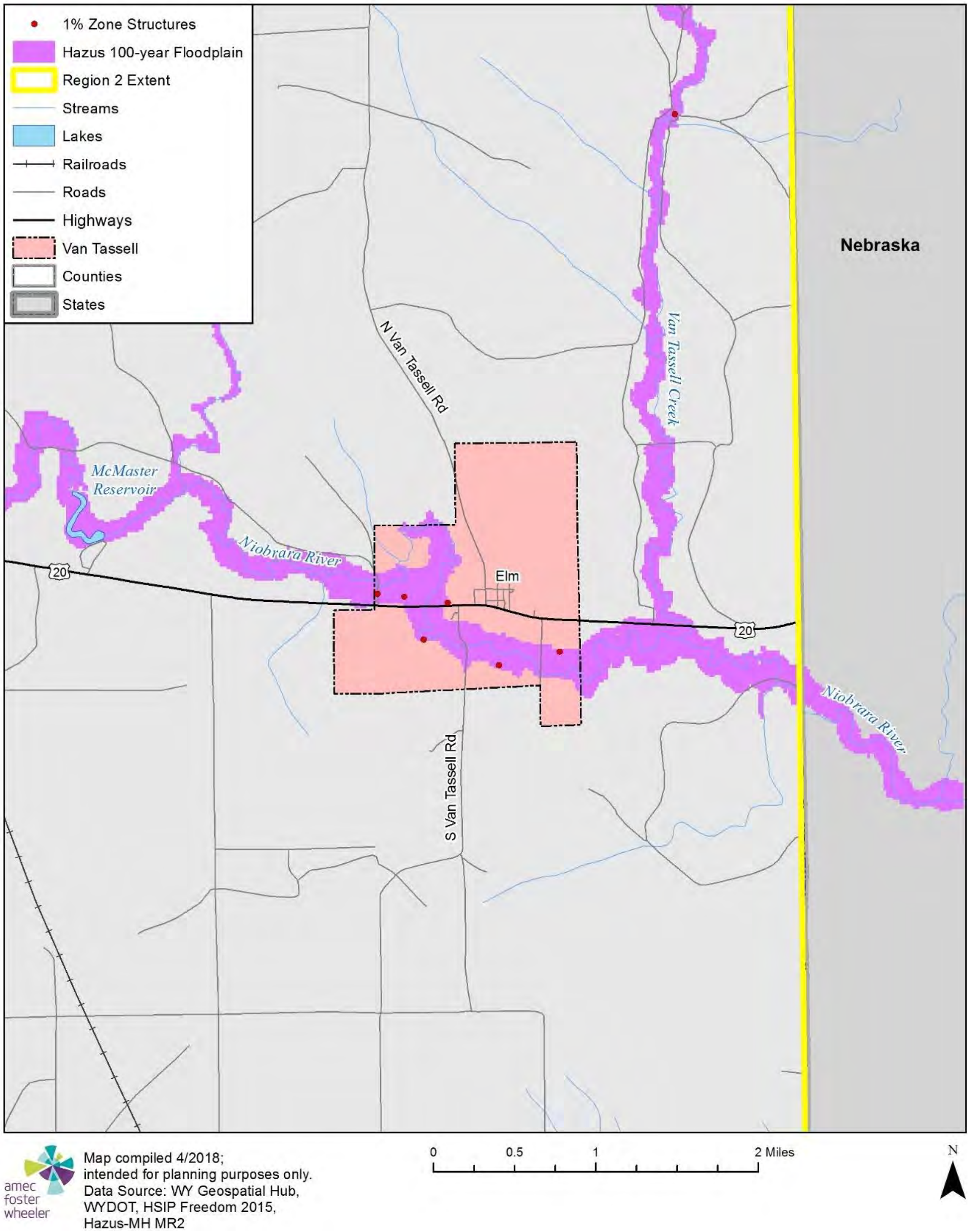


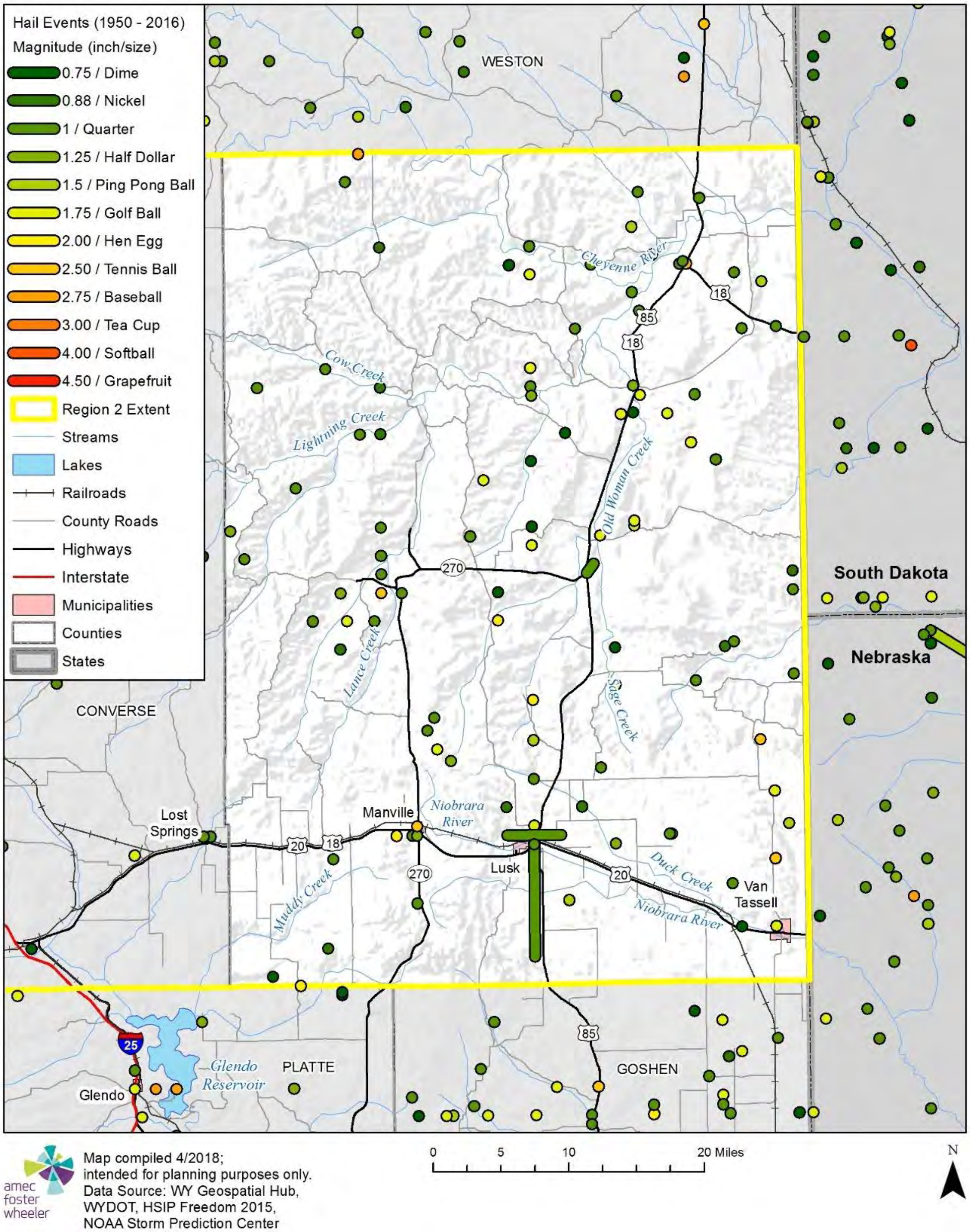
Figure 6-8   Town of Van Tassell Hazus-Derived (100-year) Flood Hazards



6.3.6 Hail

Hail storms occur sporadically throughout Region 2 and are often associated with severe summer storms; these events primarily impact buildings and agriculture. Most of the damages affect crops, though there is potential for significant structural destruction from particularly large hailstones. The probability of future occurrence for this event in Niobrara County is likely, and the overall threat hail poses is significant across the County and its jurisdictions. Though it should be noted that property damages will be higher in the municipalities (due to exposed infrastructure, cars, etc.), potential crop and livestock damages would be concentrated in the more rural and unincorporated areas. See Section 4.2.7 of the Base Plan for more information on the previously recorded hail events and associated damages. The total property damage recorded for the County since 1950 due to 141 occurrences of this hazard is $95,500, with no crop damages on file. (Source: NOAA's NCEI database.) The map below displays where NOAA-reported hail events took place in Niobrara County, from 1950-2016:

Figure 6-7 NOAA Reported Hail Events in Niobrara County



6.3.7 Hazardous Materials

As further discussed at a regional level in the Base Plan, from 2007 to 2016 Niobrara County has been exposed to at least 14 hazardous materials incidents that were significant enough to be recorded in the U.S. Coast Guard's National Response Center (NRC) database and Risk Management Plans (RMP) network; more information can be obtained at http://www.rtk.net/#rmp. While Niobrara County does not contain any RMP facilities, hazardous material handlers do exist in the form of transporter services, and hence have impacted, and can continue to impact, the County. The table below summarizes the number of events that have occurred from 2007-2016 in Niobrara County.

Table 6-10 NRC-Reported Incidents in Niobrara County: 2007-2016

Year	Niobrara
2007	**0**
2008	1
2009	1
2010	1
2011	0
2012	1
2013	2
2014	3
2015	5
2016	0
TOTAL	**14**
Yearly Average	**1.4**

Source: http://www.rtk.net/#rmp

In 2015, Niobrara County had five hazardous materials incidents (the most in its recent history). A recent incident involved a hot oil tanker overturning and spilling on the highway north of Manville, in spring 2015. The County cleaned up the mess and there was no need for assistance from the regional response team, though.

Life safety is a concern related to transportation incidents that may occur on major roadways or railways in the County. US Route 18, US Route 85, US Route 20, the Union Pacific Railroad, and the Lusk Municipal Airport are all potential sources of hazardous materials exposures. The overall significance of this type of hazard to the county is low.

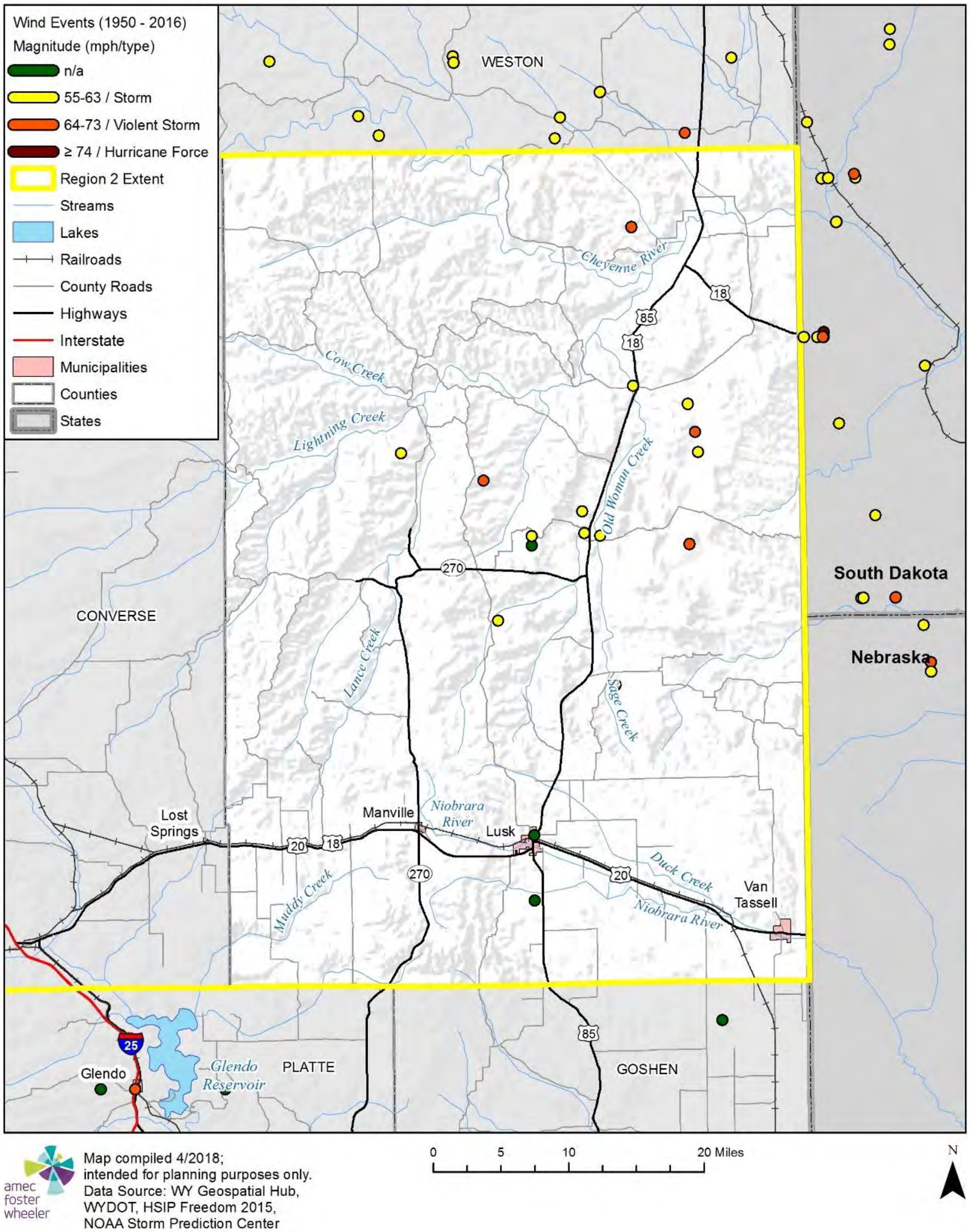
6.3.8 High Winds and Downbursts

Wind is a constant presence in Wyoming, but its effects can be often overlooked. It is difficult to assess vulnerability as it relates to location because damaging winds have occurred everywhere in

Niobrara County. The main risks associated with high wind events are related to poorly constructed buildings, flying debris, car accidents, and damages to electrical/power infrastructure.

The figure below displays NOAA's NCEI-recorded events taking place from 1950 to 2016 in the county.

Figure 6-8 NOAA Wind Events in Niobrara County, 1950-2016



High wind events are usually somewhat random and damages from high winds are often described in a regional context, though downbursts occur in smaller extents.

From 1950-2016, a total of 19 wind weather events have caused $65,000 in property damages, with a maximum recorded wind speed of 61 knots (source: NOAA's NCEI). Overall, high winds pose a moderate/medium threat across the County that does not vary between the jurisdictions. See Section 4.2.9 of the Base Plan for more information on wind zones, events, and impacts.

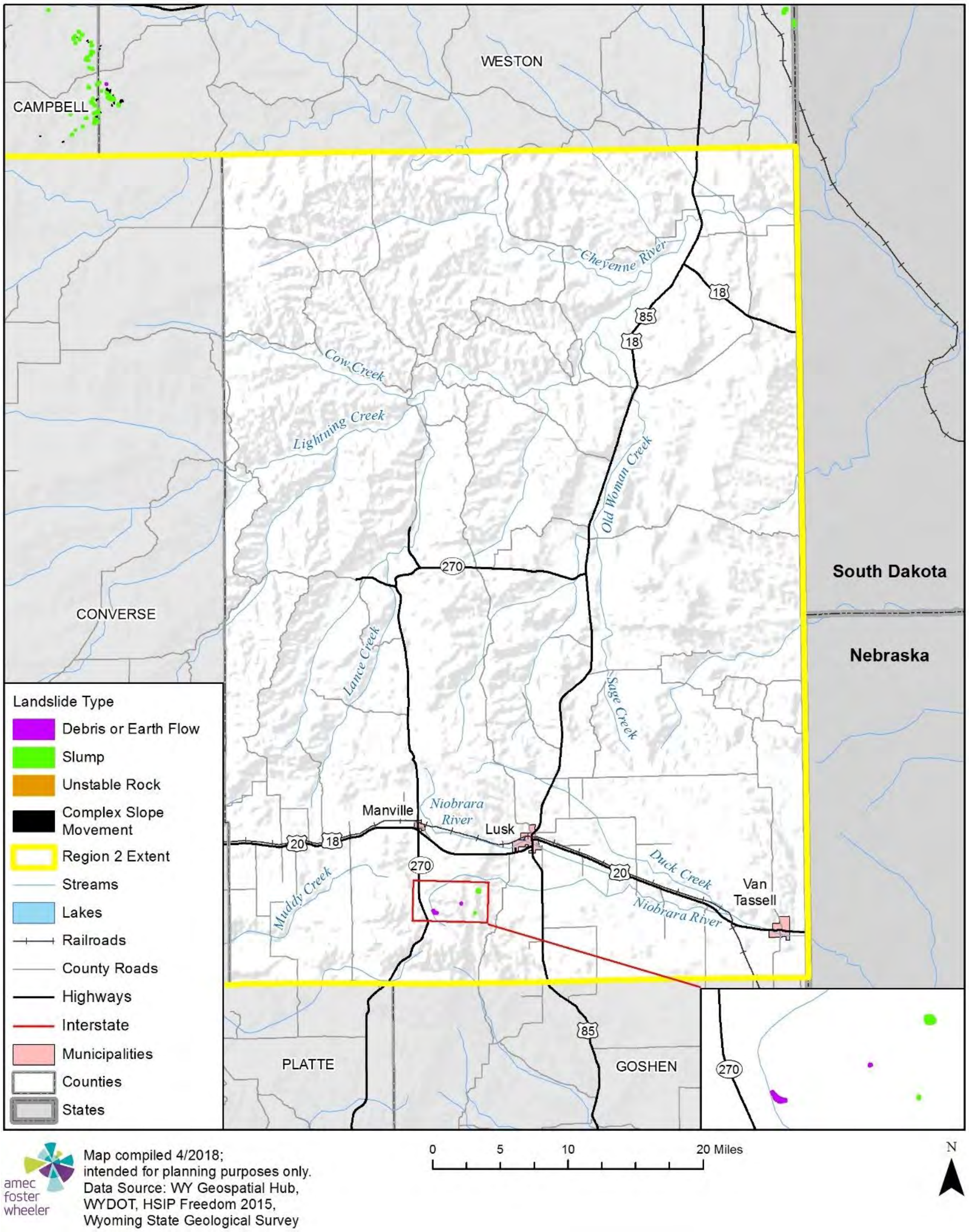
6.3.9 Landslide/Debris Flow/Rockfall

The geologic history and unique conditions of Wyoming make landslides one of the most common hazards. However, in Niobrara County, landslide deposits are very minimal, and only small amounts of slump and debris/earth flow terrains are found in the county. These small areas are located between WY highway 270 and U.S. highway 18, to the southeast of Manville but southwest of Lusk, in central-south Niobrara.

In terms of significance, landslides, debris/earth flow, and rockfall vary based on the magnitude and the location. There is also a possibility that creeks or rivers within the county could become dammed by landslide activity, resulting in a flash flood hazard downstream if the landslide dam fails or is overtopped, or flood nearby developed areas as pooling behind the landslide dam occurs. While some events are small and have limited impact on people and infrastructure, other occurrences can involve large sections of earth and may obstruct major roadways, power line corridors, or gas lines.

During the development of this regional plan, a GIS analysis of exposure to landslide hazard areas and potential property losses was performed, with the resulted detailed for all the Region 2 counties in Section 4.2.10 of the Base Plan. Niobrara County, however, did not show any estimated losses due to this hazard across its jurisdictions or unincorporated areas. No critical facilities were at risk either. As such, Niobrara County has a low degree of landslide vulnerability.

Figure 6-9 Niobrara County Landslide Hazards



6.3.10 Lightning

All areas in western Wyoming are susceptible to lighting strikes. Impacts to persons and property are likely to remain isolated. Outdoor workers and outdoor enthusiasts and livestock will remain susceptible to lightning strikes. In Niobrara County, higher elevation/mountainous areas remain more susceptible. Four lightning events have been recorded in the County from 1960-2015, with $33,739 in total damages accrued from the various events (in the form of property and crop losses). Lightning-caused wildland fires may result in more extensive and compound/secondary damages as well. The table below summarizes the recorded events from this hazard, as available in the 2016 Wyoming Multi-Hazard Mitigation Plan. Overall, lighting poses a medium significance hazard to the county.

Table 6-11 Lightning Events in Niobrara County, 1960-2015

Number of Events	Injuries	Fatalities	Property Damage	Crop Damage	Total Damage
4	0	0	$30,739	$3,000	**$33,739**

Source: 2016 Wyoming State Multi-Hazard Mitigation Plan

6.3.11 Mine and Land Subsidence

There are a few abandoned mine sites with subsidence-prone underground workings in Niobrara County, especially areas close to state and other major highways. Mines across the county have been identified and there are mitigation projects designed to reduce the impacts from underground mining and subsidence, and to remove the threat they pose to the surrounding area. The unmitigated identified mines pose little to no threat to infrastructure in the parts of the county. Mine and general land subsidence events occur occasionally, and the degree of risk and impact varies based on the characteristics of each area. Although there have not been any notable mine or land subsidence events in Niobrara County recently, occurrences can happen; however, the dollar amounts of the potential damage are not readily available.

Refer to Section 4.2.12 from the Base Plan for a more detailed vulnerability assessment and location of abandoned mine sites, mine reclamation and abandonment programs, land subsidence information, and other details relevant to Niobrara County and Region 2. The overall threat of this hazard in the county is low.

6.3.12 Severe Winter Weather

Winter storms are a yearly feature of the Wyoming climate and may occur anywhere in the state. Blizzard conditions bring the triple threat of heavy snowfall, strong winds, and low temperatures. Poor visibility and huge snowdrifts are major hazards caused by blowing snow. These storms disrupt work, make travel difficult or impossible, isolate communities, kill livestock by the hundreds or thousands, and sometimes leave human fatalities in their wake. Higher elevation and mountainous areas tend to be more susceptible to severe winter weather events, but in Niobrara

County there have not been any property or crop damages from since 1996. However, in this time period, 27 winter storms, one ice storm, and one extreme cold event have taken place (Source: NOAA's NCEI database.)

The HMPCs reported that Interstate closures are common during winter storm events, which leads to the need to shelter stranded motorists, can create economic impacts, and can cause problems due to diverted semi-trucks on city and town streets. Access to rural homes can also become an issue, especially during prolonged storms; residents are encouraged to keep a 3-day supply of food, medication, and oxygen. Impacts on livestock and wildlife can also be a major concern.

Ice jams can pose a problem across the county as well. The overall significance of this hazard is high across the County and does not largely vary between the jurisdictions. Refer to Section 4.2.13 of the Base Plan for more information.

6.3.13 Tornado

Many documented tornadoes occurring in the counties in Region 2 are given low ratings on the Fujita Scale (F0s and F1s) simply because these tornadoes are often formed over open land and result in little or no damage. Niobrara County has had 34 NCEI-reported incidents of this kind from 1950-2016, with five injuries recorded. The table below summarizes the tornado events in this time period:

Table 6-12 Tornado History in Niobrara County, 1950-2016

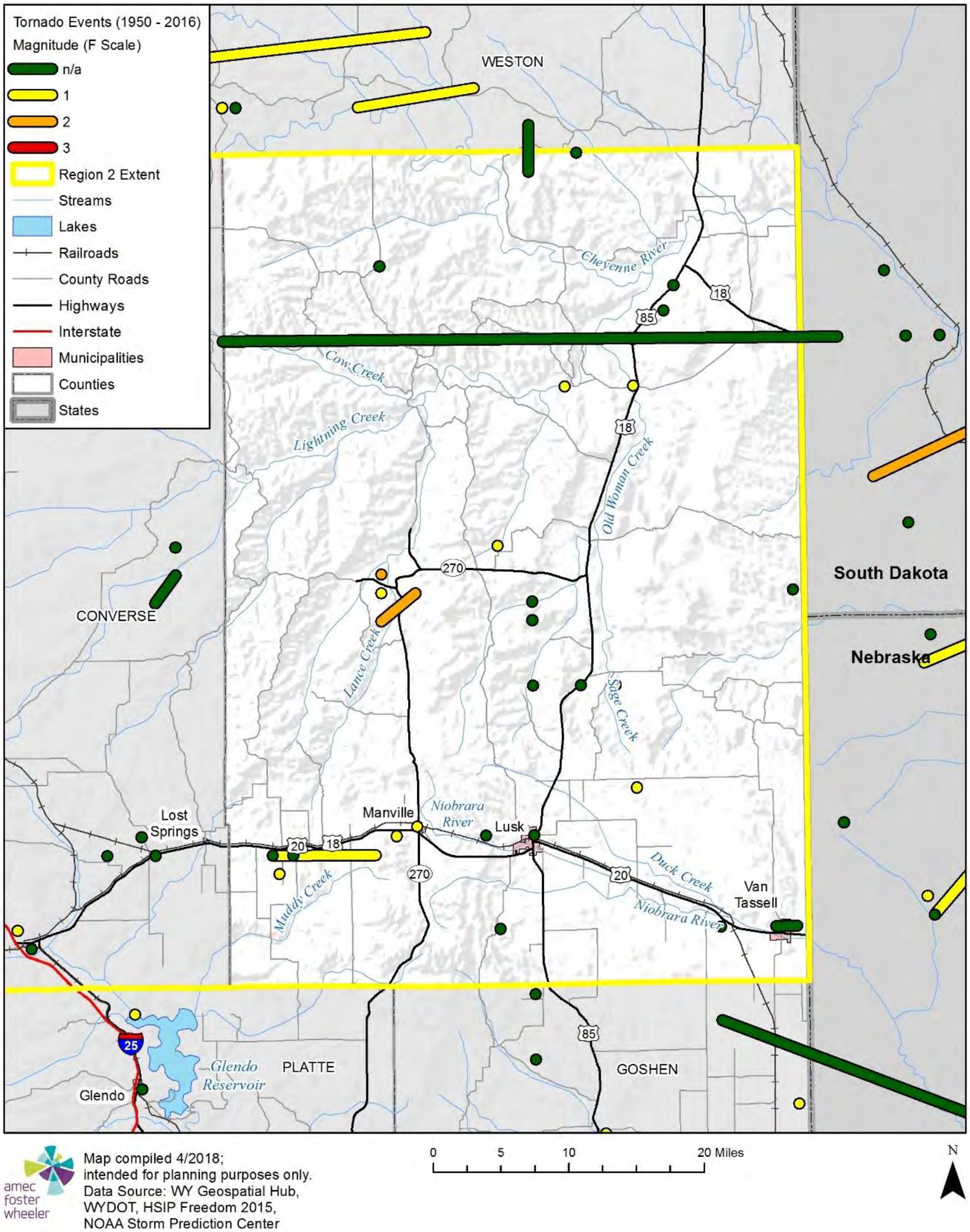
Total Incidents	Magnitude	Damage-Causing Incidents	Fatalities	Injuries	Property Damage
34	F0, F1, EF0, EF2	17	0	5	$1,780,150

Source: NOAA's NCEI

The overall significance of tornadoes in Niobrara County is medium. Region 2 tornado events tend to be rather small in terms of magnitude, with limited associated impacts, and the significance of this event does not largely vary across jurisdictions. However, Niobrara County has had a fair amount of property damages and losses reported in the last 60 or so years, and the previous Niobrara County HMP states that "[county residents] felt strongly that the number of tornadoes captured in the data significantly under-represented the actual number of tornadoes that have occurred in the County"

The map below geospatially displays the locations of NOAA-reported tornadoes across Niobrara County, though only focusing on events from 1950-2016.

Figure 6-10 NOAA Tornado Events from 1950-2016



6.3.14 Wildfire

Large wildland fires become increasingly damaging as the population expands into the more rural areas. The statewide Wildland Urban Interface (WUI) Hazard Assessment and its resultant outputs serve two primary purposes: assisting in prioritizing and planning mitigation projects, and creating a communications tool to which agencies can relate to common information and data. With the mapping analysis evaluating areas of varying wildfire vulnerability, the final output will result in a Risk, Hazard, and Value (RHV) map displaying areas of concern (Redzones) for catastrophic wildland fires. These results provide vulnerability and potential risk assessment tools.

Another method of estimating potential future impacts from wildfires is to determine the value of structures that are located within Redzones, or wildland fire building exposure values. Wildland fire building exposure value is the value of buildings that can be potentially damaged by wildland fire in an area. Building exposure values are based on Census Block level data from the U.S. Census Bureau. The methodology utilized is like the one used to model flood exposure described in the flood chapter of the Base Plan. Based on GIS analysis performed, Niobrara County has over $5.5 million in total property exposure potentially at risk to wildland fires, 16 parcels/buildings at risk, and 13 people living in the Redzones (at risk of being hurt, displaced, etc.). However, there are 0 critical facilities at risk of the Redzone throughout the county (more information in Chapter 4 of the Base Plan). Though it is not likely that the areas at risk will simultaneously face a completely destructive event, these figure estimates provide the upper end of what could be affected. Future wildfires could face compound losses such as damaged crops and watersheds within the County, and the fires could contribute to soil erosion and deposition problems. The table below summarizes Niobrara County's risk to wildfires:

Table 6-13 Wildfire Risk in Niobrara County based on Redzone Analysis

Jurisdiction	Property Type	Parcel Count	Improved Value	Est. Content Value	Total Exposure	Population
Unincorporated	Agricultural	8	$1,275,543	$1,275,543	$2,551,086	--
	Commercial	1	$8,720	$8,720	$17,440	--
	Duplex	1	$154,929	$77,465	$232,394	2
	Industrial	1	$488,474	$732,711	$1,221,185	--
	Residential	5	$1,036,026	$518,013	$1,554,039	11
	Total	**16**	**$2,963,692**	**$2,612,452**	**$5,576,144**	**13**
	Grand Total	**16**	**$2,963,692**	**$2,612,452**	**$5,576,144**	**13**

Source: Wyoming Assessor's Office, Redzone data, U.S. Census

Current resources for wildfire planning and management for Niobrara County include the following:

- Wyoming Statewide Forest Resource Assessment – 2009
- Wyoming Fire Report – 2011

- Wyoming Wildland Urban Interface Hazard Assessment – 2002
- Front Range Redzone Project
- Niobrara County Emergency Operations Plan

Below are the maps, first for Niobrara County and then for the affected jurisdictions (i.e. Town of Lusk), of Redzone vulnerability where red colors mean high risk of fires, and the oranges are the areas immediately adjacent and hence slightly less vulnerable but still at risk. A fire history map of fire locations and their magnitudes is included last, for Niobrara County; the fires shown are limited to those that initiated on federal lands and likely is not a comprehensive picture of previous fire history.

Overall, the significance of wildfires to the county is high, with around 10,523 acres burned just in the human- and natural-caused fires of over 1,000 acres in size that took place from 1980-2016. However, historically, there have been many more fires reported, most of which are of much smaller scale. Refer to Section 4.2.15 of the Base Plan for additional analysis and information pertaining to Niobrara County and Region 2, including further statistics, summaries, and details.

Figure 6-11 Niobrara County Redzone Areas

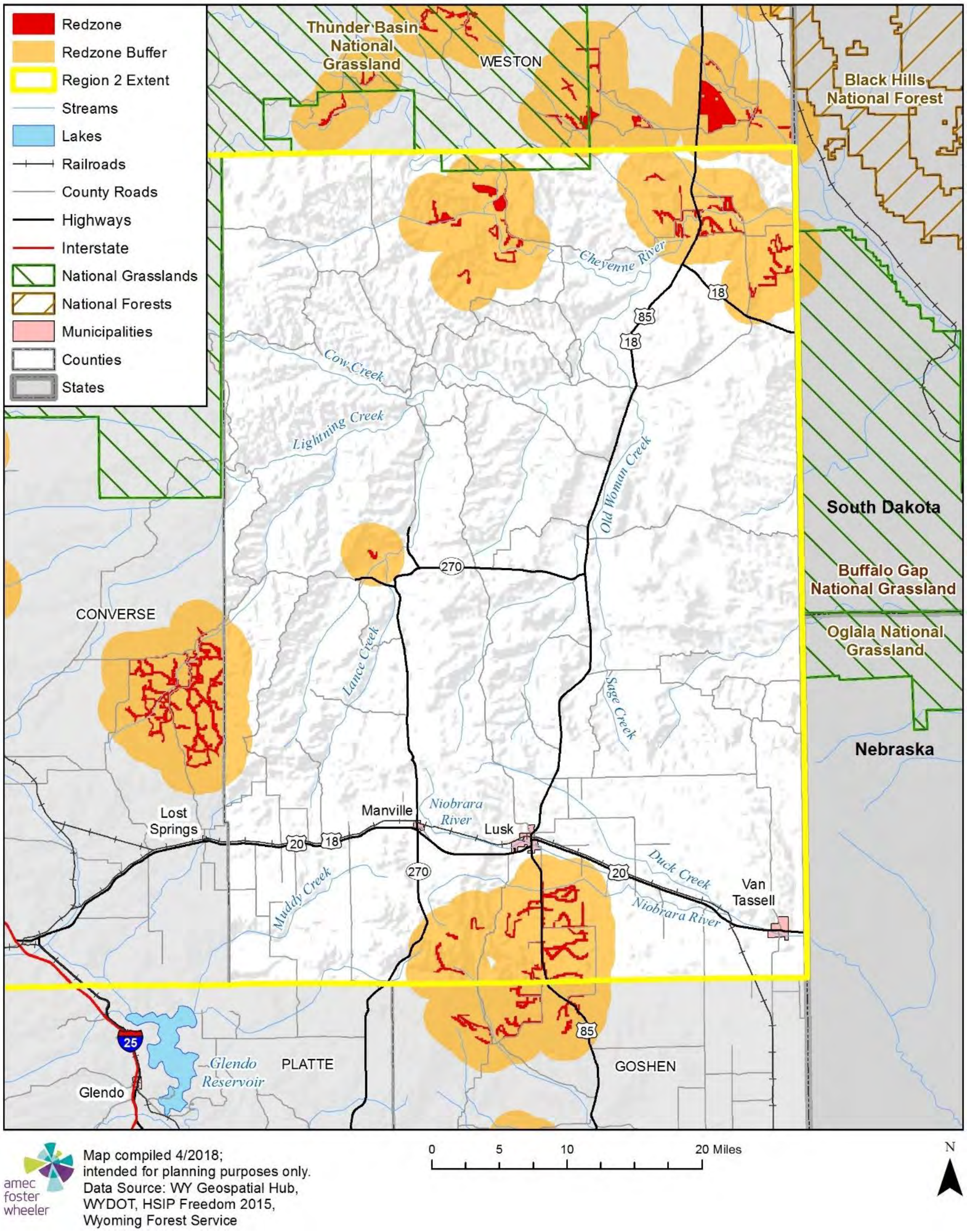


Figure 6-12 Lusk Redzone Areas

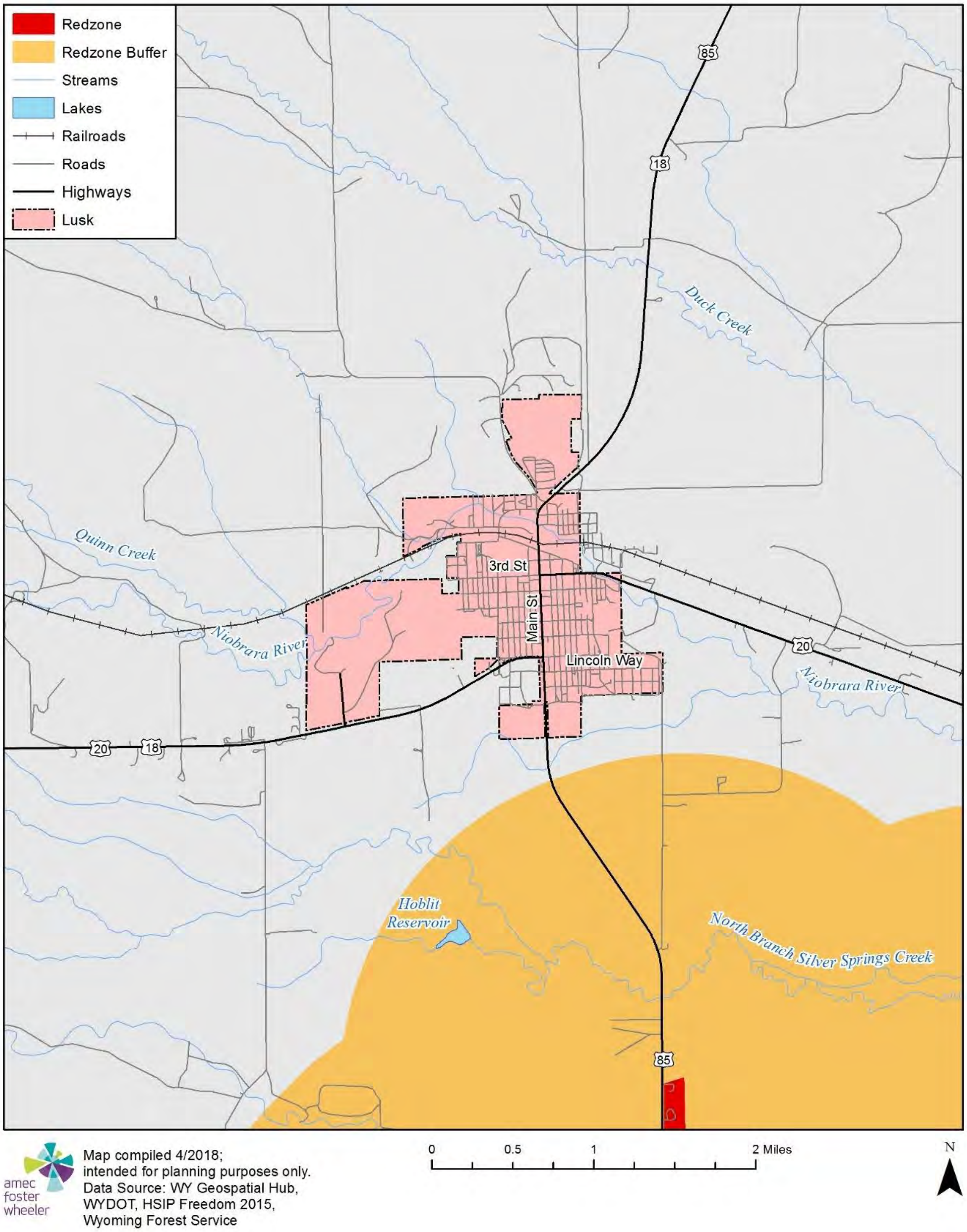
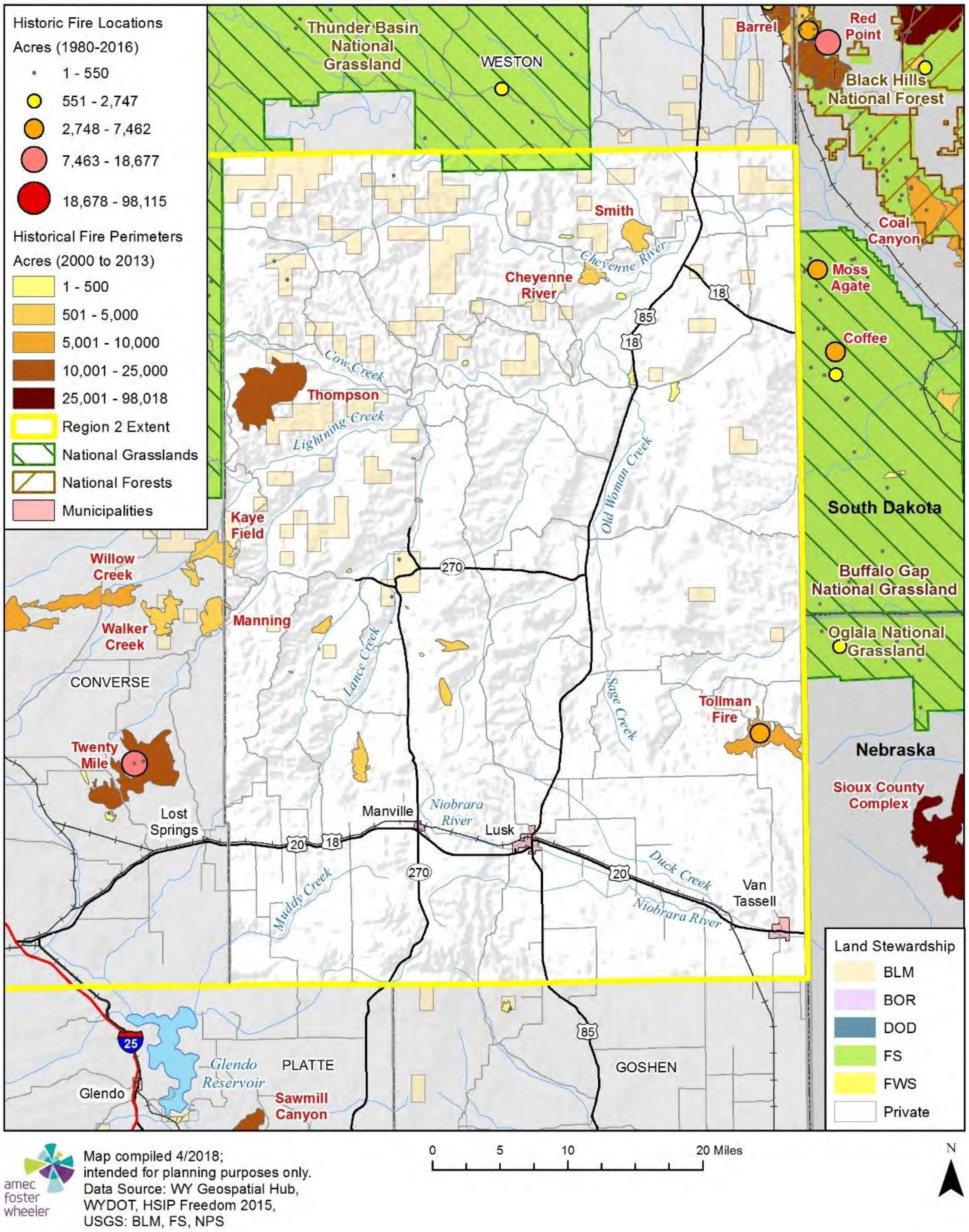


Figure 6-13 Wildfire Occurrences in Niobrara County from 1980-2016



7 Mitigation Capabilities Assessment

As part of the regional plan development, Region 2 and participating jurisdictions developed a mitigation capability assessment. Capabilities are those plans, policies and procedures that are currently in place and contribute to reducing hazard losses. Capabilities also include staffing and financial considerations, including the ability to leverage funding for mitigation projects. Combining the risk assessment with the mitigation capability assessment results in "net vulnerability" to disasters and more accurately focuses the goals, objectives, and proposed actions of this plan. The purpose of this effort was to identify policies and programs that were either in place or could be undertaken, if appropriate. Second, the HMPC conducted an inventory and review of existing policies, regulations, plans, projects, and programs to determine if they contribute to reducing hazard related losses.

7.1 Capability Summary

The 2016 Wyoming State Multi-Hazard Mitigation Plan summarizes existing mitigation capabilities of each county and some of their incorporated cities. The information was derived from county websites and through completed worksheets from the County Coordinators. Table 7-1 presents an overview of Niobrara County's mitigation capabilities as captured in the 2016 Wyoming State Mitigation Plan.

Table 7-1 Niobrara County Mitigation Capabilities Overview

Building Codes	Comprehensive Planning	Floodplain Management	GIS & Planning	Land Use Regulations	Mitigation Plan	Additional Capabilities
Town of Lusk administers bldg. permits	The County has a very general land use plan that is no longer current.	Town of Lusk FIRM: 03/18/86 All Zone A, C and X	No planning staff in the county or on retainer to the county or its communities	Not Applicable	Yes – 07/31/2015	2015-2020 Niobrara County Conservation District Land and Resource Plan speaks to the conservation of floodplains, wetlands, environmental quality, etc.

Source: Wyoming Multi-Hazard Mitigation Plan 2016

Table 7-2 provides an assessment of Niobrara County's mitigation capabilities, based on input collected from the HMPC via data collection guides during the 2018 planning process.

Table 7-2 Niobrara County Capability Assessment

Element	Niobrara County	Town of Lusk	Town of Manville	Town of Van Tassell
Planning Capabilities				
Comprehensive Plan	No, but one is being developed			Town is trying to develop ordinances
Capital Improvement Plan				
Emergency Operations Plan	In review process	In review process	In review process	In review process
Recovery Plan	No	No	No	No
Mitigation Plan	Yes – 07/31/15			
Debris Management Plan	No	No	No	No
Economic Development Plan	County working on it	Covered under county plan	Covered under county plan	Covered under county plan
Transportation Plan				
Land-use Plan	2015-2020 Niobrara Conservation District Land and Resource Use Plan and Policy	Falls under county plan	Falls under county plan	Falls under county plan
Flood Mitigation Assistance (FMA) Plan		Lusk has an FMA grant that will run through 2019 for buyouts from Flood Mitigation Assistance grant		
Watershed Plan	No	No	No	No
Community Wildfire Protection Plan or other fire mitigation plan	Wildland Fire Management Operating Plan - 2015	Covered under county plan	Covered under county plan	Covered under county plan
Critical Facilities Plan (Mitigation/ Response/ Recovery)	Overall county emergency management program	Covered under county	Covered under county	Covered under county
Policies/Ordinance				
Zoning Ordinance	No	Yes	No	In progress – to be adopted October 2018
Building Code		Yes		
Floodplain Ordinance	No	Yes	No	No
Subdivision Ordinance				
Tree Trimming Ordinance	No	No	No	No
Nuisance Ordinance	No	Yes	No	No
Storm Water Ordinance				
Drainage Ordinance				
Site Plan Review Requirements				
Historic Preservation Ordinance	Yes	Covered by county	Covered by county	Covered by county

Element	Niobrara County	Town of Lusk	Town of Manville	Town of Van Tassell
Landscape Ordinance				
Program				
Zoning/Land-use Restrictions	Planning and Zoning Regulations			
Codes Building Site/Design		Lusk Municipal Code – 2004	Manville Municipal Code	
Hazard Awareness Program	County emergency management	County emergency management	County emergency management	County emergency management
National Flood Insurance Program	No	Yes	No	No
Community Rating System (CRS)	No	No	No	No
National Weather Service (NWS) Storm Ready Certification		In progress		
Firewise Community Certification	No	No	No	No
Building Code Effectiveness Grading (BCEGs)				
ISO Fire Rating	No	Yes	No	No
Economic Development Program				
Land-use Program				
Public Education/Awareness	Yes – under county EMA	Yes	Yes	Yes
Property Acquisition		Yes		
Planning/Zoning Boards		Yes		
Stream Maintenance Program		Yes		
Tree Trimming Program	No	No	No	No
Engineering Studies for Streams (Local)				
Mutual Aid Agreements	Yes	Yes	Yes	Yes
Studies/Reports/Maps				
Flood Insurance Rate Maps (FIRM)	Not mapped	Yes	Not mapped	Not mapped
Hazard Analysis/Risk Assessment	Yes	Yes	Yes	Yes
Evacuation Route Map	No	No	No	No
Critical Facilities Inventory	Yes – as part of mitigation plan	Yes – as part of mitigation plan	Yes – as part of mitigation plan	Yes – as part of mitigation plan
Vulnerable Population Inventory	Public health working on this	No	No	No
Land-use Map				
Staff/Department				
Building Code Official		Yes		
Building Inspector				
Mapping Specialist (GIS)	Yes			
Engineer				
Development Planner				

Element	Niobrara County	Town of Lusk	Town of Manville	Town of Van Tassell
Public Works Official	Yes	Yes	Yes	No
Emergency Management Coordinator	Yes	Yes	Yes	Yes
NFIP Floodplain Administrator	N/A	Yes	N/A	N/A
Bomb and/or Arson Squad	Yes – regional team	Yes – regional team	Yes – regional team	Yes – regional team
Emergency Response Team	Yes – regional team	Yes – regional team	Yes – regional team	Yes – regional team
Hazardous Materials Expert	Yes – regional team	Yes – regional team	Yes – regional team	Yes – regional team
Local Emergency Planning Committee	Yes	Yes	Yes	Yes
Emergency Management Commission	Yes	Yes	Yes	Yes
Sanitation Department		Yes		
Transportation Department	Yes	Yes	Yes	
Economic Development Department				
Housing Department				
Historic Preservation		Yes		
Non-Governmental Organizations (NGOs)				
American Red Cross	Yes	Yes	Yes	Yes
Salvation Army	Yes	Yes	Yes	Yes
Veterans Groups				
Local Environmental Organization				
Homeowner Associations				
Neighborhood Associations				
Chamber of Commerce	Yes	Yes	Yes	Yes
Community Organizations (Lions, Kiwanis, etc.)	No	Yes	No	No
Financial Resources				
Apply for Community Development Block Grants	No	No	No	No
Fund projects through Capital Improvements funding	No	No	No	No
Authority to levy taxes for specific purposes	Yes	Yes		
Fees for water, sewer, gas, or electric services	Yes	Yes	Yes	Yes
Impact fees for new development				
Incur debt through general obligation bonds				
Incur debt through special tax bonds				

Element	Niobrara County	Town of Lusk	Town of Manville	Town of Van Tassell
Incur debt through private activities				
Withhold spending in hazard prone areas				
Additional Information				
Public education/information programs	Yes	Yes	Yes	Yes
Past or ongoing programs to reduce disaster losses	Yes – emergency management	Yes	Yes	Yes
Projects or issues related to people with Access and Functional Needs	Covered under emergency management program	Covered under emergency management program	Covered under emergency management program	Covered under emergency management progream
Outdoor warning sirens	Yes	Yes	Yes	No
Other public warning systems	Yes – CodeRed/IPAWS	Yes – CodeRed/IPAWS	Yes – CodeRed/IPAWS	Yes – CodeRed/IPAWS
Designated public tornado shelters/saferooms	In process	In process	In process	In process

Source: Data provided by jurisdictions

7.1.1 NFIP Participation and Continued Compliance

The National Flood Insurance Program (NFIP) Community Status Book outlines participation and flood map status for counties and jurisdictions across the country. Only the Town of Lusk has flood hazards mapping and participates in the NFIP currently. The County and other jurisdictions have not been mapped by the NFIP and thus participation is optional, however individuals in these areas that desire having flood insurance may not be able to obtain it.

Table 7-3 NFIP Status in Niobrara County

Jurisdiction	Effective Map Status	Date Joined	Comments
Niobrara County	Not mapped	Not mapped	Not participating, not required
Town of Lusk	03/18/86	03/18/86	Participating
Town of Manville	Not mapped	Not mapped	Not participating, not required
Town of Van Tassell	Not mapped	Not mapped	Not participating, not required

Source: NFIP Community Status Book

As a participant since 1986, the Town of Lusk will continue to comply with the NFIP to reduce flood losses and increase flood resiliency. Continued compliance with the NFIP includes continuing to adopt floodplain maps when updated as well as implementing, maintaining and updating floodplain ordinances. Actions related to continued compliance are summarized below:

- Continued designation of a local floodplain manager whose responsibilities include reviewing floodplain development permits to ensure compliance with the local floodplain management ordinances and rules;
- Suggest changes to improve enforcement of and compliance with regulations and programs;
- Participate in Flood Insurance Rate Map updates by adopting new maps or amendments to maps;
- Utilize Digital Flood Insurance Rate maps in conjunction with GIS to improve floodplain management, such as improved risk assessment and tracking of floodplain permits;
- Promote and disperse information on the benefits of flood insurance.

Also to be considered are the flood mitigation actions contained in the base Regional Plan and this annex, to support the ongoing efforts by participating counties to minimize the risk and vulnerability of communities to flood hazards, and to enhance their overall floodplain management program/s.

8 Mitigation Strategy

This section describes the mitigation strategy and mitigation action plan for Niobrara County. See Chapter 5 of the Base Plan for more details on the process used to develop and update the mitigation strategy.

8.1 Mitigation Goals

As part of the 2018 planning process, Niobrara County identified reviewed their previously identified goals to guide the development of the Hazard Mitigation Strategy. The potential hazards, risks and vulnerabilities were also considered in the development and review of the goals. In 2018 the general goals remained the same as those identified in 2015.

Goal 1: Mitigate natural hazards to reduce potential injury and loss of life, and property damage in the Town of Lusk.

Goal 2: Mitigate natural hazards to reduce potential injury and loss of life, and property damage in the Town of Manville.

Goal 3: Mitigate natural hazards to reduce potential injury and loss of life, and property damage in the Town of Van Tassell.

Goal 4: Mitigate natural hazards to reduce potential injury and loss of life, and property damage in Niobrara County.

8.2 Mitigation Actions

This section provides updates on the actions identified in the 2015 Niobrara County County Multi-Hazard Mitigation Plan and new actions identified during the 2018 Regional Plan development.

8.2.1 Identification and Implementation of Mitigation Measures

Niobrara County has identified several potential hazard mitigation projects that would benefit the County and reduce potential risks and vulnerabilities. These projects were originally developed with input from the HMPC, LEPC, and from the past public meetings and a public survey. Chapter 5 in the Base Plan includes additional information on the development and update of the mitigation strategy. The action plans were shared amongst the regional plan participants to stimulate ideas amongst the respective planning committees in each county. Table 8-1 provides a progress update on projects identified in the County's 2015 planning process. Table 8-4 lists 2015 projects that have since been completed; Table 8-2 lists 2015 projects that were deleted. Table 8-3 contains the Niobrara County's updated 2018 hazard mitigation strategy, encompassing all continuing actions from the 2015 plan, as well as new actions identified under the 2018 planning process.

Table 8-1 2015 Mitigation Action Progress

Goal	Hazards	Mitigation Project	Jurisdiction	2018 Status	2018 Comments
1	All	Test warning siren. Post information on what the tones mean.	Lusk	Continue in progress	
1	All	Review and update basic plan for continuity of town government.	Lusk	Continue in progress	
1	Flood	Investigate engineering solutions to flooding of Niobrara Creek in Lusk.	Lusk	Continue in progress	Lusk has overhauled part of creek; project in progress; Town has also been buying out flood-prone properties
1	Flood	Encourage property owners along creek to purchase flood insurance. Link to WYDOT site.	Lusk	Continue in progress	Citizens have been encouraged to purchase insurance and this process will continue
1	Flood	Monitor water levels in creek. Notify low-lying land owners of flood potential.	Lusk	Continue in progress	Creek levels are monitored
1	Hazmat	Develop an evacuation plan for Lusk.	Lusk	Continue in progress	Evacuation plan development in progress
2	All	Test warning siren. Post information on what the tones mean.	Manville	Continue in progress	
2	All	Use a basic template to plan for continuity of government.	Manville	Continue in progress	
2	Flood	Replace remaining culverts to reduce flooding.	Manville	Continue in progress	Re-engineering of Creek removed some culverts ; county-level culverts have been replaced; some remediation cleanup from 2015 floods have replaced culverts
2	Wildland Fire	Print message on July water bill about taking responsibility for reducing fire danger on private property. (Annually)	Manville	Continue in progress	
3	All	Maintain small cache of sheltering materials, supplies.	Van Tassell	Continue in progress	
3	Hazmat	Educate residents on how to respond to hazmat incident with annual mailing	Van Tassell	Continue in progress	
4	All	Educate residents about need to sign up for Code Red notification system.	Unincorporated County	Continue in progress	Information shared at health fair, through local paper, public meetings; may begin sharing information through water bills
4	All	Integrate emergency comm systems. Boost WYOLink.	Unincorporated County	Continue in progress	

Goal	Hazards	Mitigation Project	Jurisdiction	2018 Status	2018 Comments
4	All	Encourage Niobrara Electric to continue to harden power lines and create redundancy.	Unincorporated County	Continue in progress	
4	All	Update 2003 EOP	Unincorporated County	Continue in progress	
4	All	Maintain capacity to shelter small numbers for short time.	Unincorporated County	Continue in progress	
4	All	First responders and elected officials develop personal disaster plans.	Unincorporated County	Continue in progress	
4	All	Coordinate evacuation, transportation, and sheltering with Women's Prison.	Unincorporated County	Continue in progress	
4	All	Use a basic template to plan for continuity of county government.	Unincorporated County	Continue in progress	
4	Hazmat	Continue education on response to pipeline incidents (host pipeline company provided training)	Unincorporated County	Continue in progress	This task is ongoing on annual basis
4	Winter Storms	Encourage continued construction of wooden and living snow fences along roadways	Unincorporated County	Continue in progress	In progress at County level; will install fences for free if an easement is in place
4	Flood	Install erosion control on county road at Twenty-mile Creek	Unincorporated County	Continue not started	No progress as of yet but project in pipeline
4	Flood	Install erosion control to protect against loss of Cow Creek Road	Unincorporated County	Continue not started	No progress as of yet but project in pipeline
4	Hazmat	Work with Union Pacific Railroad to sponsor oil rail transport training	Unincorporated County	Continue not started	

Table 8-2 Completed 2015 Mitigation Actions

Goal	Hazards	Mitigation Project	Jurisdiction	Project Rank	Responsible Agency	Benefit/Comments	2018 Comments
2	All	Establish small cache of sheltering materials, supplies.	Manville	L	Town, County EM, Red Cross	Be prepared to shelter small number of people for short-term.	Completed
4	All	Participate in Converse-Niobrara broadband feasibility study	Unincorporated County	H	County	Determine needs to increase capacity/redundancy of broadband service	Completed 2016
4	All	Obtain a command vehicle for emergency management.	Unincorporated County	M	County	Improve ability to respond to disasters of all types.	Completed
4	All	Design and conduct an exercise using ICS (power and communications outage)	Unincorporated County	M	County EM, LEPC	Increase familiarity with ICS. Better preparation for real incident.	Completed 2018
4	Flood	Construct permanent bridge at Lance Creek to replace temporary seasonal bridge	Unincorporated County	M	County	Address temporary solution. Provide needed access for residential, oil field traffic.	A permanent bridge has been constructed
4	Flood	Drain and fill road section at Big Muddy Creek Crossing	Unincorporated County	L	County	Save critical infrastructure (road) from washout. Prevent costlier rebuild in future.	Project completed in 2015 during clean-up from flooding, including installation of larger culverts

Table 8-3 Deleted 2015 Mitigation Actions

Goal	Hazards	Mitigation Project	Jurisdiction	Project Rank	Responsible Agency	2018 Comments
4	All	Have all first responders complete ICS 100 and 200.	Unincorporated County	M	County EM	Ongoing process - response action
4	All	Host ICS 300 and 400 class in the county.	Unincorporated County	M	County EM	Ongoing process - response action
4	Drought	Aggressively control grasshoppers during drought.	Unincorporated County	M	County Weed and Pest	
4	Hazmat	Host annual awareness level hazmat course for fire, medical and law personnel.	Unincorporated County	M	County EM	Classes held annually - response action
4	Hazmat	Provide ongoing training in use of PPE. Include medical personnel as appropriate.	Unincorporated County	H	County	This task is ongoing - response action
4	Wildland Fire	Document and provide ongoing fire training (hazmat and other.)	Unincorporated County	H	County	This task in ongoing - response action
4	Other	Participate and assist public health in preparation of Isolation and Quarantine plan	Unincorporated County	H	County	Response Action

Table 8-4 Niobrara County 2018 Hazard Mitigation Strategy

Action ID	Hazards	Mitigation Project	Jurisdiction	Project Rank	Responsible Agency	Estimated Project Cost	Sources of Funding	Project Benefits
1.1	All	Test warning siren. Post information on what the tones mean.	Lusk	M	County EM	L	County	Reduce confusion. Provide advance warning. Help residents respond appropriately.
1.2	All	Review and update basic plan for continuity of town government.	Lusk	L	Town, County EM	L	Town	Allow town government to continue to function in event of disaster.
1.3	Flood	Investigate engineering solutions to flooding of Niobrara Creek in Lusk.	Lusk	H	Tow, County EM	M	Town, County EM, WOHS, FEMA	Reduce property loss and interruption of commerce and transportation from flooding. Protect lives.
1.4	Flood	Encourage property owners along creek to purchase flood insurance. Link to WYDOT site.	Lusk	M	Town	L	Town	Recoup damages after flooding.
1.5	Flood	Monitor water levels in creek. Notify low-lying land owners of flood potential.	Lusk	M	County EM	L	Town	Provide for preparation from low land flooding.
1.6	Hazmat	Develop an evacuation plan for Lusk.	Lusk	L	Town, County EM	M	Town	Be prepared for hazmat spill or release from mobile source. Reduce potential loss of life.
1.7	All	Develop a public information campaign to increase awareness of the different hazards that can impact the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce vulnerability	Lusk	H	County EM	L	Town	Better prepared residents, with emphasis on personal preparedness
2.1	All	Test warning siren. Post information on what the tones mean.	Manville	M	County EM	L	County	Reduce confusion. Provide advance warning. Help residents respond appropriately.

Action ID	Hazards	Mitigation Project	Jurisdiction	Project Rank	Responsible Agency	Estimated Project Cost	Sources of Funding	Project Benefits
2.2	All	Use a basic template to plan for continuity of government.	Manville	L	Town, County EM	L	Town	Allow town government to continue to function in event of disaster.
2.3	Flood	Replace remaining culverts to reduce flooding.	Manville	H	Town	M	Town	Complete ongoing project to replace culverts. Reduce future flood damage to property.
2.4	Wildland Fire	Print message on July water bill about taking responsibility for reducing fire danger on private property. (Annually)	Manville	H	Town	L	Town	Increase awareness of risk and reduce risk to property and lives from wildland fire.
2.5	All	Develop a public information campaign to increase awareness of the different hazards that can impact the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce vulnerability	Manville	H	County EM	L	Town	Better prepared residents, with emphasis on personal preparedness
3.1	All	Maintain small cache of sheltering materials, supplies.	Van Tassell	M	Town, County EM, Red Cross	L	Town, County EM, Red Cross	Be prepared to shelter small number of people for short-term.
3.2	Hazmat	Educate residents on how to respond to hazmat incident with annual mailing	Van Tassell	H	Town, County EM	L	Town	Residents know what to do, not do in event of spill. Protect lives.
3.3	All	Develop a public information campaign to increase awareness of the different hazards that can impact the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce vulnerability	Van Tassell	H	County EM	L	Town	Better prepared residents, with emphasis on personal preparedness

Action ID	Hazards	Mitigation Project	Jurisdiction	Project Rank	Responsible Agency	Estimated Project Cost	Sources of Funding	Project Benefits
4.1	All	Educate residents about need to sign up for Code Red notification system.	Unincorporated County	H	County EM, LEPC	L	County	Provide warning before impact to allow preparation. Reduce loss of life and property damage.
4.2	All	Integrate emergency comm systems. Boost WYOLink.	Unincorporated County	H	County EM	M	County, State	Ensure reliable communications during incidents.
4.3	All	Encourage Niobrara Electric to continue to harden power lines and create redundancy.	Unincorporated County	H	County	High	Niobrara Electric	Reduced risk of power loss and related situations during all types of incidents. Quicker recovery.
4.4	All	Update 2003 EOP	Unincorporated County	M	County EM	L	County	More effective response.
4.5	All	Maintain capacity to shelter small numbers for short time.	Unincorporated County	M	County EM	M	County EM, Red Cross	Be prepared to assist in all types of emergencies and disasters.
4.6	All	First responders and elected officials develop personal disaster plans.	Unincorporated County	L	County	L	N/A	Key individuals have plans in place. Elected officials and responders serve as example.
4.7	All	Coordinate evacuation, transportation, and sheltering with Women's Prison.	Unincorporated County	L	County EM, Sheriff	L	County, State, Corrections	Be prepared to safely evacuate prison and provide shelter to inmates if necessary.
4.8	All	Use a basic template to plan for continuity of county government.	Unincorporated County	M	County EM, County Elected Officials	L	County	Allow county government to continue to function in event of disaster.
4.9	Hazmat	Continue education on response to pipeline incidents (host pipeline company provided training)	Unincorporated County	M	County EM, LEPC	L	Participating entities	Increase effectiveness of response. Improve safety of responders. Protect people and natural resources.
4.1	Winter Storms	Encourage continued construction of wooden and living snow fences along roadways	Unincorporated County	M	County	M	UP Railroad, WYDOT, Conservation District	Prevent winter vehicle accidents from blowing and drifting snow. Save lives. Reduce property damage.

Action ID	Hazards	Mitigation Project	Jurisdiction	Project Rank	Responsible Agency	Estimated Project Cost	Sources of Funding	Project Benefits
4.11	Flood	Install erosion control on county road at Twenty-mile Creek	Unincorporated County	M	County	H	County, State, FEMA	Save critical infrastructure (road) from washout. Prevent costlier rebuild in future.
4.12	Flood	Install erosion control to protect against loss of Cow Creek Road	Unincorporated County	M	County	H	County, State, FEMA	Save critical infrastructure (road) from washout. Prevent costlier rebuild in future.
4.13	Hazmat	Work with Union Pacific Railroad to sponsor oil rail transport training	Unincorporated County	H	County, EM	L	County	Increase skill for response to oil tanker rail incident.
4.14	All	Develop a public information campaign to increase awareness of the different hazards that can impact the County, focused on identified risks, county and community mitigation actions and actions citizens can take to understand and reduce vulnerability	Unincorporated County	H	County EM	L	County	Better prepared residents, with emphasis on personal preparedness
4.15	Drought	Establish standards for sending public notices on water restrictions	Unincorporated County	H	County	L	County	Standardized system for implementation
4.16	All	Finalize voluntary database of access and functional needs populations for first responders	Unincorporated County	H	County	L	County	Better knowledge of community needs during a response
4.17	Lightning	Back up government records in case of lightning strikes	Unincorporated County	H	County	L	County; FEMA	Continuity of records; continuity of government
4.18	Tornado	Identify possible location for tornado/all weather shelters	Unincorporated County	H	County EM	L	County; FEMA	
4.19	HazMat	Ensure Local Emergency Planning Committee remains active in the County	Unincorporated County	H	County EM	L	County	Ongoing committee to review and plan around hazard issues

9 Implementation

Moving forward, the Niobrara County HMPC and LEPC will use the mitigation action tables in the previous section to track progress on implementation of each project. Implementation of the plan overall is discussed in more detail under Chapter 6 of the Regional (Base) Plan.

9.1 Incorporation into Existing Planning Mechanisms

To determine if this plan is consistent with goals identified in other community plans, the members of the Niobrara County Emergency Management department, along with the Hazard Mitigation Planning Team and LEPC, will meet with other agencies who have plans that address such issues as economic development, subdivision resolutions/ordinances, capital improvement, building permits, growth management, sustainability, environmental preservation, historic preservation, redevelopment, health and/or safety, recreation, or transportation. The process will provide an opportunity to integrate and/or correlate plans for the purpose of:

- Determining if the mitigation plan is compatible with goals stated in other plans.
- Identifying mitigation initiatives or proposed projects which serve multiple objectives for the communities and could be included in multiple plans.
- Identifying needs for revision or updating to the mitigation plan, or other plans, to provide a more comprehensive approach to hazard mitigation (including addition of new mitigation measures).

During the 2018 planning process, the HMPC discussed the importance of coordinating the mitigation plan with other planning processes, and vice versa. The group discussed opportunities to cross reference the hazard mitigation plan in other upcoming planning efforts. As described in the capability assessment, the County and municipalities already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. Where applicable, these existing mechanisms could include:

- County or community comprehensive or land use plans
- County or community development codes
- County or community Emergency Operations Plans
- Threat and Hazard Identification and Risk Assessments (THIRA)
- Community Wildfire Protection Plan (CWPP)
- Transportation plan
- Capital improvement plans and budgets including County Road/Bridge projects
- Recovery planning efforts
- Watershed planning efforts
- Wildfire planning efforts on adjacent public lands

- Firewise planning
- Master planning efforts
- River corridor and greenway planning efforts
- WYDOT rockfall and landslide mitigation efforts
- Other plans, regulations, and practices with a mitigation aspect

9.2 Funding Sources

Funding for mitigation projects may come from a variety of sources. Below is a partial list of possible sources of funding that could help fund the actions identified in Section 8.

Local Government

- General revenues in the form of matches.
- One Percent Sales Tax
- County and Municipal Utility Authorities

State of Wyoming

- Community Development Block Grant Program
- Federal Mineral Royalty Capital Construction Account
- Wyoming Water Development Program
- State and Community Highway Safety, Department of Transportation
- State Lands and Investments Board (SLIB) Grants and Loans
- Transportation Enhancement Activities Local (TEAL)
- Wildfire Mitigation Grant (State Forestry Division)

Federal Government Programs

- Federal Emergency Management Agency Hazard Mitigation Assistance Grants including:
  - Pre-Disaster Mitigation (PDM)
  - Flood Mitigation Assistance Program (FMA)
  - Hazard Mitigation Grant Program (HMGP)
  - Notice of funding availability typically released in June with applications due in October/November of each year.
  - HMPG is dependent on federally declared disasters within the state and funding amount is based on a percentage of disaster relief costs.
  - FEMA Fire Management Assistance Grants - As of June 8, 2018 FEMA is making HMPG funds available for states, territories, and federally-recognized tribes that have a Fire Management Assistance Grant (FMAG) declaration between October 1, 2016 and September 30, 2018. The HMGP post fire amount available for eligible applicants with standard state or tribal hazard mitigation plans is $425,008 per declaration
- USDA Environmental Quality Incentive Program
- USDA Conservation Reserve and Conservation Reserve Enhancement Program

- USDA Small Watersheds (NRCS)

There are many more potential funding opportunities available to the municipalities and county. Table 96 of the 2016 Wyoming State Mitigation Plan lists several other sources of federal funding.

Funding research will be done during the scoping process for each project to determine what funding mechanisms are available and appropriate for that project. Funding cycles will be monitored to ensure there is adequate time to prepare grant applications.

9.3 Monitoring, Evaluating and Updating the Plan

Niobrara County will follow the procedures to review and update this plan in accordance with Region 2 as outlined in Chapter 6 of the Base Plan. Niobrara County realizes it is important to review and update this plan regularly.

WYOMING REGION 2

REGIONAL HAZARD MITIGATION PLAN

NATRONA COUNTY PLANNING ANNEX

Natrona County
Hazard Mitigation Plan
November 2017





NATRONA COUNTY
Wyoming

amec foster wheeler

Natrona County
Hazard Mitigation Plan
2017 Update

November 2017

Developed by Natrona County

with professional planning assistance from

Amec Foster Wheeler Environment & Infrastructure, Inc.
Hazard Mitigation and Emergency Management

TABLE OF CONTENTS

Chapters

Appendixes

1 INTRODUCTION

1.1 Purpose

Natrona County including the City of Casper and towns of Bar Nunn, Edgerton, Evansville, Midwest, and Mills prepared this regional hazard mitigation plan to guide hazard mitigation planning and to better protect the people and property of the planning area from the effects of hazard events. This plan demonstrates the region's commitment to reducing risks from hazards, and serves as a tool to help decision makers direct mitigation activities and resources. This plan also maintains the planning area's eligibility for certain federal disaster assistance under the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance (HMA) grant programs.

1.2 Background and Scope

This plan builds upon years of mitigation planning and project implementation by Natrona County and its communities. This Hazard Mitigation Plan underwent a comprehensive update in 2017 and replaces the 2010 Natrona County Hazard Mitigation Plan.

Each year in the United States, disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters, because additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally-mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of $4 in avoided future losses in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council 2005).

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are determined, prioritized, and implemented. This plan documents the planning region's hazard mitigation planning process, identifies relevant hazards and risks, and identifies the strategies that each participating County and jurisdiction will use to decrease vulnerability and increase resiliency and sustainability.

This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the *Federal Register* on February 26, 2002 (44 CFR §201.6) and finalized on October 31, 2007 (hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act (DMA). While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). Because the planning area is subject to many kinds of hazards, access to these programs is vital.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to the community and its property owners by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruption. The planning area has been affected by hazards in the past and is thus committed to reducing future disaster impacts and maintaining eligibility for federal funding.

1.3 Plan Organization

Natrona County Hazard Mitigation Plan is organized in alignment with the DMA planning requirements and the FEMA plan review crosswalk as follows:

- Chapter 1: Introduction
- Chapter 2: Community Profile
- Chapter 3: Planning Process
- Chapter 4: Risk Assessment
- Chapter 5: Mitigation Strategy
- Chapter 6: Plan Adoption, Implementation, and Maintenance
- Appendices

2 Community Profile

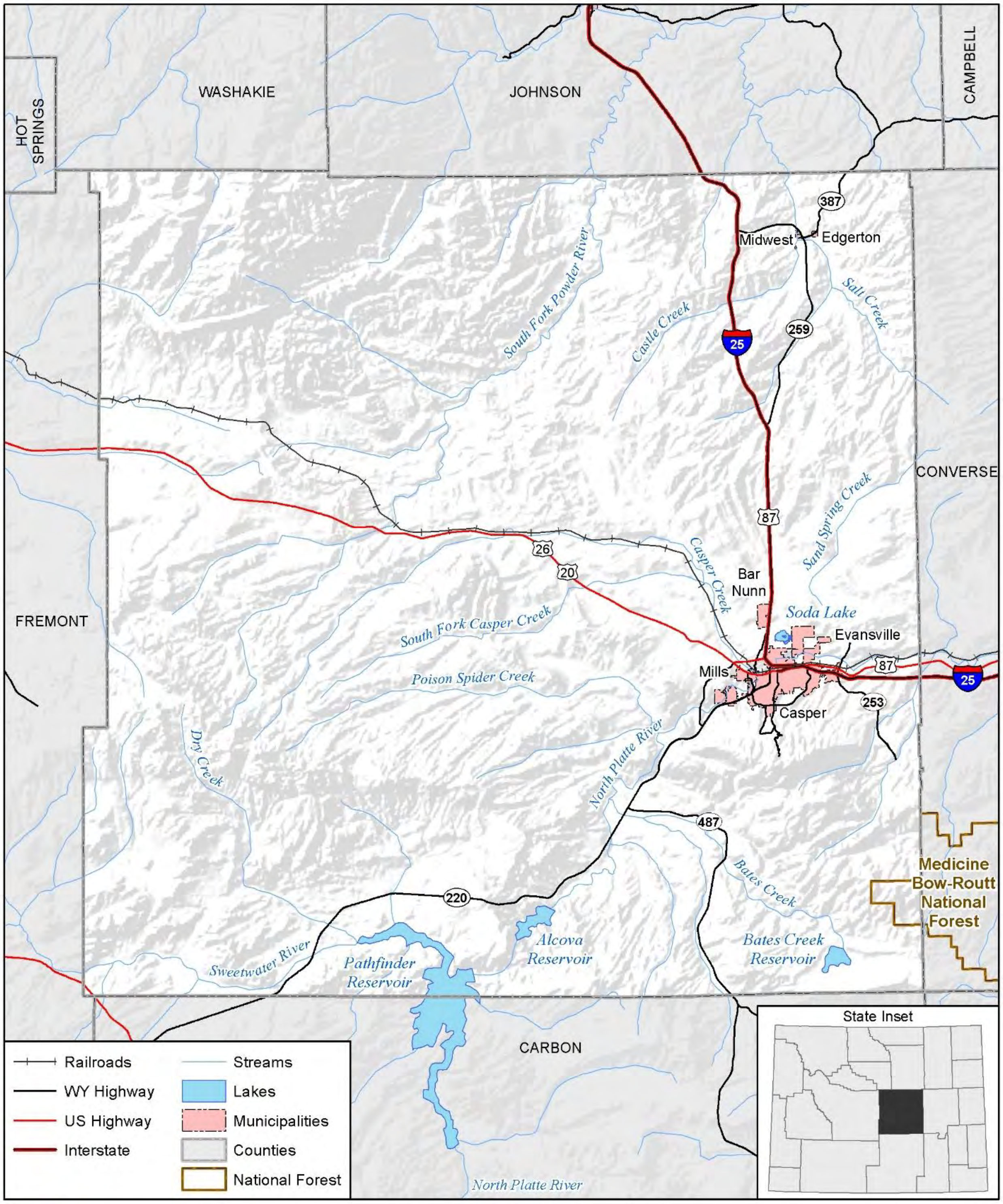
2.1 Geography and Climate

Natrona County is located in central Wyoming and has a total area of 5,376 square miles, of which 5,340 square miles is land and 35 square miles is water. Natrona County is a large area to not only respond to but also to plan for. Natrona County is bordered by Johnson County to the north, Converse County to the east, Carbon County to the south, and Fremont County to the west. Nationally protected areas in Natrona County include Medicine Bow National Forest and Pathfinder National Wildlife Refuge.

Natrona has a semi-arid climate with long, cold, but dry winters and hot but generally dry summers. Highs range from 32 degrees in January to 88 degrees in July and August. Snow can fall heavily during the winter months, being the greatest in April. Precipitation is greatest in spring and early summer.

Major roadways include Interstate 25, Highway 20, Highway 26, Highway 87 and Wyoming Highway 220. A base map of the planning region is illustrated below. Jurisdictional base maps follow the countywide base map.

Figure 2.1: Natrona County Base Map



amec foster wheeler

Map compiled 1/2017;
intended for planning purposes only.
Data Source: WY Geospatial Hub,
WYDOT, HSIP Freedom 2015

Figure 2.2: City of Casper

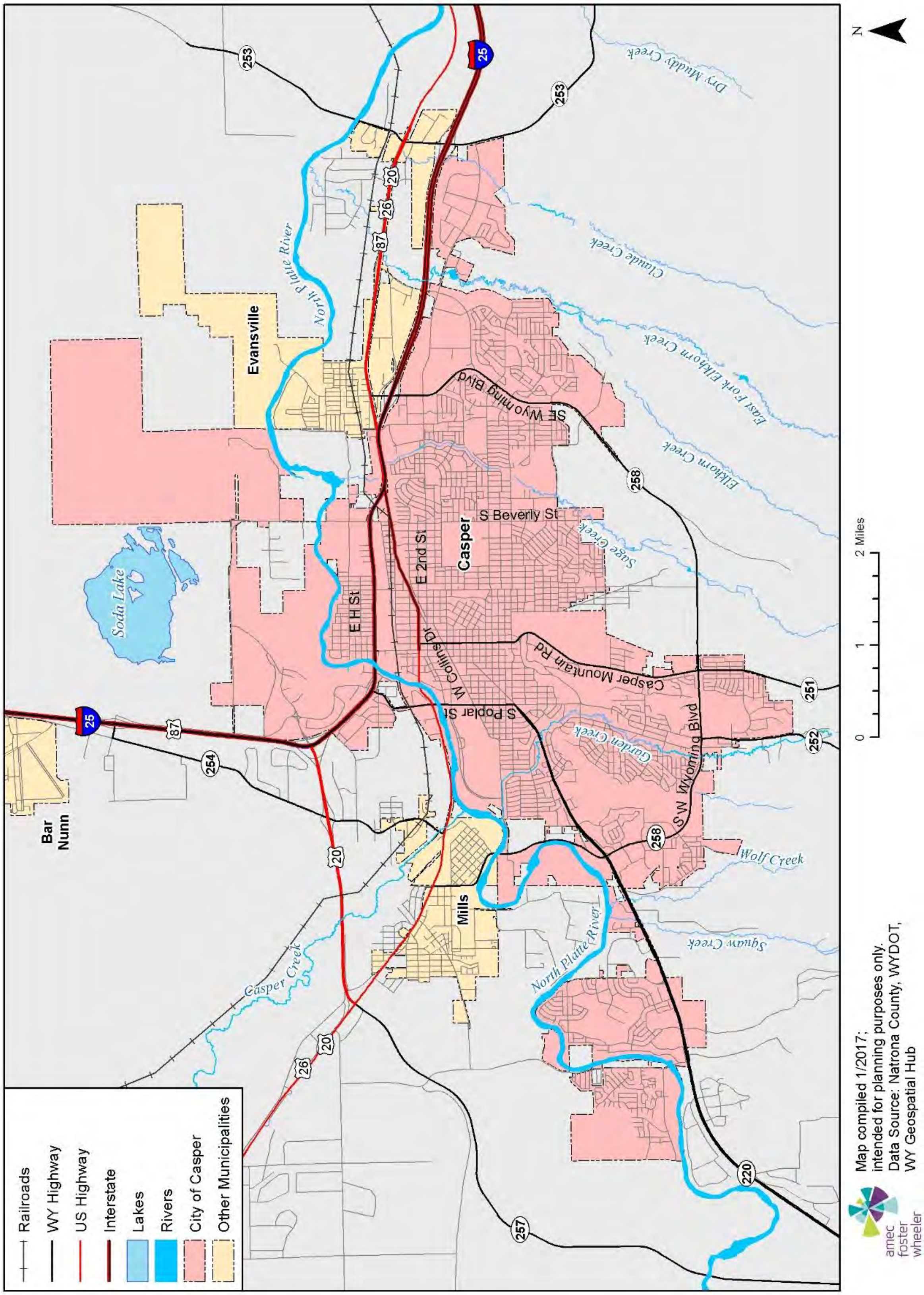


Figure 2.3: Town of Bar Nunn

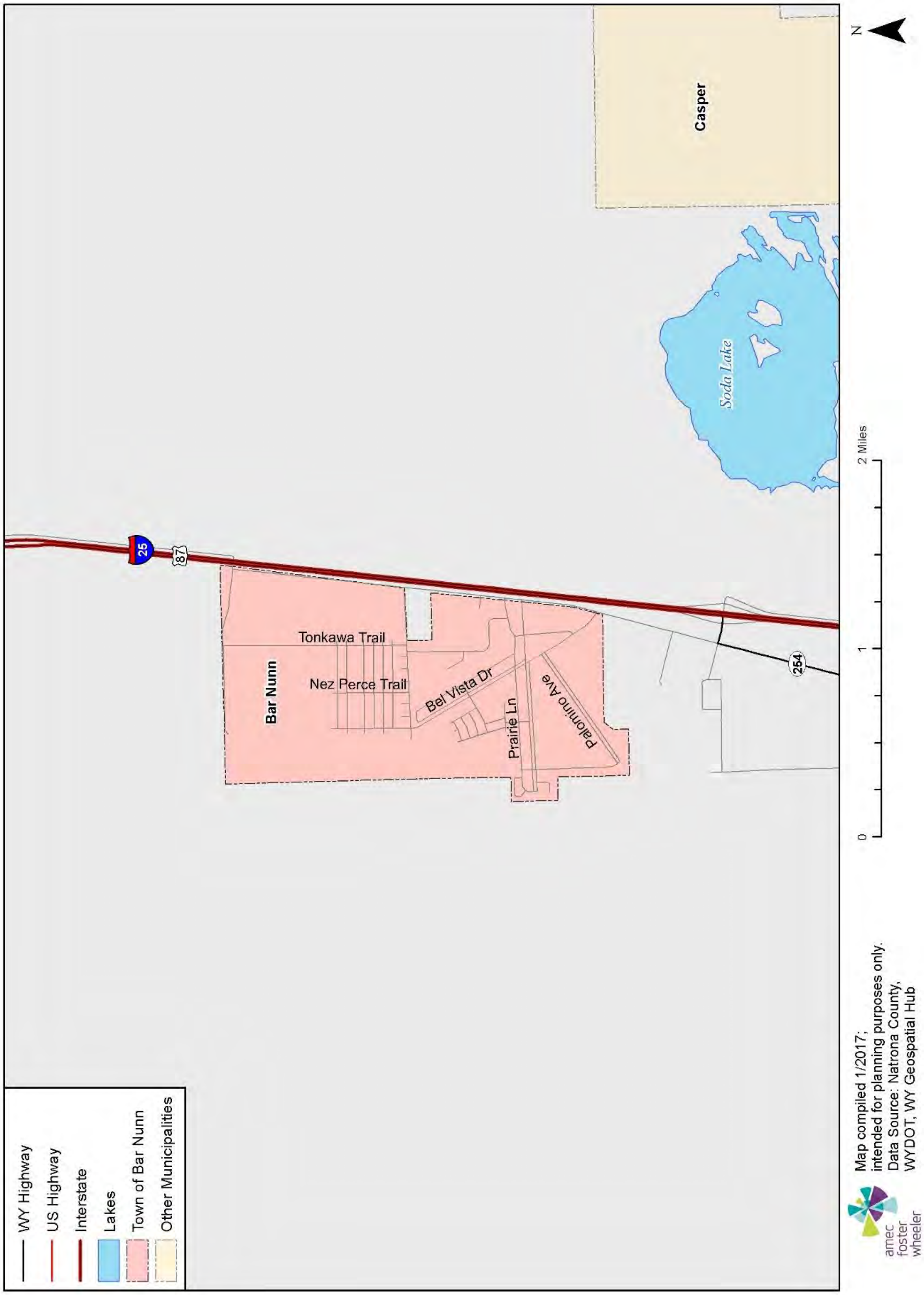


Figure 2.4: Towns of Edgerton and Midwest

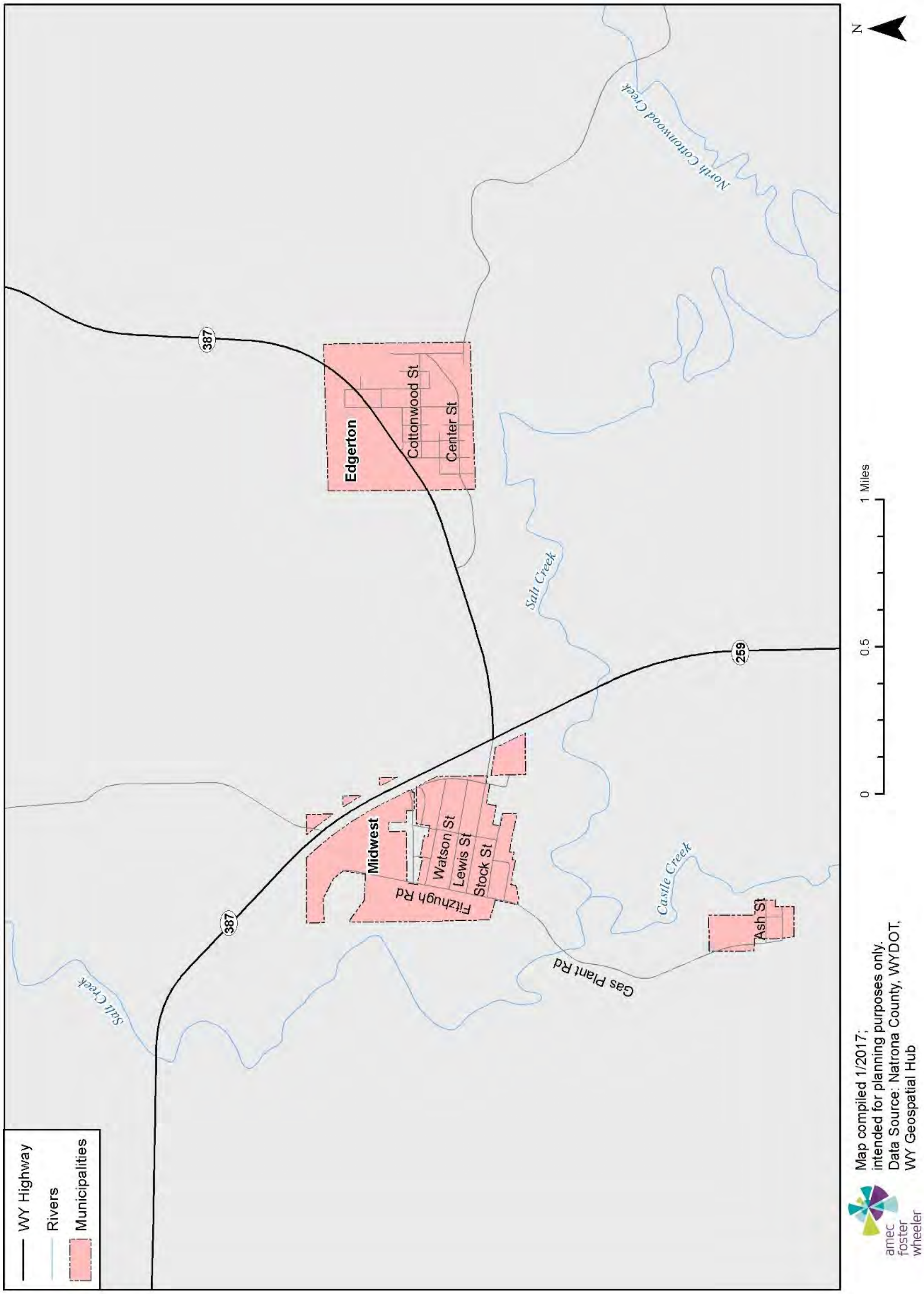


Figure 2.5: Town of Evansville

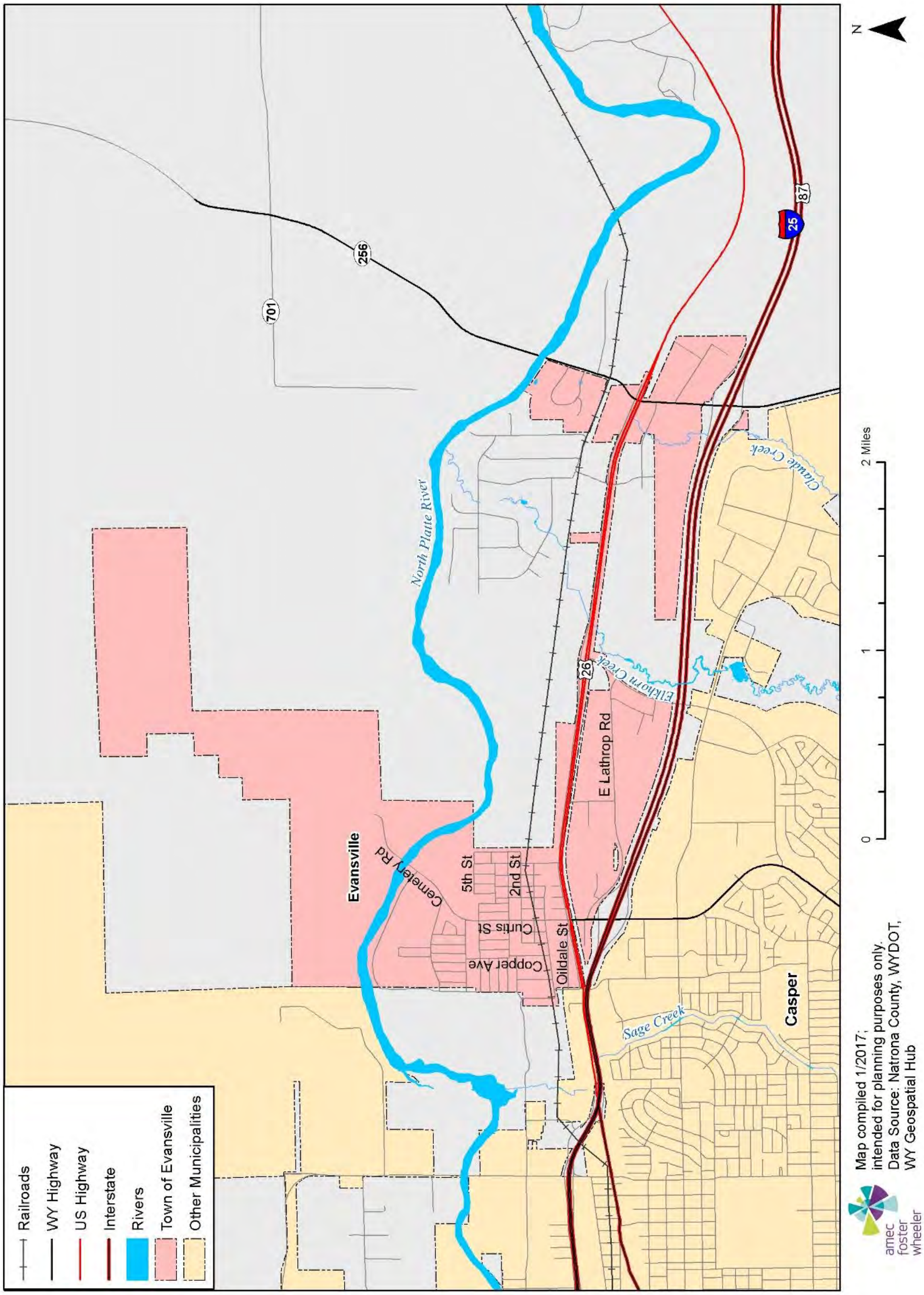
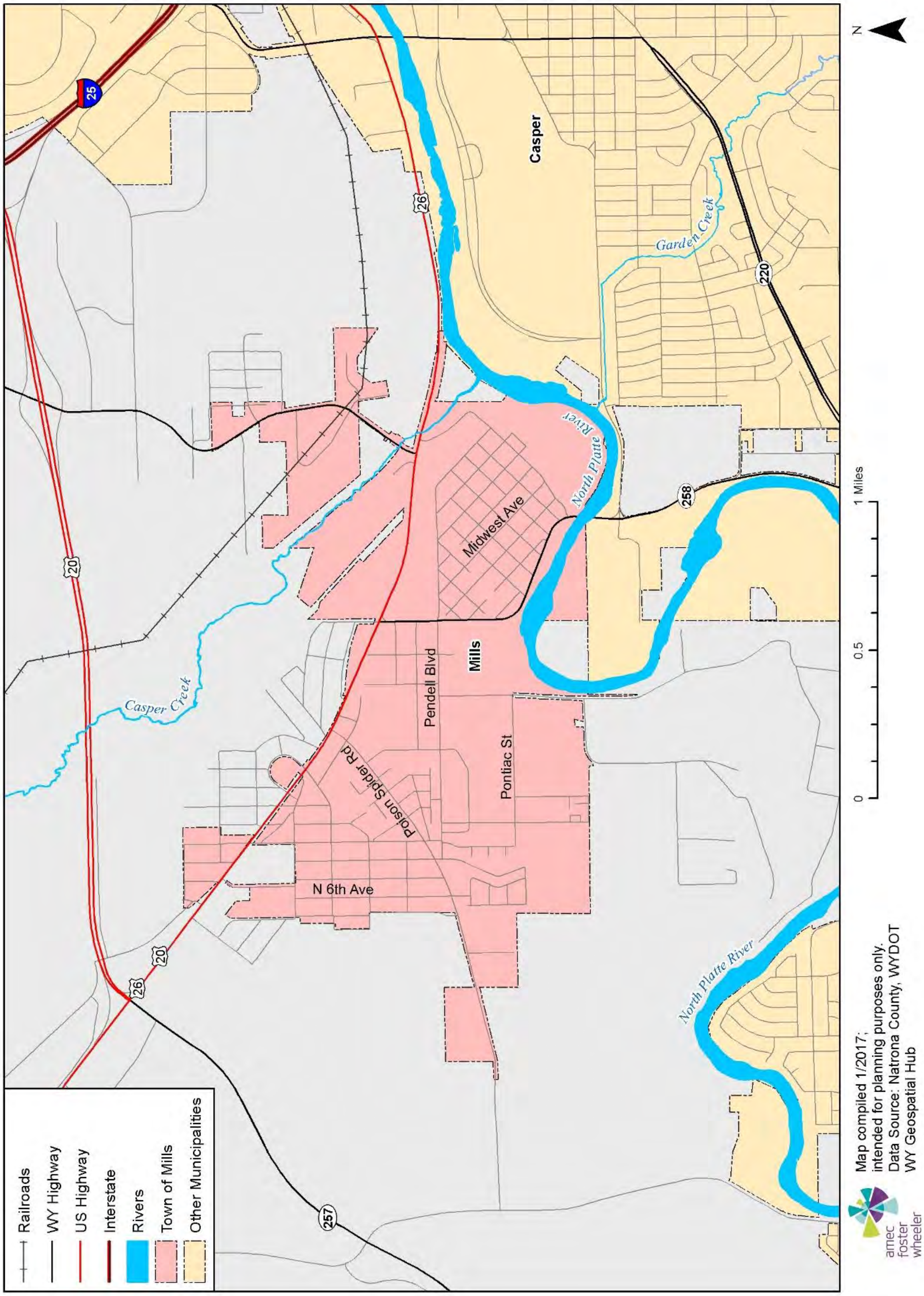


Figure 2.6: Town of Mills



2.2 Population

As of the 2010 census, the population was 75,450 and estimated to be 81,039 based on July 1, 2016 Census Bureau population estimates. Natrona County is the second-most populous county in Wyoming with its county seat in Casper. Jurisdictions in Natrona County include the City of Casper, the Town of Bar Nunn, the Town of Edgerton, the Town of Evansville, the Town of Midwest, and the Town of Mills. The population is by far the highest within the city limits of Casper. The steady population growth is an indication of the changing conditions within the County. Yet, as growth continues to occur within Natrona County, more and more people are choosing to live within the smaller communities, as well as in areas that are more highly susceptible to natural hazards such as fire, high winds, severe winter storms, and flooding. Table 2.1 describes the population and estimated population change for the planning region as a whole and each individual jurisdiction. Estimates beyond 2010 are based on the American Community Survey data from the US Census Bureau. As a whole, the Region is increasing slightly in population, but percent increase varies by jurisdiction.

