

# **Multi-Hazard Mitigation Plan**

**Campbell County**

**City of Gillette**

**Town of Wright**

**Wyoming**



Gillette, March 23, 2013

**Prepared by: Campbell County Emergency Management**

**with assistance from**

**Beck Consulting and Amec Foster Wheeler**

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## Executive Summary

Campbell County, the City of Gillette, and the Town of Wright, Wyoming, are home to an estimated 48,176 (2013 U.S. Census) residents. The three jurisdictions prepared the original Multi-Jurisdictional Joint Hazard Mitigation plan (MHMP) in 2006, for the purpose of becoming more disaster resistant. The plan was updated in 2011 and again in 2015. The plan covers Campbell County and the two incorporated communities of Gillette and Wright.

Each version of the MHMP utilized a Local Planning Team (LPT) formed with broad geographic and functional representation, in addition to representatives of Campbell County Government, the City of Gillette, and the Town of Wright. The participants attended the planning meetings to guide review and updating of the existing plan. The County Coordinator also kept the Local Emergency Planning Committee (LEPC) apprised of progress on the plan update. Contractors assisted the County for each of the plan updates.

In addition to the LPT, local government elected officials were briefed, and the public was afforded the opportunity to participate in an online survey and/or attend one of a number of open public meetings. Flyers, news releases, website postings, legal ads, and social media were used to announce the plan update, associated meetings, and the release of the draft plan for public review and comment.

The natural hazards profiled in the previous plans were updated and reorganized to include: drought; flooding; earthquakes; hail; human-caused (hazardous materials and terrorism); lightning; landslide; tornadoes, microbursts, and high winds; toxic gas seeps; winter storms; and fires. Each hazard profile contains sections that discuss past occurrences, potential impacts, vulnerability and frequency, and potential losses. Although considered separately in the planning process, the three jurisdictions covered by the Hazard Mitigation Plan, the Town of Wright, the City of Gillette and Campbell County have very similar risk profiles.

The LPT reviewed progress on the goals and projects since the completion of the 2011 update. The status of each projects was determined as; accomplished, on-going, no longer necessary, or necessary and not yet accomplished. The projects deemed necessary and not yet accomplished were carried over into the 2015 update. Additional projects were identified during the planning process. The 2015 plan has six goals and 57 projects. The goals are as follows:

- 1) Reduce the impact of severe winter weather on people, property or natural resources.
- 2) Increase the resilience of citizens by embracing their personal responsibility to be prepared and involved through education and volunteering.
- 3) Maintain the reliability and resilience of critical infrastructure.
- 4) Reduce the impacts of human-caused incidents, emergencies, or disasters.
- 5) Reduce the loss of life and property from fire.
- 6) Increase resilience through coordination of governmental policies, procedures, codes and regulations.

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## Chapter 1 INTRODUCTION

Campbell County, the City of Gillette, and the Town of Wright intend to eliminate or reduce the risk to human life and property from the effects of natural hazards through the preparation of

this Multi- Hazard Mitigation Plan. This plan identifies goals and mitigation actions (projects), and prioritizes the mitigation actions.

The plan meets the requirements of the Interim Final Rule published in the Federal Register on February 26, 2003, at 44 CFR Part 201 as part of the Disaster Mitigation Act of 2000.

### Specific Jurisdictions Represented in the Plan

*Table 1-1: Local Jurisdiction Participation*

| Jurisdictions    | 2015 Participation Level            | NFIP Participants? | Adoption of Previous Plan | Changes in participation |
|------------------|-------------------------------------|--------------------|---------------------------|--------------------------|
| City of Gillette | Elected officials, Staff and public | Yes                | Yes                       | No change                |
| Town of Wright   | Elected Officials, Staff and public | Yes                | Yes                       | No change                |
| Campbell County  | Elected Officials, Staff and public | Yes                | Yes                       | No change                |

### How the Plan is Organized

This plan is organized into five chapters with supporting materials provided in the appendices.

#### **Chapter 1. Introduction**

Chapter 1 provides background material and mitigation strategies in the context of Campbell County's unique assets, resources, and hazards.

#### **Chapter 2. Planning Process**

Chapter 2 describes how the plan was developed, including how the County, City and Town, and the public participated. Detailed documentation of the planning process is provided in Appendix A.

#### **Chapter 3. Hazard Evaluation and Risk Assessment**

Chapter 3 gives information about historical disaster occurrences in the three local jurisdictions and lists potential hazards, historical disaster information, potential losses, critical facilities, and vulnerabilities. For security reasons, pursuant to W.S. 16-4-203(b)(vi), pages 3-102 through 3-109 containing the Critical Infrastructure and Vulnerable Populations section has been removed from the publicly released portion of the plan and is available upon request from the Campbell County Emergency



Management Agency as a FOUO (For Official Use Only) document. This section has been made available to members of the Local Planning Team for their review and comment.

#### **Chapter 4. Mitigation Strategy**

Chapter 4 uses the hazard information to develop goals, objectives and projects that can lessen the chances and/or severity of a potential disaster while recognizing there are limited resources available. These prioritized projects have identified responsible parties, an estimated time of completion, and potential funding sources.

#### **Chapter 5. Plan Maintenance**

Chapter 5 describes how the plan will be maintained and kept current. Those responsible for maintaining the plan are identified.

### **Preparation of the Plan**

The backbone of the operation was the Campbell County Local Planning Team and the Emergency Management Coordinator, David King. The plan was prepared by consultant Barb Beck, Beck Consulting with assistance from AMEC Foster Wheeler. Ms. Beck briefed local government officials; convened, facilitated, and documented public and Local Planning Team meetings; and updated the plan and projects in the plan based on input obtained from the public, the local planning team, and the county coordinator. AMEC Foster Wheeler updated the hazard profiles.

### **County Profile**

“Campbell County is located on the high plains of Northeastern Wyoming. The County measures 50 miles east-west by 100 miles north-south and encompasses approximately 5,000 square miles. The County is blessed with wide-open spaces, abundant natural resources and wildlife, and the friendliest people around” (Campbell County Commissioners, <http://ccgov.net>).

The project area is the City of Gillette (incorporated 1891), Campbell County, Wyoming (incorporated 1911), and the Town of Wright (incorporated 1985). Campbell County is situated in northeast Wyoming in the Powder River Basin, The County is surrounded by Johnson County to the west, Sheridan to the northwest, Weston County to the east, Crook County to the north and east, Converse County to the south, and Powder River County, Montana to the north.