Table 2.1: Planning Area Population

	2010 Census	2011 Estimate	2012 Estimate	2013 Estimate	2014 Estimate	2015 Estimate	% Change 2010 to 2015
Natrona County	75,450	76,410	78,602	81,092	81,432	82,191	8.93
City of Casper	54,139	54,837	55,729	56,853	57,815	58,817	8.64
Town of Bar Nunn	1,932	2,011	2,223	2,331	2,447	2,573	33.17
Town of Edgerton	206	278	306	397	401	327	58.73
Town of Evansville	2,476	2,510	2,651	2,709	2,776	2,836	14.53
Town of Midwest	474	427	436	454	426	362	-23.62
Town of Mills	3,394	3,438	3,449	3,472	3,545	3,597	5.98

2.3 Mitigation Capabilities

The Wyoming State Multi-Hazard Mitigation Plan summarizes existing mitigation capabilities of each county and some of their incorporated cities. The information was derived from county websites and through completed worksheets from the County Coordinators. The table below presents a summary of Natrona County's mitigation capabilities that are highlighted in the 2016 Wyoming State Mitigation Plan and in some cases updated with 2017 information. Opportunities to expand on these capabilities were discuss during the 2017 update process as part of the updated mitigation strategy in Chapter 5 and implementation and incorporation through related planning efforts in Chapter 6.

Table 2.2: Summary of Mitigation Capabilities

Building Codes	Comprehensive Planning	Floodplain Management	GIS & Planning	Land Use Regulations	Other
County enforces building codes.	County Development Plan 2016 includes polices regarding growth in floodplains, steep slopes, and hazardous soils	Countywide DFIRM effective 5/18/15 Casper participates in the CRS and is a Class 9 community and has a floodplain management website	GIS department with 2 staff members. Planning Dept. administers zoning and subdivision regulations Casper has Planning and Zoning Dept.	County subdivision, zoning and nuisance regulations 2016 Natrona County Development Plan	The County is designated as StormReady community by National Weather Service Casper has been a Tree City USA for 17 years Casper has a Local Energy Assurance Plan

Source: Wyoming Multi-Hazard Mitigation Plan 2016

2.3.1 Mitigation Capabilities by Hazard

The following are summaries of mitigation strategies or capabilities that have been implemented in Natrona County by hazard, building on mitigation efforts highlighted in the 2010 Hazard Mitigation Plan (HMP).

All Hazards

Natrona County's first priority is life safety. Education and awareness of hazards is a key to this goal and therefore has been a leading activity and will continue to be a leading activity of mitigation. An all hazards approach has been taken in planning for events, inclusive of natural and human-caused hazards. Partnerships with private individuals, companies and other governmental entities have been used in the past and will continue to be used for future mitigation activities.

Natrona Regional Geospatial Cooperative

The Natrona Regional Geospatial Cooperative is comprised of Natrona County, the City of Casper, the Town of Evansville, Town of Mills, and the Town of Bar Nunn. The Natrona Regional Geospatial Cooperative was created in 2012 to maintain shared data and resources between all members and to create standard operating procedures. This information can be viewed at https://geosmart.casperwy.gov. GIS mapping in the County includes an inventory of addresses of rural residence for the Public Safety Communications Center's E911 system. The Metropolitan Planning Organization in conjunction with the Natrona Regional Geospatial Cooperative created a parcel map for Natrona County which includes a Growth Management Area. A database was created and continues to be updated as new parcels are created and land is developed. The parcel and address databases, among other information, was used to inform the 2017 update of this HMP to reflect current development hazard exposure and vulnerability in Chapter 4.

Casper Local Energy Assurance Plan

The Casper Local Energy Assurance Plan outlines critical facilities that must remain operational during response and recovery operations, and includes planning for backup power and fuel for these facilities. Implementation of the plan can assist with mitigation from a variety of severe weather hazards including winter storms, wind, tornadoes, hail and lightning.

Severe Weather

Continued education of the potential for severe weather, the possible results of a severe weather event, and how to be prepared for and recover from an event has been a priority with the Natrona County Emergency Management Agency. Educational forums such as Winter Weather Awareness Weeks, Spring Severe Weather Awareness Weeks, public displays, public presentations, Community Emergency Response Team (CERT) Program, and Public Service Announcements via radio, television and newspapers have also been implemented. Tying down modular homes for wind events as well as for constructed homes, and the placement of hurricane clips are examples of recommendations made to the public.

Severe weather warning systems are presently available through the NOAA weather radio or video crawlers on a local television channel, or local radio stations as well as the outdoor warning siren systems. In addition, the public service communication center together with the Natrona County Emergency Management agency has launched a program to identify citizens with disabilities throughout the County.. Mass notification system exist within the School District population as well as the Casper College community. The Natrona County EMA is focused on funding for additional mass notification systems such as Reverse 911 system and the expansion of the current outdoor warning system via grants or optional sales tax revenues (see related mitigation strategy in Chapter 5).

Due to these communication and warning capabilities Natrona County is recognized as a "StormReady" community by the National Weather Service. Other sites in the county recognized as "StormReady" include the Casper/Natrona County International Airport and Casper College.

Severe Winter Storms

Mitigation capabilities related to winter storms include public service announcements on public communication systems (television and radio) promoting winter preparedness and activation of warning systems and announcements on public communication systems in the event of an impending winter storm. Since winter storms are an annual event, public education on procedures for family preparedness and home preparedness will continue. These efforts are increased during the fall of each year before severe winter storms occur.

Flooding

Natrona County and flood-prone municipalities of Casper, Evansville and Mills have been active in floodplain management through continued compliance with the National Flood Insurance Program (NFIP). This is an integral part of reducing damage to existing and future development and emphasized in the mitigation strategy in Chapter 5 (see section on Continued Compliance with the NFIP). This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance. The Flood Insurance Rate Maps in the County were updated and adopted in 2015. More details regarding NFIP participation is shown in the following table. Flood insurance statistics are discussed in Chapter 4 in the flood hazard vulnerability discussion in relation to flood losses.

Table 2.3: NFIP Participation and Map Status

Jurisdiction	Current Effective Flood Map Date	NFIP Status Participation Status
Bar Nunn	*NSFHA	participation optional
Casper	5/18/15	Since 9/15/7
Edgerton	*NSFHA	participation optional
Evansville	5/18/15	Since 7/17/78
Midwest	*NSFHA	participation optional
Mills	5/18/15	Since 12/1/86
Natrona County	5/18/15	Since 8/15/78

* No-special flood hazard areas: An area in a low to moderate risk flood zone (Zones B, C, X) that is not in any immediate danger from flooding caused by overflowing rivers or hard rains

The City of Casper is a participant in the Community Rating System which underscores the City's commitment to managing its floodplains above and beyond the FEMA minimum standards and keeping flood insurance affordable. The City is a Class 9 as of October 2016, which results in a 5% discount on flood insurance for residents of the City.

Various projects have been implemented to lessen the impacts of flood hazards such as the construction of containment dams and detention ponds in drainages, installing storm drain systems to a higher capacity or installing where none existed, and assisting in establishing and maintaining areas along the North Platte River (The Platte River Parkway) to keep it as natural or parkland with minimal or no structures.

Figure 2.7: Photo of Elevated Home adjacent to North Platte River in Unincorporated Natrona County (Photo: Jeff Brislawn**)**

Wildfire

Wildfire mitigation has been a long-term priority with the County and land management agencies. The Casper Mountain Wildfire Mitigation Committee was started in 2001. This committee is comprised of members from private insurance carriers, Bureau of Land Management, Wyoming State Forestry, Natrona County Emergency Management, Natrona County Fire Protection District, and Casper Mountain Fire Protection District. The main focus of the original committee was to establish wildfire mitigation efforts on Casper Mountain proper.

GPS mapping of all structures and doing property surveys with homeowners has been one of the Committee's accomplishments. The committee is also the pipeline for which homeowners can get financial assistance with wildfire mitigation efforts taken on the property. The committee changed its name to Wyoming Firewise. This committee has also expanded its efforts to homeowners in the Big Horn Mountain Range, Rattle Snake Mountains, and the Alcova Lake area.

This committee continues to meet and has established future funding through federal grants. The main force of the committee is public education through personal visits and property surveys, informational booths at public gatherings, as well as producing Public Service Announcements that are shown on local television. The reviewing of resolutions and ordinances effecting future land use, and reviewing mitigation activities for future areas of development (i.e. dry hydrant systems, water sources, wide access routes) will continue to occur.

This County volunteered to be a pilot county for HAZUS projects dealing with wildfire mitigation. Since Wyoming Firewise/Natrona County has been in existence for several years, this pilot project was offered to them. The County Community Wildfire Protection Plan provides an extremely comprehensive look at each of the communities in Natrona County that are currently within fire prone areas. Mitigation activities for wildfire include constructing firebreaks on the west end of Casper Mountain. Further firebreaks are planned to be established in the central part of Casper Mountain.

Drought

In 2001, Natrona County formed a drought task force comprising members from the Fire Departments, Farm Service, rural ranchers, University of Wyoming Agricultural Extension Office, Regional Water Board, Kendrick Irrigation Board, and Emergency Management. This committee's main purpose is to educate those affected by the drought on actions to be taken. The board has also agreed to keep meeting during non-drought conditions to educate on mitigation and planning strategies for residents that could be affected by drought. Water use and ownership are critical factors during these conditions. Possible water restrictions can be placed on users as well. "Calls" on water ownership are made by those jurisdictions that have ownership to available water. Efforts are currently being done to educate all citizens on water conservation as well as strategies for future mitigation efforts against future droughts. These efforts are being led by the Natrona County Drought Task Force.

Earthquake

Public education on earthquake mitigation projects that citizens and businesses can participate in has occurred and will be on going. Some of this information includes CERT Training, lamination film for windows, strapping of gas hot water heaters, securing book cases and other wall hangings, securing computer monitors on desks, 72 hour kits, etc.

Hazardous Materials

Since 1987, Natrona County has been successful in getting facilities to identify what materials they have on hand as well as how much. The Local Emergency Planning Committee (LEPC) was formed and continues to meet. They have, however, expanded to an all hazards planning committee. The LEPC is in contact with Natrona County Planning to keep apprised of any new businesses that may come into the area that may be using, storing, or manufacturing hazardous materials.

Ordinances and resolutions will continue to be reviewed as well as federal regulations, in regards to hazardous materials, followed. The City of Casper has passed ordinances in relation to where vehicles hauling hazardous materials may be parked; adopted the Uniform Fire Code as to use, storage and disposal of hazardous materials; and has established an intra-city truck route. Natrona County has passed resolutions on adoption of the Uniform Fire Code in relation to use, storage, and disposal of hazardous materials.

In order to have a clearer picture of the hazardous materials that are being transported through each of the jurisdictions, a commodity flow study was completed in the spring of 2017. This key takeaways from this study have been integrated into the Hazardous Materials hazard profile in Chapter 4.

The Natrona County Local Emergency Planning Committee (LEPC) will continue to be the lead for mitigation strategies against hazardous materials incidents. Assisting that committee will be the local elected officials and emergency management offices.

Terrorism

Natrona County has identified several areas of potential target value to both domestic and foreign terrorists. A committee was formed comprised of representatives of all entities and all response agencies within the County. A priority listing was established of needs for a potential incident. The number one need was determined to be interoperable communications. This was placed as a priority as funding was obtained. As of 2017 this project is now in a continuum mode. The 800 MHZ system has added an additional tower site in the Alcova/Pathfinder dam areas in a partnership with Union Cellular. By placing 800 MHZ radio equipment on the Union Tower, communications are greatly improved in a once inoperable area. In addition the 800 system has been interlinked into the WYOLINK system enabling responders to communicate state-wide.

2.3.2 Safe Growth and Development

The 2016 Natrona County Development Plan is an official guidance document adopted by the Board of County Commissioners as a policy guide for making decisions about the physical development of the County. It indicates how public officials and citizens desire the local area (referred to as the "planning area") to develop in the future. It is an official statement of a governing body which outlines its major policies concerning future physical development. Preventing damage from natural hazards to future growth is one of the goals of the plan. The goals, policies, and actions related to environmental/natural hazards are excerpted below.

Environmental/Natural Hazards Goals: To minimize development in identified hazardous areas and ensure development within hazardous areas is engineered properly to mitigate the impact of existing hazards.

Flood Policies

- Policy 1 – To reduce flood danger, all subdivision plats shall define areas which lie within any 100 year flood plain, as established by the Corps of Engineers and FEMA for streams and rivers.
- Policy 2 – Building permits shall be issued in accordance with adopted FEMA Flood Hazard boundary maps and FEMA guidelines.
- Policy 3 – All subdivision proposals shall include a drainage plan with the plat of a subdivision which details storm drainage facilities.

Soils

- Policy 1 - Soil limitations shall be a major locational factor in the approval of subdivisions, building permits and other development permits, with proper corrective measures required to mitigate identified soil limitations.
    - Action 1 – Use the Natrona County Conservation District or a Wyoming Licensed Geotechnical Engineer's soils studies to require site specific data for final approval.

Slopes

- Policy 1 – Steep slopes, over ten percent, present significant engineering problems for urban development. The slope of a site shall be a major determining factor in approval of subdivision plats, building permits, and other development proposals, with corrective measures required if development is to be allowed.
    - Action 1 – Utilize the NRCS/NCCD soils studies in the preliminary development review and evaluation of soil suitability in steep slope areas.

3 Planning Process

Requirements §201.6(b) and §201.6(c)(1): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

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

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.]

3.1 Background on Mitigation Planning in Natrona County

This Multi-Hazard Mitigation Plan is an update to the 2010 Plan for Natrona County. The County, with the Office of Emergency Management (OEM) as the lead agency, recognized the need and importance of this plan and was responsible for initiating its development. The County contracted with Amec Foster Wheeler in 2016 to facilitate and develop the plan. Amec Foster Wheeler's role was to:

The Emergency Management Coordinator led Hazard Mitigation Planning Committees (HMPCs) working in concert with the hazard mitigation planning consultant. As the planning consultant, Amec Foster Wheeler's role was to:

- Provide guidance on a planning organization for the entire planning area representative of the participants;
- Meet all of the DMA requirements as established by federal regulations, following FEMA's most recent planning guidance;
- Facilitate the entire planning process;
- Identify the data requirements that the participating counties and municipalities could provide, and conduct the research and documentation necessary to augment that data;
- Develop and help facilitate the public input process;
- Produce the draft and final plan documents; and
- Ensure acceptance of the final Plan by WOHS and FEMA Region VIII

The remainder of this chapter provides a narrative description of the steps taken to prepare the hazard mitigation plan (HMP).

3.2 Local Government Participation

The Disaster Mitigation Act (DMA) planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the Hazard Mitigation Planning Committee (HMPC),
- Detail areas within the planning area where the risk differs from that facing the entire area,
- Identify specific projects to be eligible for funding, and
- Have the governing board formally adopt the plan.

For the Natrona County Multi-Hazard Mitigation Plan's HMPC, "participation" meant:

- Attending and participating in HMPC meetings;
- Establishing/reconvening a local steering committee;
- Providing available data requested by the HMPC coordinator/Amec Foster Wheeler;
- Providing/updating the hazard profile and vulnerability details specific to jurisdictions;
- Developing/updating the local mitigation strategy (action items and progress);
- Advertising and assisting with the public input process;
- Reviewing and commenting on plan drafts; and
- Coordinating the formal adoption of the plan by the governing boards.

In the interest of completing a robust process that would ultimately result in FEMA approval the County and participating municipalities met all of these participation requirements. In most cases one or more representatives for each agency attended the HMPC meetings described in Table 3.2 and also brought together department staff to help collect data, identify mitigation actions and implementation strategies, and review and provide data on plan drafts. Appendix B provides additional information and documentation of the planning process.

3.3 The 10-Step Planning Process

Amec Foster Wheeler established the planning process for the Natrona County Hazard Mitigation Plan using the DMA planning requirements and FEMA's associated guidance. This guidance is structured around a four-phase process:

1) Organize Resources
2) Assess Risks
3) Develop the Mitigation Plan
4) Implement the Plan and Monitor Progress

Into this four-phase process, Amec Foster Wheeler integrated a more detailed 10-step planning process used for FEMA's Community Rating System (CRS) and Flood Mitigation Assistance (FMA) programs. Thus, the modified 10-step process used for this plan meets the requirements of six major programs: FEMA's Hazard Mitigation Grant Program, Pre-Disaster Mitigation program, Community Rating System (CRS), Flood Mitigation Assistance Program, Severe Repetitive Loss program, and new flood control projects authorized by the U.S. Army Corps of Engineers. FEMA's March 2013 *Local Mitigation Planning Handbook* recommends a nine step process within the four phase process. Table 3.1 summarizes the four-phase DMA process, the detailed CRS planning steps and work plan used to develop the plan, the nine handbook planning tasks from FEMA's 2013 *Local Mitigation Planning Handbook*, and where the results are captured in the Plan. The sections that follow describe each planning step in more detail.

Table 3.1 Mitigation Planning Process

FEMA 4 Phase Guidance	Community Rating System (CRS) Planning Steps (Activity 510) and Amec Foster Wheeler Work Plan Tasks	FEMA Local Mitigation Planning Handbook Tasks (44 CFR Part 201)	Location in Plan
Phase I: Organize Resources	Task 1. Organize Resources	1: Determine the Planning Area and Resources	Chapters 1, 2 and 3
		2: Build the Planning Team 44 CFR 201.6(c)(1)	Chapter 3, Section 3.3.1
	Task 2. Involve the public	3: Create an Outreach Strategy y 44 CFR 201.6(b)(1)	Chapter 3, Section 3.3.1
	Task 3. Coordinate with Other Agencies	4: Review Community Capabilities 44 CFR 201.6(b)(2) & (3)	Chapter 3, Section 3.3.1 and Chapter 4, Section 4.4
Phase II: Assess Risks	Task 4. Assess the hazard	5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) & (iii)	Chapter 4, Sections 4.1-4.3
	Task 5. Assess the problem		Chapter 4, Sections 4.1-4.3
Phase III: Develop the Mitigation Strategy	Task 6. Set goals	6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii)	Chapter 5, Section 5.2
	Task 7. Review possible activities		Chapter 5, Section 5.3
	Task 8. Draft an action plan		Chapter 5, Section 5.4
Phase IV: Adopt and Implement the Plan	Task 9. Adopt the plan	8: Review and Adopt the Plan	Chapter 6, Appendix C
	Task 10. Implement, evaluate, revise	7: Keep the Plan Current	Chapter 6
		9: Create a Safe and Resilient Community 44 CFR 201.6(c)(4)	Chapter 6

3.3.1 Phase 1: Organize Resources

Planning Task 1: Organize the Planning Effort

With the County’s commitment to update the Plan, Amec Foster Wheeler worked with County Emergency Management to establish the framework and organization for the process. Organizational efforts were initiated with each jurisdiction to inform and educate the plan participants of the purpose and need for the update and continued participation. During the update of this plan, the planning process was directed through a Hazard Mitigation Planning Committee comprised of Natrona County and participating jurisdictions. The planning consultant held an initial conference call to discuss the organizational aspects of the planning process with the county Emergency Management Coordinator. Using FEMA planning guidance, representatives for the county's HMPC base membership was established, with additional invitations extended as appropriate to other federal, state, tribal, and local stakeholders and the public throughout the planning process.

Amec Foster Wheeler and the County's Emergency Management Coordinator identified key county, municipal, and other local government and initial stakeholder representatives. An email was sent to invite them to participate as members of the HMPC and to attend a series of planning workshops. Representatives from the following county and municipal departments participated on the county or jurisdictional-level HMPC during the development of the 2017 plan update.

Table 3.2 HMPC Members by Jurisdiction

Jurisdictions	Departments
Natrona County	Emergency Management
	Fire Department
	Sheriff's Office
	GIS
	Road and Bridge Department
	Casper-Natrona County Health Department
City of Casper	Fire Department Police
	Public Works Department
	Planning Department
	Police Department
	Engineering Department
Town of Bar Nunn	Administration
Town of Edgerton	Police Department
Town of Evansville	Fire Department
	Police Department
	Public Works Department
	Engineering Department
	Planning Department
Town of Midwest	Police Department
Town of Mills	Fire Department
	Police Department
	Public Works Department
	Engineering Department
	Planning Department

Stakeholders	
	WYDOT
	WYOHS
	Bureau of Land Management
	Black Hills Energy Corporation
	Red Cross

The planning process officially began with a kick-off meeting/webinar held on January 12, 2017 in combination with a meeting of the Natrona County Local Emergency Planning Commission (LEPC). The meeting covered the scope of work, project schedule and an introduction to the DMA planning requirements. The meeting was also an opportunity to revisit the list of hazards analyzed in the plan. A summary of this meeting is included in Appendix A

During the planning process, the HMPC communicated through face-to-face meetings, email, and telephone conversations. Draft documents were also shared by email. The complete draft was posted on the County website so that the HMPC members and the public could easily access and review them.

The HMPC held three primary planning meetings during the planning period (January 2017-July 2017). The purposes of these meetings are described in Table 3.2. Agendas for each of the meetings are included in Appendix A.

Planning Task 2: Involve the Public

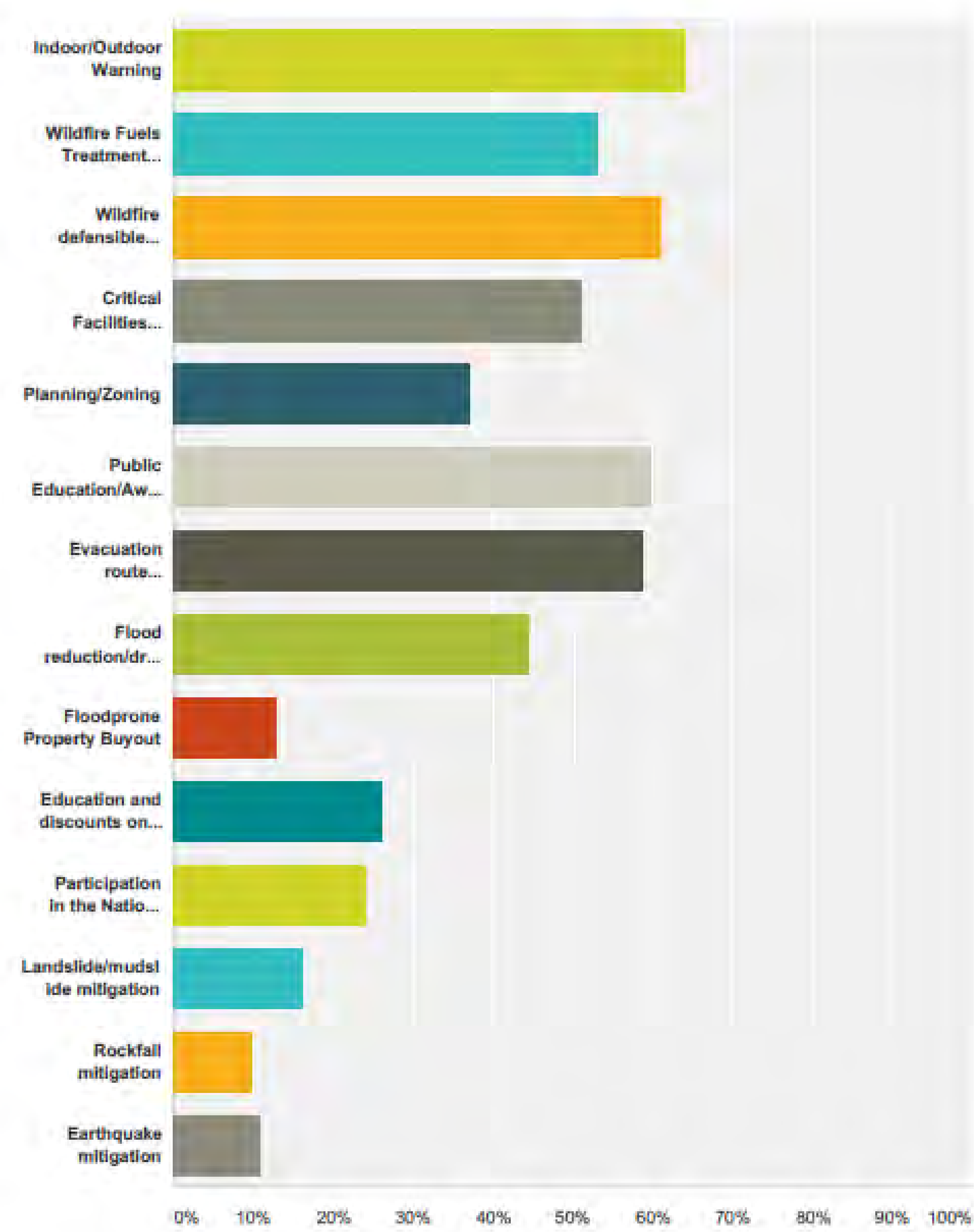
The 2017 planning process was an open one, with the public informed and involved early in the process. Mitigation planning was primarily accomplished at HMPC meetings, which in some cases such as the kickoff meeting included members of the public and local business and industry. Additional public involvement was accomplished through a public survey.

2017 Public Survey

During the 2017 planning process and drafting stage, a public survey was developed as a tool to gather public input. The survey was for the public to provide feedback to the county planning teams on topics related to hazard concerns and reducing hazard impacts. The survey provided an opportunity for public input during the planning process, prior to finalization of the plan update. The survey gathered public feedback on concerns about wildfires, floods, winter storms and other hazards and solicited input on strategies to reduce their impacts. The survey was released as both an online tool and a hardcopy form in January 2017 and closed on March 15, 2017. The County provided links to the public survey by distributing it using social media, email, and posting the link on websites. Ninety-six responses were received and shared with the county planning committees to inform the process.

The survey included a question on ranking hazard significance. The results generally track with the significance levels noted in Chapter 4 of this plan, with drought, winter storm, wildfire, and wind as being the most significant. The following graph is a display of the results from Question 4. Question 4 read: *The following types of mitigation actions may be considered in this plan. Please indicate all the types of mitigation actions that you think should have the highest priority in the Multi-Hazard Mitigation Plan. These results will be considered during the planning process.* The results indicate that public education/awareness, indoor/outdoor warning, and flood reduction/drainage improvement were popular with the public. Additional results of the survey are included in Appendix A Planning Process Documentation.

Figure 3.1 Mitigation Action Survey - Results from Question 4



Prior to finalizing, a draft of the plan was made available to the public for review and comment. The plan was placed on each county's web page and a press release and social media were used to announce the public comment period. A feedback form was provided to collect specific comments. There were no comments received from the public on the plan, however, three people viewed the survey form. There were some final edits provided by the HMPC during the public review that resulted in minor edits to the plan before submittal to FEMA.

Planning Task 3: Coordinate with Other Departments and Agencies

Early in the planning process, the HMPC determined that data collection, mitigation strategy development, and plan approval would be greatly enhanced by inviting state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation activities or their role in land stewardship in the county, representatives from state, federal, and local businesses were invited to participate on the HMPC in 2017 and are noted in Table 3.2.

Many of these stakeholders participated in the process by attending HMPC meetings or providing data and information that was used to update hazard profiles in the plan. Stakeholders were also given an opportunity to review and comment on the draft plan.

Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is an important aspect to mitigation planning. Hazard mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability from natural hazards. The County uses a variety of comprehensive planning mechanisms, such as development master plans and ordinances, to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this plan establishes a credible and comprehensive plan that ties into and supports other community programs. The development of this plan incorporated information from the following existing plans, studies, reports, and initiatives. Examples of this are described in the following table. The actions in the mitigation action strategy in Chapter 5 note related planning mechanism, where applicable, with each detailed action description.

Table 3.3 Incorporated or Referenced Plans

Plan	How Incorporated or Referenced
Natrona County Development Plan 2016	Incorporated into Community Profile, Capabilities Assessment
Community Wildfire Protection Plan	Incorporated into Risk and Vulnerability Assessment and Mitigation Strategy
Casper Local Energy Assurance Plan	Informed Risk and Vulnerability Assessment, Capabilities Assessment
Platte River Revival River Restoration Master Plan	Incorporated into Mitigation Strategy

Plan	How Incorporated or Referenced
City of Casper 2013 Stormwater Management Master Plan	Referenced and Incorporated into Mitigation Strategy in applicable actions
Wyoming Hazard Mitigation Plan (2016)	Informed data sources and information gathering and goals update

Other documents were reviewed and cited, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment, and capability assessment.

2010 Mitigation Plan Inclusion in Other Planning Mechanisms

The 2010 HMP was integrated or cross referenced into some other planning mechanisms in the County. The risk assessment portion of the 2010 plan was integrated into the other planning mechanisms listed in Table 3.4. The table lists the jurisdiction and what planning mechanism the 2010 HMP was integrated into. In some cases communities have deferred this for future planning mechanisms, as discussed in the Chapter 6 Plan Adoption, Implementation and Maintenance.

Table 3.4 2010 Hazard Mitigation Plan Inclusion in Other Planning Mechanisms

Jurisdiction	Planning Mechanism
Natrona County	Local Emergency Operations Plan (LEOP) – used to inform Hazard Vulnerability Assessment
City of Casper	LEOP adopted. Deferred for incorporation by reference in other future planning mechanisms
Town of Bar Nunn	LEOP adopted. Deferred for incorporation by reference in other future planning mechanisms
Town of Edgerton	LEOP adopted. Deferred for incorporation by reference in other future planning mechanisms
Town of Evansville	LEOP adopted. Deferred for incorporation by reference in other future planning mechanisms
Town of Midwest	LEOP adopted. Deferred for incorporation by reference in other future planning mechanisms
Town of Mills	LEOP adopted. Deferred for incorporation by reference in other future planning mechanisms
State of Wyoming	The 2016 Wyoming Hazard Mitigation Plan provides a high-level analysis of hazards profiled in local mitigation plans. Natrona County's 2010 plan is included in this analysis.

3.3.2 Phase 2: Assess Risks

Planning Tasks 4 and 5: Identify the Hazards and Assess the Risks

Amec Foster Wheeler led the HMPC in research effort to identify and document all the hazards that have, or could, impact the planning area. The existing hazard mitigation plan and Wyoming Hazard Mitigation Plan provided a basis for most of the hazard profiles. Where data permitted, Geographic Information Systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities. Sophisticated analyses for flood, landslide and wildfire hazards were performed by Amec Foster Wheeler that included an analysis of flood risk based on the recent Digital Flood Insurance Rate Maps (DFIRMs).

Also included in the 2016 plan is a capability review and document the planning area's current capabilities to mitigate risk and vulnerability from natural hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the HMPC can assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. The results of this review are captured in Chapter 2. A more detailed description of the risk assessment process and the results are included in **Chapter 4 Risk Assessment**.

3.3.3 Phase 3: Develop the Mitigation Plan

Planning Tasks 6 and 7: Set Goals and Review Possible Activities

Amec Foster Wheeler facilitated discussion sessions with the HMPC that described the purpose and the process of developing planning goals, a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This process was used to update and enhance the mitigation action plan, which is the essence of the planning process and one of the most important outcomes of this effort. The action plan and the process used to identify and prioritize mitigation actions are described in greater detail in **Chapter 5 Mitigation Strategy**.

Planning Task 8: Draft an Action Plan

Based on input from the HMPC regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7, Amec Foster Wheeler produced a complete first draft of the updated Plan. This complete draft was shared for HMPC review and comment. Other agencies were invited to comment on this draft as well. HMPC and agency comments were integrated into the second draft, which was advertised and distributed to collect public input and comments. Amec Foster Wheeler integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for the Wyoming Office of Homeland Security and FEMA Region VIII to review and approve, contingent upon final re-adoption by the governing boards of each participating jurisdiction.

3.3.4 Phase 4: Implement the Plan and Monitor Progress

Planning Task 9: Adopt the Plan

In order to secure buy-in and officially implement the plan, the plan was adopted by the governing boards of each participating jurisdiction. Since the adoption process follows the FEMA plan review and approval, copies of the adoption resolution will be included electronically in **Appendix D Records of Adoption**.

Planning Task 10: Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. Up to this point in the planning process, all of the HMPC's efforts have been directed at researching data, coordinating input from participating entities, and developing/updating appropriate mitigation actions. Each recommended action includes key descriptors, such as a lead agency and possible funding sources, to help initiate implementation. Progress on the implementation of specific actions identified in the plan is captured in a discussion and the mitigation action plan summary table in **Chapter 5 Mitigation Strategy.** An overall implementation strategy is described in **Chapter 6 Plan Adoption, Implementation and Maintenance**.

Finally, there are numerous organizations within Natrona County planning area whose goals and interests interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is paramount to the ongoing success of this plan and mitigation in Natrona County, and is addressed further in Chapter 6. A plan update and maintenance schedule and a strategy for continued public involvement are also included in Chapter 6.

4 HAZARD ANALYSIS AND RISK ASSESSMENT

44 CFR Requirement 201.6(c)(2): [The plan shall include] a risk assessment that provides the factual basis for activities proposed in the strategy to reduce the losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

As defined by the Federal Emergency Management Agency (FEMA), risk is a combination of hazard, vulnerability, and exposure. "It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage."

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction's potential risk to natural hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment builds upon the methodology described in the 2013 FEMA Local Mitigation Planning Handbook, which recommends a four-step process for conducting a risk assessment:

1) Describe Hazards
2) Identify Community Assets
3) Analyze Risks
4) Summarize Vulnerability

Data collected through this process has been incorporated into the following sections of this chapter:

Section 4.1 Hazard Identification identifies the hazards that threaten the planning area and describes why some hazards have been omitted from further consideration.

Section 4.2 Hazard Profiles discusses the threat to the planning area and describes previous occurrences of hazard events, the likelihood of future occurrences, and the County's vulnerability to particular hazard events.

4.1 Hazard Identification

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type…of all natural hazards that can affect the jurisdiction.

The Hazard Mitigation Planning Committee (HMPC) conducted a hazard identification study to determine the hazards that threaten the planning area.

4.1.1 Results and Methodology

Using existing hazards data, plans from participating jurisdictions, and input gained through planning and public meetings, the HMPC agreed upon a list of hazards that could affect the County. Hazards data from FEMA, the Wyoming Office of Homeland Security (including the 2016 State of Wyoming Multi-Hazard Mitigation Plan), the National Oceanic and Atmospheric Administration, the Spatial Hazard Events and Losses Database for the United States (SHELDUS), and many other sources were examined to assess the significance of these hazards to the planning area. The hazards evaluated in this plan include those that have occurred historically or have the potential to cause significant human and/or monetary losses in the future.

The final list of natural hazards identified and investigated for the 2017 Natrona County Multi-Hazard Mitigation Plan includes:

- Dam Failure+
- Drought
- Earthquake
- Expansive Soils*
- Flood
- Hazardous Materials
- High Winds and Downbursts++
- Landslide/Rockfall/Debris Flow*
- Severe Thunderstorms (includes Hail and Lightning)
- Severe Winter Weather
- Tornado++
- Wildland Fire

Human caused hazards include:

- Terrorism
- Technological/Cyber Incident*
- Biological Disease Outbreaks*

Changes in Hazard Identified in 2010 Plan are noted with the following:

- \+ Discussed in flood hazard in 2010
- ++ Discussed in thunderstorm hazard in 2010
- * Identified but not formally profiled in 2010

Members of the HMPC used a hazards worksheet to rate the significance of hazards that could potentially affect the County. Significance was measured in general terms, focusing on key criteria such as the likelihood of the event, past occurrences, spatial extent, and damage and casualty potential. Table 4.1 represents the worksheet used to identify and rate the hazards, and is a composite that includes input from all the participating jurisdictions. Note that the significance of the hazard may vary from jurisdiction to jurisdiction. Jurisdictional variation is summarized in significance tables at the end of each hazard profile.

Table 4.1 Natrona County Hazard Significance Summary Table

Hazard	Spatial Extent	Magnitude/ Severity	Probability of Future Occurrence	Overall Significance
Dam Failure	Limited	Limited	Unlikely	Low
Drought	Extensive	Limited	Likely	High
Earthquake	Significant	Critical	Occasional	High
Expansive Soils	Significant	Limited	Likely	Low
Flood/Flash Flood	Significant	Limited	Likely	Medium
Hazardous Materials	Limited	Limited	Highly Likely	Medium
High Wind	Extensive	Limited	Highly Likely	Medium
Landslide/Mudslide/Rockfall	Limited	Limited	Likely	Medium
Thunderstorm (including Lightning and Hail)	Extensive	Limited	Highly Likely	Medium
Tornado	Negligible	Limited	Highly Likely	Low
Winter Weather	Extensive	Limited	Highly Likely	Medium
Wildland Fire	Extensive	Critical	Highly Likely	High
Terrorism	Limited	Limited	Occasional	Low
Technological/Cyber Incident	Extensive	Critical	Likely	Medium
Biological Disease Outbreaks	Extensive	Critical	Occasional	High

Geographic Extent
Negligible: Less than 10 percent of planning area or isolated single-point occurrences
Limited: 10 to 25 percent of the planning area or limited single-point occurrences
Significant: 25 to 75 percent of planning area or frequent single-point occurrences
Extensive: 75 to 100 percent of planning area or consistent single-point occurrences

Potential Magnitude/Severity
Negligible: Less than 10 percent of property is severely damaged, facilities and services are unavailable for less than 24 hours, injuries and illnesses are treatable with first aid or within the response capability of the jurisdiction.
Limited: 10 to 25 percent of property is severely damaged, facilities and services are unavailable between 1 and 7 days, injuries and illnesses require sophisticated medical support that does not strain the response capability of the jurisdiction, or results in very few permanent disabilities.
Critical: 25 to 50 percent of property is severely damaged, facilities and services are unavailable or

Probability of Future Occurrences
Unlikely: Less than 1 percent probability of occurrence in the next year, or has a recurrence interval of greater than every 100 years.
Occasional: Between a 1 and 10 percent probability of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Likely: Between 10 and 90 percent probability of occurrence in the next year, or has a recurrence interval of 1 to 10 years
Highly Likely: Between 90 and 100 percent probability of occurrence in the next year, or has a recurrence interval of less than 1 year.

Overall Significance
Low: Two or more of the criteria fall in the lower classifications or the event has a minimal impact on the planning area. This rating is also sometimes used for hazards with a minimal or unknown record of occurrences/impacts or for hazards with minimal mitigation potential.
Medium: The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is

severely hindered for 1 to 2 weeks, injuries and illnesses overwhelm medical support for a brief period of time, or result in many permanent disabilities and a few deaths. Catastrophic: More than 50 percent of property is severely damaged, facilities and services are unavailable or hindered for more than 2 weeks, the medical response system is overwhelmed for an extended period of time or many deaths occur.	also sometimes utilized for hazards with a high impact rating but an extremely low occurrence rating. High: The criteria consistently fall along the high ranges of the classification and the event exerts significant and frequent impacts on the planning area. This rating is also sometimes utilized for hazards with a high psychological impact or for hazards that the jurisdiction identifies as particularly relevant.

Hazards Considered but not Profiled

There are several other hazards that could affect the county but are not profiled further for mitigation purposes due to very low probability or minimal vulnerability. These hazards include avalanche, windblown deposits, mine subsidence, space weather and volcanism. There are small areas of avalanche hazard on the north side of Casper Mountain but they do not affect built areas. Windblown deposits have not caused issues in the past and would likely have nuisance impacts if ancient deposits are re-mobilized. There are mines present in the County but no known issues with subsidence above underground workings. In regards to volcanism the county and region is potentially vulnerable to an eruption of the Yellowstone Caldera due to its proximity to Yellowstone National Park. A large-scale eruption would have catastrophic global impacts. Because of the overly long expected occurrence of frequency (greater than 10,000 years) for explosive volcanism at Yellowstone, and the fact that a good response or mitigation plan is not possible for an event of this magnitude, it was not analyzed in this document. Space weather could cause impacts to critical infrastructure and can be and is a hazard that should be monitored

4.1.2 Disaster Declaration History

As part of the hazard identification process, the HMPC researched past events that triggered federal and/or state emergency or disaster declarations in the planning area. Federal and/or state disaster declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments' capacities are exceeded, a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), and/or the Small Business Administration (SBA). FEMA also issues emergency declarations, which are more limited in scope and without the long-term federal recovery programs of major disaster declarations. The quantity and types of damage are the determining factors.

A USDA declaration will result in the implementation of the Emergency Loan Program through the Farm Services Agency. This program enables eligible farmers and ranchers in the affected county as well as contiguous counties to apply for low interest loans. A USDA declaration will automatically follow a major disaster declaration for counties designated major disaster areas and those that are contiguous to declared counties, including those that are across state lines. As part of an agreement with the USDA, the SBA offers low interest loans for eligible businesses that suffer economic losses in declared and contiguous counties that have been declared by the USDA. These loans are referred to as Economic Injury Disaster Loans.

Table 4.2 provides information on federal emergencies and disasters declared in Wyoming between 1963 and 2016. Those that affected Natrona County are indicated by an asterisk. Fire management assistance declarations that affected Natrona County are also included.

Table 4.2 Major Disaster Declarations in Wyoming: 1963 – 2016

Event/ Hazard	Year	Declaration Type
Heavy rains, flooding	1963	Presidential – Major Disaster Declaration
Drought	1977	Presidential - Emergency Declaration
Severe storms, flooding, mudslides*	1978	Presidential – Major Disaster Declaration
Severe storms, tornadoes	1979	Presidential – Major Disaster Declaration
Severe storms, hail, flooding	1985	Presidential – Major Disaster Declaration
Methane gas seepage	1987	Presidential - Emergency Declaration
Severe winter storm	1999	Presidential – Major Disaster Declaration
Winter storm	2000	Presidential – Major Disaster Declaration
Hensel Fire	2002	Fire Mgmt Assistance Declaration
Reese Mountain Fire	2002	Fire Mgmt Assistance Declaration
Commissary Ridge Fire	2002	Fire Mgmt Assistance Declaration
Tongue River Fire	2003	Fire Mgmt Assistance Declaration
Tornado	2005	Presidential – Major Disaster Declaration
Drought*	2006	USDA Declaration
Thorn Divide Fire Complex	2006	Fire Mgmt Assistance Declaration
Jackson Canyon Fire	2006	Fire Mgmt Assistance Declaration
Drought*	2007	USDA Declaration
Little Goose Fire	2007	Fire Mgmt Assistance Declaration
Drought*	2009	USDA Declaration
Severe freeze	2009	USDA Declaration
Flooding	2010	Presidential – Major Disaster Declaration
Severe Storms, Flooding, and Landslides	2011	Presidential-Major Disaster Declaration
Arapahoe Fire	2012	Fire Mgmt Assistance Declaration
Squirrel Creek Fire	2012	Fire Mgmt Assistance Declaration
Oil Creek Fire	2012	Fire Mgmt Assistance Declaration
Sheep Herder Hill Fire	2012	Fire Mgmt Assistance Declaration
Severe Storms and Flooding	2015	Presidential-Major Disaster Declaration

Event/ Hazard	Year	Declaration Type
Station Fire	2015	Fire Mgmt Assistance Declaration
Lava Mountain Fire	2016	Fire Mgmt Assistance Declaration
Tokawana Fire	2016	Fire Mgmt Assistance Declaration

4.2 Asset Summary

4.2.1 Assets Exposure

As a starting point for analyzing the Planning Area's vulnerability to identified hazards, the HMPC used a variety of data to define a baseline against which all disaster impacts could be compared. If a catastrophic disaster was to occur in the Planning Area, this section describes significant assets exposed or at risk in the Planning Area. Data used in this baseline assessment included:

- Total assets at risk;
- Critical facility inventory;
- Cultural, historical, and natural resources; and
- Population growth and land use/development trends.

Total Assets at Risk

Parcel data was provided by the Natrona County Assessor's Office. This data presents an inventory of the total exposure of developed properties within the county. It is important to note that depending on the nature and type of hazard event or disaster, it is generally the value of the infrastructure or improvements to the land that is of concern or at risk. Generally, the land itself is not a total loss, but may see a reduction in value. Thus the parcel analysis excludes land value.

Parcel Exposure and Preparations for Analysis

Building counts and valuations in this plan are based on data from the County Assessor's Office. The county's parcel layer was joined to the assessor's database in GIS, using only parcels with improved values. For the purposes of this plan 'improved' includes parcels that have an improvement value greater than zero. The parcel layer was joined to an address point layer for this analysis to represent buildings. The table below shows a summary of the total improved property inventory grouped by jurisdiction. Contents values were estimated as a percentage of building value based on their property type, using FEMA/HAZUS estimated content replacement values. This includes 100% of the structure value for non-residential structures and 50% for residential structures.

Table 4.3 Natrona County Total Exposure by Jurisdictions

Jurisdiction	Property Type	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure
Bar Nunn	Com Vacant Land	2	2	$0	$0	$0
	Commercial	18	21	$3,162,622	$3,162,622	$6,325,244
	Exempt	5	6	$0	$0	$0
	Industrial	2	3	$1,820,903	$2,731,355	$4,552,258
	Multi-Use	2	3	$28,438	$28,438	$56,876
	Res Vacant Land	101	105	$0	$0	$0
	Residential	848	852	$142,198,792	$71,099,396	$213,298,188
	Total	**978**	**992**	**$147,210,755**	**$77,021,811**	**$224,232,566**
Casper	Com Vacant Land	41	60	$0	$0	$0
	Commercial	1,280	2,274	$682,509,031	$682,509,031	$1,365,018,062
	Exempt	379	585	$30,763,802	$30,763,802	$61,527,604
	Industrial	17	20	$8,252,709	$12,379,064	$20,631,773
	Multi-Use	52	145	$10,428,781	$10,428,781	$20,857,562
	Res Vacant Land	136	187	$0	$0	$0
	Residential	19,959	20,906	$3,125,458,192	$1,562,729,096	$4,688,187,288
	Vacant Land	4	4	$777,103	$777,103	$1,554,206
	Total	**21,868**	**24,181**	**$3,858,189,618**	**$2,299,586,877**	**$6,157,776,495**
Edgerton	Commercial	23	32	$1,948,964	$1,948,964	$3,897,928
	Multi-Use	3	3	$110,528	$110,528	$221,056
	Residential	81	90	$2,541,310	$1,270,655	$3,811,965
	Vacant Land	1	1	$1,002	$1,002	$2,004
	Total	**108**	**126**	**$4,601,804**	**$3,331,149**	**$7,932,953**
Evansville	Com Vacant Land	5	5	$0	$0	$0
	Commercial	95	110	$71,933,571	$71,933,571	$143,867,142
	Exempt	11	19	$0	$0	$0
	Industrial	12	16	$30,840,001	$46,260,002	$77,100,003
	Multi-Use	5	203	$183,591	$183,591	$367,182
	Res Vacant Land	172	184	$0	$0	$0
	Residential	794	821	$90,523,361	$45,261,681	$135,785,042
	Vacant Land	4	4	$7,875	$7,875	$15,750
	Total	**1,098**	**1,362**	**$193,488,399**	**$163,646,719**	**$357,135,118**
Midwest	Commercial	4	4	$70,067	$70,067	$140,134
	Residential	197	206	$5,384,009	$2,692,005	$8,076,014
	Total	**201**	**210**	**$5,454,076**	**$2,762,072**	**$8,216,148**
Mills	Com Vacant Land	18	90	$0	$0	$0
	Commercial	158	219	$34,791,531	$34,791,531	$69,583,062
	Exempt	16	27	$0	$0	$0
	Industrial	9	14	$11,429,260	$17,143,890	$28,573,150

Jurisdiction	Property Type	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure
	Multi-Use	5	60	$160,378	$160,378	$320,756
	Res Vacant Land	275	336	$0	$0	$0
	Residential	970	1,256	$79,528,639	$39,764,320	$119,292,959
	Total	**1,451**	**2,002**	**$125,909,808**	**$91,860,119**	**$217,769,927**
Unincorporated	Agricultural	9	11	$0	$0	$0
	Com Vacant Land	47	64	$0	$0	$0
	Commercial	692	1,076	$194,249,175	$194,249,175	$388,498,350
	Exempt	43	174	$0	$0	$0
	Ind Vacant Land	2	2	$0	$0	$0
	Industrial	98	149	$94,061,443	$141,092,165	$235,153,608
	Multi-Use	25	40	$2,714,152	$2,714,152	$5,428,304
	Res Vacant Land	387	451	$0	$0	$0
	Residential	4,689	5,147	$608,443,069	$304,221,535	$912,664,604
	Vacant Land	7	10	$551,990	$551,990	$1,103,980
	Total	**5,999**	**7,124**	**$900,019,829**	**$642,829,016**	**$1,542,848,845**
	Grand Total	**31,703**	**35,997**	**$5,234,874,289**	**$3,281,037,761**	**$8,515,912,050**

Source: Amec Foster Wheeler analysis based on Assessor's Office data 2016

Critical Facility Inventory

For the purposes of this plan, a critical facility is defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. FEMA's HAZUS-MH loss estimation software uses the following three categories of critical assets:

- *Essential facilities* are those that if damaged would have devastating impacts on disaster response and/or recovery;
- *High potential loss facilities* are those that would have a high loss or impact on the community;
- *Transportation and lifeline facilities* are a third category of critical assets, consisting of transportation systems and utilities.

Examples of each are provided in Table 4.4 followed by a map and summary table of critical facilities by jurisdiction. Critical facilities data was provided by Natrona County Planning; supplemental data from HAZUS was used to capture wastewater facilities; Homeland Security Infrastructure Program (HSIP) data was used for communications, emergency operations centers and urgent care facilities. Each jurisdiction identified assets on a data collection guide worksheet which may capture additional facilities and additional details not within the GIS database. For a list of assets and vulnerabilities within specific jurisdictions, please refer to Appendix D.

Table 4.4 Critical Facilities Types and Examples

Essential Facilities	High Potential Loss Facilities	Transportation and Lifeline Facilities
Medical Facility	Assisted Living EPA Regulated Facility	Air Facility
Fire Department	College/University	Non-Union Communication
Hospital	Community Support	Union Communications
Law Enforcement	Day Cares	Electrical Facility
Local EOC	EPA FRS Location	
Special Medical Facility	National Shelter System Facility	
Urgent Care Facility	Nursing Home	
	Power Plant	
	Public Health Department	
	School	
	Substation	
	Tier II	

Figure 4.1 Critical Facilities in Natrona County

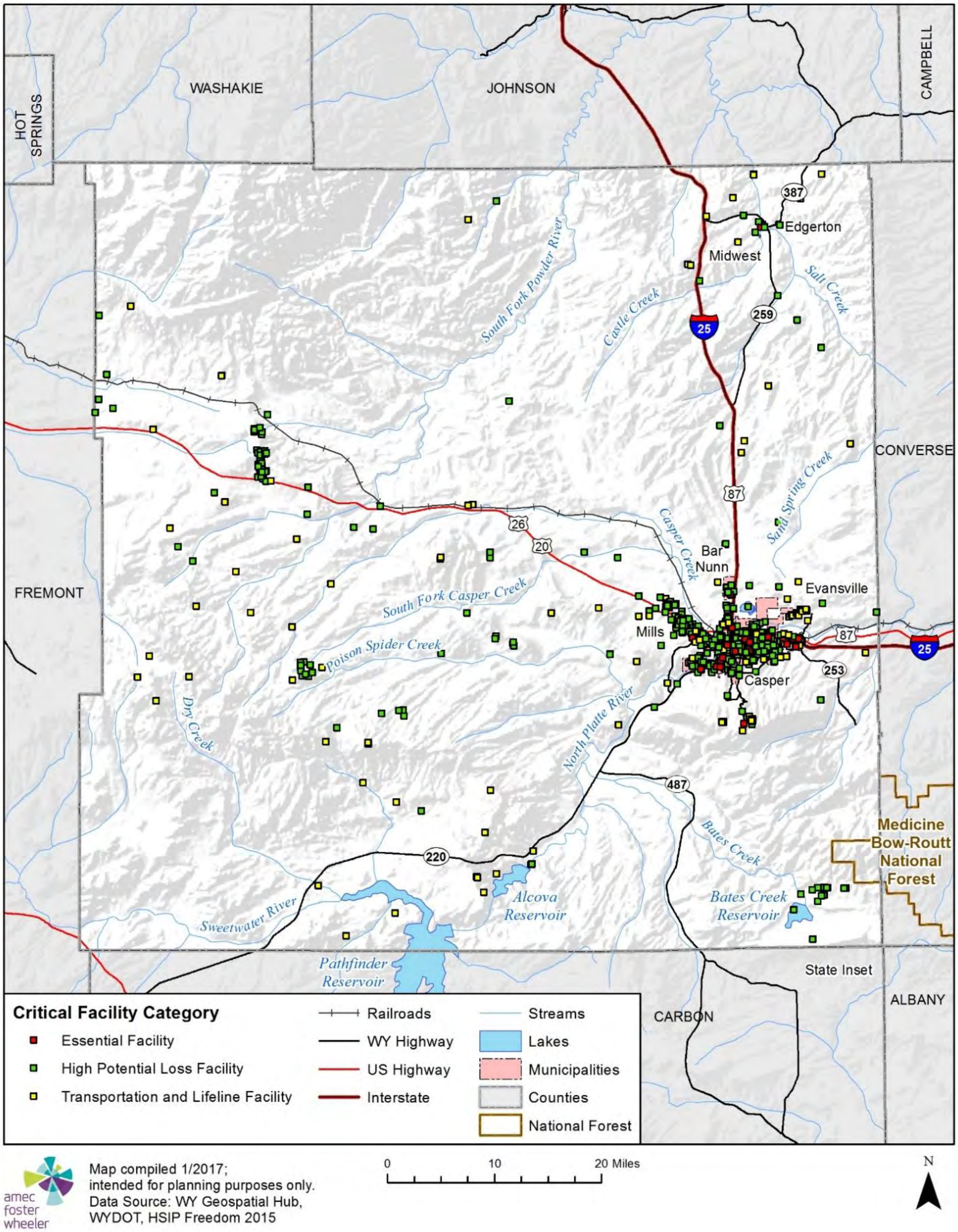


Table 4.5 Summary of Critical Facilities in Natrona County by Jurisdiction

Jurisdiction	Critical Facility Type	Facility Count
Bar Nunn	Day Cares	4
	EPA FRS Location	1
	Fire Department	1
	National Shelter System Facility	2
	School	1
	Total	9
Casper	Air Facility	1
	Assisted Living	10
	Bridge	18
	College/University	1
	Community Support	43
	Day Cares	88
	EPA FRS Location	303
	EPA Regulated Facility	2
	Fire Department	5
	Hospital	2
	Law Enforcement	7
	Local EOC	1
	Medical Facility	3
	National Shelter System Facility	30
	Nursing Home	9
	Private School	4
	Public Health Department	1
	School	25
	Special Medical Facility	45
	Substation	4
	Tier II	17
	Urgent Care Facility	2
	Total	621
Edgerton	Community Support	1
	Total	1
Evansville	Bridge	7
	Day Cares	2
	EPA FRS Location	4
	EPA Regulated Facility	1
	Fire Department	1
	Law Enforcement	1
	National Shelter System Facility	1
	School	1
	Tier II	6
	Total	24
Midwest	Fire Department	1
	Law Enforcement	1
	National Shelter System Facility	1
	School	1
	Total	4
Mills	Bridge	3
	Day Cares	7
	EPA FRS Location	16

	EPA Regulated Facility	4
	Fire Department	1
	Law Enforcement	1
	National Shelter System Facility	1
	School	1
	Tier II	11
	Total	45
Unincorporated	Air Facility	6
	Bridge	110
	Day Cares	6
	Electrical Facility	8
	EPA FRS Location	196
	EPA Regulated Facility	19
	Fire Department	2
	Law Enforcement	2
	National Shelter System Facility	5
	Non-Union Communications	83
	Power Plant	1
	School	6
	Substation	10
	Tier II	120
	Union Communications	17
	Total	591
	Grand Total	1,295

Source: Natrona County GIS, HSIP and HAZUS

Cultural, Historical, and Natural Resources

Assessing the County's vulnerability to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- In the event of a disaster, an accurate inventory of natural, historical and cultural resources allows for more prudent care in the disaster's immediate aftermath when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, for example, wetlands and riparian habitat which help absorb and attenuate floodwaters and thus support overall mitigation objectives.

Cultural and Historical Resources

Natrona County has a large stock of historically significant homes, public buildings, and landmarks. The **National Register of Historic Places** is the nation's official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the U.S. Department of the Interior National Park Service.

Table 4.6 Natrona County Historical Resources

City	Name	Address
Alcova	Pathfinder Dam Historic District	12 mi. SW. of Alcova
Arminto	Big Horn Hotel	Main St.
Arminto	Archeological Site No. 48NA83	Address Restricted
Bessemer Bend	DUX Bessemer Bend Bridge	Cty. Rd. CN1-58
Casper	Stone Ranch Stage Station	NW of Casper on US 20/26
Casper	Midwest Oil Company Hotel	136 E. 6th St.
Casper	Townsend Hotel	115 N. Centre St.
Casper	Independence Rock	60 mi. SW of Casper on WY 220
Casper	Bridger Immigrant Road---Waltman Crossing	49 mi. W of Casper on U.S. 20
Casper	Martin's Cove	W of Casper
Casper	Pathfinder Dam	45 mi. SW of Casper
Casper	Fort Caspar (Boundary Increase)	Area on N side of fort along Platte River
Casper	Fort Caspar	14 Fort Caspar Rd.
Casper	South Wolcott Street Historic District	Roughly bounded by S. Center St., E. Ninth St., S. Wolcott St., E. Seventh St., S. Beech St., and E. Thirteenth St.
Casper	Casper Buffalo Trap	Address Restricted
Casper	Rialto Theater	102 E. Second St.
Casper	Consolidated Royalty Building	137--141 S. Center St.
Casper	Casper Fire Department Station No. 1	302 S. David St.
Casper	Natrona County High School	930 S. Elm St.
Casper	Tribune Building	216 E. 2nd St.
Casper	North Casper Clubhouse	1002 E. L St.
Casper	Casper Motor Company--Natrona Motor Company	230 W. Yellowstone Hwy.
Casper	Church of Saint Anthony	604 S. Center St.
Casper	Elks Lodge No. 1353	108 E. 7th St.
Casper	Roosevelt School	140 E. K St.
Casper	Casper Federal Building	111 S. Wolcott St.
Casper	Bishop House	818 E. Second St.
Casper	Casper Army Air Base	8500 Fuller St.
Casper	Ohio Oil Company Building	159 N. Wolcott St.
Casper	Masonic Temple	105 N. Center St.
Casper	Grant Street Grocery and Market	815 S. Grant St.
Casper	Odd Fellows Building	136 S. Wolcott St.
Midwest	Teapot Rock	Off US 87
Muddy Gap	Split Rock, Twin Peaks	NW of Muddy Gap

City	Name	Address
Powder River	Chicago and Northwestern Railroad Depot	35231 W. Dakota Ave.

Source: National Register of Historic Places

It should be noted that these lists change periodically, and they may not include those currently in the nomination process and not yet listed. Additionally, as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

Many cultural and historical resources in the County are vulnerable to several hazards due to the nature of their construction. Some of these risks include earthquakes, wildfires or high winds damaging historic buildings.

Natural Resources

Natural resources are important to include in benefit/cost analyses for future projects and may be used to leverage additional funding for mitigation projects that also contribute to community goals for protecting sensitive natural resources. Awareness of natural assets can lead to opportunities for meeting multiple objectives. For instance, protecting wetlands areas protects sensitive habitat as well as reducing the force of and storing floodwaters.

Natural and Beneficial Functions

Floodplains can have natural and beneficial functions. Wetlands function as natural sponges that trap and slowly release surface water, rain, snowmelt, groundwater and flood waters. Trees, root mats, and other wetland vegetation also slow the speed of floodwaters and distribute them more slowly over the floodplain. This combined water storage and braking action lowers flood heights and reduces erosion. Wetlands within and downstream of urban areas are particularly valuable, counteracting the greatly increased rate and volume of surface water runoff from pavement and buildings. The holding capacity of wetlands helps control floods and prevents water logging of crops. Preserving and restoring wetlands, together with other water retention, can often provide the level of flood control otherwise provided by expensive dredge operations and levees.

Special Status Species

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e., endangered species) in the Planning Area. The US Fish and Wildlife Service maintains a list of threatened and endangered species nationwide. State and federal laws protect the habitat of these species through the environmental review process. Several additional species are of special concern or candidates to make the protected list.

Table 4.7 summarizes Natrona County's special status animal species in the Fish and Wildlife Service database.

Table 4.7 Threatened and Endangered Species in Natrona County

Name	Scientific Name	Status
Bald eagle	Haliaeetus leucocephalus	Recovery
Ute ladies' tresses	Spiranthes diluvialis	Threatened
Black-footed ferret	Mustela nigripes	Endangered
Gray wolf	Canis lupis	Recovery

Source: US Fish and Wildlife Service

Population, Growth and Development Trends

As part of the planning process, the HMPC looked at changes in growth and development, both past and future, and examined these changes in the context of hazard-prone areas, and how the changes in growth and development affect loss estimates and vulnerability.

The US Census Bureau estimated population of Natrona County for July 1, 2015 was 82,178, representing an 8.9% increase in population since 2010 (estimated at 75,450).

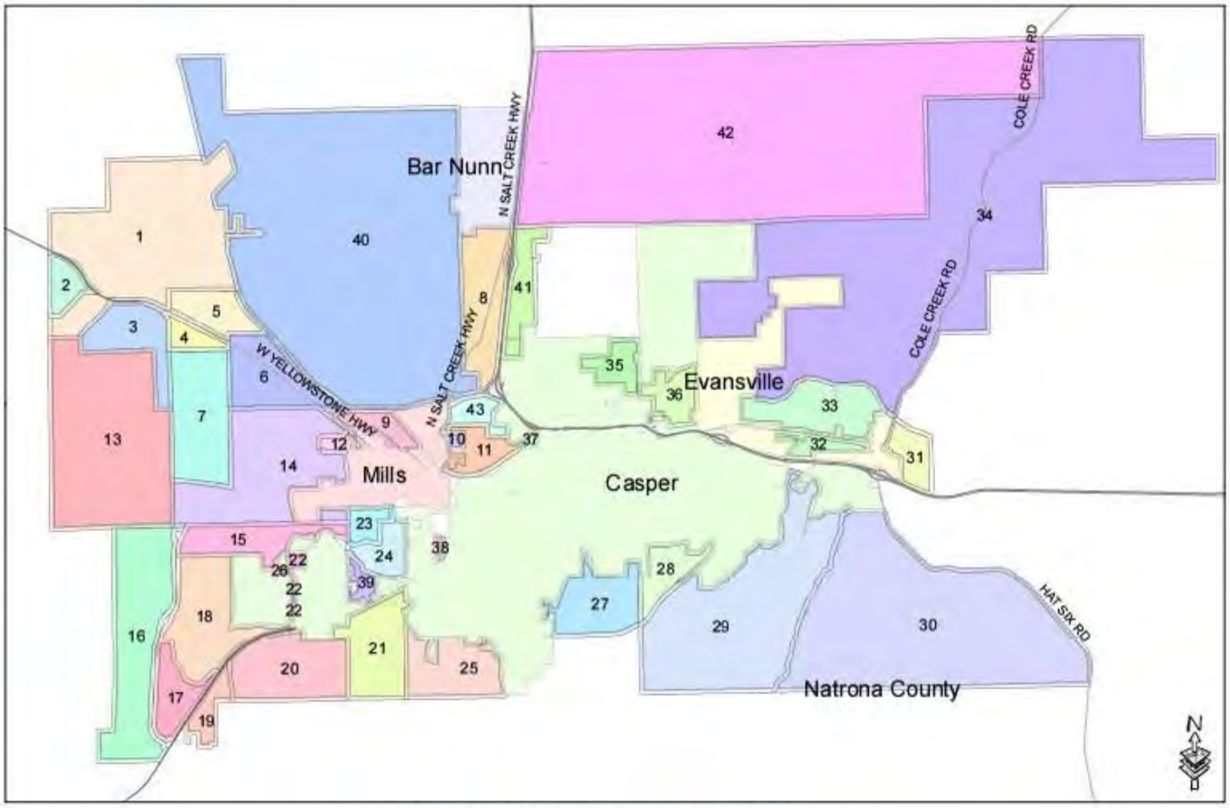
Development Trends

Natrona County Planning and Zoning Department recently published a 2016 Development Plan. The purpose of the plan is intended to:

- Establish land use designations for the urban and rural areas of the county, so that the urban and rural communities can develop in a logical manner;
- Establish land development policies so that the current zoning resolution and subdivision regulations can be updated and effectively administered;
- Establish through the Goals, Policies, and Actions, in Chapter 2, a program for implementation of the plan and actions to develop a planning program in the County
- Establish interagency coordination between the County, municipalities, and other agencies;

Chapter 5 of the Natrona Development Plan focuses on the Growth Management Area Plan and addresses planning neighborhoods based on location, size, transportation access, water, sewer, soils, topography, hydrology, floodplains, wildlife habitats, existing land use, current zoning, developmental capacity, and serviceability. The figure below shows the growth management areas exhibited in the plan. Many of these designated areas have vulnerable populations and most of the hazards profiled. An analysis of the address point layer in GIS allowed for quantifying the amounts of future buildings that could be located in hazard areas assuming that the addresses with a zero improved value or vacant parcel designation could contain development in the future. The results of this analysis are shown in the table that follows.

Table 4.8 Growth Management Area Neighborhoods by Number



Growth Management Area
Neighborhoods by Number

Figure 5-A

Source: Natrona Development Plan

Table 4.9 Potential Future Development Property Counts by Hazard and Jurisdiction

Jurisdiction	Parcel Count	Address Count	1% Annual Chance	0.2% Annual Chance	Redzone Fire Hazard	Landslide Complex	Landslide Debris	Expansive Soil Hazard
Bar Nunn	131	139	-	-	91	-	-	79
Casper	1,376	1,462	24	61	182	-	-	943
Edgerton	52	60	-	-	19	-	-	60
Evansville	70	73	4	29	-	-	-	1
Midwest	46	48	-	-	-	-	-	48
Mills	79	139	1	2	-	-	-	81
Unincorporated	1,189	1,544	58	14	374	4	1	647
Total	**2,943**	**3,465**	**87**	**106**	**666**	**4**	**1**	**1,859**

4.3 Hazard Profiles

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the…location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

The hazards identified in Section 4.1 Identifying Hazards are profiled individually in this section. Much of the profile information came from the same sources used to initially identify the hazards.

Profile Methodology

Each hazard is profiled in a similar format that is described below:

Hazard/Problem Description

This subsection gives a description of the hazard and associated problems, followed by details on the hazard specific to the County.

Geographical Area Affected

This subsection discusses which areas of the County are most likely to be affected by a hazard event.

Limited: Less than 10 percent of the planning area

Significant: 10 to 50 percent of the planning area

Extensive: 50 to 100 percent of the planning area

Past Occurrences

This subsection contains information on historic incidents, including impacts where known. Information provided by the HMPC is included here along with information from other data sources, including the National Climatic Data Center (NCDC) and SHELDUS where available.

SHELDUS is a county-level data set for the United States that tracks 18 types of natural hazard events along with associated property and crop losses, injuries, and fatalities. In 2014 this formerly free database transitioned into a fee-based service. Due to this and the availability of similar data in NCDC databases it was not used as a resource during the 2017 plan update except for when the data was already available.

When available, tables showing county-specific data from the NCDC and SHELDUS databases may be found in each hazard profile.

Frequency/Likelihood of Occurrence

The frequency of past events is used in this section to gauge the likelihood of future occurrences. Based on historical data, the likelihood of future occurrences is categorized into one of the following classifications:

- **Highly Likely**—Near 100 percent chance of occurrence in next year, or happens every year.
- **Likely**—Between 10 and 100 percent chance of occurrence in next year, or has a recurrence interval of 10 years or less.
- **Occasional**—Between 1 and 10 percent chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
- **Unlikely**—Less than 1 percent chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

The frequency, or chance of occurrence, was calculated where possible based on existing data. Frequency was determined by dividing the number of events observed by the number of years and multiplying by 100. Stated mathematically, the methodology for calculating the probability of future occurrences is:

$$\frac{\text{\# of known events}}{\text{years of historic record}} \times 100$$

This gives the percent chance of the event happening in any given year. An example would be three droughts occurring over a 30-year period which equates to 10 percent chance of that hazard occurring any given year.

Potential Magnitude

This subsection discusses the potential magnitude of impacts, or extent, from a hazard event. Magnitude classifications are as follows:

- **Catastrophic**—More than 50 percent of property severely damaged, and/or facilities are inoperable or closed for more than 30 days. More than 50 percent agricultural losses. Multiple fatalities and injuries. Critical indirect impacts.
- **Critical**—25 to 50 percent of property severely damaged, and/or facilities are inoperable or closed for at least 2 weeks. 10-50 percent agricultural losses. Injuries and/or illnesses result in permanent disability and some fatalities. Moderate indirect impacts.
- **Limited**—10 to 25 percent of area affected. Some injuries, complete shutdown of critical facilities for more than one week, more than 10 percent of property is severely damaged.
- **Negligible**—Less than 10 percent of area affected. Minor injuries, minimal quality-of-life impact, shutdown of critical facilities and services for 24 hours or less, less than 10 percent of property is severely damaged.

Vulnerability Assessment

Vulnerability is the measurement of exposed structures, critical facilities or populations relative to the risk of the hazard. For most hazards, vulnerability is a best-estimate. Some hazards, such as flood, affect specific areas so that exposure can be quantified, and vulnerability assessments result in a more specific approximation. Other hazards, such as tornados, are random and unpredictable in location and duration that only approximate methods can be applied.

Future Development

This section describes how the hazard could impact future development.

Summary

This section summarizes risk according to the area affected, likelihood, and magnitude of impacts. If the hazard has impacts on specific towns or cities in the County they are noted here, where applicable.

4.3.1 Dam Failure

Hazard/Problem Description

Dams are man-made structures built for a variety of uses, including flood protection, power, agriculture, water supply, and recreation. Dams typically are constructed of earth, rock, concrete, or mine tailings. Dams and reservoirs serve a very important role for Wyoming residents and industry. Rarely, however, the dams fail, either completely or partially, and become a significant hazard for those downstream.

Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, which can affect life and property. Two factors that influence the potential severity of a full or partial dam failure are the amount of water impounded and the density, type, and value of development and infrastructure located downstream.

Dam failure occurs when the retention function of the dam is compromised, in part or in its entirety. Damage to a dam structure that may result in a failure may be caused by many sources:

- Prolonged periods of rainfall and flooding, which result in overtopping
- Earthquake
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage or piping or rodent activity
- Improper design
- Age
- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway
- Vandalism or terrorism

A dam failure is not the only type of emergency associated with dams. Spillway discharges that are large enough to cause flooding in downstream areas or flooding upstream of dams due to backwater effects or high pool levels are both considered dam emergencies and may cause significant property damage and loss of life.[1]

Dam failures can be classified into four classifications: overtopping, foundation failure, structural failure, and other unforeseen failures. Overtopping failures result from the uncontrolled flow of water over, around, and adjacent to the dam. Earthen dams are most susceptible to this type of failure. Hydraulic failures account for approximately 28% of all dam failures. Foundation and structural failures are usually tied to seepage through the foundation of the main structure of the dam. Deformation of the foundation or settling of the embankment can also result in dam failure. Structural failures account for approximately 28% of all dam failures, and foundation problems account for another 25%. Earthquakes or sabotage account for 12% of all dam failures, while inadequate design and construction account for the remaining 7% of failures.

Dam failures result in a unique source of flash flooding, when a large amount of previously detained water is suddenly released into a previously dry area due to a failure in some way of the dam. Dams are classified into three classes. The State of Wyoming has adopted FEMA's risk classifications as set forth in FEMA's *Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams*. These guidelines define High Hazard (Class I) dams as those rated based on an expected loss of human life, should the dam fail, and Significant Hazard (Class II) dams as those rated based on expected significant damage, but not loss of human life. Significant damage refers to structural damage where humans live, work, or recreate; or public or private

[1] US Army Corps of Engineers *Flood Emergency Plans: Guidelines for Corps Dams*. Hydrologic Engineering Center, (June 1980) p 4.

facilities exclusive of unpaved roads and picnic areas. Damage refers to making the structures inhabitable or inoperable.

Geographical Area Affected

In 1981, the U.S. Army Corps of Engineers completed an inspection program for nonfederal dams under the National Dam Inspection Act (P.L. 92-367). This was a four-year work effort and included compiling an inventory of about 50,000 dams and conducting a review of each state's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of dams. Part of the inspection included evaluating the dams and assigning a hazard potential based on the effects downstream should one of the dams fail. The dams were rated (1) High, (2) Significant, and (3) Low hazard. The Corps of Engineers based the hazard potential designation on such items as acre-feet capacity of the dam, distance from nearest community downstream, population density of the community, and age of the dam.

There were 1,458 dams in Wyoming that were reviewed by the Corps of Engineers. Of that number 38 were rated high hazard, 56 were rated significant hazard, and the remaining 1,364 were rated low hazard. The Wyoming State Engineers Office inspects dams over 20 feet high or with a storage capacity of 50 acre-feet or more, although smaller dams are also inspected in highly populated areas. According to the WSEO web site[2], the WSEO regulates 1,515 dams. As a part of the regulatory process the WSEO inspects these dams once every five years. Of these dams, 84 are rated high hazard, 106 are rated significant hazard, and 1,325 are rated low hazard.

Figure 4.2 shows the dams affecting Natrona County. This list includes 4 dams upstream of Pathfinder Reservoir in Carbon County that have the potential to harm Natrona County if a cascading failure occurred. Eight dams are classified as High Hazard (Class 1) and eleven are classified as Significant hazard (Class II). Table 4.10 below provides details of the High and Significant Hazard Dams. Note in the inset map of Figure 4.2, that several smaller dams are in close proximity to the Casper area, many of which function as flood detention facilities.

[2] www.seo.wyo.gov

Figure 4.2 Locations of High and Significant Dams Affecting Natrona County

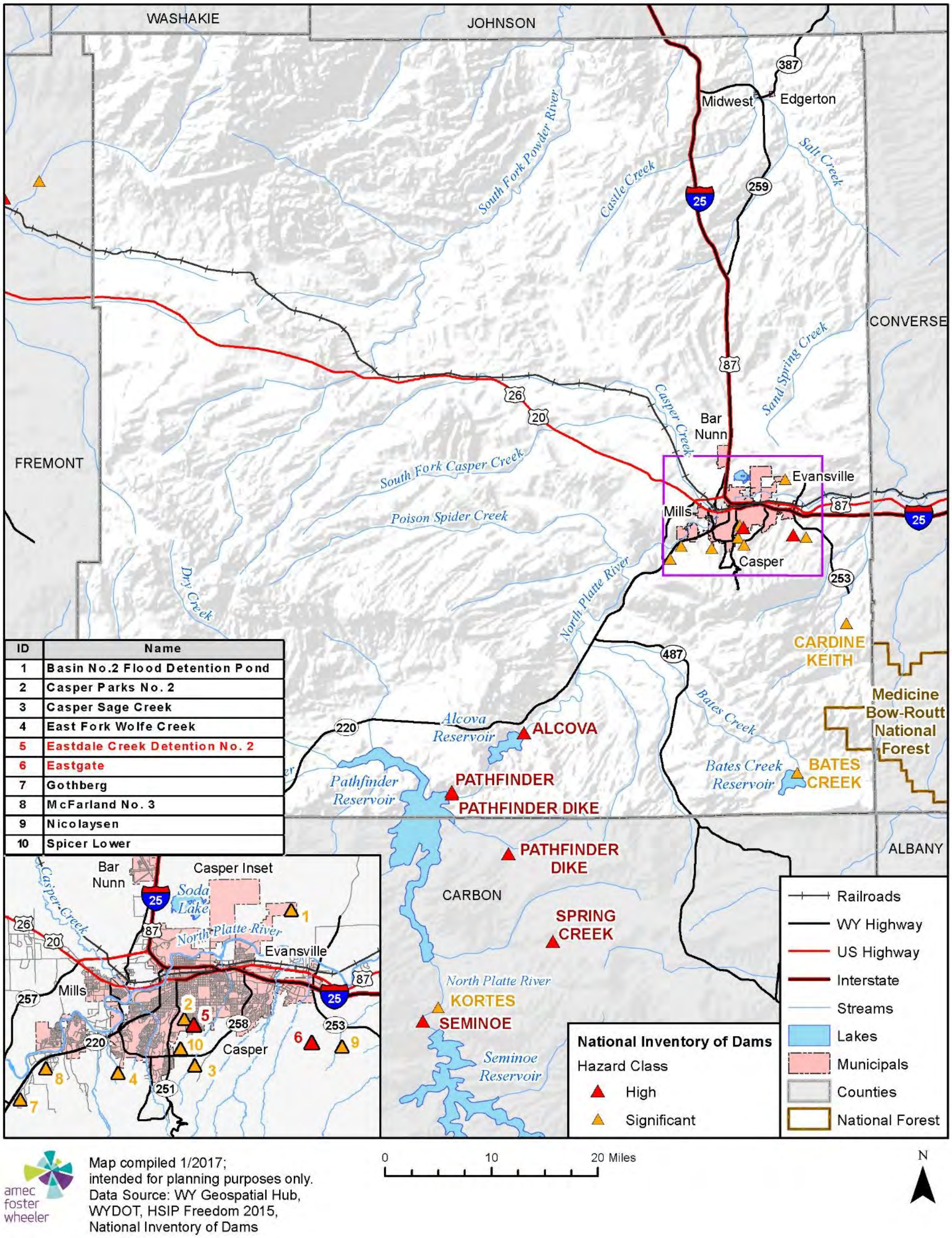


Table 4.10 High and Significant Hazard Dams Affecting Natrona County

Dam Name	Owner	River	Hazard Class	Nearest City	Distance To City	EAP	Maximum Capacity
Alcova	DOI BR	North Platte River	High	Casper	30	Y	184,300
Eastdale Creek Detention No. 2	City of Casper	Holman Draw	High	Casper	0	Y	83
Eastgate	Eastgate Ranch LLC	Jones Draw	High	Hat Six Road	1	Y	717
Pathfinder	DOI BR	North Platte River	High	Casper	45	Y	1,016,500
Pathfinder Dike	DOI BR	North Platte River	High	Casper	46	Y	1,016,500
Pathfinder Dike*	USBR	North Platte River Offstream	High	Casper	45	Y	1,128,087
Seminoe*	DOI BR	North Platte River	High	Red Buttes	64	Y	1,017,279
Spring Creek* (Enlargement)	private	Spring Creek	High	Leo	7	N	58
Basin No. 2 Flood Detention Pond	Natrona Co Intl Airport (BD of Trustees)	Airport Draw	Significant	Casper	1	N	0
Bates Creek	Bates Creek Reservoir Company	Dry Fork Bates Creek	Significant	Casper	44	N	8,885
Cardine Keith	private	Skeen Creek	Significant	Glenrock	23	N	169
Casper Parks No. 2	City of Casper, ATT: Gary Clough	Holman Draw	Significant	Casper	1	N	48
Casper Sage Creek	City of Casper, ATT	Sage Creek	Significant	Casper	2	N	165
East Fork Wolfe Creek	private	East Fork Wolf Creek	Significant	Casper	5	N	45
Gothberg	private	Dobbins Spring Creek	Significant	Casper	1	N	0
Kortes*	DOI BR	North Platte River	Significant	None	0	Y	4,739
McFarland No. 3	private	East Fork Webb Creek	Significant	Hwy 220	0.5	N	20
Nicolaysen	private	Dry Muddy Creek	Significant	Big Muddy Oil Field	10	N	475
Spicer Lower	private	Holman Draw-Offstream	Significant	Casper	0	N	0

*dams located outside of county

Source: National Inventory of Dams

Alcova Dam is a 265-foot tall zoned earthfill dam operated by the U.S. Bureau of Reclamation for water storage and hydroelectric power generation. Alcova Canyon was first surveyed for potential dam sites in 1903. In 1921 a dam was proposed at Alcova to divert water to Casper. Earthfill placement started in 1936 and was completed in 1937. The reservoir was filled in 1938 and the power plant was not started until 1952 and completed three years later.

Pathfinder Dam is a cyclopean masonry dam located on the North Platte River. Constructed between 1905 and 1909, it has been modified several times since becoming part of the North Platte Project. After delays caused by flood waters, the dam was completed on June 14, 1909. However, unusual summer rains filled the reservoir, overtaxed the spillways and threatened to overtop the unfinished auxiliary dike south of the dam, possibly allowing the river to cut a new, lower channel and potentially leaving the dam site dry. Explosive charges were placed in the crest of the main dam, to be used if the overflow occurred, thus keeping the lowest point at the dam. The dike held and the charges were not needed, but did have to be removed by explosives experts in 1949. An auxiliary dike was built at the location in 1910 to develop the reservoir's full capacity. The potential overtopping gave rise to sensational stories in Denver newspapers and caused annual nervousness in Casper downstream for a number of years thereafter. The reservoir exceeded capacity in 1984, 2010 and 2011, with overflow water diverting into the spillway to the immediate north of the dam. The dam spillway overflowed again in June 2016 due to a high amount of snowmelt runoff.

Seminoe Dam is a concrete thick-arch dam on the North Platte River in the U.S. state of Wyoming. The dam stores water for irrigation and hydroelectricity generation, and is owned and operated by the U.S. Bureau of Reclamation. It is the uppermost dam on the North Platte River and is located directly upstream from the Kortes Dam. It lies in a narrow, isolated canyon formed by the North Platte cutting through the Seminoe Mountains about 40 miles (64 km) northeast of Rawlins. The 295-foot (90 m) dam forms Seminoe Reservoir, which covers more than 20,000 acres (8,100 ha) when full.

Past Occurrences

Natrona County has suffered from dam failures in the past, some of which resulted in loss of life and damage to property. In 1906, snow melt flooding along the North Platte in Casper caused the failure of a diversion dam. The flooding destroyed a railroad embankment and resulted in a train wreck that claimed 12 lives. The HMPC explained that this event in 1906 may have been more of an embankment failure. Snow melt flooding caused another dam to fail in 1984. Dozens of residences, businesses, and farms were impacted for a total of $5 million in damages to the area.

In September of 1982, the Shriner Reservoir Dam along the South Casper Creek was reported as having completely failed. No impacts were recorded from this failure.

The HMPC reported that the Pathfinder Reservoir is full and expected to use the spillway for excess flow this spring, as occurred in 2016.

Frequency/Likelihood of Future Occurrences

Based on the past occurrences a dam fails in the county on average every 36 years, which equates to an **occasional** rating. The structural integrity of dams depends on regular inspections and maintenance, which do not always happen. Additionally, a number of the dam failures in Wyoming and other Rocky Mountain states occurred because of snow melt flooding that exceeded the capacity and strength of levees and dams. The County's dams will continue to be tested by snow melt, heavy rains, and other types of floods nearly every year. Thus, dam failures could possibly threaten Natrona County.

Potential Magnitude of Impacts

Potential impacts could include injury and loss of life, property damage, damage to infrastructure, drinking water contamination, loss of crops and livestock, evacuations and sheltering and associated costs, interruption of commerce and transportation, search and rescue, and clean-up costs. In addition, dam failure and associated flooding can cause damage to and loss of irrigation structures such as headgates and ditches. Loss or damage to water structures negatively impacts agricultural producers of crops and livestock, and can be costly to repair.

The severity and magnitude of a given dam failure will vary on a county basis and case-by-case basis. This information is considered sensitive and is not detailed due to Homeland Security concerns. Emergency management coordinators have access to inundation maps contained in the emergency action plans for the High Hazard dams in the State. High Hazard (Class I) dams, by definition, would merit a magnitude/severity rating of **catastrophic**, whereas Significant Hazard (Class II) dams rate as **critical** and Low Hazard dams fall into the **limited** rating. The magnitude/severity rating for the hazard in the County is considered mostly **critical**, mostly due to the number of Class I dams that could impact highly populated communities such as Casper.

Vulnerability Assessment

The failure of Pathfinder Dam or Alcova Dam could result in hundreds of millions of dollars of damage in downstream communities, although the probability of such an event is low.

Active faults lie very close to both Pathfinder and Alcova Reservoirs (see earthquake section). The North Granite Mountains fault system lies to the north of the reservoirs and the South Granite Mountains fault system lies to the south. The County has an Emergency Action Plan for each of these dams. These emergency action plans include specific information on flood damages if either of these dams failed. However, due to the sensitive nature of this information, it is not included in this plan. Specific details will not be given regarding the population, property, critical infrastructure or community resources that would be affected. However, if Pathfinder or Alcova Dam failed, Casper, Evansville, and Mills would be significantly impacted. The failure of these dams could result in millions of dollars of damage in the communities upstream. Several lives could be lost as well.

Another concern is the aging of the dams. Of the 1,548 dams in the State inventory, 860 or 56% were constructed before 1965 and are over fifty years old. Of the 19 dams that affect Natrona County, 13 or 68% were constructed before 1965 and are over fifty years old.

Future Development

As communities or unincorporated areas grow, previously lower-classified dams may pose greater risks, which could elevate their hazard classification. Inundation maps and emergency action plans should be consulted in the planning of new development, where applicable. Growth rates in the region do not indicate that risk is increasing substantially.

Summary

Overall, dam failure significance ranges from high to low dependent upon location in the County. The probability of such an event is low, but impacts could be significant depending upon the dam involved and where it occurred in the region.

Table 4.11 Natrona County Dam Failure Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Bar Nunn	Limited	Limited	Unlikely	Low/NA
Casper	Significant	Significant	Occasional	Medium
Edgerton	Limited	Limited	Unlikely	Low/NA
Evansville	Limited	Limited	Occasional	Medium
Midwest	Limited	Limited	Unlikely	Low/NA
Mills	Significant	Significant	Occasional	Medium
Natrona County	Limited	Limited	Occasional	Low

4.3.2 Drought

Hazard/Problem Description

Drought is described as a protracted period of deficient precipitation resulting in extensive damage to vegetation. Of all the natural weather-related disasters, drought is by far the most costly to society; it indirectly kills more people and animals than the combined effects of hurricanes, floods, tornadoes, blizzards, and wildfires. Unlike other disasters that quickly come and go, drought's long-term unrelenting destruction has been responsible in the past for mass migrations and lost civilizations. The 1980 and 1988 droughts in the US resulted in approximately 17,500 heat-related deaths and an economic cost of over $100 billion. Drought occurs in four stages and is defined as a function of its magnitude (dryness), duration, and regional extent. Severity, the most commonly used term for measuring drought, is a combination of magnitude and duration.

The first stage of drought is known as a meteorological drought. The conditions at this stage include any precipitation shortfall of 75% of normal for three months or longer. The second stage is known as agricultural drought. Soil moisture is deficient to the point where plants are stressed and biomass (yield) is reduced. The third stage is the hydrological drought. Reduced stream flow (inflow) to reservoirs and lakes is the most obvious sign that a serious drought is in progress. The fourth stage is the socioeconomic drought. This final stage refers to the situation that occurs when physical water shortage begins to affect people.

As these stages evolve over time, the impacts to the economy, society, and environment converge into an emergency situation. Without reservoir water to irrigate farms, food supplies are in jeopardy. Without spring rains for the prairie grasslands, open range grazing is compromised. Without groundwater for municipalities, the hardships to communities result in increases in mental and physical stress as well as conflicts over the use of whatever limited water is available. Without water, wetlands disappear. The quality of any remaining water decreases due to its higher salinity concentration. There is also an increased risk of fires, and air quality degrades as a result of increased soil erosion due to strong winds and blowing dust.

Geographical Area Affected

Droughts are often regional events, impacting multiple counties and states simultaneously; therefore, it is reasonable to assume that a drought will impact the entire county at the same time. According to the Wyoming State Climate Office, Wyoming is the 5th driest state in the U.S. Drought can be a normal occurrence in Wyoming due to the State's natural climate. Based on this information, the geographic extent rating for drought in Natrona County is extensive.

The North Platte is the main water source, of which the State of Nebraska has significant primacy/water rights.

Past Occurrences

The county has experienced several multi-year droughts over the past several decades. The most severe statewide drought in recent history started in 1999, but began in earnest in the spring of 2000 and lingered through 2004. 2005 was a wetter year, technically signifying the end of the drought period. Dry conditions returned in the following years and became especially severe between 2006 and 2007. According to the Wyoming State Climate Office, "conditions eased somewhat in mid-2008, but a near decade with warm temperatures and relatively little precipitation has left [Wyoming] very vulnerable" (http://www.wrds.uwyo.edu/sco/drought/drought.html). Another particularly intense but short drought occurred in 2012.

The 1999-2004 drought is considered by many to be the most severe in collective memory. According to instrument records, since 1895 there have been only seven multi-year (three years or longer) statewide droughts. Based on deficit precipitation totals (negative departures from the long term average), they are ranked statewide.

Table 4.12 Significant Multi-Year Wyoming Droughts of the Modern Instrumented Era

Years	Average Annual Precipitation (inches)	Percent of 1985-2006 Average Annual Precipitation (13.04")
1952-1956	10.65	81.69%
1900-1903	10.76	82.52%
1999-2004	11.07	84.89%
1987-1990	11.12	85.28%
1958-1964	11.67	89.49%
1974-1977	11.77	90.26%
1931-1936	11.79	90.41%

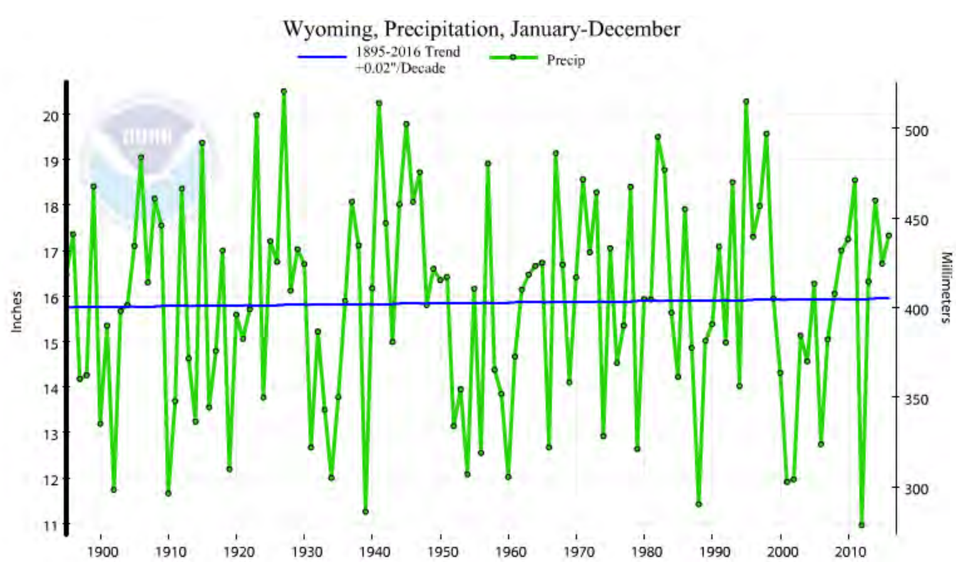
Source: Wyoming Climate Atlas

Widespread droughts in Wyoming, as determined from stream flow records, were most notable during three periods: 1929-1942, 1948-1962, and 1976-1982.

Natrona County was listed in three USDA drought disaster declarations in 2006, 2007 and 2009. Natrona County was included as a contiguous county for a 2016 USDA drought declaration.

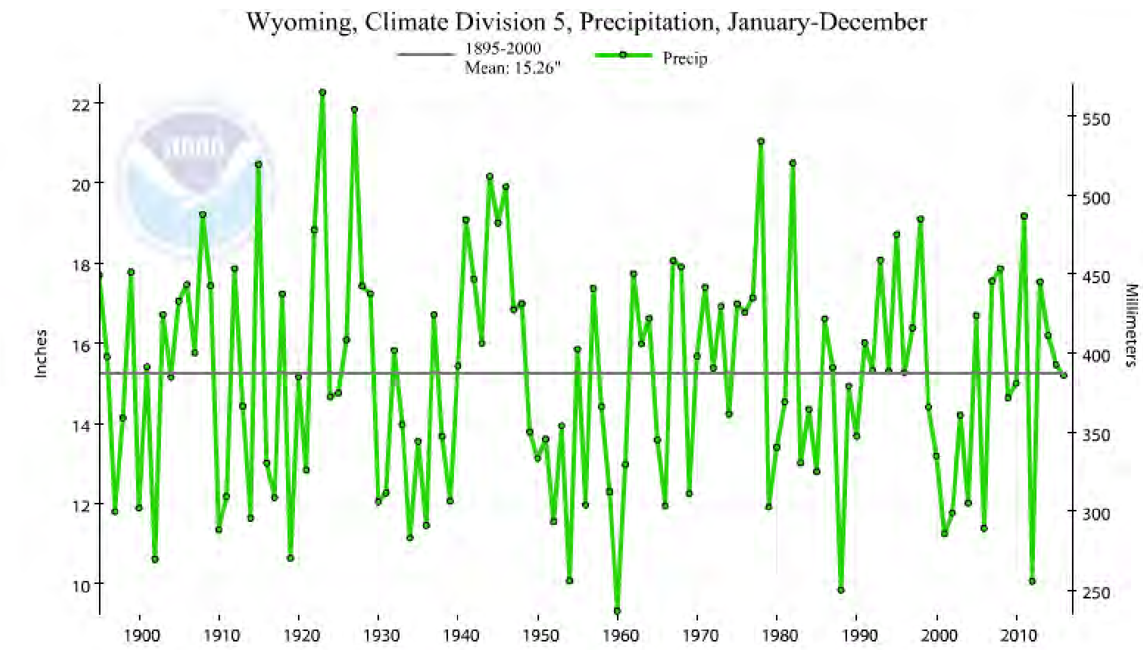
As a whole, Wyoming's precipitation record from 1895-2016 reveals that, for the first half of the 20th century (except for the Dust Bowl years of the 1930s), there was generally a surplus of moisture. These trends are displayed in the following figures. During the second half of the 20th century and into the 21st century there was an increasing trend of increased periods of drought.

Figure 4.3 Wyoming Annual Precipitation: 1895-2016



Source: http://www.ncdc.noaa.gov/cag/time-series/

Figure 4.4 Powder, Little Mo and Tongue Basin Annual Precipitation: 1895-2016

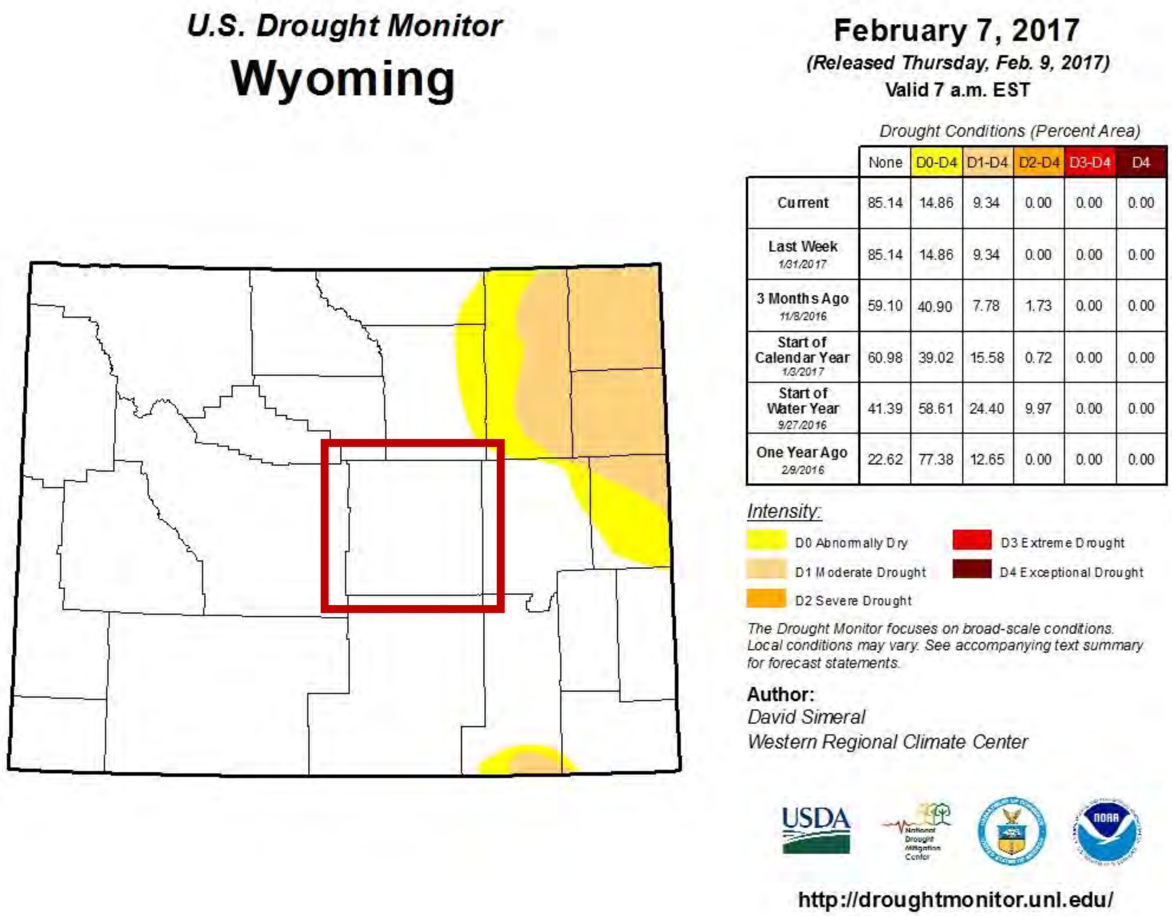


Source: National Oceanic and Atmospheric Administration

The U.S. Drought Monitor provides a general summary of current drought conditions. The U.S. Department of Agriculture (USDA), the National Oceanic and Atmospheric Administration (NOAA), and the National Drought Mitigation Center (University of Nebraska-Lincoln) collaborate on this weekly product, which is released each Thursday. Multiple drought indicators, including various indices, outlooks, field reports, and news accounts are reviewed and synthesized. In addition, numerous experts from other agencies and offices across the country are consulted. The result is the consensus assessment presented on the USDM map. The image is color-coded for four levels of drought intensity. An additional category, "Abnormally Dry," is used to show areas that might be moving into a drought, as well as those that have recently come out of one. The dominant type of drought is also indicated (i.e. agricultural and/or hydrological).