Much of the County can be characterized as rolling prairie. Elevations range from a low of 4,100 feet above sea level in the northwest corner of the County to 6,052 feet on the top of the north Pumpkin Butte. The elevation is 4,544 at Gillette and 5,010 at Wright (Campbell County Soil Survey, 2004).



The County is drained by three river basins. The southern and extreme eastern part of the County drains south to the Cheyenne River. The central portion of the County is drained by the Belle Fourche. The northwestern area of the County is drained by the Powder River which crosses the northwest tip of the County flowing north and east. The Belle Fourche, Little Powder, and Powder Rivers are perennial. Mineral resources in the County include coal, oil, natural gas, uranium, and sand and gravel.

The first commercial open pit coal mine in Wyoming, Wyodak Resources' mine east of Gillette, opened in 1925. The coal reserves of Campbell County make a significant contribution to meeting the nation's energy needs and coal from the County is burned in generation facilities in approximately half of the states in the country. Commercial oil and gas activity in the County began in the late 1940s and continues today. Since the late 1980s coal bed methane gas exploration and production has occurred in the central areas of the County (Campbell County Soil Survey, 2004.)

According to the U.S. Census Bureau, the population of Campbell County at the time of the last decennial census (2010) was 46,133 residents. At that time, the City of Gillette was home to 29,087 people, the Town of Wright to 1,807 people, and 15,239 people resided in the County outside an incorporated town or City. (<http://factfinder.census.gov>). Population density in Campbell County at that time was seven persons per square mile. Between decennial censuses, the Bureau provides population estimates. The estimated population of the County in 2013 was 48,176. The population estimates do not go below the county level.

Land ownership is a combination of private (individual and corporate), state and federal. State lands are generally arranged in a checkerboard pattern consisting of the full sections (640 acres) 16 and 36 of each township. Federal surface ownership accounts for 12.1% of the lands in Campbell County. Federal lands are managed by the Bureau of Land Management (7.4% of the County) and the Forest Service, Thunder Basin National Grassland (4.7% of the County.) The Bureau of Land Management is responsible for 236,067 surface acres and 2,125,459 acres of mineral estate in the County. The Forest Service manages 14,804 surface acres. Where mineral rights are not split estate (split estate means subsurface or mineral rights belong to a different party than surface rights) the minerals found under Forest Service lands are considered to be federal mineral estate and are managed by the Bureau of Land Management. Federal minerals, managed by the Bureau of Land Management may also be found under some private lands.

Land uses in the County in descending order consist of agriculture, coal mines (several of the largest in the world,) developed areas such as the Town of Wright and the City of Gillette, and other mineral extraction areas and pipelines within and crossing the County.

## Climate and Weather

Temperature and precipitation information is available from a station located in Gillette with averages computed from 1971 to 2010. The average winter temperature is 23.4 degrees Fahrenheit. The average summer temperature is 67.5 degrees. Total annual precipitation is 17.14 inches, 71% of which falls in April through September. The average seasonal snowfall is 65 inches (Susan Sanders, National Weather Service). The first freezing temperature (32 degrees or lower), five years in ten occurs earlier than September 20. The last freezing temperature (32 degrees or below) five years in ten occurs later than May 19 (County Soil Survey, 2004).

## Demographics

Campbell County has had a rapidly growing population with a relatively young, affluent, and homogenous workforce compared to the country as a whole. The estimated population of Campbell County in 2013 was 48,176. From 1970 – 2013, the population in the County grew 269.2% in contrast with population growth in the country as a whole of 55.1%. The population change in the County for the period 2000-2012 was 39.2%. The median age in Campbell County in 2012 was 32.1 years, younger than both the state and U.S. median age (37.1 years.) Ninety-two percent of the population of the County identifies itself racially as “white alone.”

The county has a number of licensed daycare facilities. The number of licenses daycares varies at any given time, but is tracked quarterly. In January 2013 there were 94 licensed facilities with a capacity of 1890 children. In March 2014, there were 71 licensed facilities with capacity for 1992 children and in June 2015, 62 facilities with capacity for 1,756 children.

County residents overwhelmingly speak English with only 1.4% of the County’s population reporting they “speak English less than very well.” In 2012, 7.7% of the population was below the poverty level. Poverty level is determined by income thresholds which vary depending on family size and composition. Campbell County has very few out-of-county commuters, 25,018 out of 25,609 employees work within the County. However, considerable numbers of workers at the coal mines are transported to and from work via bus.

## Economy

The economy of Campbell County is primarily based on energy extraction. Coal, oil, gas, and uranium are all produced in the County. The City of Gillette has adopted the official slogan as “The Energy Capital of the Nation.”

Total tonnage produced in Campbell County's Coal Mines in 2012 was 354,121,500 tons. This was 88% of Wyoming's total output that year of 401,457,074. With the Antelope Coal Mine (listed in Converse County yet now producing in Campbell County), another 34,316,314 tons of production, making the combined tonnage as being 97% of Wyoming's coal output that year.

"Two Wyoming mines alone, North Antelope Rochelle and Black Thunder, accounted for 20 percent of all coal mined in the U.S. in 2012." According to the Executive Summary from the *Department of Homeland Security's March 2014 Resiliency Assessment*, "Mines in the Powder River Basin supply 40 percent of the Nation's coal used in U.S. generating stations that provide on average 20 percent of the Nation's electricity."

In 2013, 32.9% of the jobs in the County were provided by mining fossil fuels with another 2% of the jobs in other mining. This is significant because on average, earnings from mining jobs are higher than for other sectors. The average annual oil and gas wage in the County in 2014 was \$107,815. The average annual mining wage (excluding oil and gas) in the County in 2014 was \$82,934. Mining support jobs paid on average \$74,157 per year. These wages compare very favorably with the average for all sectors for the period which was \$57,652.

Mining employment grew 96.4% between 1998 and 2013 going from 3,846 jobs to 7,555 jobs in the County. By contrast, non-mining employment grew at a rate of 59.4% for the same period. Just before finalization of this plan, coal mines in the county were directly affected by energy prices and the result has been a significant number of layoffs in the coal industry—approximately 15% of the coal employees. This downturn will affect not only the coal jobs, but also the service and government sectors.

Per capita income in Campbell County in 2013 was \$51,784 compared to \$45,481 for the U.S. as a whole. In 2013, non-labor income in Campbell County was 28%--meaning most income came from labor earnings rather than rent, interest, dividends, and transfer payments (such as social security and retirement.)

The average unemployment rate for Campbell County in 2014 was 3.5%--significantly below the unemployment rate for the U.S. of 6.5%. The total workforce (employed individuals 16 years of age and over) in the County in 2014 was 26,045.