As of January 7, 2017, no drought conditions are identified in Natrona County.

Figure 4.5 U.S. Drought Monitor



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	85.14	14.86	9.34	0.00	0.00	0.00
Last Week 1/31/2017	85.14	14.86	9.34	0.00	0.00	0.00
3 Months Ago 11/8/2016	59.10	40.90	7.78	1.73	0.00	0.00
Start of Calendar Year 1/3/2017	60.98	39.02	15.58	0.72	0.00	0.00
Start of Water Year 9/27/2016	41.39	58.61	24.40	9.97	0.00	0.00
One Year Ago 2/9/2016	22.62	77.38	12.65	0.00	0.00	0.00

Another useful resource to determine the impacts of drought is the Drought Impact Reporter (DIR), launched by the National Drought Mitigation Center in July 2005 as the nation's first comprehensive database of drought impacts. The Drought Impact Reporter is an interactive web-based mapping tool designed to compile and display impact information across the United States in near real-time from a variety of sources such as media, government agencies, and the public.

Information within the Drought Impact Reporter is collected from a variety of sources including the media, government agencies and reports, and citizen observers. Each of these sources provides different types of information at different spatial and temporal scales.

A search of the database for Natrona County from 2007 to 2016 (which includes the most recent severe droughts) shows a total of 128 reported impacts. The most reported impacts (52) are in the Agricultural category. The following table shows total impacts by category for the county.

Table 4.13 Natrona County Drought Impact Reporter Summary 2007-2016

Category	Total Number of Impacts Recorded
Agriculture	52
Plants and Wildlife	35
Society and Public Health	15
Water Supply and Quality	26
Fire	32
Relief, Response and Restrictions	28
Tourism and Recreation	4
Total	128

Source: http://droughtreporter.unl.edu/map/

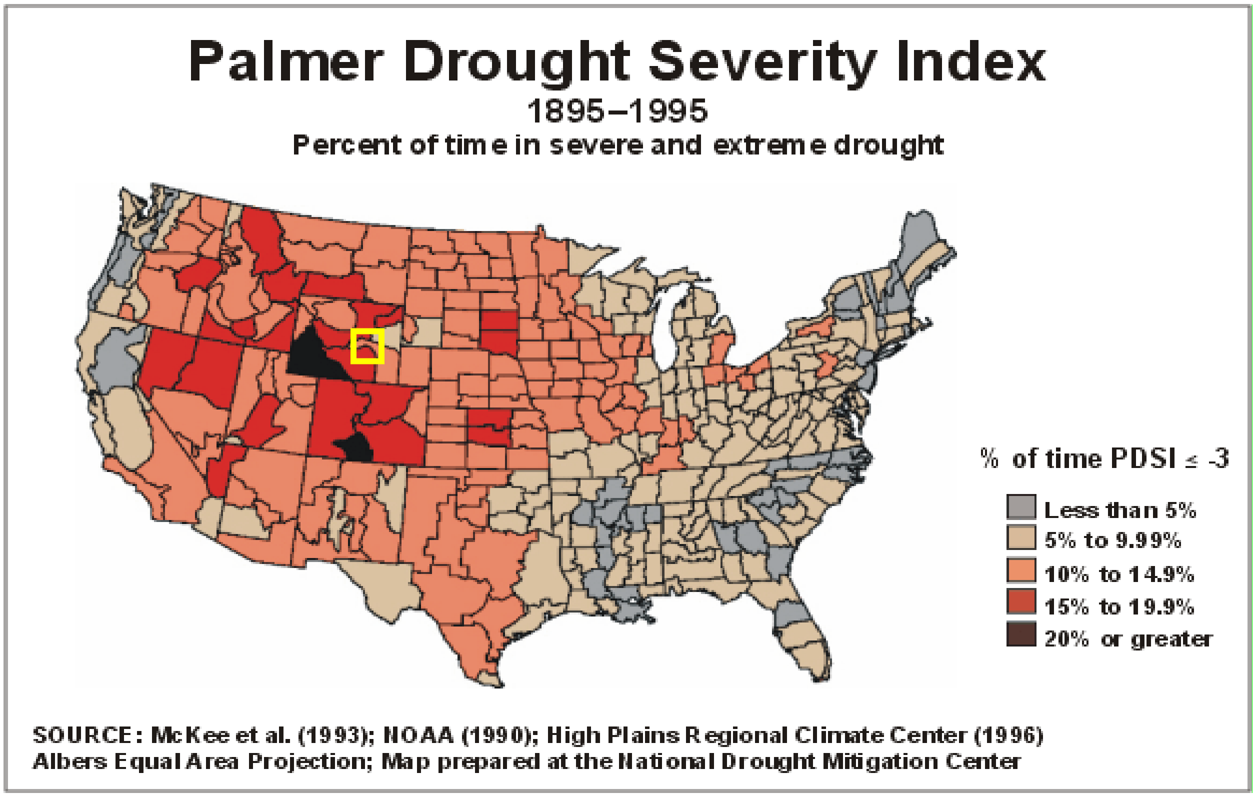
Drought effects associated with agriculture include damage to crop quality; income loss for farmers due to reduced crop yields; reduced productivity of cropland; reduced productivity of rangeland; forced reduction of foundation stock; and closure/limitation of public lands to grazing, among others. The Relief, Response & Recovery category refers to drought effects associated with disaster declarations, aid programs, requests for disaster declaration or aid, water restrictions, or fire restrictions.

Specific recorded impacts included reports on reduced yields, fire danger, water availability and impacts to livestock and wildlife.

Frequency/Likelihood of Future Occurrence

The Palmer Drought Severity Index indicates that Natrona County experienced severe or extreme drought conditions between 10% and 19% of the time between 1895 and 1995. This is consistent with the data in the Past Occurrences subsection which suggests that severe multi-year droughts have occurred roughly every ten years since the mid-20th century. An occurrence interval of roughly once every ten years corresponds to a **likely** frequency of occurrence.

Figure 4.6: Palmer Drought Severity Index for the Continental U.S.: 1895-1995



Natrona County indicated by yellow outline

Potential Magnitude

In order to calculate a magnitude and severity rating for comparison with other hazards, and to assist in assessing the overall impact of the hazard on the planning area, information from the event of record is used. In some cases, the event of record represents an anticipated worst-case scenario, and in others, it is a reflection of a common occurrence. Based upon information in the past occurrences discussion the drought of 1999-2004 is as significant, if not more significant than any other droughts in the last 100 years for the entire state. Data derived from the Wyoming Climate Atlas indicates that the most significant droughts in the last century, in terms of precipitation deficit, were in 1952-1956 and 1999-2004. In order to determine which drought period had the most significant impact on Wyoming, crop production and livestock inventory data for the two periods were compared. 1957 and 2005 were wetter years, with annual statewide precipitation totals above the 1895-2015 average. Those two years were used as endpoints for the droughts that started in 1952 and 1999 respectively. In both cases, the years following saw a return to drier conditions. Because of this, the most recent drought impacts were also calculated for 2005 and 2006, and are included in summary tables. The following tables show peak decline (%) in production during drought compared to the 5-year pre-drought production average for various commodities.

A comparison of peak commodity production changes in the late 1940s and early 1950s, and peak commodity production changes between 1994 and 2004 indicate that drought impacts to the Wyoming agricultural community were greater in the 1999-2004 drought than in the 1952-1956 drought. With the exception of dry beans, all commodities in the worst years of the 1999-2004 drought showed a greater percentage decline in production than in the 1952-1956 drought. As a result, the 1999-2004 drought will be used as the drought of historic record to calculate dollar impacts.

Table 4.14 Peak Commodity Production Changes from Pre-Drought (1947-1951) to Drought (1952-1956)

Commodity	5-Year Pre-Drought Production Average (1947-1951)	Units	Lowest Production During Drought (1952-1956)	Year of Lowest Production (1952-1956)	Percent Change
Winter Wheat	5,072	1,000 bu.	2,346	1954	-54%
Spring Wheat	1,579	1,000 bu.	600	1954	-62%
Barley	4,414	1,000 bu.	2,700	1956	-39%
Oats	4,577	1,000 bu.	2,470	1954	-46%
Dry Beans	1,009	1,000 cwt.	589	1955	-42%
Sugarbeets	413	1,000 tons	421	1955	+2%
Corn	227	1,000 bu.	161	1953	-29%
Alfalfa Hay	490	1,000 tons	675	1954	+38%
Other Hay	674	1,000 tons	442	1954	-34%
Cattle/ Calves Inventory	1,050	1,000 head	1,096	1954	+4%

Table 4.15 Peak Commodity Production Changes from Pre-Drought (1994-1998) to Drought (1999-2004)

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	Lowest Production During Drought (1999-2006)	Year of Lowest Production (1999-2006)	Percent Change
Winter Wheat	6029	1,000 bu.	2375	2002	-61%
Spring Wheat	648	1,000 bu.	96	2002	-84%
Barley	8383	1,000 bu.	4680	2002	-44%
Oats	1648	1,000 bu.	600	2005	-64%
Dry Beans	691	1,000 cwt.	514	2001	-26%
Sugarbeets	1151	1,000 tons	659	2002	-43%
Corn	6328	1,000 bu.	4165	2002	-34%
Alfalfa Hay	1581	1,000 tons	1150	2002	-27%
Other Hay	817	1,000 tons	450	2002	-45%
Cattle/ Calves Inventory	1536	1,000 head	1300	2004	-16%

Economic Impacts

Agricultural dollar impacts can also be used to show the effects of drought. Data was obtained from the U.S. Department of Agriculture (USDA) Quick Stats database (https://quickstats.nass.usda.gov).

The data below represent changes in production value for crops and changes in inventory value for cattle and calves. As such, the data should be considered impact value versus loss value. For example, with cattle and calves (Table 4.16 through Table 4.24) inventory, the inventory has decreased during the drought. Therefore the value of inventory on hand has decreased. The inventory decreased, however, because of the sale of the cattle and calves. The sales resulted in an increase in cash receipts to the farming and ranching community. The net result, however, is a decrease in inventory value, which is a negative drought impact.

Table 4.16 1999 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	1999 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6029	1,000 bu.	6105	$2.12/bu	+ 161,120
Spring Wheat	648	1,000 bu.	264	$2.54/bu	- 976,376
Barley	8383	1,000 bu.	7310	$3.03/bu	- 3,251,190
Oats	1648	1,000 bu.	1539	$1.45/bu	- 158,050
Dry Bean	691	1,000 cwt.	788	$16.00/cwt	+ 1,555,200
Sugar Beet	1150	1,000 tons	1205	$39.00/ton	+ 2,145,000
Corn	6328	1,000 bu.	6136	$1.94/bu	- 372,480
Alfalfa Hay	1581	1,000 tons	1782	$67.00/ton	+ 13,467,000
Other Hay	817	1,000 tons	1008	$60.00/ton	+ 11,436,000
Cattle/Calves Inventory	1536	1,000 head	1580	$770.00/head	+ 33,880,000
TOTAL					+$57,886,224

Table 4.17 2000 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2000 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6029	1,000 bu.	4080	$2.70/bu	- 5,262,300
Spring Wheat	648	1,000 bu.	232	$2.70/bu	- 1,124,280
Barley	8383	1,000 bu.	7885	$3.08/bu	- 1,533,840
Oats	1648	1,000 bu.	1156	$1.55/bu	- 252,650
Dry Bean	691	1,000 cwt.	762	$16.80/cwt	+ 1,196,160
Sugar Beet	1150	1,000 tons	1556	$32.50/ton	+ 195,000
Corn	6328	1,000 bu.	7656	$2.02/bu	+ 2,682,560
Alfalfa Hay	1581	1,000 tons	1449	$85.00/ton	- 11,220,000
Other Hay	817	1,000 tons	650	$80.00/ton	- 13,392,000
Cattle/Calves Inventory	1536	1,000 head	1550	$780.00/head	+$10,920,000
TOTAL					-$17,791,350

Table 4.18 2001 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2001 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6029	1,000 bu.	2880	$2.70/bu	- 8,502,300
Spring Wheat	648	1,000 bu.	168	$2.90/bu	- 1,393,160
Barley	8383	1,000 bu.	6970	$3.32/bu	- 4,691,160
Oats	1648	1,000 bu.	1344	$1.65/bu	- 501,600
Dry Bean	691	1,000 cwt.	514	$23.00/cwt	- 4,066,400
Sugar Beet	1150	1,000 tons	794	$39.70/ton	- 14,133,200
Corn	6328	1,000 bu.	6375	$2.30/bu	+ 108,100
Alfalfa Hay	1581	1,000 tons	1276	$110.00/ton	- 33,550,000
Other Hay	817	1,000 tons	605	$105.00/ton	- 22,302,000
Cattle/Calves Inventory	1536	1,000 head	1470	$780.00/head	- 51,480,000
TOTAL					-$140,511,720

Table 4.19 2002 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2002 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6029	1,000 bu.	2375	$3.70/bu	- $ 13,519,800
Spring Wheat	648	1,000 bu.	96	$3.90/bu	- $ 2,154,360
Barley	8383	1,000 bu.	4680	$3.23/bu	- $ 11,960,690
Oats	1648	1,000 bu.	750	$2.20/bu	- $ 1,975,600
Dry Bean	691	1,000 cwt.	624	$18.30/cwt	- $ 1,222,440
Sugar Beet	1150	1,000 tons	659	$42.30/ton	- $ 20,769,300
Corn	6328	1,000 bu.	4165	$2.60/bu	- $ 5,623,800
Alfalfa Hay	1581	1,000 tons	1150	$111.00/ton	- $ 47,841,000
Other Hay	817	1,000 tons	450	$106.00/ton	- $ 38,944,400
Cattle/Calves Inventory	1536	1,000 head	1320	$760.00/head	- $164,160,000
TOTAL					-$308,171,390

Table 4.20 2003 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2003 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6029	1,000 bu.	3915	$3.40/bu	-$7,187,600
Spring Wheat	648	1,000 bu.	180	$3.15/bu	-$1,474,200
Barley	8383	1,000 bu.	6975	$3.46/bu	-$4,871,680
Oats	1648	1,000 bu.	1104	$1.80/bu	-$979,200
Dry Bean	691	1,000 cwt.	645	$17.40/cwt	-$800,400
Sugar Beet	1150	1,000 tons	752	$41.20/ton	-$16,397,600
Corn	6328	1,000 bu.	6450	$2.50/bu	$305,000
Alfalfa Hay	1581	1,000 tons	1625	$80.00/ton	$3,520,000
Other Hay	817	1,000 tons	770	$73.00/ton	-$3,431,000
Cattle/Calves Inventory	1536	1,000 head	1350	$890.00/head	-$165,540,000
TOTAL					-$196,856,680

Table 4.21 2004 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2004 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6029	1,000 bu.	3510	$3.20/bu	-$8,060,800
Spring Wheat	648	1,000 bu.	240	$3.25/bu	-$1,326,000
Barley	8383	1,000 bu.	7050	$3.41/bu	-$4,545,530
Oats	1648	1,000 bu.	795	$1.55/bu	-$1,322,150
Dry Bean	691	1,000 cwt.	541	$25.90/cwt	-$3,885,000
Sugar Beet	1150	1,000 tons	812	$41.70/ton	-$14,094,600
Corn	6328	1,000 bu.	6550	$2.48/bu	$550,560
Alfalfa Hay	1581	1,000 tons	1305	$74.50/ton	-$20,562,000
Other Hay	817	1,000 tons	756	$69.50/ton	-$4,239,500
Cattle/Calves Inventory	1536	1,000 head	1300	$1020.00/head	-$240,720,000
TOTAL					-$298,205,020

Table 4.22 2005 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2005 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6029	1,000 bu.	4350	$3.50/bu	-$5,876,500
Spring Wheat	648	1,000 bu.	315	$3.19/bu	-$1,062,270
Barley	8383	1,000 bu.	5580	$3.28/bu	-$9,193,840
Oats	1648	1,000 bu.	600	$1.60/bu	-$1,676,800
Dry Bean	691	1,000 cwt.	776	$18.70/cwt	$1,589,500
Sugar Beet	1150	1,000 tons	801	$42.80/ton	-$14,937,200
Corn	6328	1,000 bu.	6860	$2.45/bu	$1,303,400
Alfalfa Hay	1581	1,000 tons	1560	$75.00/ton	-$1,575,000
Other Hay	817	1,000 tons	756	$72.00/ton	-$4,392,000
Cattle/Calves Inventory	1536	1,000 head	1400	$1140.00/head	-$155,040,000
TOTAL					-$190,860,710

Table 4.23 2006 Production and Inventory Value Impact

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2006 Production	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6029	1,000 bu.	3645	$4.58/bu	-$10,918,720
Spring Wheat	648	1,000 bu.	234	$3.80/bu	-$1,573,200
Barley	8383	1,000 bu.	4845	$3.32/bu	-$11,746,160
Oats	1648	1,000 bu.	684	$2.15/bu	-$2,072,600
Dry Bean	691	1,000 cwt.	590	$22.00/cwt	-$2,222,000
Sugar Beet	1150	1,000 tons	798	$46.80/ton	-$16,473,600
Corn	6328	1,000 bu.	5805	$2.64/bu	-$1,380,720
Alfalfa Hay	1581	1,000 tons	1400	$101.00/ton	-$18,281,000
Other Hay	817	1,000 tons	715	$103.00/ton	-$10,506,000
Cattle/Calves Inventory	1536	1,000 head	1400	$1010.00/head	-$137,360,000
TOTAL					-$212,534,000

Table 4.24 Production and Inventory Value Impact for Worst Year of Drought

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	Worst Yearly Production of Drought	Year	Value (USD)	Production and Inventory Value Impact (USD)
Winter Wheat	6029	1,000 bu.	2375	2002	$3.70/bu	-$13,519,800
Spring Wheat	648	1,000 bu.	96	2002	$3.90/bu	-$2,152,800
Barley	8383	1,000 bu.	4505	2007	$3.62/bu	-$14,038,360
Oats	1648	1,000 bu.	376	2007	$2.82/bu	-$3,587,040
Dry Bean	691	1,000 cwt.	514	2001	$23.00/cwt	-$4,071,000
Sugar Beet	1150	1,000 tons	658	2007	$40.20/ton	-$19,778,400
Corn	6328	1,000 bu.	4165	2002	$2.60/bu	-$5,623,800
Alfalfa Hay	1581	1,000 tons	1150	2002	$111.00/ton	-$47,841,000
Other Hay	817	1,000 tons	450	2002	$106.00/ton	-$38,902,000
Cattle/Calves Inventory	1536	1,000 head	1300	2004	$1,020/head	-$240,720,000
TOTAL						-$390,234,200

The 1999-2004 drought can be shown to be the drought of historic record. There have been significant impacts on the agricultural industry from the 1999-2004 drought. The worst-case year was 2002, with a negative dollar impact of $308,171,390 statewide; the total impact statewide for the 1999-2004 drought was $903,649,936. While it should be taken as an approximation, a common formula to determine individual county drought impacts using statewide data is to assume impacts are equal across the State and divide total land area by the size of the county. Natrona County makes up 18% of land area in the State of Wyoming. Using this formula, Natrona County saw a single-year negative dollar impact of $55,470,850 in 2002, and a total drought negative impact of $162,656,988 from 1999-2004.

Additionally, drought can exacerbate the risk of wildfires; increase the cost of municipal water usage; and deplete water resources used for recreation, affecting the local economy.

Vulnerability Assessment

The vulnerability of the people, buildings, and economy of Natrona County to drought is very difficult to quantify. Typically, people and structures are not directly vulnerable to drought, though secondary or indirect impacts may eventually increase vulnerability ratings. However, some areas are more vulnerable overall than others and, therefore, benefit from adequate mitigation planning and implementation. For Natrona County, the agricultural sector is the most vulnerable to drought and will benefit the most from mitigation efforts. Economic resources tied to agricultural production are extremely vulnerable to drought. Outdoor recreation, which is important to Natrona County's economy, is also vulnerable to drought. Fishing, hunting, snowmobiling and skiing are some of the activities that could be affected by drought. The geographic extent of the hazard is considered extensive. The probability of future occurrences is considered **likely**, and the potential magnitude/severity is **critical**. In addition, the HMPC considers the hazard to have an overall impact rating of **high** for the County.

Future Development

Future development in Natrona County is not anticipated to change vulnerability to drought significantly.

Summary

Drought is considered a high significance hazard for Natrona County due to the potential for extensive economic and environmental impacts. Drought can be widespread and pervasive for several years.

Table 4.25 Drought Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Bar Nunn	Extensive	Critical	Likely	High
Casper	Extensive	Critical	Likely	High
Edgerton	Extensive	Critical	Likely	High
Evansville	Extensive	Critical	Likely	High
Midwest	Extensive	Critical	Likely	High
Mills	Extensive	Critical	Likely	High
Natrona County	Extensive	Critical	Likely	High

4.3.3 Earthquake

Hazard/Problem Description

An earthquake is generally defined as a sudden motion or trembling in the Earth caused by the abrupt release of strain accumulated within or along the edge of the earth's tectonic plates. The most common types of earthquakes are caused by movements along faults and by volcanic forces, although they can also result from explosions, cavern collapse, and other minor causes not related to slowly accumulated strains.

The amount of energy released during an earthquake is usually expressed as a Moment magnitude (which succeeds the Richter magnitude) and is measured directly from the earthquake as recorded on seismographs. Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface as felt by humans or resulting damage to structures and defined in the Modified Mercalli scale (see Table 4.26 and Table 4.27). Seismic shaking is typically the greatest cause of losses to structures during earthquakes.

Table 4.26 Modified Mercalli Intensity (MMI) Scale

MMI	Felt Intensity
I	Not felt except by a very few people under special conditions. Detected mostly by instruments.
II	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.
III	Felt noticeably indoors. Standing automobiles may rock slightly.
IV	Felt by many people indoors, by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.
V	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned.
VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.
VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction.
VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, great in poorly built structures. Heavy furniture is overturned.
IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.
X	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Considerable landslides occur on steep slopes.
XI	Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.
XII	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.

Source: USGS. http://earthquake.usgs.gov/learn/topics/mercalli.php

Table 4.27 Modified Mercalli Intensity (MMI) Scale and Peak Ground Acceleration

MMI	Acceleration (%g) (PGA)
I	<0.17
II	0.17 – 1.4
III	0.17 – 1.4
IV	1.4 – 3.9
V	3.9 – 9.2
VI	9.2 – 18
VII	18 – 34
VIII	34 – 65
IX	65 – 124
X	>124
XI	>124
XII	>124

Source: Modified Mercalli Intensity and peak ground acceleration (PGA) (Wald, et al 1999).

Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, communication, and transportation lines. Other damaging effects of earthquakes include surface rupture, fissuring, ground settlement, and permanent horizontal and vertical shifting of the ground. Secondary impacts can include landslides, seiches, liquefaction, fires, and dam failure. The combination of widespread primary and secondary effects from large earthquakes make this hazard potentially devastating.

Part of what makes earthquakes so destructive is that they generally occur without warning. The main shock of an earthquake can usually be measured in seconds, and rarely lasts for more than a minute. Aftershocks can occur within the days, weeks, and even months following a major earthquake.

By studying the geologic characteristics of faults, geoscientists can often determine when the fault last moved and estimate the magnitude of the earthquake that produced the last movement. Because the occurrence of earthquakes is relatively infrequent in Natrona County and the historical earthquake record is short, accurate estimations of magnitude, timing, or location of future dangerous earthquakes in the County are difficult to estimate.

Liquefaction

During an earthquake, near surface (within 30 feet), relatively young (less than 10,000 years old), water-saturated sands and silts may act as a viscous fluid. This event is known as liquefaction (quicksand is a result of liquefaction). Liquefaction occurs when water-saturated materials are exposed to seismic waves. These seismic waves may compact the material (i.e. silts and sands), increasing the interior pore water pressure within the material mass.

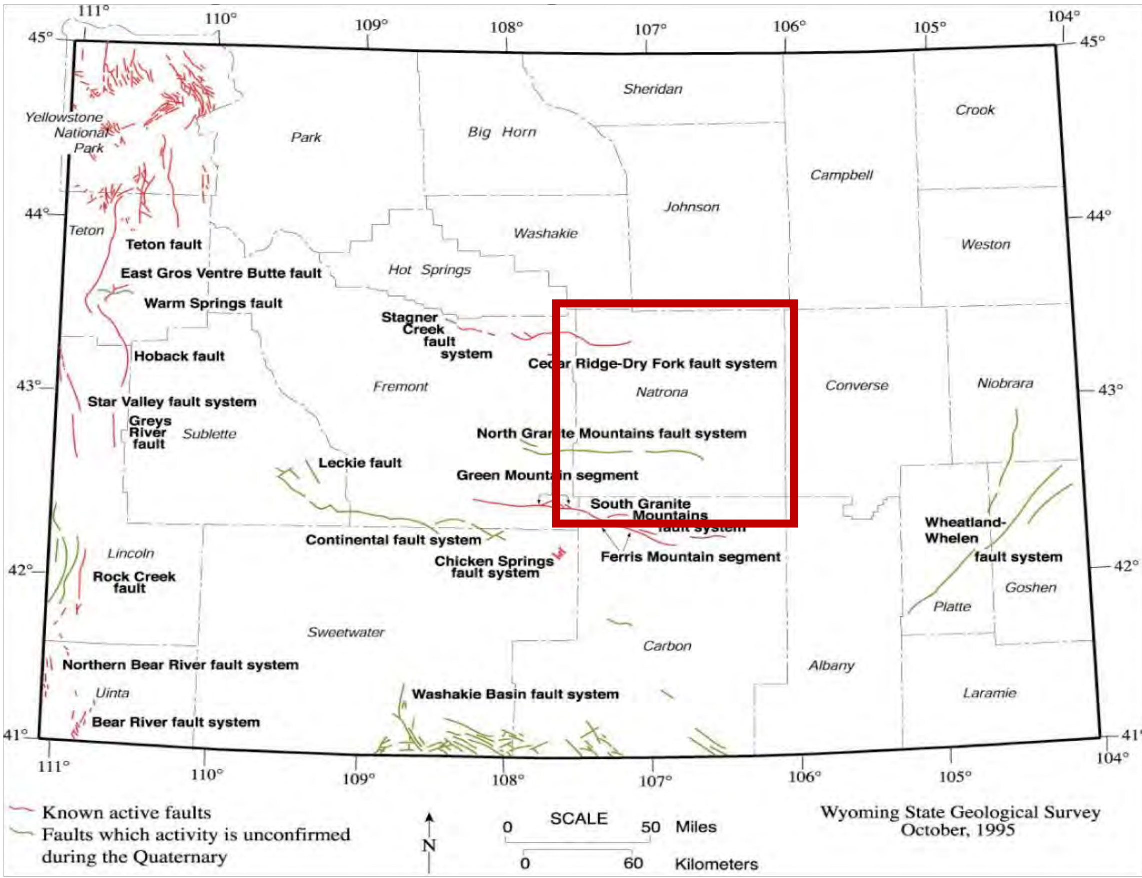
When the pore pressure rises to about the pressure of the weight of the overlying materials, liquefaction occurs. If the liquefaction occurs near the surface, the soil bearing strength for buildings, roads, and other structures may be lost. Buildings can tip on their side, or in some cases sink. Roads can shift and become unstable to drive on. If the liquefied zone is buried beneath more competent material, cracks may form in the overlying material, and the water and sand from the liquefied zone can eject through the cracks as slurry.

Geographical Area Affected

Most Wyoming earthquakes outside of Yellowstone National Park occur as a result of movement on faults. If the fault has moved within the Quaternary geological period, or last 1.6 million years, the fault is considered to be active. Active faults can be exposed at the surface or deeply buried with no significant surface expression. Historically, no earthquakes in Wyoming have been associated with exposed active faults. The exposed active faults, however, have the potential to generate the largest earthquakes. As a result it is necessary to understand both exposed and buried active faults in order to generate a realistic seismological characterization of the state.

There are approximately 80 Quaternary faults mapped in Wyoming, with 26 considered active (Source: www.wsgs.wyo.gov). In central Wyoming, the Stagner Creek fault system and the South Granite Mountain fault system are both considered potentially active and capable of generating magnitude 6.5 to 6.75 earthquakes.

Figure 4.7 Exposed Known or Suspected Active Faults in Wyoming



Source: Wyoming Geological Survey

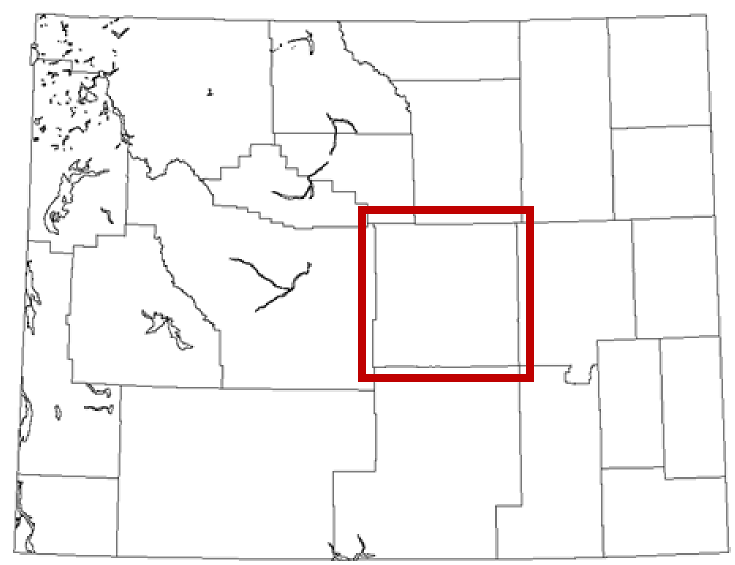
A fault system called the Cedar Ridge/Dry Fork fault system is present in the northwestern corner of the County. The 35-mile long Cedar Ridge fault comprises the western portion of the fault system, and the 15-mile long Dry Fork fault makes up the eastern portion. The only Pleistocene-age movement on the fault system was found in northeastern Fremont County (T39N R92W NE ¼ Section 10). A short scarp on the Cedar Ridge fault, approximately 0.8 miles long, was identified at that location. Since the entire fault system is approximately 50 miles long, and only one small active segment was discovered, Geomatrix (1988a) stated that the “age of this scarp and the absence of evidence for late Quaternary faulting elsewhere along the Cedar Ridge/Dry Creek fault suggest that this fault is inactive.”

There is also no compelling reason to believe that the Cedar Ridge fault system is active. Based upon its fault rupture length of 35 miles, however, if the fault did activate it could potentially generate a maximum magnitude 7.1 earthquake (Wong et al., 2001). Although there is no compelling reason to believe that the Dry Fork fault system is active, if it did activate as an isolated system, it could potentially generate a magnitude 6.7 earthquake. This is based upon a postulated fault rupture length of 15 miles (Wong et al., 2001).

The Wyoming Multi-Hazard Mitigation plan estimates that an earthquake of 6.5 magnitude is possible anywhere in the state.

Figure 4.8 shows areas in Wyoming that could experience liquefaction during an intense earthquake. Areas shown have sands and coarse silts that are less than 10,000 years in age and are within 30 feet of the surface. None of these areas are identified in Natrona County. While not identified on the map it is possible that areas along the floodplain of the North Platte River may be susceptible to liquefaction.

Figure 4.8 Wyoming Liquefaction Coverage



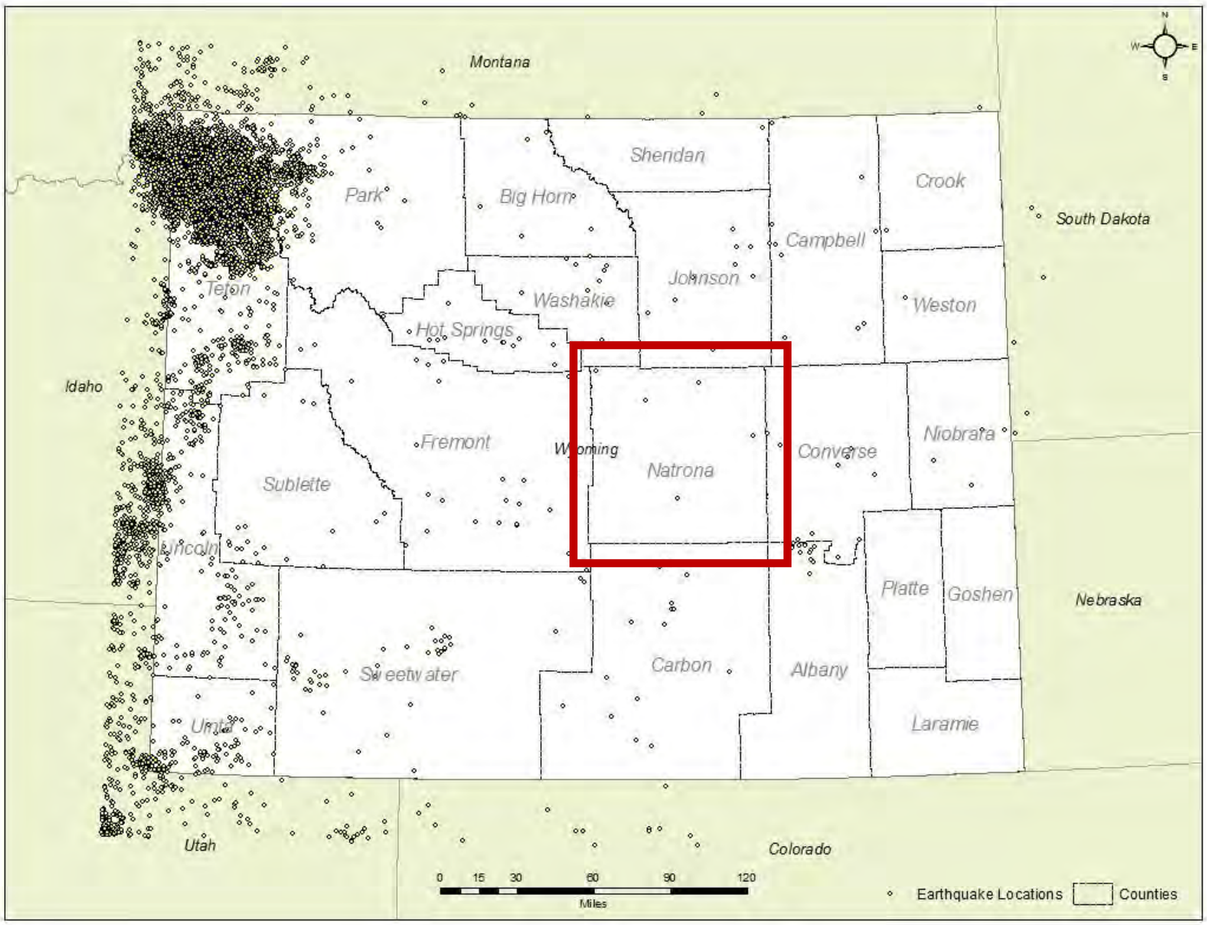
Natrona County outlined in red
Source: Wyoming Geological Survey

Past Occurrences

Prior to the 1950s, most earthquakes were detected and located by personal reports. After the Hebgen Lake earthquake in 1959 near Yellowstone Park, monitoring in Wyoming started to improve and earthquakes were more commonly located by seismometers.

Since 1871, the state has logged some 47,000 earthquakes, with the majority of the events taking place in the western third of the state (see Figure 4.9) where the majority of the active, or Quaternary Period, faults are identified.

Figure 4.9 Wyoming Historic Earthquake Occurrences Statewide Since 1963- 2010



Source: Wyoming Geological Survey - Wyoming Earthquake Hazard and Risk Analysis: HAZUS-MH Loss Estimations for 16 Earthquake Scenarios Report

Historically, earthquakes have occurred in every county in Wyoming. The first was reported in Yellowstone National Park in 1871.

According to the *Basic Seismological Characterization for Natrona County, Wyoming,* published in January 2003 by the Wyoming State Geological Survey (http://www.wrds.uwyo.edu/wrds/wsgs/hazards/quakes/seischar/Natrona.pdf), Natrona County has a long history of earthquakes. Noted in the report are twelve magnitude 2.5, or Intensity III and greater earthquakes that have been recorded in Natrona County. These earthquakes are discussed below:

The first earthquake that occurred in Natrona County took place on December 10, 1873, approximately 2 miles south of Powder River. People in the area reported feeling the earthquake as an intensity III event. Two of the earliest recorded earthquakes in Wyoming occurred near Casper.

On June 25, 1894, an estimated intensity V earthquake was reported approximately 3 miles southwest of Evansville. Residents on Casper Mountain reported that dishes rattled to the floor and people were thrown from their beds. Water in the Platte River changed from fairly clear to reddish, and became thick with mud due to the riverbanks slumping into the river during the earthquake (Mokler, 1923).

An even larger earthquake was felt in the same area on November 14, 1897. This intensity VI-VII earthquake, *one of the largest recorded in central and eastern Wyoming, caused considerable damage to a few buildings.* As a result of the earthquake, a portion of the Grand Central Hotel was cracked from the first to the third story. Some of the ceilings in the hotel were also severely cracked. In another part of Casper, a person sitting in a chair was thrown to the floor (Mokler, 1923).

On October 25, 1922, an intensity IV-V earthquake was detected approximately 6 miles north-northeast of Barr Nunn. The event was felt in Casper; at Salt Creek, 50 miles north of Casper; and at Bucknum, 22 miles west of Casper. Dishes were rattled and hanging pictures were tilted near Salt Creek. No significant damage was reported at Casper (Casper Daily Tribune, October 26, 1922).

One of the first earthquakes recorded near Midwest occurred on December 11, 1942. The intensity IV-V event occurred approximately 14 miles south of Midwest. Although no damage was reported, the event was felt in Casper, Salt Creek, and Glenrock (Casper Tribune-Herald, December 12, 1942). On August 27, 1948, another intensity IV earthquake was detected approximately 6 miles north-northeast of Bar Nunn. No damage was reported (Casper Tribune-Herald, August 27, 1948).

In the 1950's, two earthquakes caused some concern among Casper residents. On January 23, 1954, an intensity IV earthquake occurred approximately 7 miles northeast of Alcova. Although this event did not result in any reported damage, one area resident reported that he thought that an intruder in the attic of his house had fallen down (Casper Tribune-Herald, January 24, 1954). On August 19, 1959, an intensity IV earthquake was recorded north of Casper, approximately 6 miles north-northeast of Bar Nunn. People in Casper reported feeling this event (Reagor, Stover, and Algermissen, 1985). It is uncertain if this earthquake actually occurred in the Casper area, as it coincides with the Hebgen Lake, Montana, earthquakes that initiated on August 17, 1959.

Only one earthquake was reported in Natrona County in the 1960s. On January 8, 1968, a magnitude 3.8 earthquake occurred approximately 10 miles north-northwest of Alcova. No damage was reported. An earthquake of no specific magnitude or intensity occurred approximately 13 miles southeast of Ervay on June 16, 1973. No one felt this earthquake and no damage was reported.

No other earthquakes occurred in Natrona County until March 9, 1993, when a magnitude 3.2 earthquake was recorded 17 miles west of Midwest. No damage was reported. A magnitude 3.1 earthquake also occurred in the far northwestern corner of the county on November 9, 1999. No one reported feeling this earthquake that was centered approximately 32 miles northwest of Waltman.

On February 1, 2003, a magnitude 3.7 earthquake occurred approximately 16 miles north-northeast of Casper. Numerous Casper residents felt this event. One person reported feeling two jolts in rapid succession.

Several earthquakes have also occurred near Natrona County. The first took place on August 11, 1916, in eastern Fremont County. No damage was reported from this intensity III event, which was centered approximately 39 miles southwest of Ervay (Reagor, Stover, and Algermissen, 1985). On August 27, 1938, an intensity III earthquake was recorded in northern Albany County, approximately 45 miles southeast of Casper. No damage was associated with the event (Neumann, 1940). A magnitude 4.7 earthquake occurred in southwestern Johnson County on June 3, 1965. No one reported feeling this event, which was centered approximately 17 miles northwest of Midwest (U.S.G.S. National Earthquake Information Center). On May 11, 1967, a magnitude 4.8 earthquake occurred in southwestern Campbell County, approximately 24 miles northeast of Edgerton. No one felt this earthquake and no damage was reported. Several earthquakes were recorded in the region in the 1970s. The first occurred in Fremont County on April 22, 1973, approximately 28 miles southwest of Ervay. This magnitude 4.8, intensity V earthquake rattled dishes and disturbed pictures on walls in Jeffrey City (Casper Star Tribune, April 24, 1973). On May 29, 1973, an earthquake of no specific magnitude or intensity occurred near the Ferris Mountains in Carbon County, approximately 23 miles southwest of Alcova. This earthquake was not felt (Reagor, Stover, and Algermissen, 1985). In December 1975, two earthquakes occurred in eastern Fremont County. A magnitude 3.5 earthquake occurred on December 19, 1975, approximately 13 miles west-southwest of Ervay (Reagor, Stover, and Algermissen, 1985). This earthquake did not cause any damage. Later the same month, on December 30, 1975, an earthquake of no specific magnitude or intensity was recorded approximately 24 miles northwest of Ervay. No one reported feeling this event.

On June 6, 1978, a magnitude 4.0 earthquake was recorded in southeastern Hot Springs County, approximately 50 miles northwest of Waltman (Reagor, Stover, and Algermissen, 1985). No damage was associated with this earthquake. On November 15, 1983, a magnitude 3.0, intensity III earthquake occurred in western Converse County, approximately 15 miles northeast of Casper. No damage was reported.

In 1984, a series of earthquakes were recorded in northern Albany County. The most significant earthquake to occur in the area occurred on October 18, 1984. This magnitude 5.5, intensity VI event was centered approximately 44 miles southeast of Casper. It was felt in Wyoming, South Dakota, Nebraska, Colorado, Utah, Montana, and Kansas. Stover (1985) reports that cracks were found in the exterior brick walls of the Douglas City Hall and a public school in Medicine Bow. Chimneys were cracked at Casper, Douglas, Guernsey, Lusk, and Rock River. A wall in a Laramie-area school was slightly cracked by the earthquake. The earthquake was one of the largest felt in eastern Wyoming. A number of aftershocks occurred in the same area; the most significant were magnitude 4.5, intensity IV and magnitude 3.8 events occurring on October 18, 1984; a magnitude

3.5 event on October 20, 1984; magnitude 3.3 events on October 19, November 6, and December 17, 1984; a magnitude 3.1 event on October 22, 1984; a magnitude 3.2 event on October 24, 1984; and a magnitude 2.9 event on December 5, 1984. On June 12, 1986, a magnitude 3.0 earthquake occurred in the same general area.

Four earthquakes occurred near Natrona County in the 1990s. A magnitude 3.8, intensity III earthquake occurred near Bairoil in southeastern Fremont County on June 1, 1993. No damage was reported from this earthquake, which was centered approximately 41 miles south-southwest of Ervay (Case, 1994). On October 9, 1993, a magnitude 3.7, intensity IV earthquake occurred in northern Albany County, approximately 37 miles southeast of Casper. The earthquake was felt in Garrett. A magnitude 4.2 earthquake was recorded in western Converse County on October 19, 1996. Its epicenter was located approximately 15 miles northeast of Casper. No damage was reported, although many Casper residents reported feeling the earthquake. On December 11, 1996, a magnitude 3.4 earthquake occurred in Fremont County, approximately 38 miles south-southwest of Ervay. No damage was associated with this earthquake.

A magnitude 3.0 earthquake was recorded in northern Carbon County on February 1, 2000. No one reported feeling this event, which was centered approximately 22 miles south of Alcova (U.S.G.S. National Earthquake Information Center). On April 13, 2000, a magnitude 3.3 earthquake occurred in northern Albany County, approximately 39 miles southeast of Casper. No damage was reported. In 2000, two earthquakes occurred in northeastern Sweetwater County near the town of Bairoil (approximately 47-48 miles south-southwest of Ervay). A magnitude 4.00 event was recorded on May 26, 2000, and a magnitude 3.2 event was recorded four days later on May 30, 2000. People reported feeling both earthquakes (U.S.G.S. National Earthquake Information Center). Most recently, a magnitude 3.0 earthquake occurred on November 8, 2000, in northeastern Fremont County. This event was centered approximately 36 miles northwest of Waltman. No one reported feeling this earthquake (U.S.G.S. National Earthquake Information Center).

Some HMPC members noted feeling earthquakes in the past including an M4 event in 1984 near Glenrock, an event on northern county line around 2006 that cracked stucco on buildings, and an M3 event in January 2017.

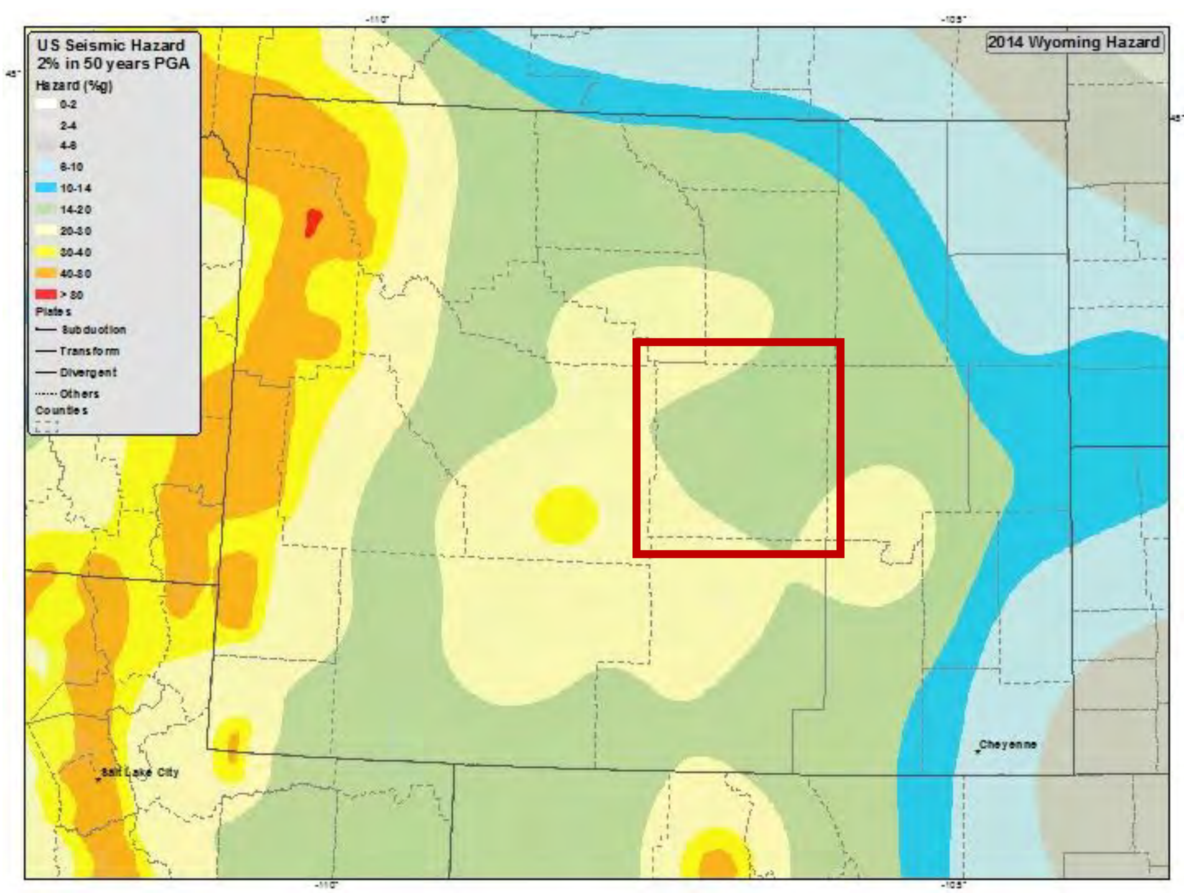
Frequency/Likelihood of Future Occurrence

Based on past occurrences the region is likely to experience one 2.5 or greater earthquake approximately every ten to fifteen years; however also based on past occurrences, the earthquakes are likely to cause little to no damage. To determine the likelihood of damaging earthquakes the U.S. Geological Survey (USGS) publishes probabilistic acceleration maps for 500-, 1000-, and 2,500-year time frames. The maps show what accelerations may be met or exceeded in those time frames by expressing the probability that the accelerations will be met or exceeded in a shorter time frame. For example, a 10% probability that acceleration may be met or exceeded in 50 years is roughly equivalent to a 100% probability of exceedance in 500 years. The 2,500-year (2% probability of exceedance in 50 years) map is shown in the figure below. The International

Building Code uses a 2,500-year map as the basis for building design. The maps reflect current perceptions on seismicity in Wyoming based on available science. In many areas of Wyoming, ground accelerations shown on the USGS maps can be increased further due to local soil conditions. For example, if fairly soft, saturated sediments are present at the surface, and seismic waves are passed through them, surface ground accelerations will usually be greater than would be experienced if only bedrock was present. In this case, the ground accelerations shown on the USGS maps would underestimate the local hazard, as they are based upon accelerations that would be expected if firm soil or rock were present at the surface.

As the historic record is limited, it is nearly impossible to determine when a 2,500-year event last occurred in the county. Because of the uncertainty involved, and based upon the fact that the new International Building Code utilizes 2,500-year events for building design, it is suggested that the 2,500-year probabilistic maps be used for regional and county analyses. This conservative approach is in the interest of public safety.

Figure 4.10 2500-year probabilistic acceleration map (2% probability of exceedance in 50 years) – Natrona County Highlighted by Red Rectangle



Potential Magnitude

Limited damages have been documented in the County from historic earthquakes. Because of the limited historic record, however, it is possible to underestimate the seismic hazard in the County if historic earthquakes are used as the sole basis for analysis. Earthquake and ground motion probability maps give a more reasonable estimate of damage potential in areas with or without exposed active faults at the surface. USGS earthquake probability maps that are used in support of the modern building codes suggest a scenario that would result in moderate damage to buildings and their contents, with damage increasing from the northwest to the east.

Vulnerability Assessment

The Wyoming State Geological Survey conducted a study in 2011 to model loss estimations for 16 earthquake scenarios in order to quantify the magnitude of earthquake impacts around the state. The scenarios included four random event scenarios run on the basis of data from historic earthquakes that occurred near Casper, Gillette, Laramie Peak, and Estes Park, Colorado. Each of the historic, random event earthquake scenarios used a 6.0 magnitude event. The Estes Park Scenario was based on an event occurring in 1882, the Casper area event in 1897, and the Gillette and Laramie Peak events in 1984 (Source: Wyoming Geological Survey, "Wyoming Earthquake Hazard and Risk Analysis: HAZUS-MH Loss Estimations for 16 Earthquake Scenarios, 2011*)*

HAZUS (Hazards U.S.) is a nationally standardized, GIS-based, risk assessment and loss estimation computer program that was originally designed in 1997 to provide the user with an estimate of the type, extent, and cost of damages and losses that may occur during and following an earthquake. It was developed for the FEMA by the National Institute of Building Sciences (NIBS). There have been a number of versions of HAZUS generated by FEMA, with HAZUS-MH (HAZUS - Multi-Hazard) being the most recent release.

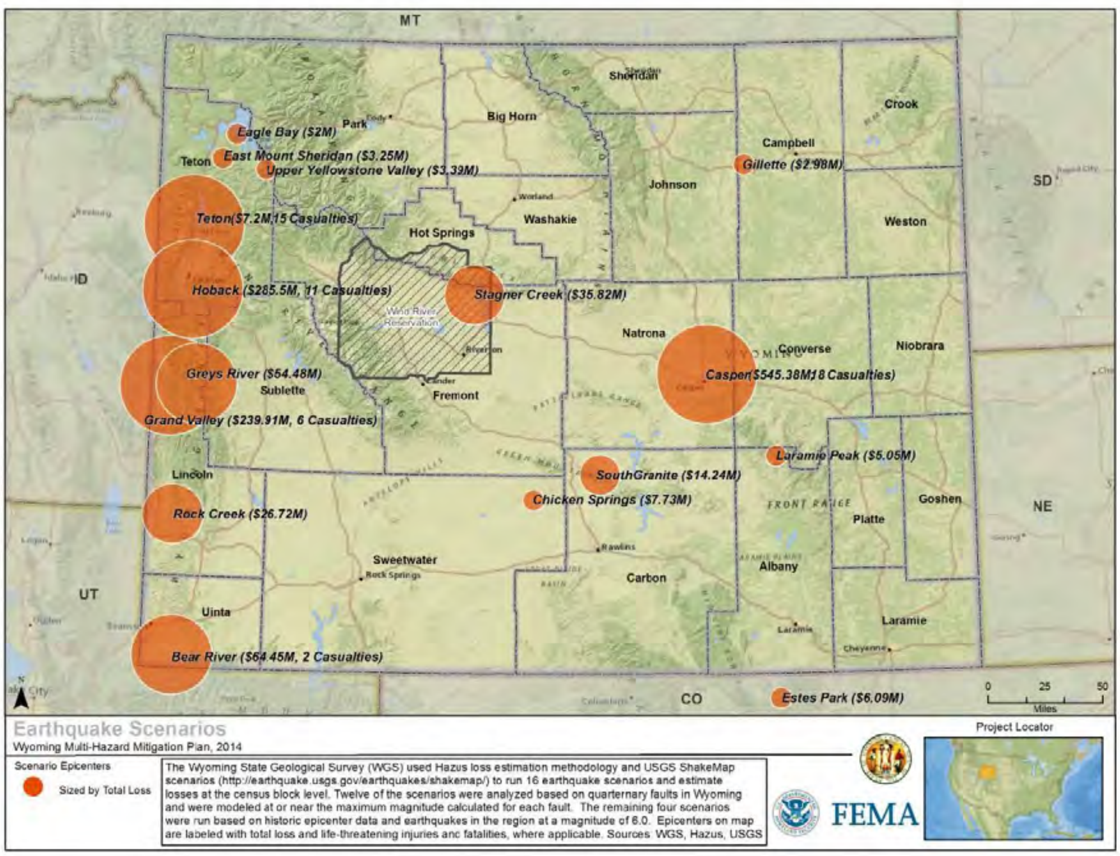
The study included information regarding the likelihood of damage to local and regional infrastructure, including fire stations, police stations, sheriffs' departments, schools, and hospitals. The scenarios reflect anticipated functionality of each infrastructure system immediately following the scenario earthquake, on day seven following the earthquake and one month after the earthquake. Additional information provided includes anticipated households displaced or seeking temporary shelter, electrical outages anticipated, number of households without potable water, debris generated by the scenario and economic losses resulting from three categories: buildings, transportation and utilities.

The map in Figure 4.11 shows epicenter locations of the scenarios, sized by total loss. Epicenters on map are labeled with total loss and if applicable, life-threatening injuries and fatalities.

Casper Area 1897 Random Event Scenario

The Wyoming Geological Survey modeled a "random event" based on a repeat of the November 14th, 1897 earthquake, one of the largest ever experienced in the area. Modeled at an M 6.0 epicentered under Casper the scenario resulted in total economic loss of $564.11 million dollars for the region. $545.38M of the loss was in building losses and 8 casualties. The regional direct economic loss for utilities would be 15.302 million dollars. Natrona County would expect the highest losses at $15.137 million dollars. The losses reflect damage to potable water, waste water, and natural gas pipelines; as well as losses to waste water, oil system, natural gas, electrical power, and communication facilities. The scenario results show that 7,832 of those would sustain at least moderate damage from the earthquake. The earthquake would generate 266,000 tons of debris. Schools in the Casper area, with the exception of Red Creek Elementary, would be between 29-72% functional the day of the earthquake, with those closest to the epicenter having the lowest functionality. The schools would be between 44-93% functional on day 7 and over 74% functional on day 30.

Figure 4.11 HAZUS-MH Earthquake Scenarios for Wyoming, 2011



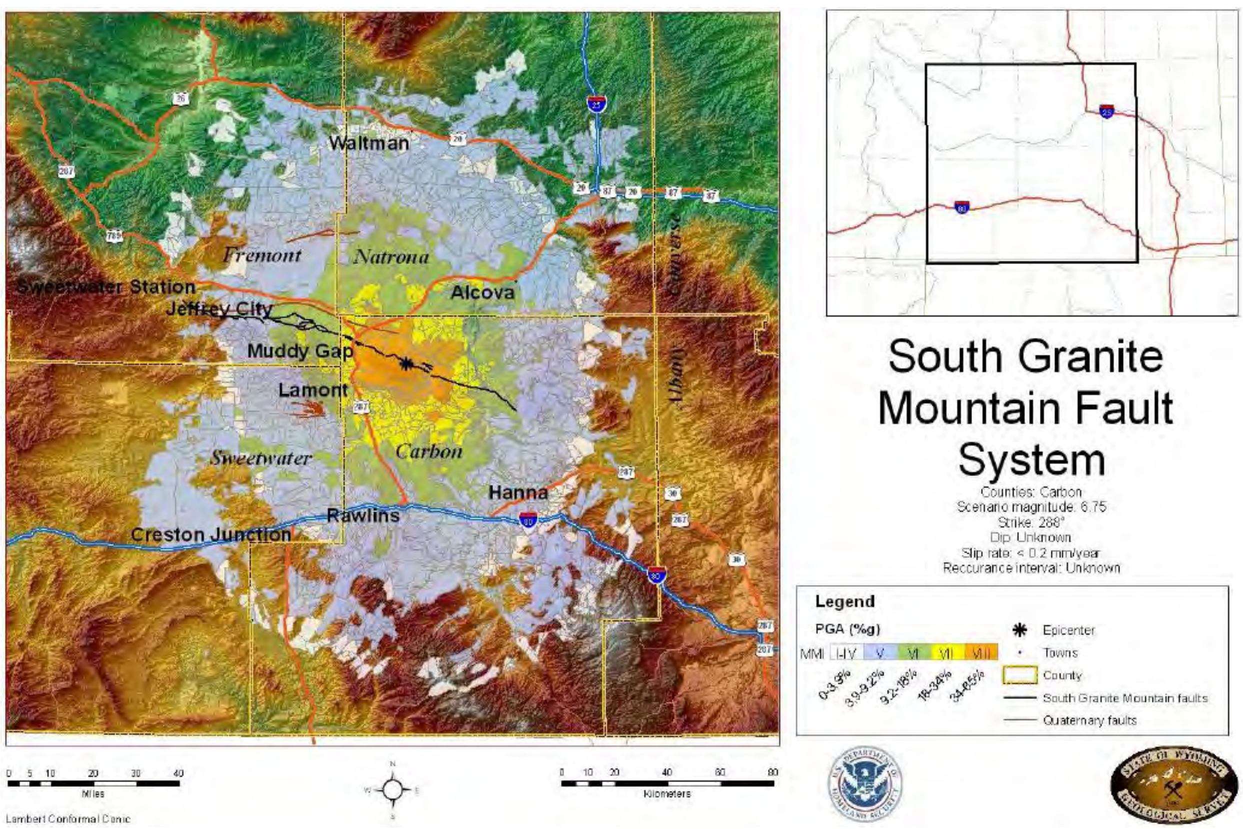
(Source: Wyoming Multi-Hazard Mitigation Plan, 2014)

Fault Based Scenario

Of the 16 modeled fault-based scenarios the South Granite Mountain fault system scenario had the most impact on Natrona County. The earthquake scenario was modeled at magnitude 6.75. The earthquake would cause damage in Carbon, Fremont, Natrona and Sweetwater Counties. Scenario results estimate that very light damage would be expected up to 45 miles from the epicenter, including Worland and Jeffrey City (Figure 4.12). Light damage would be expected as far as 30 miles, including the town of Alcova. The total population in the scenario region is 16,732 based on the 2000 census. The scenario results estimate that only 3 households would be displaced, and one person would seek temporary shelter. There are 12,197 buildings in the area and scenario results show that 437 of those would sustain at least moderate damage from the earthquake. The earthquake would generate 6,000 tons of debris.

The following map shows ground accelerations based on a magnitude 6.75 earthquake from the South Granite Mountain Fault System.

Figure 4.12 South Granite Mountain Fault System



Source: Wyoming Earthquake Hazard and Risk Analysis: HAZUS-MH Loss Estimations for 16 Earthquake Scenarios

Alcova schools would be 92% functional at day one, and 100% functional by day seven.

The modeled earthquake would cause a total economic loss of $22.387 million dollars for the region. Direct economic losses are estimated in three categories: buildings, transportation, and utilities.

Buildings

Direct economic losses for buildings, which include structural and content damage, would total $14.245 million dollars for the region. Natrona County is modeled to have $2.992 million dollars in direct economic losses for buildings.

Transportation

Direct transportation losses for the region are expected to be $1.145 million dollars. Natrona County would be expected to see $144,000 in damage to bridges and airports.

Utilities

The regional direct economic loss for utilities would be $6.997 million dollars. Natrona County's losses are predicted to be $586,000 from damage to wastewater and natural gas pipelines and facilities, as well as electrical facilities.

Essential Facilities

Essential facilities include fire stations, hospitals, police stations, and schools. Several details on the estimated impacts to these facilities can be referenced in the WYGS report. As a general consensus, damage to essential facilities in Natrona is projected to be minimal to non-existent.

Probabilistic Scenario

In the Wyoming Multi-Hazard Mitigation Plan, HAZUS 2.1 was used to develop losses associated with a 2,500 year probabilistic earthquake scenarios for each county in the State of Wyoming. This scenario uses USGS probabilistic seismic contour maps to model ground shaking with a 2% probability of being exceeded in 50 years (or a 2,500 year event). Total losses include building, contents, inventory, and income-related losses.

The following table lists total loss, loss ratio (total loss/total building inventory value), and ranges of casualties within severity levels. HAZUS provides casualty estimates for 2 a.m., 2 p.m., and 5 p.m. to represent periods of the day that different sectors of the community are at their peak occupancy loads. The casualty ranges represent the lowest to highest casualties within these times of day. Casualty severity levels are described as follows;

- Level 1: Injuries will require medical attention but hospitalization is not needed
- Level 2: Injuries will require hospitalization but are not considered life-threatening

- Level 3: Injuries will require hospitalization and can become life-threatening if not promptly treated
- Level 4: Victims are killed by the earthquake

The table is sorted and ranked by total loss.

There are two methods for ranking counties to determine where earthquake impacts may be the greatest. Either loss ratios or total damage figures can be used. The loss ratio is determined by dividing the sum of the structural and non-structural damage by the total building value for the county. The loss ratio is a better measure of impact for a county, since it gives an indication of the percent of damage to buildings.

Table 4.28 2500-Year Probabilistic Scenario Loss Estimates, 2015 Valuations

Rank	County	Total Loss ($M)	Loss Ratio	Casualties Level 1	Casualties Level 2	Casualties Level 3	Casualties Level 4
1	Teton	$654	27%	150-300	40-90	0-20	10-30
2	Lincoln	$528	63%	190-220	50-60	0-20	10-20
3	Natrona	$268	11%	50-60	10	0	0
4	Uinta	$247	18%	90-120	20-30	0-10	0-10
5	Sweetwater	$181	19%	50	10	0	0

Source: Wyoming State Hazard Mitigation Plan 2016

The total damage figure by itself does not reflect the percentage of building damage, since small damage to a number of valuable buildings may result in a higher total damage figure than may be found in a county with fewer, less expensive buildings, with a higher percentage of damage.

In summary, it is estimate that if a worst-case earthquake occurred in Natrona County, total loss would be in the neighborhood of $268M, or an 11% loss ratio. The probability of such an event is 2% in fifty years. Damages to critical facilities would be concentrated to hospitals, though impacted facilities would return to almost 100% functionality within two weeks of the earthquake.

Liquefaction Vulnerability

There have been little, if any, reported damages from liquefaction in Wyoming. Given that ground motions associated with Intensity VIII or larger are usually needed to trigger liquefaction, and that only small areas of the region would experience that level of shaking during the 2% event (2% probability of exceedance in 50 years), liquefaction would be a rare occurrence in the County. The 2016 Wyoming State Hazard Mitigation Plan notes that Natrona County has $0 in exposure to liquefaction.

Future Development

Future development in the county is not anticipated to significantly affect vulnerability to earthquakes, but will result in a slight increase in exposure of the population and building stock

Summary

Natrona County is at moderate risk due to the closer proximity of potentially active faults within and near the County and the history of having experienced one of the strongest earthquakes in central Wyoming. It is estimated that if a worst-case event occurred in Natrona County, $268 million in combined capital stock and income losses could occur. Though the probability is low, WSGS studies indicate the possibility of a 6.5 magnitude could occur anywhere in the state.

Table 4.29 Earthquake Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Bar Nunn	Significant	Critical	Occasional	High
Casper	Significant	Critical	Occasional	High
Edgerton	Significant	Critical	Occasional	High
Evansville	Significant	Critical	Occasional	High
Midwest	Significant	Critical	Occasional	High
Mills	Significant	Critical	Occasional	High
Natrona County	Significant	Critical	Occasional	High

4.3.4 Expansive Soils

Hazard/Problem Description

Soils and swelling bedrock contain clay which causes the material to increase in volume when exposed to moisture and shrink as it dries. They are also commonly known as expansive, shrinking and swelling, bentonitic, heaving, or unstable soils and bedrock. In general, the term refers to both soil and bedrock contents although the occurrence of the two materials may occur concurrently or separately. The difference between the materials is that swelling soil contains clay, while swelling bedrock contains claystone.[3]

The clay materials in swelling soils are capable of absorbing large quantities of water and expanding 10 percent or more as the clay becomes wet. The force of expansion is capable of exerting pressures of 15,000 pounds per square foot or greater on foundations, slabs, and other confining structures.[4] The amount of swelling (or potential volume of expansion) is linked to five main factors: the type of mineral content, the concentration of swelling clay, the density of the materials, moisture changes in the environment, and the restraining pressure exerted by materials

[3] Colorado Geological Survey Department of Natural Resources, *A Guide to Swelling Soils for Colorado Homebuyers and Homeowners*. (Denver, Colorado.) 1997. p 15-16.
[4] Ibid., p 17.

on top of the swelling soil. Each of these factors impact how much swelling a particular area will experience, but may be modified, for better or worse, by development actions in the area.

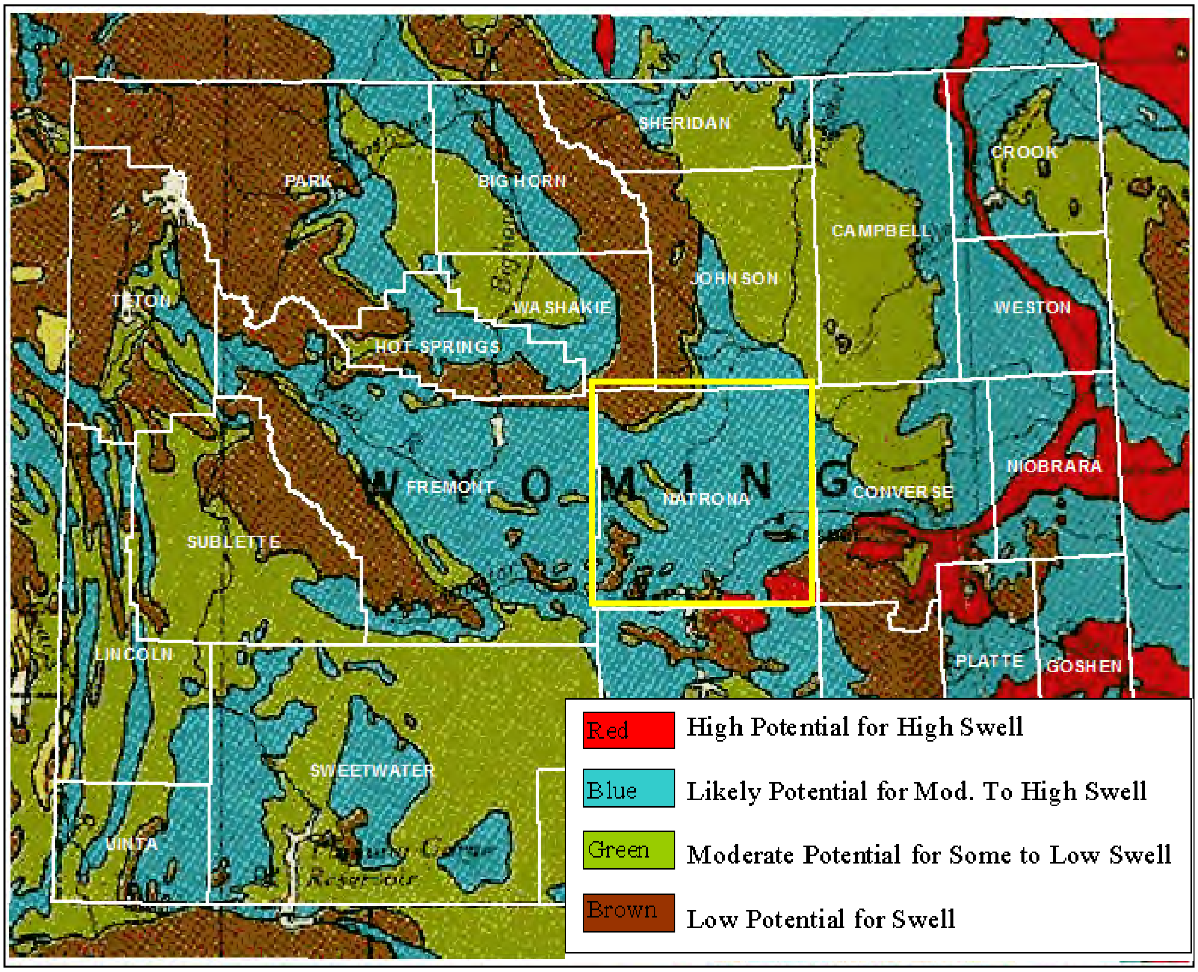
- **Low**—this soils class includes sands and silts with relatively low amounts of clay minerals. Sandy clays may also have low expansion potential, if the clay is kaolinite. Kaolinite is a common clay mineral.
- **Moderate**—this class includes silty clay and clay textured soils, if the clay is kaolinite, and also includes heavy silts, light sandy clays, and silty clays with mixed clay minerals.
- **High**—this class includes clays and clay with mixed montmorillonite, a clay mineral which expands and contracts more than kaolinite.

Geographical Area Affected

Expansive soils are known to be present in Natrona County. The figures below illustrate possible expansive soils locations in Wyoming. Figure 4.13 is based on select geologic formations from the Love and Christiansen 1985 Geologic Map of Wyoming.

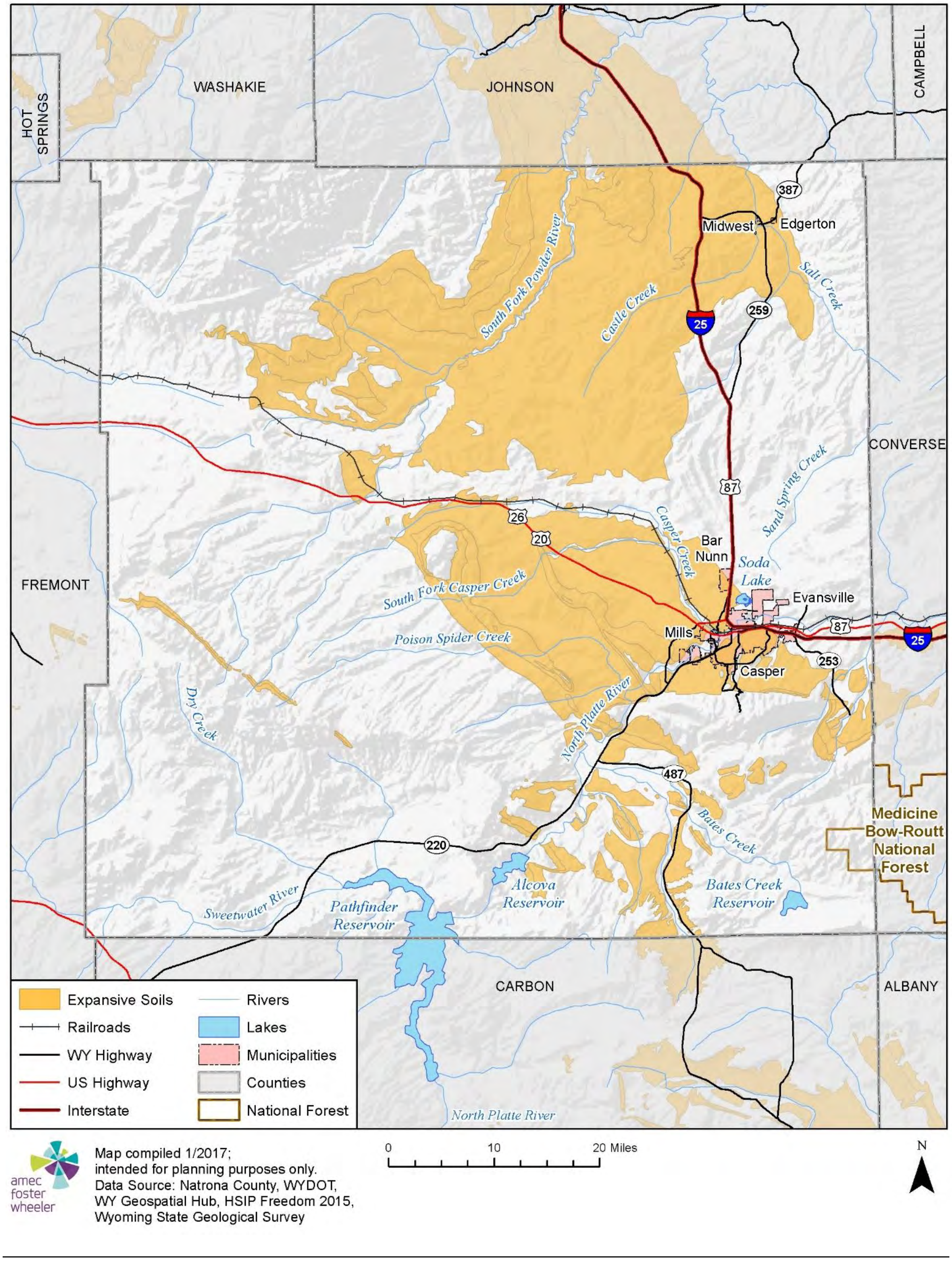
Figure 4.14 is based on data from the Wyoming State Geological Survey which displays much of Natrona County at risk to expansive soils. Those formations selected have characteristics that could lead to expansive soils where they outcrop. Deposits of calcium montmorillonite can also contribute to swelling problems, but these areas have not been completely mapped. According to the HMPC, specific problem areas include the Indian Hills area, Hwy 220, Red Butte Antelope Hills and areas close to the foot of Casper Mountain particularly on the west end. CY Junior High had foundation issues which were mitigated when it was re-built. Based on the figures below, expansive soils are estimated to affect a **limited** portion of the planning area.

Figure 4.13 Expansive Soil Potential in Wyoming



Source: The map above is based upon "Swelling Clays Map of the Conterminous United States" by W. Olive, A. Chleborad, C. Frahme, J. Shlocker, R. Schneider and R. Schuster. It was published in 1989 as Map I-1940 in the USGS Miscellaneous Investigations Series. Land areas were assigned to map soil categories based upon the type of bedrock that exists beneath them as shown on a geologic map. In most areas, where soils are produced "in situ", this method of assignment was reasonable. However, some areas are underlain by soils which have been transported by wind, water or ice. The map soil categories would not apply for these locations.

Figure 4.14 Expansive Soils in Natrona County



Past Occurrences

Very little data exists on expansive soil problems and damages in Wyoming. Studies on the issue have not been performed and no database exists to catalog occurrences. The 2016 State of Wyoming Multi-Hazard Mitigation Plan does not list specific events in Natrona County.

Frequency/Likelihood of Occurrence

Expansive soils will be a **likely** problem for the Natrona County.

Potential Magnitude

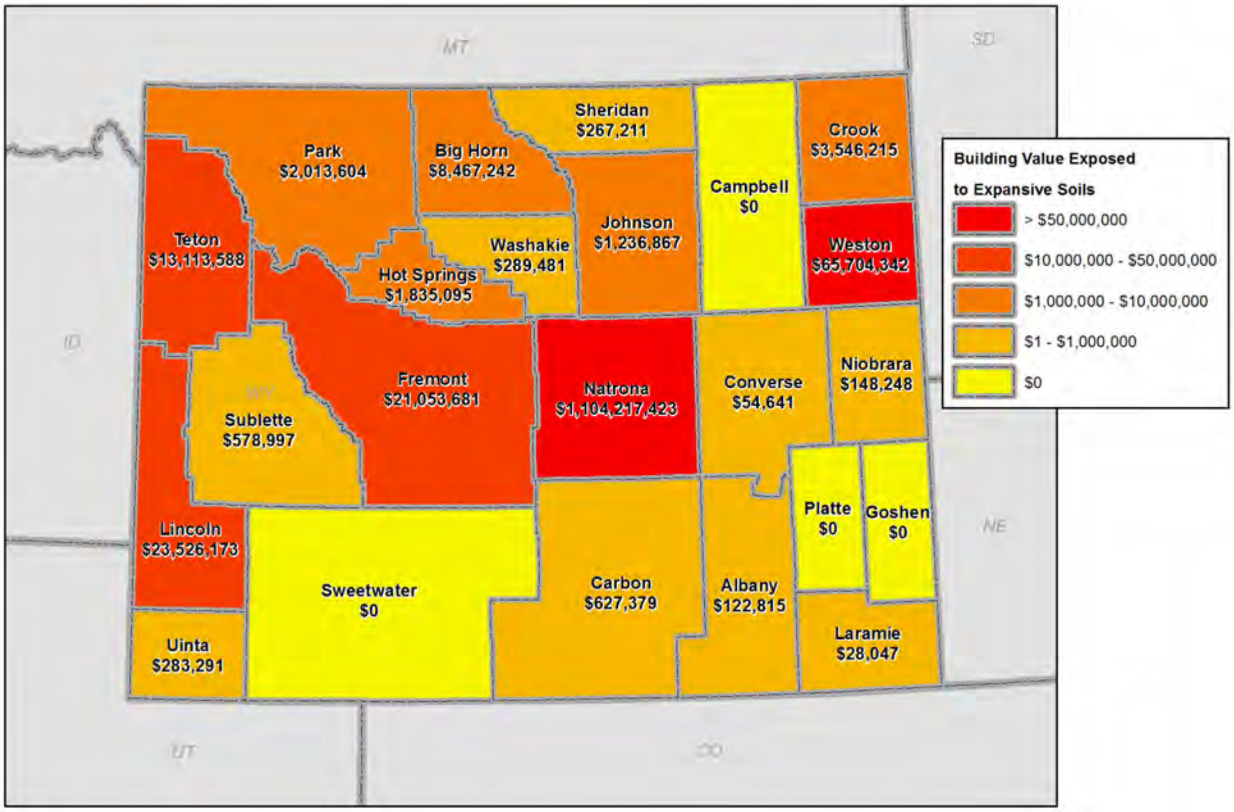
The potential magnitude of expansive soils events and damages is estimated to be **significant** in Natrona County. No impacts related to expansive soils have been reported thus far. Because damages from expansive soils tend to happen over an extended period of time, it is difficult to estimate the potential severity of a problem. Many deposits of expansive soils do not inflict damage over large areas. Instead, these deposits can often create localized damage to individual structures and supply lines, such as roads, railways, bridges and power lines.

Vulnerability Assessment

According to the Wyoming State Multi-Hazard Mitigation Plan there are two measurements used for calculating future impacts: historic dollar damages and building exposure values. There are not enough current data to accurately estimate historic damages.

The Wyoming State Geological Survey (WSGS) calculated the building exposure values for buildings that may occur within the areas of expansive soils. All expansive soils mapped have been digitized and the expansive soil layer was then digitally crossed with the Census block building values. In the event of an expansive soil boundary dissecting a census block, the proportional value of the buildings in the census block will be assigned to the expansive soil. In a case where a census block is within an expansive soil, the combined values of all the buildings in the census block are assigned. The values derived by county are shown in the map below. These damage estimates assume an instantaneous event, which would damage all of the property of suspected expansive areas at one time. This scenario is extremely unlikely, meaning that the exposed damage estimates most likely are vastly overstated. It is far more likely that damage from these soils will be individual events, which will cause damage to a small number of buildings or road segments over time. Natrona County has the highest building exposure by county for expansive soils in Wyoming with a value of $1,104,217,423.

Figure 4.15 Wyoming Exposure to Shrinking/Swelling Soils by County



Source: State of Wyoming Multi-Hazard Mitigation Plan

The table below provides a summary of critical infrastructures within Natrona County at risk to expansive soils hazards.

Table 4.30 Critical Infrastructure at Risk to Expansive Soils in Natrona County

Jurisdiction	Critical Facility Type	Facility Count
Bar Nunn	Day Cares	3
	EPA FRS Location	1
	Fire Department	1
	National Shelter System Facility	2
	School	1
	Total	8
Casper	Air Facility	1
	Assisted Living	7
	Bridge	3
	College/University	1
	Community Support	16
	Day Cares	74
	EPA FRS Location	102
	Fire Department	4
	Hospital	1

Jurisdiction	Critical Facility Type	Facility Count
	Law Enforcement	1
	Medical Facility	1
	National Shelter System Facility	25
	Nursing Home	7
	Private School	3
	School	21
	Special Medical Facility	27
	Tier II	4
	Urgent Care Facility	2
	Total	300
Edgerton	Community Support	1
	Total	1
Evansville	Day Cares	2
	Total	2
Midwest	Fire Department	1
	Law Enforcement	1
	National Shelter System Facility	1
	School	1
	Total	4
Mills	Day Cares	4
	EPA FRS Location	10
	EPA Regulated Facility	3
	Law Enforcement	1
	Tier II	8
	Total	26
Unincorporated	Air Facility	2
	Bridge	46
	Day Cares	4
	Electrical Facility	1
	EPA FRS Location	158
	EPA Regulated Facility	6
	Fire Department	1
	Law Enforcement	2
	National Shelter System Facility	2
	Non-Union Communications	6
	School	2
	Substation	7
	Tier II	24
	Union Communications	5
	Total	266
	Grand Total	607

Summary

Overall, expansive soils are a medium significance hazard for the County.

Table 4.31 Expansive Soil Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Bar Nunn	Limited	Limited	Occasional	Medium
Casper	Limited	Limited	Occasional	Medium
Edgerton	Limited	Limited	Occasional	Medium
Evansville	Limited	Limited	Occasional	Medium
Midwest	Limited	Limited	Occasional	Medium
Mills	Limited	Limited	Occasional	Low
Natrona County	Limited	Limited	Occasional	Medium

4.3.5 Flood

Hazard/Problem Description

Floods can and have caused significant damage in Natrona County. They have caused millions of dollars in damage in just a few hours or days. A flood, as defined by the National Flood Insurance Program, is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from: overflow of waters; unusual and rapid accumulation or runoff of surface waters from any source; or, a mudflow. Floods can be slow or fast rising, but generally develop over a period of many hours or days. Causes of flooding relevant to the County include:

- Rain in a general storm system
- Rain in a localized intense thunderstorm
- Melting snow
- Rain on melting snow
- Urban stormwater drainage
- Ice Jams
- Dam failure
- Levee Failure
- Rain on fire damaged watersheds

The area adjacent to a river channel is its floodplain. In its common usage, “floodplain” most often refers to that area that is inundated by the 100-year flood, the flood that has a 1 percent chance in any given year of being equaled or exceeded. The 100-year flood is the national standard to which communities regulate their floodplains through the National Flood Insurance Program.

Natrona County is susceptible to multiple types of floods including riverine flooding, flash floods, slow rise floods, ice jams and possibly dam or levee failure.

Riverine flooding is defined as when a watercourse exceeds its "bank-full" capacity and is usually the most common type of flood event. Riverine flooding generally occurs as a result of prolonged rainfall, or rainfall that is combined with soils already saturated from previous rain events. Slow rise floods associated with snowmelt and sustained precipitation usually are preceded with adequate warning, though the event can last several days.

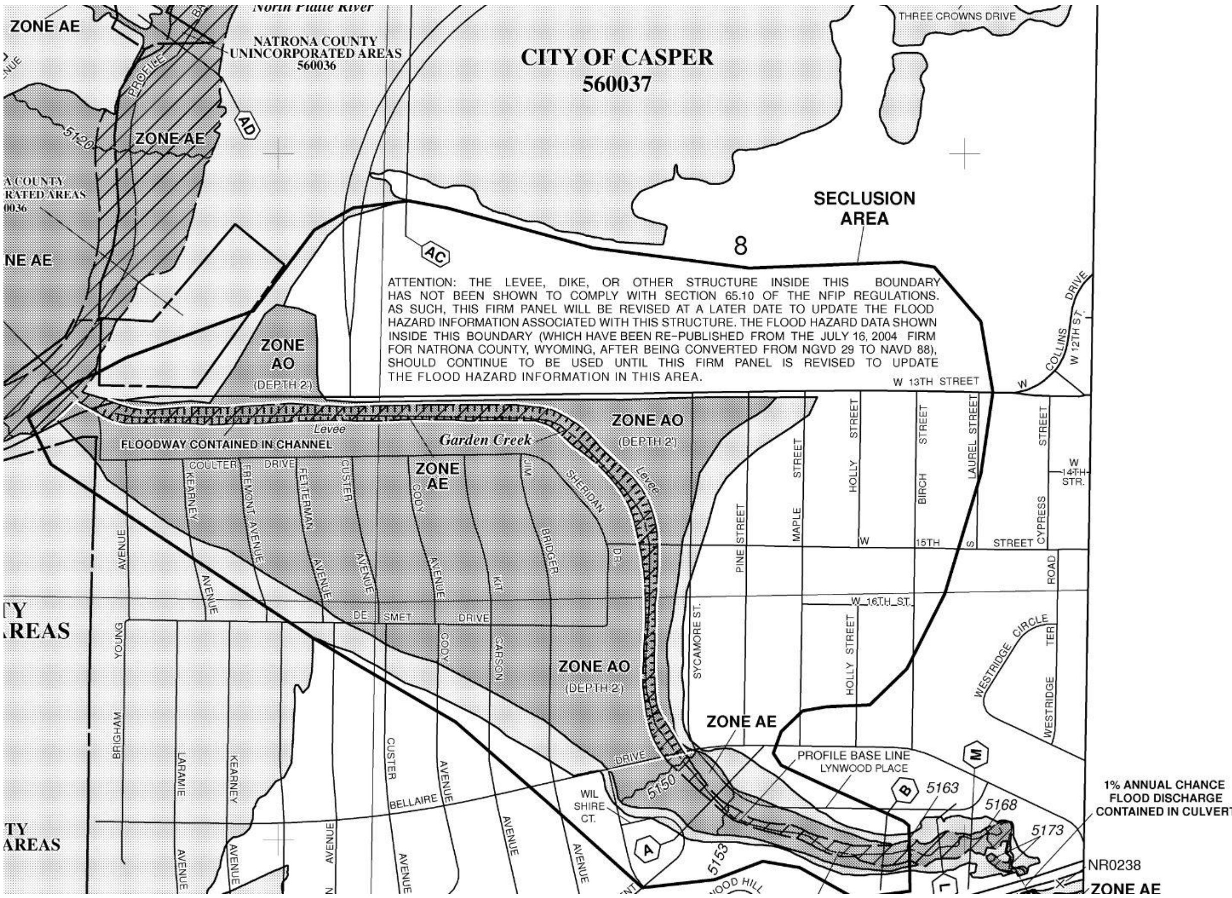
Floods can also occur with little or no warning and can reach full peak in only a few minutes. Such floods are called flash floods. A flash flood usually results from intense storms dropping large amounts of rain within a brief period. Flash floods, by their nature, occur very suddenly but usually dissipate within hours. Even flash floods are usually preceded with warning from the National Weather Service in terms of flash flood advisories, watches, and warnings.

Floods can occur for reasons other than precipitation or rapidly melting snow. They can also occur because of ice jams, which have occurred in Natrona County in the past. An ice jam is a stationary accumulation of ice that restricts flow. Ice jams can cause considerable increases in upstream water levels, while at the same time downstream water levels may drop. Types of ice jams include freeze up jams, breakup jams, or combinations of both. These types of floods can be slow or fast rising, but generally develop over a period of many hours or days.

Levee failure can also cause a flash flood and is a risk in the planning area. A levee is an earthen embankment constructed along the banks of rivers, canals and coastlines to protect adjacent lands from flooding by reinforcing the banks. By confining the flow, levees can also increase the speed of the water. Levees can be natural or man-made. A natural levee is formed when sediment settles on the river bank, raising the level of the land around the river. To construct a man-made levee, workers pile dirt or concrete along the river banks, creating an embankment. This embankment is flat at the top, and slopes at an angle down to the water. For added strength, sandbags are sometimes placed over dirt embankments. Natural disasters such as Hurricane Katrina demonstrate that, although levees can provide strong flood protection, they are not failsafe. Levees can *reduce* the risk to individuals and structures behind them; but they do not eliminate risk entirely. Levees are designed to protect against a specific flood level; severe weather could create a higher flood level that the levee cannot withstand. Levees can fail by either overtopping or breaching. Overtopping occurs when floodwaters exceed the height of a levee and flow over its crown. As the water passes over the top, it may erode the levee, worsening the flooding and potentially causing an opening, or breach, in the levee. A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning. Unfortunately, in the rare occurrence when a levee system fails or is overtopped, severe flooding can occur due to increased elevation differences associated with levees and the increased water velocity that is created. It is also important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure. In 2011, Emergency Management Coordinator Lt. Stewart Anderson reported "crews had constructed a levee of sorts" on the North Platte River in preparation for flooding.

FEMA Flood Insurance Rate Maps (FIRM) maps are provided for the City of Casper, the Town of Evansville, and the Town of Mills. The City of Casper includes a "Seclusion Area" in its firm panel with a levee. In March 2011, FEMA made a commitment to update the way flood hazards for non-accredited levee systems were analyzed and mapped. As a result, some ongoing FIRM updates that included non-accredited levee systems were delayed or otherwise impacted while FEMA developed the updated levee analysis and mapping approach. Seclusion mapping was developed by FEMA as a process to allow the release of these impacted FIRM updates. Levee seclusion mapping will maintain the flood hazard information as depicted on the current effective FIRM with map notes explaining that these flood hazards will be updated at a later time when the updated levee analysis and mapping approach is applied. Levee seclusion mapping will allow FEMA to provide community officials, residents, and business owners with updated information about their local flood hazards, while identifying those areas where the levee-related flood hazards were not updated. The image below displays the FIRM panel in Casper that includes a seclusion area.

Figure 4.16 City of Casper FIRM Seclusion Area



Erosion and channel migration can be exacerbated by flooding. In the 2017 update to this plan the HMPC expressed concerns of erosion along the North Platte River. Members from the HMPC commented with specific geographic examples of where this is occurring. The Eastdale Drainage behind Dragon Wall has sloughing/stability issues. Areas near Mills and Chamberlin Road and an area behind Wolf Creek are experiencing erosion issues as well.

The potential for flooding can also change and increase through various land use changes and changes to land surface. A change in the built environment can create localized flooding problems inside and outside of natural floodplains by altering or confining watersheds or natural drainage channels. These changes are commonly created by human activities. Flooding in the communities in the County could be exacerbated by inadequate drainage and channel systems that would not stand up to the 1% annual chance flood. Inadequate culverts and drainage systems can cause flooded roads and flood adjacent properties.

Increased flooding can also be can also be created by other events such as wildfires. Wildfires create hydrophobic soils, a hardening or "glazing" of the earth's surface that prevents rainfall from being absorbed into the ground, thereby increasing runoff; erosion, and downstream sedimentation of channels.

Geographical Area Affected

All areas within the planning area have the potential for flooding. The extent of the flooding varies based on the location in the county.

Natrona County is predominantly split between two river basins. The majority of the northern half of the county is in the Powder/Tongue River Basin, while the southern half lies within the Platte River Basin. An area of the northwest part of the county is located in the Wind/Bighorn River Basin.

The Powder River Basin includes the lower elevation lands reaching from the Bighorn Mountains in north central Wyoming to the Black Hills on the Wyoming/South Dakota border. This region also includes the watersheds of the Tongue, Little Missouri, Belle Fourche and Cheyenne rivers, tributaries of the Yellowstone and Missouri.

The North Platte River basin is located in the southeast corner of the state. The river flows north into Wyoming from Colorado. The Sweetwater River, one of the North Platte's major tributaries, flows in from the west. The North Platte River Basin covers roughly 22,000 square miles in Wyoming, about one quarter of the state. The headwaters flow from the mountains surrounding North Park, Colorado, as well as the Medicine Bow and Sierra Madre and other, minor ranges of southeast Wyoming.

Casper, Mills, and Evansville are all located in the Platte River Basin. The North Platte River runs through each of the three municipalities.

Figure 4.17 shows the Natrona County flood hazards, followed by maps showing flood hazards by municipality. The majority of the unincorporated area has not been mapped by the NFIP. Flood hazards in these areas are approximated based on modeling of the 1% annual chance flood using Hazus.