*Table 1-2: Largest Economic Sectors, Campbell County, 2013*

| Sector  | Number of Jobs | Percent of Jobs |
|---|----------------|-----------------|
| Agriculture, Forestry, Fishing, Hunting, and Mining           | 6,482          | 24.9            |
| Education, Health Care, Social Assistance                     | 4,593          | 17.6            |
| Retail Trade  | 2,194          | 8.4             |
| Construction  | 2,183          | 8.4             |
| Arts, Entertainment, Recreation, Accommodations, Food Service | 1,987          | 7.6             |
| Transportation, Warehousing, Utilities                        | 1,908          | 7.3             |

The source for the information in the Economy section above was the Economic Profile System (EPS) accessed on August 14, 2015. EPS compiles a broad range of the most current social, economic, and demographic information from publicly-available federal data sources including the Department of Commerce (Bureau of Economic Assistance), the Department of Labor

(Bureau of Labor Statistics), the American Community Survey, and the U.S. Census Bureau. Please see [www.headwaterseconomics.org](http://www.headwaterseconomics.org).

## Transportation

The primary vehicle corridor crossing the County is Interstate 90, which crosses the center of the County passing through Gillette in an east-west direction. Highway 59 is the most heavily traveled state highway in Wyoming and runs north-south through the County, linking Gillette and Wright with Douglas to the south. State Highways 14 and 16 run generally northwest-southeast in the north half of the County turning due east at Gillette. State Highway 50 runs southwest from Gillette in the southern half of the County. State Highway 387 runs south and west from Wright linking it with Casper, which is south of the Town of Wright. Highway 450 runs south and east from Wright to the Weston County line, continuing on to the east; to Newcastle.

The road network in the County also includes approximately 1,000 miles of County roads (160 miles paved, 840 miles gravel), 14 major County bridges, roads providing access to energy development, and private roads and drives which access rural residences, subdivisions, and ranches.

Burlington Northern Santa Fe (BNSF) Railroad has two main rail lines in the County. One line crosses the County in a northwest to southeast direction as far as Gillette, then continues in an easterly direction parallel to Interstate 90. Approximately 10 miles east of Gillette, the line intersects at the "Donkey Creek Junction." A rail spur serves the large coal mines north and east of Gillette and ties in at Donkey Creek. The second line running to the south continues on to Douglas while serving the mines in the southern half of the County. The Union Pacific Railroad also operates some coal-shipping trains into and out of the County, primarily south from Donkey Creek Junction.

Gillette is home to the Gillette-Campbell County Airport. The airport sits at an elevation of 4,363 feet above sea level northwest of the City. Delta and United provide commercial air service which hubs into either Salt Lake City or Denver. For the purposes of emergency management this facility is considered critical. The airport also provides 287 local jobs. The airport serves approximately 55,000 passengers a year and reported the first six months of 2015 had an increase in traffic of approximately 19% compared to the same period in 2014. During this period, the airport served 29,761 travelers.

The Gillette-Campbell County Airport is a certificated Federal Aviation Regulation Part 139 airport. Aircraft Rescue and Fire Fighting is an Index "A" with Index "B" capabilities. The Gillette-Campbell County Airport is a TSA Category IV Security Airport.

## Development Trends

Given the current and projected demand for energy, and the development trends of the past ten years, additional land use conversion from agriculture to mineral extraction is expected. Along with the increased energy production come more jobs and with these jobs, the need for more housing. Land use change to accommodate the growing population is occurring primarily in the vicinity of Gillette. However, both of the incorporated communities in Campbell County and the unincorporated areas of the County have experienced growth since this plan was last updated.

Campbell County amended their Natural Resource and Land Plan in 2014. The plan emphasizes city-county cooperation in managing anticipated growth. The City of Gillette's Comprehensive Plan was last updated in 2013. Land development policies is one of eight core focus areas of the plan. The plan supports residential, industrial, and commercial infill development. According to the plan "In the past ten years, there has been \$3.2 billion invested in public and private projects in the County." The plan contains a stated goal of improving consistency between city and county policies, regulations, design standards, and review processes.

At the first Local Planning Team meeting for the MHMP update held in May 2015, planning team members were asked to report their observations on development. The following information is what they provided collectively with respect to ongoing and planned industrial, commercial, and residential development.

### Industrial

- Westward expansion of the Belle Ayre Coal Mine towards Hwy 59S
- Expansion of the Eagle Butte Coal Mine towards Highways 14/16 and 59N
- North Antelope/Rochelle Coal Mine is relocating transmission lines around their operation
- City of Gillette is working to improve water availability to Southern and Winland Industrial Parks
- New liquid natural gas plant south of Savageton, plus new transmission lines

### Commercial/Educational

- Large Menards store under construction in Gillette, opened early winter 2015
- Numerous new hotels planned/under construction in Gillette (on Boxelder Road and Highways 14/16)
- Three new banks and a credit union (First Interstate, Pinnacle, First Northern, and credit union based in S.D.)
- Many new restaurants
- New elementary school at Stocktrail and 8<sup>th</sup> Street
- Gillette College expansion—dormitories, activity center, rodeo and agriculture complex
- New nursing home under construction on Douglas Highway
- Farmer's Coop truck stop (by CamPlex)

Residential (additional detail provided below by the City of Gillette)

- New residential development is occurring in many locations—primarily around and within existing communities
- Gap Subdivision on Hwy 59S

As was true during the 2011 update, and is still the case in 2015, uranium solution mining and wind energy are still developing and/or increasing their operational capacity. Solution mining, or in-situ leaching, is the process of recovering uranium from a water-saturated, underground ore body in a manner which leaves overlying rock strata and the land surface intact. From the recovery or production well, the uranium-bearing solution is piped to a surface plant where a series of conventional chemical processes extract uranium from the solution (Rocky Mountain Energy White Paper). This process is currently increasing production in the Pumpkin Buttes and will bring new workers to the area. A new uranium solution mining startup in northwestern Crook County will result in product being transported into Campbell County through Gillette and Wright for processing in the Pumpkin Buttes area of southwest Campbell County. The Local Planning Team discussed this development in anticipation of potential additional hazmat challenges associated with moving material from the extraction site to the processing site.

Lands in and around the City of Gillette and south of the Town of Wright have been subdivided. Residential development near Gillette is occurring both inside and outside of the City limits. Gillette and Campbell County are coordinating land use approvals and policies in a 39-square mile area surrounding the City. Development in Wright is governed by the Municipal Code adopted in 2010. Both communities have building inspectors and have adopted the appropriate international building codes.