Figure 4.17 Natrona County 1% Annual Chance Flood Hazards

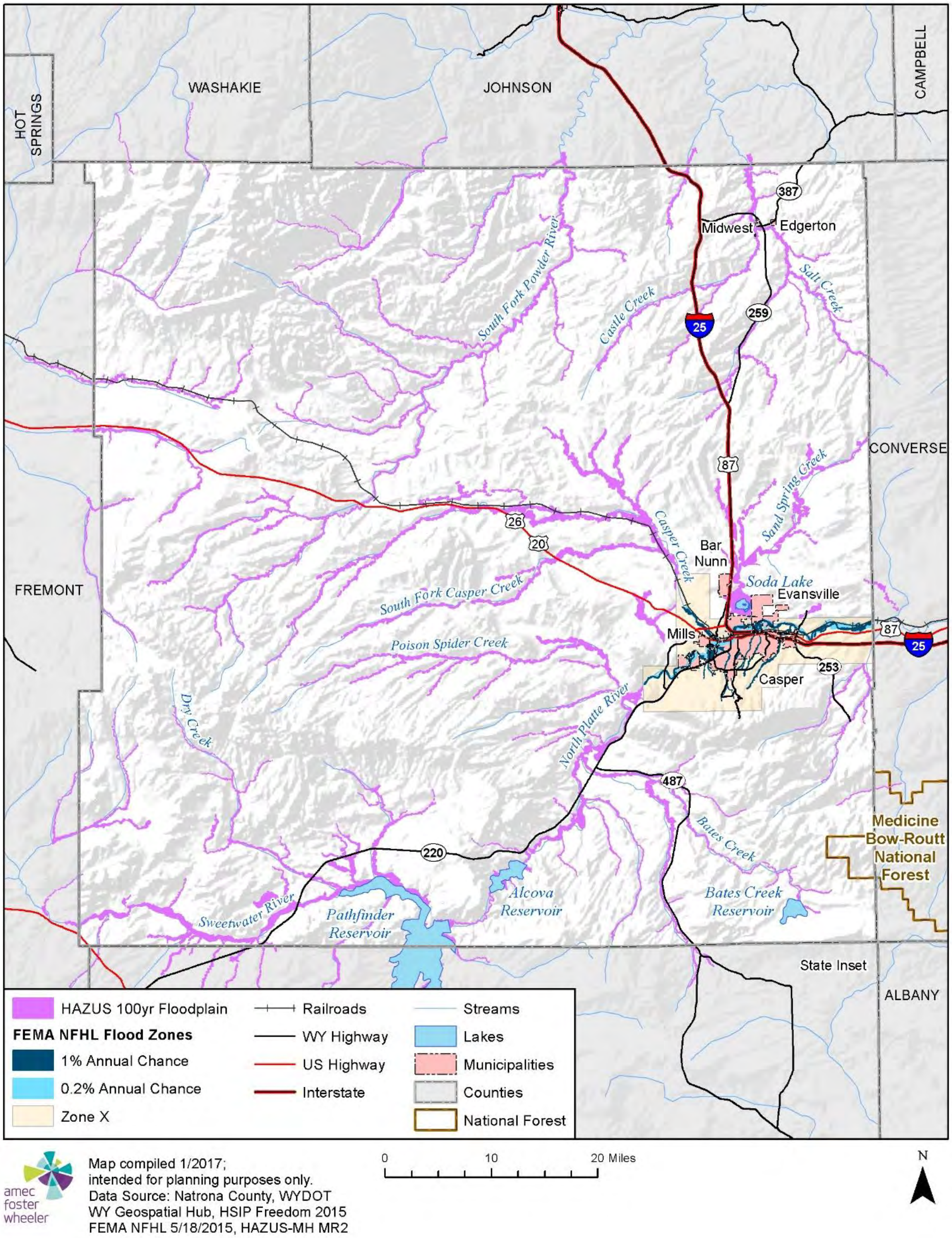


Figure 4.18 Bar Nunn 1% Annual Chance Flood Hazards

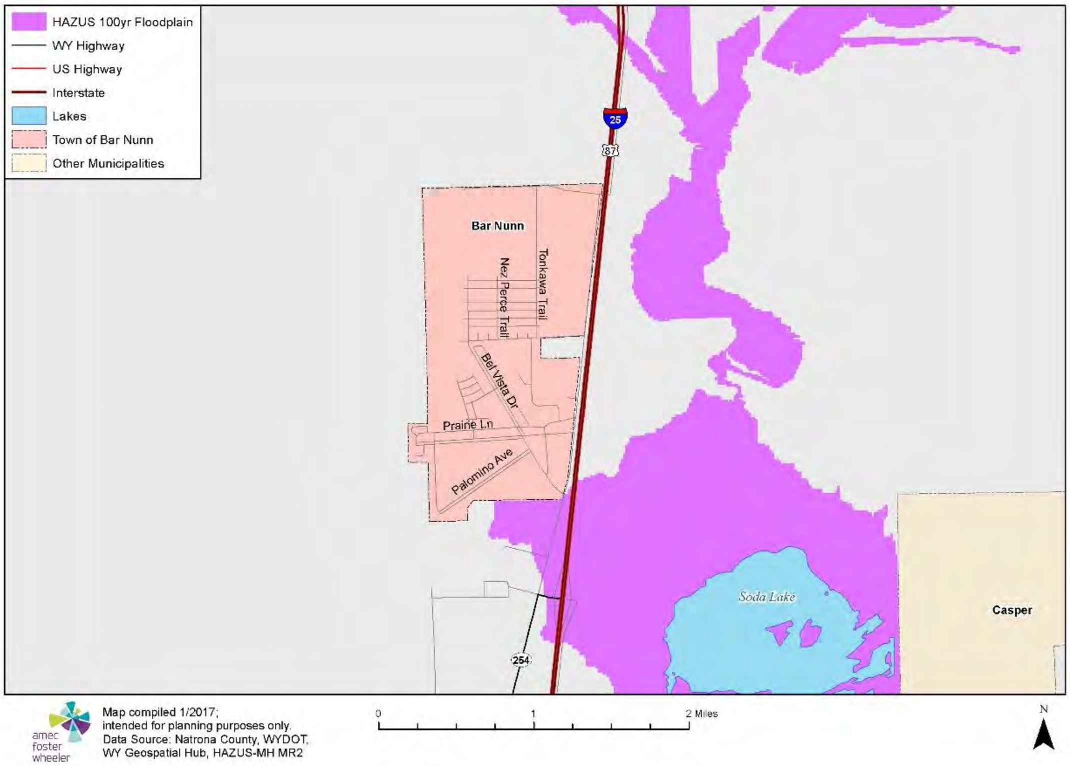


Figure 4.19 Midwest and Edgerton 1% Annual Chance Flood Hazards

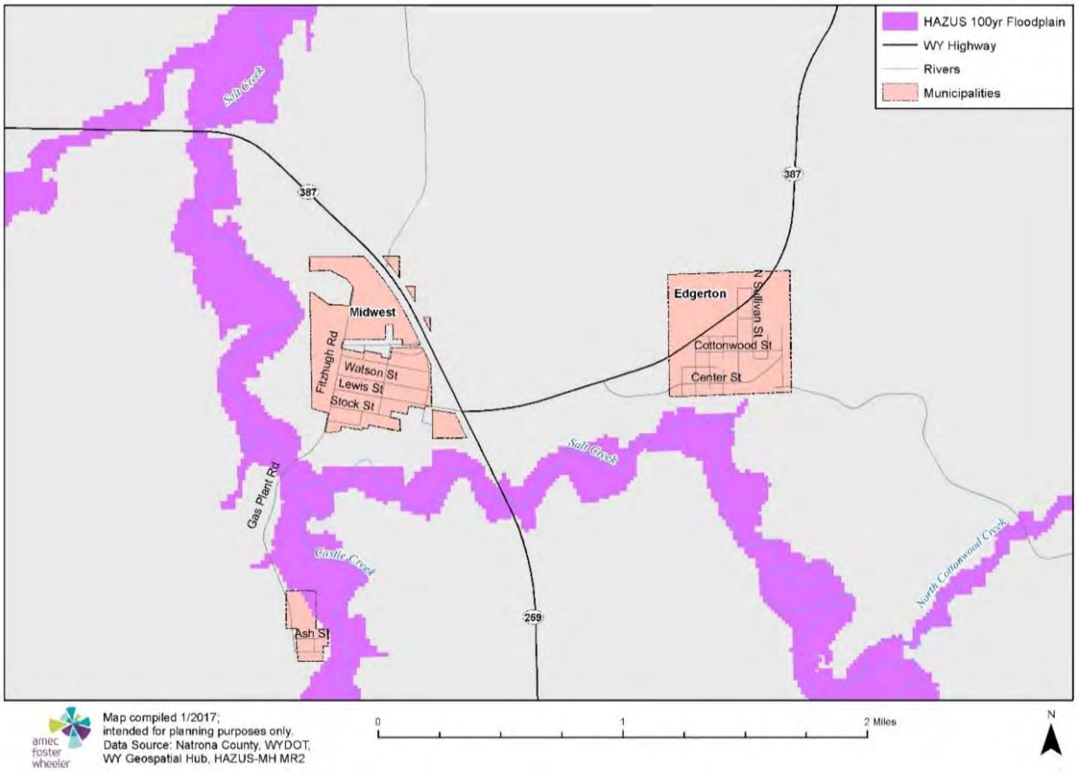


Figure 4.20 Casper 1% Annual Chance Flood Hazards

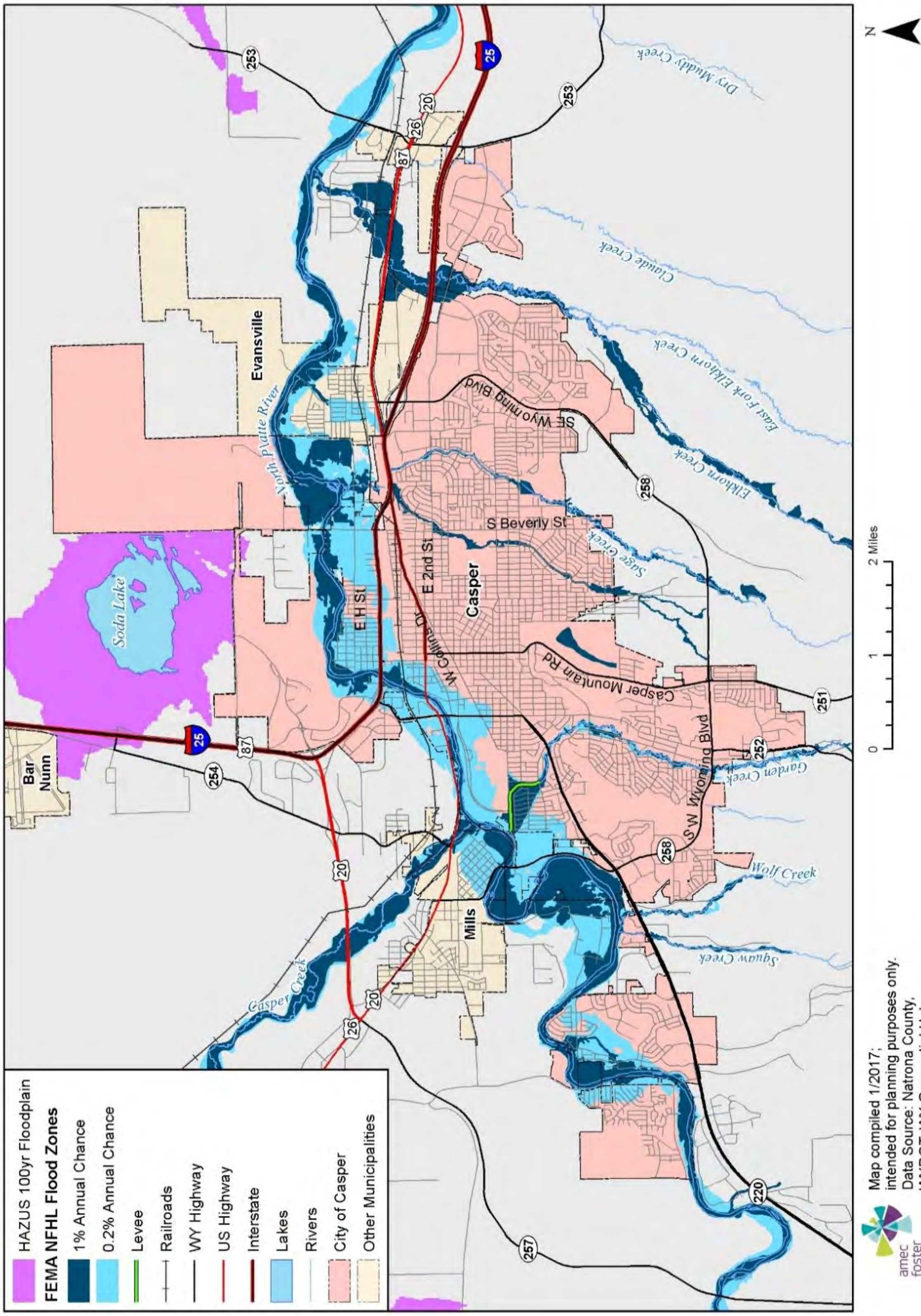


Figure 4.21 Evansville 1% Annual Chance Flood Hazards

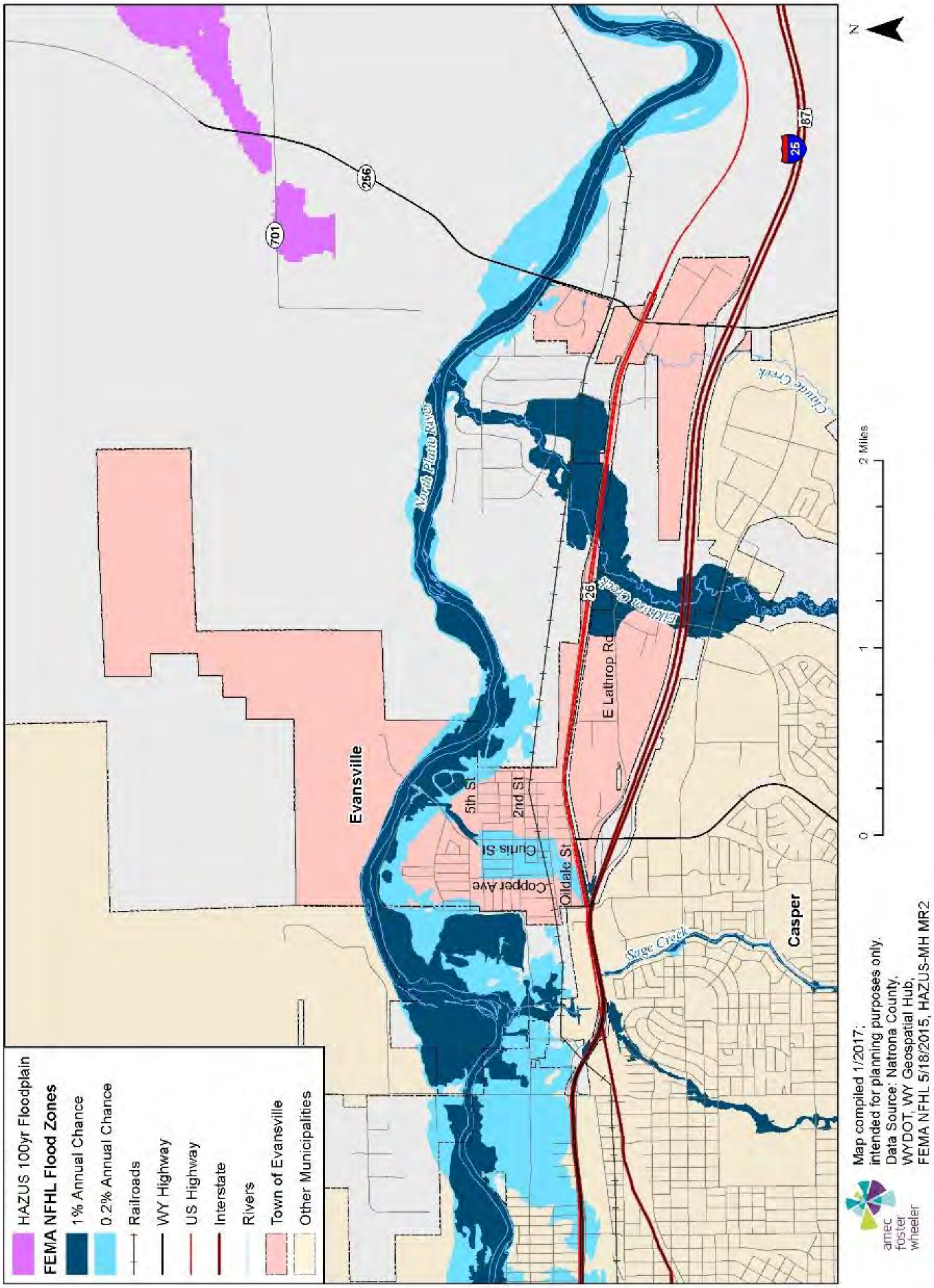
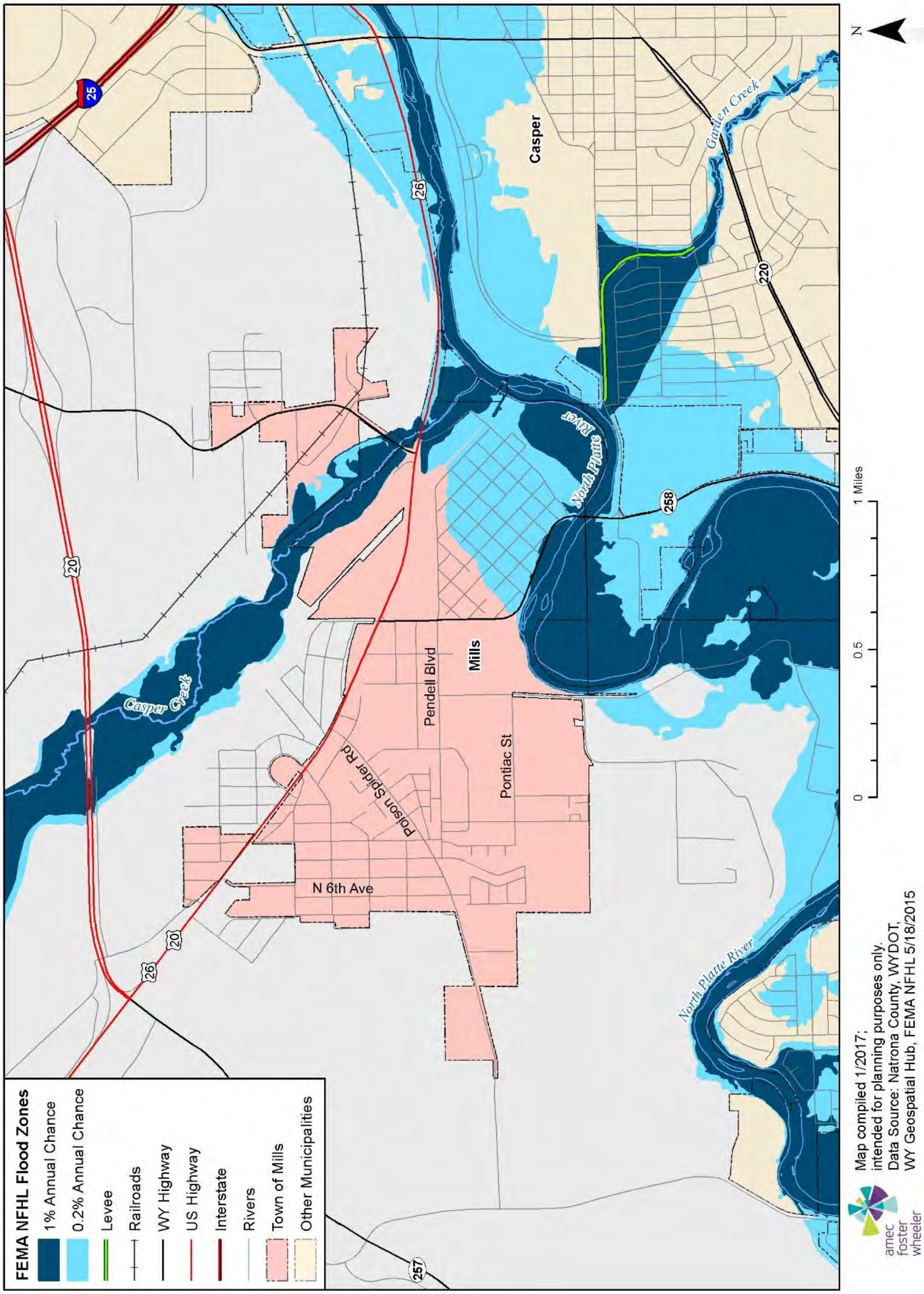


Figure 4.22 Mills 1% Annual Chance Flood Hazards



Past Occurrences

A brief history of significant floods is presented below, while a more extensive summary is included in the county annexes. A damaging flood occurs in the area every year on average, based upon the NCDC data presented below.

Table 4.32 Flood Occurrences in Natrona County

Date	Type of Event	Property Damage
1/29/1996	Flood	$2,000
3/13/1996	Flood	$0
6/19/1998	Flood	$0
1/29/1996	Flood	$2,000
5/29/2001	Flash Flood	$0
5/29/2001	Flash Flood	$0
5/29/2001	Flash Flood	$0
6/16/2003	Flash Flood	$0
7/13/2004	Flash Flood	$0
7/25/2005	Flash Flood	$500,000
8/3/2005	Flash Flood	$85,000
7/19/2007	Flash Flood	$50,000
7/19/2007	Flash Flood	$5,000
7/25/2007	Flash Flood	$300,000
8/2/2007	Flash Flood	$500,000
8/3/2007	Flash Flood	$50,000
8/3/2007	Flash Flood	$15,000
6/13/2009	Flash Flood	$2,000
7/3/2009	Flash Flood	$5,000,000
7/29/2013	Flash Flood	$200,000
8/9/2013	Flash Flood	$17,000
8/9/2013	Flash Flood	$0
8/5/2014	Flash Flood	$200,000
5/24/2015	Flash Flood	$100,000
5/24/2015	Flash Flood	$0
6/5/2015	Flash Flood	$0
10/2/2015	Flash Flood	$40,000
	Total	$7.066,000

Source: NCDC

In May 2001, flash flooding along Teapot and Castle Creeks occurred. No property or crop damage was reported.

In June of 2003, flash flooding occurred and caused rocks, boulder, mud and water to be displaced over Highway 220. No property or crop damage was reported.

In July of 2004, minor flooding reported along Poison Spider Creek with water flowing atop Poison Spider Road. No property or crop damage was reported.

In July of 2005, a line of strong thunderstorms moved west to east across Natrona County between 4:30 p.m. and 6:30 p.m. These storms originated over the Bighorn Mountains of Wyoming and rapidly intensified near the Natrona County International Airport, 6 miles west of Casper, where a 54 kt wind gust was reported. The airport received nearly an inch of rain between 5:35 p.m. and 6:05 p.m. The storms hit the Casper area between 5:50 p.m. and 6:20 p.m. with similar strong outflow winds followed by reports of up to 1.44 inches of rainfall over this 30 minute period. The brief torrent of rain produced flooding on the north side of downtown Casper, shutting down portions of Interstate 25. Portions of Poplar and McKinley streets near the interstate were also blocked with water and mud, which in some cases flowed into business buildings. The strong outflow winds that preceded the storm snapped the top of a cottonwood tree off of its 18 inch diameter trunk and ripped a sheet metal roof off a RV storage shed. Property damage totaled $500,000. There was no crop damage reported.

In August of 2005, in the early evening hours, a strong thunderstorm and its associated heavy rainfall neared the Casper area dropping a significant amount of rainfall. Within the city of Casper, rainfall totals ranged from 1 to 1.5 inches in less than an hour which led to an area of flash flooding. The rushing water moved cars several feet, approached the doorsteps and flooded the basements of several homes in the Allendale area, and caused an underground drainage pipe to give way causing a 20-foot wide sinkhole. Property damage totaled $85,000. There was no crop damage reported.

In July of 2007, Strong and severe thunderstorms spread south along the eastern slopes of the Bighorn Mountains during the afternoon and early evening. These storms produced long periods of hail and very heavy rain. Additional thunderstorms brought heavy rain to areas west and southwest of Casper, including the area near the Jackson Canyon fire burn scar. Property damage reached $105K. Crop damage reached $6K. Later in the month, copious moisture was brought north into Wyoming in strong monsoonal flow. Low-level upslope flow from the north aided the development of showers and thunderstorms. Atmospheric moisture values were around 200 percent of normal. Rainfall estimated by radar to be three inches or more fell in a swath from Emigrant Gap to Bar Nunn. The heavy rain caused flash flooding along Poison Spider Road and other nearby roads as culverts could not handle the large volume of water. Portions of a ranch along Poison Spider Road were under several feet of water. A mobile home park south of Bar Nunn was flooded as water flowed from surrounding higher terrain. The lower floor of the rural Poison Spider Elementary School sustained flood damage as the water poured in through several doorways. Property damage totaled $585K. There was no crop damage reported.

In August of 2007, Thunderstorms producing heavy rain formed northwest of Casper during the late evening. The storms tracked southeast along and south of U.S. Highway 20/26 over areas that had been hard hit by heavy rain over the previous two weeks. Natrona County Emergency Management officials reported flooding at the intersection of Poison Spider and 12 Mile roads at 8:57 p.m. Flooding along Poison Spider Road continued to increase through 10:00 p.m. with additional reports of ditches overflowing in and around Mills. Heavy rainfall of nearly one inch fell in less than 30 minutes at the Natrona County International Airport causing flooding. The Poison Spider Elementary School was flooded for the second time in eight days causing upwards of $100,000 in damage. Total property damage was $500K. The next day, one to two inches of rain fell on already saturated ground west of Casper along Poison Spider Road. Also, rainfall of 0.50 to 1.50 inches fell in less than one hour in and near the city of Casper. The rain produced flash flooding along Poison Spider and Paradise Valley roads and in some locales around Paradise Valley. Urban flooding was also observed along Interstate 25 in Casper. This event resulted in $65K in property damage. There was no crop damage reported.

In June of 2009, severe thunderstorms developed in a moist, upslope flow air mass east of the Continental Divide. The severity of the storms was aided by a disturbance that moved northeast across the area and a favorable jet stream position. Rainfall of one to two inches fell in and around Casper. One location at Wyoming Medical Center recorded 1.75 inches of rain. The water accumulated at the intersection of Poplar and CY avenues and flooded the area. There was $2K reported in property damage. There was no crop damage reported.

In July of 2009, a vicious thunderstorm struck the city of Casper between about 5:15 and 6:00MST at the start of the July 4th holiday weekend. Extreme rainfall rates falling on the urbanized landscape produced flash flooding throughout Casper, with the most extensive inundation centered on the intersection of Poplar and Collins streets. Nearly one inch of rain fell in 21 minutes at the Natrona County International Airport northwest of the city. A precipitation gauge along the North Platte River in Casper reported 1.79 inches of rain in 30 minutes. Final tallies around town showed rainfall from around one inch up to a high of about 2.25 inches occurred within about a 35 minute time frame. Several streets, including Poplar and McKinley were reported to be rivers carrying rocks and other debris toward downtown Casper. Reports indicated one to three feet of water was present on some city streets. The flash flooding floated several cars and sent storm drains shooting wildly into the air. One storm drain cover injured an individual as the surging water displaced it. Emergency management estimated anywhere from 800 to 1000 structures, mainly homes, were impacted by the flooding. In addition to hundreds of impacted homes, many well-known locations also sustained damage, including the Nicolaysen Art Museum, Wyoming Medical Center, Central Wyoming Fairgrounds, Three Crowns Golf Course, and several city school buildings. Major damage also occurred at Casper College where five buildings, including the gymnasium and theater, were significantly impacted. Retaining wall bricks and landscape gravel were washed from a hillside at the college and cascaded to neighboring residences and streets below. The Hall of Justice on North David Street also sustained significant damage when water poured through a door into an underground garage. The building's elevator shafts and the ceilings in several sheriff's offices were also damaged. Property damage resulted in $5M. There was no reported crop damage.

In July of 2013, Heavy rain began falling around 7:00MST over east Casper and the east end of Casper Mountain. Thunderstorms had approached the area from the southwest and a low-level northeast flow made for a slower progression over east Casper. The result was rainfall of one-half to one-inch in about 25 minutes. Street flooding was observed along East 2nd Street from Wyoming Boulevard toward Hat Six Road. The water was up to two feet deep near the intersection of Blackmore Road and East 2nd Street. Hail around one-half inch in diameter accumulated to a depth of several inches. The most significant flooding occurred at the Hat Six Ranch at the east end of Casper Mountain. The steep canyons and hillsides above the ranch were torched the previous September by the Sheep Herder Hill Wildfire. Excessive rainfall quickly brought a mix of rock, mud, and debris down one canyon and another draw damaging two homes, at least three vehicles, and two all-terrain vehicles. Water and debris eventually found the Clear Fork Muddy Creek channel and spread out to be anywhere from 50 to 100 yards wide. One additional ranch received damage as the creek swept northeast and eventually topped the Hat Six Road. Property damage reached $200K. There was no reported crop damage.

In August of 2014, slow-moving thunderstorms produced very heavy rain near the Red Wall and Gray Wall in northern Natrona County. Radar estimated up to 3.5 inches of rain fell within one hour in the Hackett Creek drainage, while widespread 1.5 inch amounts were estimated across a larger area near the walls. The Alkali, Indian, and Willow creek drainages were significantly impacted. Damage to county roads was extensive as culverts could not handle the volume of water and debris which washed down hillsides and across the roads. There were numerous instances of water, mud, and debris across Willow Creek and Baker Cabin roads. Small reservoirs quickly filled with water and overflow channels were utilized. Large hail also occurred with the thunderstorms which further complicated the situation. Hail stones larger than a quarter were still visible in deep drifts the morning after the deluge. Hay meadows, backcountry roads, and a ranch fence line were all damaged by the flood waters and hail. Near the Willow Creek Ranch and downstream near the rural Willow Creek School, the flood waters on Willow Creek were estimated at over 100 yards wide and at least 4 to 5 feet deep. The high water re-routed the creek and left a large amount of sediment and debris behind. Farther upstream near the two walls, the flood waters tore loose the soil and grass of Hackett Creek scouring out the creek bed. Numerous fences were destroyed and at least one residence reported flooding near the school. The school itself was damaged when a small drainage overflowed a county road sending water and debris cascading into the building. Property damage reached $200K. There was no reported crop damage.

In May of 2015, A slow-moving upper level low south of Wyoming sent waves of moisture northward over central and eastern Wyoming during the Memorial Day holiday weekend. Measured and estimated rainfall totals ranged from two to around five inches. This resulted in flooding and flash flooding in several areas. Johnson County saw significant flooding along the tributaries and main stem of the Powder River and around Buffalo. The greatest impact was felt in Hot Springs County where heavy rains in the Wind River Canyon resulted in several mud and rock slides that closed State Highway 789 between Thermopolis and Shoshoni. Several storm spotters reported flash flooding on Salt Creek in Natrona County. Some county and Bureau of Land

Management roads were washed out. At least one fracking trailer was destroyed south of town. Property damage in the area of Salt Creek totaled $100K.

In October of 2015, West-northwest moving showers and thunderstorms tracked up the south slope of the Bighorn Mountains during the late afternoon of October 2. Heavy rain estimated at 0.75 inch to around 1.00 inch fell in a 20 to 30 minute period in the Buffalo Creek drainage. The water quickly ran off the steep slopes into creeks and streams feeding Buffalo Creek. Eyewitness reports indicated the creek went from a dry creek to well outside its banks in just minutes. The raging waters damaged a county road in several spots, overtopped and damaged a ranch road, and ruined fence line at a rural ranch. Property damage reached $40K. There was no reported crop damage.

During the HMP Risk and Goals meeting, recent occurrences were noted. Periodic flooding has occurred in the past five years including 2012, 2015, and 2016. 2016 flooding along the North Platte was minimal due to mitigation and greenway efforts along the Platte River Parkway. Flash flooding resulted in evacuations in the 33 Mile area June 5, 2015 (the day after flooding in Lusk in 2015).

Frequency/Likelihood of Occurrence

With 27 recorded floods in the last twenty years, a flood of at least minimal magnitude occurs roughly every year in the County. Most of these floods were less than the 100-year flood; the chance of a 100-year flood occurring within any 30-year period is 26%. The chance of a 100-year flood occurring in any 100-year period is approximately 63%. Using the formula in Section 4.2, this yields a 10-100 % probability. This corresponds to a **Likely** occurrence rating, meaning that a flood has a 10-100 percent chance of occurrence in the next year somewhere in the County.

Potential Magnitude

Magnitude and severity can be described or evaluated in terms of a combination of the different levels of impact that a community sustains from a hazard event. Specific examples of negative impacts from flooding on the County span a comprehensive range and are summarized as follows:

- Floods cause damage to private property that often creates financial hardship for individuals and families;
- Floods cause damage to public infrastructure resulting in increased public expenditures and demand for tax dollars;
- Floods cause loss of personal income for agricultural producers that experience flood damages;
- Floods cause loss of income to businesses relying on recreational uses of regional waterways;
- Floods cause emotional distress on individuals and families; and
- Floods can cause injury and death.

Floods present a risk to life and property, including buildings, their contents, and their use. Floods can affect crops and livestock. Floods can also affect lifeline utilities (e.g., water, sewerage, and power), transportation, jobs, tourism, the environment, and the local and regional economies. The impact of a flood event can vary based on geographic location to waterways, soil content and ground cover, and construction. The extent of the damage of flooding ranges from very narrow to widespread based on the type of flooding and other circumstances such as previous rainfall, rate of precipitation accumulation, and the time of year.

The magnitude and severity of the flood hazard is usually determined by not only the extent of impact it has on the overall geographic area, but also by identifying the most catastrophic event in the previous flood history. Sometimes it is referred to as the "event of record." The flood of record is almost always correlated to a peak discharge at a gage, but that event may not have caused the worst historic flood impact in terms of property damage, loss of life, etc. The flood of record in Natrona County occurred in July 2009 just west of Casper. Intense rainfall accompanied a strong thunderstorm which gained strength just west of Casper before blasting though town. Longtime residents reported this to be the worst flash flooding they had seen in the city. Several streets, including Poplar and McKinley were reported to be rivers carrying rocks and other debris toward downtown Casper. Reports indicated one to three feet of water was present on some city streets. The flash flooding floated several cars and sent storm drains shooting wildly into the air. One storm drain cover injured an individual as the surging water displaced it. Emergency management estimated anywhere from 800 to 1000 structures, mainly homes, were impacted by the flooding. In addition to hundreds of impacted homes, many well-known locations also sustained damage, including the Nicolaysen Art Museum, Wyoming Medical Center, Central Wyoming Fairgrounds, Three Crowns Golf Course, and several city school buildings. Major damage also occurred at Casper College where five buildings, including the gymnasium and theater, were significantly impacted. Retaining wall bricks and landscape gravel were washed from a hillside at the college and cascaded to neighboring residences and streets below. The Hall of Justice on North David Street also sustained significant damage when water poured through a door into an underground garage. The building's elevator shafts and the ceilings in several sheriff's offices were also damaged. Property damage totaled $5M.

One method of examining the magnitude and severity of flooding in the planning area is to examine the damage losses and payments from the National Flood Insurance Program. This information is not comprehensive, because it only reflects the communities which participate in the NFIP, but it is a useful overview of flood damages in the planning area. The information below represents the composite of unincorporated and community-specific policies, claims and payments. There were no repetitive losses or substantial damage claims reported.

Table 4.33 NFIP Claims and Payments in Natrona County 1978-2016

Jurisdiction	Policies	Coverage	# of Claims	Paid Losses	# of Policies in A Zones	# of Policies in Non A Zones
Barr Nunn	n/a	n/a	n/a	n/a	n/a	n/a
Casper	223	$45,597,900	20	$125,586	134	89
Edgerton	n/a	n/a	n/a	n/a	n/a	n/a
Evansville	2	$630,000	0	0	0	2
Midwest	n/a	n/a	n/a	n/a	n/a	n/a
Mills	4	$735,000	0	0	0	4
County	46	$14,083,500	1	$2,726	21	25

Source: FEMA Policy and Claim Statistics http://www.fema.gov/policy-claim-statistics-flood-insurance

The potential magnitude for a flood event in the planning area is generally **limited**. An event of limited magnitude would result in some injuries, a complete shutdown of critical facilities for over a week, and damages to more than 10% of the planning area. This is consistent with the flood event history in the County. The flood history indicates that damaging floods have occurred consistently in the County. Fortunately, there has been no loss of life or any significant injury caused by floods in the county.

Vulnerability Assessment

Population

Vulnerable populations in the County include residents living in known flooding areas or near areas vulnerable to flash floods. Certain populations are particularly vulnerable. This may include the elderly and very young; those living in long-term care facilities; mobile homes; hospitals; low-income housing areas; temporary shelters; people who do not speak English well; tourists and visitors; and those with developmental, physical, or sensory disabilities. These populations may be more vulnerable to flooding due to limitations of movement, fiscal income, challenges in receiving and understanding warnings, or unfamiliarity with surroundings.

As part of this plan's preparation, an estimate of the population exposed to flooding was created using a GIS overlay of existing DFIRMs on potentially flooded parcels. The flood-impacted population for each jurisdiction in the county was then calculated by taking the number of parcel units in the 1% annual chance and .02% annual chance floodplains and multiplying that number by the average household size based on the Census Bureau's estimate for the county. The average household factor was 2.44 in Natrona County.

Property and Economic Losses

GIS analysis was used to estimate Natrona County's potential property and economic losses. The parcel layer was used as the basis for the inventory of developed parcels. An address point layer was used to represent buildings, which was overlaid on the floodplain layer. For the purposes of this analysis, the flood zone that intersected the address point was assigned as the flood zone for the entire parcel. In some cases, there are parcels in multiple flood zones, such as Zone A and X 500. Another assumption with this model is that every parcel with an improvement value greater than zero was assumed to be developed in some way. Only improved parcels, and the value of those improvements, were analyzed and aggregated by jurisdiction, property type and flood zone. The summarized results for the planning area are shown below

Table 4.34 shows the count and improved value of parcels in the planning area, broken out by each jurisdiction, that fall in a floodplain, by 1% annual chance flood and 0.2% annual chance flood. The table also shows loss estimate values which are calculated based upon the improved value and estimated contents value. The estimated contents value is 50% of the improved value; the total value is the sum of the improved and estimated contents values; the loss estimate is 25% of the total value based on FEMA's depth-damage loss curves. For example, a two-foot flood generally results in about 25% damage to the structure (which translates to 25% of the structure's replacement value).

Table 4.34 Natrona County FEMA 1% Annual Chance Flood Risk Summary by Jurisdiction

Jurisdiction	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Casper	488	669	$55,332,980	$30,192,351	$85,525,331	$21,381,333	1,379
Evansville	5	5	$1,973,011	$1,865,907	$3,838,918	$959,730	2
Mills	10	16	$839,867	$801,531	$1,641,398	$410,349	12
Unincorporated	345	441	$50,084,868	$37,242,907	$87,327,775	$21,831,944	781
Total	848	1,131	$108,230,726	$70,102,695	$178,333,421	$44,583,355	2,174

Table 4.35 Natrona County FEMA .02% Annual Chance Flood Risk Summary by Jurisdiction

Jurisdiction	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Casper	1,801	2,072	$240,271,148	$159,052,979	$399,324,127	$99,831,032	3,887
Evansville	258	277	$23,774,147	$12,065,397	$35,839,544	$8,959,886	583
Mills	294	379	$15,171,838	$12,192,736	$27,364,574	$6,841,144	651
Unincorporated	265	399	$47,901,073	$32,389,893	$80,290,966	$20,072,742	559
Total	2,618	3,127	$327,118,206	$215,701,005	$542,819,211	$135,704,803	5,680

Based on this analysis, the planning area has significant assets at risk to the 100-year and greater floods. There are 848 improved parcels within the 100-year floodplain (1% annual chance) for a total improved value of $108M. There are 2,618 improved parcels within the 500-year floodplain (0.2% annual chance) for a total value of $327M. Overall, Natrona County potentially faces almost

$169 million in losses from flooding. Approximately $44 million of that is based on damage estimates from the 1% annual chance flood, with the remaining $135 million in damages resulting from the 0.2% annual chance flood. Flood losses from the 0.2% annual chance flood would be particularly devastating since development is typically not regulated within this zone.

Appendix C contains more information on the property types at risk by jurisdiction, and maps that show the locations of at-risk structures.

Critical Facilities and Community Assets

GIS analysis of flood hazards in Natrona County indicates that there are 126 critical facilities and/or community assets that are potentially exposed to flood hazards. There are 14 facilities in the 100-year floodplain and 112 in the 500-year. The map and tables below summarize the facilities that are potentially at risk.

Figure 4.23 Critical Facilities within the .02% and 1% Chance FEMA Flood Zone

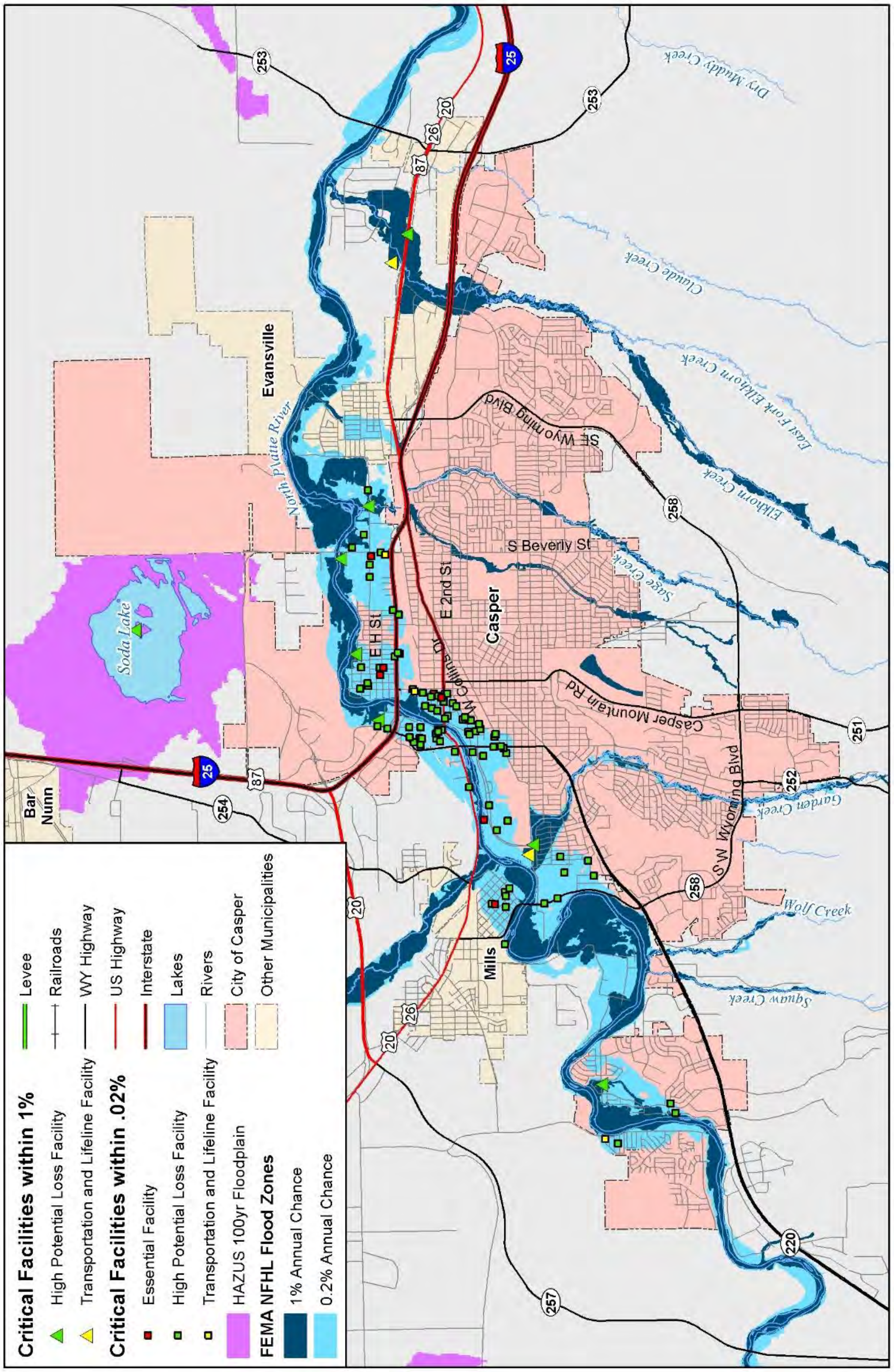


Table 4.36 Critical Facilities within 1% Chance FEMA Flood Zone

Jurisdiction	Critical Facility Type	Facility Count
Casper	Community Support	1
	EPA FRS Location	3
	Substation	1
	Total	5
Evansville	EPA FRS Location	1
	Total	1
Unincorporated	EPA FRS Location	2
	Substation	3
	Tier II	3
	Total	8
	Grand Total	14

Table 4.37 Critical Facilities within 0.2% Chance FEMA Flood Zone

Jurisdiction	Critical Facility Type	Facility Count
Casper	Community Support	8
	Day Cares	5
	EPA FRS Location	56
	EPA Regulated Facility	1
	Fire Department	1
	Law Enforcement	3
	EOC (on 2nd floor)	1
	National Shelter System Facility	2
	School	1
	Special Medical Facility	3
	Substation	2
	Tier II	8
	Total	91
Mills*	Day Cares	3
	EPA FRS Location	1
	Senior/community center (former Fire Station #9)	1
	National Shelter System Facility	1
	School	1
	Tier II	1
	Total	8
Unincorporated	Air Facility	1
	EPA FRS Location	10
	National Shelter System Facility	1
	Substation	1
	Total	13
	Grand Total	112

*The Mills town Hall, Public Works department and Water Treatment Plant are all near the river according to the HMPC

Natural, Historic, and Cultural Resources

Natural resources are generally resistant to flooding except where natural landscapes and soil compositions have been altered for human development or after periods of previous disasters such as drought and fire. Wetlands, for example, exist because of natural flooding incidents. Areas that are no longer wetlands may suffer from oversaturation of water, as will areas that are particularly impacted by drought. Areas recently suffering from wildfire damage may erode because of flooding, which can permanently alter an ecological system.

Tourism and outdoor recreation is an important part of the County's economy. If part of the planning area were damaged by flooding, tourism and outdoor recreation could potentially suffer.

Future Development

For NFIP participating communities, floodplain management practices implemented through local floodplain management ordinances should mitigate the flood risk to new development in floodplains. As the unincorporated County is not mapped there is potential for flood prone development to occur. The HMP noted that after the construction of Pathfinder Reservoir, development has encroached closer to the North Platte River.

Summary

Overall, flooding presents a **medium risk** for Natrona County. A 0.2% annual chance flood would have significant consequences. Somewhere in the county floods almost every year. Flooding has damaged homes, infrastructure (roads and bridges), and caused agricultural losses in the planning area in the past. Flood risk varies by jurisdiction.

Table 4.38 Flood Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Bar Nunn	Limited	Limited	Likely	Medium
Casper	Significant	Critical	Likely	High
Edgerton	Limited	Limited	Likely	Medium
Evansville	Significant	Limited	Likely	Medium
Midwest	Limited	Limited	Likely	Medium
Mills	Significant	Critical	Likely	High
Natrona County	Significant	Limited	Likely	Medium

4.3.6 Hazardous Materials

Hazard Description

Generally, a hazardous material is a substance or combination of substances which, because of quantity, concentration, or physical, chemical, or infectious characteristics, may either (1) cause or significantly contribute to, an increase in mortality or an increase in serious, irreversible, or incapacitating reversible, illness; or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, disposed of, or otherwise managed. Hazardous material incidents can occur while a hazardous substance is stored at a fixed facility, or while the substance is being transported.

The U.S. Department of Transportation, U.S. Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) all have responsibilities in regards to hazardous materials and waste.

The U.S. Department of Transportation has identified the following classes of hazardous materials:

- Explosives
- Compressed gases: flammable, non-flammable compressed, poisonous
- Flammable liquids: flammable (flashpoint below 141 degrees Fahrenheit) combustible (flashpoint from 141 - 200 degrees)
- Flammable solids: spontaneously combustible, dangerous when wet
- Oxidizers and organic peroxides
- Toxic materials: poisonous material, infectious agents
- Radioactive material
- Corrosive material: destruction of human skin, corrodes steel

Natrona County is home to several gas plants, refineries and mines, and hazardous materials transportation routes, pipelines and rail lines run across the County, creating a likely potential for hazardous materials releases.

Geographical Areas Affected

Hazmat incidents can occur at a fixed facility or during transportation. Hazardous materials facilities are identified and mapped by the counties they reside in, along with the types of materials stored there. Some facilities contain extremely hazardous substances; these facilities are required to generate Risk Management Plans (RMPs), and resubmit these plans every five years.

Hazardous materials routes are also present in the County. Interstate 25 goes directly north through the county and the Casper metropolitan area. Major rail lines run through the county as well, and can convey hazardous materials. The HMPC explained that railroad goes through the Casper metropolitan area and Evansville, which can include cars carrying ore from uranium mines. Generally, any infrastructure or populations located within a half mile of a hazardous materials route or fixed facility can be considered at elevated risk for impacts from a hazmat incident.

A 2017 commodity flow study conducted by the University of Wyoming Department of Civil and Architectural Engineering examined HAZMAT traffic from four different study locations in Natrona County. Using data from the 2015 Wyoming Vehicle Miles Report a monthly average daily traffic (MADT) was calculated for each of the study locations. HAZMAT truck percentages are based on the percentage of HAZMAT trucks counted during field data collection. Using the estimated number of HAZMAT trucks per day, the study went on to calculate the potential range of hazardous materials transported by different truck body configurations (straight truck, truck-trailer, and multi-trailer).

Total min amount = MADT ×% of trucks × %of HAZMAT trucks × body config. × min capacity
Total max amount = MADT ×% of trucks × %of HAZMAT trucks × body config. × max capacity

Table 4.39 displays the minimum and maximum amount of hazardous materials transported along these major routes.

Table 4.39 HAZMAT Traffic Assessment in Natrona County

Study Location	Monthly Average Daily Traffic	% of Truck	% of HAZMAT Trucks	Monthly Average Number of HAZMAT trucks per day	Total Amount (US gallons/day) Min/Max
US 220 MP 108	3,082	17.9%	10.5%	58	424,401/806,511
US 20/26 MP 12	2,211	11.6%	10.7%	27	217,245/407,116
I-25 East of Casper MP 182.06	8,188	17.9%	12.7%	186	1,131,353/2,061,772
I-25 North of Casper MP 192	5,505	17.9%	15.3%	151	966,289/1,768,941

The estimated minimum/maximum amounts of the transported HAZMATs were 424,401/806,511 US gallons/day for US 220 south of Casper, 217,245/407,116 US gallons/day for US 20/26 west of Casper, 1,131,353/2,061,772 US gallons/day for I-25 south of Casper and 966,289/1,768,941 US gallons/day for I-25 north of Casper. It should be noted that these numbers were estimated without taking seasonal variation into account due to lack of seasonal factors for HAZMAT transportation in Wyoming.

Data analysis showed that the most common HAZMAT class being transported is class 3, which is flammable liquids. Accordingly, it would indicate that the most likely HAZMAT incident could happen would involve a class 3 HAZMAT of flammable liquids. Flammable liquids (Class 3) HAZMAT has the highest percentage among the transported HAZMAT classes. It represents 55.8% of transported HAZMAT on 1st location, 85.4% on 2nd location, 78.5% on 3rd location and 85.3% on 4th location, averaged for both directions.

Past Occurrences

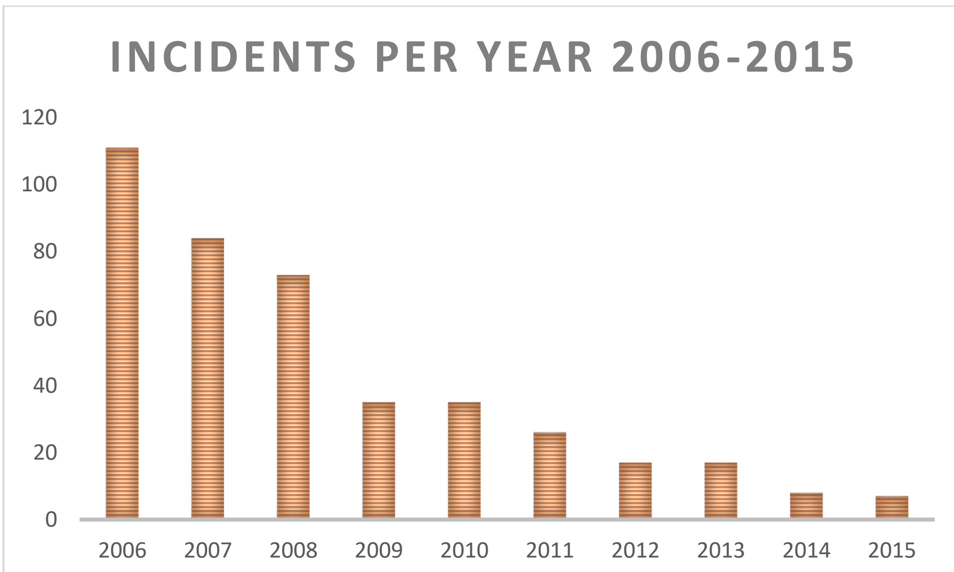
There are a variety of mechanisms to get an idea of the number and types of historical hazardous materials spills in Natrona County. One such repository is the catalog of hazardous materials spill and accident reports at the National Response Center (NRC) as part of the Right to Know Network (RTK NET). The figure below shows a ten-year record for reported incidents in the Natrona County.

413 hazardous materials incidents were recorded between 2006 and 2015 in Natrona County. Zero fatalities, hospitalizations, injuries and evacuations were recorded, and no property damage was reported in any of these incidents.

The HMPC reported a high number of incidents in Midwest. It was speculated that this could be venting of CO2 which would need to be reported. Gas lines has been hit during digs that did not call ahead.

Natrona County has seen a sharp decline in the number of recorded incidents. Between 2006 and 2015, the number has steadily dropped from a high of 111 reported incidents in 2006 to seven incidents recorded in 2015. The following figure shows this trend.

Figure 4.24 Hazardous Materials Spills/Accidents Reported to the NRC 2006-2015



Source: National Response Center

According the NRC site, the incident types with the highest rates of reports were fixed-site incidents (152) and pipeline incidents (236); together, incidents of these types made up 94% of total incidents reported.

Figure 4.25 Hazardous Materials Spills/Accidents by Type 2006-2015

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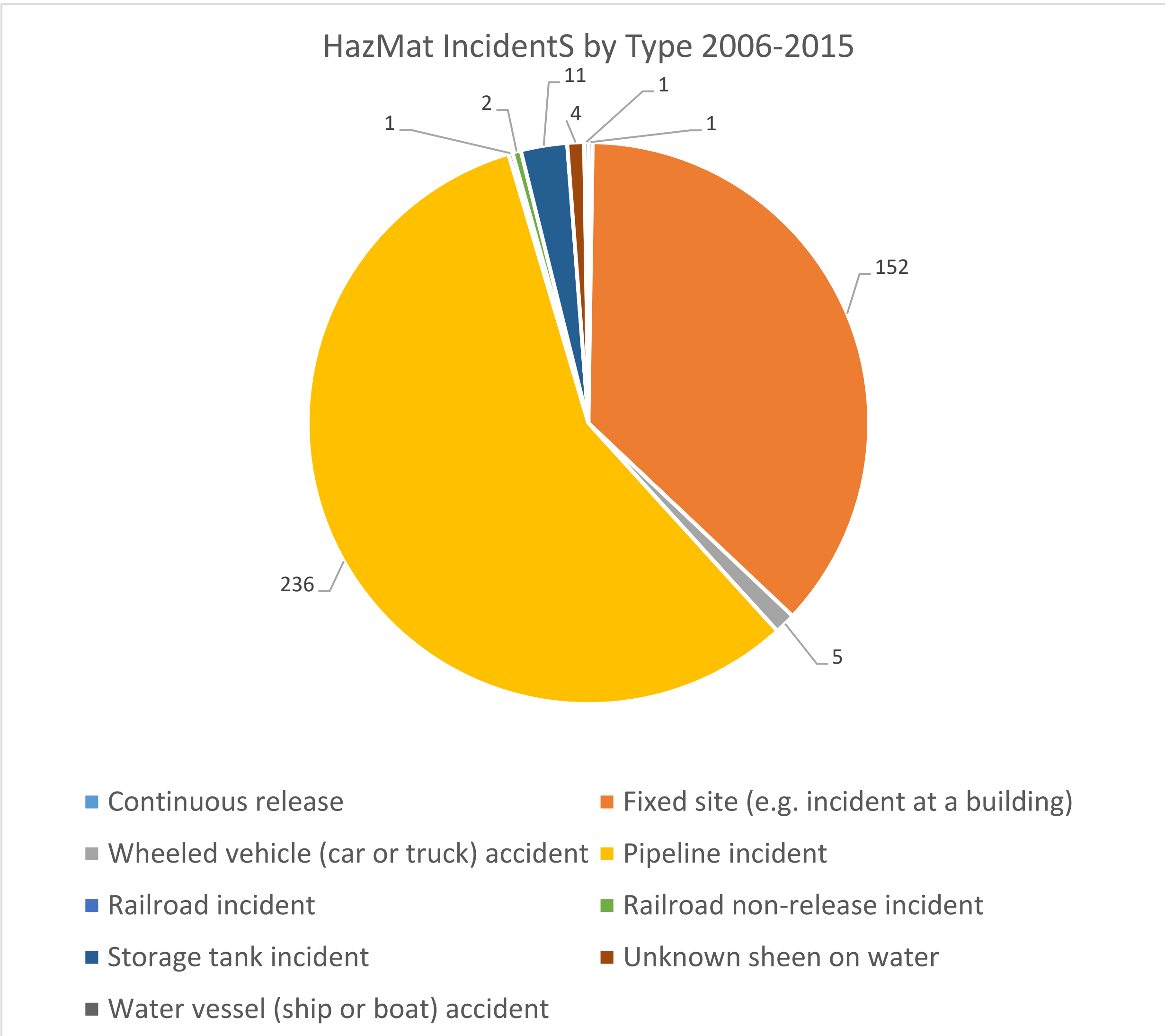
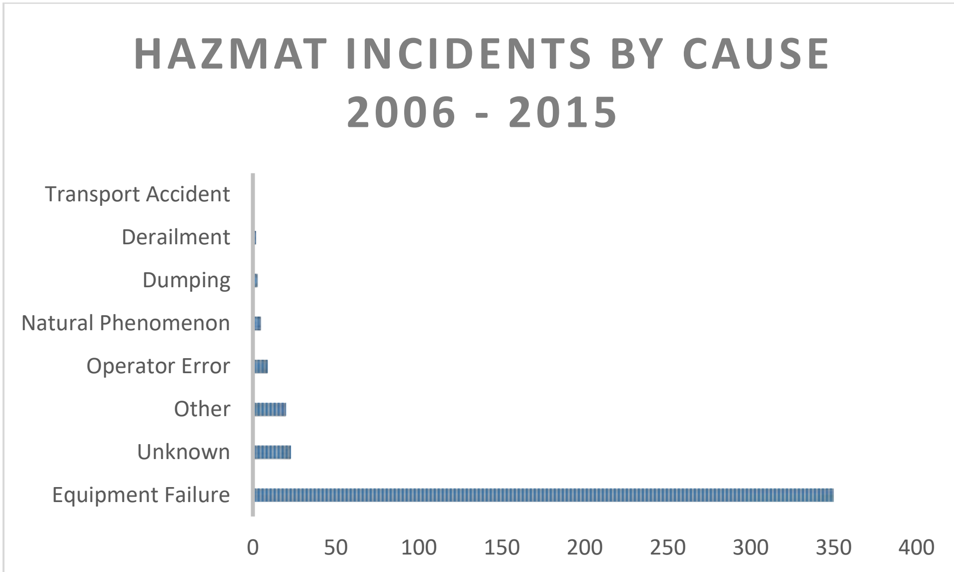


Source: National Response Center

Equipment failure was by far the most prevalent reason for hazardous materials spills and accidents in Natrona County. Operator error, natural phenomenon, dumping derailment and transportation accidents were also responsible for spills reported in the County. The figure below shows incidents by cause in the County between 2006 and 2015.

Figure 4.26 Hazardous Materials Spills/Accidents by Cause 2006-2015



Source: National Response Center

According to the data, the community of Midwest experienced the highest number of incidents with 258, followed by Casper with 84. Evansville, Alcova, Mills, Edgerton, Arminto, Bishop and Bar Nunn also experienced hazardous materials incidents, but at a much lower rate than the two top communities.

Table 4.40 Hazardous Materials Incidents by Community 2006-2015

City	Incidents
Midwest	258
Casper	84
Evansville	3
Alcova	2
Mills	2
Edgerton	2
Arminto	1
Bishop	1
Bar Nunn	1
Unidentified	58
Total	413

Source: National Response Center

In addition to local first responders, eight Regional Emergency Response Teams across the State of Wyoming respond to a variety of incidents, including those incidents involving hazardous materials. Natrona County is serviced by the Region 2 RERT, located in Casper. The following table shows records of Region 2 RERT mission assignments pertaining to hazardous materials releases, according the 2016 Wyoming State Hazard Mitigation Plan. It should be noted that this data is *regional*, not county-specific.

Table 4.41 Region 2 RERT Mission Assignments – Hazardous Materials: 2004-2015

Type	Number
Fixed Facility	5
Truck/Highway	16
Rail	-
Pipeline	-
Aircraft	2
Orphan Drum	1
Total	24

Source: 2016 Wyoming State Hazard Mitigation Plan

According to the HMPCs, small-level hazardous materials incidents occur frequently throughout the year in the county. Some of the history of incidents since 2006 include:

- 2006: January 12 – HWY 220 Accident involving roll- over of semi-truck carrying sodium cyanide
- 2008: April 25 – Tanker truck oil spill of motor oil on Robertson Road and CY Avenue
- 2009: May 30 – Oil Camp Road, several oil tanks on fire
- 2009: June 19 – Radiological incident at Tuboscope on Zero Road, Wyoming Recycling, and City of Casper Balefill
- 2016: March 2 – Gas leak and explosion in Bar Nunn with one injury

Likelihood of Future Occurrence

According to National Response Center data, Natrona County experiences multiple hazardous materials incidents each year; there is a 100% chance that the County will experience a hazardous materials incident in any given year.

Potential Magnitude of Impacts

Impacts that could occur from hazardous waste spills or releases include:

- Injury
- Loss of life (human, livestock, fish and wildlife)
- Evacuations
- Property damage
- Air pollution
- Surface or ground water pollution/contamination
- Interruption of commerce and transportation

Numerous factors go into the ultimate impacts of a hazardous materials release, including method of release, the type of material, location of release, weather conditions, and time of day. This makes it difficult to nail down precise impacts. Hazardous materials found in the County will have at least one of the impacts listed above, and probably more.

Historical data doesn't provide much to go on, as NRC data doesn't record any fatalities, injuries or economic impacts from hazardous materials incidents in the last ten years.

Vulnerability Assessment

Natrona County and many of the municipalities have energy pipelines, Interstate and state highways, and railroad tracks which carry many types of hazardous materials. A variety of hazardous materials originating in the County or elsewhere are transported along these routes, and could be vulnerable to accidental spills. Consequences can vary depending on whether the spill affects a populated area vs an unpopulated but environmentally sensitive area.

Because of the volatility of some hazardous materials and the increased risk they pose to the facility and the surrounding area, the 1990 Clean Air Act requires facilities that use extremely hazardous substances to develop a Risk Management Plan (RMP). These plans help local fire, police and emergency response personnel prepare for and respond to chemical emergencies. There are 4 RMP facilities located in Natrona County, as noted in the following table.

Table 4.42 RMP Facilities in Natrona County

Community	Number of Facilities
Casper	2
Evansville	1
Midwest	1
Total	4

Source: http://www.rtknet.org

The GIS analysis conducted in the 2017 update of the plan identified critical facilities at risk to hazards, including hazardous materials facilities. See the vulnerability discussion in the flood, landslide, and wildfire hazard sections, each of which identify EPA or Tier II facilities potentially at risk to hazard incidents.

Potential losses can vary greatly for hazardous material incidents. For even a small incident, there are cleanup and disposal costs. In a larger scale incident, cleanup can be extensive and protracted. There can be deaths or injuries requiring doctor's visits and hospitalization, disabling chronic injuries, soil and water contamination can occur, necessitating costly remediation. Evacuations can disrupt home and business activities. Large-scale incidents can easily reach $1 million or more in direct damages.

Future Development

Fixed facilities with hazardous materials are identified and mapped. Transportation routes are also identified. Considerations should be given to hazardous materials when new development is planned to ensure that high concentrations of vulnerable populations are not located nearby (e.g. schools and nursing homes). If an uptick in oil and gas development and extraction occurs, this could result in greater exposure for transportation incidents.

Summary

Table 4.43 Hazardous Materials Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Bar Nunn	Negligible	Limited	Highly Likely	Medium
Casper	Significant	Limited	Highly Likely	Medium
Edgerton	Negligible	Limited	Highly Likely	Medium
Evansville	Significant	Limited	Highly Likely	Medium
Midwest	Negligible	Limited	Highly Likely	Medium
Mills	Limited	Limited	Highly Likely	Medium
Natrona County	Limited	Limited	Highly Likely	Medium

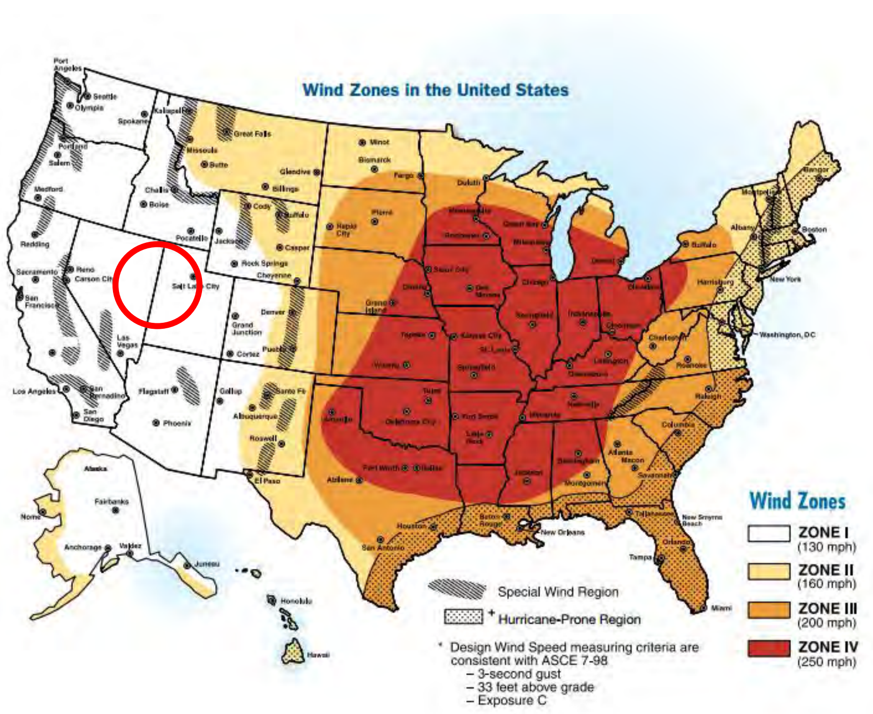
4.3.7 High Winds and Downbursts

Hazard Description

Wind, because of its constant presence in Wyoming, can be overlooked as a hazard. Upon analysis, wind can be a damage-inducing hazard and warrants review in the County. Wyoming's wind is also becoming an economic factor as renewable wind energy is developed around the state.

The wind zone map shown below indicates the potential magnitude of wind speeds. Most of the Planning area is in Zone II, which could expect winds up to 160 mph.

Figure 4.27 Wind Zones in the United States

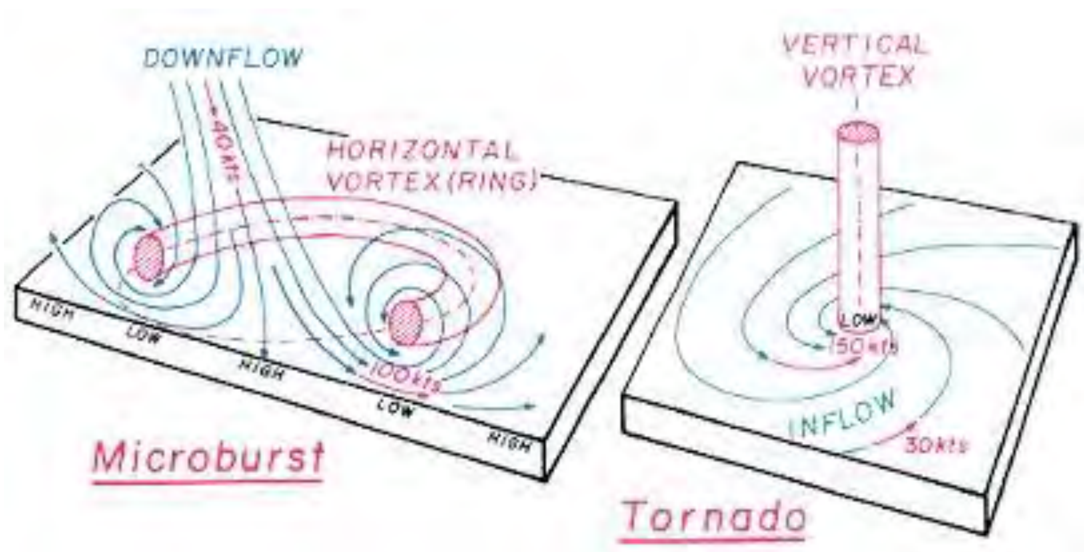


This profile examines the hazard that high winds present including downbursts, a subcategory of high winds. A downburst is a strong down draft which causes damaging winds on or near the ground. Downbursts are much more frequent than tornadoes, and for every one tornado there are approximately 10 downburst damage reports. Downbursts can be associated with either a heavy precipitation or non-precipitation thunderstorm (dry or wet downbursts), and often occur in the dissipating stage of a thunderstorm. Microbursts and macrobursts are categories of downbursts, classified by length of duration, velocity of wind, and radius of impact.

Microbursts generally last between five and 15 minutes, and impact an area less than three miles wide. Macrobursts can last up to 30 minutes with winds up to 130 miles per hour, and can impact areas larger than three miles in radius. Microbursts and macrobursts may induce dangerous wind shears, which can adversely affect aircraft performance, cause property damage and loss of life.

A downburst can occur when cold air begins to descend from the middle and upper levels of a thunderstorm (falling at speeds of less than 20 miles an hour). As the colder air strikes the Earth's surface, it begins to 'roll' outward. As this rolling effect happens, the air expands causing further cooling and having the effect of pulling the shaft of air above it at higher and higher speeds.

Figure 4.28 Schema of Microburst and Tornado



Source: www.erh.noaa.gov

Downbursts can be mistaken for tornadoes by those that experience them since damages and event characteristics are similar. Tornado winds can range from 40 mph to over 300 mph. Downbursts can exceed winds of 165 mph and can be accompanied by a loud roaring sound. Both downbursts and tornadoes can flatten trees, cause damage to homes and upend vehicles. In some instances, aerial surveying is the best method to determine what kind of event has taken place.

Figure 4.29 Aerial Image of Downburst Damage

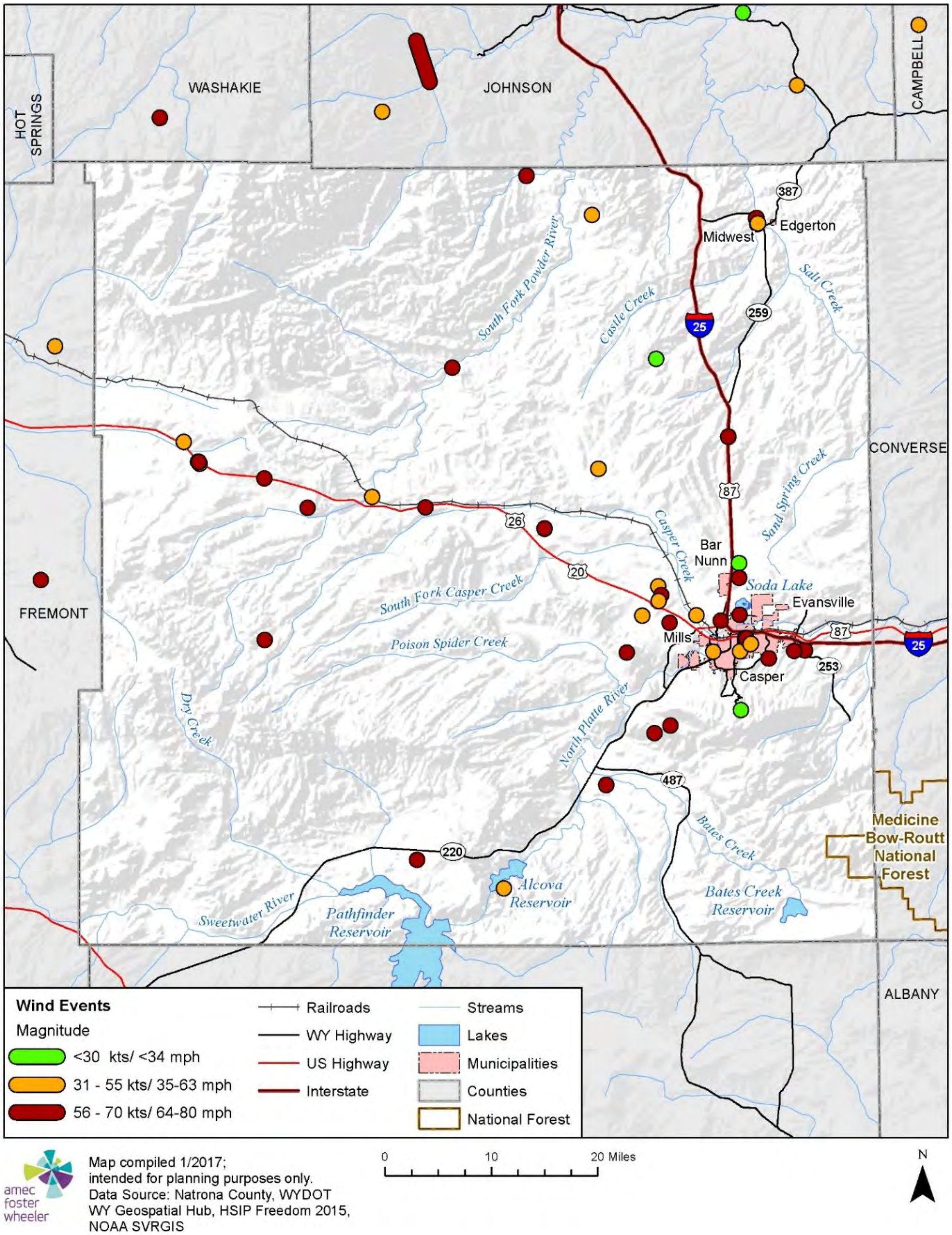
Source: T. Fujita

In this photograph, trees are blown down in a straight line - a very strong indication of a downburst as opposed to a tornado.

Past Occurrences

In the County, most documented wind events causing damage typically range between 50-59 mph; max wind speeds of up to 85 mph have been recorded. It should be noted that the data is limited by what the NCDC is able to record, and what equipment was in place at the time.

Figure 4.30 High Wind Events in Natrona County



Source: NCDC

Table 4.44 Natrona County High Wind History with Impacts 1996-2015

Date	Time	MPH	Deaths	Injuries	Property Damage	Crop Damage
1/4/2008	2045	68	0	0	$50,000	0
1/27/2008	1030	43	0	0	$12,000	0
1/27/2008	530	57	0	0	$10,000	0
12/25/2008	19	59	0	0	$15,000	0
1/8/2009	940	52	0	0	$10,000	0
5/4/2010	1036	52	0	0	$15,000	0
10/24/2010	1230	52	0	0	$50,000	0
12/29/2010	351	53	0	0	$10,000	0
2/13/2011	420	56	0	0	$1,000	0
11/3/2011	1313	56	0	0	$5,000	0
12/29/2011	856	56	0	0	$20,000	0
1/19/2012	550	79	0	0	$30,000	0
3/26/2012	1301	69	0	0	$2,000	0
1/3/2014	930	56	0	0	$20,000	0
8/17/2015	1910	52	0	0	$50,000	0
2/18/2016	416	69	0	0	$20,000	0
Total					$320,000	

Source: NCDC

Table 4.45 Summary of Wind Weather Events and Impacts in Natrona County 1996-2015

MPH	# of Events	Total Property Damage	Total Crop Damage	Total Fatalities	Total Injuries
30-39	24	0	0	0	0
40-49	10	$12,000	0	0	0
50-59	110	$206,000	0	0	0
60-69	73	$72,000	0	0	0
70-79	17	$30,000	0	0	0
>80	1	0	0	0	0
	235	$320,000	0	0	0

Specific examples from high wind incidents that caused damages or casualties include:

On January 4, 2008, a strong pressure gradient across Wyoming produced damaging southwest wind in favored locations from Sweetwater County northeast through Natrona and southern Johnson counties. Sustained wind speeds of 40 to 45 mph were common in this region. Notable peak wind gusts included 78 mph at Casper/Natrona County International Airport and 85 mph at a RAWS site in western Natrona County. The hurricane force wind ripped a 15x20-foot section off the roof of the Casper Events Center. Several power poles were reported down between Pathfinder and Casper. Total property damage was $50K.

On December 25, 2008, favorable southwest flow increased significantly over central Wyoming in advance of a powerful Pacific storm. The winds were strongest across Natrona County where sustained speeds of 40 mph with gusts over 65 mph were common Christmas Day. The wind ripped a portion of a roof from a house in southwest Casper and downed a power line in downtown Casper. At the Natrona County International Airport a peak wind speed of 68 mph was recorded at 9:45 and 10:49MST Christmas Day. A peak gust to 75 mph was clocked the same morning at Fales Rock RAWS. Total property damage was $15K.

On May 4, 2010, favorable upper level dynamics coupled with a cold front associated with an approaching Pacific storm system brought high winds to much of the area. Winds to 113 mph were recorded at ridgetop level on Mount Coffin, and maximum gusts of 76 mph were recorded at lower elevation at the Camp Creek RAWS site. Wind gusts caused roof damage at a machinery plant in Bar Nunn, four miles north of Casper. Eastbound lanes of Interstate 80 on the east side of Rock Springs were closed after a truck was toppled near milepost 107 around 12:30MST. Total property damage was $15K.

On October 24, 2010, a tight pressure gradient ahead of a Pacific storm system brought high wind to Natrona and southeast Fremont counties. Wind gusts up to 60 mph were recorded by automated weather stations. The wind was strong enough to topple a two story bank building under construction in downtown Casper. Total property damage was $50K.

On December 29, 2011, a strengthening pressure gradient ahead of a winter storm system brought high wind to areas east of the Continental Divide. High wind was recorded along the Green Mountains and Rattlesnake Hills north through Natrona and Johnson counties. A large McDonald's sign was blown down onto a roadway near the intersection of CY Avenue and Wyoming Boulevard in southwest Casper at 10:57MST Thursday, December 29. Total property damage was $20K.

On January 19, 2012, high wind was noted throughout the day in the Green Mountains and Rattlesnake Range. A gust of 91 mph was recorded by a Department of Transportation official at the site where two tractor-trailers were toppled approaching South Pass on State Highway 28. Total property damage was $30K.

On January 3, 2014, a vigorous cold front in combination with an upper level disturbance produced high wind and heavy snow across portions of northern and central Wyoming. Gusty southwest winds ahead of the cold front were strong enough to topple an empty semitrailer on Wyoming Boulevard on the south side of Casper. The truck blew over about 9:30MST on Friday, January 3. A brief period of strong westerly wind also occurred near Clark where a peak speed of 89 mph was clocked around 7:00MST. Strong northwest wind behind the cold front favored a period of 60+ mph wind gusts during the early evening across the Interstate 90 corridor through northern Johnson County. Behind the cold front, much colder air filtered into the Wind River Basin. As the upper level disturbance crossed the region it helped to produce snow in Fremont County. Up to 10 inches of snow was reported in Riverton with 6 to 8 inches in Lander. Much of the snow fell during an intense period from mid-evening Friday to around midnight. Total property damage was $20K.

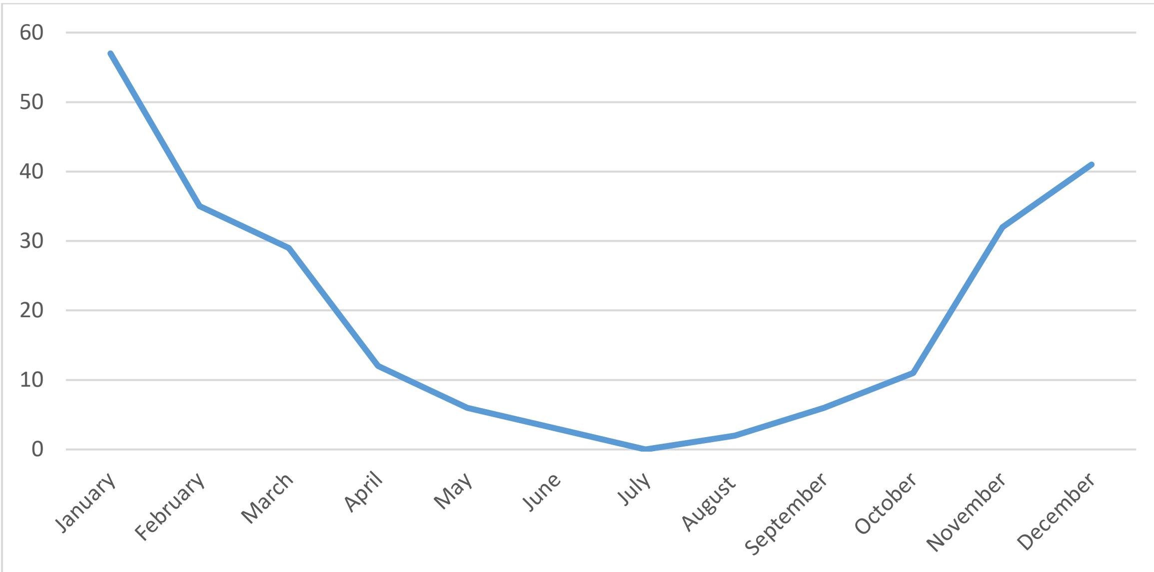
On August 17, 2015, a severe thunderstorm erupted over the southern Bighorn Mountains west of Kaycee in the warm, moist air ahead of a cold front dropping south from Montana. The storm increased in intensity as it moved southeast off the Bighorns and tapped more unstable air over southern Johnson and northern Natrona counties. High winds also plagued both counties and eastern Fremont County in the wake of the cold front. A strong pressure gradient allowed for northerly wind gusting to around 60 mph. The wind was strong enough to damage a storage unit at Alcova in southern Natrona County. A portion of the unit, which was oriented perpendicular to the wind, was torn apart and tossed over 100 feet into the North Platte River. Strong north wind in the wake of a cold front struck a storage unit oriented west-to-east on the north side of the North Platte River. The nearly perpendicular wind eventually tore a portion of the roof and walls from the unit and threw the debris over 100 feet into the river. Total property damage was $50K.

On February 18, 2016, the passage of a potent Pacific cold front in concert with a favorable jet stream position, strong mid-level winds, and a tightening pressure gradient led to widespread high wind east of the Continental Divide. Some foothill locations experienced the strong wind over an extended period spreading across two days. The strongest winds were in the wind prone areas near Clark where a wind gust of 103 mph was recorded on Thursday, February 18. In northern Johnson County, damage was reported in and around the town of Buffalo where wind gusts of 71 to 81 mph were recorded. The damage consisted of three downed light poles, roof damage of varying degrees, and trees toppled. A semi-truck was overturned by high winds along Outer Drive on the south side of Casper around 7:45MST on Friday. Strong wind on the west side of Cody blew down at least one billboard later that afternoon. Wind gusts near or above hurricane force were also recorded outside of Casper and in the Absaroka Range. The strong westerly flow also brought heavy snow to the Tetons. Snowfall of 15 inches was reported at Jackson Hole Mountain Resort. Many locations across Natrona County reported wind gusts over 58 mph. Some of the highest gusts included 79 mph along Outer Drive south of Casper, 73 mph at Twenty Mile Hill, and 66 mph at the airport west of Casper. On Outer Drive, a semi-truck was overturned by the wind around 7:45MST. Total property damage was $20K.

Likelihood of Future Occurrences

NCDC records 237 confirmed and documented high wind incidents specifically impacting the County since 1996. This means that the region averages about 11 high wind incidents per year.

Figure 4.31 High Wind Events by Month for Natrona County 1996-2016



Source: NCDC

The Planning area experiences an average of 11 significant high wind events per year somewhere in the county, with a damaging event being recorded by NCDC approximately once every .8 years. Based on NCDC data, incidence of recorded events appears to spike between October to February.

Vulnerability

Vulnerability as it relates to location is mostly random, as damaging winds have occurred everywhere in the County. Damage from high winds is often described in regional or broad areas, but downburst damage will impact a small area most generally less than three miles in diameter. Because state or presidential emergency or disaster declarations have not been necessary in the aftermath of wind events in the County, and because damage to personal property is dealt with by numerous private insurance companies, it is difficult to estimate actual monetary impacts that have occurred due to damaging winds. See section on Potential Losses for loss estimates based on reported damage.

Specific vulnerabilities from high wind events include damage to poorly constructed buildings, building collapse and damage, flying debris, semi rollovers and car accidents, and downed power lines and electric system damage. Cascading hazards caused by high winds can include power loss and hazardous materials spills; depending on the time of year, winds can also exacerbate snow and blizzards by creating deep snow drifts over roads and affecting the normal flow of traffic. Damages recorded by the NCDC for the county include downed power lines, torn off roofs and building damage, and downed tree limbs and debris.

The HMPC noted a substation in Midwest/Edgerton that could take up to 7 days to replace parts if damaged by wind, due to 1940's era construction.

Potential Losses

The 2016 Wyoming State Hazard Mitigation Plan lists wind events by county over a time period of 55.5 years. Natrona County has 84 recorded events, which results in a 100% chance each year, and a Highly Likely probability. According to NCDC recorded events, the annual occurrence rate for significant, damaging high wind in Natrona County is about 11 times per year and an average annualized loss of $5,245 a year. Natrona County suffered 16 damage-causing wind events between 1996 and 2016, and a cumulative $320,000 in damage as a result of these events ($20,000/event average).

Future Development

During the construction period buildings are vulnerable to wind, and construction materials can become airborne if not properly secured. Future residential or commercial buildings built to code should be able to withstand wind speeds of at least 150 miles per hour.

Summary

Many areas of the United States are prone to damaging wind events, and while Natrona County may not be counted in a high category for occurrences across the nation, it does have a history of such episodes which should be anticipated for the future. Primary damage is structural and utility-borne. Although minimal deaths and injuries have been reported, the frequency of occurrence is due consideration, as well as the hazard to rural citizens and town populations from falling trees, power poles, and flying debris.

Photos and scattered reports document property damage (including damage to private utilities) occurring as a result of wind events, yet cumulative losses due to wind damage have been negligible.

Table 4.46 High Winds and Downbursts Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Bar Nunn	Extensive	Limited	Highly Likely	Medium
Casper	Extensive	Limited	Highly Likely	Medium
Edgerton	Extensive	Limited	Highly Likely	Medium
Evansville	Extensive	Limited	Highly Likely	Medium
Midwest	Extensive	Limited	Highly Likely	Medium
Mills	Extensive	Limited	Highly Likely	Medium
Natrona County	Extensive	Limited	Highly Likely	Medium

4.3.8 Landslide/Rockfall/Debris Flow

Hazard/Problem Description

A landslide is a general term for a variety of mass movement processes that generate a downslope movement of soil, rock, and vegetation under gravitational influence. Landslides are a serious geologic hazard common to almost every state in the United States. It is estimated that nationally they cause up to $2 billion in damages and from 25 to 50 deaths annually. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth material to landslide include: saturation by water, erosion or construction, alternate freezing or thawing, earthquake shaking, and volcanic eruptions.

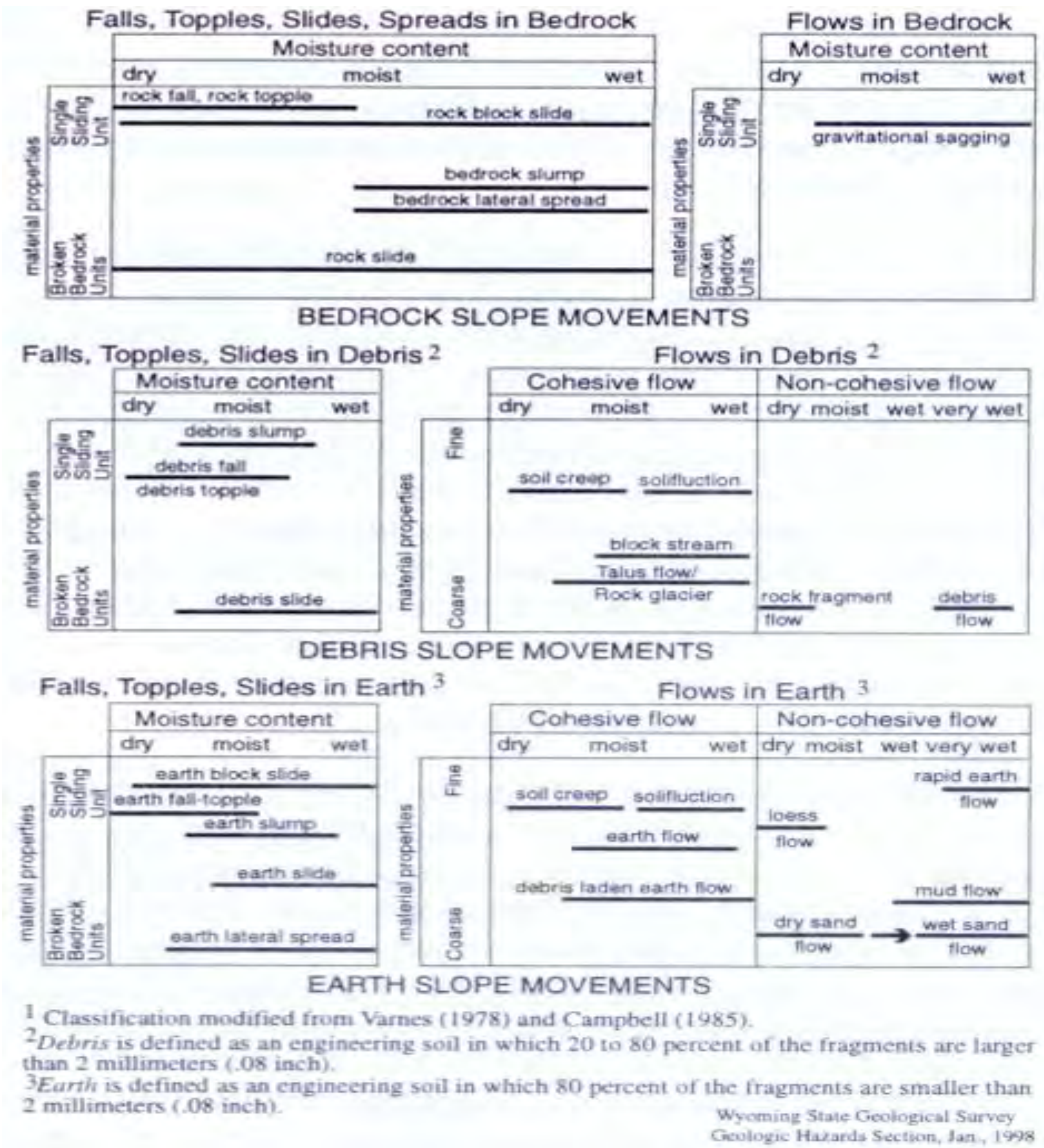
Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Generally significant landsliding follows periods of above-average precipitation over an extended period, followed by several days of intense rainfall. It is on these days of intense rainfall that slides are most likely.

Areas that are generally prone to landslide hazards include existing old landslides; the bases of steep slopes; the bases of drainage channels; and developed hillsides where leach-field septic systems are used. Landslides are often a secondary hazard related to other natural disasters. Landslide triggering rainstorms often produce damaging floods. Earthquakes often induce landslides that can cause additional damage.

Slope failures typically damage or destroy portions of roads and railroads, sewer and water lines, homes and public buildings, and other utility lines. Even small-scale landslides are expensive due to clean up costs that may include debris clearance from streets, drains, streams and reservoirs; new or renewed support for road and rail embankments and slopes; minor vehicle and building damage; personal injury; and livestock, timber, crop and fencing losses and damaged utility systems.

There are many types of landslides present in Wyoming. In order to properly describe landslide type, the Geologic Hazards Section developed a landslide classification modified from Varnes (1978) and Campbell (1985). As can be seen in Figure 4.32, there are five basic types of landslides that occur in three types of material. Falls, topples, slides, lateral spreads, and flows can occur in bedrock, debris, or earth. While individual landslide types can occur in nature, most landslides are complex, or composed of combinations of basic types of landslides.

Figure 4.32 Wyoming Landslide Classifications



Rockfall

A rockfall is the falling of a detached mass of rock from a cliff or down a very steep slope. Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Rockfalls are caused by the loss of support from underneath through erosion or triggered by ice wedging, root growth, or ground shaking. Changes to an area or slope such as cutting and filling activities can also increase the risk of a rockfall. Rocks in a rockfall can be of any dimension, from the size of baseballs to houses. Rockfall occurs most frequently in mountains or other steep areas during the early spring when there is abundant moisture and repeated freezing and thawing. Rockfalls are a serious geological hazard that can threaten human life, impact transportation corridors and communication systems and result in other property damage.

Spring is typically the landslide/rockfall season in Wyoming as snow melts and saturates soils and temperatures enter into freeze/thaw cycles. Rockfall and landslides are influenced by seasonal patterns, precipitation and temperature patterns. Earthquakes could trigger rockfalls and landslides too.

Debris Flow

Debris flows, sometimes referred to as mudslides, mudflows, lahars, or debris avalanches, are common types of fast-moving landslides. They are a combination of fast moving water and a great volume of sediment and debris that surges down slope with tremendous force. These flows generally occur during periods of intense rainfall or rapid snowmelt and may occur with little onset warning, similar to a flash flood. They usually start on steep hillsides as shallow landslides that liquefy and accelerate to speeds that are typically about 10 miles per hour, but can exceed 35 miles per hour. Figure 4.33 describes identifying characteristics of debris flows. The consistency of debris flow ranges from watery mud to thick, rocky mud that can carry large items such as boulders, trees, and cars. Debris flows from many different sources can combine in channels, and their destructive power may be greatly increased. When the flows reach flatter ground, the debris spreads over a broad area, sometimes accumulating in thick deposits that can wreak havoc in developed areas. Mudflows are covered under the National Flood Insurance Program; however, landslides are not.

Figure 4.33 Field Evidence of Debris Flow

Geographical Area Affected

Landslides are one of the most common geologic hazards in Wyoming. Figure 4.34 below shows mapped landslides in the County. The map below is based on GIS data from the Wyoming State Geological Survey. Note the relatively high concentration of landslide deposits near Casper shown on the subsequent map. Landslide areas also exist throughout Natrona County. Most have had very little effect on property, except those located on the north side of Casper Mountain where some homes are located. Narrows on Hwy 220 and the Wolf Creek drainage are also areas of concern. The most affected jurisdiction would be unincorporated areas of Natrona County. Mills and Bar Nunn are not affected based on available mapping.

Figure 4.34 Natrona County Landslide Areas

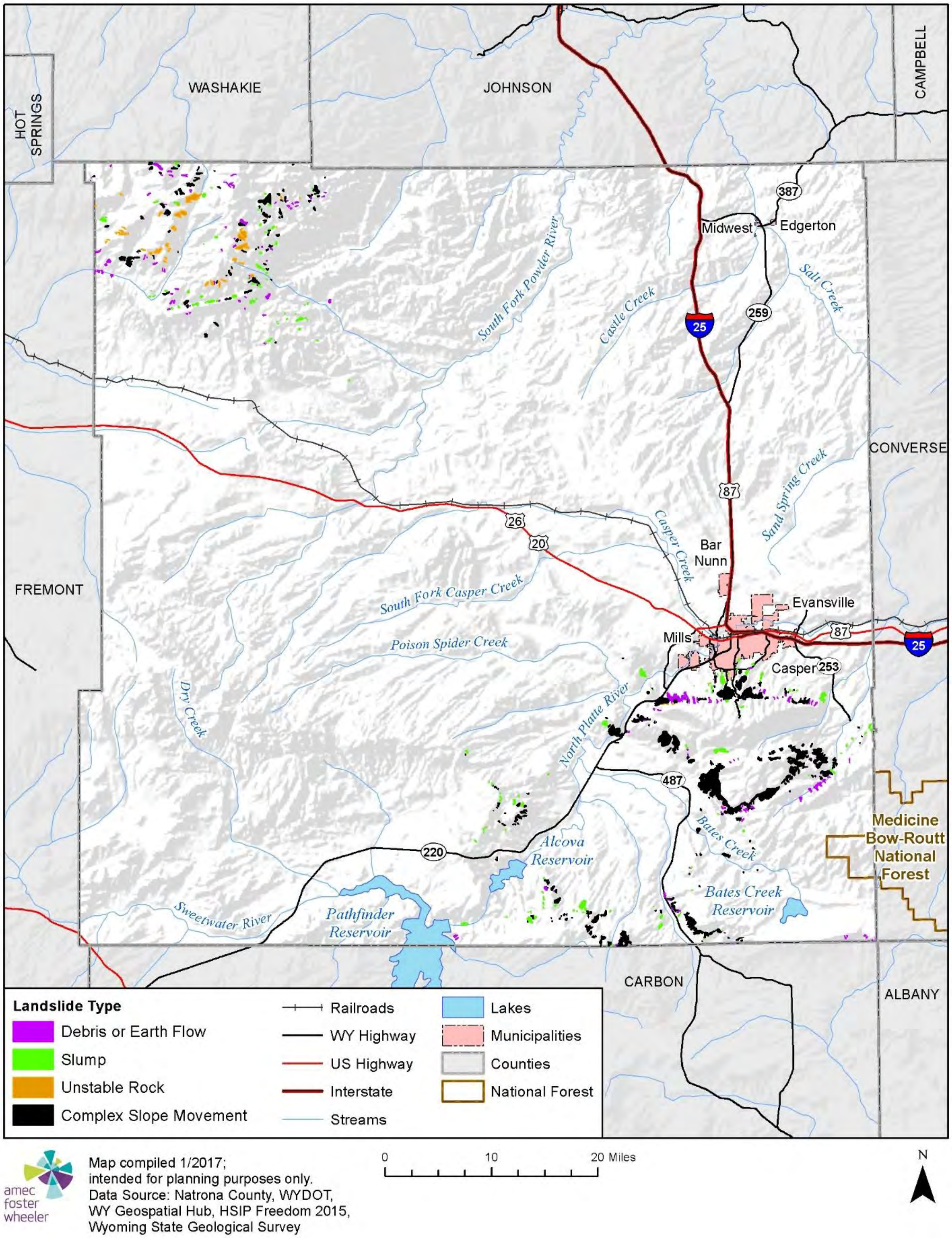
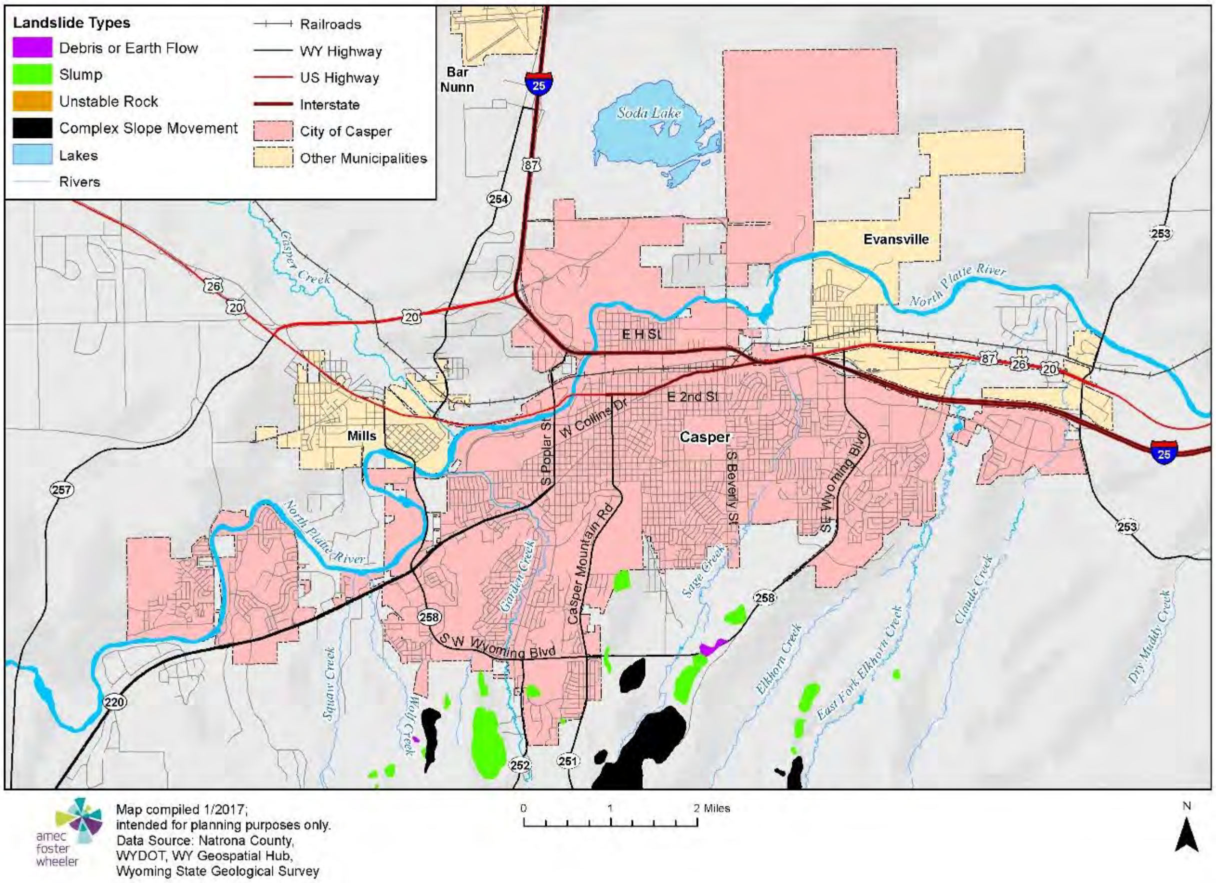


Figure 4.35 Casper Landslide Areas



Past Occurrences

Since landslides, debris flows, and rockfalls occur regularly in Wyoming, previous occurrences are limited to those that caused a particular high amount of damage or incurred some other cost or unique impact. The HMPC reported debris flows in the spring of 2013 on Sheepherder Hill burn scar after wildfires in the area. There have also been debris flows on Alcova Lake Shore Drive and associated rockfall risk.