### **Town of Wright Building Permits**

2010 – 32 Buildings  
2011 – 20 Buildings  
2012 – 22 Buildings

2013 – 177 Buildings  
2014 – 58 Buildings

(Note: According to the Building Officer, the relatively larger numbers of building permits issued in 2013 and 2014 were mostly related to previous storm damage.)

### **City of Gillette Building Permits**

As the most populated community in Campbell County, it is understandable the City of Gillette has experienced the most rapid growth. The following information was obtained from the City of Gillette Planning Department.

Table 1.3. displays the residential building permits issued by the City of Gillette from May 1, 2011 through April 30, 2015. For the period, a total of 53 permits were issued for mobile homes, 13 permits were issues for enhanced manufactured homes, and 585 permits were

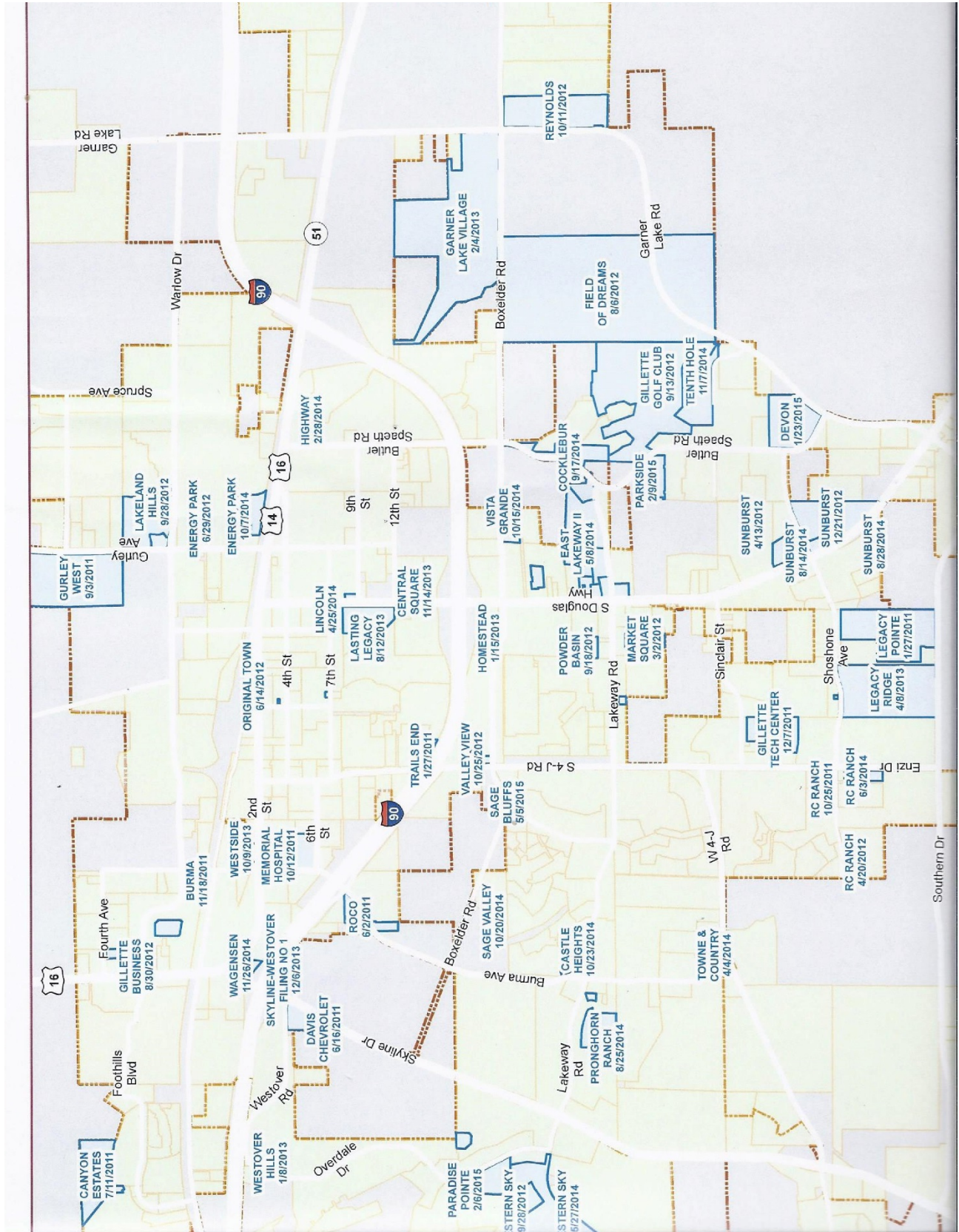
issued for single family homes. Corresponding with the numbers of permits, most of the valuation (just under \$244 million) has come from new single family dwellings—a development pattern consistent with many areas of the less urban west.

*Table 1-3: Residential Building Permits Issued by City of Gillette*

| <b>Period</b>        | <b>Permit Type</b>         | <b># of Permits Issued</b> | <b>Total Valuation of Permits</b> |
|----------------------|----------------------------|----------------------------|-----------------------------------|
| 5/1/2011 – 4/30/2012 | Mobile Home                | 19                         | \$ 3,479,101                      |
|                      | Enhanced manufactured home | 1                          | \$ 198,909                        |
|                      | Single Family              | 183                        | \$75,137,554                      |
|                      |                            |                            |                                   |
| 5/1/2012 – 4/30/2013 | Mobile Home                | 9                          | \$ 1,009,442                      |
|                      | Enhanced manufactured home | 8                          | \$ 1,882,050                      |
|                      | Single Family              | 148                        | \$62,857,895                      |
|                      |                            |                            |                                   |
| 5/1/2013 – 4/30/2014 | Mobile Home                | 11                         | \$ 1,656,942                      |
|                      | Enhanced manufactured home | 1                          | \$ 206,368                        |
|                      | Single Family              | 121                        | \$ 2,709,374                      |
|                      |                            |                            |                                   |
| 5/1/2014 – 4/30/2015 | Mobile Home                | 14                         | \$ 2,901,231                      |
|                      | Enhanced manufactured home | 3                          | \$ 712,890                        |
|                      | Single Family              | 133                        | \$53,292,452                      |



Figure 1-1: Sample of the subdivisions in Gillette, 2011-2015



## Campbell County

Campbell County does not have a planning department. Building permits for residential construction are optional in the County. Septic permits are issued, but the County's records lump septic permits for new construction with permits for septic system replacements. The Building Department did not believe septic permits to be a good indicator of growth or development.

According to the County Building Department, the best quantifiable method to determine any trends in growth in the unincorporated areas is to look at the number of plumbing permits issued by the County. Plumbing permits include all sectors, residential, commercial, and industrial development. The permit numbers show both volume and short-term trends. When asked about the level of activity in unincorporated areas, the Building Department reported construction activity has been robust and steady over the past five years.

*Table 1-4: County Plumbing Permits 2011-2015*

| Year | # Permits Issued |
|------|------------------|
| 2010 | 405              |
| 2011 | 299              |
| 2012 | 259              |
| 2013 | 225              |
| 2014 | 243              |

Table 1.4 shows a decline in number of permits issued from 2010 to 2011 and a relatively stable situation for the past four years.

Based on both anecdotal and quantifiable evidence all three jurisdictions have been growing both in population and development. Gillette as the County seat has seen the most rapid growth. Following the recent downturn in energy prices, this trend will likely slow for the immediate timeframe because as explained above in the Economic section, the County has a high reliance on the mining sector. Changes in the mining sector affect development trends in Campbell County in the future.

## Chapter 2 PLANNING PROCESS

An overview of the planning process is provided in this chapter. Documentation of the planning process—including meeting invitations, agendas, sign-in sheets, meeting summaries, flyers, and media releases—is provided in Appendix A.

### Process Followed to Update the Plan

Campbell County began the update process by applying for a grant from FEMA in 2014. County Coordinator David King, met with the Campbell County Commissioners, the Gillette City Council, and Wright Town Council to obtain letters of commitment from all three entities for the grant application. Campbell County was notified by the state the grant had been approved by FEMA. Campbell County advertised and selected Beck Consulting in the spring of 2015. Work began immediately, identifying project milestones and a tentative schedule.

The consultant and coordinator briefed the Wright Town Council on May 11, 2015, and all of the local elected officials in the County at their regularly scheduled coordination meeting held on June 3, 2015.

*Figure 2-1: Wright Town Council, May 2015*



To ensure the involvement of key personnel, the Campbell County Emergency Management Coordinator developed a list of individuals who were invited to serve as the Local Planning Committee. These individuals were selected to provide broad-based, knowledgeable input and represented local, state and federal government; elected officials at the local and state level, business and industry; utilities; and not-for-profit organizations.

All planning committee meetings were open to the public. The first meeting was held at the Campbell County Library in Gillette on May 12, 2015. Participants were provided a one-page briefing paper, an agenda, and a list of the types of projects appropriate for a MHMP. Following an explanation of the reasons for and benefits of preparing a multi-hazard mitigation

plan, the LPT was split into several small working groups to identify natural hazard concerns and potential mitigation actions to address them.

The LPT met for a second time at the Campbell County Library in Gillette on June 4, 2015. A reminder invitation email was sent out to the planning committee members prior to the meeting. At the second committee meeting, the participants worked together to review the past goals, objectives and projects and determine if these were still accurate, if some needed updated or removed and how they should be ranked.

Due to the lack of public attendance at plan update public meetings in 2011, an online survey was created and made available on the County's Website from July 23<sup>rd</sup> through August 17<sup>th</sup>, 2015. This survey allowed the public to "stay at home" and participate in ranking the hazards, the vulnerability, the goals, objectives and projects. The survey generated 195 online responses and two surveys were received via U.S. Mail. The availability of the survey was publicized on the County's, City of Gillette and Town of Wright's websites in addition to being promoted on the social media (Facebook) pages of all three entities. One public meeting was held in Gillette on September 16, 2015 to allow interested citizens an opportunity to come learn about the plan and offer ideas.

The third local planning team meeting was held in Gillette on September 17, 2015. Initial results of the risk assessment research and of the public survey were provided. The LPT spent the rest of the meeting reviewing and refining the projects--including prioritizing the projects as high, medium, or low--and finalizing the mitigation action plan.

The draft document was made available for public review from April 5 through April 18, 2016. The draft plan was posted on the county, website with links to the county site from the city, and town websites. The availability of the draft plan, and was announced on the county website and through multiple social media outlets including the Gillette Area Classified Facebook group with 24,280 members, the County Facebook page with 2,243 likes, the City of Gillette Facebook page with 10,578 likes, and the Town of Wright Facebook page with 633 likes.

No public comments were received during the public comment period. Following the close of the comment period, the Local Planning Team reconvened on April 21 to go over the draft and suggest any edits before review by the elected bodies. A small number of edits based on LPT comments were made and plan was provided to the three elected bodies for a final review. The Plan Review Tool was completed. The Plan Review Tool identifies the locations in the plan where each requirement is addressed. The plan and review tool were then forwarded to the Wyoming Office of Homeland Security and subsequently FEMA for final review. The plan was adopted by the three local jurisdictions following a determination by FEMA it was approvable.



## How the Jurisdictions Participated in the Plan Update

Campbell County, the City of Gillette, and the Town of Wright participated in the planning process and guided the development of goals and mitigation actions. They provided local plans and data, access to staff, representatives for the Local Planning Team, overall philosophical guidance on the approach they would support, suggested project ideas, made hard copies of the draft plan available for review at their offices, posted electronic copies of the draft plan on their websites and promoted the process throughout on their social media (Facebook) pages, reviewed the draft plan, and adopted the plan following completion.

Town, City, County, state and federal personnel were contacted for information. Existing local, state, and federal plans, including the Wyoming Multi-Hazard Mitigation Plan, and numerous websites were reviewed for relevant information. Information sources are cited with the appropriate text and a listing of the local plans reviewed is provided below.

## How the Public Was Involved in the Update and Opportunity for Involvement by Other Interests

Other interests in the County were able to obtain information about the MHMP update process and offer input through the following opportunities.

- County Emergency Management web pages
- Social media announcements
- Print media releases and legal ads
- Town, City and County elected body publicly-noticed meetings
- Updates by the coordinator at LEPC meetings
- LPT agendas and meetings
- Gillette and Wright public meetings
- Online survey through the County's website
- Campbell County Fair Booth
- Announcement on the Wyoming Office of Homeland Security webpage circulated to all county coordinators in the state of Wyoming
- Release of the draft plan and a 30-day public comment period.

*Figure 2-2: June LPT Meeting, Campbell County Library in Gillette*



### How the Planning Team Reviewed and Analyzed the Existing Plan

The Local Planning Team (LPT) met three times to review and analyze the existing plan and to suggest updates to the existing plan and one final time to provide input and approve submitting the final plan to the governing bodies of the three jurisdictions. A description of each meeting is provided above. Meeting agendas and summaries are provided in Appendix A.