Frequency/Likelihood of Occurrence

The probability of a landslide causing damage in the County is difficult to determine because of the poor historic data. However given it is reasonable to assume that damaging events have between 10 and 100 percent chance of occurrence in next year, or a recurrence interval of 10 years or less. Therefore, landslides, rockfalls or debris flows are **likely** to occur. Heavy periods of precipitation or significant development could have an effect on slope stability. Typically there is a landslide/rockfall 'season' that coincides with increased freeze-thaw cycles and wetter weather in the spring and early summer.

Potential Magnitude

There are three measures of future landslide impacts – historic dollar damages, estimated yearly damages, and building exposure values. There are not enough current data to estimate historic or yearly dollar damages. In general terms, landslides can threaten human life, impact transportation corridors and communication systems, and cause damage to property and other infrastructure. Actual losses can range from mere inconvenience to high maintenance costs where very slow or small-scale destructive slides are involved. The potential magnitude of landslides, rockfall and debris flows in the County would be **limited**. However even a small isolated event has potential to close state or US highways in the region that can result in long detours for days or weeks. With the added cost of detours, and the potential for life safety impacts, some landslides could have greater costs.

Vulnerability Assessment

Population

The overall vulnerability of population is **low**. The general population is not overly vulnerable to landslides, but rockfall can cause serious injury or death.

General Property

During the 2017 development of this plan a GIS analysis of exposure to landslide hazard areas was performed. Table 4.47 summarizes landslide exposure in the county, based on an intersect of improved parcels with landslide hazard areas. There are 124 properties in landslide hazard zones based on this analysis.

Table 4.47 Landslide Exposure by Jurisdiction

Jurisdiction	Property Type	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure
Casper	Commercial	1	1	$5,629,648	$5,629,648	$11,259,296
	Residential	2	2	$541,281	$270,641	$811,922
	Total	3	3	$6,170,929	$5,900,289	$12,071,218
Unincorporated	Res Vacant Land	1	1	$0	$0	$0
	Residential	7	7	$2,431,837	$1,215,919	$3,647,756
	Total	8	8	$2,431,837	$1,215,919	$3,647,756
	Sub Total	11	11	$8,602,766	$7,116,207	$15,718,973
Complex Slope Movement Landslide						
Unincorporated	Commercial	2	2	$110,197	$110,197	$220,394
	Exempt	1	1	$0	$0	$0
	Res Vacant Land	1	1	$0	$0	$0
	Residential	109	118	$30,335,164	$15,167,582	$45,502,746
	Sub Total	113	122	$30,445,361	$15,277,779	$45,723,140
	Grand Total	124	133	$39,048,127	$22,393,986	$61,442,113

Essential Infrastructure, Facilities, and Other Important Community Assets

Transportation networks are the most exposed aspect of the Planning area to landslide and debris flow incidents. Residents and visitors alike are impacted by landslides when roads are damaged by landslides. This includes Highway 487 and Highway 220 near Casper. The loss of transportation networks could potentially cause secondary damage to the overall County's infrastructure, including revenue, transportation availability, emergency response mechanisms and other essential capabilities by preventing the means of these resources from activating or moving between locations.

The table below indicates two critical facilities in the unincorporated area of Natrona County potentially at risk to landslides.

Table 4.48 Critical Facilities at Risk to Landslides in Natrona County

Landslide	Jurisdiction	Critical Facility Type	Name
Complex Slope Movement	Unincorporated	EPA FRS Location	BROKEN WRENCH LLC
Debris or Earth Flow	Unincorporated	EPA FRS Location	KINDER ENTERPRISES INCORPORATED

Future Development

The severity of landslide problems is directly related to the extent of human activity in hazard areas. Human activities such as property development and road construction can also exacerbate the occurrence of landslides. Future development in areas on the north side of Casper Mountain should be done carefully to prevent landslide damage to property or people. Adverse effects can be mitigated by early recognition and avoiding incompatible land uses in these areas or by corrective engineering. Improving mapping and information on landslide hazards and incorporating this information into the development review process could prevent siting of structures and infrastructure in identified hazard areas.

Summary

Overall, landslides, rockfalls and debris flows range from **low** to **medium** significance hazards in the County. Landslides have the potential for direct property impacts including residential structures but more likely infrastructure corridors including roads and highways, power line corridors, and gas lines.

Table 4.49 Landslide Hazard Risk Summary

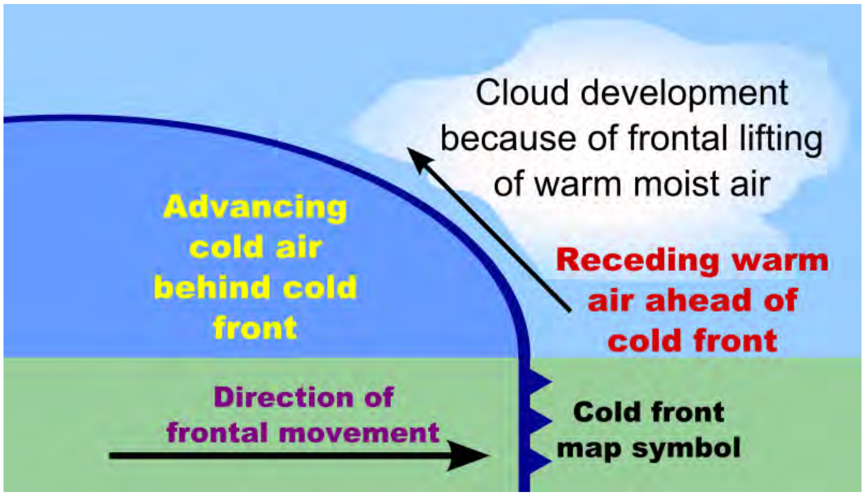
	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Bar Nunn	Negligible	Negligible	Unlikely	Low
Casper	Limited	Limited	Occasional	Medium
Edgerton	Negligible	Negligible	Unlikely	Low
Evansville	Negligible	Negligible	Unlikely	Low
Midwest	Negligible	Negligible	Unlikely	Low
Mills	Negligible	Negligible	Unlikely	Low
Natrona County	Limited	Limited	Occasional	Medium

4.3.9 Severe Thunderstorms (includes Hail and Lightning)

Hazard/Problem Description

Severe thunderstorms in Natrona County are generally characterized by heavy rain, often accompanied by strong winds and sometimes lightning and hail. Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. According to the National Weather Service, a thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. This chapter profiles several sub-hazards that can impact the County in different ways – monsoon, hail and lightning. Flooding as a result of the monsoon is addressed in the Flood profile.

Figure 4.36 Formation of a Thunderstorm



Source: NASA. http://rst.gsfc.nasa.gov/Sect14/Sect14_1c.html

Thunderstorms result from the rapid upward movement of warm, moist air. They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that can reach heights of greater than 35,000 feet. As the rising air reaches its dew point, water droplets and ice form and begin falling the long distance through the clouds towards earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of air that spreads out at Earth's surface and causes strong winds associated with thunderstorms.

The term monsoon generally refers to a seasonal wind shift, or monsoon circulation, that produces a radical change in moisture conditions in a given area or region. In the southwestern United States, this shift in wind direction is primarily the result of two meteorological changes:

- The movement northward from winter to summer of the huge upper level subtropical high pressure system, specifically known as the Bermuda High, and
- The intense heating of the Mojave Desert creates rising air and surface low pressure, called a thermal low.

These two features then combine to create a strong southerly flow that helps bring in moisture (i.e., from the Gulf of Mexico, the Gulf of California, and the Pacific Ocean) that lifts and forms thunderstorms when it encounters Wyoming.

Hail

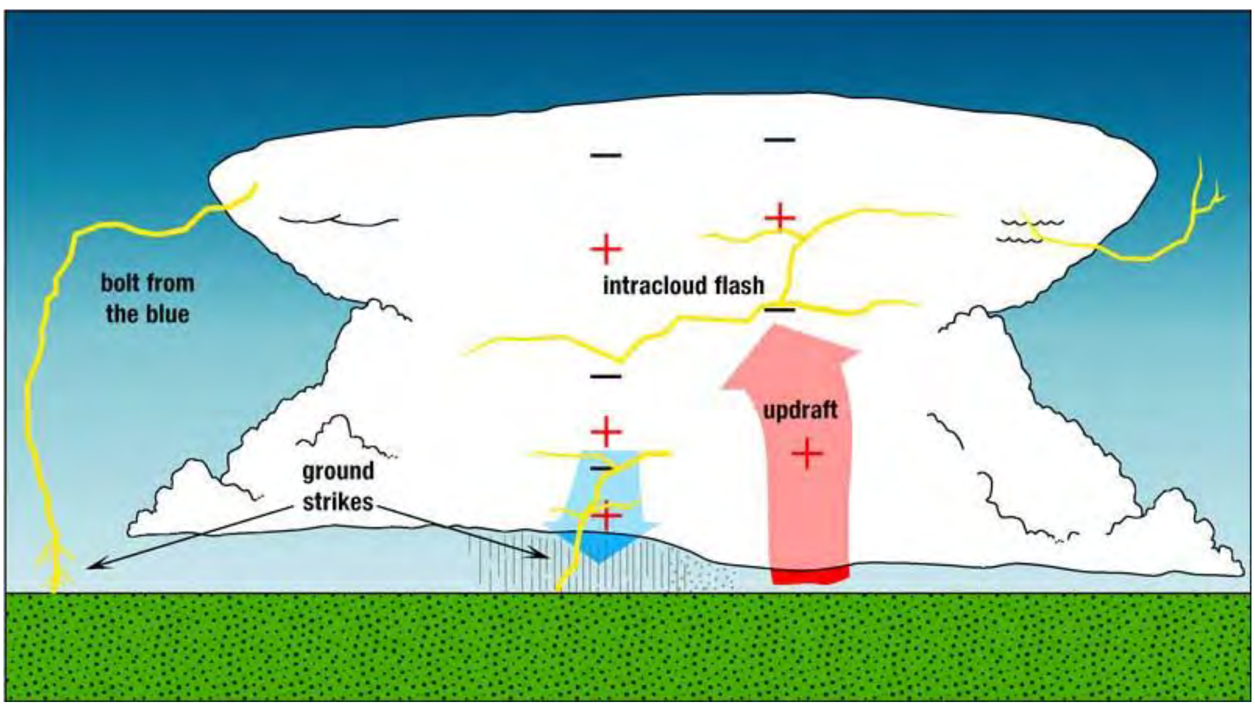
Hail is formed when water droplets freeze and thaw as they are thrown high into the upper atmosphere by the violent internal forces of thunderstorms. Hail is sometimes associated with severe storms within Natrona County. Hailstones are usually less than two inches in diameter and can fall at speeds of 120 miles per hour (mph). Severe hailstorms can be quite destructive, causing damage to roofs, buildings, automobiles, vegetation, and crops.

Lightning

Lightning is defined as any and all of the various forms of visible electrical discharge caused by thunderstorms. Thunderstorms and lightning are usually (but not always) accompanied by rain. Cloud-to-ground lightning can kill or injure people by direct or indirect means. Objects can be struck directly, which may result in an explosion, burn, or total destruction. Damage may also be indirect, when the current passes through or near an object, which generally results in less damage.

Cloud-to-ground lightning is the most damaging and dangerous type of lightning. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a large minority of flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat. Positive lightning also has a longer duration, so fires are more easily ignited. And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

Figure 4.37 Cloud to Ground Lightning



Source: National Weather Service

Location

Thunderstorms are generally expansive in size. The entire county is susceptible to any of the effects of a severe thunderstorm, including monsoon, hail and lightning. The typical thunderstorm is 15 miles in diameter, and lasts 30 minutes. Thunderstorms generally move from west to east across the county.

Extent

The National Weather Service classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. The table below indicates the hailstone measurements utilized by the National Weather Service.

Table 4.50 Hailstone Measurements

Average Diameter	Corresponding Household Object
.25 inch	Pea
.5 inch	Marble/Mothball
.75 inch	Dime/Penny
.875 inch	Nickel
1.0 inch	Quarter
1.5 inch	Ping-pong ball
1.75 inch	Golf-Ball
2.0 inch	Hen Egg
2.5 inch	Tennis Ball
2.75 inch	Baseball
3.00 inch	Teacup
4.00 inch	Grapefruit
4.5 inch	Softball

Source: National Weather Service

Damaging hail events occur sporadically throughout the County, usually associated with severe summer storms and wind events. Hail up to 3 inches in diameter has been recorded by the NCDC in Natrona County

Lightning is measured by the Lightning Activity Level (LAL) scale, created by the National Weather Service to define lightning activity into a specific categorical scale. The LAL is a common parameter that is part of fire weather forecasts nationwide. The LAL is reproduced below and the planning area is susceptible to all levels:

Table 4.51 Lightning Activity Level Scale

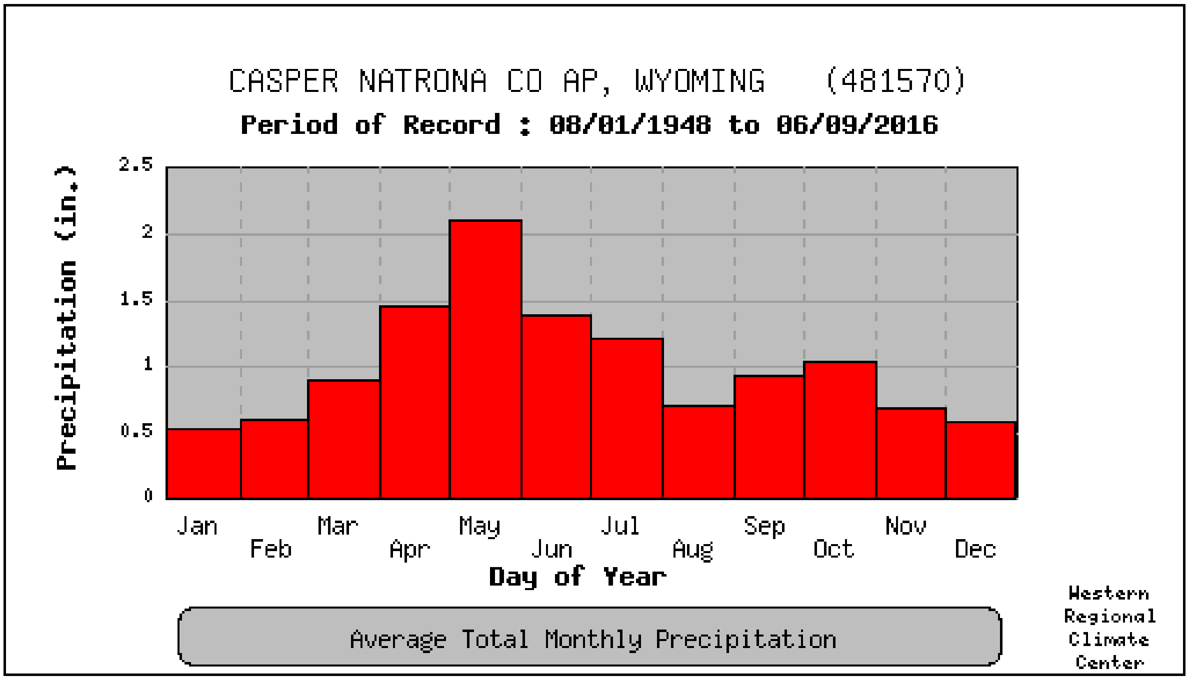
Level	Description
LAL 1	No thunderstorms
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a five minute period
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a five minute period.
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud to ground strikes in a five minute period.
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a five minute period.
LAL 6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag warning.

Source: National Weather Service. Natrona County is at risk to experience lightning in any of these categories.

Previous Occurrences

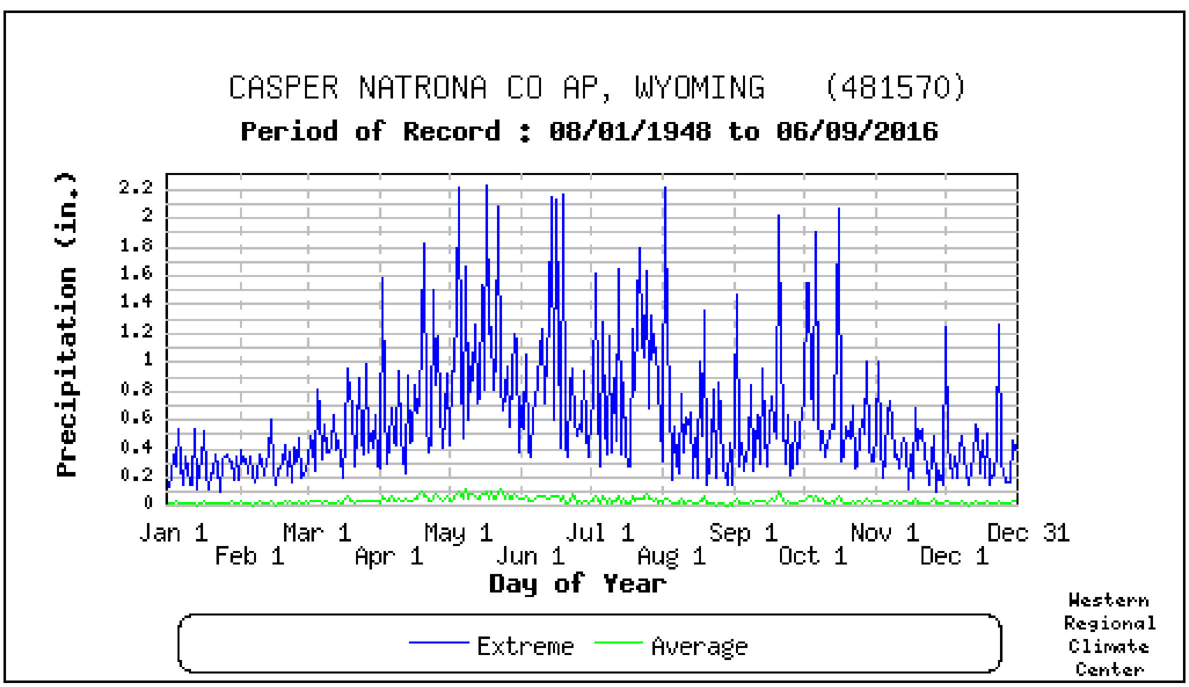
Average monthly precipitation totals for Natrona County are shown in Figure 4.38. Precipitation extremes for the County are shown in Figure 4.39. Many of these extremes have occurred between April and July.

Figure 4.38 Natrona County Monthly Average Total Precipitation (Casper Coop Station)



Source: Western Regional Climate Center

Figure 4.39 Natrona County Daily Precipitation Average and Extremes (Casper Coop Station)



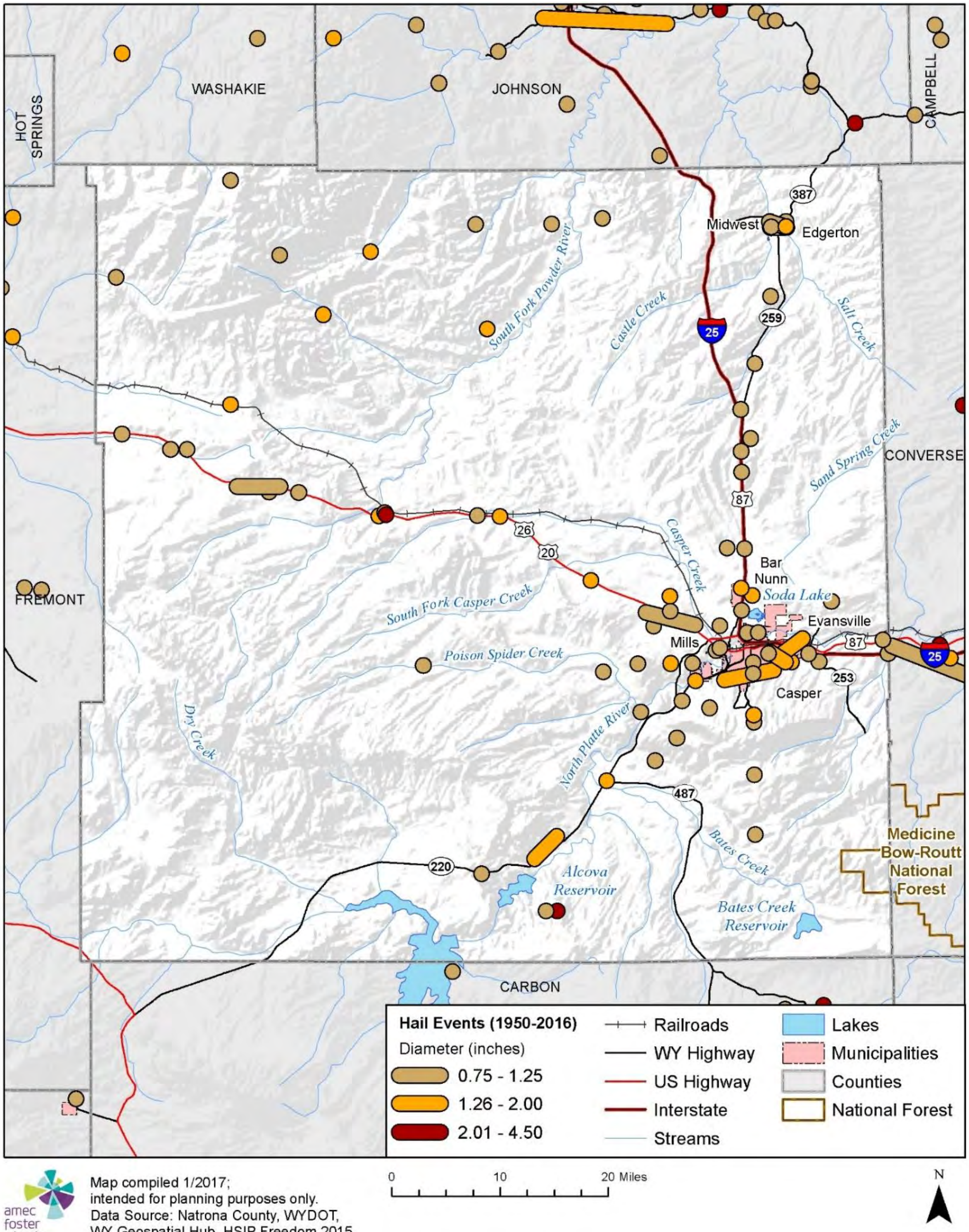
Source: Western Regional Climate Center

Heavy rain, thunderstorms, lightning, and hail in the County are many in number and occur on a yearly basis. The NCDC has not recorded a heavy rain incident between 1960 and 2015.

Hail

The map below exhibits hail events within the NOAA SVRGIS database. This data has the United States severe report database (tornadoes 1950-2016, hail/wind 1955-2016) converted into shapefile file format as well as a Geographic Information System database.

Figure 4.40 Natrona County Hail Events



Map compiled 1/2017; intended for planning purposes only. Data Source: Natrona County, WYDOT, WY Geospatial Hub, HSIP Freedom 2015, NOAA SVRGIS

The NCDC records any hail events with hailstones that are .75 inch or larger in diameter, or any hail of a smaller diameter which causes property and/or crop damage, or casualties. According to the NCDC definition, there have been 123 separate hail incidents in the County since 1955. The cumulative hail incidents had a total recorded property damage of $125,000. No deaths and one injury have been associated with these storms in the region during this timeframe. Statewide, 4 injuries have been reported since 1955. Most hail-related injuries are minor and go unreported.

Table 4.52 Natrona County Hail History with Impacts 1955-2015

Location	Date	Time	Hail Size	Deaths	Injuries	Property Damage	Crop Damage
Midwest	7/20/2000	1940	1.75	0	1	$108,000	0
Powder River	6/22/2013	1147	2.75	0	0	$10,000	0
Unknown	7/24/1994	1745	1	0	0	$5,000	0
Petrie	6/22/2013	1148	1.75	0	0	$2,000	0
Powder River	6/22/2013	1125	1.5	0	0	$2,000	0

Source: National Climactic Data Center

Historically, 5 of the 123 NCDC recorded incidents had some level of recorded impact. While most storms don't have much impact, history shows a few outliers, summarized below:

On July 24, 1994, numerous car windshields were damaged by hail up to one inch in diameter from a lone thunderstorm over central Wyoming. Total property damage was $5K.

On July 20, 2000, a large hailstorm caused extensive damage to homes and vehicles. At least 90 sparrows were killed. Unofficial reports of some softball size hail. Total property damage was $108K.

On June 22, 2013, strong to severe thunderstorms erupted over the eastern Wind River Mountains during the morning hours and moved east-northeast across Fremont and Natrona counties. A favorable wind profile helped the storms become severe and produce hail up to the size of baseballs at Powder River. There were numerous reports of quarter to golf ball sized hail in a swath from Castle Gardens to around Natrona. As the storm approached Casper at least three funnel clouds were observed, one of which briefly touched down northeast of Evansville. Total property damage was $14,000.

Lightning

Vaisala's National Lightning Detection Network (NLDN) recorded 347,035 cloud to ground lightning flashes in Wyoming in 2015; they also record an average of 279,632 cloud to ground lightning flashes per year between 2006 and 2015 for the state. This ranks Wyoming 39th nationally for flashes per square mile, averaging 2.9 cloud to ground lightning flashes per square mile, per year.

Nationally, Wyoming ranks 36th in number of lightning fatalities, 33rd in injuries, and 40th in property damage from 1959 to 1994 according to the National Oceanic and Atmospheric

Administration, National Severe Storms Laboratory (NOAA, NSSL). Wyoming is number one in the nation in lightning deaths per capita according to the National Weather Service in Salt Lake City. According to the NCDC, lightning has been responsible for 8 deaths, 75 injuries, over $1 million in property damage and $91,000 in crop damage in Wyoming between 1996 and 2015.

The NCDC records lightning incidents that have some sort of measurable impact; Table 4.53 includes all lightning incidents recorded by the NCDC in Natrona County.

Table 4.53 Natrona County Lightning History 1969– 2015

Location	Date	Begin Time	Fatalities	Injuries	Property Damage	Crop Damage
Casper	5/8/2006	1410	0	0	$65,000	0
Mills	5/30/2009	1300	0	0	$150,000	0
Freeland	8/12/2013	1330	0	0	$35,000	0
Total			0	0	$250,000	0

On May 8, 2006, lightning struck the peak of a roof at a house on Platte River Road igniting a fire within the structure. Smoke quickly spread throughout the house and into the attic. A portion of the home's cement foundation was blown apart. The home's lone resident was not injured but did report that she felt the house shake when the bolt struck. Total property damage was $65K.

On May 30, 2009, a lightning strike destroyed or damaged five oil tanks about 20 miles west of Casper near the intersection of county roads 201 and 210. The strike occurred about 1:00MST blowing the lid off one tank containing about 400 barrels of crude oil. The fire quickly spread to a nearby tank and burning crude oil ignited the other tanks. Two additional propane tanks were burned but did not explode. A nearly century old storage building at the site was also completely destroyed. Total property damage was $150K.

On August 12, 2013, a 160-ton haystack was set ablaze by a lightning strike. The fire burned through the night but did not spread beyond the stack. The value of the 190 bales of hay that were burned was estimated at about $35K.

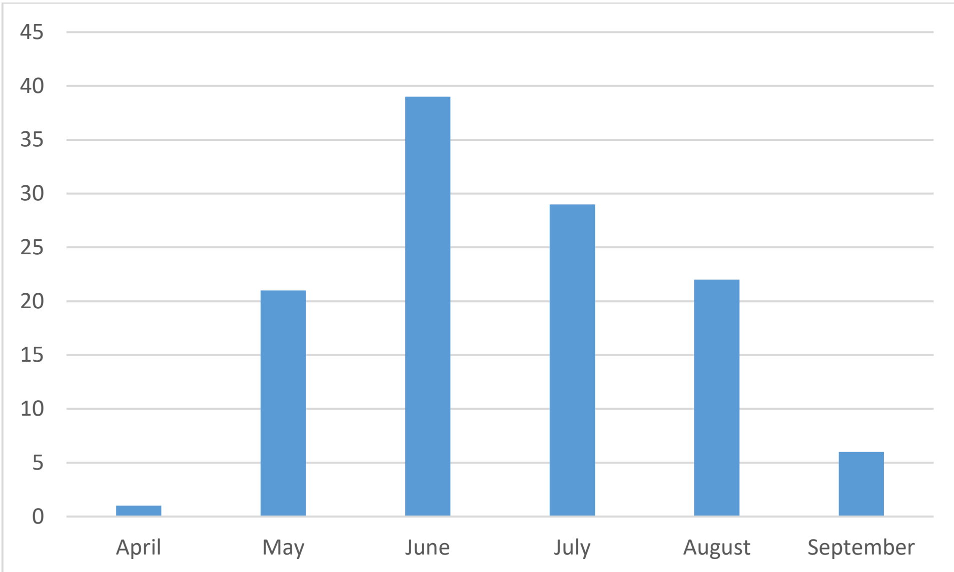
Probability of Future Occurrences

Hail

With 123 hail events over 61 years, hail is estimated to occur at least 2 times per year in Natrona County.

Figure 4.41 displays the month that hail events occur. Hail has only been recorded to occur from April to September. The highest amount of events occur in June and July.

Figure 4.41 Month of Occurrence - Hail Events in Natrona County 1955 to 2016



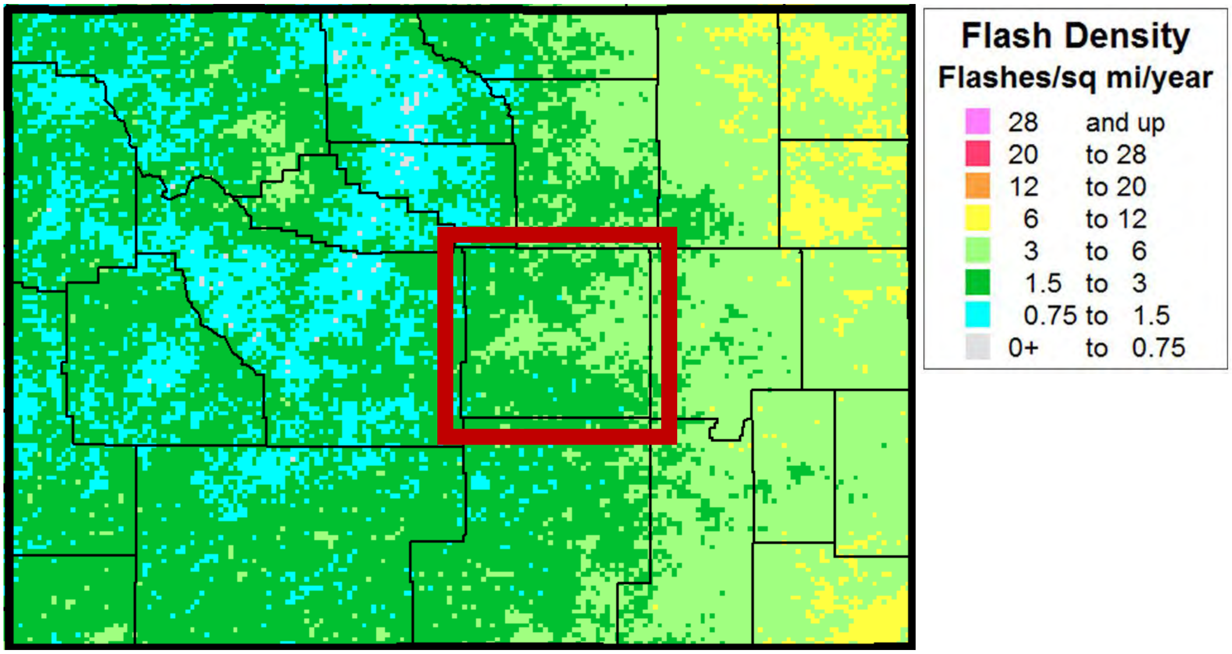
Source: National Climactic Data Center

Lightning

Nationwide, lightning strikes are routinely monitored by Vaisala, Inc. with accuracies to within a 0.625-mile (1 kilometer) resolution. The Wyoming annual lightning strike frequency is depicted in Figure 4.42 for the period of 2005 through 2014. Clearly the eastern plains have more than three times the cloud to ground lightning strikes as the western half of the state. Despite annual variation, the locations of maximum and minimum strikes do not change much from year to year. A warming climate may also affect the frequency of lighting; in 2014 researchers at the University of Berkeley conducted a study that found that for every one degree Celsius rise in the average global temperature, there will be a 12 percent increase in the amount of lightning strikes.

(Source: Science Magazine, http://www.sciencemag.org/content/346/6211/851.abstract;)

Figure 4.42 Average annual lightning flash density (flashes/sq. mi/year) 2005-2014 over Wyoming.



Source: Illustration courtesy of Vaisala Inc.

U.S. statistics show that one in 345,000 lightning flashes results in a death and one in 114,000 results in an injury nationwide. According to meteorologists at Vaisala, Inc., the odds for an individual being hit by lightning sometime in the course of an 80-year lifespan is about 1 in 3,000.

Vulnerability Assessment

Population

Exposure is the greatest danger to people from severe thunderstorms. People can be hit by lightning, pelted by hail, and caught in rising waters. Serious injury and loss of human life is rarely associated with hailstorms.

While national data shows that lightning causes more injuries and deaths than any other natural hazard except extreme heat, there doesn't seem to be any trend in the data to indicate that one segment of the population is at a disproportionately high risk of being directly affected. Anyone who is outside during a thunderstorm is at risk of being struck by lightning. Aspects of the population who rely on constant, uninterrupted electrical supplies may have a greater, indirect vulnerability to lightning. As a group, the elderly or disabled, especially those with home health care services relying on heavily on an uninterrupted source of electricity. Resident populations in nursing homes, residential facilities, or other special needs housing may also be vulnerable if electrical outages are prolonged. If they do not have a back-up power source, rural residents and agricultural operations reliant on electricity for heating, cooling, and water supplies are also especially vulnerable to power outages.

Economy

Economic impact of severe thunderstorms are typically short term. Lightning can cause power outages and fires. Hail can destroy exposed property; an example is car lots, where entire inventories can be damaged. Generally, long-term economic impacts center more on hazards that cascade from a severe thunderstorm, including wildfires ignited by lightning and flooding.

Built Environment

The Natrona County Planning Area experiences a rainy season in the summer. These summer storms can include significant precipitation, winds, and hail. According to historical hazard data, severe weather is an annual occurrence in Natrona County. Damage and disaster declarations related to severe weather have occurred and will continue to occur in the future. Heavy rain and thunderstorms are the most frequent type of severe weather occurrences in the County. Utility outages, downing of trees, debris blocking streets and damage to property can be a direct result of these storm events. Given the nature of these types of storms, the entire County is potentially at risk.

Natural, Historic and Cultural Resources

There are no indications that cultural or historic resources are more vulnerable to lightning than as previously accounted for as general structures. Natural resources may be vulnerable to indirect impacts of lightning, such as wild fires caused by lightning strikes. The presence of large areas of water, or of wide, open spaces in natural habitats may increase the danger of lightning strikes to trees, people, or structures, but these vulnerabilities are not directly related to natural resources. Campgrounds are areas where lightning strikes have more dangerous impacts, so populations utilizing the campgrounds may have a higher vulnerability.

Lightning doesn't just strike unprotected people, as both the NCDC and the HMPCs reported that lightning causes the death of unprotected livestock. The 1996 strike in Burlington killed 11 head of cattle.

Structure fire ignition is also a concern; the 2010 strike in Wapiti started an attic fire, culminating in extensive damage to the home.

Finally, lightning can also have many cascading impacts, including power failure and ignition of wildfires.

Risk Summary

Natrona County will continue to experience hail on an annual basis. Hail damage to property is expected to be highest in the municipalities; much of the damage to both property and crops is covered under insurance policies.

Table 4.54 Severe Thunderstorms Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Bar Nunn	Limited	Limited	Highly Likely	Medium
Casper	Limited	Limited	Highly Likely	Medium
Edgerton	Limited	Limited	Highly Likely	Medium
Evansville	Limited	Limited	Highly Likely	Medium
Midwest	Limited	Limited	Highly Likely	Medium
Mills	Limited	Limited	Highly Likely	Medium
Natrona County	Limited	Limited	Highly Likely	Medium

4.3.10 Tornado

Hazard Description

A tornado is a swirling column of air extending from a thunderstorm to the ground. Maximum winds in tornadoes are often confined to extremely small areas, and vary tremendously over very short distances, even within the funnel itself. Tornadoes can have wind speeds from 40 mph to over 300 mph, the majority displaying wind speeds of 112 mph or less. Erratic and unpredictable, they can move forward at up to 70 miles per hour, pause, slow down and change directions. Most have a narrow path, less than 100 yards wide and a couple of miles long. However, damage paths from major tornadoes can be more than a mile wide and 50 miles long.

Based on national statistics for 1970 – 1980, for every person killed by a tornado, 25 people were injured and 1,000 people received some sort of emergency care. Tales of complete destruction of one house next to a structure that is totally unscathed are well documented. Within a building, flying debris or missiles are generally stopped by interior walls. However, if a building has no partitions or has any glass, brick or other debris blown into the interior, the tornado winds can be life threatening. In order to examine tornado activity and the potential impact on Natrona County and its residents, it is important to understand how tornadoes are rated.

Rating a Tornado

In 1971, Dr. T. Theodore Fujita of the University of Chicago devised a six-category scale to classify U.S. tornadoes into intensity categories, F0 through F5. These categories are based upon the estimated maximum winds occurring within the funnel. The Fujita Tornado Scale (or the "F Scale") became the definitive scale for estimating wind speeds within tornadoes based upon the damage done to buildings and structures. It is used extensively by the National Weather Service in investigating tornadoes, and by engineers in correlating damage to building structures and techniques with different wind speeds caused by tornadoes.

Table 4.55 Fujita Scale Description

F-Scale Number	Intensity Phrase	Wind Speed	Type of Damage Done
F0	Gale tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages signboards.
F1	Moderate tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe tornado	158-206 mph	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.

Recent Changes to Tornado Rating Scale

Devastating tornadoes in Jarrell, Texas on May 1997 and Moore/Oklahoma City on May 1999 demonstrated that wind estimates in the original F-scale may be too high. From 2000 to 2004, the Wind Science and Engineering Research Center at Texas Tech University, in cooperation with numerous expert meteorologists, civil engineers and the National Weather Service (NWS), developed an Enhanced Fujita Scale, or EF-scale. In addition to improving the ranking process, it was essential to the development team that the new EF-scale support and be consistent with the original F-scale. The EF-scale documentation includes additional enhanced descriptions of damage to multiple types of structures and vegetation with photographs, a PC-based expert system, and enhanced training materials.

In February 2007, the Enhanced Fujita scale replaced the original Fujita scale in all tornado damage surveys in the United States. The following table compares the estimated winds in the original F-scale with the operational EF-scale that is currently in use by the NWS.

Table 4.56 The Enhanced Fujita Tornado Scale

	Fujita Scale		Operational EF-Scale	
F Number Fastest	Fastest 1/4 – mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85
1	73-112	79-117	1	86-110
2	113-157	118-161	2	111-135
3	158-207	162-209	3	136-165
4	208-260	210-261	4	166-200
5	261-318	262-317	5	Over 200

Geographical Areas Affected

The entire area of the Natrona County is susceptible to tornadoes. While some areas may see more tornadoes than others, this is more of a statistical anomaly than a causal result.

Past Occurrences

Tornado statistics, especially prior to the 1970s, must be viewed as incomplete since many twisters have occurred without being witnessed. Wyoming's open rangelands experience little if any damage from these storms, so many go unreported. Many documented tornadoes occurring in Natrona County are given low ratings on the Fujita Scale (F0s and F1s) simply because these tornadoes are often formed over open land and result in little or no damage.

Since 1950, there have been 35 tornadoes recorded for Natrona County by the National Climatic Data Center. From 1950-2016, there were eight injuries, no fatalities, and $352,680 in total recorded property damage in the County. A full accounting of those tornadoes can be found in the following table. The HMPC noted a specific tornado in 1987 near Bar Nunn that ripped roofs off of two homes.

Table 4.57 Tornado History 1950-2016, Natrona County

Location	Date	Time	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Natrona Co.	5/28/1962	1130	F0	-	-	0	0
Natrona Co.	6/7/1962	1400	-	-	-	$25,000	0
Natrona Co.	6/11/1962	1630	F2	-	4	$25,000	0
Natrona Co.	6/12/1962	1600	F1	-	-	$30	0
Natrona Co.	6/15/1962	1600	F1	-	-	$25,000	0
Natrona Co.	7/27/1962	1505	F1	-	-	0	0
Natrona Co.	9/2/1968	1418	-	-	-	$30	0
Natrona Co.	5/15/1969	1457	-	-	-	$30	0
Natrona Co.	5/29/1971	200	F2	-	3	0	0
Natrona Co.	8/9/1974	1743	F1	-	-	$30	0
Natrona Co.	5/8/1975	1705	F1	-	-	$30	0
Natrona Co.	7/20/1978	1840	F2	-	1	$25,000	0

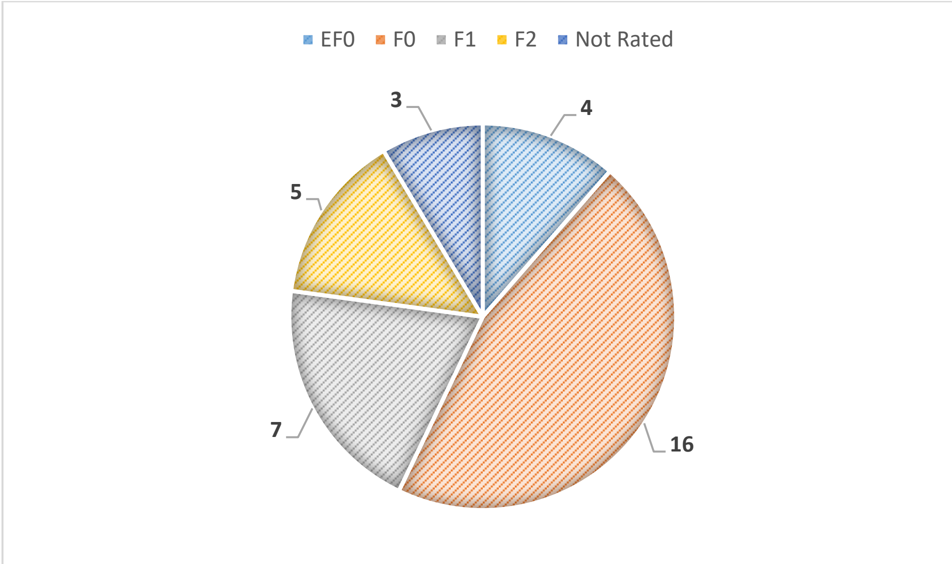
Location	Date	Time	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Natrona Co.	7/27/1979	2110	F0	-	-	0	0
Natrona Co.	5/24/1980	1830	F0	-	-	0	0
Natrona Co.	6/5/1982	2001	F0	-	-	$30	0
Natrona Co.	6/13/1984	1610	F0	-	-	0	0
Natrona Co.	6/18/1984	1455	F0	-	-	0	0
Natrona Co.	6/12/1986	2000	F1	-	-	0	0
Natrona Co.	6/18/1987	1520	F2	-	-	$250,000	0
Natrona Co.	7/21/1987	1950	F2	-	-	0	0
Natrona Co.	7/7/1988	1750	F1	-	-	$2,500	0
Natrona Co.	7/7/1988	1820	F0	-	-	0	0
Natrona Co.	7/7/1988	1825	F0	-	-	0	0
Natrona Co.	7/8/1988	1400	F0	-	-	0	0
Natrona Co.	6/7/1991	1410	F0	-	-	0	0
Natrona Co.	6/2/1995	1525	F0	-	-	0	0
Evansville	5/26/1998	1130	F0	-	-	0	0
Powder River	6/9/1998	1355	F0	-	-	0	0
Natrona	6/3/2001	1140	F0	-	-	0	0
Alcova	6/26/2001	1425	F0	-	-	0	0
Casper	9/8/2003	1530	F0	-	-	0	0
Allendale	5/7/2008	1412	EF0	-	-	0	0
Fry	6/22/2013	1306	EF0	-	-	0	0
Alcova	8/12/2013	1230	EF0	-	-	0	0
Paradise Valley	5/23/2014	1235	EF0	-	-	0	0
Totals				0	8	$352,680	$-

Source: National Climatic Data Center

Additionally, the 2010 Natrona County plan noted tornadoes or funnel clouds occurring on June 4 and August 26 of 2006; July 23 and 25 and August 2 and 22 of 2007; June 18 of 2008; and June 20, July 3 and August 24 of 2009.

The NCDC data allows for examination and statistical analysis of tornadoes occurring in the county. 57% of the historical tornadoes were rated F0 or EF0.

Figure 4.43 Natrona County Tornados by Rating: 1950-2016



The data also allows for the development of profiles on historical time periods of tornadoes. Figure 4.44 and Figure 4.45 give historical perspective on the time of year and time of day that tornadoes in the planning area have occurred.

Figure 4.44 Natrona County Historical Tornadoes by Month: 1950-2016

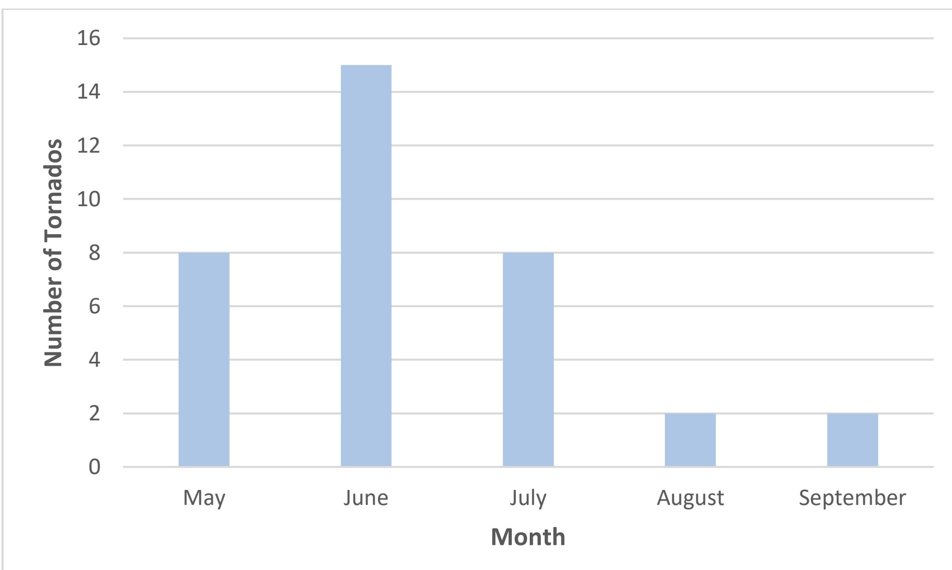
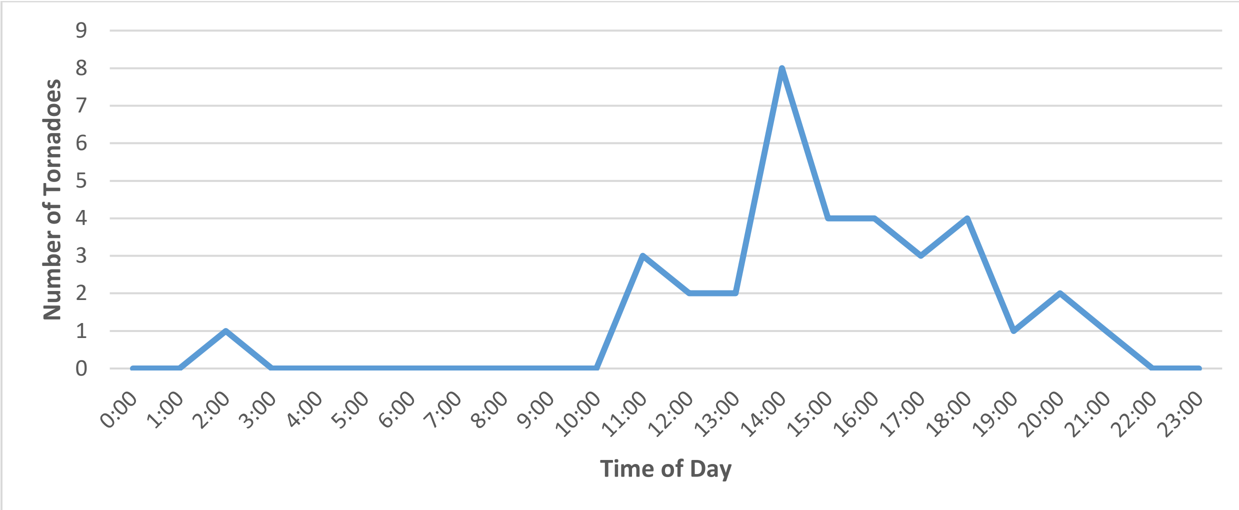


Figure 4.45 Historical Tornadoes by Time of Day: 1950-2016



Most tornadoes recorded in Natrona County cause no recorded injuries, no recorded fatalities, and little to no damage to property ($2,500 - $25,000 range). Of the 35 tornadoes that have been recorded by the NCDC in Natrona County from 1950 to 2016, 12 have caused property damage and none have caused crop damage.

Frequency

On average, Natrona County experiences a tornado every 1.87 years. Recorded tornadoes in the County occurred during the months of May through September; most of the tornadoes occurred between 11 a.m. and 11 p.m. Historical ratings vary between F0 and F2 on the F-scale; after the advent of the EF-scale, the planning area has experienced four EF-0 tornadoes. Most recorded tornadoes in the County were rated as F-0 or EF-0.

NCDC has recorded eight injuries and no fatalities attributed to these tornadoes. Cumulatively, the storms have caused $352,680 in recorded property damage, and no recorded crop damage. Almost two-thirds of the recorded property damage occurred June 18, 1987 when an F2 tornado hit Casper and caused $250,000 in property damage in and around the city.

Likelihood of Occurrence

According to the NCDC, a tornado occurs somewhere in the planning area every two years. An average tornado occurs in June in the evening, is rated EF-0 or EF-1, and causes less than $25,000 worth of damage to property, though it mostly strikes rural areas causing no damage. This is due more to chance than any environmental factor, however, as inhabited areas are statistically equally at risk of a tornado strike; the potential for injuries, fatalities and damage in these areas is much greater.

Potential Magnitude of Impacts

The National Weather Service considers tornadoes to be among nature's most violent storms. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Tornadic winds can cause people and autos to become airborne, rip ordinary homes to shreds, and turn broken glass and other debris into lethal missiles. Even weaker tornados can cause large economic damages.

According to NCDC records, the storm of record for Natrona County is the Casper tornado in 1987; the storm caused $250,000 in property damage, and no injuries or fatalities were recorded.

Though the strength of the tornado often dictates the impacts, it is important to remember that the location (rural or urban) of the tornado is just as important when assessing these risks. Impacts can vary depending on multiple factors, including the size and strength of a tornado, and its path.

Vulnerability Assessment

Because of its rural composition, people or property within the county have not had a history of being severely impacted during past tornado incidents. While the F-Scale ratings of historical tornadoes in the county are low, those ratings are partially based on recorded damage. Recorded damage may have been much more substantial if these tornadic events had impacted one of the many communities in the planning area, rather than timber, outlying range, and farm acreage.

Tornadoes occur at random locations throughout the jurisdiction; for that reason all structures, critical facilities, essential services, and populations are considered vulnerable.

Future Development

Any future development that is exposed and above ground will be vulnerable to a direct or indirect hit by a tornado. In areas where building codes are not in place and enforced, buildings may not be built to withstand tornado-force winds.

Summary

Tornadoes are a credible threat, and will continue to occur in Natrona County. While the County has been relatively lucky in its tornado history in its past, it is not immune to the threat of a much larger and more ferocious tornado. Depending on a tornado's size, ferocity and path, it can cause devastating damage to people, property and infrastructure.

Table 4.58 Tornado Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Bar Nunn	Negligible	Limited	Highly Likely	Low
Casper	Negligible	Limited	Highly Likely	Low
Edgerton	Negligible	Limited	Highly Likely	Low
Evansville	Negligible	Limited	Highly Likely	Low
Midwest	Negligible	Limited	Highly Likely	Low
Mills	Negligible	Limited	Highly Likely	Low
Natrona County	Negligible	Limited	Highly Likely	Low

4.3.11 Severe Winter Weather

Hazard/Problem Description

The National Weather Service defines a storm as "any disturbed state of the atmosphere, especially affecting the Earth's surface, and strongly implying destructive and otherwise unpleasant weather." Winter storms occur during the winter months and produce snow, ice, freezing rain, sleet, and/or cold temperatures. Winter storms are an annual occurrence in climates where precipitation may freeze and are not always considered a disaster or hazard. Disasters occur when the severe storms impact the operations of the affected community by damaging property, stalling the delivery of critical services, or causing injuries or deaths among the population.

Winter storm watches and warnings may be helpful for determining the difference between a seasonal winter storm and a severe winter storm. Warnings are issued if the storm is producing or suspected of producing heavy snow or significant ice accumulations. Watches are usually issued 24 to 36 hours in advance for storms capable of producing those conditions, though criteria may vary between locations. Winter Weather Advisories are issued when a low pressure system produces a combination of winter weather that presents a hazard but does not meet warning criteria.[5]

Heavy snow can immobilize the planning region, isolating communities, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse roofs and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow removal, damage repair, and business losses can have a tremendous impact on cities and towns. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days until damages are repaired. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

[5] This information is drawn from the National Weather Association Online Glossary, which may be accessed at http://www.weather.gov/glossary/

Some winter storms are accompanied by strong winds, creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chills. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Blowing snow can reduce visibilities to only a few feet in areas where there are no trees or buildings. Serious vehicle accidents can result with injuries and deaths.

Winter storms in the County, including strong winds and blizzard conditions, may cause localized power and phone outages, closures of streets, highways, schools, businesses, and non-essential government operations, and increase the likelihood of winter-weather related injury or death. People may be stranded in vehicles or other locations not suited to sheltering operations or isolated from essential services. A winter storm can escalate, creating life threatening situations when emergency response is limited by severe winter conditions. Natrona County is prepared with the delivery of extra oxygen as a preventative measure if a large storm is forecasted. The dialysis center also has a generator hookup and contract with a generator company after previous occurrences. All fire stations have backup generators to ensure doors can be opened. Other issues associated with severe winter storms include the threat of physical overexertion that may lead to heart attacks or strokes. Snow removal costs can pose significant budget impacts, as can repairing the associated damages caused by downed power lines, trees, structural damages, etc. Heavy snowfall during winter can also lead to flooding or landslides during the spring if the area snowpack melts too quickly.

Extreme cold often accompanies a winter storm or is left in its wake. It is most likely to occur in the winter months of December, January, and February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities. Extreme cold temperatures can destroy crops and cause utility outages, leaving people without water or power until the utility companies are able to restore service.

What constitutes extremely cold temperatures varies across different areas of the United States, based on normal climate temperatures for the time of year. In Wyoming, cold temperatures are normal during the winter. When temperatures drop at least 20 degrees below normal winter lows, the cold is considered extreme and begins to impact the daily operations of the county. Extreme cold/wind chill impacts inanimate objects, plants, animals and water supplies.

The effects of extremely cold temperatures are amplified by strong to high winds that can accompany winter storms. Wind-chill measures how wind and cold feel on exposed skin and is not a direct measurement of temperature. As wind increases, heat is carried away from the body faster, driving down the body temperature, which in turn causes the constriction of blood vessels, and increases the likelihood of severe injury or death to exposed persons. Animals are also affected by wind-chill however cars, buildings, and other objects are not.

In 2001, the NWS implemented an updated Wind-Chill Temperature index. This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 4.46 National Weather Service Wind-Chill Chart

NWS Windchill Chart

Temperature (°F)

Wind (mph) / Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

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

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

Effective 11/01/01

Geographical Area Affected

Winter storms are a yearly feature of the Wyoming climate and may occur anywhere in the state. Generally, severe winter storm events are considered regional, which implies the storms impact multiple counties simultaneously, often for extended time periods. It is possible for the geographic extent of the hazard to vary significantly within a single county - a regional storm may directly impact only a small portion of the planning area while still extending over a large portion of the surrounding area. However, even in these instances, the impacts and effects of a regional hazard are still felt within the planning area. Therefore, while the percent of the planning area directly affected ranges from less than 10% to 100% depending on the specific circumstances, if any portion of the planning area is impacted by the storm, then the entire planning area suffers indirect impacts. Sheltering of stranded travelers on I-25 can be an issue, even from storms affecting Colorado. Midwest can quickly be overwhelmed with shelter needs when I-25 is closed to Casper.

Past Occurrences

Monthly temperature extremes and averages for Natrona County are shown in the following figure. Monthly snowfall extremes and averages for the County are also shown.

Figure 4.47 Natrona County Daily Temperature Average and Extremes (Casper Coop Station)

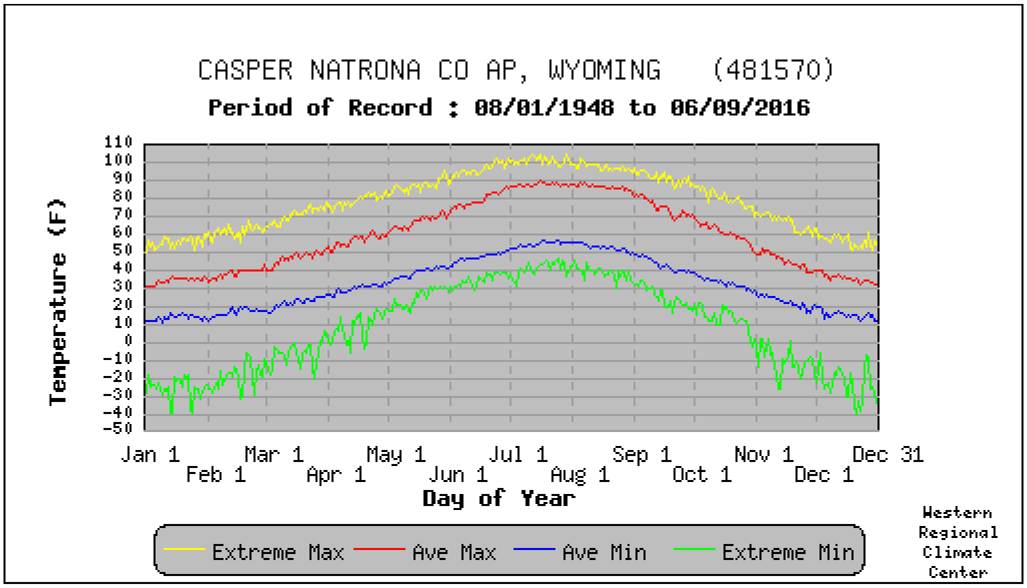
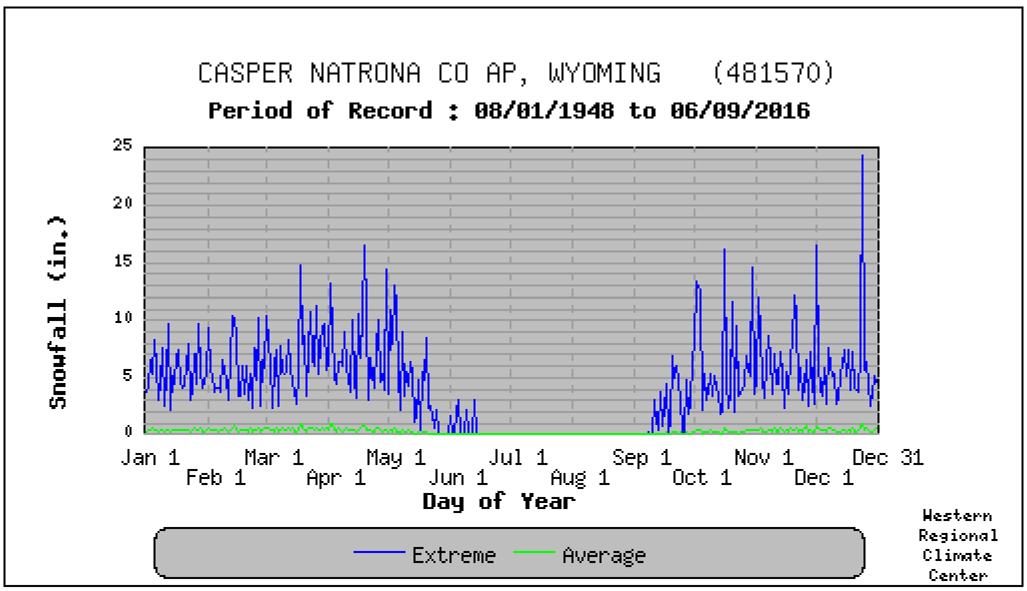


Figure 4.48 Natrona County Daily Snowfall Average and Extremes (Casper Coop Station)



The winter storm history in Natrona County extends from 1996 to December 2016. The County has experienced 212 winter storm incidents during this timeframe. There has been one winter storm in the County that has caused recorded damage.

Table 4.59 Summary of NCDC Winter Weather Events in Natrona County 1996- 2016

Year	# of Winter Storm Events	# of Blizzard Events	# of Cold/Wind Chill Events	# of Heavy Snow Events	Total Events
1996	6	3	12	13	34
1997	4	1	0	4	9
1998	9	0	0	10	19
1999	3	0	0	2	5
2000	7	0	0	5	12
2001	2	1	0	5	8
2002	0	1	0	7	8
2003	19	0	0	1	20
2004	0	0	0	9	9
2005	0	0	0	3	3
2006	7	0	0	0	7
2007	13	0	0	1	14
2008	19	0	0	0	19
2009	22	0	0	0	22
2010	14	0	0	4	18
2011	18	0	0	0	18
2012	5	0	0	0	5
2013	19	0	0	1	20
2014	20	0	4	0	24
2015	15	0	0	0	15
2016	10	0	0	0	10
Totals	212	6	16	65	299

Source: NCDC

On October 3, 2013, a potent early season winter storm moved into Wyoming and continued through much of Friday, October 4. Snow began in the higher elevations of western Wyoming early Thursday morning. Rain across the lower elevations changed to snow during the afternoon and evening hours of Thursday as colder air moved across Wyoming from west to east. With impressive upper level dynamics and ample moisture, snowfall rates approached two inches an hour at some locations. The wet, heavy snow fell on trees that still had full foliage and brought many limbs and trees down onto streets and power lines. Natrona County was hardest hit with 14,000 customers without power at the peak of the storm. Several warming shelters were established Friday along the I-25 corridor to help those without heat. The heavy snow also brought many road closures to central Wyoming. In Casper, snowfall of 16.2 inches was the tenth highest storm total since records began in 1937 and held a liquid water content of 2.14 inches. The highest snowfall amounts fell in the higher elevations with over two feet of snow recorded in the higher elevations of the Wind River, Bighorn, and Absaroka ranges, as well as Casper Mountain. The highest amount was at the Reno Hill SNOTEL where 34 inches of snow was recorded. Many lower elevation locations east of the Continental Divide reported 6 to 12 inches of snow. Most areas of Natrona County received over a foot of snow including 16.2 inches at the Casper Airport and up to 22 inches in the foothill areas of Casper Mountain. The heavy, wet snow fell on trees that still had full foliage and caused branches and in some cases whole trees to fall. Many of these landed on power lines and caused widespread power outages. Around 14,000 customers were without power at the peak of the storm. Property damage totaled $3M.

The HMPC noted a past occurrence when a nursing home had to relocate persons during a storm event when their generator ran out of fuel. In 2012, a severe cold snap resulted in tree mortality.

Frequency/Likelihood of Occurrence

Winter storms are an annual occurrence in Wyoming, often occurring multiple times each winter, and affecting entire regions in their size and scope. Since 1996, the County has averaged almost 14 days with a recorded severe winter incident per year.

Potential Magnitude

The damages caused by severe winter storms and blizzards very and are dependent on several factors: the duration of the storm; the geographic extent; the time of year; meteorological factors such as wind, moisture content of the snow, ground and air temperatures; and the advance warning of the storm. Impacts from the storm dictate the magnitude of the event, emphasizing that the amount of snow may not always directly correlate to how bad the storm is. Damaged power lines and dangerous or impassable roadways may forestall the delivery of critical services such as medical and emergency assistance, the delivery of food supplies and medications, or even the provision of basic utilities such as heat and running water. When events happen with a long warning time, it is possible to pre-mitigate the effects of insufficient supply levels or to pre-test emergency generators, which may prevent some of the previously described impacts from occurring. Unanticipated storms increase the number of people stranded, both in cars and at public locations, which may increase the number of injuries and deaths attributed to the event (often caused by exposure) and place uneven and unanticipated strains on public sheltering capacities. The weight of the snow, driven by the water content of the fall, increases the potential for damages caused to structures and trees. Lighter snow caused by extreme cold increases the damages caused to livestock, agriculture and landscaping due to freezing conditions. Winter storms which go through periods of thaw and freeze prolong dangerous icy conditions, increasing the likelihood of frozen and damaged water pipes, impassable or dangerous roadways, damaged communication lines, or more extensive damages to infrastructure and structures caused by seeping water freezing under roofs, porches, patios, inside sidings, or causing damage to vehicles.

Winter storms usually cover a significant part of the State, and as such are easier to describe regionally than on a county by county basis.

Vulnerability Assessment

Population

The threat to public safety is typically the greatest concern during severe winter storms. While virtually all aspects of the population are vulnerable to severe winter weather, there are segments of the population that are more vulnerable to the potential indirect impacts of a severe winter storm than others, particularly the loss of electrical power. As a group, the elderly or disabled, especially those with home health care services that rely heavily on an uninterrupted source of electricity. Resident populations in nursing homes or other special needs housing may also be vulnerable if electrical outages are prolonged. If they do not have a back-up power source, rural residents and agricultural operations reliant on electricity for heating and water supplies are also especially vulnerable to power outages.

Severe winter weather also increases the vulnerability of the commuting population. While there is no way to quantify which of these accidents occur during severe winter storms versus regular winter storms, the numbers indicate that winter driving conditions raise the vulnerability of the commuting population.

General Property

Property vulnerabilities to severe weather include damage caused by high winds, ice, or snow pack and subsequently melting snow. Vehicles may be damaged by the same factors, or temporarily un-useable due to the driving conditions created by severe winter weather. Contents of homes, storage units, warehouses and storefronts may be damaged if the structures are compromised or fail due to the weather, or during potential flooding caused by melting snow. Very wet snow packs down densely and is very heavy. This may create strains on structures, causing partial or entire collapses of walls, roofs, or windows. This is impacted both by architecture and construction material, and should be assessed on a building-by-building basis. These records are probably tracked via insurance or other private vendors. Crops, livestock and other agricultural operations are also highly vulnerable to severe winter storms.

Essential Infrastructure, Facilities, and Other Important Community Assets

The physical structures which comprise essential infrastructure are as vulnerable as those outlined in the General Property subsection of this profile. Severe winter weather may also disrupt the availability of services from essential infrastructure, including utility delivery (gas, electric and water), telephone service, emergency response personnel capabilities, road plowing, and childcare availability. Severe winter storms may even halt the operation of an area for periods of time, making the vulnerability of the counties even higher.

As mentioned previously, ice or heavy accumulations of snow, particularly with blowing and drifting, can temporarily impact the roadway system. These accumulations also require vast amounts of overtime for county and local highway and streets departments to remove snow and melt ice. Ice storms or high winds in winter storms can cause extensive loss of overhead utility lines due to buildup either on the lines or on adjacent trees that either collapse due to the weight or blow down onto the utility lines. Services such as telephone, electricity, and cable TV are frequently affected by winter storms. The overall vulnerability of essential infrastructure is medium.

Natural, Historic and Cultural Resources

Natural resources may be damaged by the severe winter weather, including broken trees and death of unsheltered wildlife. Unseasonable storms may damage or kill plant and wildlife, which may impact natural food chains until the next growing season. Historical areas may be more vulnerable to severe winter storms due to construction and age of structures. Cultural resources generally experience the same vulnerabilities outlined in General Property, in addition to lost revenue impacts due to transportation impacts. The overall vulnerability of these resources is medium.

Future Development

Where building codes are applicable, future residential or commercial buildings built to code should be able to withstand snow loads from severe winter storms. Future power outages or delays in power delivery to future developments may be mitigated by construction considerations such as buried power lines. Future development will also require future considerations for snow removal capacity including equipment, personnel, and logistical support. Adequate planning will help establish the cost-effective balance.

Public education efforts may help minimize the risks to future populations by increasing knowledge of appropriate mitigation behaviors, clothing, sheltering capacities, and decision making regarding snow totals, icy roads, driving conditions, and outdoor activities (all of which are contributors to decreased public safety during severe winter storms). New establishments or increased populations who are particularly vulnerable to severe winter storms (such as those with health concerns or those who live in communities that may be isolated for extended periods of time due to the hazard) should be encouraged to maintain at least a 72-hour self-sufficiency as recommended by FEMA. Encouraging contingency planning for businesses may help alleviate future economic losses caused by such hazards while simultaneously limiting the population exposed to the hazards during commuting or commerce-driven activities.

Summary

Winter Storms are generally a medium significance hazard in the County.

Table 4.60 Winter Storm Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Bar Nunn	Significant	Limited	Highly Likely	Medium
Casper	Significant	Limited	Highly Likely	Medium
Edgerton	Significant	Limited	Highly Likely	Medium
Evansville	Significant	Limited	Highly Likely	Medium
Midwest	Significant	Limited	Highly Likely	Medium
Mills	Significant	Limited	Highly Likely	Medium
Natrona County	Significant	Limited	Highly Likely	Medium

4.3.12 Wildfire

Hazard/Problem Description

Wildfire is defined as a highly destructive fire or any instance of uncontrolled burning in grasslands, brush or woodlands. Wildfire has encroached into urban interface situations as more people move closer to forest settings. As defined by the National Interagency Fire Center (NIFC), a “wildland fire” is any non-structure fire, other than prescribed fire, that occurs in the wildland. The term “wildland/urban interface” or WUI is widely used within the wildland fire management community to describe any area where man-made buildings are constructed close to or within a boundary of natural terrain and fuel, where high potential for wildland fires exists. “Aspect” refers to the direction in which a slope faces. “Fuel” consists of combustible material, including vegetation, such as grass, leaves, ground litter, plants, shrubs, and trees that feed a fire.

Wildfires can occur at any time of the year, but are most likely to occur during the spring, summer or fall. Thunderstorms that contain lightning frequently start wildfires, but they can also be caused by humans. Wyoming’s semi-arid climate and rural character make the state vulnerable to catastrophic wildland fires, which comprise more than 50% of all fires in Wyoming.

As the population and the wildland/urban interface in Wyoming increases, the more significant the risk of wildland fire hazard. The past 100 years of wildland fire suppression has led to heavy vegetation growth and thus has greatly increased the potential fuel-load for a wildfire to burn. As the wildland/urban interface has grown into these densely packed forests, the potential for catastrophic wildland fires has increased as well. Fires have historically played a natural role on western landscapes. For example, some species of trees occupy sites following fire until replaced by more shade-tolerant species. In some cases regeneration of vegetation can be enhanced by fire. Fires may have positive or negative effects, or both, depending upon the resources at risk in the fire area.

Geographical Area Affected

While brushfires could ignite anywhere across the county, the wildland and wildland-urban interface areas are of most concern and are shown in Figure 4.49 based on the Wildland Urban Interface Hazard Assessment. This assessment was produced by a joint venture of the Wyoming State Forestry Division, USFS, BLM, NPS, and other interested parties. This Geographic Information System (GIS)-based mapping effort builds on the Front Range Redzone Project in Colorado (the first fire-hazard mapping program of its kind). The Assessment maps fire hazard incorporating population density against slope, aspect, and fuels. With the mapping analysis evaluating areas of varying wildfire vulnerability, the final output results in a Risk, Hazard, and Value (RHV) map displaying areas of concern (Redzones) for catastrophic wildland fires.

The following figures show RedZone areas, based on available data.

Figure 4.49 Wildland Fire Redzones

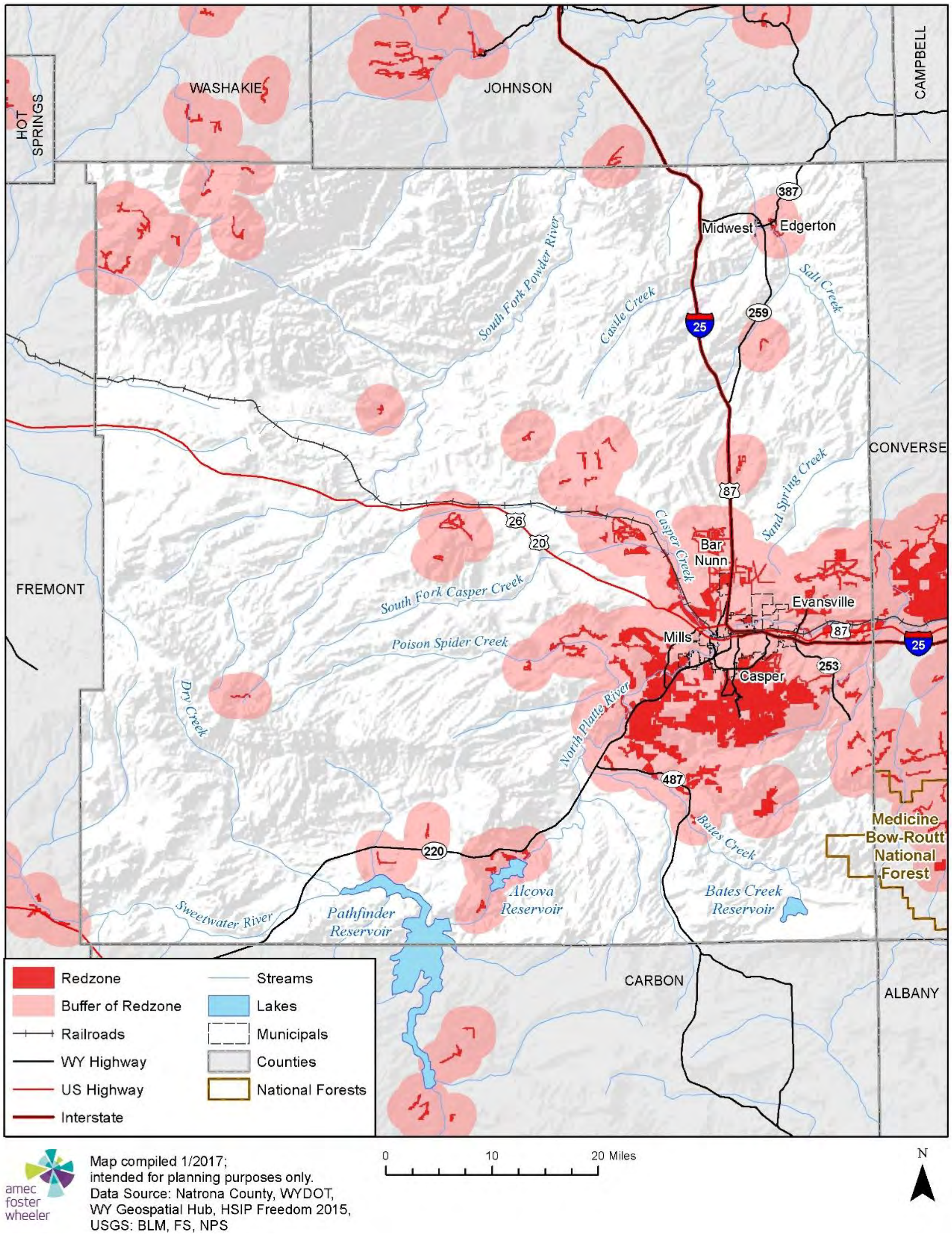


Figure 4.50 Casper Redzones

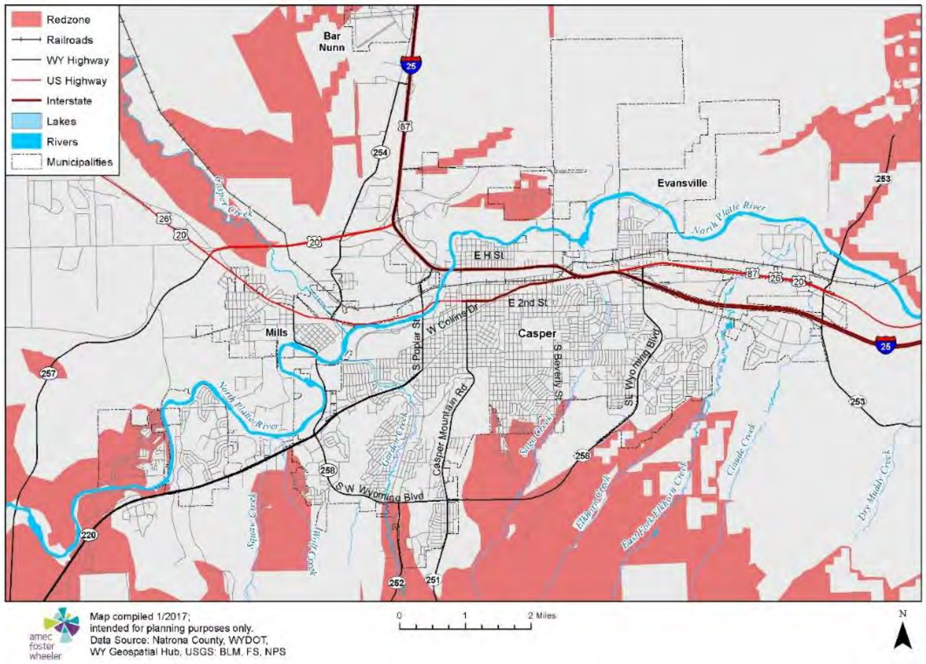
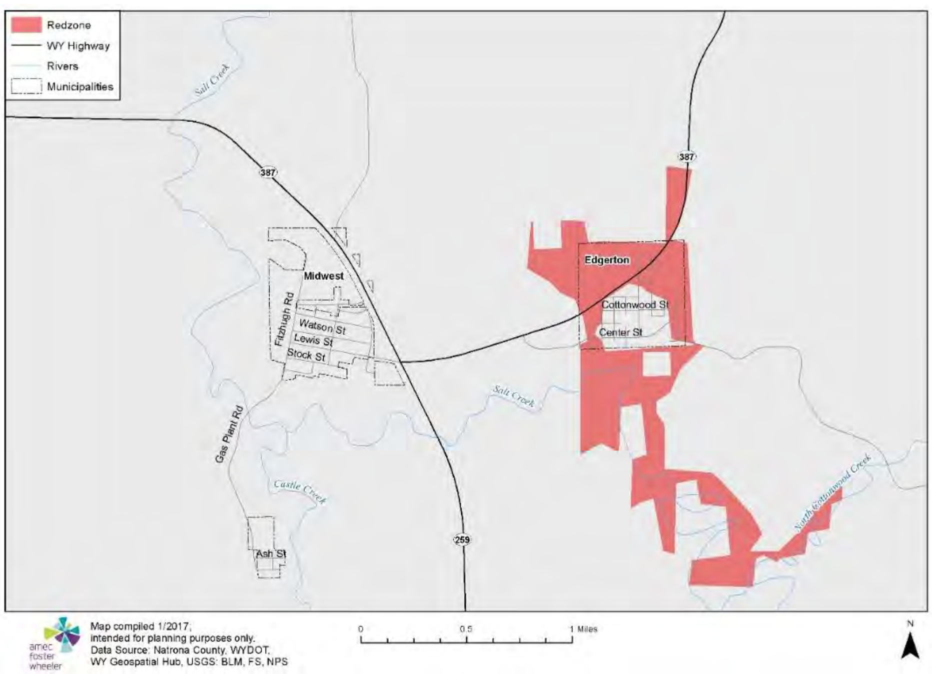


Figure 4.51 Midwest and Edgerton Redzones



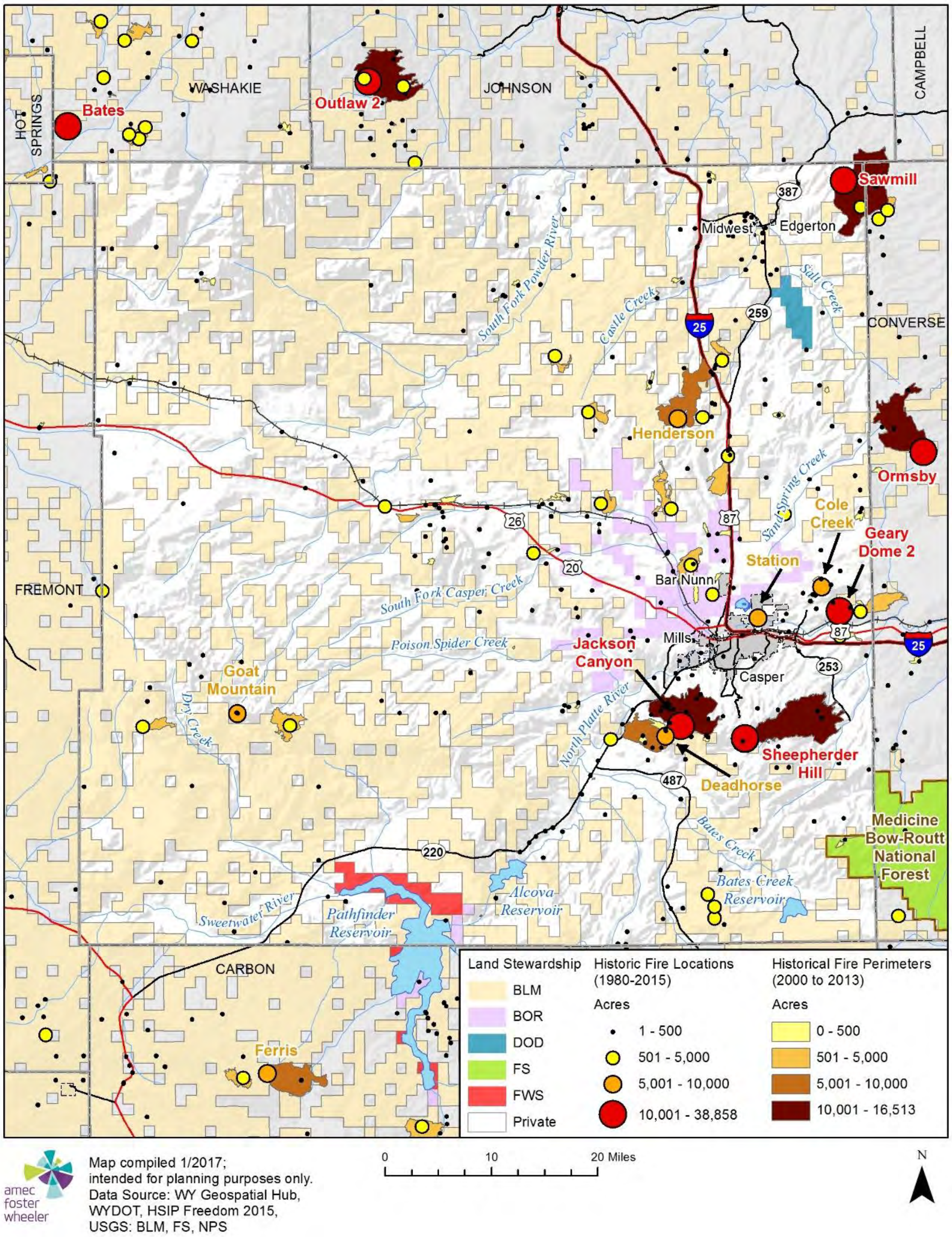
Past Occurrences

The Federal Wildland Occurrence Database was used to analyze fire history in Natrona County.

The Federal Wildland Fire Occurrence database, maintained by the USGS and other agencies, includes perimeter and point GIS layers for fires on public lands throughout the United States. The data includes fires dating back to 1980. The Bureau of Land Management, and US Forest Service reports include fires of 10 acres and greater. The database is limited to fires on federal lands. Some fires may be missing altogether or have missing or incorrect attribute data. Some fires may be missing because historical records were lost or damaged, fires were too small for the minimum cutoffs, documentation was inadequate, or fire perimeters have not yet been incorporated into the database. Also, agencies are at different stages of participation. For these reasons, the data should be used cautiously for statistical or analytical purposes.

The following figure shows a map of wildfires that have affected the area based on the Federal Wildland Occurrence Database. Most of the recorded fires occurred in the eastern part of the county.

Figure 4.52 Wildland Fire Occurrences in Natrona County 1935 - 2015



Historically, most significant fires in Natrona County have occurred in the eastern areas of the county. There have been several fires affecting over 1,000 acres, and many smaller fires throughout the county. According to the Federal Wildland Occurrence data, a total of 38 fires burned 159,858 acres; many of these fires were relatively small, burning only a few acres. The largest fire in the County occurred in 2006, when the Sawmill fire burned 16,503 acres. The following table describes wildfires in Natrona County that burned 1,000 or more acres between 1980 and 2015. During the HMP Risk and Goals Meeting, it was noted that Bar Nunn was evacuated in 2016 due to a nearby wildfire. It was also noted that there have been two major wildland fires between 2014 and 2016 which the BLM has done studies on.

Table 4.61 Wildfires over 1,000 acres in Natrona County: 1980-2015

Fire Name	Acres Burned	Cause	Year
Sawmill	16,503	Natural	2006
Sheepherder Hill	15,556	Human/Natural	2012
Geary D. 2	14,700	Natural	1996
Jackson Canyon	11,765	Natural	2006
Station AKA Cole Creek	9,516	Human	2015
Cole Creek	9,290	Human	1996
Henderson	8,390	Natural	2000
Goat Mtn	6,661	Natural	1985
Deadhorse	5,900	Natural	2000
Poison Spider	3,166	Natural	2006
Geary Dome	2,879	Human	2010
205	2,573	Human	2011
33 Mile	2,514	Natural	2000
Mudsprings	2,266	Human	1991
Arapahoe	2,073	Human	2011
Sherwood	2,000	Natural	1980
Ormsby	1,667	Natural	1995
Casper Cre	1,354	Natural	2001
Sage Hen	1,271	Natural	2005
Hemmingway	1,069	Natural	2000
Lawn Creek	1,033	Human	1998

Source: Federal Wildland Occurrence Database

NCDC tracks wildfire incidents, including damages. The systems records $10.34 million in property damage caused by fires since the year 2000, with major damages concentrated in four burns.

Table 4.62 Wildfire Property Damage Natrona County: 2000-2015

Fire	Year	Property Damages
Jackson Canyon	2006	$1.24 million
Bone Creek	2007	$100,000
Sheep Herder Hill	2012	$4 million
Station AKA Cole Creek	2015	$5 million
Total		$10.34 million

Source: NCDC

The 2005 CWPP notes that historically, fires occur infrequently at the higher elevations in the county, and relatively frequently at the lower elevations.

Frequency/Likelihood of Occurrence

Wildfires are **highly likely** to occur in each jurisdiction within Natrona County each year, meaning that there is nearly a 100% chance of a fire happening in any given year. It is important to note that the risk of wildfires occurring may increase during times of drought, especially prolonged droughts such as the statewide Wyoming drought that began between 1999 and 2000 and the 1988 drought in northwestern Wyoming.

It is important to note that this probability is based on total fires; many fires recorded in Natrona County are relatively small in size or cause relatively little property damage.

Potential Magnitude

According to the NCDC, the most damage caused by a single fire is $5 million. It is important to note that these are property damages; in the $5 million fire, it was estimated that the fire itself cost an additional $5 million in suppression costs that were not accounted for in the property damage data. Much more damaging fires could be possible given the development in WUI areas.

Wildfires can have significant economic impacts as they often coincide with the busy tourist season in the summer months. It is important to note that the magnitude of a wildfire can be intensified by drought; drought can also cause significant complications to firefighting operations.

Vulnerability Assessment

The principal wildfire mitigation plan for Natrona County is the "Natrona County Wildfire Hazard Assessment and Mitigation Plan" completed in 2005. Wildland fire hazard assessment was conducted on the landscape and community scales. The landscape scale considered the entire county. Five communities were identified for the community-level assessment, as well as an assessment for isolated home sites. Communities were designated based on common characteristics for wildland fire assessment.

The 2005 Natrona County Wildfire Protection Plan identified the following communities for community-specific planning. See that document for additional descriptions of these communities and mitigation recommendations.

- Alcova Reservoir – moderate to high vulnerability
- Rattlesnake – high to extreme vulnerability
- Casper Mountain Complex - high to extreme vulnerability
- Goose Egg – high to extreme vulnerability
- South Bighorn Mountain – high to extreme vulnerability

The planning process also included planning for isolated home sites, though they were not given a specific vulnerability rating.

The 2005 Natrona County CWPP identified issues that exacerbate fire hazards, protection capabilities and overall vulnerability. These include:

- Fuel hazards within or adjacent to WUI communities;
- Prevention and home site protection is lacking in WUI communities;
- Infrastructure, particularly roads and driveways, is inadequate in some locations;
- Fire protection capability and mitigation is lacking with regard to:
  - Firefighter safety;
  - Firefighter effectiveness;
  - Need for new equipment, technology and training;
  - Need for closer interagency collaboration, teamwork and training;
  - Absence of evacuation plans where needed;
  - Need for additional county standards, requirements or protocol with regard to rural subdivision roads, fire mitigation, fuel management or FireWise principles;
  - Community-based strategies for fuel reduction projects;
  - Uncertain priorities as to where mitigation and improvement work should be conducted.

Population

The most exposed population are those living in the wildland-urban interface (WUI) zones, where residential properties are directly intruding into traditional wildland areas. The exposure of the population in these zones increases with the exposure of the corresponding general property, examined in the section below. Other exposed groups include children, the elderly, or those with breathing conditions who may be exposed to high levels of smoke.

Population at-risk estimates were developed by multiplying the average household size from the U.S. Census for the county by the number of residential structures within the Redzone. These results are shown in the table below. It is important to note that many of these structures may include seasonal homes that could be vacant, although the likelihood of them being occupied during fire season is higher.

General Property

GIS is a tool that is used to compare, capture, input, output, store, manipulate, analyze, model, and display spatial data. In the case of the Wildland Urban Interface Hazard Assessment, wildfire hazard vulnerability is determined by comparing values such as slope, vegetation, housing density, and aspect. The following is from the *Wyoming Wildland Urban Interface Hazard Assessment Methodology*—a report written by the Wyoming State Forestry Division:

"The Wildland Urban Interface Hazard Assessment uses three main layers to determine fire danger—Risk, Hazard, and Values. The following lists include the data used to create each of the three layers.

1) Risk – Probability of Ignition
    a. Lightning Strike density
    b. Road density
    c. Historic fire density
2) Hazard – Vegetative and topological features affecting intensity and rate of spread
    a. Slope
    b. Aspect
    c. Fuels – Interpreted from GAP Vegetation information.
3) Values – Natural or man-made components of the ecosystem on which a value can be placed
    a. Housing Density – Life and property
4) Non-flammable areas Mask – a mask was created to aid in the analysis for areas that will not carry fire such as water and rock areas. These areas show in the final assessment as a zero value for hazard."

The statewide Wildland Urban Interface Hazard Assessment and its resultant outputs serve two primary purposes: assisting in prioritizing and planning mitigation projects and creating a communications tool to which agencies can relate to common information and data. With the mapping analysis evaluating areas of varying wildfire vulnerability, the final output will result in a Risk, Hazard, and Value (RHV) map displaying areas of concern (Redzones) for catastrophic wildland fires.

Another method of estimating vulnerability is to determine the value of structures that are located within Redzones, or wildland fire building exposure values. Wildland fire building exposure value is the value of buildings that can be potentially damaged by wildland fire in an area. The total building exposure value is $917,900,339 according to this analysis. The Redzone analysis also includes a buffer zone to exhibit potential areas at risk within two miles of the Redzone; since wildfires can spread rapidly, it is important to consider areas close to the Redzone boundary. According to the Redzone Buffer analysis, the total building exposure value is $2,929,510,041. The table below summarizes exposure by jurisdiction. The following table shows the exposure values within the Redzones in the County.

Table 4.63 Building Exposure within the RedZone

Jurisdiction	Building Count	Improved Value	Est. Content Value	Total Exposure
Bar Nunn	522	$90,555,706	$46,070,426	$136,626,132
Casper	1,254	$234,695,278	$117,347,639	$352,042,917
Edgerton	38	$1,988,923	$1,602,821	$3,591,744
Unincorporated	2,177	$280,137,954	$145,501,592	$425,639,546
Total	3,991	$607,377,861	$310,522,478	$917,900,339

Buildings in the RedZone buffer may also be affected, even if they are not in the RedZone proper. The following table shows building exposure that falls within the RedZone buffer area.

Table 4.64 Building Exposure within the RedZone Buffer

Jurisdiction	Building Count	Improved Value	Est. Content Value	Total Exposure
Bar Nunn	992	$147,210,755	$77,021,811	$224,232,566
Casper	24,181	$3,858,189,618	$2,299,586,877	$6,157,776,495
Edgerton	126	$4,601,804	$3,331,149	$7,932,953
Evansville	1,360	$193,488,399	$163,646,719	$357,135,118
Midwest	210	$5,454,076	$2,762,072	$8,216,148
Mills	2,002	$125,909,808	$91,860,119	$217,769,927
Unincorporated	6,722	$869,201,885	$619,611,973	$1,488,813,858
Total	35,593	$5,204,056,345	$3,257,820,718	$8,461,877,063

The following table details exposure by jurisdiction and property type. For most communities in the RedZone, residential property presented by far the greatest amounts of exposure.

Table 4.65 RedZone Fire Hazard by Jurisdiction and Property Type

Property Type	Building Count	Improved Value	Est. Content Value	Total Exposure	Population
BAR NUNN					
Com Vacant Land	1	$0	$0	$0	
Commercial	1	$140,946	$140,946	$281,892	
Industrial	1	$722,100	$1,083,150	$1,805,250	
Res Vacant Land	31	$0	$0	$0	
Residential	488	$89,692,660	$44,846,330	$134,538,990	1,191
Total	522	90,555,706	46,070,426	$136,626,132	1,191
CASPER					
Commercial	3	$6,696,169	$6,696,169	$13,392,338	
Exempt	11	$0	$0	$0	
Industrial	1	$1,522,792	$2,284,188	$3,806,980	
Multi-Use	1	$122,248	$122,248	$244,496	
Residential	1,238	$234,695,278	$117,347,639	$352,042,917	3,021
Total	1,254	234,695,278	117,347,639	$352,042,917	3,021
EDGERTON					
Commercial	12	$1,216,719	$1,216,719	$2,433,438	
Residential	26	$772,204	$386,102	$1,158,306	63
Total	38	1,988,923	1,602,821	$3,591,744	63
UNINCORPORATED NATRONA COUNTY					
Agricultural	2	$0	$0	$0	

Commercial	143	$8,204,804	$8,204,804	$16,409,608	
Exempt	38	$0	$0	$0	
Industrial	3	$791,863	$1,187,795	$1,979,658	
Multi-Use	7	$849,714	$849,714	$1,699,428	
Property Type	**Building Count**	**Improved Value**	**Est. Content Value**	**Total Exposure**	**Population**
Residential	1,981	$270,064,587	$135,032,294	$405,096,881	4,834
Vacant Land	3	$226,986	$226,986	$453,972	
Total	2,177	$280,137,954	$145,501,592	$425,639,546	4,834

Any flammable materials are vulnerable during a wildfire, including structures and personal property. The vulnerability of general property increases as the distance of the property to wildfire-prone areas decreases, and is particularly high for structures located in the WUI. These structures receive an even higher level of vulnerability if the properties surrounding them are not properly mitigated for fire. Appropriate mitigation techniques include using non-flammable materials such as concrete for construction, leaving appropriate spaces between buildings and vegetation areas filled with non-flammable materials (such as decorative rock or stone), and clearing of underbrush and trees.