- Determined the status of projects from the 2011 plan,
- Listed hazards of concern,
- Identified local plans for review,
- Provided updated information for the development trends section,
- Made suggestions for public survey questions,
- Identified projects for deletion,
- Suggested new/additional projects,
- Validated preliminary project priorities,
- Reviewed the draft plan

## Review and Incorporation of Existing Local Plans

Table 2-1: Existing Local Plans

| Plan Name  | Jurisdiction    | Date | Remarks  |
|--|-----------------|------|--|
| <b>CAMPBELL COUNTY</b>   |                 |      |  |
| Amended Campbell County Natural Resource and Land Use Plan (draft) | Campbell County | 2015 | Purpose of plan is to document county's goals, objectives, and policies to be considered in planning processes by state and federal agencies. Contains great deal of background data. Emphasis on multi-jurisdictional coordination and cooperation. References wildfire and drought.  |
| Campbell County Zoning Regulations                                 | Campbell County | 2011 | Defines uses. Sections for administration, site plan review, districts, and special use regulations. Does not address natural hazards.   |
| Campbell County Public Notification and Warning Plan               | Campbell County | 2015 | Addresses sirens, emergency alert system, weather radio, and city watch. Describes four activation levels. Includes weather non-weather, and mine events.  |
| Campbell County Community Wildfire Protection Plan                 | Campbell County |      |  |
| <b>CITY OF GILLETTE</b>  |                 |      |  |
| The Gillette Plan, 2013 Comprehensive Plan Update                  | Gillette        | 2013 | One of the plan themes is "Protection of Natural Resources." Land development policies is one of eight core focus areas. Supports residential, industrial, and commercial infill development. In past ten years, there has been \$3.2 billion invested in public and private projects in the Co. Stated goal of improving consistency between city and county policies, regulations, design standards, and review processes. |
| Subdivision Regulations, Ordinance #3727                           | Gillette        | 2011 | Section IV. Construction Standards and Design identifies Hazardous Conditions to be Avoided or Eliminated. Includes; soil, flooding, subsidence, 15% or greater slopes, shallow water table, geologic hazards, shallow coal seams, mud and debris flows  |
| Condominium Platting Regulations                                   | Gillette        |      | Must identify soil problems  |
| FY2014-2015 Capital Improvements Plan                              | Gillette        | 2014 | Lists Gillette-Madison Pipeline project at \$134 million for FY2014-2019<br>\$16 million in drainage projects for same period  |
| Storm Water Ordinance  | Gillette        | 2015 | Draft storm water requirements. Comments being taken.  |
| Zoning Ordinance #979  | Gillette        | 2009 | Establishes 17 zoning districts and allowed uses. Section 11, development plans require drainage and   |



|   |                                       |                | detention. Section 15 PUD Regulations requires delineation of floodplain on plats.  |
|---|---------------------------------------|----------------|---|
| Plan Name   | Jurisdiction                          | Date           | Remarks   |
| <b>TOWN OF WRIGHT</b>   |                                       |                |   |
| Town Code   | Town of Wright                        | 2010           | Title 9 adopts international codes for buildings, mechanical, plumbing, abatement of dangerous buildings, residential, fuel gas, and fire. Subdivision regulations require identification of boundaries of 110-year storm. Title 12 Chapter 1 is Flood Damage Prevention. Designates Building Official as Floodplain Administrator. Requires permits for development in special flood hazard areas. |
| <b>ALL</b>  |                                       |                |   |
| Campbell County, City of Gillette, Town and Wright Joint Response Framework | Gillette<br>Wright<br>Campbell County | September 2015 | How the jurisdictions will conduct all-hazard responses. Conforms to CPG 101 v.2. Scalable.   |

The Wyoming Multi-Hazard Mitigation Plan was consulted to ensure this plan was comprehensive and consistent with the state plan. Other state and federal plans, reports, and data bases were consulted depending on the subject matter. Those sources are cited in the body of the plan where appropriate.

## Chapter 3 HAZARD PROFILES AND RISK ASSESSMENT

### **This chapter identifies:**

- Natural hazards to which Campbell County is susceptible
- Other hazards of concern to citizens
- Documented historical occurrences of these hazards
- Potential impacts
- Vulnerability to damage
- Estimated costs of damage
- Critical infrastructure and vulnerable populations
- Risks for each jurisdiction

This chapter includes a short description of methodology, followed by a list of the identified hazards discussed in this chapter. Detailed profiles of each hazard type are provided including past occurrences, probability of future events, vulnerability, potential loss estimates, critical assets, and populations which could be affected by various hazards.

### **Methodology:**

Information on historical natural hazards and disasters in Campbell County was obtained from a variety of sources. At the local planning meetings, participants provided their priorities for natural and other disasters of concern. When this plan was updated in 2011 local newspapers for the past 50 years were also searched.

State and federal websites and databases were searched. Information from the Bureau of Land Management, Forest Service, National Weather Services' National Climate Data Center, the Western Regional Climate Center, Federal Emergency Management Agency (FEMA), Spatial Hazard Events and Losses Database for the United States (SHELDUS), the National Oceanic and Atmospheric Administration (NOAA) and the National Response Center was reviewed. Information was requested from and provided by the Wyoming State Forestry Division, the Wyoming Fire Marshal's Office, the Wyoming Department of Environmental Quality, Wyoming Geological Survey, Wyoming Office of Homeland Security, and USDA Natural Resources Conservation Service and Farm Service Agency.

Existing written plans were reviewed as well. These plans are cited in the text and listed in the reference sections at the end of each chapter. Both the Wyoming Multi-Hazard Plan and the Project Impact Hazard/Risk Assessment and Mitigation Plan were utilized extensively for information on past occurrences of natural hazards.

Hazards were evaluated as follows:

1. Identification of hazards which may occur. Identified through:

- Meetings and discussions with community leaders (County Commissioners, City and Town Officials, and County Emergency Management Coordinator)
  - Multi-Hazard Mitigation Plan
  - Public meetings
  - Review of hazard lists in the FEMA “How-to Guide: Understanding your Risks” and initial research on recommended websites
  - Review of the State of Wyoming Multi-Hazard Mitigation Plan
  - Review of the Project Impact Hazard/Risk Assessment and Mitigation Plan
  - Researching other plans, reports, newspapers and local histories
2. Prioritize the hazards and focus on the most prevalent.
- Hazards were prioritized by the Hazard Mitigation Planning Committee (LPT) at the first public meeting.
  - Hazards were initially prioritized by the online public survey (2011)
3. Profile hazard events.
- This included:
- Mapping the geographic extent of hazards which can occur in predictable areas.
  - Obtaining data on historical occurrences—frequency, severity, and related damage when available.

Vulnerability and potential loss estimates were assessed as follows:

1. Identify the future potential for the hazard to cause damages. Past occurrences were considered along with the factors which could potentially increase risk.
2. Inventory assets. This includes structures and operations important to Campbell County, the City of Gillette and Town of Wright’s economies as well as vulnerable populations which could be particularly hard-hit by a disaster. Inventories of critical facilities included location and replacement value, identified using information provided by representatives of the various facilities.

For security reasons, pursuant to W.S. 156-4-203(b)(vi), the Critical Infrastructure and Vulnerable Populations section on pages 3-102 through 3-109 has been removed from the publicly released portion of plan and is available from the Campbell County Emergency Management Agency as a FOUO (For Official Use Only) document. This section has been made available to members of the Local Planning Team and local elected officials for their review and comment.

Affected population ratings at the end of each hazard profile are based on the following:

- Low = sporadic impacts on individual properties
- Medium = significant impact locally
- High = half or more of the jurisdictions’ population is significantly impacted

3. Estimate losses. Generally, losses were estimated using information from past events since hazards in Campbell County can vary in location and extent.

The GIS Map Book (**Appendix A**) accompanying this plan shows the mapping of Total Building Loss for the populated areas of City of Gillette and Town of Wright.

### **Hazard Analysis:**

In the following sections, each of the hazards identified by the Local Planning Team (LPT) is presented, with detailed threat, vulnerability, and consequence information. The hazards reviewed are:

- Severe Winter Storms
- Tornadoes, Microbursts, and Wind\*
- Wildland Fire
- Hazardous Materials
- Toxic Gas Seeps
- Flooding
- Lightning\*
- Drought
- Dam Failure\*
- Earthquakes
- Terrorism\*
- Hail\*
- Landslides

\*added or modified in 2015 update

During the 2015 update the LPT revisited the list of hazards from the 2011 plan. Disease Epidemic, a hazard included in the 2011 plan, was discussed at the first LPT meeting. The Public Health representative on the committee noted they now do separate planning for disease epidemics, and the LPT decided a chapter profiling disease was no longer necessary.

Lightning and Hail were separated from the Thunderstorms hazard within the old plan and assessed separately. This allowed for deeper review of each hazard and better alignment with the hazards in the Wyoming Hazard Mitigation Plan. Microbursts and Tornadoes were combined because of similarities. Wind was also added to this profile as it is now a hazard included in the 2014 Wyoming Hazard Mitigation Plan. Dam failure was added in the 2015 update due to the presence of dams within the County which could have damaging consequences should a failure occur. Terrorism was added to recognize the 'All-Hazard' aspect of this plan.

Table 3-1: Summary of Priority Hazards - Campbell County

| Hazard                  | Probability of Occurrence | Population Impacted | Loss Potential | Jurisdictions at Risk   |
|-------------------------|---------------------------|---------------------|----------------|---|
| Dam Failure             | Low                       | Low                 | Medium         | Gillette and Unincorporated Areas                                     |
| Drought                 | High                      | Medium              | Low            | All   |
| Earthquakes             | Low                       | Medium              | High           | All, with slightly higher risk in the southern region and in Gillette |
| Flooding                | Medium                    | Medium              | High           | All   |
| Hail                    | High                      | Medium              | Medium         | All   |
| Hazardous Materials     | High                      | Medium              | High           | All   |
| Landslides              | High                      | Low                 | Medium         | Gillette and Unincorporated Areas                                     |
| Lightning               | High                      | Low                 | Low            | All   |
| Lightning               | High                      | Low                 | Low            | All   |
| Terrorism               | Medium                    | Medium              | Medium         | All   |
| Tornadoes & Microbursts | High                      | Medium              | High           | All   |
| Toxic Gas Seeps         | High                      | Low                 | Low            | All   |
| Wildland Fire           | High                      | Medium              | High           | All   |
| Winter storms           | High                      | High                | Medium         | All   |

## Severe Winter Storms

### Narrative

Severe winter storms affect far more people in Wyoming than their summer counterparts, even though they are inherently less violent. This is because severe snowstorms are often so extensive they usually require a day or two to cross and completely exit the state and they typically impact three or more days. 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 large numbers of livestock, and sometimes leave human fatalities in their wake (*Source: Wyoming Multi-Hazard Mitigation Plan, 2014*).

Most of the data used to compile this hazard analysis comes from the National Climatic Data Center (NCDC). Five different storm types were reviewed for this data, as defined below:

Blizzard – A winter storm which produces the following conditions for three hours or longer: (1) Sustained winds or frequent gusts 30 knots (35 mph) or greater, and (2) falling and/or blowing snow reducing visibility frequently to less than one-quarter mile, on a widespread or localized basis.

Winter Storm – A winter weather event which has more than one significant hazard (i.e., heavy snow and blowing snow; snow and ice; snow and sleet; sleet and ice; or snow, sleet and ice) and meets or exceeds locally/regionally defined 12 and/or 24 hour warning criteria for at least one of the precipitation elements, on a widespread or localized basis. Normally, a winter storm would pose a threat to life or property.

Winter Weather – A winter precipitation event which causes a death, injury, or a significant impact to commerce or transportation but does not meet locally/regionally defined warning criteria.

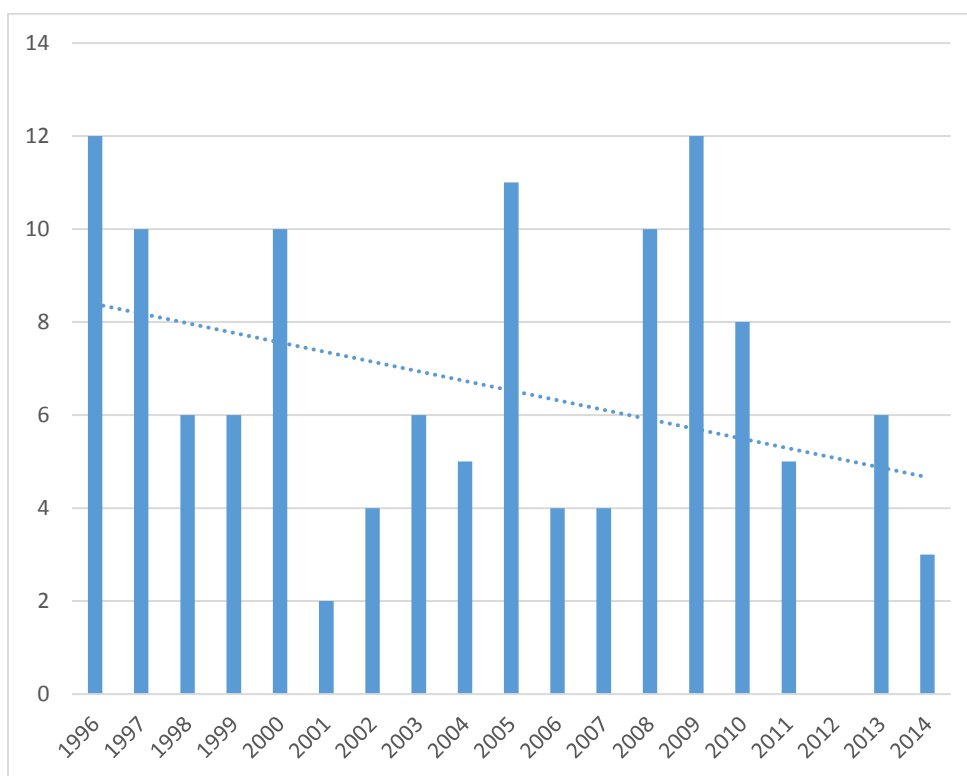
Ice Storm – An ice storm is a type of winter storm characterized by freezing rain, also known as a glaze event or, in some parts of the United States, as a silver thaw. The U.S. National Weather Service defines an ice storm as a storm which results in the accumulation of at least 0.25-inch (6.4 mm) of ice on exposed surfaces.