Essential Infrastructure, Facilities, and Other Important Community Assets

These aspects of the County may be exposed directly or indirectly to wildfire. Direct exposures are similar to those of General Property and increase as the infrastructure or facilities and capabilities moves into the WUI zone. Communications lines passing through susceptible areas such as forests are more exposed than those located in cities and other more urban areas. The indirect exposure of response capability increases seasonally and with the number of occurrences. Though the populations making up the response capability are not directly exposed to all fire events, the response of some of the personnel to an event lessens the capabilities overall for response to other emergency situations. If there is a large increase in the number of simultaneous wildland fires, even small ones, the response capability of the county could easily be compromised.

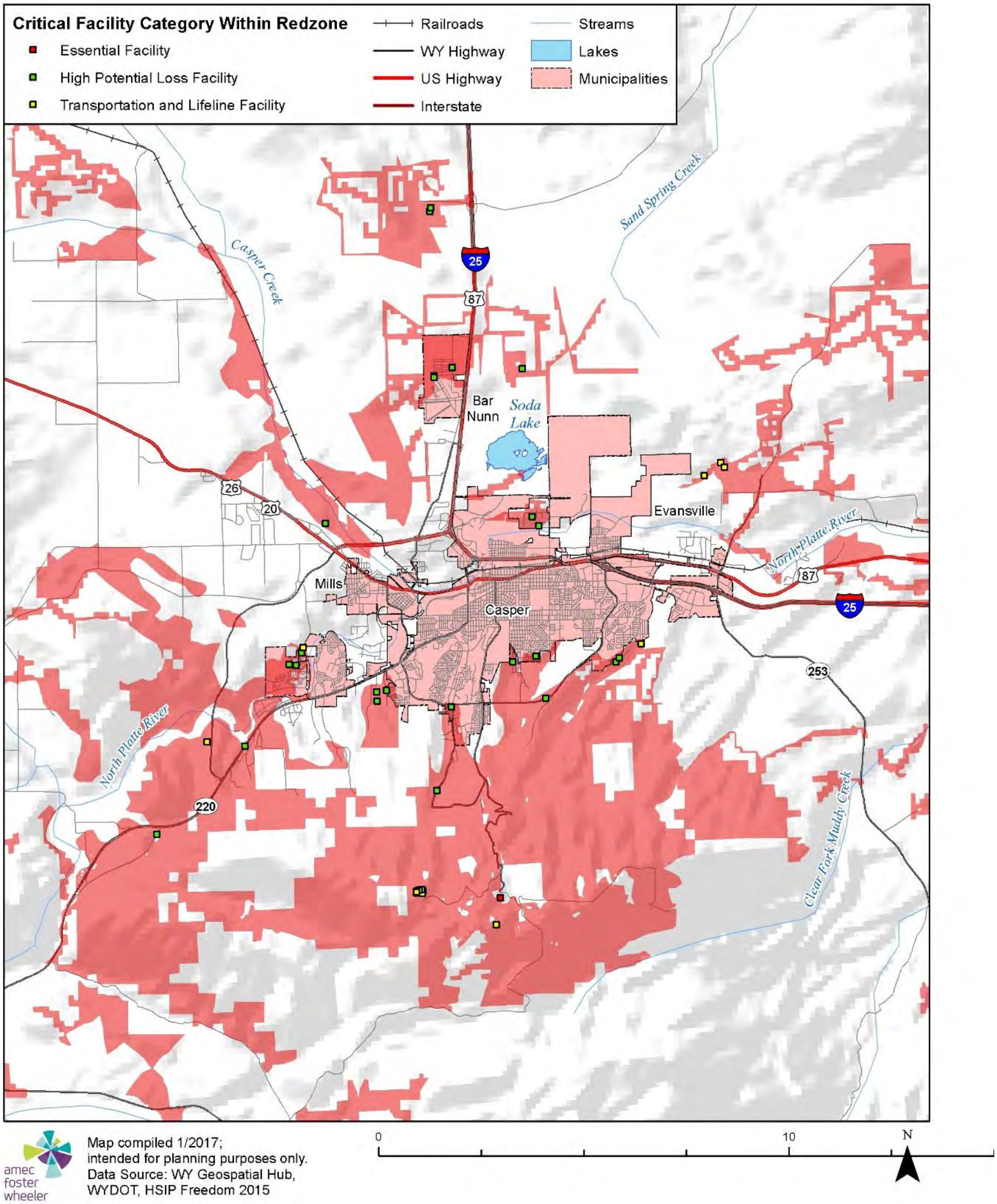
The following table shows numbers of facilities that fall within the RedZones, along with the type of facility. Forty-nine critical facilities reside in the RedZones in the County.

Table 4.66 Critical Facilities within Redzone

Jurisdiction	Critical Facility Type	Facility Count
Bar Nunn	Day Cares	3
	Total	3
Casper	Day Cares	4
	EPA FRS Location	1
	Total	5
Unincorporated	Air Facility	2
	Bridge	6
	Day Cares	1
	EPA FRS Location	15
	Fire Department	1
	Non-Union Communications	14
	Substation	1
	Union Communications	1
	Total	41
	Grand Total	49

The following figure shows critical facilities located within the County's RedZone areas.

Figure 4.53 Natrona County Critical Facilities within RedZone



Natural, Historic and Cultural Resources

Other natural resources and natural areas may actually benefit from wildland fire, as at some level they must also be exposed to wildfire for a healthy ecological development of the area. Historic and cultural resources could include cabins in the WUI. In addition, older buildings may be exempt from internal fire mitigation such as sprinklers and fire suppression technology, which may increase the vulnerability of the resource. The Casper Mountain backdrop is an important natural resource that is susceptible to wildfires.

Future Development

The wildland/urban interface (WUI) is a very popular building location, as shown by national and statewide trends. More and more homes are being built in the interface. Overall, Wyoming has less developed wildland urban interface than most western states. According to the 2016 Wyoming Hazard Mitigation Plan the areas of highest existing risk from wildfire (number of square miles of the wildland urban interface with homes now) mainly occur within Park, Teton and northern Lincoln Counties. Throughout Wyoming there remains potential for future home construction in undeveloped, forested private lands adjacent to fire-prone public lands. Building homes in these high-risk areas would put lives and property in the path of wildfires. Regulating growth in these areas will be a delicate balance between protecting private property rights and promoting public safety.

Using GIS, analysis was conducted on potential building sites in the county that could be built in the RedZone. The following table shows these sites, separated by jurisdiction.

Table 4.67 Potential Future Development Property Counts in RedZone Area

Jurisdiction	Parcel Count	Address Count	In Redzone Fire Hazard
Bar Nunn	131	139	91
Casper	1,376	1,462	182
Edgerton	52	60	19
Evansville	70	73	-
Midwest	46	48	-
Mills	79	139	-
Unincorporated	1,189	1,544	374
Total	2,943	3,465	666

Summary

Wildfires occur within the county on generally an annual basis. Based on GIS analysis, the planning area has almost $919 million in building and content value potentially at risk to wildland fires in the Redzone. This estimate is not including the extended buffer, which would reach almost $8.5 billion in building value potentially at risk. Though it is not likely that the areas at risk will simultaneously face a completely destructive event, this figure provides the upper end of what could be affected.

Overall, wildfire is a **high** significance hazard in Natrona County.

Table 4.68 Natrona County Wildfire Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Bar Nunn	Extensive	Critical	Likely	High
Casper	Extensive	Critical	Likely	High
Edgerton	Extensive	Critical	Likely	High
Evansville	Extensive	Critical	Likely	High
Midwest	Extensive	Critical	Likely	High
Mills	Extensive	Critical	Likely	High
Natrona County	Extensive	Critical	Highly Likely	High

4.3.13 Terrorism

Terrorism is the use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom. Terrorists often use threats to create fear among the public, try to convince citizens that their government is powerless to prevent terrorism, and to get immediate publicity for their cause. Terrorism has been used throughout history to intimidate, coerce, and bring harm to populations. Terrorism can be propagated by foreigners, and also U.S. citizens hostile towards the government or other entities.

There are many different types of terrorism, and the United States has had many incidents of terrorism over the past century. Most terrorist attacks include a CBRNE component - chemical, biological, radiological, nuclear and/or explosives. Armed attacks are also a concern, and a growing mechanism for terrorism is cyberterrorism – the use of hacking to attack computer networks and systems.

History

New York's World Trade Center has been targeted twice and the Federal Building in Oklahoma City once. Both of these attacks resulted in a large number of fatalities. Americans have also been killed in other terrorist aircraft incidents. A number of attempts have been stopped. In addition to these high profile cases, domestic terrorists have targeted entities such as laboratories, resort development, and auto dealerships – making statements in favor of environmental protection.

In the past few years, active shooter and incidents involving threats of explosive devices have become more prevalent.

None of these types of attacks has occurred in Natrona County; however, the county and individuals who live in or frequent the county could be potential targets for terrorism.

Impacts

Natrona County has identified certain assets and infrastructure as critical to the daily life of county residents; the targeting or loss of one or more of these assets could have severe consequences, depending on the specifics of an attack. Impacts of a terrorist attack in Natrona County could include fear and panic, civil unrest, property loss and damage, damage or destruction of infrastructure, loss of life, and interruption of communications, business and/or general commerce. Law Enforcement agencies have identified several potential targets throughout Natrona County. These specific potential targets will not be identified in this Plan. Historically, most of the terrorist events have been that of either bomb threats or an actual explosive device found. All jurisdictions have a potential of being affected by this event or having such an event occur within their jurisdiction.

The HMPC reported two incidents of “white powder” letters that turned out to be benign. One included a threatening letter to the GSA office and one went to the Casper Star Tribune.

Future Impacts

Future impacts would be tied to the type of attack and target, but most impacts from terrorist attacks include injuries, fatalities, economic disruption, environmental concerns, and fear.

Summary

Terrorism is a risk throughout the country. Without breaking down analysis by the different types of terrorism that could be used, it is difficult to identify a single assessment that extensively covers “terrorism” as a single hazard. While certain types of attacks could cause more and greater impacts that others, the overall risk of terrorism in Natrona County remains low.

Table 4.69 Natrona County Terrorism Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Natrona County	Limited	Limited	Occasional	Low

4.3.14 Technological Human Caused-Cyber Incident

The embedding of technology into critical infrastructure now requires continuous access to web and network resources to conduct daily operations, maintenance, and communications. Vital government resources such as emergency services, banking, finance, transportation and utility distribution rely on technological components that can be compromised through cyber-attacks. The ability to successfully respond to cyber-related threats is to proactively mitigate through the adoption and practice of the following interdependent functions: prevention, protection, detection, identification, response, and recovery. Implementing these strategic functions are measures of progressive posturing required to offset the consistent frequency in which malicious actions can quickly penetrate and compromise system integrity. Access to effective cyber and network security training for personnel is also needed in order to stay aware of current trends pertaining to this evolving issue within the industry and profession.

Table 4.70 Natrona County Cyber Incident Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Natrona County	Extensive	Critical	Likely	Medium

4.3.15 Biological Disease Outbreak

Biological disease outbreaks include the occurrence of a larger number of cases of a specific illness or syndrome than expected in a certain location during a certain time frame. This definition also includes those biological agents found in the environment, diagnosed in animals or have an elevated presence of zoonotic disease(s) and/or an increase in the population of disease-carrying species, that have the potential for transmission to humans, including vector-borne illnesses.

The biological disease outbreaks of greatest concern are pandemic ones, which is a global disease outbreak. A pandemic flu is a virulent human flu that causes a global outbreak, or pandemic, of serious illness. A flu pandemic occurs when a new influenza virus emerges for which people have little or no immunity, and for which there is no vaccine. This disease spreads easily person-to-person, causes serious illness, and can sweep across the country and around the world in very short time. The U.S. Centers for Disease Control and Prevention has been working closely with other countries and the World Health Organization to strengthen systems to detect outbreaks of influenza that might cause a pandemic and to assist with pandemic planning and preparation.

In recent years, health professionals are concerned by the possibility of an avian (or bird) flu pandemic associated with a highly pathogenic avian H5N1 virus. Since 2003, avian influenza has been spreading through Asia. A growing number of human H5N1 cases contracted directly from handling infected poultry have been reported in Asia, Europe, and Africa, and more than half the infected people have died. There has been no sustained human-to-human transmission of the disease, but the concern is that H5N1 will evolve into a virus capable of human-to-human transmission.

An especially severe influenza pandemic could lead to high levels of illness, death, social disruption, and economic loss. Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines.

Past Occurrences

There were three acknowledged pandemics in the twentieth century:

- 1918-19 Spanish flu (H1N1)—This flu is estimated to have sickened 20-40 percent of the world's population. Over 20 million people lost their lives. Between September 1918 and April 1919, 500,000 Americans died. The flu spread rapidly; many died within a few days of infection, others from secondary complications. The attack rate and mortality was highest among adults 20-50 years old; the reasons for this are uncertain.
- 1957-58 Asian flu (H2N2)—This virus was quickly identified due to advances in technology, and a vaccine was produced. Infection rates were highest among school children, young adults, and pregnant women. The elderly had the highest rates of death. A second wave developed in 1958. In total, there were about 70,000 deaths in the United States. Worldwide deaths were estimated between 1 and 2 million.
- 1968-69 Hong Kong flu (H3N2)—This strain caused approximately 34,000 deaths in the United States and more than 700,000 deaths worldwide. It was first detected in Hong Kong in early 1968 and spread to the United States later that year. Those over age 65 were most likely to die. This virus returned in 1970 and 1972 and still circulates today.

To date, the 21st century has seen one acknowledged pandemic.

- 2009 Swine Flu (H1N1)—This strain caused more than 14,700 deaths worldwide to date, according to the WHO. It was first detected in the United States in early 2009 and spread to the world later that year. About 70 percent of people who have been hospitalized with this 2009 H1N1 virus have had one or more medical conditions previously recognized as placing people at "high risk" of serious seasonal flu-related complications. This included pregnancy, diabetes, heart disease, asthma, and kidney disease. Young children were also at high risk of serious complications from 2009 H1N1, just as they are from seasonal flu. And while people 65 and older were the least likely to be infected with 2009 H1N1 flu, if they got sick, they were also at "high risk" of developing serious complications from their illness.

Likelihood of Future Occurrences

Occasional: According to historical data, four influenza pandemics have occurred since 1918. This is an average of a pandemic approximately every 24 years or an approximate 4 percent chance of pandemic in any given year. Less extensive biological disease outbreaks occur annually.

Although scientists cannot predict when the next influenza pandemic will occur or how severe it will be, wherever and whenever it starts, everyone around the world will be at risk. If an influenza pandemic does occur, it is likely that many age groups would be seriously affected. The greatest risks of hospitalization and death—as seen during the last two pandemics in 1957 and 1968 as well as during annual outbreaks of influenza—will be to infants, the elderly, and those with underlying health conditions. However, in the 1918 pandemic, most deaths occurred in young adults.

Summary

Based on a Public Health Risk Assessment done for Natrona County biological disease had a high hazard risk index. Overall, biological disease is a **high** significance hazard in Natrona County.

Table 4.71 Natrona County Cyber Biological Disease Outbreak Hazard Risk Summary

	Geographic Extent	Potential Magnitude	Probability of Future Occurrence	Overall Significance
Natrona County	Extensive	Critical	Occasional	High

5 MITIGATION STRATEGY

Requirement §201.6(c)(3): [The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

5.1 Mitigation Strategy: Overview

This section describes the mitigation strategy process and mitigation action plan for the Natrona County Hazard Mitigation Plan. It describes how the HMPC met the following requirements from the 10-step planning process:

- Planning Step 6: Set Goals
- Planning Step 7: Review Possible Activities
- Planning Step 8: Draft an Action Plan

The results of the planning process, the risk assessment, the goal setting, the identification of mitigation actions, and the hard work of the HMPC led to this mitigation strategy and action plan. Section 5.2 below identifies the goals of this plan and Section 5.4 describes the mitigation action plan.

5.2 Goals and Objectives

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

Up to this point in the planning process, the HMPC had organized resources, assessed hazards and risks, and documented mitigation capabilities; the resulting goals and mitigation actions were developed and updated based on these tasks. During the original development as well as 2017 update of this plan, the County held a series of meetings designed to achieve a collaborative mitigation strategy as described further throughout this section.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable and are sometimes developed in mitigation planning as an intermediate step between goals and mitigation actions or projects.

The update of goals for Natrona County was initiated through a facilitated discussion at two planning workshops held in February and March 2017. The HMPC members were provided a PowerPoint presentation that explained goals, objectives and actions and listed examples of each. A worksheet with the 2010 plan goals was provided to allow HMPC members to provide suggestions for revisions. Through a facilitated discussion the group felt that the goals and objectives remained valid, with some minor wording revisions to reflect current conditions. Objective 2.2 below was added to further define the multi-jurisdictional and collaborative nature of this plan.

The updated goals and objectives for the Natrona County Hazard Mitigation plan are listed below.

Goal 1: Continue to implement actions to mitigate the effect of hazards through education, ordinances and resolutions, and proper project analysis, to enhance life safety and reduce the property losses.

Objective 1.1: The County and jurisdictions will participate in activities and support mitigation projects that enhance the protection of citizens from hazards.

Objective 1.2: The County and jurisdictions will create public awareness campaigns to educate citizens of the possible hazards associated with all hazards that affect the planning area.

Goal 2: Continue coordination among all entities of Natrona County to assess all hazards and take various actions to reduce or eliminate the risk factors of those hazards.

Objective 2.1: The County and jurisdictions will participate and support projects that ensure emergency services are properly equipped and trained to provide the level of service the community deserves.

Objective 2.2: Continue multi-jurisdictional collaboration on hazard mitigation projects to the benefit of all jurisdictions

Goal 3: Reduce the economic impact on the local economy caused by the effects of hazards in the communities.

Objective 3.1: Communities working together shall develop policies for hazard prone areas that either limit development or provide additional mitigation measures within those areas.

5.3 Identification and Analysis of Mitigation Actions

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

The next step in the mitigation strategy is to identify and analyze a comprehensive range of specific mitigation actions and projects to reduce the effects of each hazard on new and existing buildings and infrastructure. During the 2017 Plan update, the HMPC analyzed viable mitigation options by hazard that supported the identified goals. The HMPC was provided with the following list of categories of mitigation actions, which originate from the Community Rating System:

- **Prevention**: Administrative or regulatory actions or processes that influence the way land and buildings are developed and built.
- **Property protection**: Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area.
- **Structural**: Actions that involve the construction of structures to reduce the impact of a hazard.
- **Natural resource protection**: Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
- **Emergency services**: Actions that protect people and property during and immediately after a disaster or hazard event.
- **Public information/education and awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

In order to identify and select mitigation actions to support the mitigation goals, each hazard identified and profiled in Chapter 4 was evaluated. At the mitigation strategy workshops the HMPC was also provided a matrix showing examples of potential mitigation action alternatives for each of the above categories, for each of the identified hazards. The HMPC was also provided a handout that explains the categories and provided further examples. Finally, another reference document titled "Mitigation Ideas" developed by FEMA was distributed. This document lists the common alternatives for mitigation by hazard grouped by the FEMA categories of Plans and Regulations, Structure and Infrastructure Projects, Education and Awareness, Natural Systems Protection and Emergency Services. The HMPC was asked to consider both future and existing buildings in considering possible mitigation actions. A facilitated discussion then took place to examine and analyze the options. Appendix B provides the matrix of alternatives considered. Each proposed action was written on a large sticky note and posted on flip charts in the meeting rooms underneath the hazard it addressed. The result was a number of new project ideas with the intent of reducing the impacts of the identified hazards.

The mitigation strategy builds on existing local authorities, policies, programs, and resources, as well as the ability to expand on and improve these existing tools. Those capabilities are noted in Chapter 2 and can be assessed to identify gaps to address or strengths to enhance through new mitigation actions. For instance, gaps in design or enforcement of existing regulations could be addressed through additional personnel or a change in procedure or policy.

Based upon the key issues identified in the risk assessment the HMPC came to consensus on proposed mitigation actions for each hazard for their jurisdictions. Certain hazard impacts were best reduced through multi-hazard actions. A lead for each new action was identified to provide additional details on the project so they could be captured in the plan. Final action strategies are discussed in Section 5.4.

5.3.1 Prioritization Process

Once the mitigation actions were identified, the HMPC was provided FEMA's recommended prioritization criteria STAPLEE to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. STAPLEE is an acronym for the following:

- Social: Does the measure treat people fairly? (e.g., different groups, different generations)
- Technical: Is the action technically feasible? Does it solve the problem?
- Administrative: Are there adequate staffing, funding, and other capabilities to implement the project?
- Political: Who are the stakeholders? Will there be adequate political and public support for the project?
- Legal: Does the jurisdiction have the legal authority to implement the action? Is it legal?
- Economic: Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- Environmental: Does the action comply with environmental regulations? Will there be negative environmental consequences from the action?

Other criteria used to assist in evaluating the priority of a mitigation action includes:

- Does the action address hazards or areas with the highest risk?
- Does the action protect lives?
- Does the action protect infrastructure, community assets or critical facilities?
- Does the action meet multiple objectives (Multiple Objective Management)?

At the mitigation strategy workshops, the HMPC used STAPLEE to determine which of the new identified actions were most likely to be implemented and effective. Keeping the STAPLEE criteria in mind, each member 'voted' for the new mitigation actions by sticking a colored dot on the sticky note on which the action was written. The number of dots next to each action was totaled as an indication of relative priority and translated into 'high,' 'medium' and 'low.' The results of the STAPLEE evaluation process produced prioritized mitigation actions for implementation within the planning area.

The process of identification and analysis of mitigation alternatives allowed the HMPC to come to consensus and to prioritize recommended mitigation actions for their jurisdictions. During the voting process, emphasis was placed on the importance of a benefit-cost review in determining project priority as this is a requirement of the Disaster Mitigation Act regulations; however, this was a planning level analysis as opposed to a quantitative analysis. Quantitative cost-benefit analysis will be considered in additional detail when seeking FEMA mitigation grant funding for eligible projects identified in this plan.

Each mitigation action developed for this plan contains a description of the problem and proposed project, the entity with primary responsibility for implementation, any other alternatives considered, a cost estimate, expected project benefits, potential funding sources, and a schedule for implementation. Development of these project details for each action led to the determination of a high, medium, or low priority for each.

5.4 Mitigation Action Plan

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

This section outlines the development of the updated mitigation action plan. The action plan consists of the specific projects, or actions, designed to meet the plan's goals. Over time the implementation of these projects will be tracked as a measure of demonstrated progress on meeting the plan's goals.

5.4.1 Progress on Previous Mitigation Actions

As part of the update process Natrona County reviewed the previously identified actions in the 2010 plan to assess progress on implementation. These reviews were completed using a worksheet and a facilitated discussion to capture information on each action including if the action was completed or deferred to the future. Actions that were not completed were discussed for continued relevance and were either continued in this plan or in some cases recommended for deletion.

The County and the majority of their participating jurisdictions have been very successful in implementing actions identified in this plan, thus, working steadily towards meeting the plan's goals. Progress on mitigation actions previously identified in these planning mechanisms are detailed in the mitigation action strategy that follows. These completed actions were also discussed with the plan participants to showcase progress and stimulate ideas amongst the respective jurisdictions. Reasons that some actions have not been completed include low priority, lack of funding, or lack of administrative resources. See Table 5.1 for more details on progress on implementation.

5.4.2 Continued Compliance with NFIP

Given the significance of the flood hazard in the planning area and as required by DMA, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP). Natrona County and jurisdictions that participate in the NFIP including Casper, Mills, and Evansville will continue to make every effort to remain in good standing with the program. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance. Actions related to continued compliance include:

- Continued designation of a local floodplain manager whose responsibilities include reviewing floodplain development permits to ensure compliance with the local floodplain management ordinances and rules;
- Suggest changes to improve enforcement of and compliance with regulations and programs;

- Participate in Flood Insurance Rate Map updates by adopting new maps or amendments to maps;
- Utilize Digital Flood Insurance Rate maps in conjunction with GIS to improve floodplain management, such as improved risk assessment and tracking of floodplain permits;
- Promote and disperse information on the benefits of flood insurance.

Also to be considered are the flood mitigation actions contained in this plan that support the ongoing efforts by participating counties to minimize the risk and vulnerability of the community to the flood hazard, and to enhance their overall floodplain management program. It is also important to note that the City of Casper is a participant in the Community Rating System which underscores the City's commitment to managing its floodplains above and beyond the FEMA minimum standards and keeping flood insurance affordable.

5.4.3 Mitigation Action Plan

The mitigation action plan presents the recommendations developed by the County planning team, outlining how each jurisdiction can reduce the risk and vulnerability of people, property, infrastructure, and natural resources to future disaster losses. The actions are captured in Table 5.1 including a description of the action, priority, hazards intended to be mitigated, the parties responsible for implementation, and an action identification number to make actions easier to track and reference in the future. Some mitigation actions are detailed further in the pages that follow. These details include the action description, hazard(s) mitigated, lead and partner agencies responsible for initiating implementation, costs, and timeline. Many of the action items included in this plan are a collaborative effort among local, state, and federal agencies and stakeholders in the planning area.

Further, it should be clarified that the actions included in this mitigation strategy are subject to further review and refinement; alternatives analyses; and reprioritization due to funding availability and/or other criteria. The jurisdictions are not obligated by this document to implement any or all of these projects. Rather, this mitigation strategy represents the desires of each community to mitigate the risks and vulnerabilities from identified hazards. The participating jurisdictions also realize that new needs and priorities may arise as a result of a disaster or other circumstances and reserves the right to support new actions, as necessary, as long as they conform to their overall goals, as listed in this plan.

Where feasible it is recommended that mitigation be integrated and implemented through existing planning mechanisms. Specific related mechanisms are noted in the table where applicable and also discussed in Chapter 6.

Table 5.1 Mitigation Action Strategy

ID	Mitigation Project	Responsible Party	Budget (estimates)	Timeline for Completion	Priority /Additional Funding Sources needed?	Jurisdiction that will benefit	Hazard(s) Mitigated	2017 Status and comments
MJ-1	Alert and Warning System	Natrona County Emergency Management Director	Currently budgeted	On-going	High/No	Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills, Natrona County	All hazards	Completed/Continuing Phase 1 is complete with 95% of sirens installed. The project will continue as funding allows.
MJ-2	Develop a Ready, Set, Go Program for All Hazards	Natrona County Emergency Management Director	Absorbed into prepared-ness budget line.	Jan 2019	Low/No	Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills, Natrona County	All hazards	New in 2017.
MJ-3	Public Education (CERT) and 72 Hour Preparedness Training	Natrona County Emergency Management Director	Currently budgeted	On-going	High/No	Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills, Natrona County	All hazards	Completed/Continuing. CERT Training occurs twice a year. This project was updated to include 72 Hour Preparedness Training to encourage self-sufficiency for all hazard events.

ID	Mitigation Project	Responsible Party	Budget (estimates)	Timeline for Completion	Priority /Additional Funding Sources needed?	Jurisdiction that will benefit	Hazard(s) Mitigated	2017 Status and comments
MJ-4	Wyoming Firewise	Natrona County Emergency Management Director	Currently budgeted	On-going	High/No	Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills, Natrona County	Wildfire	Completed/Continuing. Firewise activities are ongoing on a quarterly basis and include education and awareness on defensible space and other mitigation techniques.
MJ-5	Electronic Mass Notification System	Natrona County Emergency Management Director	$100,000	By 2013	Medium/No	Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills, Natrona County	All hazards	Completed. CodeRed has been installed for mitigation of loss of life by mass notification of dangerous weather or other hazard events.
MJ-6	Continue to offer immunizations to residents and educate the public about novel diseases	Natrona County Public Health Preparedness	Variable depending on outbreak	Ongoing annually and during disease outbreaks	Low/No	Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills, Natrona County	Biological disease	New in 2017
NC-1	Updated floodplain mapping	Natrona County Emergency Management Director	$35,000	Complete	Medium/Yes	Natrona County	Flood	Completed. The Glendale St Letter of Map Revision was completed May 2015 and has been incorporated into new maps.

ID	Mitigation Project	Responsible Party	Budget (estimates)	Timeline for Completion	Priority /Additional Funding Sources needed?	Jurisdiction that will benefit	Hazard(s) Mitigated	2017 Status and comments
C-1	Garden Creek Detention Basin	City of Casper - Engineering	$1,245,000	NA	NA	City of Casper	Flood	Deleted. This project is no longer recommended.
C-2	Industrial Avenue Storm Sewer Improvements	City of Casper - Engineering	$250,000	By 2018	High/Yes	City of Casper	Flood	Deferred. Not completed due to other priorities. An updated project narrative was developed in 2017
C-3	Emigrant Gap Draw Channel Improvements	City of Casper - Engineering	$850,000	By 2020	Medium/Yes combination of Federal, State, County and City funds	City of Casper; Natrona County	Flood	New in 2017 Identified in City of Casper 2013 Stormwater Management Master Plan; County and NRCS potential partners
C-4	Sun Drive Detention Pond on Sage Creek	City of Casper - Engineering	$500,000	By 2020	Medium/Yes HMGP, City of Casper 1% Sales Tax Funds, and WYDOT funds	City of Casper; WYDOT	Flood	New in 2017 Identified in City of Casper 2013 Stormwater Management Master Plan; WYDOT partner

ID	Mitigation Project	Responsible Party	Budget (estimates)	Timeline for Completion	Priority /Additional Funding Sources needed?	Jurisdiction that will benefit	Hazard(s) Mitigated	2017 Status and comments
C-5	Eastdale Creek Diversion to Sage Creek	City of Casper - Engineering	$2,500,000	By 2021	Medium/Yes HMGP, City of Casper 1% Sales Tax Funds, and WYDOT funds	City of Casper; WYDOT	Flood	New in 2017 Identified in City of Casper 2013 Stormwater Management Master Plan; WYDOT partner Reduce flooding of Interstate 25 (I-25) and approximately five (5) private properties.
C-6	North Platte River Restoration	City of Casper - Engineering	Varies based on project	2021	High/Yes	Casper, Natrona County, Mills	Flood, wildfire	New in 2017 This project links the HMP with implementation of priority projects in the Platte River Revival River Restoration Master Plan with flood and wildfire benefits.
C-7	Cyber Threat Prevention, Protection, Response and Recovery	City of Casper in partnership with Natrona County	$5-10k/yr.	On-going by 2020	High/No – currently budgeted	Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills, and Natrona County	Technological Human Caused Cyber & Network Threats	New in 2017
C-8	City of Casper Central Service Center Hardening Project	City of Casper - Engineering	$520,000	By 2013	Medium/Yes	City of Casper	All hazards	Completed

ID	Mitigation Project	Responsible Party	Budget (estimates)	Timeline for Completion	Priority /Additional Funding Sources needed?	Jurisdiction that will benefit	Hazard(s) Mitigated	2017 Status and comments
C-9	City of Casper Events Center Hardening Project	City of Casper - Engineering	$600,000	By 2020	Medium/Yes	City of Casper	All hazards	Completed. This project included security hardening and generator installation
C-10	Flood Hazard Notification and Education	City of Casper- Planning Tech	$20,000	2018 and annually	Medium/Yes	City of Casper	Flood	Completed/Continuing The City has created webpages designed to provide citizens with floodplain information as well as mapping information See updated narrative developed in 2017
M1	Chamberlain Street bank stabilization	Town of Mills - Engineering Director	$380,000	By 2019	High/Yes	Town of Mills in coordination with County River Master Plan	Flood	Deferred but still a priority. There is one home and some land that is being negatively impacted by streambank erosion.
M2	Hardening of the Town of Mills fire department	Town of Mills - Fire Department - Chief	TBD	By 2020	High/Yes	Town of Mills	All hazards	Completed. A generator was installed in 2013 with help from a FEMA grant.
E1	Stabilization of ditch bank and installation of storm sewer pipe along the existing	Town of Evansville Engineering Director	$150,000	By 2020	Medium/Yes	Town of Mills	Flood	Deferred due to other priorities but still a needed project.

ID	Mitigation Project	Responsible Party	Budget (estimates)	Timeline for Completion	Priority /Additional Funding Sources needed?	Jurisdiction that will benefit	Hazard(s) Mitigated	2017 Status and comments
E2	Hardening of the Town of Evansville Police Department for Flood and Severe Weather	Town of Evansville - Police Department Chief	TBD	By 2020	Medium/Yes	Town of Evansville	All hazards	Deferred. Not completed due to lack of funding but still needed.
E3	Hardening of the Town of Evansville Community Center	Town of Evansville - Planning - Mayor	TBD	By 2013	Medium/Yes	Town of Evansville	All hazards	Complete.
E4	Address evacuation of Evansville due to Train Derailment or other hazards, including developing an alternate route	Town of Evansville Police Department Chief	TBD	By 2020	High/Yes	Town of Evansville	Hazardous Materials, Floods, wildfire	New in 2017
BN1	Develop additional emergency access/egress for Bar Nunn	Town of Bar Nunn Administration	TBD	By 2020	High/Yes	Town of Bar Nunn	Hazardous Materials, wildfire	New in 2017

ID	Mitigation Project	Responsible Party	Budget (estimates)	Timeline for Completion	Priority /Additional Funding Sources needed?	Jurisdiction that will benefit	Hazard(s) Mitigated	2017 Status and comments
BN2	Cheat grass/flash fuels eradication	Town of Bar Nunn Maintenance	$20,000	Spring 2020	High/ Budgeted/Mitigation grant funding/Donation of labor/equipment	Town of Bar Nunn	Wildland Fire	New in 2017
ED1	Water storage and treatment facility fire break	Town of Edgerton Public Works	$7,000	2020	High/ Town of Edgerton general fund FEMA Mitigation grant funding/Donation of labor/equipment	Town of Edgerton Town of Midwest	Wildland Fire	New in 2017
MW1	North boundary fire break	Town of Midwest Public Works	$7,000	Spring 2019	High/ Budgeted/Mitigation grant funding/Donation of labor/equipment	Town of Midwest	Wildland Fire	New in 2017

5.4.4 Mitigation Actions – Additional Information

The following narratives provide additional information on the mitigation actions identified in the previous action strategy table by County and municipality.

County and Multi-Jurisdictional Actions

New or Continuing Projects

Mitigation Project Title	**MJ- 1 Alert and Warning System**
Hazard(s) Mitigated	Earthquake, Flood, Winter Storms, Thunderstorm, Dam Failure, Wildfire, Terrorism, Hazardous Materials, High Winds
Project Description, Issue/Background	Natrona County utilizes several avenues of mass notification measures with the purpose to warn people throughout Natrona County of impending or actual disaster/emergencies. The Warning systems may be utilized to warn or alert officials, emergency response personnel, and the general public in the event of local, state and national disasters and emergencies and other natural and technological events. Current warning resources include outdoor warning siren systems, mobile sirens and public address systems utilized primarily by emergency vehicles, the NOAA all hazards alert radio system via the National Weather Service in Riverton, Wyoming. Specialized weather alter radios with accessory equipment to include a strobe light and pillow vibrator are offered to hearing impaired citizens. All such avenues are utilized to warn the public of an emergency event or disaster. The Emergency Alert System (EAS) is also another means of notification utilized in Natrona County. The EAS is set to monitor radio stations and the National Weather Service. It can be activated by the 24 hour warning point and goes out via a public safety frequency to all local radio and television stations. In addition, the Natrona County School District as well as Casper College have instituted their own mass notification systems within their student and staff population. The Natrona County Emergency Management Agency continues the effort to provide education and training on existing notification systems available throughout Natrona County as well as exploring new technology to include SMS (short messaging system), voice and email avenues of notification. The outdoor warning siren system is largely in place as of Spring 2017 with the majority of the system operational. Due to public feedback the County is no longer using the voice message on siren system to lessen confusion.
Related planning mechanisms	
Jurisdictions that will benefit	Natrona County, Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills
Responsible Office/ Agency	Natrona County Emergency Management
Partners	Two-Way Radio Service Natrona County School District #1

	Casper College Anadarko Petroleum Corporation Communication Technologies, Inc. National Weather Service - Riverton, WY
Priority (High, Medium, Low)	Low
Cost Estimate	$5-25k
Benefits (Avoided Losses)	mitigate loss of life, injury
Potential Funding source	FEMA, WOHS, Local budget
Timeline for Completion	Identified in 2010 and continuing. The remainder of the outdoor warning siren system is mostly completed by spring as of Spring 2017 and expanded with new housing development thereafter. As funding becomes available reverse 911 system and additional mass notification systems will be implemented. Public education is still in progress.

Mitigation Project Title	**MJ-2 - Develop a Ready, Set, Go Program for All Hazards**
Hazard(s) Mitigated	Wildfire, Flood, Terrorism, Hazardous Materials
Project Description, Issue/Background	The Ready, Set, Go Program outlines actions that citizens can do to prepare themselves and their property for an evacuation to mitigate loss of life, injury, and essential personal property. Originally intended for wildfire hazards, the principles can be applied to all hazards. Several hazards could result in mass-evacuations including floods, hazardous materials incidents and terrorism. This project would result in a plan and public education program to mitigate loss of life and injury in future hazard events.
Related planning mechanisms	Community Wildfire Protection Plan
Jurisdictions that will benefit	Natrona County, Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills
Responsible Office/ Agency	Natrona County Emergency Management
Partners	Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills
Priority (High, Medium, Low)	Low
Cost Estimate	$25,000
Benefits (Avoided Losses)	mitigate loss of life, injury, and essential personal property
Potential Funding source	FEMA, WOHS, Local budget
Timeline for Completion	New in 2017. Complete by Jan 2019

Mitigation Project Title	MJ- 3 Public Education (CERT) and 72 Hour Preparedness Training
Hazard(s) Mitigated	Earthquake, Flood, Winter Storms, Thunderstorm, Dam Failure, Wildfire, Terrorism, Hazardous Materials, High Winds
Project Description, Issue/Background	Public surveys in 2010 and during the 2017 HMP update showed a high demand for more public education on the hazards that affect Natrona County and how to prepare for such hazards. An education program consisting of billboards, newspaper articles, booths at public gatherings, slides at local movie theaters, and video productions to be shown on both local television stations as well as through cable television. Different hazards will be emphasized during different times of the year. The CERT classes started in March of 1999. Presently approximately 850 persons have been trained. We will be targeting school crises management teams, church teams, building teams as well as neighborhood teams. The emphasis will be to help the participants prepare their families as well as working as a team in the case of a disaster/emergency on an "all hazards" approach. This project is being planned for as a perpetual project as funding allows.
Related planning mechanisms	
Jurisdictions that will benefit	Natrona County, Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills
Responsible Office/ Agency	Natrona County Emergency Management
Partners	Natrona County School District # 1 NALCO/EXXON Chemical EV. Design Citizen Corps Council Many Local Businesses
Priority (High, Medium, Low)	Low
Cost Estimate	$500 per class plus response equipment
Benefits (Avoided Losses)	mitigate loss of life, injury, and essential personal property
Potential Funding source	FEMA, WOHS, Local budget
Timeline for Completion	Ongoing annually and continuing. No ending date

Mitigation Project Title	**MJ- 4 Wyoming FireWise**
Hazard(s) Mitigated	Wildfire
Project Description, Issue/Background	This project was identified in 2010 Plan and is ongoing. The project is for education, establishing the different areas of risk, mapping, and designing examples of ways to reduce the impact of wildfire damage to homes and other structures. The Wyoming FireWise committee has also been applying for and receiving grants for cost share on fuel reduction/mitigation projects. Casper Mountain has served as the pilot project for this endeavor and will serve as an example to the rest of the state of Wyoming. Funds were also applied for the construction of fuel breaks to lessen the impact of a wild fire. The committee is comprised of State Forestry, BLM, private landowners, fire districts and Emergency Management. Aerial mapping was completed and updated 2016 maps will be available for inclusion in the future updates. The hiring of temporary summer help to map out, with GPS, homes and other structures was completed and is now ready to be entered into GIS system once it is up and running. Several homeowners signed up for personal reviews of their property located on Casper Mountain. This committee has also expanded this project to educate homeowners in the Rattle Snake Mountain Range, South Big Horn Mountains and the Alcova Reservoir area. Fire breaks along west side of Casper Mountain were completed by fall of 2010. Fire breaks projects on central part of Casper Mountain were completed by fall of 2006.
Related planning mechanisms	Community Wildfire Protection Plan
Jurisdictions that will benefit	Natrona County, Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills
Responsible Office/ Agency	Wyoming FireWise committee
Partners	Bar Nunn, Casper, Edgerton, Evansville, Midwest, Mills State Farm Insurance, Wyoming State Forestry, Natrona County Emergency Management, BLM, University of Wyoming Agricultural Extension Office, Casper Mountain Fire District, Natrona County Fire Protection District, Natrona County Assessor’s Office Private Citizens
Priority (High, Medium, Low)	Low
Cost Estimate	Variable depending on treatment areas
Benefits (Avoided Losses)	Benefits of the project include the placement of water sources with easy access by firefighters in the event of a fire. Firebreaks will slow and/or stop an advancing fire giving firefighters the chance to attack or gain more time to evacuate. The education process has already been working in that landowners are starting to improve their properties making them more fire resistant and therefore making their homes more survivable.
Potential Funding source	State Legislature, Local budget
Timeline for Completion	Identified in 2010 Plan. Ongoing through 2020.

Natrona County Completed Mitigation Actions Identified in 2010 Plan

- Electronic Mass Notification System: CodeRed has been installed for mitigation of loss of life by mass notification of dangerous weather or other hazard events.

City of Casper

New or Continuing Projects

Mitigation Project Title	**Lower Eastdale Creek Channel Improvements**
Hazard(s) Mitigated	Flood/Flash Flood
Project Description, Issue/Background	Eastdale Creek is a medium sized, well-developed drainage basin passing through the central section of the City of Casper. It is bordered on the west by the Saint Mary Street storm sewer system and on the east by Sage Creek. The development in the basin begins at 29th Street and runs north, and the portion of the basin south of there is only sparsely developed as it extends just to the base of Casper Mountain. The total drainage area encompasses 2,370 acres. The channel slope is steep in the upstream reaches and flattens toward the outfall at the North Platte River. Eastdale Creek possesses multiple flooding problems within the developed area, with multiple storm sewers unable to even convey the 10-year flood. Overtopping occurs for the 100-year flood at South Jefferson Street, Drake Place and Bryan Evansville Road. Interstate 25 is also impacted and flooded at the underpass for East Yellowstone Highway and at the frontage road on the north side during the 100-year flood event. The impact to Bryan Evansville Road is a particular concern since it is directly adjacent to the Sam H. Hobbs Regional Wastewater Treatment Plant. The proposed Lower Eastdale Creek Channel Improvements would allow the current 10-year storm event to be conveyed within the proposed channel and culverts, and would convey the future 100-year storm event assuming the Eastdale Creek Diversion to Sage Creek were completed. The existing culverts and open channel along Hereford Lane, from Bryan Evansville Road upstream approximately 1,000 linear feet, cannot even convey the 5-year storm event. Overtopping of a private driveway and Bryan Evansville Road, as well as ditch overspill onto private property east of the channel, happen on a regular basis, often multiple times each year. The proposed improvement include multiple box culverts at 700 Hereford Lane and at Bryan Evansville Road, along with widening of the earthen channel. The estimated cost to construct these channel improvements is $325,000. No property acquisition will be necessary for this project as storm drainage easements have been secured in recent years and will allow for the complete construction project.
Related planning mechanisms	City of Casper 2013 Stormwater Management Master Plan

Jurisdictions that will benefit	City of Casper
Responsible Office/ Agency	City of Casper - Engineering Division
Partners	
Priority (High, Medium, Low)	High
Cost Estimate	$325,000
Benefits (Avoided Losses)	Reduce localized flooding of approximately five (5) private properties and a parallel road section.
Potential Funding source	HMGP and City of Casper 1% Sales Tax Funds
Timeline for Completion	Construction time estimated at 3 months, desired completion date of 11/01/18.

Mitigation Project Title	**Industrial Avenue Storm Sewer Improvements**
Hazard(s) Mitigated	Flood/Flash Flood
Project Description, Issue/Background	Located in the heart of the Old Yellowstone District, Industrial Avenue houses warehouses, auto body shops, and other industrial businesses. The Old Yellowstone District is a redevelopment area adjacent to the downtown core. West Yellowstone Highway, a street immediately adjacent to Industrial Avenue, has undergone reconstruction, incorporating the city's "Design Standards for Commercial/Downtown Streetscape and Parks," including trees, benches, and decorative lights. Completion of this project has spurred some redevelopment within the adjacent areas. Industrial Avenue is located within the 500-year flood plain of the North Platte River. Flat topography in the area creates numerous drainage challenges, further compounded by existing undersized 8-inch and 12-inch storm sewer serving the approximately 10-acre drainage basin. Replacement of the undersized storm sewers with 24-inch storm sewers will help alleviate the drainage issues for the 25 lots immediately adjacent and provide impetus for additional business growth in the area. The estimated cost to replace the undersized storm sewers along Industrial Avenue between Spruce Street and Elm Street is $100,000. To accommodate the existing drainage conditions, the roadway is inverted. To bring the roadway up to current standards, with a crowned pavement section, curb and gutter, and sidewalk would cost an additional $150,000. This cost does not include the additional cost for trees, benches, decorative lights, or other enhancements identified in the downtown design standards.
Related planning mechanisms	2010 Natrona County Multi-Jurisdiction Hazards Mitigation Plan
Jurisdictions that will benefit	City of Casper
Responsible Office/ Agency	City of Casper - Engineering Division
Partners	Old Yellowstone District
Priority (High, Medium, Low)	High
Cost Estimate	$250,000
Benefits (Avoided Losses)	Reduce localized flooding of approximately twenty-five (5) private properties and associated streets and alleys.
Potential Funding source	HMGP and City of Casper 1% Sales Tax Funds
Timeline for Completion	Construction time estimated at 3 months, desired completion date of 11/16/18.

Mitigation Project Title	**Emigrant Gap Draw Channel Improvements**
Hazard(s) Mitigated	Flood/Flash Flood
Project Description, Issue/Background	Emigrant Gap Draw is a large, mostly undeveloped drainage basin with its outfall to the North Platte River located near the far west edge of the City of Casper. There is some rural development in the upper portion of the basin, and no true urban development anywhere within the basin. The total drainage area encompasses 9,025 acres. The channel slope is only moderate to gradual throughout, although nearby ridges are steep in portion of the basin. Emigrant Gap Draw possesses one particular flooding area of concern in the lower portion of the basin where the drainage comes into the City of Casper city limits. Under current conditions the drainage channel can convey the 10-year flood event, but a 100-year flood event would result in a flow rate of approximately 930 cubic feet per second spilling into a residential area just south of the channel and inundating at least 9 homes. The proposed channel improvements are designed to widen the channel, flatten the slope (reducing erosion), repair an existing berm, and allow the 100-year flood event to pass through the channel without spilling into the nearby residential neighborhood. The length of the channel improvements project will be approximately 2,100 feet long and a drop structure would be installed at the upstream end of the project. The estimated cost to construct the channel improvements is $750,000. Property necessary to construct the improvements is estimated to cost an additional $100,000.
Related planning mechanisms	City of Casper 2013 Stormwater Management Master Plan
Jurisdictions that will benefit	City of Casper, Natrona County
Responsible Office/ Agency	City of Casper - Engineering Division
Partners	Natrona County and possibly National Resources Conservation Service
Priority (High, Medium, Low)	Medium
Cost Estimate	$850,000
Benefits (Avoided Losses)	Reduce localized flooding of approximately twenty-five (5) private properties and associated streets and alleys.
Potential Funding source	Some combination of Federal, State, County and City funds.
Timeline for Completion	Construction time estimated at 4 months, desired completion date of 11/1/19.

Mitigation Project Title	**Eastdale Creek Diversion to Sage Creek**
Hazard(s) Mitigated	Flood/Flash Flood
Project Description, Issue/Background	Eastdale Creek is a medium sized, well-developed drainage basin passing through the central section of the City of Casper. It is bordered on the west by the Saint Mary Street storm sewer system and on the east by Sage Creek. The development in the basin begins at 29th Street and runs north, and the portion of the basin south of there is only sparsely developed as it extends just to the base of Casper Mountain. The total drainage area encompasses 2,370 acres. The channel slope is steep in the upstream reaches and flattens toward the outfall at the North Platte River. Eastdale Creek possesses multiple flooding problems within the developed area, with multiple storm sewers unable to even convey the 10-year flood. Overtopping occurs for the 100-year flood at South Jefferson Street, Drake Place, and Bryan Evansville Road. Interstate 25 is also impacted and flooded at the underpass for East Yellowstone Highway and at the frontage road on the north side during the 100-year flood event. The impact to I-25 is most significant since it is a major traffic corridor for the general public and emergency vehicles. The proposed Eastdale Creek Diversion to Sage Creek would place a cap on the flood flow at 700 cubic feet per second in Eastdale Creek, diverting approximately 830 cubic feet per second to Sage Creek. This will require a diversion channel between 1,200 and 1,500 feet long, two 78” diameter concrete pipes of 240 feet in length, and a 9’x7’ concrete box culvert of 625 feet in length. These conveyance improvements will ensure that the diverted flows are delivered into the Sage Creek drainage, but further downstream channel improvement (2,000 feet in length) will be required in Sage Creek to allow for this added flow during a 100-year flood event. The primary benefit of the project would be the flooding mitigated on the I-25 underpass below East Yellowstone Highway. The estimated cost to construct the diversion channel, culverts and downstream channel improvements is $2,400,000. Property necessary to construct the improvements is estimated to cost an additional $100,000. Coordination and possible funding by the Wyoming Department of Transportation will be considered due to the significant positive impact to Interstate 25 and East Yellowstone Highway.
Related planning mechanisms	City of Casper 2013 Stormwater Management Master Plan
Jurisdictions that will benefit	City of Casper, Wyoming Department of Transportation (WYDOT)
Responsible Office/ Agency	City of Casper - Engineering Division
Partners	Wyoming Department of Transportation (WYDOT)
Priority (High, Medium, Low)	Low

Cost Estimate	$2,500,000
Benefits (Avoided Losses)	Reduce flooding of Interstate 25 (I-25) and approximately five (5) private properties.
Potential Funding source	HMGP, City of Casper 1% Sales Tax Funds, and WYDOT funds
Timeline for Completion	Construction time estimated at 6 months, desired completion date of 11/01/20.

Mitigation Project Title	**Flood Hazard Education**
Hazard(s) Mitigated	Flood/Flash Flood
Project Description, Issue/Background	The City of Casper desires to expand its efforts to notify and engage the citizens within the city that are located in a flood hazard area. The City has created webpages (available at casperwy.gov) designed to provide citizens with floodplain information as well as mapping information (available at casperwy.geosmart.gov). Plans are to continue outreach through utility billing notices, direct mailers, and community presentations with an estimated cost of $15,000 to $20,000.
Related planning mechanisms	2010 Natrona County Multi-Jurisdiction Hazards Mitigation Plan
Jurisdictions that will benefit	City of Casper
Responsible Office/ Agency	City of Casper - Planning
Partners	
Priority (High, Medium, Low)	High
Cost Estimate	$20,000
Benefits (Avoided Losses)	Raise awareness so citizens can take action such as purchase of flood insurance
Potential Funding source	City of Casper 1% Sales Tax Funds
Timeline for Completion	2018 and annually

Mitigation Project Title	North Platte River Restoration
Hazard(s) Mitigated	Flood, Erosion, Wildfire
Project Description, Issue/Background	This project links the HMP with implementation of priority projects in the Platte River Revival River Restoration Master Plan with flood and wildfire benefits. The river restoration includes wetland creation, floodplain re-connection, channel re-construction/stabilization and revegetation. Also includes remove of Russian Olive trees, an invasive species that impede flood flows.
Related planning mechanisms	Platte River Revival River Restoration Master Plan
Jurisdictions that will benefit	City of Casper, Natrona County, Mills
Responsible Office/ Agency	City of Casper - Engineering
Partners	Natrona County
Priority (High, Medium, Low)	High
Cost Estimate	Varies depending on project
Benefits (Avoided Losses)	Reduced flooding and erosion; Raise flood awareness so citizens can take action such as purchase of flood insurance
Potential Funding source	City of Casper 1% Sales Tax Funds, NRCS

Mitigation Project Title	**Cyber Threat Prevention, Protection, Response and Recovery**
Hazard(s) Mitigated	Terrorism, Technological Human Caused-Cyber
Project Description, Issue/Background	The embedding of technology into critical infrastructure now requires continuous access to web and network resources to conduct daily operations, maintenance, and communications. Vital government resources such as emergency services, banking, finance, transportation and utility distribution rely on technological components that can be compromised through cyber-attacks. The ability to successfully respond to cyber-related threats is to proactively mitigate through the adoption and practice of the following interdependent functions: prevention, protection, detection, identification, response, and recovery. Implementing these strategic functions are measures of progressive posturing required to offset the consistent frequency in which malicious actions can quickly penetrate and compromise system integrity. Access to effective cyber and network security training for personnel is also needed in order to stay aware of current trends pertaining to this evolving issue within the industry and profession.
Related planning mechanisms	
Jurisdictions that will benefit	City of Casper, Natrona County
Responsible Office/ Agency	City of Casper – IT and GIS
Partners	Natrona County
Priority (High, Medium, Low)	High
Cost Estimate	$5-10k/yr.
Benefits (Avoided Losses)	Reduce the potential for cyber-crime and associated disruptions of government business.
Potential Funding source	City budget
Timeline for Completion	On-going by 2020

Completed Projects

The following projects identified in the 2010 HMP were completed between 2010-2017.

City of Casper Central Service Center Hardening Project

The City of Casper operates a Central Service Center. Located just off Interstate 25 and Bryan Stock Trail, the Service Center is strategically located to provide support and service to the community and various city facilities. Housing the city garage and Streets Division, the Service Center provides support not only to the Street Division fleet of excavators, dozers, road graders, trucks and scrapers, but also to emergency service vehicles, including police and fire.

Housing the bulk of the City's heavy equipment and the only City facility with the capability to service this equipment along with emergency service vehicles, it is imperative that the Service Center maintain operations in the event of an emergency. The immediate need is the installation of an emergency generator with associated switch gear. The estimated cost for this installation is $520,000. Maintaining operations will allow continued service to the citizens of Casper and surrounding communities. This project was completed in May of 2014 with Optional 1%#13 Sales Tax funds for a total cost of $394,056.

City of Casper Events Center Hardening Project

The City of Casper operates a multi-use Events Center located just off Interstate 25 and Events Drive/ East Road. The Events Center is a strategic facility as identified by the Center for Disease Control, Wyoming Department of Health, City of Casper-Natrona County Department of Health, and the City of Casper for the purposes of terrorism preparedness and emergency response stockpiling and distribution center, inoculation center, and business continuity incident command center.

The Events Center with its higher elevation location, convenient access, numerous parking lots, spacious grounds, large arena floor, sizeable ancillary rooms and multifaceted services make it a primary facility for the aforementioned activities. The Events Center's functioning in these capacities has a direct impact on the citizens of Casper, Mills, Bar Nunn, and Evansville. As a long-term shelter for post event housing this facility could become the temporary home for 2,645 individuals.

For the Events Center to effectively serve, as mentioned above, decisive action to ensure uninterrupted electrical power supply is needed. In 2010 the immediate need was the installation of an emergency generator with associated gear and engineering fees. The estimated cost of this purchase and installation is $600,000. This project was completed in December 2016 with One Cent #15 Sales Tax funds allocated to the Events Center Upgrades for a total cost of $490,786.

Town of Mills

New or Continuing Projects

Mitigation Project Title	**Chamberlain Street bank stabilization**
Hazard(s) Mitigated	Flood
Project Description, Issue/Background	This project was identified in the 2010 HMP and deferred due to other priorities but still a needed project. There is one home and some land that is being negatively impacted by streambank erosion. The intent of the project is bank stabilization. In order to stabilize the bank additional storm water inlets are needed, as the current storm water system cannot capture enough storm water in addition the area that continually washes out will be stabilized and any remaining storm water will be channelized and diverted downstream from the washout area. This project will protect Chamberlain Street from washout as well as the private property the washouts occur upon.
Related planning mechanisms	Platte River Revival River Restoration Master Plan
Jurisdictions that will benefit	Town of Mills
Responsible Office/ Agency	Town of Mills Engineering Director
Partners	County, Casper
Priority (High, Medium, Low)	High
Cost Estimate	$380,000
Benefits (Avoided Losses)	Prevent erosion and avoid potential property loss
Potential Funding source	Some combination of Federal, State, County and City funds.
Timeline for Completion	Complete by 2020

Completed Projects

Hardening of the Town of Mills Fire Department

The intent of this project was to create a safe room for tornado sheltering purposes and an emergency services operation staging area. This dual purpose area can be used on a daily basis for training. In the event of any hazards event, the room would be utilized to continue the services required by the Town of Mills emergency personnel.

2017 Status: Completed; A generator was installed in 2013 with help from a FEMA grant.

Town of Evansville

New or Continuing Projects

Mitigation Project Title	**Hardening of the Town of Evansville Police Department**
Hazard(s) Mitigated	Flood
Project Description, Issue/Background	The town's Police Department building is susceptible to stormwater flooding, particularly the basement which has been inundated in the past. This would include flood proofing the facility, focused mainly on the entrance. Included in this project would the strengthening of the walls, reconfiguring the entrance to provide protection from heavy rains and sealing any openings that may also promote water infiltration. Upgraded sump pumps may also be needed.
Related planning mechanisms	
Jurisdictions that will benefit	Town of Evansville
Responsible Office/ Agency	Town of Evansville - Police Department Chief
Partners	
Priority (High, Medium, Low)	High
Cost Estimate	$50,000-$70,000
Benefits (Avoided Losses)	mitigate impacts to Police Department and ensure continuity of services during flood and severe weather events
Potential Funding source	FEMA, WOHS, Local budget
Timeline for Completion	Continuing project from 2010 but was not completed due to lack of funding. Complete by 2020

Mitigation Project Title	**Stabilization of ditch bank and installation of storm sewer pipe along the existing drainage ditch on Oildale Street behind Smith RV.**
Hazard(s) Mitigated	Flood
Project Description, Issue/Background	This project was identified in the 2010 HMP and deferred due to other priorities but still a needed project. Currently, runoff form the City of Casper is conveyed to the non- engineered detention pond south of U.S. 20/26 in the WYDOT ROW. Runoff from the detention pond is conveyed in undersized storm sewer piping across the Smith RV Lot to the north to an existing drainage ditch along Oildale Street. The drainage channel then conveys the storm water to the east, then to the north where it enters a storm sewer system in Copper Avenue. The banks of the existing drainage ditch are failing and causing sloughing and erosion on the Smith RV Lot. During the July 3, 2009 storm event, the drainage portion of Oildale Street was severely under-cut and failed along the north side of the drainage ditch. Stabilization of the drainage ditch and installation of properly sized storm sewer pipe will prevent erosion and provide better conveyance of storm water through this area of Town.
Related planning mechanisms	
Jurisdictions that will benefit	Town of Evansville
Responsible Office/ Agency	Town of Evansville Engineering Director
Partners	City of Casper, WYDOT
Priority (High, Medium, Low)	Medium
Cost Estimate	$150,000
Benefits (Avoided Losses)	Prevent erosion and provide better conveyance of storm water through this area of Town.
Potential Funding source	Some combination of Federal, State, County and City funds.
Timeline for Completion	Complete by 2020

Mitigation Project Title	**Address evacuation of Evansville due to Train Derailment or other hazards, including developing an alternate route**
Hazard(s) Mitigated	Flood, Wildfire, Hazardous Materials, Terrorism,
Project Description, Issue/Background	This project would address evacuation of Evansville due to wildfires, hazardous materials incidents, train derailments or other hazards, including evaluation of options including potentially developing an alternate route. The Town's location adjacent to the North Platte River and the railroad make evacuation complex depending on the incident. This would entail working with County emergency management to formally plan for evacuation and identify all feasible routes.
Related planning mechanisms	
Jurisdictions that will benefit	Town of Evansville
Responsible Office/ Agency	Town of Evansville - Police Department Chief
Partners	Natrona County Emergency Management
Priority (High, Medium, Low)	High
Cost Estimate	$20,000
Benefits (Avoided Losses)	mitigate loss of life, injury
Potential Funding source	FEMA, WOHS, Local budget
Timeline for Completion	New in 2017. Complete by 2020

Completed Projects

Hardening of the Town of Evansville Community Center.

The intent of this project was to create a safe room for tornado sheltering purposes and an emergency services operation staging area. This dual purpose area can be used on a daily basis for training. In the event of any hazards event, the room would be utilized to continue the services required by the Town of Evansville emergency personnel.

2017 Status: Completed

Town of Barr Nunn

New projects

Mitigation Project Title	**Develop additional emergency access/egress for Bar Nunn**
Hazard(s) Mitigated	Wildfire, Hazardous Materials, Terrorism,
Project Description, Issue/Background	This project would address evacuation of Barr Nunn due to wildfires, hazardous materials incidents or other hazards, including evaluation of options including potentially developing an alternate route. The Town was forced to evacuate due to a wildfire/grass fire in 2016 (Ridgecrest Fire). The concern about limited evacuation options was also noted in the public survey completed during the 2017 update of this plan.
Related planning mechanisms	Community Wildfire Protection Plan
Jurisdictions that will benefit	Bar Nunn
Responsible Office/ Agency	Bar Nunn – Administration
Partners	Natrona County Emergency Management
Priority (High, Medium, Low)	Low
Cost Estimate	$15,000 to review and plan for alternatives.
Benefits (Avoided Losses)	mitigate loss of life, injury
Potential Funding source	FEMA, WOHS, Local budget
Timeline for Completion	New in 2017. Complete in 2021

Mitigation Project Title	**Cheat grass/flash fuels eradication**
Hazard(s) Mitigated	Wildland fire
Project Description, Issue/Background	Through the planning process, the Town of Bar Nunn, in consultation with the community, identified wildland fire as the current threat with the most significant probability of occurrence and resulting loss. In 2014, a large grass fire resulted in a burn scar which has now been invaded by dense strands of cheat grass. The invasive cheat grass is a flash fuel with a high probability of ignition and the rapid spread of wildland fire.

	The Town of Bar Nunn in conjunction with the Bar Nunn Fire Department is requesting a mitigation project consisting of eradicating the cheat grass and weedy flash fuels through spraying and construction of fire breaks. This project will aid in establishing and/or strengthening defensible space.
Related planning mechanisms	Town Council meetings with community attendance and participation. Planning involved the Fire Chief and Town Maintenance Supervisor.
Jurisdictions that will benefit	Town of Bar Nunn
Responsible Office/ Agency	Town of Bar Nunn Maintenance
Partners	Bar Nunn Fire Department Natrona County Weed and Pest Department
Priority (High, Medium, Low)	High
Cost Estimate	$20,000
Benefits (Avoided Losses)	Structure protection.
Potential Funding source	Budgeted Mitigation grant funding Donation of labor and/or equipment usage from community partners
Timeline for Completion	Spring 2020

Town of Edgerton

New projects

Mitigation Project Title	**Water Storage and Treatment Facility fire break**
Hazard(s) Mitigated	Wildland Fire
Project Description, Issue/Background	Through the planning process, the Town of Edgerton, in consultation with the community, identified a mitigation objective of reducing the risk and vulnerability of critical infrastructure; specifically, the water storage and treatment facility. The water storage and treatment facility serves both the Town of Edgerton and the Town of Midwest. The water is piped to the Town of Edgerton water storage and treatment facility from the City of Casper via a forty mile long underground pipeline. The objective is to reduce the risk of wildland fire threat to the electrical service to and electrical operating systems inside the facility. The mitigation action is the construction of a 50 foot wide fire break around the perimeter of the facility. This mitigation action will reduce the probability of wildland fire encroaching on the facility, thus reducing the potential of the water service and quality being compromised. The fire break will be constructed by removing vegetation within the defined area. Effort will be given to stabilization of the soil to prevent wind blowing and control soil erosion.
Related planning mechanisms	
Jurisdictions that will benefit	Town of Edgerton Town of Midwest
Responsible Office/ Agency	Town of Edgerton Public Works
Partners	Salt Creek Emergency Services (Volunteer Fire Department)
Priority (High, Medium, Low)	High
Cost Estimate	$7,000
Benefits (Avoided Losses)	
Potential Funding source	Town of Edgerton general fund FEMA Mitigation grant funding Donation of labor and/or equipment usage from community partners
Timeline for Completion	2020

Town of Midwest

New projects

Mitigation Project Title	**North boundary fire break**
Hazard(s) Mitigated	Wildland fire
Project Description, Issue/Background	Through the planning process, the Town of Midwest, in consultation with the community, identified wildland fire as the current threat with the most significant probability of occurrence and resulting loss. The area of immediate concern being the north side of the town's boundary, specifically along the northern edge of the alley ways behind the residential buildings on Navy Row and Burek Street. The objective is to enhance the fire interruption capabilities of the existing alleys and reduce the probability of wildland fire encroaching on the structures within the town. The mitigation action is to construct a 50 foot wide fire break along the alley ways. This mitigation action will enhance fire break effectiveness of the alley way between the residential structures and the grass/brush fields to the north of town. The fire break will be constructed by removing vegetation within the defined area. Effort will be given to stabilization of the soil to prevent wind blowing and control soil erosion.
Related planning mechanisms	Town Council meetings with community attendance and -participation.
Jurisdictions that will benefit	Town of Midwest
Responsible Office/ Agency	Town of Midwest Public Works
Partners	Salt Creek Emergency Services (Volunteer Fire Department)
Priority (High, Medium, Low)	High
Cost Estimate	$7,000
Benefits (Avoided Losses)	Structure protections
Potential Funding source	Budgeted Mitigation grant funding Donation of labor and/or equipment usage from community partners
Timeline for Completion	Spring 2019

6 PLAN ADOPTION, IMPLEMENTATION AND MAINTENANCE

Requirement §201.6(c)(4): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. This chapter provides an overview of the strategy for plan implementation and maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

6.1 Formal Adoption

The purpose of formally adopting this plan is to secure buy-in from participating jurisdictions, raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes Planning Step 9 of the 10-step planning process: Adopt the Plan. The governing board for each participating jurisdiction has adopted this local hazard mitigation plan by passing a resolution. A copy of the generic resolution and the executed copies are included in Appendix C, Plan Adoption. This plan will be updated and re-adopted every five years in concurrence with the required DMA local plan update requirements.

6.2 Implementation

Natrona County has made demonstrated progress toward successful plan implementation since this plan's initial development. Continued implementation will be accomplished by adhering to the schedules identified for each action and through constant, pervasive, and energetic efforts to network and highlight the benefits to the counties, communities and stakeholders. This effort is achieved through the routine actions of monitoring meeting agendas for hazard mitigation related initiatives, coordinating on the topic at meetings, and promoting a safe, sustainable community. Additional mitigation strategies could include consistent and ongoing enforcement of existing policies and vigilant review of programs for coordination and multi-objective opportunities. **Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development.**

Simultaneous to these efforts, it is important to maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the more costly recommended actions. This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements. When funding does become available, the County and municipalities will be in a position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, state and federal earmarked funds, benefit assessments, and other grant programs, including those that can serve or support multi-objective applications.

6.2.1 Role of Hazard Mitigation Planning Committee in Implementation and Maintenance

With adoption of this plan, the County will be responsible for the plan implementation and maintenance. The County, led by Emergency Management, will reconvene its HMPC for plan implementation and maintenance. This HMPC will be the same committee (in form and function, if not actual individuals) that developed this HMP and will also be responsible for the next formal update to the plan in five years.

The County's HMPC will:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high-priority, low/no-cost recommended actions;
- Ensure hazard mitigation remains a consideration for community decision makers;
- Maintain a vigilant monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Report on plan progress and recommended changes to county and municipal officials; and
- Inform and solicit input from the public.

The HMPC will not have any powers over respective County staff; it will be purely an advisory body. The primary duty is to see the plan successfully carried out and to report to the county commissioners, municipal boards, and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on county websites (and others as appropriate).

6.3 Maintenance

Plan maintenance implies an ongoing effort to monitor and evaluate plan implementation and to update the plan as progress, roadblocks, or changing circumstances are recognized.

6.3.1 Maintenance Schedule

The emergency management coordinator is responsible for initiating plan reviews and consulting with the heads of participating departments in the County. In order to monitor progress and update the mitigation strategies identified in the action plan, the county and the standing HMPC will conduct an annual review of this plan and/or following a hazard event. An annual mitigation action progress report will be prepared by the HMPC and kept on file to assist with for future updates.

This plan will be updated, approved and adopted within a five-year cycle as per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000 unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule. The County will inquire with WOHS and FEMA for funds to assist with the update. Funding sources may include Emergency Management Performance Grants, Pre- Disaster Mitigation, Hazard Mitigation Grant Program (if a presidential disaster has been declared), and Flood Mitigation Assistance grant funds. The next plan update should be completed and reapproved by WOHS and FEMA Region VIII within five years of the FEMA final approval date. The planning process to prepare the update should begin no later than 12 months prior to that date.

6.3.2 Maintenance Evaluation Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions;
- Increased vulnerability as a result of new or altered hazards
- Increased vulnerability as a result of new development.

Updates to this plan will:

- Consider changes in vulnerability due to action implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Incorporate new data or studies on hazards and risks;
- Incorporate new capabilities or changes in capabilities;
- Incorporate growth and development-related changes to infrastructure inventories; and
- Incorporate new action recommendations or changes in action prioritization.

In order to best evaluate any changes in vulnerability as a result of plan implementation, the County will adhere to the following process:

- A representative from the responsible office identified in each mitigation measure will be responsible for tracking and reporting on an annual basis to the department lead on action status and provide input on whether the action as implemented meets the defined objectives and is likely to be successful in reducing vulnerabilities.

Updating of the plan will be by written changes and submissions, as the HMPC deems appropriate and necessary, and as approved by the respective participating agencies. In keeping with the five-year update process, the HMPC will convene public meetings to solicit public input on the plan and its routine maintenance and the final product will be adopted by the governing council.

6.3.3 Incorporation into Existing Planning Mechanisms

Another important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into other existing plans and mechanisms. Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. As described in the capability assessment, the participating jurisdictions already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. Where applicable, these existing mechanisms could include:

- Natrona County Development Plan 2016
- Casper 2013 Stormwater Management Master Plan
- Casper Platte River Revival River Restoration Master Plan
- Community comprehensive plans
- County or community land development codes
- County or community emergency operations plans
- Threat and Hazard Identification and Risk Assessments (THIRA)
- Community Wildfire Protection Plans (CWPP)
- Transportation plans
- Capital improvement plans and budgets
- Recovery planning efforts
- Watershed planning efforts
- Wildfire planning efforts on adjacent public lands
- Other master planning efforts
- Other plans, regulations, and practices with a mitigation aspect

HMPC members involved in these other planning mechanisms will be responsible for integrating the findings and recommendations of this plan with these other plans, programs, etc., as appropriate. As an action step to ensure integration with other planning mechanisms the County Emergency Manager will discuss this topic at the annual meeting of the HMPC previously described in the Maintenance Schedule. The HMPC will discuss if there are opportunities to incorporate the plan into other planning mechanisms and who would be responsible for leveraging those opportunities. As described in Section 6.2 Implementation, incorporation into existing planning mechanisms will be done through the process of:

- Monitoring other planning/program agendas;
- Attending other planning/program meetings;
- Participating in other planning processes;
- Ensuring that the related planning process cross-references the hazard mitigation plan, where appropriate, and

- Monitoring community budget meetings for other community program opportunities.

The successful implementation of this mitigation strategy will require constant and vigilant review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community.

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

6.3.4 Continued Public Involvement

Continued public involvement is imperative to the overall success of the plan's implementation. The update process provides an opportunity to solicit participation from new and existing stakeholders and to publicize success stories from the plan implementation and seek additional public comment. The plan maintenance and update process will include continued public and stakeholder involvement and input through attendance at designated committee meetings, web postings, press releases to local media, and through public hearings.

When the HMPC reconvenes for the update, they will coordinate with all stakeholders participating in the planning process—including those that joined the committee since the planning process began—to update and revise the plan. Public notice will be posted and public participation will be invited, at a minimum, through available website postings and press releases to the local media outlets, primarily newspapers, or through public surveys. As part of this effort, at least one public meeting will be held (or a public survey developed) and public comments will be solicited on the plan update draft.

APPENDIX A - PLANNING PROCESS DOCUMENTATION

From: Clarissa Daugherty <cdaugherty@natronacounty-wy.gov>
Sent: Thursday, January 05, 2017 9:58 AM
To: To:; Aaron Buck; Air Methods Charles; Air Methods Jeremy; Audrey Gray; Bryon Preciado; Casper College Security; Casper Mountain Fire (E-mail; Chief Tim Cortez; Chris Jones; Cindi Shank; Clarissa Daugherty; Commissioners; Connie Jacobson; Dan Beall; Daniel Griswold; Darin Pepple; Ed Opella; Elkhorn Valley Rehab Hospital; Eric Chapman; Eric Evenson; Ernie Nichols; Gus Holbrook; Jamie Jones; jeff goetz; Jim Wetzel; John Becker; Kenny King; Leo Malsom; Leo Malsom; Lorrie Jackson; Mark Harshman (E-mail; Mark Sellers; Matthew Epp- Barnunn Zoning and Planning; Michael Steinberg; Michele Berens, WBI; Mike Hendershot (E-mail; Mike Magee; Northway, Daniel; Rae Smith, Americorps VISTA, Redcross; Rick Ratcliff; RoadBridge; Robert Hoover; Robert Hoover; Salt Creek Joint Powers; Scott Warren; Steve Schulz; Stew Anderson; Theresa Simpson; TOM LAUGHREY; Town of Edgerton; Town of Midwest; Trey Warne; Wayne Reynolds; WYDOT PIO; wyofire12@gmail.com; Brislawn, Jeff P; Ada Kari; Adam Wilson (E-mail; Andrea Nester; April Ramos; Bob Dundas (E-mail; Bob Fenton; Brian Connely; bpreciado@millspd.org; Bryan Anderson - State Forestry; calvin.goddard@wyo.gov; Cary Bone; Chris Dray; Shank, Cindi; Cordell Anthony; Craig Johnson - Chevron; Craig Short; Dan Hobbs; Daniel Northway; Danny Morse; Deb Harris; Ed Opella; Emily Lacroix; Forrest Chadwick; Gayle Schnorenberg; Gust Hatanelas; Heather Duncan-Malone; Jamie Jones; James Ogden; James Samet; Jeff Erdahl; Jim Fitz; Joe Nickerson-CPD; John Becker; John Farrell (E-mail; John Lawson; Justin Lindberg; Karla Case; Kelly Spitz (E-mail; Ken Dockweiler; Kenny Longfritz; Kevin Lynnot; Kevin MacMancus; Kimberly Catellier; Laura Briot; Lori Reed; Lucas Murphy; Marcia Jones; Marge Cole - CATC; Matt Gacke; Matt Keating; Mike Bradford, BOR Safety Manager; Mike Coleman; mthomas@uranerz.com; Miles Ellis, BLM AFMO; Nan Holbrook; Paul Kordonowy; Paul Phillips; Richard Bell (E-mail; Rick Lopez; Riley DeWitt, SCES Chief; Rob Hendry; roberthoover@townofbarnunn.com; Sam Roggow; Scott Radden WLC; Scott S Smith; Sean Peverley; Stan Mitchem; Steve Freel; Steve magness; Steve Schlager; Stew Anderson; Tate Belden; Tony Giles; Ty Jones; Tyler Keller; Van Frazier
Subject: FW: CHANGE OF DATE! Mitigation Kickoff meeting:

Good Morning,
It has come to my attention that a few folks did not receive the email regarding the date change for the mitigation plan update/LEPC meeting. Below is the original email from Lt. Anderson. The meeting/webinar has been moved to January 12, 2017 at 10 am. We will send instructions for connection to the webinar early next week, if you choose to attend from your office. Otherwise it will be held in the EOC.

Thanks,

Rissa Daugherty
Administrative Assistant
Natrona County Emergency Management
201 N David; 2nd Floor
Casper, Wy 82601
Phone: (307 235-9205
Fax: (307)235-9652

From: Stew Anderson
Sent: Friday, December 16, 2016 12:52 PM
Subject: CHANGE OF DATE! Mitigation Kickoff meeting:

Greetings;
Please see the date change for the Mitigation Planning/Special LEPC meeting webinar. It has been changed to Thursday January 12, 2017 1000-1200.
We will be sending out the webinar information in the near future.

We have finally began our update process for the Natrona County Multi-Jurisdictional All Hazards Mitigation Plan. This process will need to involve all entities in Natrona County and, when it is finished, adoption by all entities. This plan is a FEMA requirement in order to receive funding if we were to qualify for a federal disaster declaration and for Mitigation Grants. Agencies included in the planning process can, and in some cases should, include jurisdictional planning departments, public works, fire, law enforcement, jurisdictional engineering departments, elected officials, member of the public/private sector, non-governmental agencies, GIS departments and the emergency manager from each entity.

This process will include three or four meetings in the next several months with completion and adoption, if all goes well, this Spring.
This will involve going through the plan, deleting projects no longer needed or completed, adding new projects, updating our historical data and success projects that have been done in the past. If your entity has any mitigation type of projects planned for the future, or in progress, whether they are funded yet or not, please start gathering that information so that we may add the project into the plan update.

Our initial kick-off meeting is a planned webinar hosted by the contractor that we are working with to complete the update. The tentative date and time for this webinar will be Thursday January 12, 2017 from 10:00 AM to 12:00 PM. Please save the date and time for this initial meeting.
Since this planning process includes the private sector, we will also be calling this an LEPC meeting with the meeting dedicated solely to the Mitigation plan update. This is the reason this email is also being sent to the LEPC members.

More information will be forthcoming on this kickoff meeting/webinar. Please spread the word to those particular folks in your public works, planning, engineering, etc. departments so that they may join in if they wish.
Please contact me with any questions.
Thank you;

Lt. Stewart Anderson
Natrona County Emergency Manager
Office: 307-235-9205
Cell: 307-262-1899

From: Clarissa Daugherty <cdaugherty@natronacounty-wy.gov>
Sent: Wednesday, January 11, 2017 10:35 AM
To: Constance Lake; Aaron Buck; Air Methods Charles; Air Methods Jeremy; Audrey Gray; Bryon Preciado; Casper College Security; Casper Mountain Fire (E-mail; Timothy Cortez; Chris Jones; Cindi Shank; Clarissa Daugherty; Commissioners; Dan Beall; Daniel Griswold; Darin Pepple; Ed Opella; Elkhorn Valley Rehab Hospital; Eric Chapman; Eric Evenson; Ernie Nichols; Gus Holbrook; Jamie Jones; jeff goetz; Jim Wetzel; John Becker; Kenneth King; Leo Malsom; Leo Malsom; Lori Jackson; Mark Harshman; Mark Sellers; Matthew Epp- Barnunn Zoning and Planning; Michael Steinberg; Michele Berens, WBI; Mike Hendershot (E-mail; Mike Magee; Northway, Daniel; Rae Smith, Americorps VISTA, Redcross; Rick Ratcliff; RoadBridge; Robert Hoover; Robert Hoover; Salt Creek Joint Powers; Scott Warren; Steve Schulz; Stew Anderson; Theresa Simpson; TOM LAUGHREY; Town of Edgerton; Town of Midwest; Trey Warne; Wayne Reynolds; WYDOT PIO; wyofire12@gmail.com; Brislawn, Jeff P; Ada Kari; Adam Wilson (E-mail; Andrea Nester; April Ramos; Bob Dundas (E-mail; Bob Fenton; Brian Connely; bpreciado@millspd.org; Bryan Anderson - State Forestry; calvin.goddard@wyo.gov; Cary Bone; Chris Dray; Shank, Cindi; Cordell Anthony; Craig Johnson - Chevron; Craig Short; Dan Hobbs; Daniel Northway; Danny Morse; Deb Harris; Ed Opella; Emily Lacroix; Forrest Chadwick; Gayle Schnorenberg; Gust Hatanelas; Heather Duncan-Malone; Jamie Jones; James Ogden; James Samet; Jeff Erdahl; Jim Fitz; Joe Nickerson-CPD; John Becker; John Farrell (E-mail; John Lawson; Justin Lindberg; Karla Case; Kelly Spitz (E-mail; Ken Dockweiler; Kenny Longfritz; Kevin Lynnot; Kevin MacMancus; Kimberly Catellier; Laura Briot; Lori Reed; Lucas Murphy; Marcia Jones; Marge Cole - CATC; Matt Gacke; Matt Keating; Mike Bradford, BOR Safety Manager; Mike Coleman; mthomas@uranerz.com; Miles Ellis, BLM AFMO; Nan Holbrook; Paul Kordonowy; Paul Phillips; Richard Bell (E-mail; Rick Lopez; Riley DeWitt, SCES Chief; Rob Hendry; roberthoover@townofbarnunn.com; Sam Roggow; Scott Radden WLC; Scott S Smith; Sean Peverley; Stan Mitchem; Steve Freel; Steve magness; Steve Schlager; Stew Anderson; Tate Belden; Tony Giles; Ty Jones; Tyler Keller; Constance Lake
Subject: Mitigation Planning Webinar
Attachments: NatronaCountyKickoffMtgPresentation.pdf

Good Morning!
Below is the information for connecting to the Webinar tomorrow, January 12, 2017 at 10 am. If you will be attending in the EOC, located at 201 N. David 2nd Floor please RSVP. If you choose to attend from your location you will need the following information. Please let me know which one works best for you. For those of you that have already RSVP'd, please disregard this email.

Attached to this email is a draft copy of the presentation.

Click on the 'Join Skype Meeting' to link to the presentation(located at the end of this email). In addition, call in to the meeting using the toll-free number listed below. Please mute your phones.

If you have trouble joining, please click the Try Skype Web App. You will

have to download the app plug in. Once you join the meeting, please type
your name and agency in the Guest Name Box.

You will need to mute your computer in two ways, one by actually muting
your computer speakers and the other by muting your speaker in the Skype
Conference. I have added a picture to show where mute is in the conference.

....
--> Join Skype Meeting
Trouble Joining?   Try Skype Web App

Join by Phone
Toll-free number: +1 (866) 384-2989
Toll number: +1 (810) 893-7590
Conference ID: 6110772673

Thanks,

Rissa Daugherty
Administrative Assistant
Natrona County Emergency Management
201 N David; 2nd Floor
Casper, Wy 82601
Phone: (307 235-9205
Fax: (307)235-9652

SIGN-IN SHEET

Natrona County Hazard Mitigation Plan Update Project

Meeting #1 (Kickoff) and LEPC Meeting, January 12, 2017, 10:00am- noon

County Emergency Operations Center, Casper, WY and Webinar

Name	Email Address	Phone	Jurisdiction/ Department/ Organization/Affiliation	Title
Jerome Flores	JFlores@SinclairOil.Com	(800)321-3994	Sinclair Trans. Co.	Reg. Compliance
Rissa Daugherty		(307)262-7217	Natrona Co EMA	Admin
Danny Hobbs	Danny.Hobbs@wyo.gov	262-4352	WyDOT	Area Supervisor
Jeff Erdahl	jeff.erdahl@wyo.gov	473-2244	WYDOT	Area Supervisor
Lance Jones	ljones@caspercollege.edu	268-2672	Casper College	Director Security
Paula Reece	preece@natronacounty-wy.gov		NC GIS Dept	GIS Specialist
Mike Hendershot	mikehendershot@bresnan.net		Private citizen	Retired public safety
Jolene Martinez	jmartinez@casperwy.gov	235-8332	City of Casper	Projects Coordinator
Constance Lake	clake@casperwy.gov	235-8346	Casper	MPO Specialist
Denyse Wyskup	dwyskup@casperwy.gov	235-8455	Casper	Regional GIS Administrator
Andrew Beamer	abeamer@casperwy.gov	235-8341	Casper	PSD
Matt Palmer	mpalmer@usdg.com	797-2350	Casper Crude to Rail	Terminal Manager
Ken King	kking@casperwy.gov	235-8222	Casper Fire	Chief
Craig Short	cshort@blm.gov	307-261-7698	BLM Fire	Fire Mgmt Specialist
Nanette Holbrook	nholbrook@millswy.gov	307-266-4796	Mills Police Dept	Admin

Name	Email Address	Phone	Jurisdiction/ Department/ Organization/Affiliation	Title
Matt Gache	mattgacke@msn.com	307-266-5732	Evansville Fire Dept	Assistant chief
Lori Neibauer	lori.neibauer@blackhillscorp.com	307-262-0582	Blackhills Energy	Field Coordinator
Jesse Henderson	jesse.henderson@Blackhillscorp.com	307-262-4700	Black Hills Energy	Supervisor/Gas Operations
Steve Anderson	andersos@natronacounty-wy.gov	307-235-[illegible]	Natrona EM	NCEMA Coord.
Teresa Davis	TeresaD@cwhp.org	307-577-4832	Central Wyoming Hospice	Dir. of Clinical services
John Becker	beckerj@natronacounty-wy.gov	307 235 2282	Natrona County Sheriff's Office	Lt.
Daniel Beall	DBeall@millswy.gov	307-262-3824	Mills Fire Dept	Fire Chief
Richard Ratcliff		307-234-8826	Natrona Co. Fire Dist	Fire chief
Danny Griswold	dgriswold@casperwy.gov	307-253-6601	Casper Fire-EMS	Division Chief

Summary of Natrona County Hazard Mitigation Plan Update
Kick-Off Meeting Conference Call/Webex and LEPC Meeting
Natrona County EOC
January 12, 2017, 10:00 am- 11:30am

Opening Remarks and Introductions

Welcome remarks and a call to order of the LEPC meeting was done by Stew Anderson with Natrona County Emergency Management. A motion was made and to approve the LEPC minutes from the previous meeting, which was approved. Jeff Brislawn, the project manager from Amec Foster Wheeler began the webinar presentation and asked everyone in the room at the Natrona County EOC or on the call to introduce themselves. Present at the EOC were 24 participants, documented in a sign-in sheet. A mix of people representing the County, municipalities, and local business and industry were present including:

Natrona County
- Natrona GIS
- Natrona Fire Department
- Stew Anderson- Natrona County Emergency Management
- Sheriff's Office

City of Casper
- City of Casper
- City of Casper Community Development
- Casper Fire Department

Town of Edgerton
- Edgerton Police Department (Jamie Jones)

Town of Evansville
- Evansville Fire Department

Town of Midwest
- Midwest Police Department (Jamie Jones)

Town of Mills
- Mills Police Department
- Mills Fire Department

Other stakeholders
- Regional GIS
- Teresa Davis- Clinical Services of Central Wyoming
- BLM Fire
- Black Hills Energy
- National Weather Service-Riverton
- Sinclair Transportation
- Private Citizen
- Casper Crude to Rail
- Casper College

Additionally there were 15 persons that participated remotely via the Skype for Business webinar. These included:
- Melinda Gibson- Wyoming Office of Homeland Security
- Calvin Goddard
- Jamie Jones

- Jeff Goetz WYDOT
- Justin Lindberg
- Michele Berens(name truncated)Ty Jones
- 8 others (names or affiliation were not noted in Skype login)

Three staff members from Amec Foster Wheeler, the consulting firm hired to facilitate the planning process and develop the updated plan, were on the call including Jeff Brislawn, Kyle Karsjen and Mackenzie Bosher.

Mitigation, Mitigation Planning, and Disaster Mitigation Act (DMA) Requirements

A PowerPoint presentation was presented via Skype by Jeff Brislawn. The presentation described importance of mitigation planning and the process thereof, including the 9 step planning process that will be followed to ensure compliance with the DMA 2000. The plan is intended to identify hazards, assets at risk, and ways to reduce impacts through long-term, sustainable mitigation projects. The plan will also maintain eligibility for FEMA mitigation grant funding.

After Jeff's overview of the disaster declarations in Wyoming, Stew Anderson commented that Natrona County has had three Fire Management Assistance Grants (FMAG) also. The first two dealt with the Casper Mountain Fire and the third was the Station Fire in 2015. He mentioned this to bring up the pilot project that FEMA was working on to help communities receive mitigation funds for the fire impacted area. Melinda Gibson noted that there is not an official program yet for fire mitigation funding and FMAG, the county just happened to have good timing to be included into the pilot program. Jeff commented that he hoped the pilot project may turn into a regular standing grant associated with future FMAG declarations.

Objectives and Schedule for Plan Development

All municipalities within Natrona County that participate in the plan will maintain or create eligibility for FEMA mitigation funds. This meeting is the first meeting of a committee formed to provide input to the plan update process. A definition of participation in the planning process was provided that includes:

- Attend and participate in planning meetings/workshops
- Provide available data requested of the County Emergency Management coordinator and Amec Foster Wheeler
- Provide input on local mitigation strategy (actions/projects)
- Advertise and assist with public input process
- Review and comment on plan drafts
- Coordinate formal adoption

It was discussed how each jurisdiction needs to commit to the above elements to receive full credit for participation in the plan.

Hazard Mitigation Planning Committee Organization and Roles

The Hazard Mitigation Planning Committee (HMPC) will include members of appropriate county departments, e.g., Building, Planning, Public Works, Police/Fire/Public Safety, and Emergency Management and include municipalities and special districts (fire and school).

Goals of the process were discussed that included:

- Thoroughly update the plan per most current FEMA planning guidance
- Revisit and update risk assessment
- Update the mitigation strategies
- Note implementation progress of loss reduction activities

The plan will be developed over the next six months. There will be two planning workshops. The meetings will occur in February and March. An email group will be developed for the HMPC for sharing information on upcoming meetings. Amec Foster Wheeler will be drafting the updated risk assessment in the next couple of months. A complete draft for FEMA review is targeted to be complete by early June of 2017. The final approved plan is anticipated to be ready for adoption by September of 2017. Stew commented that the longest part of the process is FEMA approval. He confirmed that there are grants waiting for this plan to be approved.

During the discussion of scheduling and organization, Stew emphasized that the HMP becomes a living document. This means that if Project A has priority over Project B, but Project B gets funding, Project B may take priority over time. Melinda agreed with this statement and stressed that this plan is not intended to "tie anyone's hands," but to facilitate organization and keep everyone on the same page with regards to overall mitigation priorities.

Review of Identified Hazards

A list of natural hazards was discussed, based on the hazards in the 2010 HMP, to start a discussion about what hazards should formally profiled and analyzed in the plan update. Jeff compared the list in the existing plan with hazard profiled in the State Hazard Mitigation Plan. The hazards discussed to be profiled in the plan update included:

- Dam Failure
- Drought
- Earthquake
- Flood
- Severe Thunderstorm (Lightning and Hail)
- Hazardous Materials
- Landslide
- Tornado
- Wildfire
- Wind
- Winter Storm
- Terrorism (CBRNE, Sabotage)

Comments on hazards:

Flood: There were concerns of river erosion control along the river. Multiple community members spoke about specific locations where this occurs including sloughing on the Eastdale Drainage behind Dragon Wall, erosion near Mills and Chamberlin Road, and occurrences behind Wolf Creek. The main concern was whether this should be listed as a separate hazard or should be included in the Flood Profile. Jeff recommended placing these occurrences in the flood profile.

Although Stew mentioned that highest significance hazards depend on time of year, Flooding was also one of the highest concerns in the planning area. One comment was that since the last plan, there have been Casper Stormwater Plan updates within the county. There have also been updates to the River Master Plan. Jeff asked if these were online, and the answer was that they were not but could be made available.

HazMat: Stew mentioned that 15-20 years ago, he put in a request for a Hazardous Materials Survey/Commodity Flow study. The hope is to receive the survey this year from the State in the spring. While he is unsure how soon it will be available, he says it may be a last minute addition.

Terrorism: Stew questioned why CBRNE and Sabotage were listed in the section "Other Hazards Considered but not profiled," rather than included in the Terrorism profile. Jeff concluded that those hazards will be included within the Terrorism profile.

Wildfire: Although Stew mentioned that highest significance hazards depend on time of year, wildfire was one of the highest concerns in the planning area. The County will check with State Forestry on any updates to Red Zone fire hazard designations.

Planning for Stakeholder and Public Involvement

The planning team was encouraged to involve the public and stakeholders in the planning process. Possible involvement techniques discussed included:

- Develop an online and hardcopy survey
- Social media or email blasts
- Mentioning the planning efforts and 'piggybacking' at other public forums such as to Comprehensive plan meetings, council or commissioner meetings or Firewise updates
- Advertising through public portal on GIS
- Advertising through recently distributing crowdsourcing app that could be connected into their web-mapping capabilities, which would allow areas of concern to be added by the public onto a map
- Engage Chamber of Commerce

Stew mentioned that the LEPC email distribution includes members of the public. The group thought that a public survey and 'piggybacking' would get the best results. Jeff will send Stew a draft survey that can be converted to a web version that can be easily distributed electronically.

Coordinating with Other Agencies / Related Planning Efforts / Recent Studies

A discussion was held on how to coordinate this planning process with other agencies and departments in order to meet one of the DMA planning requirements. WOHS recommended including rural electric associations and water districts as stakeholders. Stew recommended health care providers as stakeholders, and also County Planning and Zoning. Stew was unsure if the Town of Bar Nunn was represented online.

A discussion on coordination with other plans/policies and hazard information sources occurred, and the following was suggested by the HMPC:

- Casper and Mills are updating their Comprehensive and Land Use Plans
- Will check with County whether Bar Nunn, Evansville, or Casper have updates to their Comprehensive Plans.
- The County's Comprehensive Plan was recently updated

Information Needs

Jeff mentioned that if anyone has incident logs or damage assessments, those could be useful. GIS data collection was already underway.

Tim Troutman of NWS commented that they can provide information on weather hazards. Jeff noted that the National Climatic Data Center database is being used as a resource and noted that it often is not complete in regards to damage losses. Tim agreed.

Jeff recommended participating jurisdictions begin reviewing projects/actions in 2010 and prepare notes on progress (a status form will be developed and shared at a later date).

Next Steps/Next Meeting Timing

Amec Foster Wheeler HIRA update	Feb 10
HMPC meeting to discuss HIRA and Goals	Week of Feb 20th
HMPC meeting to update mitigation actions	Week of March 13th
First draft of HMP for HMPC review	Mid April
HMPC comments by	Late April
Public/State review draft	Mid May
Public comments due	End of May
Plan to FEMA	Early June
Conditional Approval	Late July
Local adoption	August
Target for approved, adopted plan	September 2017

Jeff will convene with County OEM to identify specific dates. An email will follow with more information on future meetings.

Questions and Answers/Adjourn

The presentation concluded at 11:30 am. Stew made a motion to adjourn the LEPC meeting.

Summary prepared by Mackenzie Bosher, Amec Foster Wheeler.

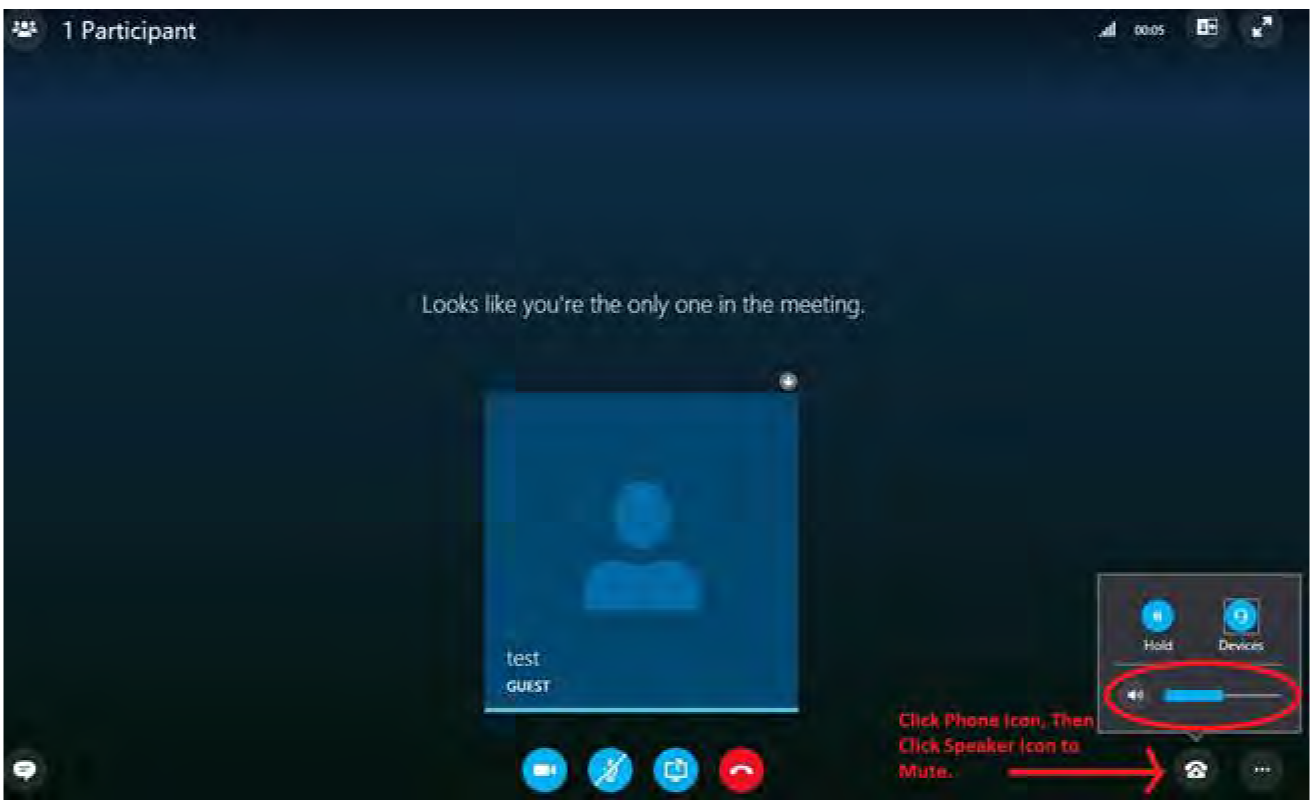
Good Morning!
Below is the information for connecting to the Webinar tomorrow, January 12, 2017 at 10 am. If you will be attending in the EOC, located at 201 N. David 2nd Floor please RSVP. If you choose to attend from your location you will need the following information. Please let me know which one works best for you. For those of you that have already RSVP'd, please disregard this email.

Attached to this email is a draft copy of the presentation.

Click on the 'Join Skype Meeting' to link to the presentation(located at the end of this email). In addition, call in to the meeting using the toll-free number listed below. Please mute your phones.

If you have trouble joining, please click the *Try Skype Web App*. You will have to download the app plug in. Once you join the meeting, please type your name and agency in the Guest Name Box.

You will need to mute your computer in two ways, one by actually muting your computer speakers and the other by muting your speaker in the Skype Conference. I have added a picture to show where mute is in the conference.



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Trouble Joining? Try Skype Web App

Join by Phone

Toll-free number: +1 (866) 384-2989

Toll number: +1 (810) 893-7590

Conference ID: 6110772673

Thanks,

Rissa Daugherty

Administrative Assistant

Natrona County Emergency Management

201 N David; 2nd Floor

Casper, Wy 82601

Phone: (307 235-9205

Fax: (307)235-9652

Stew,

The link to the online survey is now active and included below.   Can you distribute this to the HMPC and encourage them to share broadly through whatever channels possible (email lists, social media, post link on web etc.). Please document how this is distributed (an email will do, or a link to a website).

Here is some text that can be used with the notice about the survey link:

Natrona County Hazard Mitigation Plan Update 2017 Public Survey

Provide feedback to the multi-jurisdictional Hazard Mitigation Planning committee to inform the update of the Natrona County Hazard Mitigation Plan. The survey is intened to gather public feedback on concerns about floods, wildfires, winter storms and other hazards and strategies to reduce their impacts. Take a quick, five question survey and let your concerns and ideas be heard. Please complete by March 15, 2017.
Click the link below to start the survey:
https://www.surveymonkey.com/r/NatronaHMP2017

NATRONA COUNTY HAZARD MITIGATION PLAN UPDATE 2017

RISK ASSESSMENT and GOALS Meeting

February 24, 9:00am – noon

Evansville Community Center

71 Curtis St., Evansville WY 82636

- **Introductions**
- **Review of the Planning Process**
- **Review of Identified Hazards**
- **Vulnerability Assessment Overview by Hazard**
- **Capability Assessment Overview**
- **Updating Goals for the Mitigation Plan**
- **Mitigation Action Strategy update needs**
- **Update on Public Involvement Activities/public meeting planning**
- **Next Steps**
- **Questions and Answers/Adjourn**

Summary of the Natrona County Risk Assessment and Goals Meeting
2017 Hazard Mitigation Plan Update
February 28, 2017
9:00am – 12:00 pm
Evansville Community Center
Evansville, WY

Introductions and Opening Remarks

Jeff Brislawn of Amec Foster Wheeler, the consulting firm hired by the County to facilitate the plan update process, began the meeting with welcoming remarks. Jeff asked everyone around the room to introduce themselves. Twelve persons representing a mix of County agencies and the municipalities of Casper, Mills, Midwest and Evansville and local stakeholders were present and documented on a sign in sheet. Representatives from the WYDOT, Casper-Natrona County Health Department, Central Wyoming Hospice and the Red Cross were also present.

Review of Mitigation, Disaster Mitigation Act (DMA) Requirements, and the Planning Process

A PowerPoint presentation was presented by Jeff Brislawn, the project manager from AMEC Foster Wheeler. Jeff outlined the nine step planning process being followed and discussed the project status. The update of the 2010 Hazard Mitigation Plan (HMP) will allow the County and participating municipalities to remain eligible for FEMA mitigation grants.

Risk Assessment Presentation and Discussion

Jeff outlined the general risk assessment requirements before beginning a detailed discussion of each hazard. He presented details on each hazard that will be included in the draft updated risk assessment chapter. Refer to the PowerPoint presentation and draft Hazard Identification and Risk Assessment (HIRA - forthcoming) chapter for specific details on each hazard. Several valuable details were learned during the risk assessment conversation among participants. The group discussed several hazard incidents that have occurred in the past five years. Highlights of the discussion are noted by hazard in the table below.

Hazard or Topic	Meeting Discussion
Wildfire	• There have been two major wildland fires in the past two years; BLM did a study on one of them. • Bar Nunn was evacuated in 2016 due to a nearby wildfire (Ridgecrest Fire) • Redzone mapping and analysis was discussed

	• Jeff noted that the redzone areas were determined in a statewide study done by the WY Division of Forestry that looked at housing density and fuels and topography. Much of the Casper metropolitan area is within the redzone "buffer" area, and that risk ratings from the more detailed County CWPP would be noted in the HMP.
Flood	• Jeff displayed some flood risk maps and analysis based on FEMA flood insurance rate maps. HAZUS flood modeling of approximate 1% annual chance areas is utilized for some areas of the county that is not mapped in the NFIP. • Periodic flooding has occurred in the past five years including 2012, 2015 and 2016. 2016 flooding was not bad along the North Platte due to mitigation and greenway efforts along the Platte River Parkway. • Flash flooding resulted in evacuations in the 33 Mile area June 5, 2015 (the day after the flooding in Lusk in 2015) • Jeff showed a slide summarizing critical facilities in the 1% and 0.2% annual chance flood zones. This includes hazardous materials and public safety facilities. The County EOC is located in the 0.2% zone but on the 2nd floor. • The Mills town Hall, Public Works department and Water Treatment Plant are all near the river • Fire station #9 in Mills is now a senior/community center • After the construction of Pathfinder Reservoir development has encroached closer to the N Platte River.
Dam Failure	• Pathfinder Reservoir is full and expected to use the spillway for excess flow this spring/summer, as occurred in 2016 • The 1906 Coal Creek Flood – noted as a dam failure- may have been more of an embankment failure.
Earthquake	• Jeff presented loss scenarios based on HAZUS modeling • Some HMPC members noted feeling earthquakes including: A M4 event in 1984 or 86 near Glenrock. An event on northern county line about 10 years ago that cracked stucco on buildings. A M3 event occurred in January 2017.
Landslide/Debris Flow/Rockfall	• Activity increases during wet cycles • Debris flow risk increases after wildfires; this happened on Sheepherder Hill burn scar in spring of 2013 • There have been debris flows on Alcova Lake Shore Drive; rockfall risk too • Rockfall hazard areas exist on Casper Mountain • Other problem areas include the narrows on Hwy 220 and the Wolf Creek drainage
Expansive Soils	• Jeff showed a map of potential problem areas, which covers a large portion of the County

	• Problem areas include the Indian Hills area, Hwy 220, Red Butte, Antelope Hills and areas close to the foot of Casper Mountain particularly on the west end. • CY Junior High had foundation issues which were mitigated when it was re-built. • Public Health requires special septic systems on tight soils in conformance with WY DEQ regulations.
Drought	• 2002-2004 worst, causes wildfires, effects on agriculture, cattle, pasture, and hay • Contributes to wildfires • Water source mostly the N Platte, of which the State of Nebraska has significant primacy/water rights • Mills has 8 wells and the N Platte River for supply • Has resulted in water restrictions, sometimes when pumps go down
Thunderstorm (Hail and Lightning)	• Hail can ruin crops and have economic impacts (roofs and vehicles) • Hail Has resulted in numerous roof and gutter damage • Not aware of significant issues with lightning, aside from sparking wildfires. It was thought an oil storage facility caught fire after a strike
Tornado	• A tornado in 1987 near Bar Nunn ripped roofs off two homes
Severe Winter Storm	• A severe winter storm in early October 2013 caused power outages • Crops, Calving and Lambing risks, and livestock operations impacts • Traffic accidents • Power impacts – trees on lines, particularly in fall and spring snow events • First responder impacts • Sheltering of stranded travelers on I-25 can be an issue, even from storms affecting Colorado. Midwest can quickly be overwhelmed with shelter needs when I-25 is closed to Casper. • A nursing home had to relocate persons during one storm event when their generator ran out of fuel. • Delivery of extra oxygen is done as a preventative measure if a large storm is forecasted • The dialysis center has a generator hookup and contract with a generator company now • All fire stations have backup generators now to ensure doors can be opened and use as shelter if needed
Extreme Cold	• Severe cold snap in November 2012 resulted in tree mortality • Livestock and agricultural impacts were noted • Temperatures of – 32 experienced in January • Results in heavy loads on power system

	• Frozen pipes sometimes result in house fires when blow torches are used for warm up • Frostbite risk increases
High Wind	• Often results in power outages and property damage • Results in blowing snow, ground blizzards, “sleeping semi’s” • Roof damage • Trampolines vulnerable • Substation in Midwest/Edgerton could take up to 7 days to replace parts if damaged due to 1940’s era construction • Losses likely under-reported
Avalanche	• There are some hazard areas on Casper Mtn that have resulted in 2-3 events but minor impacts
HAZMAT	• Fixed sites and Transportation hazards • Tier 11 facilities identified • A commodity flow study is expected to be completed this spring • Many petroleum and other flammable products transported by truck • Railroad goes through the Casper metro area, which includes cars carrying ore from uranium mines • Incident statistics were discussed, including a high number recorded in Midwest. It was speculated that this could be venting of Co2 which would need to be reported. • Gas lines have been hit during digs that did not call ahead.
Terroristic events	• This will be mentioned as a possible concern in the plan but without specifics or details • Two incidents of “white powder” letters that turned out to be benign were noted – one with a threatening letter to the GSA office and one that went to the Casper Star Tribune. • The post office has a biological detection system for anthrax
Pandemics / Public Health Hazards	• A discussion about why this hazard was not on the list of hazards profiled. Sometimes these are covered in other planning mechanisms. A jurisdictional public health risk assessment has been completed which will be provided to Amec. • H1N1 virus in 2009 was the most recent public health incident
Growth and Development trends	• Jeff noted that projections into 2040 indicate continued steady growth. • In relation to hazards there is growth occurring in WUI areas • Casper sees about 5-6 floodplain development permits a year for substantial improvements or new construction in the floodplain which must be mitigated for the 100 year event. • The downturn in oil and gas has resulted in lower growth in recent years.

Risk Summary Review

Jeff provided a handout with specific risk summaries for each hazard. This is a draft document for HMPC. The intent is to summarize the hazard significance as the basis and need for mitigation actions.

Capability Assessment Review

Jeff briefly reviewed highlights of existing capabilities in the county to mitigate hazards, including numbers of National Flood Insurance Policies, the emergency management program, and the county Community Wildfire Protection Plan. Casper participates in the NFIP Community Rating System which helps lower the cost of flood insurance in return for floodplain management activities above standard FEMA regulations. Other capabilities noted included warning and notification systems (R911, Code Red, NAWAS, sirens). All fire stations have generators. Casper developed a local energy assurance paln in 2011 that focused on backup power needs. The county used a pilot mitigation grant program associated with federal Fire Management Assistance declarations to do re-seeding and erosion control on a burn area.

Coordination and Integration with Other Plans

Jeff asked the group if other plans reference or integrate aspects of the HMP within the past 5 years. The group noted that the EOP mentions the HMP. The THIRA is also sourcing the HMP. Jeff encouraged cross-referencing of the plan in other mechanisms in the future as opportunities permit. Opportunities might include Firewise planning and the update of the Mills Land Use Plan. The MPO/Casper is in the process of updating its master land use plan.

Plan Goals Update

Jeff presented a slide with the goals and objectives from the 2010 HMP. The update presents an opportunity to revisit the twelve goals and adjust if necessary. Jeff will provide the goals and objectives in a worksheet as a followup to the meeting. Changes, if any, will be finalized at the next planning workshop.

Planning for Public Involvement

Jeff noted that public involvement will include a public survey and advertisement of the draft updated plan for review and comment. The survey is available and can be easily shared via email or social media. The group noted that the survey is on the County website and has been shared through Facebook. So far 90 responses have been received. Jeff will share results of the survey before the next meeting after it closes in mid-March.

Mitigation Action Strategy Update

Jeff noted the next step in the process is updating the hazard mitigation strategy. As a starting point the group will need to provide a status on the existing actions from the 2010 plan. A handout was provided which will be discussed further in the next meeting. Jeff encouraged the participating entities to review prior to the next meeting. The City of

Casper noted that they had already begun reviewing their projects and could provide status updates.

Plan Timeline/Next steps

Jeff summarized the next steps in the process.

- HMPC homework:
  - Review the handout on the mitigation strategy and note status of actions
  - Provide any more information to inform the HIRA and review the draft HIRA prior to the next meeting
  - Start formulating ideas for new mitigation projects

The next and final HMPC planning meeting will be held the week of March 20th or April 3rd (date/time TBD) to update mitigation actions for the plan. Jeff emphasized that this is an important meeting and will form the basis for the mitigation action plan. A calendar update will be sent out to save the date. The meeting materials will also be shared electronically, including the presentation and worksheets. There was a question about the overall schedule. The goal is to have a draft plan in late April, public review draft in May and a plan sent for FEMA approval in June and a final for adoption in August/September.

SIGN-IN SHEET 28

Natrona County Hazard Mitigation Plan Update Project

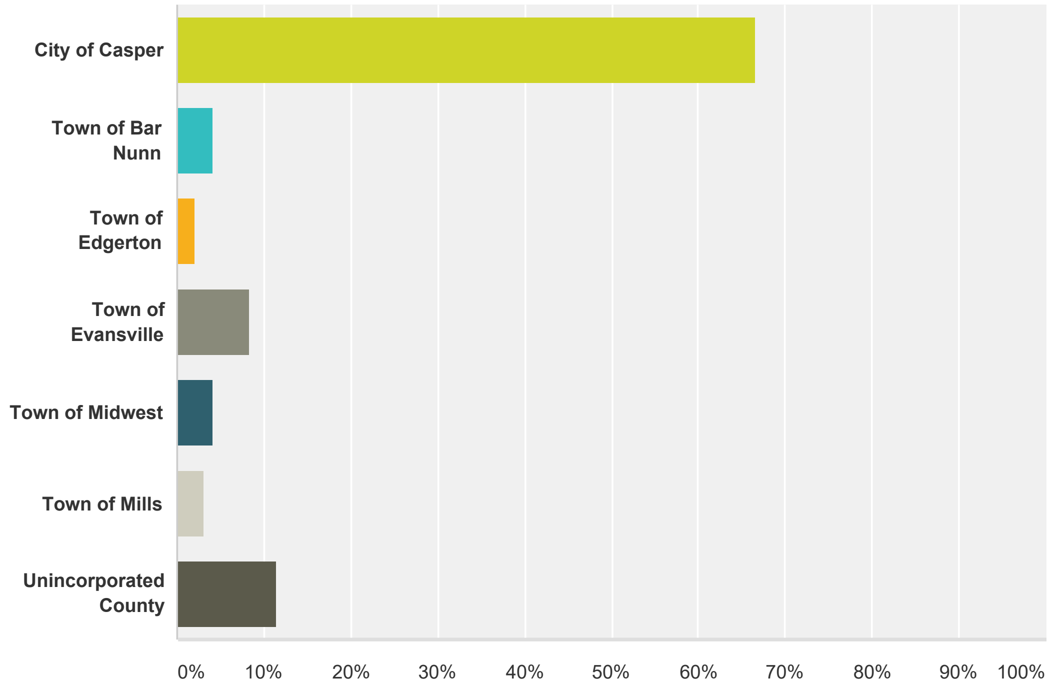
Meeting #2 Risk and Goals Meeting, February ~~24~~, 2017, 9:00am- noon

Evansville Community Center, Evansville, WY

Name	Email Address	Phone	Jurisdiction/ Department/ Organization/Affiliation	Title
Rissa Daugherty	cdaugherty@natronacounty-wy.gov	3072359205	NCEMA	Admin
Paula Reece	preece@natronacounty-wy.gov	307-235-9407	NC GIS Dept	GIS Specialist
JAIME JONES	midwestpd@rtconnect.net	3072622422 0786	Midwest F.D	Chief
Jeff Erdahl	jeff.erdahl@wyo.gov	473-3244	WYDOT	Area Maintenance Supervisor
RAE SMITH	rae.smith@redcross.org	307-267-1993	RED CROSS	DISASTER PREPAREDNESS SPECIALIST
Dan Beall	D.Beall@millswy.gov	307-262-3824	Mills FD	Fire Chief
Teresa Davis	TeresaD@cwhp.org	577-4832	Central Wyoming Hospital	Dir. Clinical Services
Audrey Gray	agray@cnchd.org	307-577-9737	Casper-Natrona County Health Department	public Health preparedness manager
Constance Lake	clake@casperwy.gov	307-235-8346	City of Casper/MPO	MPO Specialist
Matt Gacke	mattgacke@msn.com	307-266-5732	Evansville Fire Dept.	Assistant Fire chief
Stew Anderson	andersos@natronacounty-wy.gov	235-9205	Natrona EMA	County Coordinator
Jeff Brislawn	jeff.brislawn@amecfw.com	303-704-5506	AMEC Foster Wheeler	Project Manager

Q1 Indicate the community you reside in:

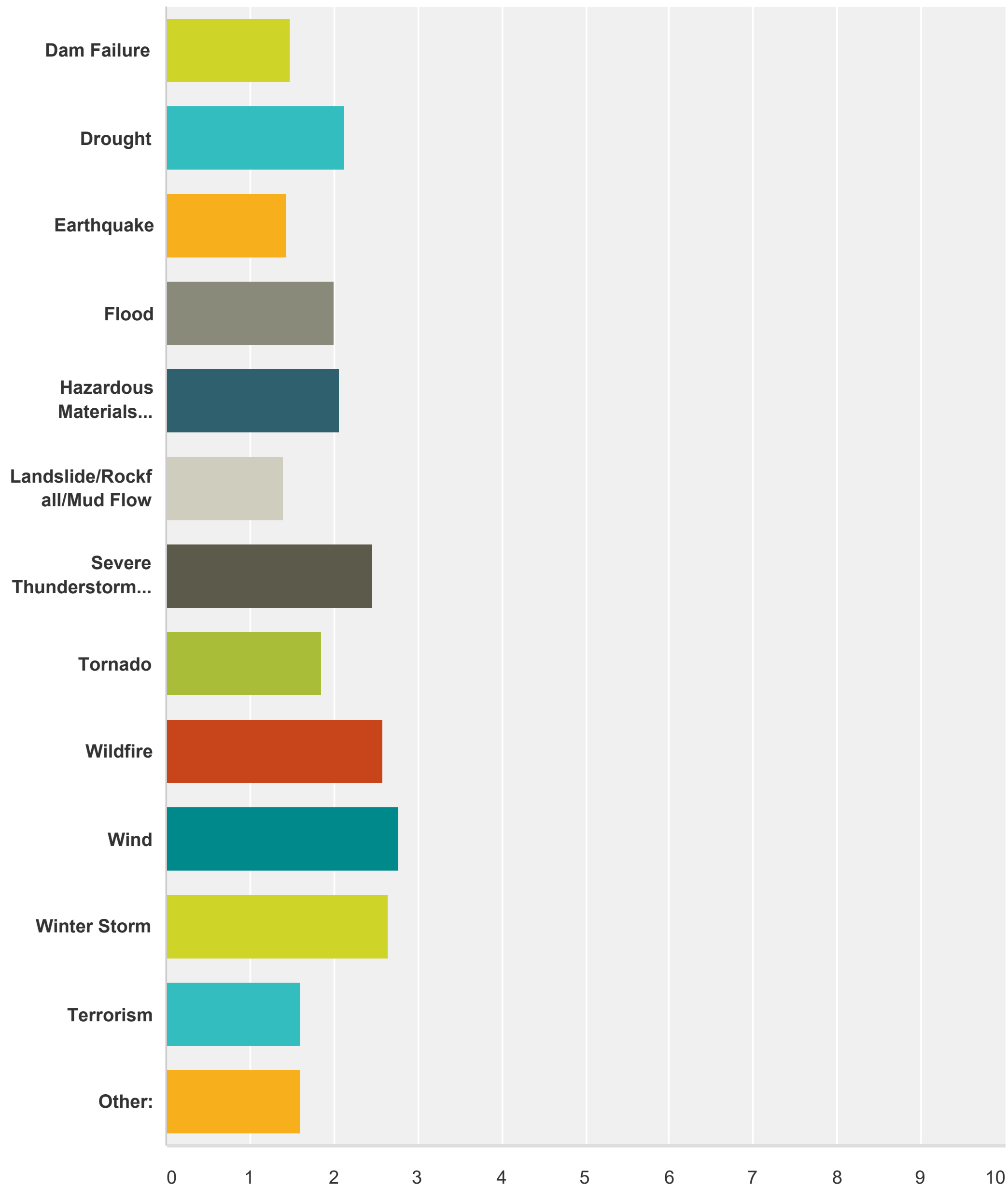
Answered: 96 Skipped: 0



Answer Choices	Responses	
City of Casper	**66.67%**	64
Town of Bar Nunn	**4.17%**	4
Town of Edgerton	**2.08%**	2
Town of Evansville	**8.33%**	8
Town of Midwest	**4.17%**	4
Town of Mills	**3.13%**	3
Unincorporated County	**11.46%**	11
Total		**96**

Q2 The hazards addressed in the Hazard Mitigation Plan are listed below. Please indicate the level of significance in your community that you perceive for each hazard. Please rate these hazards 1 through 3 as follows: 1=low, 2=moderate, 3=high.

Answered: 96 Skipped: 0



	1=Low	2=Moderate	3=High	Total	Weighted Average
Dam Failure	59.38% 57	33.33% 32	7.29% 7	96	1.48

Drought	**17.89%** 17	**52.63%** 50	**29.47%** 28	95	2.12
Earthquake	**62.50%** 60	**31.25%** 30	**6.25%** 6	96	1.44
Flood	**25.00%** 24	**50.00%** 48	**25.00%** 24	96	2.00
Hazardous Materials Incident	**23.96%** 23	**45.83%** 44	**30.21%** 29	96	2.06
Landslide/Rockfall/Mud Flow	**66.67%** 64	**28.13%** 27	**5.21%** 5	96	1.39
Severe Thunderstorm (including Lightning and Hail)	**7.37%** 7	**38.95%** 37	**53.68%** 51	95	2.46
Tornado	**27.08%** 26	**59.38%** 57	**13.54%** 13	96	1.86
Wildfire	**6.25%** 6	**29.17%** 28	**64.58%** 62	96	2.58
Wind	**4.17%** 4	**14.58%** 14	**81.25%** 78	96	2.77
Winter Storm	**2.08%** 2	**31.25%** 30	**66.67%** 64	96	2.65
Terrorism	**55.21%** 53	**29.17%** 28	**15.63%** 15	96	1.60
Other:	**56.00%** 14	**28.00%** 7	**16.00%** 4	25	1.60

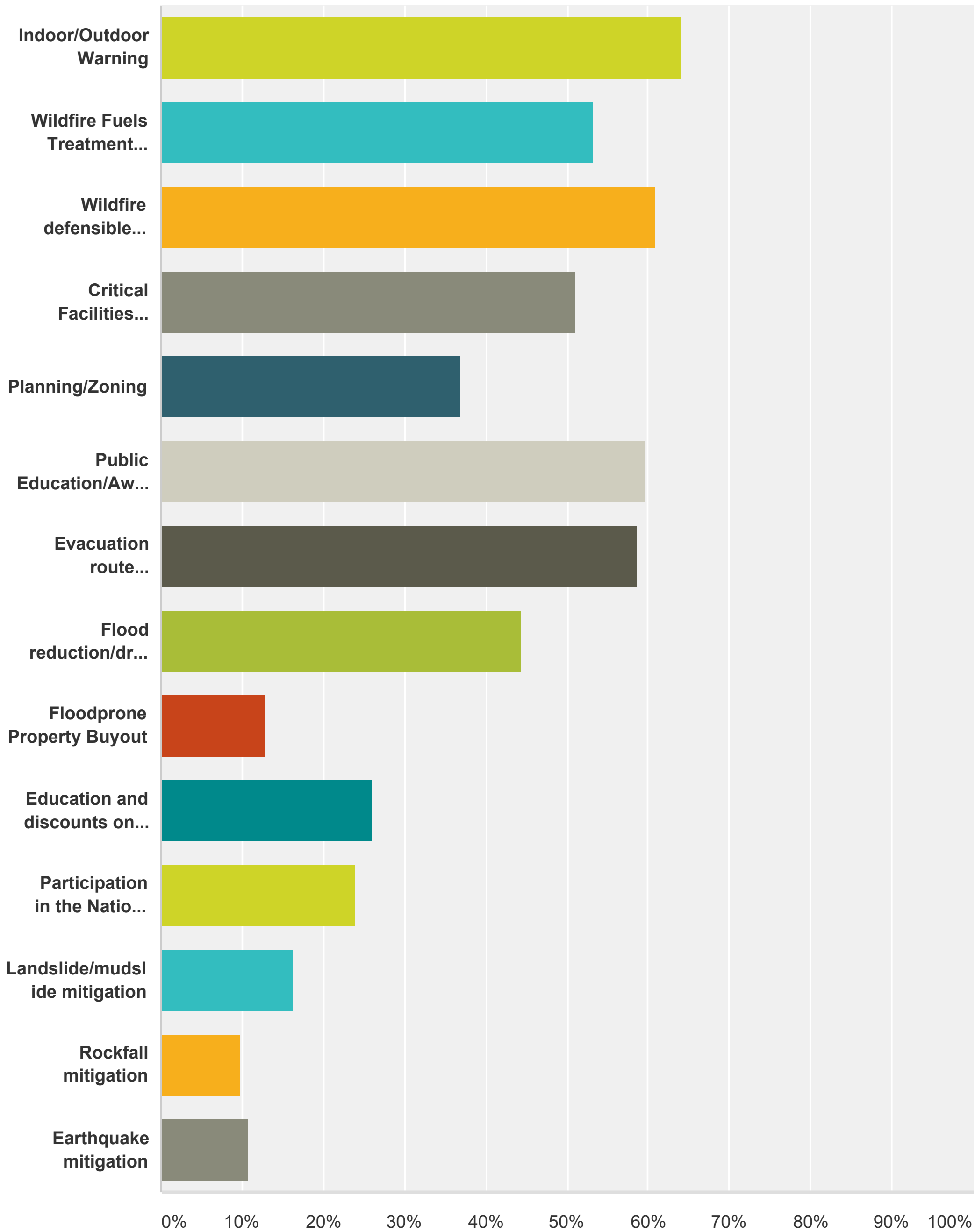
Q3 Do you have information on specific hazard issues/problem areas that you would like the planning committee to consider? Note the jurisdiction.

Answered: 20 Skipped: 76

#	Responses	Date
1	Deep flooding creating deep pot holes near Whyoming and Blackmore rd. Area is hazardous in any foul weather.	2/17/2017 10:30 AM
2	During the Eclipse I am worried about the sewer, water and trash. How is Casper going to plan for that? Are we going to have enough water and what is going to happen with all the sewage and trash.	2/15/2017 3:09 PM
3	Wildfire planning for local residents living on the mountain.	2/15/2017 11:07 AM
4	reduce the vehicular traffic on Outer Drive during high winds as bad accidents happen with high wind/trucks!	2/14/2017 4:06 PM
5	None	2/14/2017 3:39 PM
6	Not really statistics however when people become fearful, economy falls, and ignorance surfaces.. people become hateful and destroy the property/lives of others.	2/14/2017 2:12 PM
7	Limited access to the town of Bar Nunn for emergency evacuations and responders.	2/13/2017 8:35 AM
8	NONE	2/13/2017 7:32 AM
9	None at this time.	2/10/2017 3:58 PM
10	Refinery Fire-Moderate	2/10/2017 9:15 AM
11	na	2/10/2017 9:07 AM
12	Wildland fuel mitigation along creek drainages in Casper	2/9/2017 2:15 PM
13	Lack of evacuation routes in and out of the town of Bar Nunn	2/9/2017 10:23 AM
14	No.	1/27/2017 10:12 PM
15	No	1/27/2017 8:29 PM
16	Not at this time	1/27/2017 4:12 PM
17	We need another way out of Bar Nunn. We are land locked if the one way out to Casper is blocked.	1/27/2017 3:57 PM
18	Natural Gas or hazardous substances released in the air or area.	1/27/2017 3:37 PM
19	I've always been concerned about the communities ability to evacuate being center and McKinley are the only means to enter the highway. With the choice of the state to close Beverly has made my fear of our ability to leave quickly to be of great concern.	1/27/2017 3:32 PM
20	City of Casper - when the sirens go off, it's nearly impossible to hear or understand what they are saying	1/27/2017 3:21 PM

Q4 The following types of mitigation actions may be considered in the plan. Please place a check next to the types of mitigation actions that you think should have the highest priority in the plan.

Answered: 92 Skipped: 4



Answer Choices	Responses	
Indoor/Outdoor Warning	**64.13%**	59

Wildfire Fuels Treatment projects	**53.26%**	49
Wildfire defensible space projects	**60.87%**	56
Critical Facilities Protection	**51.09%**	47
Planning/Zoning	**36.96%**	34
Public Education/Awareness	**59.78%**	55
Evacuation route development	**58.70%**	54
Flood reduction/drainage improvement	**44.57%**	41
Floodprone Property Buyout	**13.04%**	12
Education and discounts on flood insurance	**26.09%**	24
Participation in the National Flood Insurance Program	**23.91%**	22
Landslide/mudslide mitigation	**16.30%**	15
Rockfall mitigation	**9.78%**	9
Earthquake mitigation	**10.87%**	10
Total Respondents: 92		

Q5 Please comment on any other pre-disaster strategies that the planning committee should consider for reducing future losses caused by hazards.

Answered: 11 Skipped: 85

#	Responses	Date
1	We live on HWY 20/26 W and would love to be able to hear the warning sirens that are available in town. The closest one on 10 Mile Rd, we can't hear. Perhaps some further out for rural residents? It is growing greatly. Thank you for your consideration!	2/23/2017 7:13 AM
2	Research other states efforts to reduce hazards for any condition and implement those ideas to advance in all areas! New Mexico tilts roads with groves for fast water run off during monsoon seasons... "wake up" lines are used to help keep snow from building up in tire groves allowing better traction... left hand turns from incline need more time in poor weather - too many People run too many lights due to this issue!	2/17/2017 10:30 AM
3	Water quality for residents residing on mountain in regard to well water.	2/15/2017 11:07 AM
4	Currently live in the County, south and west of Casper. It is beyond time that Natrona County and the Natrona County Commissioners enact updated Planning & Zoning guidelines and ENFORCE siad Planning and Zoning guidelines. I have neighbors that have TOO much clutter and in the case of any emergency, would potentially cause unlimited hazards.	2/14/2017 3:39 PM
5	Emergency preparedness	2/14/2017 2:12 PM
6	na	2/10/2017 9:07 AM
7	Public shelters for emergency from tornados to whatever.	1/28/2017 4:25 AM
8	N/A	1/27/2017 10:12 PM
9	I admin Casper''s largest pet recovery group, Casper Pets Lost N Found on facebook. Currently we have 7000 members. We always strive to support Metro and uphold all Ordinances and by-laws. I have been thinking of sitting down with Tory Metro (we have a good relationship) to see what plans are in place for pets in cases of disaster. We gained some experience with the Cole Creek fire and livestock; but would like to see about cats and dogs for the people of Casper and develop a plan in which our membership and board for information dissemination to the community.	1/27/2017 4:08 PM
10	Again the ability for the community to evacuate entering the highway is limited with Beverly being closed. If a high profile vehicle was to become wedged or a car in one of the underpasses it could severely impede the ability to leave Casper quickly.	1/27/2017 3:32 PM
11	Wind tearing down property	1/27/2017 3:25 PM

Q6 Provide your name and email address if you would like to be added to a distribution list for upcoming activities related to the planning process:

Answered: 21 Skipped: 75

#	Responses	Date
1	Kathy Chong katz333@msn.com	2/23/2017 11:05 AM
2	Leah Smith lsmith@cnchd.org	2/21/2017 8:00 AM
3	kdlitl20@msn.com	2/15/2017 11:07 AM
4	Jon Kinder jkinder@bresnan.net	2/14/2017 3:39 PM
5	Rita Goehring rmgoehring@gmail.com	2/14/2017 2:12 PM
6	Wayne L. Reynolds reynoldw@natronacounty-wy.gov	2/13/2017 7:32 AM
7	Dan Adcock Publisworks2@evansvillewy.com	2/10/2017 3:58 PM
8	Michelle SCJPB@yahoo.com	2/10/2017 8:44 AM
9	Christa Wiggs cmkarau@hotmail.com	1/31/2017 12:45 PM
10	KnopAtWork@gmail.com	1/28/2017 3:49 PM
11	Elmer parson elmerp@tribcsp.com	1/28/2017 11:34 AM
12	dniegisch@usa.net	1/28/2017 4:25 AM
13	Jody VonSeggern wyomingjody@gmail.com	1/27/2017 7:43 PM
14	Issac Zent. Ibzent@gmail.com	1/27/2017 5:34 PM
15	Mike Coley KE7AZF@gmail.com	1/27/2017 4:46 PM
16	Stefanie woinarowicz 664 wagon trail evansville wyoming 82636	1/27/2017 4:39 PM
17	Carla Edwards Carla370@yahoo.com P O Box 4096 Casper 82604.	1/27/2017 4:08 PM
18	Danielle Steinberg Kodi2004pup@yahoo.com	1/27/2017 4:01 PM
19	Traci.c462@live.com	1/27/2017 4:00 PM
20	keely.cvic@yahoo.com	1/27/2017 3:37 PM
21	Preston Pilant Prestonpilant@gmail.com	1/27/2017 3:32 PM

NATRONA COUNTY HAZARD MITIGATION PLAN UPDATE 2017

Mitigation Strategy Meeting

March 22, 2017, 1:00- 4:00 pm
County EOC, 201 N. David, Casper, WY

- **Introductions**
- **Review of the Planning Process**
- **Goals Update**
- **Review of possible mitigation activities and alternatives**
- **Discuss criteria for mitigation action selection and prioritization**
- **Review of progress on existing actions in the plan**
- **Brainstorming Session: Development of new mitigation actions (group process)**
- **Prioritize mitigation actions (group process)**
- **Discuss plan implementation and maintenance**
- **Discuss next steps**
- **Questions and Answers/Adjourn**

Mitigation Action Selection and Prioritization Criteria

Does the proposed action protect lives?

Does the proposed action address hazards or areas with the highest risk?

Does the proposed action protect critical facilities, infrastructure, or community assets?

Does the proposed action meet multiple objectives (multi-objective management)?

STAPLE/E

Developed by FEMA, this method of applying evaluation criteria enables the planning team to consider in a systematic way the social, technical, administrative, political, legal, economic, and environmental opportunities and constraints of implementing a particular mitigation action. For each action, the HMPC should ask, and consider the answers to, the following questions:

Social

Does the measure treat people fairly (different groups, different generations)?

Technical

Will it work? (Does it solve the problem? Is it feasible?)

Administrative

Is there capacity to implement and manage project?

Political

Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support it?

Legal

Does your organization have the authority to implement? Is it legal? Are there liability implications?

Economic

Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development? Does it reduce direct property losses or indirect economic losses?

Environmental

Does it comply with environmental regulations or have adverse environmental impacts?

Example Mitigation Actions by FEMA categories with Hazards Identified in the Natrona Hazard Mitigation Plan 2017

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Landslides/ Debris Flows/ Rockfalls; soil hazards; subsidence	Weather Extremes (Tornado, hail, lightning, wind, temps, drought)	Earth quakes	Wildfires	Severe Winter Storm
PLANS and REGULATIONS								
Building codes and enforcement		■	■	■	■	■	■	■
Comprehensive Watershed Tax		■						
Density controls	■	■	■	■			■	
Design review standards		■	■	■		■	■	
Easements		■	■	■			■	
Environmental review standards		■	■	■		■	■	
Floodplain development regulations	■	■	■					
Hazard mapping	■	■	■	■			■	
Floodplain zoning	■	■	■					
Forest fire fuel reduction							■	
Housing/landlord codes			■		■			
Slide-prone area/grading/hillside development regulations				■			■	
Manufactured home guidelines/regulations		■			■	■		
Minimize hazardous materials waste generation			■					
Multi-Jurisdiction Cooperation within watershed	■	■						
Open space preservation	■	■		■			■	
Performance standards	■	■		■	■	■	■	■
Periodically contain/remove wastes for disposal			■					
Pesticide/herbicide management regulations			■					
Special use permits	■	■	■	■			■	
Stormwater management regulations		■	■					
Subdivision and development regulations	■	■	■	■		■	■	
Surge protectors and lightning protection					■			

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Landslides/ Debris Flows/ Rockfalls; soil hazards; subsidence	Weather Extremes (Tornado, hail, lightning, wind, temps, drought)	Earth quakes	Wildfires	Severe Winter Storm
Tree Management					■		■	■
Transfer of development rights		■		■			■	
Utility location			■	■	■			■
STRUCTURE AND INFRASTRUCTRE PROJECTS								
Acquisition of hazard prone structures	■	■		■			■	
Facility inspections/reporting	■	■	■			■		
Construction of barriers around structures	■	■	■					
Elevation of structures	■	■						
Relocation out of hazard areas	■	■	■	■			■	
Structural retrofits (e.g., reinforcement, floodproofing, bracing, etc.)		■	■	■	■	■	■	■
Channel maintenance		■		■				
Dams/reservoirs (including maintenance)	■	■						
Isolate hazardous materials waste storage sties			■					
Levees and floodwalls (including maintenance)		■						
Safe room/shelter					■	■		■
Secondary containment system			■					
Site reclamation/restoration/revegetation		■		■				
Snow fences								■
Water supply augmentation					■			
Debris Control		■		■				
Defensible Space							■	
Stream stabilization		■		■				
EDUCATION AND AWARENESS								
Flood Insurance	■	■						
Hazard information centers	■	■	■	■	■	■	■	■

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Landslides/ Debris Flows/ Rockfalls; soil hazards; subsidence	Weather Extremes (Tornado, hail, lightning, wind, temps, drought)	Earth quakes	Wildfires	Severe Winter Storm
Public education and outreach programs	■	■	■	■	■	■	■	■
Real estate disclosure	■	■	■	■	■	■	■	■
Crop Insurance					■	■		
Lightning detectors in public areas					■			
NATURAL SYSTEMS PROTECTION								
Best Management Practices (BMPs)		■	■	■	■		■	
Forest and vegetation management	■	■		■	■		■	■
Hydrological Monitoring	■	■	■	■	■			
Sediment and erosion control regulations	■	■	■	■				
Stream corridor restoration		■		■				
Stream dumping regulations		■	■					
Urban forestry and landscape management		■		■	■		■	■
Wetlands development regulations		■	■	■			■	
EMERGENCY SERVICES								
Critical facilities protection	■	■	■	■	■	■	■	■
Emergency response services	■	■	■	■	■	■	■	■
Facility employee safety training programs	■	■	■	■	■	■	■	■
Hazard threat recognition	■	■	■	■	■	■	■	■
Hazard warning systems (community sirens, NOAA weather radio)	■	■	■	■	■	■	■	■
Health and safety maintenance	■	■	■	■	■	■	■	■
Post-disaster mitigation	■	■	■	■	■	■	■	■
Evacuation planning	■	■	■	■			■	

Summary of the Natrona County Mitigation Strategy Meeting
2017 Hazard Mitigation Plan Update
March 22, 2017
1:00 – 3:30 PM
Natrona County EOC, Casper, WY

Introduction and Opening Remarks

Jeff Brislawn, project manager with Amec Foster Wheeler, initiated the meeting with a discussion of the agenda for the afternoon. Jeff asked everyone around the room to introduce themselves; 8 persons from various County departments and the City of Casper and Town of Evansville were in attendance and documented on a sign in sheet. Stakeholders included Sinclair Transportation. Handout materials were provided.

Jeff presented the PowerPoint slide deck that outlined the meeting agenda and topics.

Review of the Planning Process

Jeff reviewed the planning process that has taken place so far. The process is currently in Phase III – Develop a Mitigation Plan. Jeff also reviewed the findings of the process up to the point of the meeting, including the draft hazard identification and risk assessment. Jeff presented a slide that summarized the hazard significance ratings. Some discussion about the overall significance ratings occurred; Jeff suggested the group review the draft HIRA and recommend any changes that might be warranted. Jeff also presented the results of the public survey. The survey was distributed via emergency management Facebook and received about 96 responses. Wind and winter storm ranked as high significance hazards; the group noted this could be due to the time of year the survey was taken (February- March) and recent wind and winter storm events.

Plan Goals

Jeff reviewed the broad mitigation goals developed for the plan at the previous meeting. The group validated the goals with some minor revisions and some adjustments/additions to the objectives. Jeff will draft the revised goals and objectives that will be included in the updated plan.

Review of Possible Mitigation Activities and Alternatives

Jeff presented information on typical mitigation activities and alternatives and referred to handouts with further details and guidance. Jeff reviewed ideas for possible mitigation activities and alternatives based on the risk assessment. Jeff outlined potential project criteria and action requirements, including the requirements of the Disaster Mitigation Act of 2000. Each hazard and each participating jurisdiction must have at least one true mitigation action (not preparedness) pertaining to them. The group was provided a handout with a matrix of typical mitigation alternatives organized by FEMA categories for the hazards identified in the plan. Another reference document titled “Mitigation Ideas” developed by FEMA was made available for reference at the meeting. This reference discusses the common alternatives for mitigation by hazard.

Coordination with Other Plans

The group also discussed the importance of coordinating the mitigation plan with other planning processes, and vice versa. The group discussed opportunities to cross reference the hazard mitigation plan in other planning efforts. Jeff noted that projects in other plans can be linked with the HMP through an action item that notes implementation of the mitigation – related actions present in plans such as CWPPs or capital improvement plans. The 2012 River Master Plan was noted has having projects and a geomorphic assessment that identifies erosion hazard areas.

Review of progress on 2010 Plan actions and identification of new actions

Each action from the 2010 plan was discussed with the group. The group provided input on whether the action had been completed and if not reasons why. Some actions were determined to still be relevant and should continue in the updated plan. Others were recommended to be deleted. Jeff took notes on the revisions to the action table. Action priorities were revisited and modified in some cases. Completed and deleted actions will be moved to separate tables in the updated plan. The continuing, deferred and new actions will be grouped together in an updated action strategy table.

During the discussion some new actions to include in the plan were brainstormed. To stimulate ideas Jeff noted some possible ideas in his presentation, and also referred the group to the public survey results which included some mitigation recommendations, and the FEMA Mitigation Ideas publication. New action ideas were noted on large sticky notes by the participants. These were then posted on flip chart paper, organized by hazards. Jeff posted project descriptions of several drainage projects previously provided by the City of Casper. These actions and their dot prioritization include:

1. Develop a Ready, Set, Go Program for All Hazards (1 dot)
2. Address evacuation of Evansville due to Train Derailment or other hazards, including developing an alternate route (6 dots)
3. Improve clarity of warning messages on sirens (1 dot and public survey recommendation)
4. Develop additional emergency access/egress for Bar Nunn (5 dots and public survey recommendation)
5. Sun Drive Detention Pond on Sage Creek (1 dot)
6. Eastdale Creek Diversion to Sage Creek
7. Lower Eastdale Creek Channel Improvements (2 dots)
8. Emigrant Gap Draw Channel Improvements
9. Industrial Avenue Storm Sewer Improvements
10. North Platte River Restoration (includes flood, erosion, and wildfire mitigation)
11. Flood hazard education and awareness (2 dots)

12. Continue to offer immunizations to residents (biological disease – may be noted as an ongoing capability)
13. Continue to educate the public about novel diseases (biological disease – may be noted as an ongoing capability)

Jeff will enter the proposed mitigation projects into the action table. He will be in touch to identify points of contact to flesh out the specifics of the different projects. In addition he will send out a sample action for 'Continued Participation in the National Flood Insurance Program,' which is a requirement for all NFIP communities.

Action Prioritization

The group was provided with a decision-making tools to consider when prioritizing the actions. This including FEMA's recommended criteria, STAPLE/E (which considers social, technical, administrative, political, legal, economic, and environmental constraints and benefits). Other criteria used to recommend what actions might be more important, more effective, or more likely to be implemented than another included:

- Does action protect lives?
- Does action address hazards or areas with the highest risk?
- Does action protect critical facilities, infrastructure or community assets?
- Does action meet multiple objectives (Multiple Objective Management)?

The actions noted previously were given an initial prioritization based on consideration of the above and input from the group. The group was provided sets of sticky dots, 4 per person, which they used to "vote" on the projects using the above criteria. Jeff will compile the results into a relative high, medium, low prioritization based on this initial dot method.

Next Steps
Jeff provided a new action worksheet for participants to flush out the details of proposed actions. These are due April 7th from the constituents. Comments on the draft HIRA are also due then. A target for the first complete draft is the end of April.

The meeting adjourned at 3:30 PM.

Natrona County Hazard Mitigation Plan
New Mitigation Action Worksheet

Use this to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Jeff Brislawn by **April 7th.** **Note Jurisdiction:**

Mitigation Project Title	
Hazard(s) Mitigated	
Project Description, Issue/Background	
Related planning mechanisms	
Jurisdictions that will benefit	
Responsible Office/ Agency	
Partners	
Priority (High, Medium, Low)	
Cost Estimate	
Benefits (Avoided Losses)	
Potential Funding source	
Timeline for Completion	

Prepared by: ______________________

Title/Dept: ______________________

Phone: ______________________

Email: ______________________

Please return worksheets by mail, email, or fax to: Jeff Brislawn
jeff.brislawn@amecfw.com
Phone: 303-704-5506
Fax: 303-935-6575
1942 Broadway, Suite 314, Boulder, CO 80302

SIGN-IN SHEET
Natrona County Hazard Mitigation Plan Update Project
Meeting #3 Mitigation Strategy Meeting, March 22, 2017, 1:00-4:00 pm
County EOC, 201 N. David Casper, WY

Name	Email Address	Phone	Jurisdiction/ Department/ Organization/Affiliation	Title
Jerome Flores	jfloresj@sinclairoil.com	(307) 324-3190	Sinclair Trans. Co.	Safety & Reg. Comp.
Matt Gacke	mattgacke@msn.com	307-266-5732	mattgacke@msn.com	Evansville Fire Dept.
Audrey Gray	agray@cnchd.org	307-577-9737	agray@cnchd.org	PHP Manager
Denyse Wyskup	dwyskup@casperwy.gov	235-8455	City of Casper/Regional GIS	Regional GIS Administrator
Constance Lake	clake@casperwy.gov	235-8346	Casper Cmty Dev	MPO Specialist
Jolene Martinez	jmartinez@casperwy.gov	235-8332	Casper/Engineering Office	special projects coordinator
Amanda Huckabay	ahuckabay@cnchd.org	577-9751	CNCHD	PHP Specialist
Jeff Brislawn	Jeff.brislawn@amecfw.com	303-704-5506	Amec Foster Wheeler	Project Manager

November 2, 2017 at 1:30 pm
Bar Nunn Fire Station
Mitigation Planning Meeting – Town of Bar Nunn

In attendance:

John Harlin- Natrona County Emergency Management Coordinator
Stacia Hill- Natrona County Emergency Management Deputy Coordinator
Robert Hoover – Fire Chief, Town Council Member
Chuck Johnson – Town of Bar Nunn Maintenance Supervisor

Identified Areas of Concern or Threats:
Wildfire
Airplane crash
Threats to Elementary School
Flooding from Severe Rain Storms
Natural Disasters

Meeting notes:

Wildfire – The town of Bar Nunn will start construction of a new interchange on Interstate 25 in the spring of 2018. Currently there are only two routes of ingress/ egress for emergency responders and citizens during disaster response and evacuation. This interchange will eventually connect US HWY 20-26 near the Casper Natrona County International Airport, Town of Bar Nunn, Interstate 25 and the Town of Evansville. The Town annually maintains fire breaks on the north and west sides of the town to mitigate the potential of wild fires impacting the Town. In 2014 there was a large grass fire north west of the Town. This fire left a large burn scar that now contains cheat grass. The Town of Bar Nunn would like to mitigate the cheat grass flash fuels by spraying work with the Ag Extension this coming spring and summer to eliminate the cheat grass

As of the summer of 2017 the Town of Bar Nunn finished a project that looped all fire hydrants so water volume and pressure is no longer an issue in the event of a large fire.

In the summer of 2017 an addition was added to the Elementary School. Along with that project a complete sprinkler system was added to the entire school. All future plans for building public buildings will now have sprinkler systems installed. The town has adopted fire resistant construction standards. The town of Bar Nunn plans on building a new town Hall. Construction is to begin in 2 to 5 years. This building will also have a sprinkler system installed.

Flooding- All new areas of development have retention areas built in anticipation of heavy rain storms that cause major flooding of street and homes. Bar Nunn is relatively flat so water run-off has been an issue. In the new development on the north end of Bar Nunn retention areas have been built to contain the run off and remove it from the residential areas reducing the potential of flooding. They have also constructed retention areas around the school. All new development areas in the Town of Bar Nunn are being planned to the 100 year flood plan.

The threat of an airplane crash at or just east of the Interstate is a large concern for the Town of Bar Nunn. Most commercial and private aircraft either approach or depart directly over the southern half of the town. The crash of an airplane has the potential to cause significant damage to the Town of Bar Nunn. The Town of Bar Nunn is now notified of any potential aircraft situation that is approaching the airport. It is realized they cannot control or build barriers from this happening but they have taken measures to ensure they are notified by the Public Safety Communication Center and have made plans for removing key equipment to outlying areas. There have been situations when aircraft have landed on the streets of Bar Nunn when they could not make it to the airport to due fuel and or mechanical problems with the aircraft.

Robert Hoover has also asked for and will provide a secure location for a CERT trailer to be stored in the town. This would aid in the response if there was a significant event that occurred in the area.

End of meeting

November 6, 2017 at 5:30PM
Edgerton Town Hall
Mitigation Planning Meeting – Town of Edgerton

In attendance:

John Harlin- Natrona County Emergency Management Coordinator
Stacia Hill- Natrona County Emergency Management Deputy Coordinator
H.H. "Buck" King – Mayor
Cindy Aars – Council Member
Paul Brow – Council Member
Cathy Andreen – Council Member
Frank Tucker – Council Member
Chad Leatherwood – Water Distribution Manager

Identified areas of concern:
Lighting and Thunder storms
Hail
Wind Storms
Wild Fires
Earthquake
Tornados

Meeting notes:

<u>Hail, Lighting and Thunder Storms</u> – Edgerton gets severe storms every year. In 2016 a severe thunderstorm producing hail and high wind impacted the town. This storm caused significant damage throughout the town. The town council believes not much planning can be done to circumvent damage from these storms. The Town Hall, where critical communications is located, does not have a backup power source. The Town Hall is the designated tornado shelter and warming/ cooling shelter. There was discussion as to the possibility of installing a generator backup in the future. Council members will respond to the town hall if there is a serious power outage or disaster.

<u>Flooding</u> – is not too much of a concern. The town is built above the flood plain. A number of years ago there was a major storm and they received 2" of rain in 20 minutes. Salt Creek, which runs along the outside of town, was able to handle the rainfall. There was very minor flooding on one roadway but within a very short time the water ran off and or seeped into the ground. Currently there are no flood mitigation plans.

<u>Wild fires</u> – are a concern due to the fact that Edgerton is surrounded by private property ranch land and Bureau of Land Management lands. There are areas that could pose a serious problem in the event of a fire. The Town identified the potential threat of wild land fire would have to the water storage tank and treatment facility. To mitigate the wild land fire threat, the Town discussed creating a firebreak and

weed control around the perimeter of the water storage tank and treatment facility. There were no additional properties within the Town boundary identified as in need of wild fire mitigation efforts.

Earthquake – could cause major problems with the potable water supply for the town. Currently a 40 mile long pipeline carries water from Casper to Edgerton. If an earthquake damaged the waterline the town could possibly deplete it stores and be out of drinking water in 5 to 7 days. The town has planned, and contracted in the past, commercial water tankers to bring water into the town. The Town's water tower can hold approximately 1.5 million gallons of water; however the maintained level is 500,000 gallons. They currently utilize electronically actuated back flow valves and butterfly isolation valves with manual backup valves. Accessing and operating the manual valves takes a considerable amount of time and may not be sufficient in an emergency situation. The recommendation would be to evaluate the water control system. The Town would like to install a generator and/or battery back up to the valve and water operating system. In the event of water system compromise, the Town would institute a boiling order and conduct community education.

The town of Edgerton and the town of Midwest share this water supply pipeline and water storage tank.

Tornados - The Town uses the basement of the town hall as a shelter for tornados. They could also affect the power for the town and, as previously noted, having a backup generator would be beneficial. There is an outdoor warning siren system in place that works well in the area. The siren system is powered by solar charged batteries.

The Town has adopted all the National Building codes and has memorandums of understanding for new construction. They also require all new construction, once passed by the Town Council, to also have permits and inspections from the Natrona County Building Inspector.

The Town has above ground power transmission. There has been discussion about changing to underground power systems. At this point the cost is prohibitive but if there was a large storm or tornado that went through the area and cause significant damage to the current power lines they would look at changing to underground at that time.

End of meeting.

November 8, 2017
Midwest Town Hall
Mitigation Planning Meeting – Midwest

In attendance:

John Harlin- Natrona County Emergency Management Coordinator
Stacia Hill- Natrona County Emergency Management Deputy Coordinator
Guy Chapman – Mayor
Amanda DeWitt – Council Member
Darla Lindsay – Council Member
Katie Bachmeier – Council Member
Jaime Jones – Chief of Police
James Durand- Public Works Department

Community Members
Eugene Dickerson
Katie Piatt
Jan Bunderson
Michelle Gibbs
Chad Leatherwood
Ron Moore
Paula Chapman
Frank Tucker
Daryl Shepard

Identified areas of Concern:
Wild Fire Danger
Earthquakes
Tornados
Chemical Release

Wildfire - The Town of Midwest's greatest concern currently is Wildland fire. They have identified strategies to mitigate the impact of a wild land fire on the town. In the spring of 2018 the town will mow and/or grade a large fire break on the north edge of town. It could be mowed out 50' to 100' or a grader could remove the vegetation every 1 to 2 years. On the east side of town they have cleared all greasewood and vegetation in a 4 acre area. This will continue to be maintained. On the south end of town there seems to be a lot of brush that is growing up but they will address that area again this spring. The west side of the town poses no real issue at this time.

Critical Infrastructure – at this time there are no structures that have sprinkler systems in them in the event of fire. The systems could be added to the Town Hall, Fire Station, Police Station and the school. The buildings do have fire alarms.

Water system – the town also shares the same water system that Edgerton has. There is vulnerably to the system in the event of a large fire, earthquake, and tornados. Midwest also stated they could strengthen the water system by having a generator and creating a better fire break around the tower.

Severe winter storms, severe thunderstorms and tornados- shelter facilities; the fire station, church and school all have basements that have been designated as shelter locations.

The town of Midwest is serviced by outdoor warning sirens. The sirens feature solar charged battery power.

Flooding does not pose a large problem. The town of Midwest is higher in elevation than the flood plain. They also have storm sewers and catch basins in the event of heavy rain.

APPENDIX B - CRITICAL FACILITIES BY JURISDICTION IN NATRONA COUNTY

Jurisdiction	Critical Facility Type	Facility Count
Bar Nunn	Day Cares	4
	EPA FRS Location	1
	Fire Department	1
	National Shelter System Facility	2
	School	1
	Total	**9**

Jurisdiction	Critical Facility Type	Facility Count
Casper	Air Facility	1
	Assisted Living	10
	Bridge	18
	College/University	1
	Community Support	43
	Day Cares	88
	EPA FRS Location	303
	EPA Regulated Facility	2
	Fire Department	5
	Hospital	2
	Law Enforcement	7
	Local EOC	1
	Medical Facility	2
	National Shelter System Facility	30
	Nursing Home	9
	Private School	4
	Public Health Department	1
	School	25
	Special Medical Facility	45
	Substation	4
	Tier II	17
	Urgent Care Facility	2
	Total	**620**

Jurisdiction	Critical Facility Type	Facility Count
Edgerton	Community Support	1
	Total	**1**

Jurisdiction	Critical Facility Type	Facility Count
Evansville	Bridge	7
	Day Cares	2
	EPA FRS Location	4
	EPA Regulated Facility	1
	Fire Department	1
	Law Enforcement	1
	National Shelter System Facility	1
	School	1
	Tier II	6
	Total	**24**

Jurisdiction	Critical Facility Type	Facility Count
Midwest	Fire Department	1
	Law Enforcement	1
	National Shelter System Facility	1
	School	1
	Total	**4**

Jurisdiction	Critical Facility Type	Facility Count
Mills	Bridge	3
	Day Cares	7
	EPA FRS Location	16
	EPA Regulated Facility	4
	Fire Department	1
	Law Enforcement	1
	National Shelter System Facility	1
	School	1
	Tier II	11
	Total	**45**

Jurisdiction	Critical Facility Type	Facility Count
Unincorporated	Air Facility	6
	Bridge	110
	Day Cares	6
	Electrical Facility	8
	EPA FRS Location	196
	EPA Regulated Facility	19
	Fire Department	2
	Law Enforcement	2
	National Shelter System Facility	5
	Non-Union Communications	83
	Power Plant	1
	School	6
	Substation	10
	Tier II	120
	Union Communications	17
	Total	**591**

APPENDIX C - FLOOD EXPOSURE DETAILS

1% Annual Chance

Table A.1. Casper

Property Type	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Commercial	11	84	$5,051,721	$5,051,721	$10,103,442	$2,525,861	
Exempt	13	18	$0	$0	$0	$0	
Res Vacant Land	2	2	$0	$0	$0	$0	
Residential	462	565	$50,281,259	$25,140,630	$75,421,889	$18,855,472	1,379
Total	**488**	**669**	**$55,332,980**	**$30,192,351**	**$85,525,331**	**$21,381,333**	**1,379**

Table A.2. Evansville

Property Type	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Commercial	3	3	$1,758,803	$1,758,803	$3,517,606	$879,402	
Exempt	1	1	$0	$0	$0	$0	
Residential	1	1	$214,208	$107,104	$321,312	$80,328	2
Total	**5**	**5**	**$1,973,011**	**$1,865,907**	**$3,838,918**	**$959,730**	**2**

Table A.3. Mills

Property Type	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Commercial	7	8	$763,194	$763,194	$1,526,388	$381,597	
Exempt	2	3	$0	$0	$0	$0	
Residential	1	5	$76,673	$38,337	$115,010	$28,752	12
Total	**10**	**16**	**$839,867**	**$801,531**	**$1,641,398**	**$410,349**	**12**

Table A.4. Unincorporated

Property Type	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Com Vacant Land	5	5	$0	$0	$0	$0	
Commercial	28	73	$5,117,428	$5,117,428	$10,234,856	$2,558,714	
Exempt	3	3	$0	$0	$0	$0	
Industrial	7	9	$9,198,301	$13,797,452	$22,995,753	$5,748,938	
Multi-Use	3	10	$886,915	$886,915	$1,773,830	$443,458	
Res Vacant Land	21	26	$0	$0	$0	$0	
Residential	278	315	$34,882,224	$17,441,112	$52,323,336	$13,080,834	769

Total	345	441	$50,084,868	$37,242,907	$87,327,775	$21,831,944	781

Table A.5. 1% Annual Chance Summary by Jurisdiction

Jurisdiction	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss
Casper	488	669	$55,332,980	$30,192,351	$85,525,331	$21,381,333
Evansville	5	5	$1,973,011	$1,865,907	$3,838,918	$959,730
Mills	10	16	$839,867	$801,531	$1,641,398	$410,349
Unincorporated	345	441	$50,084,868	$37,242,907	$87,327,775	$21,831,944
Total	**848**	**1,131**	**$108,230,726**	**$70,102,695**	**$178,333,421**	**$44,583,355**

0.2% Annual Chance

Table A.6. Casper

Property Type	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Com Vacant Land	5	8	$0	$0	$0	$0	
Commercial	190	256	$69,544,805	$69,544,805	$139,089,610	$34,772,403	
Exempt	67	108	$1,095,930	$1,095,930	$2,191,860	$547,965	
Industrial	5	5	$2,107,754	$3,161,631	$5,269,385	$1,317,346	
Multi-Use	8	13	$2,978,567	$2,978,567	$5,957,134	$1,489,284	
Res Vacant Land	49	89	$0	$0	$0	$0	
Residential	1,477	1,593	$164,544,092	$82,272,046	$246,816,138	$61,704,035	3,887
Total	**1,801**	**2,072**	**$240,271,148**	**$159,052,979**	**$399,324,127**	**$99,831,032**	**3,887**

Table A.7. Evansville

Property Type	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Commercial	3	3	$355,402	$355,402	$710,804	$177,701	
Exempt	2	4	$0	$0	$0	$0	
Res Vacant Land	27	29	$0	$0	$0	$0	
Residential	224	239	$23,417,500	$11,708,750	$35,126,250	$8,781,563	583
Vacant Land	2	2	$1,245	$1,245	$2,490	$623	
Total	**258**	**$277**	**$23,774,147**	**$12,065,397**	**$35,839,544**	**$8,959,886**	**583**

Table A.8. Mills

Property Type	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population

Com Vacant Land	2	21	$0	$0	$0	$0	
Commercial	15	21	$1,388,874	$1,388,874	$2,777,748	$694,437	
Exempt	6	7	$0	$0	$0	$0	
Industrial	1	1	$3,912,380	$5,868,570	$9,780,950	$2,445,238	
Res Vacant Land	52	62	$0	$0	$0	$0	
Residential	218	267	$9,870,584	$4,935,292	$14,805,876	$3,701,469	651
Total	**294**	**$379**	**$15,171,838**	**$12,192,736**	**$27,364,574**	**$6,841,144**	**651**

Table A.9. Unincorporated

Property Type	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss	Population
Com Vacant Land	1	2	$0	$0	$0	$0	
Commercial	40	155	$11,089,932	$11,089,932	$22,179,864	$5,544,966	
Exempt	1	1	$0	$0	$0	$0	
Industrial	3	3	$2,694,324	$4,041,486	$6,735,810	$1,683,953	
Multi-Use	3	4	$400,133	$400,133	$800,266	$200,067	
Res Vacant Land	5	5	$0	$0	$0	$0	
Residential	212	229	$33,716,684	$16,858,342	$50,575,026	$12,643,757	559
Total	**265**	**$399**	**$47,901,073**	**$32,389,893**	**$80,290,966**	**$20,072,742**	**559**

Table A.10. 0.2% Annual Chance Summary by Jurisdiction

Jurisdiction	Parcel Count	Building Count	Improved Value	Est. Content Value	Total Exposure	Potential Loss
Casper	1,801	2,072	$240,271,148	$159,052,979	$399,324,127	$99,831,032
Evansville	258	277	$23,774,147	$12,065,397	$35,839,544	$8,959,886
Mills	294	379	$15,171,838	$12,192,736	$27,364,574	$6,841,144
Unincorporated	265	399	$47,901,073	$32,389,893	$80,290,966	$20,072,742
Total	**2,618**	**3,127**	**$327,118,206**	**$215,701,005**	**$542,819,211**	**$135,704,803**

Figure 1 : Casper Structures within Floodplain

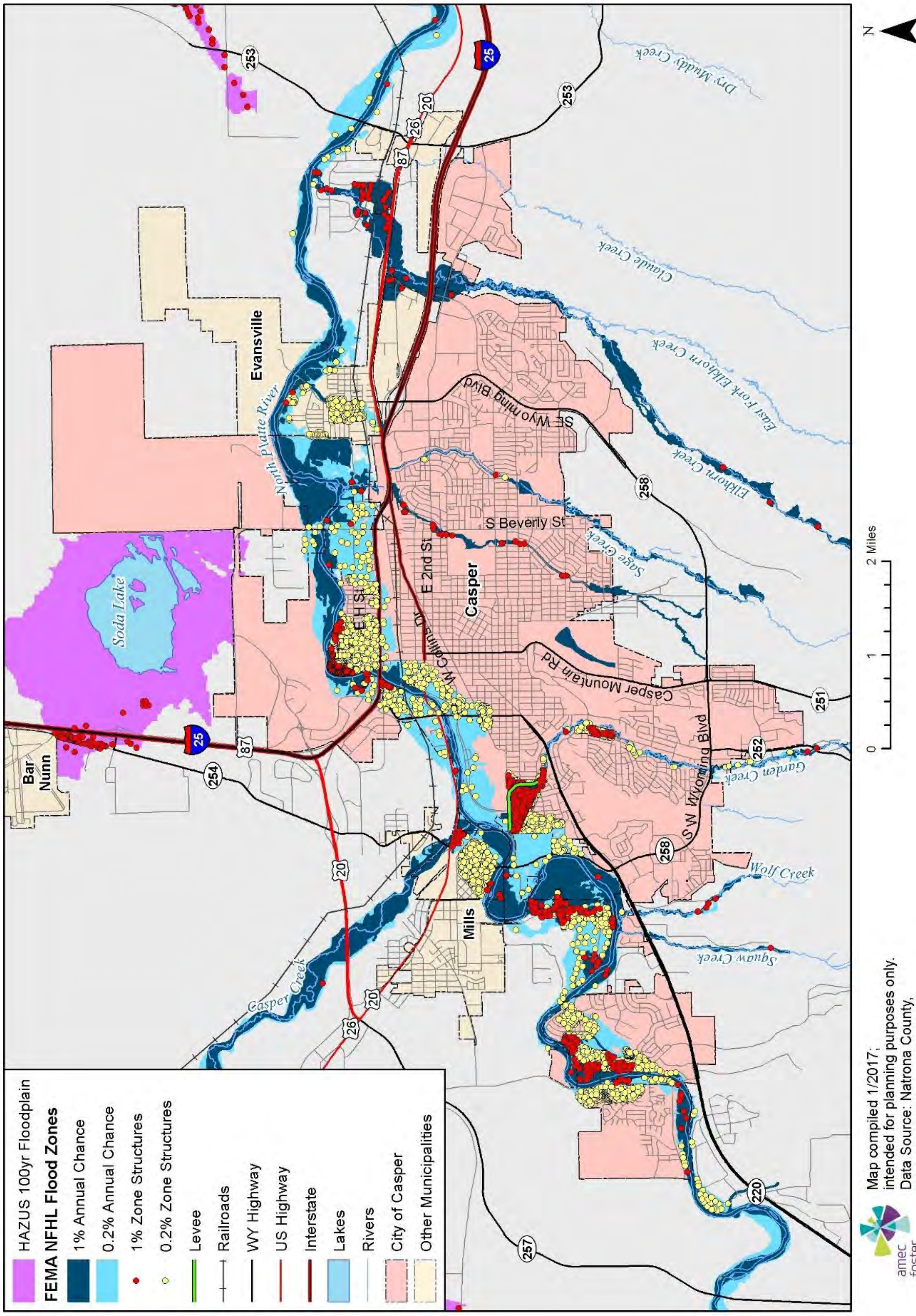


Figure 2 : Evansville Structures within Floodplain

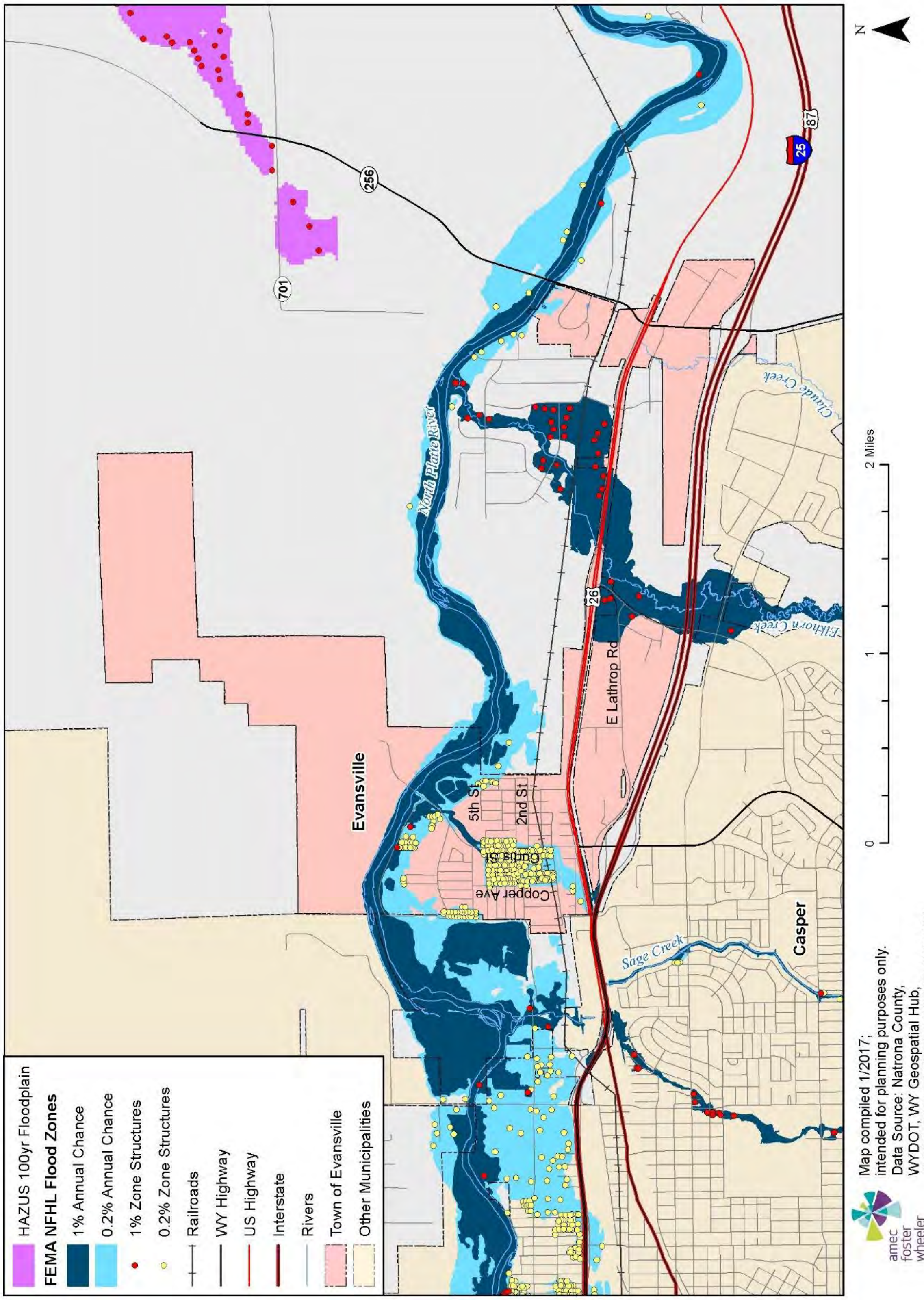
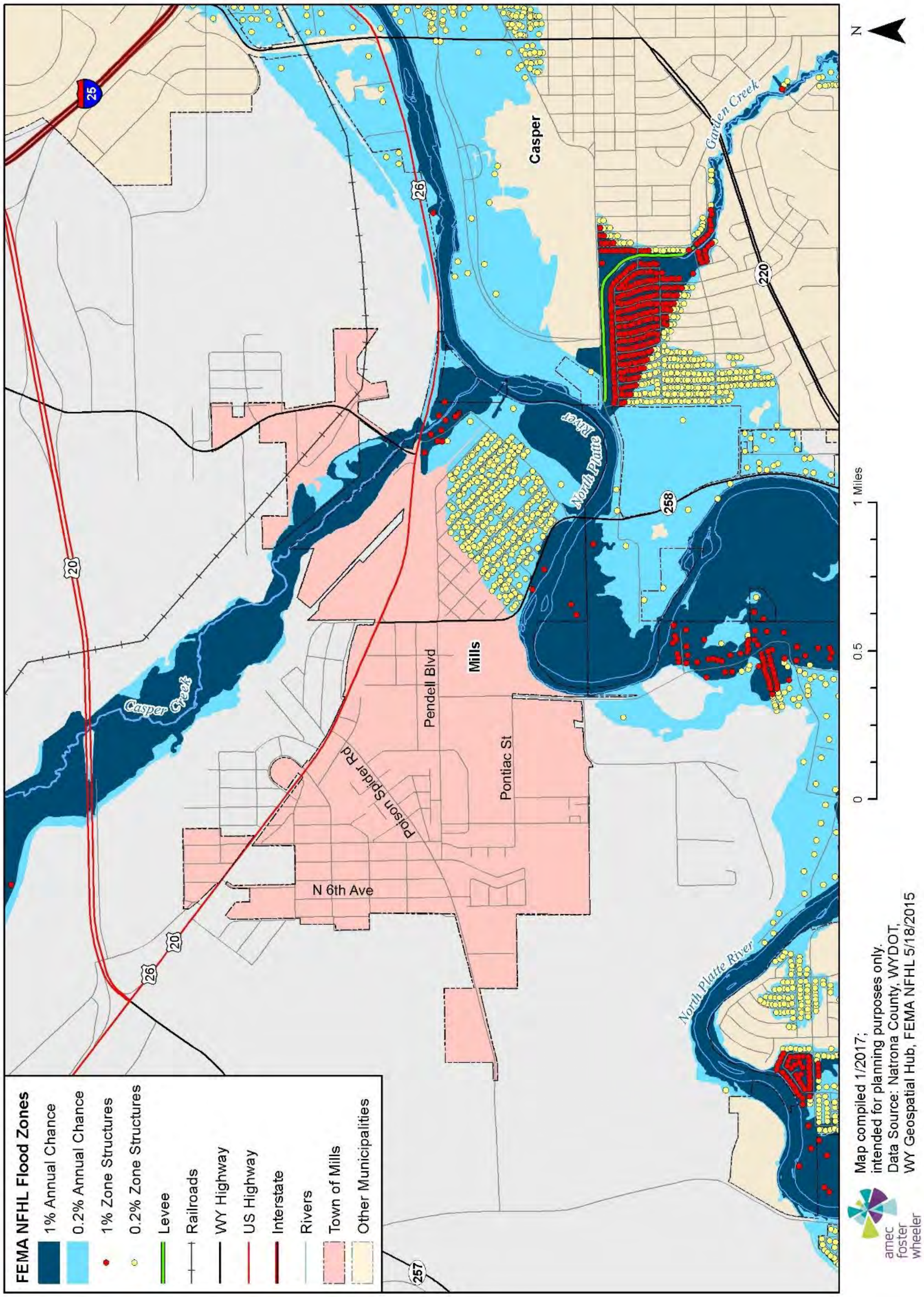


Figure 3 : Mills Structures within Floodplain



APPENDIX D - RECORD OF ADOPTION

Wyoming Region 2
Regional Hazard Mitigation Plan
Appendix A
Planning Process Documentation

Appendix C

Board of Commissioners
Converse County, Wyoming

107 No. 5th St., Suite 114 • Douglas, WY 82633-2448 • 307-358-2244 • Fax 307-358-5998
Rick Grant, Chair • Robert Sharp, Vice-Chair • Mike Colling • Tony Lehner • Jim Willox

February 10, 2016

Melinda Gibson, State Hazard Mitigation Officer
Wyoming Office of Homeland Security
5500 Bishop Boulevard
Cheyenne, WY 82002

Re: Regional Mitigation Planning

Dear Mrs. Gibson,

Please accept this letter as notice of our county's interest in participating in a regional mitigation planning effort. Our County Coordinator has explained to us this is an opportunity to participate in a regional mitigation plan, with no monetary impact to our county. This planning effort will result in a FEMA-approved regional mitigation plan, which will be in effect for five years.

We understand our county's active participation is required, and will involve working closely with the counties in our region and with a mitigation planning contractor. The contractor will do the majority of the work, with information provided through local leadership's attendance and participation in several meetings. Mitigation discussions at those meetings will inform the contractor of hazards our region, county and local jurisdictions are subject to and mitigation actions we believe will lessen the impact of those hazards on our residents.

We have also been made aware one benefit of a current, FEMA-approved mitigation plan is our eligibility to apply for federal mitigation grant funding. This opportunity will make mitigation project completion more attainable for us.

Please consider our County Coordinator, Russ Dalgarn, your point of contact for the regional mitigation planning effort. He can be reached at 358-6880. He will coordinate details as necessary to ensure our county and its jurisdictions are active participants in the regional mitigation plan.

Best Regards,

Richard C. Grant, Jr., Chairman
Board of County Commissioners

Appendix C

NIOBRARA COUNTY COMMISSIONERS

Richard A. Ladwig, Chairman | Greg B. Starck, Vice-Chair | Patrick H. Wade, Member

February 3, 2016

Melinda Gibson, State Hazard Mitigation Officer
Wyoming Office of Homeland Security
5500 Bishop Boulevard
Cheyenne, WY 82002

Re: Regional Mitigation Planning

Dear Mrs. Gibson,

Please accept this letter as notice of our county's interest in participating in a regional mitigation planning effort. Our County Coordinator has explained to us this is an opportunity to participate in a regional mitigation plan, with no monetary impact to our county. This planning effort will result in a FEMA-approved regional mitigation plan, which will be in effect for five years.

We understand our county's active participation is required, and will involve working closely with the counties in our region and with a mitigation planning contractor. The contractor will do the majority of the work, with information provided through local leadership's attendance and participation in several meetings. Mitigation discussions at those meetings will inform the contractor of hazards our region, county and local jurisdictions are subject to and mitigation actions we believe will lessen the impact of those hazards on our residents.

We have also been made aware one benefit of a current, FEMA-approved mitigation plan is our eligibility to apply for federal mitigation grant funding. This opportunity will make mitigation project completion more attainable for us.

Please consider our County Coordinator, James Santistevan, your point of contact for the regional mitigation planning effort. He can be reached at 307-340-0893. He will coordinate details as necessary to ensure our county and its jurisdictions are active participants in the regional mitigation plan.

Best Regards,

Richard A. Ladwig

County Commission Chairman

424 S. Elm St.
PO Box 420
Lusk WY 82225

A PUBLIC OFFICE IS A PUBLIC TRUST

PHONE (307) 334-2211
FAX (307) 334-3013

FEB 8 2016

Today's Agenda

- What is Hazard Mitigation?
- Process Review
- Goals Review
- Review of Current Mitigation Activities and Alternatives – Assessing Progress
- Discuss Criteria for Mitigation Action Selection and Prioritization
- Brainstorm: New Mitigation Actions
- Prioritize Mitigation Actions
- Implementation and Maintenance
- Next Steps
- Questions and Answers
- Adjourn

Wyoming Region 2
Regional Hazard Mitigation Meetings
2018 Hazard Mitigation Plan Update

June 19 – Natrona County
June 20 – Converse County
June 21 – Niobrara County

Introduction and Opening Remarks

Each county's meeting began with opening remarks from the County Emergency Management Coordinator. Kyle Karsjen, project manager with Wood plc, began with welcoming remarks. Kyle asked everyone at each meeting to go around the room to introduce themselves. Attendance was documented on sign-in sheets attached to these meeting minutes. Handout materials were provided.

Kyle presented the PowerPoint slide deck that outlined the meeting agenda and topics. The topics for each meeting were:

- Review the hazard analysis and risk assessment
- Review existing plan goals
- Report on current hazard mitigation activities
- Identify new mitigation actions
- Discuss and verify plan implementation and maintenance

Review of the Planning Process

Kyle reviewed the planning process that has taken place so far for each county, including progress on the Hazard Identification and Risk Assessment (HIRA) and other plan elements. With each county's plan being completed recently, the meeting functioned as a review of progress made and a chance to make changes based on plan implementation progress.

Kyle noted the results of the online regional public survey, which had 104 responses at the time of these meetings. Among the results, the primary findings of the survey relate to the public's belief on what is considered the highest natural threat to the community, as well as the perception of what types of hazard mitigation projects should be the focus of the HMPC's work.

Kyle reviewed the findings of the process up to the point of the meeting, including the draft hazard identification and risk assessment. At each meeting, the HMPCs walked through high-level results of the hazard analysis and risk assessment and were asked to review the document in full once published.

Plan Goals

Kyle reviewed the mitigation goals identified in each county's plan; no HMPC made changes to existing goals. The goals will be included in the updated plan for review by the HMPC, during which there will be opportunity for final review and comment.

Review of Possible Mitigation Activities and Alternatives

Kyle presented information on typical mitigation activities and alternatives and referred to handouts with further details and guidance. Kyle outlined potential project criteria and action requirements, including the requirements of the Disaster Mitigation Act of 2000. Each hazard must have at least one true mitigation action (not preparedness) pertaining to them. Another reference document titled "Mitigation Ideas" developed by FEMA was suggested at the meeting, which can be found online at https://www.fema.gov/media-library/assets/documents/30627. This reference discusses the common alternatives and best practices for mitigation by hazard.

Action Prioritization

The group was provided with decision-making tools to consider when prioritizing the actions. This including FEMA's recommended criteria, STAPLE/E (which considers social, technical, administrative, political, legal, economic, and environmental constraints and benefits). Other criteria used to recommend what actions might be more important, more effective, or more likely to be implemented than another included:

- Does action protect lives?
- Does action address hazards or areas with the highest risk?
- Does action protect critical facilities, infrastructure or community assets?
- Does action meet multiple objectives (Multiple Objective Management)?

Actions continuing from each county's plan were reviewed for relative priority (high, medium, low). Any new actions developed will also need a relative prioritization based on these criteria.

Review of progress on previous plan actions and identification of new actions

Each County's existing hazard mitigation strategies were presented to their respective HMPCs; each group walked through each action and noted any progress from the last plan's finalization. The group was provided a handout as a reference; the handout provided a bulleted summary of the findings of the HIRA, a list of mitigation actions identified in each county's current plan, and potential new mitigation measures. Using this information, the HMPC was given the opportunity to add any new mitigation measures to the mix. New mitigation actions were then prioritized.

One of the takeaways from the public survey was that the public is interested in being provided information on hazards that pose a risk to where they live. In response to this, each county added a new mitigation measure on public information that will provide:

- Information on community-specific risks from the hazard mitigation plan
- Information on citizen-based actions that can be taken to reduce personal risk

County-specific mitigation actions that were added to the plan are as follows:

Natrona County

Hazard	Added Mitigation Actions
Dam failure	• Public information campaign to increase public awareness on dam failure risk in the County
Drought	• Public information campaign to increase public awareness on drought risk in the County
Earthquake	• Public information campaign to increase public awareness on earthquake risk in the County
Expansive Soil	• Public information campaign to increase public awareness on expansive soils risk in the County
Flood	• Public information campaign to increase public awareness on flood risk in the County
Hazardous Materials	• Public information campaign to increase public awareness on hazardous materials risk in the County
Hail	• Public information campaign to increase public awareness on hail risk in the County
High Wind and Downburst	• Public information campaign to increase public awareness on high wind and downburst risk in the County
Landslide, Rockfall and Debris Flow	• Public information campaign to increase public awareness on landslide, rockfall and debris flow risk in the County
Lightning	• Public information campaign to increase public awareness on lightning risk in the County
Tornado	• Public information campaign to increase public awareness on tornado risk in the County
Wildfire	• Public information campaign to increase public awareness on wildfire risk in the County
Winter Weather	• Public information campaign to increase public awareness on severe winter weather risk in the County

Converse County

Hazard	Added Mitigation Actions
Dam failure	• Public information campaign to increase public awareness on dam failure risk in the County
Drought	• Public information campaign to increase public awareness on drought risk in the County
Earthquake	• Participate in Great Wyoming Shakeout statewide earthquake drill, and encourage schools to participate as well • Public information campaign to increase public awareness on earthquake risk in the County
Expansive Soil	• Continue soils testing for expansive soils in Glenrock and Douglas in identified risk areas • Public information campaign to increase public awareness on expansive soils risk in the County
Flood	• Remove debris from storm sewers, culverts and other waterways • Public information campaign to increase public awareness on flood risk in the County
Hazardous Materials	• Public information campaign to increase public awareness on hazardous materials risk in the County
Hail	• Public information campaign to increase public awareness on hail risk in the County
High Wind and Downburst	• Continue 50/50 tree trimming program in Glenrock and Douglas • Public information campaign to increase public awareness on high wind and downburst risk in the County
Landslide, Rockfall and Debris Flow	• Public information campaign to increase public awareness on landslide, rockfall and debris flow risk in the County
Lightning	• Public information campaign to increase public awareness on lightning risk in the County

Tornado	• Review the need for saferooms in rural schools, develop an implementation plan and investigate funding availability and feasibility • Public information campaign to increase public awareness on tornado risk in the County
Wildfire	• Public information campaign to increase public awareness on wildfire risk in the County
Winter Weather	• Continue programs across the County to subsidize water usage during winter months to prevent frozen pipes, and ensure these programs are publicized • Public information campaign to increase public awareness on severe winter weather risk in the County

Niobrara County

Hazard	Added Mitigation Actions
Dam failure	• Public information campaign to increase public awareness on dam failure risk in the County
Drought	• Implement a process to encourage water conservation across the county and its communities during times of drought; educate citizens on water conservation techniques • Finalize voluntary database of access and functional needs populations for first responders • Public information campaign to increase public awareness on drought risk in the County • Establish standards for sending public notices on water restrictions
Earthquake	• Public information campaign to increase public awareness on earthquake risk in the County
Expansive Soil	• Public information campaign to increase public awareness on expansive soil risk in the County

Flood	• Public information campaign to increase public awareness on flood risk in the County
Hazardous Materials	• Public information campaign to increase public awareness on hazardous materials risk in the County
Hail	• Public information campaign to increase public awareness on hail risk in the County
High Wind and Downburst	• Public information campaign to increase public awareness on high wind and downburst risk in the County
Landslide, Rockfall and Debris Flow	• Public information campaign to increase public awareness on landslide, debris flow and rockfall risk in the County
Lightning	• Back up government records in case of lightning strikes • Public information campaign to increase public awareness on lightning risk in the County
Tornado	• Public information campaign to increase public awareness on tornado risk in the County • Identify possible location for tornado/all weather shelters
Wildfire	• Public information campaign to increase public awareness on wildfire risk in the County
Winter Weather	• Public information campaign to increase public awareness on winter weather risk in the County

Implementation and Maintenance
Following a group discussion on mitigation actions, each county's HMPC reviewed the existing implementation and maintenance language in previous county plans. Each county's HMPC reviewed this language and finalized the specific actions the county would take to ensure that the plan is implemented effectively over the next five years.

Next Steps
Kyle wrapped up each meeting with next steps, which are:

- The HIRA is now posted on Google Drive at https://drive.google.com/open?id=1-rj3NEzIwIV_XBKFmvuMuw5GHjJDKm7K. Please review the document and provide any comments back by **July 13, 2018** (please note revised date).

- Kyle will work through the county emergency management coordinators for any additional information necessary for plan finalization.
- HMPCs will be provided an opportunity to review other plan elements as they are published.

Public Meetings

Following its HMPC meeting, each county held a public meeting to give the public the opportunity to provide input and comment, and to learn more about the planning process and the purpose of the hazard mitigation plan. Each meeting had 1-2 members of the public attend. Each meeting was geared toward attendees specific concerns, and how those concerns related to hazard mitigation planning.

SIGN-IN SHEET
Region 2 Hazard Mitigation Plan Update Project
Niobrara County Update Meeting - June 21st, 2018

Name	Email Address	Title	Organization	Jurisdiction
Jacob Gordon	jgordon@townoflusk.org	Officer	Lusk PD	Town of Lusk
Matt Smith	msmith@luskwyopd.org	Officer	Lusk PD	Town of Lusk
Amanda Kraft	amanda.kraft@wyo.gov	Lieutenant	Dept. of Corrections	Wyo. Women's Center
Doug Lytle	Lytle75@yahoo.com	Mayor	Town of Lusk	Town of Lusk
Cory Wilcox	LuskAmbulance@Gmail	EMS	Town of Lusk	Town of Lusk
Todd Skrukrud	Pworkstownoflusk@gmail	PWD	Town of Lusk	Town of Lusk
Calvin Carstensen	C.Carstensen@townofLusk.org [redacted]	Council	Town of Lusk	Lusk
Kelly Dean	Kdean@niobraracounty.org	Deputy	Niobrara Co. Sheriff	Niobrara
JOHN P. MIDKIFF	midkiff@wyoming.com	COMMISSIONER	NIOBRARA	—
Pat Wade	pwadecc@gmail.com	Commissioner	Niobrara	Niobrara
Richard A. Ladwig	rfsupply59@gmail.com	Commissioner	Niobrara	Niobrara
Jackie King	Jackie.King@mail.house.gov	Dep. State Director	Liz Congresswoman Cheney	Niobrara, Converse, Natrona
Justin Rogers	justin_rogers@enzi.senate.gov	Field Representative	Senator Enzi	Carbon, Converse, Natrona, Niobrara
Heather Saul	heather.saul@wyo.gov	Public Health Response Coord.	Niobrara Public Health	Niobrara/Goshen
James SANTISTEVAN	niobraracountyema@gmail	EMA	Niobrara County EMA	Niobrara County

wood.

Public Meeting 6-21-18

Regional Hazard Mitiagtion Plan

Sign IN Sheet

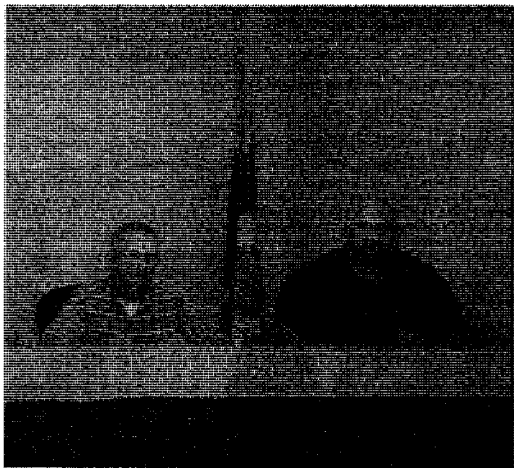
James SANTISTEVAN Niobrara County EMA

Elaine Sednek

Richard A Ladwig Niobrara County Commission

JOHN P. MIDKIFF NIOBRARA COUNTY COMMISSIONER

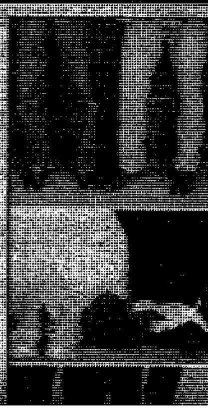
Pat Wade "



...uncilman Mark Kupke, center, finish... town... Councilwoman Becky Blackburn, left, and... ...eir positions for the Town of Lusk.
Photo/Lori Himes

Councilwoman Becky Blackburn, Mayor Doug Lytle, Councilman Tom Dooper and Councilman Cal Carstensen take their oaths of office. R. Dean Nelson was named as councilman to fill the position vacated by Mayor Lytle.
Photo/Lori Himes

Councilmembers Darlene Adams and Billy Hite were sworn in by Manville Mayor Rola Ross, while outgoing board member Jeremy Nasland looks on.
Photo/Lori Himes



SIGN-IN SHEET
Regional Hazard Mitigation Committee Meeting
June 19, 2018 2:00 pm to 5:00 pm
NCSO, EOC, 201 N. David, Casper, WY

Name	Email Address	Phone	Jurisdiction/Department/Organization	Title
Jesse Henderson	Jesse.henderson@BlackhillsCorp.Com	262-4700	Black Hills Energy	Gas Operations Supervisor
Lori Neibauer	Lori.neibauer@blackhillscorp.com	307-262-0582	Black Hills Energy	Utility Construction Planner
Tim Morgan	timothy.Morgan@blackhillscorp.com	307-358-3683	Black Hills Energy	Operation Supervisor
JOHN HARLIN	harlinj@natronacounty-wy.gov	307 235-9205	NATRONA COUNTY EMERGENCY MGMT.	COORDINATOR
Audrey Gray	agray@cnchd.org	307-577-9737	publichealth preparedness manager.	CNCHD.
H.H. "BUCK" KING JR	hhbuckking@yahoo.com	307/473-6763	TOWN MAYOR	MAYOR
JEROME FLORES	jflores@SINCLAIROIL.Com	(307)320-6337	SINCLAIR TRANS. Co.	SAFETY + REG. Comp.
Paula Reece	preece@natronaCounty-wy.goV	307-235-9406	NC GIS Dept	GIS Specialist
Steven Rud	srud@wyomingmedicalcenter.org	307577-2102	Wyoming Medical center Ambulance	Ambulance Manager
Collin Baldacci	cbaldacci@wyomingmedicalcenter.org	307-577-2623	Wyoming Medical Center Disaster	Disaster Specialist
Mark Harshman	mharshman@casperwy.gov	307-235-8324	City of Casper FD	Deputy Chief

SIGN-IN SHEET
Regional Hazard Mitigation Public Meeting
June 19, 2018 6:00 pm to 8:00 pm
NCSO, EOC, 201 N. David, Casper, WY

Name	Email Address	Phone	Jurisdiction/Department/Organization	Title
~~Paula Reece~~	~~preece@natronacounty-wy.gov~~	~~307-235-9406~~	~~NC GIS Dept~~	~~GIS Specialist~~
Kerrie Langmade	Klangmade1@gmail.com	262-3948	NCSD #1	Crisis Leader/teacher
JACKIE KING	Jackie.King@mail.house.gov	261-5585	Natrona, Converse Niobrara	Dep State Dir Congresswoman Cheney
Callie Baldacci	cbaldacci@wyomingmedicalcenter.org	577-2623	Wyoming Med Center	Disaster Coordinator

SIGN-IN SHEET
Region 2 Hazard Mitigation Plan Update Project
Converse County Update Meeting - June 20th, 2018

Name	Email Address	Title	Organization	Jurisdiction
Mary Schell	maryschell@conversecountywy.gov	AA	CCEMA	Converse
Nick Larramendy	nick.larramendy@wyo.gov	DHRC	CCPH	Converse
Russ Dalgarn	russ.dalgarn@conversecountywy.gov	EMA Coordinator	EMA	Converse
Melanie Cielinski	mcielinski@glenrockhealth.com	Admin.	Glenrock Health Center	"
Joe Perko	jrperko@[illegible].com	Water Op	Town of Rolling Hills	"
Jacque Stoldt	jacquestoldtrhe@gmail.com	Councilperson	" "	"
Jerome Flores	jflores@sinclairoil.com	Safety & Reg. Comp.	Sinclair Trans. Co.	

wood.

SIGN-IN SHEET
Region 2 Hazard Mitigation Plan Update Project
Converse County Update Meeting - June 20th, 2018

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wood.

CONVERSE COUNTY HAZARD MITIGATION PLAN - PUBLIC MEETING

JUNE 20, 6-8 PM

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Converse County
Hazard Identification & Risk Assessment Summary

Hazard	Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Significance
Dam Failure	Limited	Occasional	Critical	Medium
Drought	Significant	Likely	Critical	High
Earthquake	Limited	Occasional	Critical	High
Expansive Soils	Limited	Likely	Negligible	Low
Flood	Limited	Likely	Limited	Medium
Hail	Significant	Likely	Limited	Medium
Hazardous Materials	Significant	Highly Likely	Limited	Medium
High Winds/ Downbursts	Significant	Likely	Negligible	Medium
Landslide/Rockfall/Debris Flow	Limited	Unlikely	Limited	Low
Lightning	Significant	Occasional	Limited	Low
Mine & Land Subsidence	Significant	Occasional	Negligible	Low
Severe Winter Weather	Significant	Highly Likely	Limited	High
Tornado	Significant	Occasional	Limited	Medium
Wildfire	Significant	Highly Likely	Critical	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Probability of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

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Dam Failure Risk Summary

- 1 high hazard dam (LaPrele), and 7 significant hazard dams impacting the county
- Douglas is potentially at risk from 6 of those 8 high/significant hazard dams
- 4 of the 8 high/significant hazard dams are more than 50 years old
- LaPrele has an Emergency Action Plan, but the 7 significant hazards dams do not
- Low probability, but high potential consequence

Possible Mitigation Actions:

- Increase risk awareness of potential dam failure impacts

Drought Risk Summary

- 6 multi-year droughts since 1895
- The 2000-2004 drought is considered by many to be the most severe in collective memory; economic loss statewide was over $961M
- From 1895-1995, the County had 1 drought per 20 years; since 1995, that has increased to one every 2.2 years

Possible Mitigation Actions:

- Require or encourage water conservation during drought conditions
- Encourage activities to prevent overgrazing
- Educate residents on water saving techniques
- Educate farmers on soil and water conservation practices
- Develop a plan to provide cooling centers
- Create a voluntary database of access and functional needs populations for first responders
- Develop a community network to contact and assist vulnerable persons (such as the elderly or homebound) during extreme heat events
- Increase risk awareness of drought and its potential impacts

Earthquake Risk Summary

- No active faults have been identified in Converse County
- Converse County has had 16 earthquakes since 1947, ranging from magnitude 2.9 to 5.5
- 2500-Year Probabilistic Scenario Loss Estimate for Converse County is $50M

Possible Mitigation Actions:

- Adopt and enforce building codes
- Conduct inspections of buildings for safety
- Protect critical facilities and infrastructure from the impacts of earthquakes
- Implement structural mitigation techniques for earthquakes
- Increase risk awareness of the potential impacts of earthquakes, including potential mitigation measures
- Conduct outreach to builders, architects, engineers, and inspectors on potential mitigation measures for an earthquake
- Provide information on structural and non-structural retrofitting

Expansive Soils Risk Summary

- Less than 1% of County is susceptible to expansive soils
- Buildings vulnerable to expansive soils = $54,641
- Critical facilities vulnerable to expansive soils = 4 bridges

Possible Mitigation Actions:

- Manage development in hazard areas
- Increase risk awareness of expansive soils, identified hazard areas and potential mitigation alternatives

Flood Risk Summary

- 17 significant flood events since 1941, averaging 1 every 4.5 years
- $1.2M total reported property damage
- 100-year flood plain: 239 parcels; 462 exposed population; $20M exposed property
- 500-year flood plain: 274 parcels; 551 exposed population; $71M exposed property
- 31 total NFIP policies, with 5 claims paid
- Critical facilities in 100-year flood plain include communications towers, electric substation, power plants, and a fire station

Possible Mitigation Actions:

- Elevate or retrofit structures and utilities
- Remove existing structures from flood hazard areas
- Protect and restore natural flood mitigation measures
- Adopt and enforce building codes and development standards
- Improve stormwater management planning
- Improve stormwater drainage system capacity
- Adopt policies to reduce stormwater runoff
- Improve compliance with NFIP above minimum requirements
- Participate in the Community Rating System (CRS)
- Educate property owners about flood risk and mitigation techniques
- Increase risk awareness on floods, flood hazard areas and potential mitigation measures

Hail Risk Summary

- 104 recorded hail events (1950-2016), causing 1 injury, $100,000 damage
- Most common May through August, between 1 pm and 10 pm
- Hail less than 2” is most common; up to 2.75” has been recorded

Possible Mitigation Actions:

- Locate/identify safe rooms and other types of shelter
- Ensure that parks and other open spaces have accessible shelter close at hand in case of severe weather
- Protect buildings from hail damage
- Increase risk awareness of hail and its potential impacts

Converse County
Hazard Identification & Risk Assessment Summary

Hazardous Materials Hazard Risk Summary

- 45 incidents report to NRC, 2000-2016, averaging 4.5 per year
- Occur year-round, with a slight increase in the warmer months
- Most common 5:00am to 6:00pm, peaking in the 9 AM hour
- 48% of spills are motor vehicle incidents
- 6 Risk Management Plan (RMP) Facilities and 10 licensed waste handlers

Possible Mitigation Actions:

- Update land use plan and zoning ordinance to ensure industrial uses are separated from residential uses, densely developed areas, and uses with vulnerable populations such as schools or nursing homes
- Ensure a Local Emergency Planning Committee is active and an emergency plan is prepared and up to date
- Identify brownfield sites and seek grant funding for mitigation
- Increase risk awareness of hazardous materials around the county

High Winds & Downbursts Risk Summary

- 19 recorded high wind events (1950-2016): 52.4 knots average, 71 knots max
- $60,000 reported property damage; no reported injuries or fatalities
- Most common June to August, between 2:00 pm and 10:00 pm
- Damages include downed power lines, damage to roofs & buildings, downed tree limbs, & debris

Possible Mitigation Actions:

- Adopt and enforce building codes and design standards
- Protect power lines and infrastructure from high winds
- Ensure that parks and other open spaces have accessible shelter close at hand in case of severe weather
- Retrofit residential/public buildings to withstand high winds
- Conduct regular tree trimming maintenance to protect power lines
- Increase risk awareness of high winds

Landslide, Rockfall, Debris Flow Risk Summary

- Minimal risk in Converse County
- Potential impacts to I-25, Highway 18, State Highway 59

Possible Mitigation Actions:

- Manage development in identified hazard areas
- Prevent/mitigate impacts to roadways
- Remove existing buildings and infrastructure from identified hazard areas
- Increase risk awareness

Lightning Risk Summary

- Average lightning flash density varies from 1.5 to 6 flashes per square mile per year
- 9 damaging strikes recorded 1960-2015; $352,339 total damage
- 3 fatalities: in 1960, 1973, and 1976

Possible Mitigation Actions:

- Protect critical facilities and equipment from lightning strikes
- Ensure that parks and other open spaces have accessible shelter close at hand in case of severe weather
- Increase risk awareness of lightning and its potential impacts

Mine/Land Subsidence Risk Summary

- Several abandoned coal mines susceptible to subsidence
- Risk to Glenrock is high
- Wyoming Mine Subsidence Insurance Program may provide some assistance

Possible Mitigation Actions:

- Manage development in high-risk areas
- Remove existing structures and infrastructure from hazard areas
- Increase risk awareness, including potential impacts and areas of greatest risk

Severe Winter Weather Risk Summary

- Includes blizzard, extreme cold, heavy snow, ice storm, winter storm
- Since 1996: 48 winter storms, 8 Extreme Cold, 0 Ice Storms
- No injuries, fatalities, or damages reported
- Winter low temperatures average 13°F; lowest recorded is -43°F (1919)
- Average 180 days per year with low temperatures below 32°F

Possible Mitigation Actions:

- Adopt and enforce building codes and design standards
- Protect buildings, power lines, infrastructure from severe winter weather and its impacts
- Conduct regular tree trimming maintenance to protect power lines
- Identify potential warming shelters for persons for protection from the impacts of severe winter weather
- Educate property owners about freezing pipes
- Increase risk awareness of severe winter weather

Tornado Risk Summary

- 34 tornado touchdowns reported in county (1950-2016)
- 8 damaging tornadoes caused $205,150 damage and 5 injuries
- Highest rated was F2 in 1982: winds 113-157 mph
- Most common May-July; prime hours are between 3:00 pm to 9:00 pm

Possible Mitigation Actions:

- Adopt and enforce building codes and design standards
- Protect buildings, power lines, infrastructure
- Encourage construction of safe rooms
- Increase risk awareness

Converse County
Hazard Identification & Risk Assessment Summary

Wildfire Hazard Risk Summary

- 29 recorded fires of 1000+ acres since 1980 (average of 0.78 per year)
- 2006 Boner fire was largest to date: 53,930 acres
- Several areas of concern, including Rolling Hills, Glenrock, & SE tip of county
- Total Redzone exposure: 553 parcels, $144M value, population of 1230
- Critical facilities at risk include electric substations, power plants, communications towers, and fire stations

Possible Mitigation Actions:

- Update zoning ordinance to specify conditions for development in the Interface and Intermix
- Adopt growth management strategies to limit expansion in Interface and Intermix areas
- Encourage fire-resistant construction techniques
- Create buffers around critical facilities and infrastructure
- Retrofit critical facilities and infrastructure with ignition-resistant materials
- Design and implement a fuels management program
- Reduce risk through land use planning
- Encourage homeowners in wildfire risk areas to implement home wildfire mitigation techniques, and provide guidance on these activities
- Increase risk awareness

All Hazards/Other Hazards

Possible Mitigation Actions:

- Develop a capital improvements plan to fund improvements to failing infrastructure
- Purchase backup generators for critical facilities

Natrona County
Hazard Identification & Risk Assessment Summary

Hazard	Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Significance
Dam Failure	Limited	Occasional	Critical	Medium
Drought	Significant	Likely	Critical	High
Earthquake	Significant	Occasional	Critical	High
Expansive Soils	Negligible	Likely	Negligible	Low
Flood	Significant	Likely	Critical	High
Hail	Significant	Likely	Limited	Medium
Hazardous Materials	Significant	Highly Likely	Limited	Medium
High Winds/ Downbursts	Significant	Likely	Negligible	Medium
Landslide/Rockfall/Debris Flow	Limited	Occasional	Limited	Medium
Lightning	Significant	Likely	Limited	Medium
Mine & Land Subsidence	Limited	Occasional	Negligible	Low
Severe Winter Weather	Significant	Highly Likely	Limited	High
Tornado	Significant	Occasional	Limited	Medium
Wildfire	Significant	Likely	Critical	High

<u>Geographic Extent</u>
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

<u>Probability of Future Occurrences</u>
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

<u>Magnitude/Severity</u>
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

<u>Significance</u>
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

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Dam Failure Risk Summary

- 8 high hazard dams, and 11 significant hazard dams impacting the county
- All high hazard dams have Emergency Action Plans except Spring Creek
- Casper is potentially at risk from 12 of those 19 high/significant hazard dams
- 13 of the 19 high/significant hazard dams are more than 50 years old
- Alcova & Pathfinder dams are both located close to active faults
- Pathfinder dam has overtopped 4 times in the last 3 decades
- Low probability, but high potential consequence

Completed Mitigation Actions:
- None

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Increase risk awareness of potential dam failure impacts

Drought Risk Summary

- 6 multi-year droughts since 1895
- The 2000-2004 drought is considered by many to be the most severe in collective memory; economic loss statewide was over $961M
- From 1895-1995, the County had 1 drought per 20 years; since 1995, that has increased to one every 2.2 years

Completed Mitigation Actions:
- None

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Require or encourage water conservation during drought conditions
- Encourage activities to prevent overgrazing
- Educate residents on water saving techniques
- Educate farmers on soil and water conservation practices
- Develop a plan to provide cooling centers
- Create a voluntary database of access and functional needs populations for first responders
- Develop a community network to contact and assist vulnerable persons (such as the elderly or homebound) during extreme heat events
- Increase risk awareness of drought and its potential impacts

Earthquake Risk Summary

- Cedar Ridge-Dry Fork fault system, capable of generating up to a 6.7 earthquake
- North Granite Mountains fault system not confirmed as active
- 7 earthquakes since 1993, ranging from magnitude 2.5 to 3.7
- 2500-Year Probabilistic Scenario Loss Estimate for county is $268M, 60-70 casualties

Completed Mitigation Actions:

- None

Current Mitigation Actions:

- None

Possible Mitigation Actions:

- Adopt and enforce building codes
- Conduct inspections of buildings for safety
- Protect critical facilities and infrastructure from the impacts of earthquakes
- Implement structural mitigation techniques for earthquakes
- Increase risk awareness of the potential impacts of earthquakes, including potential mitigation measures
- Conduct outreach to builders, architects, engineers, and inspectors on potential mitigation measures for an earthquake
- Provide information on structural and non-structural retrofitting

Expansive Soils Risk Summary

- Only 2% of County is susceptible to expansive soils
- Buildings vulnerable to expansive soils = $1.1B, the highest in the state
- 607 critical facilities vulnerable to expansive soils

Completed Mitigation Actions:

- None

Current Mitigation Actions:

- None

Possible Mitigation Actions:

- Manage development in hazard areas
- Increase risk awareness of expansive soils, identified hazard areas and potential mitigation alternatives

Flood Risk Summary

- 36 significant flood events since 1961, averaging 1.5 per year
- $11M total reported property damage
- 100-year flood plain: 1131 parcels; 2161 exposed population; $178M exposed property
- 500-year flood plain: 3127 parcels; 5680 exposed population; $543M exposed property
- 259 total NFIP policies, with 21 claims paid

- Critical facilities in 100-year flood plain include communications towers, electric substation, power plants, and a fire station

Completed Mitigation Actions:
- NC-1: Updated floodplain mapping

Current Mitigation Actions:
- C-2: Industrial Avenue Storm Sewer Improvements
- C-3: Emigrant Gap Draw Channel Improvements
- C-4: Sun Drive Detention Pond on Sage Creek
- C-5: Eastdale Creek Diversion to Sage Creek
- C-6: North Platte River Restoration
- C-10: Flood Hazard Notification and Education
- M1: Chamberlain Street bank stabilization
- E1: Stabilization of ditch bank and installation of storm sewer pipe along the existing drainage
- E4: Address evacuation of Evansville due to Train Derailment or other hazards, including developing an alternate route

Possible Mitigation Actions:
- Elevate or retrofit structures and utilities
- Remove existing structures from flood hazard areas
- Protect and restore natural flood mitigation measures
- Adopt and enforce building codes and development standards
- Improve stormwater management planning
- Improve stormwater drainage system capacity
- Adopt policies to reduce stormwater runoff
- Improve compliance with NFIP above minimum requirements
- Participate in the Community Rating System (CRS)
- Educate property owners about flood risk and mitigation techniques
- Increase risk awareness on floods, flood hazard areas and potential mitigation measures

Hail Risk Summary
- 126 recorded hail events (1950-2016), causing 1 injury, $125,000 damage
- Most common May through August, between 1 pm and 10 pm
- Hail less than 2” is most common; up to 2.75” has been recorded

Completed Mitigation Actions:
- None

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Locate/identify safe rooms and other types of shelter
- Ensure that parks and other open spaces have accessible shelter close at hand in case of severe weather
- Protect buildings from hail damage
- Increase risk awareness of hail and its potential impacts

Hazardous Materials Hazard Risk Summary
- 309 incidents report to NRC, 2000-2016, averaging 4.5 per year
- Steep decline from 70+ incidents per year before 2009, to 7-8 per year since 2014
- Occur year-round, with a slight increase in the warmer months
- Most common 5:00am to 6:00pm, peaking in the 9 AM hour
- 84% of spills are storage tanks and fixed sites
- 4 Risk Management Plan (RMP) Facilities and 31 licensed waste handlers

Completed Mitigation Actions:
- None

Current Mitigation Actions:
- E4: Address evacuation of Evansville due to Train Derailment or other hazards, including developing an alternate route
- BN1: Develop additional emergency access/egress for Bar Nunn

Possible Mitigation Actions:
- Update land use plan and zoning ordinance to ensure industrial uses are separated from residential uses, densely developed areas, and uses with vulnerable populations such as schools or nursing homes
- Ensure a Local Emergency Planning Committee is active and an emergency plan is prepared and up to date
- Identify brownfield sites and seek grant funding for mitigation
- Increase risk awareness of hazardous materials around the county

High Winds & Downbursts Risk Summary
- 93 recorded high wind events (1950-2016): 52.9 knots average, 70 knots max
- $145,500 reported property damage; no reported injuries or fatalities
- Most common June to August, between 2:00 pm and 10:00 pm
- Damages include downed power lines, damage to roofs & buildings, downed tree limbs, & debris

Completed Mitigation Actions:
- None

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Adopt and enforce building codes and design standards
- Protect power lines and infrastructure from high winds
- Ensure that parks and other open spaces have accessible shelter close at hand in case of severe weather
- Retrofit residential/public buildings to withstand high winds
- Conduct regular tree trimming maintenance to protect power lines
- Increase risk awareness of high winds

Landslide, Rockfall, Debris Flow Risk Summary
- Unincorporated areas are most at risk
- Key areas: north side of Casper Mountain where homes are located, along Hwy 220, and the Wolf Creek drainage

Completed Mitigation Actions:
- None

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Manage development in identified hazard areas
- Prevent/mitigate impacts to roadways
- Remove existing buildings and infrastructure from identified hazard areas
- Increase risk awareness

Lightning Risk Summary
- Average lightning flash density varies from 1.5 to 6 flashes per square mile per year
- 13 damaging strikes recorded 1960-2015
- 3 injuries, no fatalities, $362,771 total damage

Completed Mitigation Actions:
- None

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Protect critical facilities and equipment from lightning strikes
- Ensure that parks and other open spaces have accessible shelter close at hand in case of severe weather
- Increase risk awareness of lightning and its potential impacts

Mine/Land Subsidence Risk Summary

- Several abandoned mines susceptible to subsidence
- Wyoming Mine Subsidence Insurance Program may provide some assistance

Completed Mitigation Actions:
- None

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Manage development in high-risk areas
- Remove existing structures and infrastructure from hazard areas
- Increase risk awareness, including potential impacts and areas of greatest risk

Severe Winter Weather Risk Summary

- Includes blizzard, extreme cold, heavy snow, ice storm, winter storm
- Since 1996: 159 winter storms, 1 Extreme Cold, 0 Ice Storms
- 1 injury, 0 fatalities, $3M damages reported
- Winter low temperatures average 14.8°F; lowest recorded is -41°F (1990)
- Average 180 days per year with low temperatures below 32°F

Completed Mitigation Actions:
- None

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Adopt and enforce building codes and design standards
- Protect buildings, power lines, infrastructure from severe winter weather and its impacts
- Conduct regular tree trimming maintenance to protect power lines
- Identify potential warming shelters for persons for protection from the impacts of severe winter weather
- Educate property owners about freezing pipes
- Increase risk awareness of severe winter weather

Tornado Risk Summary

- 33 tornado touchdowns reported in county (1950-2016)
- 12 damaging tornadoes caused $655,300 damage and 8 injuries
- Highest rated have been EF2s: winds 113-157 mph
- Most common May-July; prime hours are between 3:00 pm to 9:00 pm

Completed Mitigation Actions:
- None

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Adopt and enforce building codes and design standards
- Protect buildings, power lines, infrastructure
- Encourage construction of safe rooms
- Increase risk awareness

Wildfire Hazard Risk Summary
- 21 recorded fires of 1000+ acres since 1980 (average of 0.57 per year)
- 2012 Sheepherder fire was largest to date: 15,556 acres
- Areas of concern in SE county, including Casper, Mills, Bar Nunn, and Evansville
- Total Redzone exposure: 4,649 parcels, $1.1B value, population of 10,252
- Critical facilities at risk include power plants, communications towers, fire and EMS stations, and a day care facility

Completed Mitigation Actions:
- None

Current Mitigation Actions:
- MJ-4: Wyoming Firewise
- C-6: North Platte River Restoration
- E4: Address evacuation of Evansville due to Train Derailment or other hazards, including developing an alternate route
- BN1: Develop additional emergency access/egress for Bar Nunn

Possible Mitigation Actions:
- Update zoning ordinance to specify conditions for development in the Interface and Intermix
- Adopt growth management strategies to limit expansion in Interface and Intermix areas
- Encourage fire-resistant construction techniques
- Create buffers around critical facilities and infrastructure
- Retrofit critical facilities and infrastructure with ignition-resistant materials
- Design and implement a fuels management program
- Reduce risk through land use planning
- Encourage homeowners in wildfire risk areas to implement home wildfire mitigation techniques, and provide guidance on these activities
- Increase risk awareness

All Hazards/Other Hazards

Completed Mitigation Actions:
- MJ-5: Electronic Mass Notification System (CodeRed)
- C-8: City of Casper Central Service Center Hardening Project
- C-9: City of Casper Events Center Hardening Project
- M2: Hardening of the Town of Mills Fire Department
- E3: Hardening of the Town of Evansville Community Center

Current Mitigation Actions:
- MJ-1: Alert and Warning System
- MJ-2: Develop a Ready, Set, Go Program for All Hazards
- MJ-3: Public Education (CERT) and 72 Hour Preparedness Training
- MJ-6: Continue to offer immunizations to residents and educate the public about novel diseases
- C-7: Cyber Threat Prevention, Protection, Response and Recovery
- E2: Hardening of the Town of Evansville Police Department for Flood and Severe Weather

Possible Mitigation Actions:
- Develop a capital improvements plan to fund improvements to failing infrastructure
- Purchase backup generators for critical facilities

Niobrara County
Hazard Identification & Risk Assessment Summary

Hazard	Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Significance
Dam Failure	Limited	Low	Limited	Low
Drought	Significant	Likely	Critical	High
Earthquake	Limited	Occasional	Limited	Low
Expansive Soils	Negligible	Likely	Negligible	Low
Flood	Limited	Likely	Limited	Low
Hail	Significant	Likely	Limited	Medium
Hazardous Materials	Limited	Likely	Limited	Low
High Winds/ Downbursts	Significant	Likely	Negligible	Medium
Landslide/Rockfall/Debris Flow	Limited	Unlikely	Limited	Low
Lightning	Significant	Occasional	Limited	Low
Mine & Land Subsidence	Limited	Unlikely	Negligible	Low
Severe Winter Weather	Significant	Highly Likely	Limited	High
Tornado	Significant	Occasional	Limited	Medium
Wildfire	Significant	Likely	Critical	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Probability of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

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Dam Failure Risk Summary

- 79 low-hazard dams; 0 high/significant hazard dams impacting the county
- County EOP identifies three potentially-significant dams, Duel Reservoir on Cow Creek, Field Reservoir on Cottonwood Draw, and Pfister No. 2 Reservoir on Oat Creek

Current Mitigation Actions:

- None

Possible Mitigation Actions:

- Increase risk awareness of potential dam failure impacts

Drought Risk Summary

- 6 multi-year droughts since 1895
- The 2000-2004 drought is considered by many to be the most severe in collective memory; economic loss statewide was over $961M
- From 1895-1995, the County had 1 drought per 20 years; since 1995, that has increased to one every 2.2 years

Current Mitigation Actions:

- Aggressively control grasshoppers during drought

Possible Mitigation Actions:

- Require or encourage water conservation during drought conditions
- Encourage activities to prevent overgrazing
- Educate residents on water saving techniques
- Educate farmers on soil and water conservation practices
- Develop a plan to provide cooling centers
- Create a voluntary database of access and functional needs populations for first responders
- Develop a community network to contact and assist vulnerable persons (such as the elderly or homebound) during extreme heat events
- Increase risk awareness of drought and its potential impacts

Earthquake Risk Summary

- No active fault lines identified in the county
- Wheatland-Whelen fault system not confirmed as active
- 5 earthquakes since 1992, ranging from magnitude 2.9 to 3.7
- 2500-Year Probabilistic Scenario Loss Estimate for county is $4M, no casualties

Current Mitigation Actions:

- None

Possible Mitigation Actions:
- Adopt and enforce building codes
- Conduct inspections of buildings for safety
- Protect critical facilities and infrastructure from the impacts of earthquakes
- Implement structural mitigation techniques for earthquakes
- Increase risk awareness of the potential impacts of earthquakes, including potential mitigation measures
- Conduct outreach to builders, architects, engineers, and inspectors on potential mitigation measures for an earthquake
- Provide information on structural and non-structural retrofitting

Expansive Soils Risk Summary
- 29% of County is susceptible to expansive soils.
- Buildings vulnerable to expansive soils = $148,248.
- No critical facilities identified as vulnerable to expansive soils.

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Manage development in hazard areas
- Increase risk awareness of expansive soils, identified hazard areas and potential mitigation alternatives

Flood Risk Summary
- 13 significant flood events since 1961, averaging 1 every 4.3 years
- $1.7M total reported property & crop damage
- 100-year flood plain: 174 parcels; 128 exposed population; $35.4M exposed property
- 500-year flood plain: none
- 5 total NFIP policies, with 0 claims paid
- Critical facilities in 100-year flood plain include communications towers, and an electric substation

Current Mitigation Actions:
- Investigate engineering solutions to flooding of Niobrara Creek in Lusk
- Encourage property owners along creek to purchase flood insurance. Link to WYDOT site
- Monitor water levels in creek. Notify low-lying land owners of flood potential
- Replace remaining culverts to reduce flooding
- Install erosion control on county road at Twenty-mile Creek
- Install erosion control to protect against loss of Cow Creek Road
- Construct permanent bridge at Lance Creek to replace temporary seasonal bridge
- Drain and fill road section at Big Muddy Creek Crossing

Possible Mitigation Actions:

- Elevate or retrofit structures and utilities
- Remove existing structures from flood hazard areas
- Protect and restore natural flood mitigation measures
- Adopt and enforce building codes and development standards
- Improve stormwater management planning
- Improve stormwater drainage system capacity
- Adopt policies to reduce stormwater runoff
- Improve compliance with NFIP above minimum requirements
- Participate in the Community Rating System (CRS)
- Educate property owners about flood risk and mitigation techniques
- Increase risk awareness on floods, flood hazard areas and potential mitigation measures

Hail Risk Summary

- 141 recorded hail events (1950-2016), causing 0 injuries, $95,500 damage
- Most common May through August, between 1 pm and 10 pm
- Hail less than 2” is most common; up to 3.5” has been recorded

Current Mitigation Actions:

- None

Possible Mitigation Actions:

- Locate/identify safe rooms and other types of shelter
- Ensure that parks and other open spaces have accessible shelter close at hand in case of severe weather
- Protect buildings from hail damage
- Increase risk awareness of hail and its potential impacts

Hazardous Materials Hazard Risk Summary

- 14 incidents report to NRC, 2000-2016, averaging 1.4 per year
- Occur year-round, with a slight increase in the warmer months
- Most common 5:00am to 6:00pm, peaking in the 9 AM hour
- 48% of spills are motor vehicle incidents
- 0 Risk Management Plan (RMP) Facilities and 5 licensed waste handlers

Current Mitigation Actions:

- Develop an evacuation plan for Lusk
- Educate residents on how to respond to hazmat incident with annual mailing
- Host annual awareness level hazmat course for fire, medical and law personnel
- Work with UPRR to sponsor oil rail transport training
- Continue education on response to pipeline incidents (host pipeline company provided training)
- Provide ongoing training in use of PPE. Include medical personnel as appropriate

Possible Mitigation Actions:

- Update land use plan and zoning ordinance to ensure industrial uses are separated from residential uses, densely developed areas, and uses with vulnerable populations such as schools or nursing homes
- Ensure a Local Emergency Planning Committee is active and an emergency plan is prepared and up to date
- Identify brownfield sites and seek grant funding for mitigation
- Increase risk awareness of hazardous materials around the county

High Winds & Downbursts Risk Summary

- 19 recorded high wind events (1950-2016): 43.3 knots average, 61 knots max
- $65,000 reported property damage; no reported injuries or fatalities
- Most common June to August, between 2:00 pm and 10:00 pm
- Damages include downed power lines, damage to roofs & buildings, downed tree limbs, & debris

Current Mitigation Actions:

- None

Possible Mitigation Actions:

- Adopt and enforce building codes and design standards
- Protect power lines and infrastructure from high winds
- Ensure that parks and other open spaces have accessible shelter close at hand in case of severe weather
- Retrofit residential/public buildings to withstand high winds
- Conduct regular tree trimming maintenance to protect power lines
- Increase risk awareness of high winds

Landslide, Rockfall, Debris Flow Risk Summary

- No identified landslide areas with the potential to seriously impact lives, property, etc
- One small landslide area has been identified in Silver Springs Quadrangle

Current Mitigation Actions:

- None

Possible Mitigation Actions:

- Manage development in identified hazard areas
- Prevent/mitigate impacts to roadways
- Remove existing buildings and infrastructure from identified hazard areas
- Increase risk awareness

Lightning Risk Summary

- Average lightning flash density varies from 3 to 12 flashes per square mile per year
- 4 damaging strikes recorded 1960-2015
- No injuries or fatalities, $33,739 total damage

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Protect critical facilities and equipment from lightning strikes
- Ensure that parks and other open spaces have accessible shelter close at hand in case of severe weather
- Increase risk awareness of lightning and its potential impacts

Mine/Land Subsidence Risk Summary
- A handful of abandoned mines near Goshen County line are susceptible to subsidence
- Wyoming Mine Subsidence Insurance Program may provide some assistance

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Manage development in high-risk areas
- Remove existing structures and infrastructure from hazard areas
- Increase risk awareness, including potential impacts and areas of greatest risk

Severe Winter Weather Risk Summary
- Includes blizzard, extreme cold, heavy snow, ice storm, winter storm
- Since 1996: 27 winter storms, 1 Extreme Cold, 1 Ice Storm
- No reported injuries, fatalities, or damages
- Winter low temperatures average 12.7°F; lowest recorded is -41°F (1990)
- Average 190 days per year with low temperatures below 32°F

Current Mitigation Actions:
- Encourage continued construction of wooden and living snow fences along roadways

Possible Mitigation Actions:
- Adopt and enforce building codes and design standards
- Protect buildings, power lines, infrastructure from severe winter weather and its impacts
- Conduct regular tree trimming maintenance to protect power lines
- Identify potential warming shelters for persons for protection from the impacts of severe winter weather
- Educate property owners about freezing pipes
- Increase risk awareness of severe winter weather

Tornado Risk Summary
- 34 tornado touchdowns reported in county (1950-2016)
- 17 damaging tornadoes caused $1.8M damage and 5 injuries
- Highest rated have been EF2s: winds 113-157 mph
- Most common May-July; prime hours are between 3:00 pm to 9:00 pm

Current Mitigation Actions:
- None

Possible Mitigation Actions:
- Adopt and enforce building codes and design standards
- Protect buildings, power lines, infrastructure
- Encourage construction of safe rooms
- Increase risk awareness

Wildfire Hazard Risk Summary
- 3 recorded fires of 1000+ acres since 1980 (average of 1 every 12.3 years)
- 2002 Sheepherder fire was largest to date: 5,025 acres
- Total Redzone exposure: 16 parcels, $5.6M value, population of 13
- No critical facilities identified in the Redzone

Current Mitigation Actions:
- Print message on July water bill about taking responsibility for reducing fire danger on private property (Annually)
- Document and provide ongoing fire training (hazmat and other)

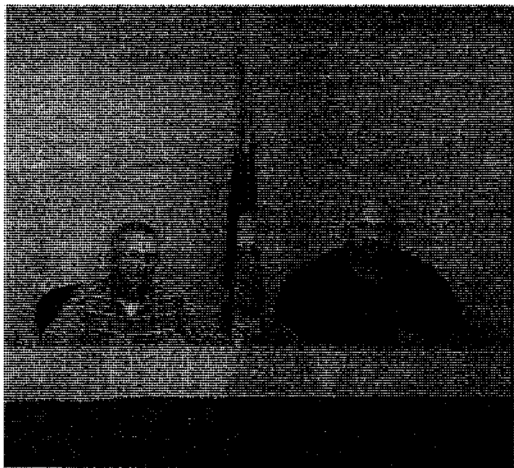
Possible Mitigation Actions:
- Update zoning ordinance to specify conditions for development in the Interface and Intermix
- Adopt growth management strategies to limit expansion in Interface and Intermix areas
- Encourage fire-resistant construction techniques
- Create buffers around critical facilities and infrastructure
- Retrofit critical facilities and infrastructure with ignition-resistant materials
- Design and implement a fuels management program
- Reduce risk through land use planning
- Encourage homeowners in wildfire risk areas to implement home wildfire mitigation techniques, and provide guidance on these activities
- Increase risk awareness

All Hazards/Other Hazards

Current Mitigation Actions:
- Test warning siren. Post information on what the tones mean
- Review and update basic plan for continuity of town government
- Use a basic template to plan for continuity of government
- Establish & Maintain small cache of sheltering materials, supplies
- Educate residents about need to sign up for Code Red notification system
- Participate in Converse-Niobrara broadband feasibility study
- Integrate emergency comm systems; boost WYOLink.
- Encourage Niobrara Electric to continue to harden power lines and create redundancy.
- Update 2003 EOP

- Maintain capacity to shelter small numbers for short time
- Obtain a command vehicle for emergency management
- First responders and elected officials develop personal disaster plans
- Coordinate evacuation, transportation, and sheltering with Women's Prison
- Have all first responders complete ICS 100 and 200
- Host ICS 300 and 400 class in the county
- Design and conduct an exercise using ICS (power and communications outage)
- Participate and assist public health in preparation of Isolation and Quarantine plan

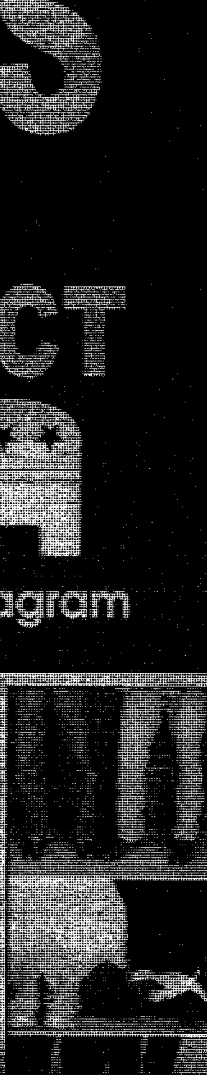
Possible Mitigation Actions:
- Develop a capital improvements plan to fund improvements to failing infrastructure
- Purchase backup generators for critical facilities



uncilman Mark Kupke, center, finish town Councilwoman Becky Blackburn, left, and heir positions for the Town of Lusk.
Photo/Lori Himes

Councilwoman Becky Blackburn, Mayor Doug Lytle, Councilman Tom Dooper and Councilman Cal Carstensen take their oaths of office. R. Dean Nelson was named as councilman to fill the position vacated by Mayor Lytle.
Photo/Lori Himes

Councilmembers Darlene Adams and Billy Hite were sworn in by Manville Mayor Rola Ross, while outgoing board member Jeremy Nasland looks on.
Photo/Lori Himes



CC EmA 6/13/18 DB

Between May 27 and June 2, the Converse County Sheriff's Office responded to 133 calls for service from the community, issued 15 citations and made eight arrests:

Arrests and citations

• Derick Nicholas, 24, of Greeley, Colorado, was cited for possession of a controlled substance and no proof of insurance May 27.

• Joan Jackson, 55, of Glenrock, was cited for dog at large May 28.

• A warning was issued for expired registration and non-compliance with livestock paperwork May 28.

• Michael Fulfer, 48, of Casper, was arrested for driving while under the influence May 29.

Investigations

• A dispute between neighbors was reported on Sage Hills Road May 28.

• Theft was reported on North Fifth Street May 28.

• A deputy assisted stranded motorists on Upper Horseshoe May 28.

• A dog running loose was reported on Walker Creek Road May 30.

• A deputy assested a stranded mororist on HWY 59 May 31.

• A dog killing chickens was reported on Bridger's Crossing May 31.

• A dog at large was reported on Huxtable Road May 31. The dog was transported to the humane society.

• Two dogs at large were reported on Brownfield Road June 1.

• A dog at large was reported on Brownfield Road June 1.

• Domestic violence was reported on HWY 91 June 1.

• A traffic accident was reported on Green Drive June 2.

• A suspicious vehicle was reported at the Dave Johnston Power Plant June 2.

LEPC Meeting / Regional Hazardous Mitigation Plan

The Local Emergency Planning Committee will be meeting at:
The Converse County Courthouse Community Room

Wednesday, June 20, 2018
1:00 p.m.

&

Public meeting: for Regional Hazardous Mitigation Plan that evening from 6 to 8 p.m. in Community Room
For more info, contact: Russ or Mary at CCEMA
307-358-6880

Affidavit of Publication

THE STATE OF WYOMING,

COUNTY OF CONVERSE

I, Matt Adelman do solemnly swear that I am the Publisher of THE GLENROCK INDEPENDENT, a weekly newspaper of general circulation, published weekly at Glenrock, Converse County, Wyoming that the notice attached, and which is part of the affidavit and a part of the proof of publication of legal

Legal #2462
Converse County Emergency Management Meeting June 20, 2018

was published in said newspaper **2 times,** the first publication having been made on the **31st** day of **May, 2018** and the last publication on the 7th day of **June, 2018.** Notice was published in the regular and entire issue of every number of said paper during the period of time of publication, and that the notice was published in the newspaper proper, and not in a supplement.

In testimony whereof, I have hereunto set my hand this 7th day of **June, 2018.**

Fees: $0

Signed Matt Adelman

Subscribed and sworn to before me this 7th day of **June, 2018**. My commission expires **11/06/21.**

Janet Caster
Notary Public - Janet Caster

JANET CASTER - NOTARY PUBLIC
County of Converse
State of Wyoming
My Commission Expires November 6, 2021

Public Meeting...

Public Meeting on Multi-Hazard Mitigation Plan Update
Wednesday 6-20-18, 6-8 pm, Converse County Courthouse Community Room

Converse County is updating its Multi-Hazard Mitigation Plan as part of a regional hazard mitigation planning effort that includes Converse, Natrona and Niobrara counties and their municipalities. The plan identifies hazards such as floods, wildfires, drought, severe weather, hazardous materials and landslides among others and assesses their potential impacts to people and property. A public meeting is being held to discuss the plan and solicit input on ideas to mitigate, or reduce, the impacts of hazards before they occur again. There will be a short presentation followed by a question and answer period. All are welcome to attend, learn more about the plan and hazards in the county, and participate in the process.

The public can also provide input to the plan via an online survey that will close June 15, 2018; the survey can be accessed and filled out at https://www.surveymonkey.com/r/WY_R2
Publish: May 31 & June 7, 2018

2462

CONVERSE COUNTY HAZARD MITIGATION PLAN - PUBLIC MEETING

JUNE 20, 6-8 PM

NAME	JURISDICTION	EMAIL
Russ Dalgarn	Converse EMA	Russ.dalgarn@conversecountywy.go[illegible]
Mary Schell	Converse	mary.schell@conversecounty.wy.gov
Joel Schell	Converse	joel.schell@gmail.com
Colin Tiernan	converse	colin@douglas-budget.c[illegible]
Jackie King	Converse	Jackie.King@mail.house.go[illegible]
Justin Rogers	Converse	justin_rogers@enzi.senate.gov

SIGN-IN SHEET
Regional Hazard Mitigation Public Meeting
June 19, 2018 6:00 pm to 8:00 pm
NCSO, EOC, 201 N. David, Casper, WY

Name	Email Address	Phone	Jurisdiction/Department/Organization	Title
~~Paula Reece~~	~~preece@natronacounty-wy.gov~~	~~307-235-9406~~	~~NC GIS Dept~~	~~GIS. Specialist~~
Kerrie Langmade	Klangmade1@gmail.com	262-3948	NCSD#1	Crisis Leader/teacher
JACKIE King	Jackie.King@mail.house.gov	261-5585	Natrona, Converse Niobrara	Dep. State Dir Congresswoman Cheney
Callie Baldacci	cbaldacci@wyomingmedicalcenter.org	577-2623	Wyoming Med Center	Disaster Coordinator

Public Meeting 6-21-18

Regional Hazard Mitiagtion Plan

Sign IN Sheet

James SANTISTEVAN Niobrara County EMA

Elaine Sedneke

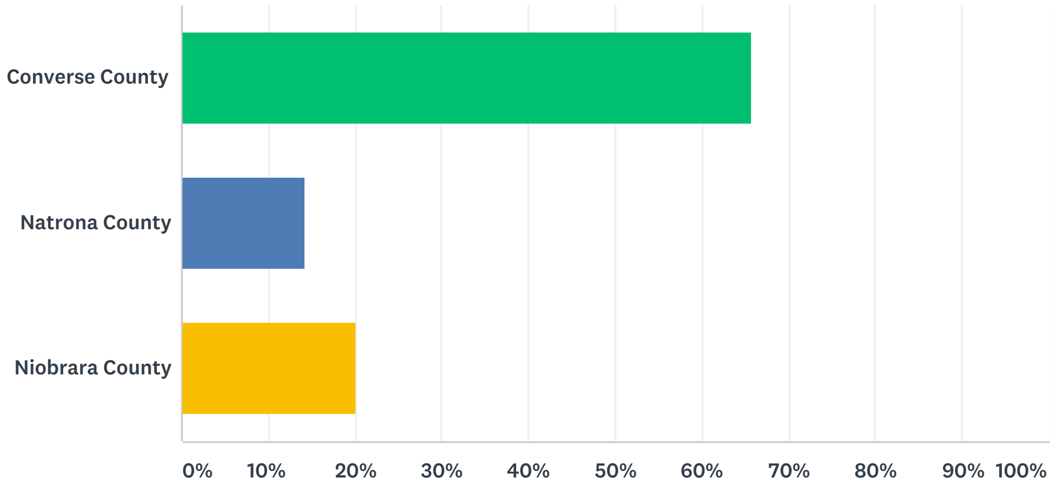
Richard A Ladwig Niobrara County commission

JOHN P. MIDKIFF NIOBRARA COUNTY COMMISSIONER

Pat Wade "

Q1 Indicate the county you currently reside in:

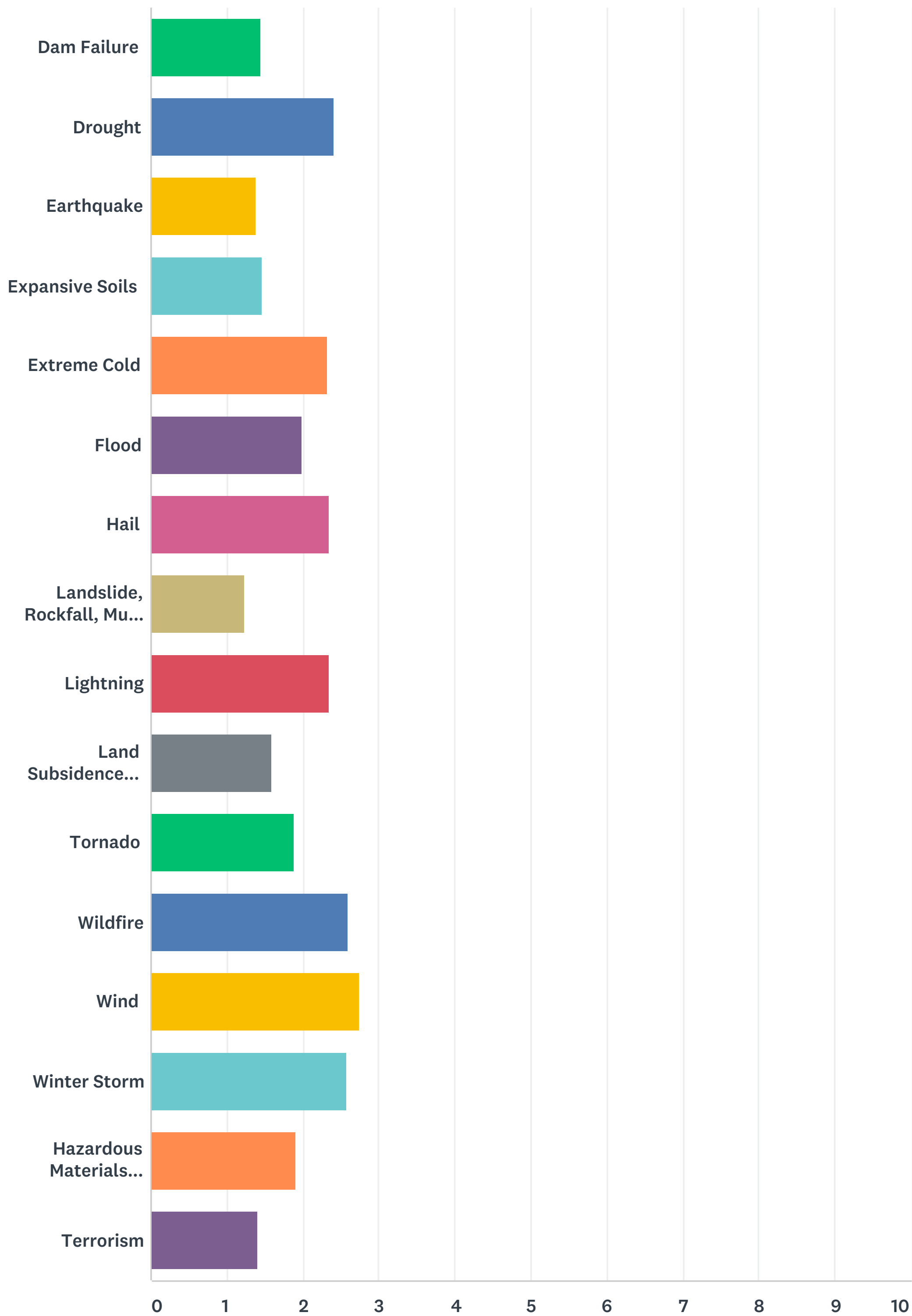
Answered: 105 Skipped: 1



ANSWER CHOICES	RESPONSES	
Converse County	65.71%	69
Natrona County	14.29%	15
Niobrara County	20.00%	21
TOTAL		105

Q2 The hazards addressed in the Regional Multi-Hazard Mitigation Plan update are listed below. Please indicate the level of significance that you perceive for each hazard.

Answered: 88   Skipped: 18



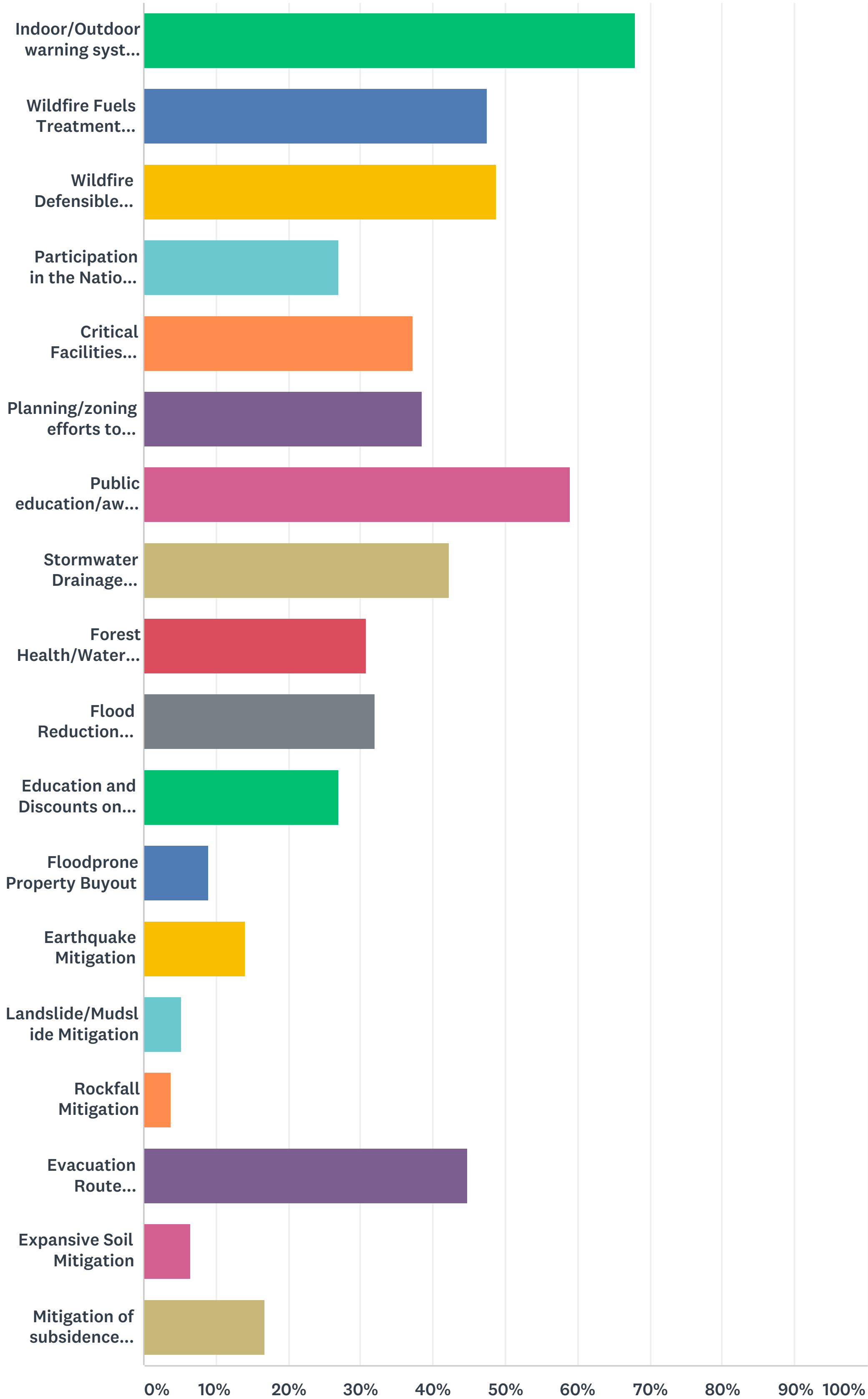
	LOW	MODERATE	HIGH	TOTAL	WEIGHTED AVERAGE
Dam Failure	64.77% 57	25.00% 22	10.23% 9	88	1.45
Drought	10.34% 9	39.08% 34	50.57% 44	87	2.40
Earthquake	70.11% 61	21.84% 19	8.05% 7	87	1.38
Expansive Soils	57.47% 50	37.93% 33	4.60% 4	87	1.47
Extreme Cold	10.34% 9	47.13% 41	42.53% 37	87	2.32
Flood	20.69% 18	59.77% 52	19.54% 17	87	1.99
Hail	11.76% 10	41.18% 35	47.06% 40	85	2.35
Landslide, Rockfall, Mud Flow	77.01% 67	21.84% 19	1.15% 1	87	1.24
Lightning	10.47% 9	45.35% 39	44.19% 38	86	2.34
Land Subsidence (natural or mining related)	52.33% 45	34.88% 30	12.79% 11	86	1.60
Tornado	29.89% 26	51.72% 45	18.39% 16	87	1.89
Wildfire	1.16% 1	38.37% 33	60.47% 52	86	2.59
Wind	1.16% 1	23.26% 20	75.58% 65	86	2.74
Winter Storm	5.81% 5	30.23% 26	63.95% 55	86	2.58
Hazardous Materials Incident	37.93% 33	34.48% 30	27.59% 24	87	1.90
Terrorism	64.37% 56	29.89% 26	5.75% 5	87	1.41

Q3 Do you have information on specific hazard issues/problem areas that you would like the planning committees to consider? Note the county and, if applicable, the municipality to which it applies.

Answered: 25   Skipped: 81

Q4 The following types of mitigation actions may be considered in this plan. Please indicate all the types of mitigation actions that you think should have the highest priority in the Regional Multi-Hazard Mitigation Plan.

Answered: 78 Skipped: 28



ANSWER CHOICES	RESPONSES	
Indoor/Outdoor warning systems for hazards	67.95%	53

Wildfire Fuels Treatment projects	47.44%	37
Wildfire Defensible Space Projects	48.72%	38
Participation in the National Flood Insurance Program	26.92%	21
Critical Facilities Protection	37.18%	29
Planning/zoning efforts to mitigate hazard impacts	38.46%	30
Public education/awareness of hazards and impacts	58.97%	46
Stormwater Drainage Improvements	42.31%	33
Forest Health/Watershed Protection	30.77%	24
Flood Reduction and/or Drainage Improvement	32.05%	25
Education and Discounts on Flood Insurance	26.92%	21
Floodprone Property Buyout	8.97%	7
Earthquake Mitigation	14.10%	11
Landslide/Mudslide Mitigation	5.13%	4
Rockfall Mitigation	3.85%	3
Evacuation Route Development	44.87%	35
Expansive Soil Mitigation	6.41%	5
Mitigation of subsidence prone areas	16.67%	13
Total Respondents: 78		

Q5 Please comment on any other pre-disaster mitigation strategies that the planning committees should consider for reducing future losses caused by natural or human caused hazards.

Answered: 13 Skipped: 93

From: Melinda Gibson <melinda.gibson@wyo.gov>
Sent: Wednesday, August 08, 2018 7:33 AM
To: Mary Schell
Cc: Karsjen, Kyle; Russ Dalgarn
Subject: Re: Regional Mitigation Planning Participation

Mary & Russ-

Thank you for pursuing this!! I appreciate it. Good work.

Kyle, I assume this information will document Lost Spring's participation in the Regional Plan... Please let me know if you need anything further.

Best Regards,

Melinda

Melinda Gibson, CFM

State Hazard Mitigation Officer
Wyoming Office of Homeland Security

5500 Bishop Blvd - East Door

Cheyenne, WY 82002
melinda.gibson@wyo.gov
307.286.2670 - Work Cell

307.777.4914 - Desk
307.635.6017 - Fax

To achieve great things, two things are needed; a plan, and not quite enough time.
♫ Leonard Bernstein, 1918 - 1990 ♫

On Tue, Aug 7, 2018 at 11:36 AM, Mary Schell <mary.schell@conversecountywy.gov> wrote:

Hi Melinda,

Russ and I met with Leda Price, the mayor of Lost Springs, yesterday at 4:00 p.m. We reviewed the concerns that you outlined. Just to let you know a little about Leda, she is in her 70's and works as a nurse for the local senior center. She runs a catering business/bar in Lost Springs and also serves as the mayor of a Town that includes a total of 4 people.

We used the outline provide by Kyle for our County Hazardous mitigation plan and went over each area that Lost Springs was included in. I will attach that printout for you. Leda provided input indicating that everywhere that the Town of Lost Springs was listed in, was accurate. We are removing Lost Springsfrom 4.3.2, 4.3.3, 4.3.5, & 3.4.1.

Russ and I believe that Leda was thrown off as we started our local update a few months prior to the New regional hazardous mitigation plans that incorporate 3 counties. Leda did participate in our local Hazardous mitigation plan meetings.

Please let me know if this works for your purposes.

Thank you,

Mary Schell

Admin Assistant
CCEMA
111 Cedar Street
Douglas, Wyoming 82633
307-358-6880
307-358-3448 Fax
mary.schell@conversecountywy.gov

On Jul 31, 2018, at 10:56 AM, Melinda Gibson <melinda.gibson@wyo.gov> wrote:

Good Morning Russ & Mary.

Per our phone conversation a few minutes ago, it's unfortunate that one community in Converse County has not participated in the regional mitigation planning effort to this point. Because they've not been present for meetings or phone calls, I am asking you to pursue that community in the next 1 1/2 weeks to ensure their participation is documented.

Without their participation in the mitigation plan, they are not eligible to pursue federal mitigation grant funding for their community's mitigation projects should they choose to pursue grant funding... So it's CRITICAL to get their input. As part of their community leadership role, I know they're concerned with their fiduciary responsibilities to <u>ensure all options are available for the betterment of their community</u> now and into the future. They will want to ensure their options are not limited in any way for the future.

Please visit with the following community has not participated in the regional mitigation planning effort to this point:

Lost Springs

Following is the information needed from them to document their participation in the plan:

1) Please provide Lost Springs with current mitigation planning status... Let them know they're part of the regional mitigation plan, that it gives them access to federal funding to pursue mitigation projects, talk about natural hazards... and ask them for their opinion on the natural hazards in the county. Which hazards do they feel impact their community most significantly?

2) The Lost Springs representative should be able to tell you the status of mitigation strategies/projects identified in the last county plan. (You'll probably have to bring the plan with you, and ask them about their specific projects/strategies.)

3) Ask them if they have any new mitigation projects that have 'risen to the surface' over the past couple years (since their last mitigation planning effort) as projects they'd like to pursue.

Document/outline the discussion and their responses with an email to me and copied to the contractor, Kyle Karsjen.

At this point we're working with a VERY tight deadline. Please get this back to us by the end of next week, August 10.

Any questions, feel free to contact me. You'll find my contact information below in the signature block.

Best Regards,

Melinda

Melinda Gibson, CFM

State Hazard Mitigation Officer
Wyoming Office of Homeland Security

5500 Bishop Blvd - East Door

Cheyenne, WY 82002
melinda.gibson@wyo.gov
307.286.2670 - Work Cell

307.777.4914 - Desk
307.635.6017 - Fax

To achieve great things, two things are needed; a plan, and not quite enough time.
♫ Leonard Bernstein, 1918 - 1990 ♫

E-Mail to and from me, in connection with the transaction
of public business, is subject to the Wyoming Public Records
Act and may be disclosed to third parties.

E-Mail to and from me, in connection with the transaction
of public business, is subject to the Wyoming Public Records
Act and may be disclosed to third parties.

From: Melinda Gibson <melinda.gibson@wyo.gov>

Sent: Wednesday, August 08, 2018 3:04 PM

To: Kyle Karsjen

Cc: James Santistevan

Subject: Region 2-Manville mitigation planning participation

Kyle-

Please find information forwarded from the Town of Manville's Clerk (at Manville Mayor Rola Ross's request) below regarding their current mitigation efforts and their most significant natural hazard, thus documenting their participation in the Regional Mitigation Planning effort.

Please let me know if you need further information from us to document Manville's participation in the regional planning effort.

Best Regards,

Melinda

Melinda Gibson, CFM

State Hazard Mitigation Officer
Wyoming Office of Homeland Security

5500 Bishop Blvd - East Door

Cheyenne, WY 82002
melinda.gibson@wyo.gov
307.286.2670 - Work Cell

307.777.4914 - Desk
307.635.6017 - Fax

To achieve great things, two things are needed; a plan, and not quite enough time.
♫ Leonard Bernstein, 1918 - 1990 ♫

---------- Forwarded message ----------
From: James Santistevan <niobraracountyema@gmail.com>
Date: Wed, Aug 8, 2018 at 2:21 PM
Subject: Fwd: mitigation planning participation
To: Melinda Gibson <melinda.gibson@wyo.gov>

Hope this helps

James Santistevan
Niobrara County Emergency Management Coordinator/LEPC Chairman
PO Box 462
Lusk, WY 82225
307.340.0893
niobraracountyema@gmail.com

---------- Forwarded message ---------
From: <townofmanville@vcn.com>
Date: Wed, Aug 8, 2018, 1:48 PM
Subject: mitigation planning participation
To: <niobraracountyema@gmail.com>
Cc: rola ross <raross@wyomail.com>

Dear James,

This is Melody Miles the town clerk of Manville. I was asked to respond to you per Rola Ross's request.

Our problem was the flood. We replaced culverts, cleared debris from the creek bottom to try and mitigate the problem. We are now concerned about fires that may en crouch on the abandoned buildings and empty lots causing enormous devastation to our small community. We are forever looking for new area's to improve our community within problem area's that may be foreseeable.

If I can help you with any other information or be of any further assistance please don't hesitate to contact me.

Melody Miles
Clerk of Manville
307-334-2142 office   Wednesdays from 9am-2pm
307-840-5214 cell

From: Melinda Gibson <melinda.gibson@wyo.gov>

Sent: Wednesday, August 08, 2018 2:58 PM

To: John Harlin

Cc: Kyle Karsjen

Subject: Re: Regional Planning Participation

Good on ya, John!! Thanks for getting in touch with your jurisdictions and discussing the regional mitigation plan!

Kyle- I assume this will meet the necessary requirements for these 4 communities. Please let us know if you need anything further from us.

Best Regards,

Melinda

Melinda Gibson, CFM

State Hazard Mitigation Officer
Wyoming Office of Homeland Security

5500 Bishop Blvd - East Door

Cheyenne, WY 82002
melinda.gibson@wyo.gov
307.286.2670 - Work Cell

307.777.4914 - Desk
307.635.6017 - Fax

To achieve great things, two things are needed; a plan, and not quite enough time.
♫ Leonard Bernstein, 1918 - 1990 ♫

On Wed, Aug 8, 2018 at 2:54 PM, John Harlin <harlinj@natronacounty-wy.gov> wrote:

> Melinda and Kyle,

Attached are notes from my conversations with our Regional HMP partners in those jurisdictions who have not participated in the planning process during the previous opportunities.

Since the Regional HMP comes directly on the heels of the County's HMP there was some confusion as to the duplication of effort. I have explained the process and anticipate their participation as we move forward.

Best Regards,

John

John Harlin

Lieutenant

Natrona County Sheriff's Office

Emergency Management Division

201 N. David, 2nd Floor

Casper, Wyoming 82601

Office: 307.235.9289

Fax: 307.235.9652

Cell: 307.262.1898

Email:harlinj@natronacounty-wy.gov

Website: http://www.natrona.net/122/Emergency-Management-Administration

Facebook: https://www.facebook.com/Natrona-County-Emergency-Management-245543751964/

From: Melinda Gibson [mailto:melinda.gibson@wyo.gov]

Sent: Tuesday, July 31, 2018 10:47 AM
To: John Harlin
Cc: Kyle Karsjen
Subject: Regional Planning Participation

Good Morning John.

Per our phone conversation a few minutes ago, it's unfortunate that the communities in Natrona County have not participated in the regional mitigation planning effort to this point. Because they've not been present for meetings or phone calls, I am asking you to pursue them in the next 1 1/2 weeks to ensure their participation is documented.

Without their participation in the mitigation plan, they are not eligible to pursue federal mitigation grant funding for their community's mitigation projects should they choose to pursue grant funding… So it's CRITICAL to get their input. As part of their community leadership role, I know they're concerned with their fiduciary responsibilities to ensure all options are available for the betterment of their community now and into the future. They will want to ensure their options are not limited in any way for the future.

Please visit with the following communities who've not participated in the regional mitigation planning effort to this point:

Bar Nunn

Evansville

Midwest

Mills

Following is the information needed from them to document their participation in the plan:

1) Please provide the communities with current mitigation planning status… Let them know they're part of the regional mitigation plan, that it gives them access to federal funding to pursue mitigation projects, talk about natural hazards… and ask them for their opinion on the natural hazards in the county. Which hazards do they feel impact their community most significantly?

2) The community representative should be able to tell you the status of mitigation strategies/projects identified in the last county plan. (You'll probably have to bring the plan with you, and ask them about their specific projects/strategies.)

3) Ask them if they have any new mitigation projects that have 'risen to the surface' over the past couple years (since their last mitigation planning effort) as projects they'd like to pursue.

Document/outline the discussion and the community responses with an email to me and copied to the contractor, Kyle Karsjen.

At this point we're working with a VERY tight deadline. Please get this back to us by the end of next week, August 10.

Any questions, feel free to contact me. You'll find my contact information below in the signature block.

Best Regards,

Melinda

Melinda Gibson, CFM

State Hazard Mitigation Officer
Wyoming Office of Homeland Security

5500 Bishop Blvd - East Door

Cheyenne, WY 82002
melinda.gibson@wyo.gov
307.286.2670 - Work Cell

307.777.4914 - Desk
307.635.6017 - Fax

To achieve great things, two things are needed; a plan, and not quite enough time.

♫ Leonard Bernstein, 1918 - 1990 ♫

E-Mail to and from me, in connection with the transaction
of public business, is subject to the Wyoming Public Records
Act and may be disclosed to third parties.

E-Mail to and from me, in connection with the transaction
of public business, is subject to the Wyoming Public Records
Act and may be disclosed to third parties.

From: Melinda Gibson <melinda.gibson@wyo.gov>

Sent: Thursday, August 09, 2018 1:54 PM

To: Kyle Karsjen

Cc: James Santistevan

Subject: Fwd: mitigation vantassell

Hi Kyle.

Please see information from Van Tassell below. Please let us know if you need anything further to document their participation in the planning effort.

Best Regards,

Melinda

Melinda Gibson, CFM

State Hazard Mitigation Officer
Wyoming Office of Homeland Security

5500 Bishop Blvd - East Door

Cheyenne, WY 82002
melinda.gibson@wyo.gov
307.286.2670 - Work Cell

307.777.4914 - Desk
307.635.6017 - Fax

To achieve great things, two things are needed; a plan, and not quite enough time.
♫ Leonard Bernstein, 1918 - 1990 ♫

---------- Forwarded message ----------
From: James Santistevan <niobraracountyema@gmail.com>
Date: Thu, Aug 9, 2018 at 1:22 PM

Subject: Fwd: mitigation vantassell
To: Melinda Gibson <melinda.gibson@wyo.gov>

Here you go

James Santistevan
Niobrara County Emergency Management Coordinator/LEPC Chairman
PO Box 462
Lusk, WY 82225
307.340.0893
niobraracountyema@gmail.com

---------- Forwarded message ---------
From: bp matthews <matthewsranch@yahoo.com>
Date: Thu, Aug 9, 2018, 1:10 PM
Subject:
To: niobraracountyema@gmail.com <niobraracountyema@gmail.com>

Date: 08-09-2018

Jim

Van Tassell has no mitigation plan as of the date. Natural hazards we have concerns about are wildland fire, flooding, tornado's, and winter blizzard's

We have no new mitigation plans or projects and have not look into any projects as of today. We have been concentrating on a long term community plan and re-doing the town zoning ordinances.

As the mayor of the town I would like to stay in any future mitigation plans for the county and local towns.

William Matthews Mayor

Van Tassell, Wyoming.

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REGIONAL HAZARD MITIGATION PLAN DRAFT FOR CONVERSE, NATRONA AND NIOBRARA COUNTIES FOR PUBLIC REVIEW - Message (HTML)

File | Message | Insert | Options | Format Text | Review | Adobe PDF | SENDINC

Paste | Cut | Copy | Format Painter | Clipboard | Basic Text | Address Book | Check Names | Names | Attach File | Attach Item | Signature | Include | Attach File via Adobe Document Cloud | Adobe Document Cloud | Follow Up | High Importance | Low Importance | Tags | Zoom | Zoom

This e-mail message cannot be delivered to **hulshizerd@natronacounty-wy.gov** because the e-mail address is no longer valid.

Send

To...

Cc... Aaron Shatto; asundell@casperwy.gov; agray@cnchd.org; bandress@casperwy.gov; brook@visitcasper.com; bmclimore@millswy.gov; christopher.lorenzen@caspercollege.edu; cbaldacci@wyomingmedicalcenter.org; cramsey232007@gmail.com; dandersen@casperwy.gov; hulshizerd@natronacounty-wy.gov; janet.milek@wyo.gov; jparks@casperwy.gov; jeff.goetz@wyo.gov; John Harlin; jhatcher@casperwy.gov; jmartinez@casperwy.gov; kbleizeffer@wyomingmedicalcenter.org; clinton.haver@wyo.gov; Matt Gacke <mgacke@natronacounty-wy.gov>; pmcjunkin@casperwy.gov; dpabrams@bresnan.net; tanya6230@myncsd.org; kelly.weidenbach@cnchd.org

Bcc...

Subject: REGIONAL HAZARD MITIGATION PLAN DRAFT FOR CONVERSE, NATRONA AND NIOBRARA COUNTIES FOR PUBLIC REVIEW

Can you please share the following information on your sites.

Thank you!

SEPTEMBER 17, 2018 – Would you like to learn more about what Converse, Natrona and Niobrara counties are doing to minimize the impacts of floods, wildfires, winter storms, hazardous materials incidents, and other hazards? A draft of the Regional Hazard Mitigation Plan is being made available for public review and comment. The plan assesses risks posed by

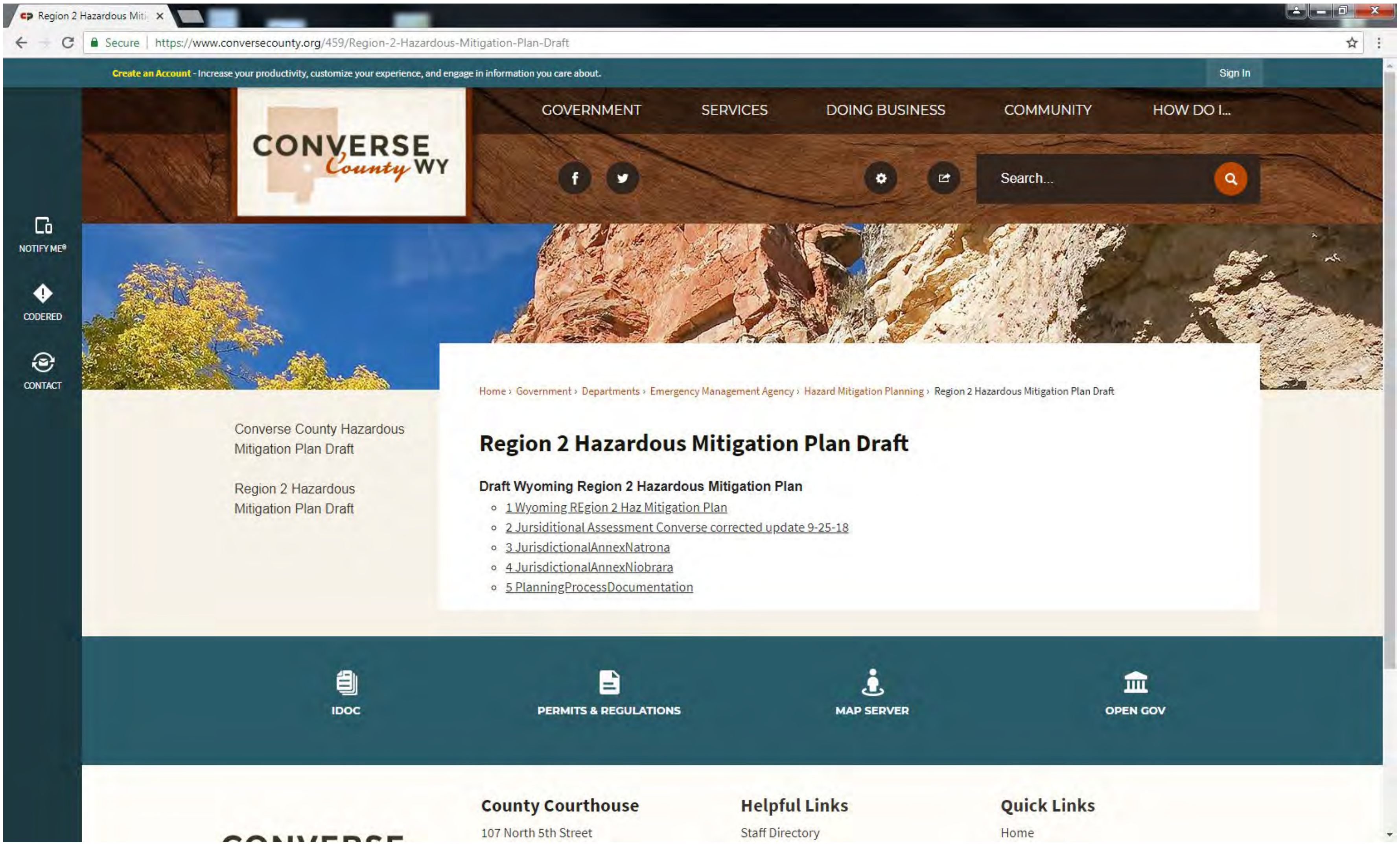
Sendinc Settings

Logged in as: shill@natronacounty-wy.gov

Send Secure via Sendinc

Save to Sent Folder | Notify When Read | Copy Me | Expire When Read | Expires In 7 Days

See more about: Aaron Shatto.


Region 2 Hazardous Miti
Secure | https://www.conversecounty.org/459/Region-2-Hazardous-Mitigation-Plan-Draft
Create an Account - Increase your productivity, customize your experience, and engage in information you care about.
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CONVERSE County WY
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SERVICES
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CONTACT
Home › Government › Departments › Emergency Management Agency › Hazard Mitigation Planning › Region 2 Hazardous Mitigation Plan Draft
Converse County Hazardous Mitigation Plan Draft
Region 2 Hazardous Mitigation Plan Draft
Region 2 Hazardous Mitigation Plan Draft
Draft Wyoming Region 2 Hazardous Mitigation Plan
1 Wyoming REgion 2 Haz Mitigation Plan
2 Jursiditional Assessment Converse corrected update 9-25-18
3 JurisdictionalAnnexNatrona
4 JurisdictionalAnnexNiobrara
5 PlanningProcessDocumentation
IDOC
PERMITS & REGULATIONS
MAP SERVER
OPEN GOV
County Courthouse
107 North 5th Street
Helpful Links
Staff Directory
Quick Links
Home

Public Notices

Notice is hereby given that the Petition of Welco Operating Capital I LLC for determination of heirship of said decedent has been filed in the District Court of the Eighth Judicial District in and for Converse County, Wyoming at Douglas, Wyoming; that the date of death of said decedent was December 30, 1972; that said decedent was a resident of Deschutes County, State of Oregon and at the time of her death the description of the real property interest of which said decedent died seized is:

All her right, title and interest in and to the oil, gas and other minerals in the following described lands, to wit:

Township 33 North, Range 68 West, 6th P.M.
Section 7: E1/2W1/2, W1/2E1/2

That said Petition shall be heard by the above entitled Court in the Courtroom of said Court in the County Building, Douglas, Wyoming on October 17, 2018 at 8 o'clock a.m. or as soon thereafter as the matter can be heard. That the children of the decedent claim entitlement to an interest in the above described property.

DATED this 6th day of September, 2018.
WELCO OPERATING CAPITAL I LLC,
PETITIONER

By: ______________________
HARRY B. DURHAM, III, Wyo Bar No. 5-1278
Brown, Drew, Massey & Durham, LLP
159 North Wolcott, Suite 200
Casper, Wyoming 82601
(307) 234-1000
Its Attorneys

Publish: September 12, 19, 26 & October 3, 2018 2617

Probate No. 6752...

STATE OF WYOMING) IN THE DISTRICT COURT
) SS.
COUNTY OF CONVERSE) EIGHTH JUDICIAL DISTRICT

Probate No. 6752

Probate No. 6767...

STATE OF WYOMING) IN THE DISTRICT COURT
) SS.
COUNTY OF CONVERSE) EIGHTH JUDICIAL DISTRICT

Probate No. 6767

IN THE MATTER OF THE ESTATE OF)
LYLE M. WILSON also known as)
LYLE MILTON WILSON,)
)
Deceased.)

NOTICE OF APPLICATION

TO ALL PERSONS INTERESTED IN SAID ESTATE:

You are hereby notified that on the 31st day of August, 2018, an Application for Summary Procedure for Distribution of Property was filed in the above named court by a distributee of said decedent. That there will be no administration of said estate and petitioner seeks to enter a decree establishing the right and title to real property. That said decree shall be presented to the Court, in the Courtroom of said Court, in the Converse County Courthouse, 107 North 5th Street, Douglas, Wyoming on October 24, 2018 at 8:00 a.m. or as soon thereafter as the matter can be heard.

DATED this 11th day of September, 2018.
PATRICIA L. WILSON, Petitioner

By:______________________
HARRY B. DURHAM, III (5-1278)
E. JEANNÉE NUNN (7-4816)
Brown, Drew, Massey & Durham, LLP
159 North Wolcott, Suite 200
Casper, Wyoming 82601
(307) 234-1000
Her Attorneys

Regional Hazard Mitigation Plan Draft...

REGIONAL HAZARD MITIGATION PLAN DRAFT FOR CONVERSE, NATRONA AND NIOBRARA COUNTIES AVAILABLE FOR PUBLIC REVIEW AND COMMENT

SEPTEMBER 17, 2018 – Would you like to learn more about what Converse, Natrona and Niobrara counties are doing to minimize the impacts of floods, wildfires, winter storms, hazardous materials incidents, and other hazards? A draft of the Regional Hazard Mitigation Plan is being made available for public review and comment. The plan assesses risks posed by hazards, identifies ways to reduce those risks, and allows each county and municipalities to be eligible for mitigation grant funding from FEMA. County planning teams, including representatives from all municipalities, developed the plan with assistance from a consultant. The plan identifies hazard mitigation goals and mitigation projects for the counties, with the intent of reducing losses from hazard events before they occur again. A public survey and series of public workshops were held during the planning process to solicit input on the hazards and ideas for mitigation projects. The counties in the Region are now soliciting public comment on the plan before it is finalized and submitted for FEMA review and approval. The final plan will be adopted by each participating county and municipality before it becomes official. More information can be obtained from your local county emergency management office.

Comments will be accepted through September 28, 2018.

The draft plan can be accessed at the Wyoming Office of Homeland Security website: http://hls.wyo.gov

An online form to provide feedback on the plan can be accessed here: https://www.surveymonkey.com/r/WYR2_Review

Publish: September 19 & 26, 2018 2638

Public Notice

er costs in the amount of $506.11, plus attorneys' fees, costs expended, and accruing interest and late charges after the date of first publication of this notice of sale;

WHEREAS, the property being foreclosed upon may be subject to other liens and encumbrances that will not be extinguished at the sale. Any prospective purchaser should search the status of title before submitting a bid;

NOW, THEREFORE **PennyMac Loan Services, LLC**, as the Mortgagee, will have the Mortgage foreclosed as by law provided by causing the mortgaged property to be sold at public venue by the Sheriff or Deputy Sheriff in and for Converse County, Wyoming to the highest bidder for cash at 10:00 o'clock in the forenoon on October 2, 2018 at the front door of the Converse County Courthouse located at 107 North 5 th , Douglas, Wyoming, Converse County, for application on the above-described amounts secured by the Mortgage, said mortgaged property being described as follows, to-wit:

LOT 28, OREGON TRAIL ESTATES, AN ADDITION TO THE TOWN OF GLENROCK,
CONVERSE COUNTY, WYOMING;
with an address of **162 Ft. Laramie, Glenrock, Wyoming 82637.**

Together with all improvements thereon situate and all fixtures and appurtenances thereto.

Dated this 27th day of August, 2018.

PennyMac Loan Services, LLC
By: Lucky McMahon, #6-4270
Tamara Schroeder Crolla, #6-3976
Weinstein & Riley, P.S.
123 West 1 st Street, Suite 433
Casper, Wyoming 82601-2482
307-462-2690

Publish: August 30, September 6, 13, & 20, 2018 2536

C.C. Emergency Management...

Publish: September 13 & 20, 2018 2546

Regional Hazard Mitigation Plan Draft...

REGIONAL HAZARD MITIGATION PLAN DRAFT FOR CONVERSE, NATRONA AND NIOBRARA COUNTIES AVAILABLE FOR PUBLIC REVIEW AND COMMENT

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Publish: September 19 & 26, 2018 2638

Town of

WALSWORTH PUBLISHING COMPANY	1,972.51
VISA	1,977.97
MENARDS-CASPER	2,043.61
XEROX FINANCIAL SERVICES	2,111.00
XEROX FINANCIAL SERVICES	2,111.00
BIRCH COMMUNICATIONS	2,187.14
FOOD SERVICE OF AMERICA	2,276.26
ADRENALINE FUNDRAISING	2,315.00
CAMBIUM LEARNING, INC. (Sopris, Voyager,	2,479.40
AMPLIFIED IT, LLC	2,677.95
SYNCB/AMAZON	2,779.96
CRISIS PREVENTION INSTITUTE	3,199.00
EDUCATIONAL DISCOVERY TOURS	3,200.00
TRICIA BERG CONSULTING, LLC	3,434.64
BOUND TO STAY BOUND BOOKS	3,534.02
LEXIA LEARNING SYSTEMS, INC.	3,806.67
ECI LLC	4,038.01
GLENROCK OFFICIALS & TIMERS ASSOC	4,062.05
TOWN OF GLENROCK	4,646.01
PHOENIX LEARNING SYSTEMS	4,737.59
WALSH'S WATER TREATMENT SERVICE	4,930.00
INSTRUCTURE INC	5,000.00
SHRIVER THERAPY GROUP INC	5,082.84
EDUCATIONAL ADVANTAGES INC	5,606.00
BIG HORN ROOFING	5,613.00
GRAINGER, INC. W.W	5,690.70
KONE, INC.	5,992.56
VISA	6,228.69
(CPU VENTURE TECH)	6,336.00
ASSOCIATED SUPPLY CO.	6,447.20
AAKER SIGNS AND DESIGNS	6,593.97
VIBES FINE & PERFORMING ARTS LLC	7,225.00
ISC, INC	7,391.73
IXL LEARNING	7,695.00
SYSCOMONTANA INC.	10,314.49
SCHOOL SPECIALTY INC	10,928.97
UNIVERSAL ATHLETIC SERVICES, INC	11,702.03
FOLLETT SCHOOL SOLUTIONS	12,635.32
BRUCO INC	16,585.32
ROCKY MOUNTAIN POWER	16,634.61
NATIONAL BUSINESS FURNITURE	18,617.96
MODERN ELECTRIC COMPANY	22,368.00

Work Orders

Dates displayed in
Mountain Daylight Time

10/26/2018 8:30:05AM

Work Order	**41922**

Summary	FW: Wyoming Region 1 Hazard Mitigation Plan for FEMA review		
Requestor	Stacia Hill	**Type**	Website
Requestor Call Back Number		**Asset ID**	
Department	Sheriff	**Department Number**	
Location	SO	**Date Entered**	9/14/2018 9:19:33AM
Assigned Technician	Gray, Heather	**Date Assigned**	9/14/2018 9:19:33AM
Priority	Medium	**Expected Completion Date**	9/17/2018 9:22:11AM
Date Completed	9/17/2018 8:05:51AM	**Charge**	
Status	Completed	**Hours**	0.25

Work Order Description

9/14/2018 9:19:33AM EmailRequestManagement

Work Order created via E-mail Monitor Policy: Default

From: EHill@natronacounty-wy.gov
To: helpdesk@natronacounty-wy.gov
CC:
Subject: FW: Wyoming Region 1 Hazard Mitigation Plan for FEMA review

Information submitted 9/14/2018 9:19:32 AM by Eileen Hill :

News and calendar

All Natrona County e-mails and attachments are public records under the Wyoming Public Records Act, W.S. § 16-4-201 et seq., and are subject to public disclosure pursuant to this Act. Email to and from me, in connection with the transaction of public business, is subject to the Wyoming Public Records Act and may be disclosed to third parties.

From: Stacia Hill
Sent: Friday, September 14, 2018 9:08 AM
To: Eileen Hill
Subject: FW: Wyoming Region 1 Hazard Mitigation Plan for FEMA review

Eileen we would like this to go out on Monday September 17th.

Thank you and let me know if you have any questions.

Stacy

From: John Harlin
Sent: Thursday, September 13, 2018 11:45 AM
To: Stacia Hill
Subject: FW: Wyoming Region 1 Hazard Mitigation Plan for FEMA review

John Harlin
Lieutenant

Natona County Sheriff's Office
Emergency Management Division
201 N. David, 2nd Floor
Casper, Wyoming 82601
Office: 307.235.9289
Fax: 307.235.9652
Cell: 307.262.1898
Email:harlinj@natronacounty-wy.gov
Website: http://www.natrona.net/122/Emergency-Management-Administration
Facebook: https://www.facebook.com/Natrona-County-Emergency-Management-245543751964/

From: Karsjen, Kyle [mailto:kyle.karsjen@woodplc.com]
Sent: Thursday, September 13, 2018 10:49 AM
To: Melinda Gibson; Brislawn, Jeff P; Dalgarn, Russ; Dalgarn, Russ; John Harlin; James Santistevan; Mary Schell
Subject: RE: Wyoming Region 1 Hazard Mitigation Plan for FEMA review

Hi everyone,

Attached is a press release that can be targeted for release Monday, September 17. Please coordinate with your PIO's, webmaster, etc to blast this out through traditional and social media. Please document your efforts to get the word out.

Let me know if there are any questions.

Kyle

Kyle Karsjen

Amec Foster Wheeler's parent company is now owned by Wood plc
Senior Emergency Management Specialist, Environment and Infrastructure, Inc., Amec Foster Wheeler
Hazard Mitigation and Emergency Management Program
1942 Broadway, Suite 314, Boulder, CO 80302
O 303 820 4661
kyle.karsjen@woodplc.com-- www.woodplc.com

From: Melinda Gibson
Sent: Wednesday, September 12, 2018 2:50 PM
To: Brislawn, Jeff P
Cc: Karsjen, Kyle ; Dalgarn, Russ ; Dalgarn, Russ ; John Harlin ; James Santistevan
Subject: Re: Wyoming Region 1 Hazard Mitigation Plan for FEMA review

The Region 2 Mitigation Plan has been posted on the WOHS website as of this afternoon. If you all want to advertise its location to the public, here's the link to our home page: http://hls.wyo.gov You will see the information on the draft plan on the right hand side of the home page.

While the plan is out for public comment, I will also be completing the state's review of the plan.

Best Regards,

Melinda

Melinda Gibson, CFM
State Hazard Mitigation Officer
Earthquake Program Manager
Wyoming Office of Homeland Security
5500 Bishop Blvd - East Door
Cheyenne, WY 82002
melinda.gibson@wyo.gov
307.286.2670 - Work Cell
307.777.4914 - Desk
307.635.6017 - Fax
http://hls.wyo.gov/mitigation.aspx - Website

To achieve great things, two things are needed; a plan, and not quite enough time.
? Leonard Bernstein, 1918 - 1990 ?

On Wed, Sep 12, 2018 at 2:03 PM, Brislawn, Jeff P wrote:
Melinda,
The final Wyoming Region 1 Hazard Mitigation Plan for FEMA review can be obtained from this Google Drive:
https://drive.google.com/drive/folders/1XsLxMtBWXOaNy8V7-lLZpKRgzNRKd6kO?usp=sharing

It is one combined PDF document. The Plan Review tool will also be on the drive once I get the input from Crook County on jurisdictional contacts. The County is working to get me the information this afternoon. Please submit the plan and review tool to FEMA so they can initiate their review.
Thanks,
Jeff

Jeff Brislawn
Hazard Mitigation Lead/Sr Associate
Hazard Mitigation and Emergency Management Program
Direct: 303-209-3781
Mobile: 303-704-5506
www.woodplc.com

project communications and similar factual, non-commercial electronic communications.

Please click http://www.woodplc.com/email-disclaimer for notices and company information in relation to emails originating in the UK, Italy or France.

As a recipient of an email from a John Wood Group Plc company, your contact information will be on our systems and we may hold other personal data about you such as identification information, CVs, financial information and information contained in correspondence. For more information on our privacy practices and your data protection rights, please see our privacy notice at https://www.woodplc.com/policies/privacy-notice

E-Mail to and from me, in connection with the transaction
of public business, is subject to the Wyoming Public Records
Act and may be disclosed to third parties.

Attachment 1: image001.jpgAttachment 2: image003.pngAttachment 3: image002.pngAttachment 4: R2 HMP Public Review Press Releasev2.doc

Resolution

9/17/2018 8:05:48AM **Gray, Heather**

I published the news item, document and added the link to the document in the news item.

9/14/2018 1:52:19PM **Gray, Heather**

I drafted a news item and added a document to the document center. I will publish these and add the document link to the news item on Monday.

Adams, Donna (Colorado, Nevada Utah)

From: Stacia Hill <shill@natronacounty-wy.gov>
Sent: Friday, October 26, 2018 8:32 AM
To: 'Karsjen, Kyle'
Cc: John Harlin
Subject: FW: Regional Hazard Mitigation Plan

Kyle here is one more that is from the County IT department that manages the website. It shows the posting job.

Stacia Hill
Natrona County Sheriff's Office
EMA Deputy Coordinator
201 N. David, 2nd Floor
Casper, Wyoming 82601
307-235-9205
shill@natronacounty-wy.gov

From: Heather Gray
Sent: Friday, October 26, 2018 8:28 AM
To: Stacia Hill
Subject: RE: Regional Hazard Mitigation Plan

Stacia,

The following screenshots might be helpful also.

View Item

Last modified by Heather Gray on 9/17/2018 8:00:28 AM

Start Date:
09/14/2018

End Date:
09/28/2018

Title:
Regional Hazard Mitigation Plan Draft Available for Public Review and Comment

Brief Description:
Regional Hazard Mitigation Plan Draft for Converse, Natrona and Niobrara Counties available for public review and comment.

Link Text:
Read on...

Complete Text:
Would you like to learn more about what Converse, Natrona and Niobrara counties are doing to minimize the impacts of floods, wildfires, winter storms, hazardous m incidents, and other hazards? A draft of the Regional Hazard Mitigation Plan is being made available for public review and comment. The plan assesses risks posed by hazards, identifies ways to reduce those risks, and allows each county and municipalities to be eligible for mitigation grant funding from FEMA. County planning teams including representatives from all municipalities, developed the plan with assistance from a consultant. The plan identifies hazard mitigation goals and mitigation proj the counties, with the intent of reducing losses from hazard events before they occur again. A public survey and series of public workshops were held during the plann process to solicit input on the hazards and ideas for mitigation projects. The counties in the Region are now soliciting public comment on the plan before it is finalized submitted for FEMA review and approval. The final plan will be adopted by each participating county and municipality before it becomes official. More information can obtained from your local county emergency management office.

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An online form to provide feedback on the plan can be accessed here:
https://www.surveymonkey.com/r/WYR2_Review

Start Date:
09/14/2018

End Date:
09/28/2018

Title:
Regional Hazard Mitigation Plan Draft Available for Public Review and Comment

Brief Description:
Regional Hazard Mitigation Plan Draft for Converse, Natrona and Niobrara Counties available for public review and co

Link Text:
Read on...

Complete Text:
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http://hls.wyo.gov
An online form to provide feedback on the plan can be accessed here:
https://www.surveymonkey.com/r/WYR2_Review

Image:

I can also send you a pdf of the helpdesk request if you would like.

Thank you,

Heather Gray
Natrona County IT
200 N Center Rm 105

From: Stacia Hill
Sent: Friday, October 26, 2018 8:23 AM

To: Heather Gray <hgray@natronacounty-wy.gov>
Subject: RE: Regional Hazard Mitigation Plan

No you don't need to repost post it. I just need to show that it was posted there during the public review time and I never to a screen shot or anything of it. So Just trying to capture that information. Hopefully this email will work.

Thank you

Stacy

From: Heather Gray
Sent: Friday, October 26, 2018 8:21 AM
To: Stacia Hill; Eileen Hill
Subject: RE: Regional Hazard Mitigation Plan

Stacia,

Yes, you did. It was published on September 17th. The comment period ended on September 28th, so the article expired on September 29th. Do we need to repost it?

Thank you,

Heather Gray
Natrona County IT
200 N Center Rm 105

From: Stacia Hill
Sent: Friday, October 26, 2018 8:15 AM
To: Eileen Hill <EHill@natronacounty-wy.gov>; Heather Gray <hgray@natronacounty-wy.gov>
Subject: Regional Hazard Mitigation Plan

Did I ask either of you to publish to the county website the REGIONAL HAZARD MITIGATION PLAN DRAFT FOR CONVERSE, NATRONA AND NIOBRARA COUNTIES AVAILABLE FOR PUBLIC REVIEW AND COMMENT? This would have been in September.

Stacia Hill
Natrona County Sheriff's Office
EMA Deputy Coordinator
201 N. David, 2nd Floor
Casper, Wyoming 82601
307-235-9205
shill@natronacounty-wy.gov

Adams, Donna (Colorado, Nevada Utah)

From: Heather Gray <hgray@natronacounty-wy.gov>
Sent: Friday, October 26, 2018 8:21 AM
To: Stacia Hill; Eileen Hill
Subject: RE: Regional Hazard Mitigation Plan

Stacia,

Yes, you did. It was published on September 17th. The comment period ended on September 28th, so the article expired on September 29th. Do we need to repost it?

Thank you,

Heather Gray
Natrona County IT
200 N Center Rm 105

From: Stacia Hill
Sent: Friday, October 26, 2018 8:15 AM
To: Eileen Hill <EHill@natronacounty-wy.gov>; Heather Gray <hgray@natronacounty-wy.gov>
Subject: Regional Hazard Mitigation Plan

Did I ask either of you to publish to the county website the REGIONAL HAZARD MITIGATION PLAN DRAFT FOR CONVERSE, NATRONA AND NIOBRARA COUNTIES AVAILABLE FOR PUBLIC REVIEW AND COMMENT? This would have been in September.

Stacia Hill
Natrona County Sheriff's Office
EMA Deputy Coordinator
201 N. David, 2nd Floor
Casper, Wyoming 82601
307-235-9205
shill@natronacounty-wy.gov

The Lusk Herald

MONDAY, NOVEMBER 5, 2018

Regional Hazard Mitigation Plan Draft

Posted Sep 19, 2018

A draft of the Regional Hazard Mitigation Plan is being made available for public review and comment.

If you wish to see more...

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WEATHER

Douglas Weather

48°
28°

TUESDAY	39°	25°	
WEDNESDAY	37°	25°	
THURSDAY	34°	19°	

theweather.com +info

NEWS

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424 South Elm, Lusk, WY

Hours:
Monday through Friday,
8 AM to 4 PM

Chairman of Niobrara County Commissioners
Richard Ladwig

Welcome to the Niobrara County, Wyoming Website!

As the least populated county in Wyoming, we strive to be first in service and to be your county of choice! Our website is designed to provide residents, businesses and visitors with a great source of information about County government and the community in which you live.

You will find links to Niobrara County services and connections to community resources such as the library, hospital, Town of Lusk, schools and special districts as well as other state agencies.

News & Announcements

SEPTEMBER 17, 2018

REGIONAL HAZARD MITIGATION PLAN DRAFT FOR CONVERSE, NATRONA AND NIOBRARA COUNTIES AVAILABLE FOR PUBLIC REVIEW AND COMMENT

SEPTEMBER 17, 2018 - Would you like to learn more about what Converse, Natrona and Niobrara counties are doing to minimize the impacts of floods, wildfires, winter storms, hazardous materials incidents, and other hazards? A draft of the Regional Hazard Mitigation Plan is being made available for public review and comment. The plan assesses risks posed by hazards, identifies ways to reduce those risks, and allows each county and municipalities to be eligible for mitigation grant funding from FEMA. County planning teams, including representatives from all municipalities, developed the plan with assistance from a consultant. The plan identifies hazard mitigation goals and mitigation projects for the counties, with the intent of reducing losses from hazard events before they occur again. A public survey and series of public workshops were held during the planning process to solicit input on the hazards and ideas for mitigation projects. The counties in the Region are now soliciting public comment on the plan before it is finalized and submitted for FEMA review and approval. The final plan will be adopted by each participating county and municipality before it becomes official. More information can be obtained from your local county emergency management office.

Comments will be accepted through September 28, 2018.

The draft plan can be accessed at the Wyoming Office of Homeland Security website: http://hls.wyo.gov

An online form to provide feedback on the plan can be accessed here: https://www.surveymonkey.com/r/WYR2_Review

- Home
- Chamber of Commerce
- Clerk of District Court
- Conservation District
- County Assessor
- County Attorney
- County Clerk
- County Commissioners
- County Coroner
- County Extension
- County Hospital
- County Library
- County Treasurer
- Emergency Management
- Planning and Zoning
- Public Health
- Road and Bridge
- School District
- Sheriff
- Town of Lusk
- Town of Manville

https://www.theweather.com/douglas-c10090.htm

Adams, Donna (Colorado, Nevada Utah)

From: James Santistevan <niobraracountyema@gmail.com>
Sent: Thursday, September 20, 2018 6:08 AM
To: Karsjen, Kyle
Subject: Re: Wyoming Region 2 Hazard Mitigation Plan for FEMA review
Attachments: image003.png

Our survey is on the county website and in the Lusk Hearld paper and e paper. I will send you a copy of the paper one later today.

James Santistevan
Niobrara County Emergency Management Coordinator/LEPC Chairman
PO Box 462
Lusk, WY 82225
307.340.0893
niobraracountyema@gmail.com

On Wed, Sep 19, 2018, 8:50 AM Karsjen, Kyle <kyle.karsjen@woodplc.com> wrote:

> Good morning all,
>
> Hopefully everyone was able to get the public notified that the Region 2 mitigation plan is out for review. As a reminder, please send me copies of however you posted it – screen shots, newspaper posts, facebook posts etc. so I can include these in the plan.
>
> Kyle
>
> ---
>
> **From:** Karsjen, Kyle
> **Sent:** Thursday, September 13, 2018 10:49 AM
> **To:** Melinda Gibson <melinda.gibson@wyo.gov>; Brislawn, Jeff P <jeff.brislawn@woodplc.com>; Dalgarn, Russ <russ.dalgarn@conversecountywy.gov>; Dalgarn, Russ <mary.schell@conversecountywy.gov>; John Harlin <harlinj@natronacounty-wy.gov>; James Santistevan <niobraracountyema@gmail.com>; Mary Schell <mary.schell@conversecountywy.gov>
> **Subject:** RE: Wyoming Region 1 Hazard Mitigation Plan for FEMA review

Hi everyone,

Attached is a press release that can be targeted for release Monday, September 17. Please coordinate with your PIO's, webmaster, etc to blast this out through traditional and social media. Please document your efforts to get the word out.

Let me know if there are any questions.

Kyle

Kyle Karsjen

Amec Foster Wheeler's parent company is now owned by Wood plc

Senior Emergency Management Specialist, Environment and Infrastructure, Inc., Amec Foster Wheeler

Hazard Mitigation and Emergency Management Program

1942 Broadway, Suite 314, Boulder, CO 80302

O 303 820 4661

kyle.karsjen@woodplc.com www.woodplc.com

From: Melinda Gibson <melinda.gibson@wyo.gov>
Sent: Wednesday, September 12, 2018 2:50 PM
To: Brislawn, Jeff P <jeff.brislawn@woodplc.com>
Cc: Karsjen, Kyle <kyle.karsjen@woodplc.com>; Dalgarn, Russ <russ.dalgarn@conversecountywy.gov>; Dalgarn, Russ <mary.schell@conversecountywy.gov>; John Harlin <harlinj@natronacounty-wy.gov>; James Santistevan <niobraracountyema@gmail.com>
Subject: Re: Wyoming Region 1 Hazard Mitigation Plan for FEMA review

The Region 2 Mitigation Plan has been posted on the WOHS website as of this afternoon. If you all want to advertise its location to the public, here's the link to our home page: http://hls.wyo.gov You will see the information on the draft plan on the right hand side of the home page.

While the plan is out for public comment, I will also be completing the state's review of the plan.

Best Regards,

Melinda

Melinda Gibson, CFM

State Hazard Mitigation Officer

Earthquake Program Manager
Wyoming Office of Homeland Security

5500 Bishop Blvd - East Door

Cheyenne, WY 82002
melinda.gibson@wyo.gov
307.286.2670 - Work Cell

307.777.4914 - Desk
307.635.6017 - Fax

http://hls.wyo.gov/mitigation.aspx - Website

To achieve great things, two things are needed; a plan, and not quite enough time.
♫ Leonard Bernstein, 1918 - 1990 ♫

On Wed, Sep 12, 2018 at 2:03 PM, Brislawn, Jeff P <jeff.brislawn@woodplc.com> wrote:

> Melinda,
>
> The final Wyoming Region 1 Hazard Mitigation Plan for FEMA review can be obtained from this Google Drive:
>
> https://drive.google.com/drive/folders/1XsLxMtBWXOaNy8V7-lLZpKRgzNRKd6kO?usp=sharing

It is one combined PDF document. The Plan Review tool will also be on the drive once I get the input from Crook County on jurisdictional contacts. The County is working to get me the information this afternoon. Please submit the plan and review tool to FEMA so they can initiate their review.

Thanks,
Jeff

Jeff Brislawn
Hazard Mitigation Lead/Sr Associate

Hazard Mitigation and Emergency Management Program
Direct: 303-209-3781

Mobile: 303-704-5506
www.woodplc.com

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Wyoming Region 2

Regional Hazard Mitigation Plan

Appendix B

Records of Adoption (electronic)