Heavy Snow - A Heavy snow event is defined by snowfall rates of four inches (10 cm) or more in 12 hours, or six inches (15 cm) or more in 24 hours.

## Past Occurrences

There have been a few winter storms in the County which have caused great damage, economic impact, and brought about change in livestock practices. The recorded winter storm history in Campbell County extends from 1886 to present. The data was derived from the monthly Storm Data reports from National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC). Other sources are unpublished reports from the Wyoming Office of Homeland Security, newspaper accounts and periodicals from public libraries. Storms of statewide impact also occurred in 1931, 1960, 1963, 1965, 1967, 1973, and 1975-1980. Loss of human life occurred in 1887, 1888, 1949, 1982, 1984, 1986, 1987, 1996, 1997, 1999, and 2003 (*Wyoming Multi-Hazard Mitigation Plan, 2010*).

Figure 3-1: Severe Winter Storm Events by Year



Source: <http://www.ncdc.noaa.gov>

Since 1996, Campbell County has been affected by an average of 6.5 NCDC-recorded severe winter storms (inclusive of: blizzard, winter storm, ice storm, heavy snow and winter weather) per year, with a downward trend in the number of storms per year (see **Figure 1**). In that time period, 2009 and 1996 had the most winter weather activity with 12 events, while 2012 had none. See **Appendix B** for a list of severe winter storm events.



A typical severe winter weather event in Campbell County forms over the central Rocky Mountains and moves east over the northern plains, impacting not just the county, but the region or whole state. The impact of a storm may vary greatly within the county due to its size and shape in addition to the presence of the Big Horn Mountains to the west and the Black Hills to the east. Both mountain ranges have significant influence on storm paths and intensity. A storm can bring heavy snow, strong winds/wind gusts, snowdrifts and cold temperatures. It usually takes one to two days to pass through. Most of the major storms passing through the county have dropped between four to eight inches of snow, with up to 18 inches recorded in spots. Often poor visibility, wind chill and drifting cause the most significant problems.

## **Impacts**

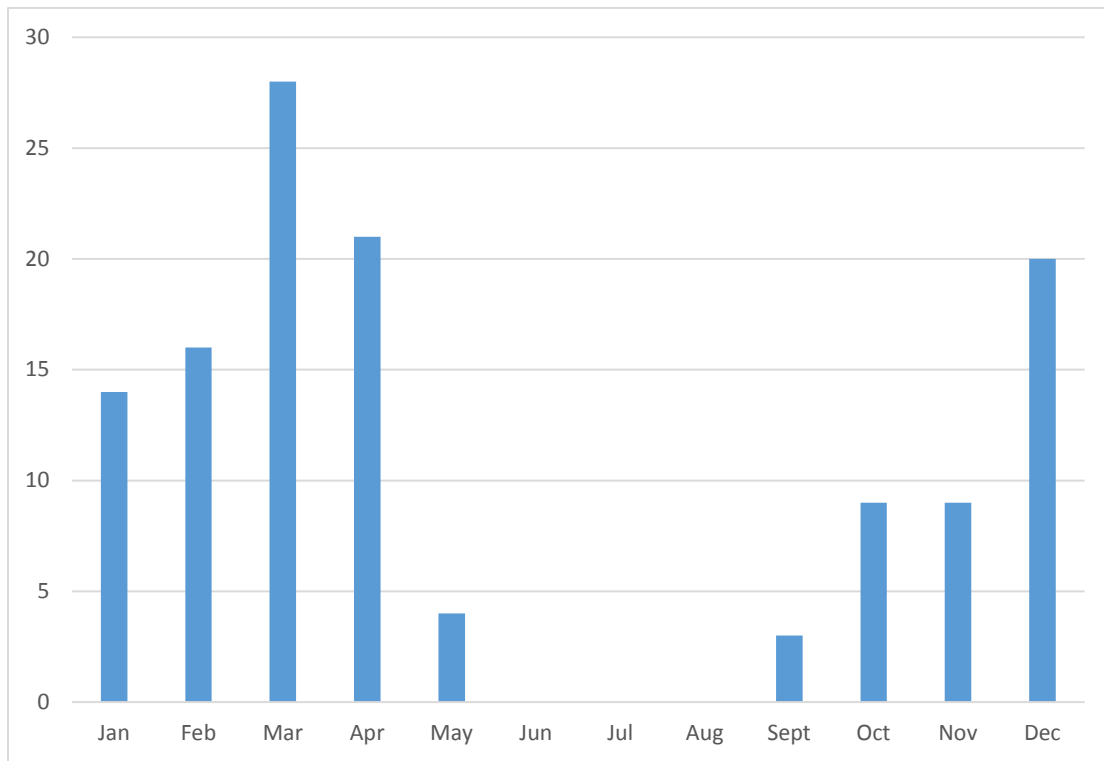
Impacts from severe winter storms identified include the following:

- Injury/loss of life
- Loss of utilities (gas, electric, water, wastewater, etc.)
- Business interruption
- Food shortages
- Medication shortages
- Transportation interruption
- Loss of emergency response access
- Stranded people (mine workers, locals, travelers)
- Increased risks to emergency responders
- Injuries associated with loss of utilities
- Property damage
- Loss of livestock

## **Frequency**

Based on the total number of events during the last five year period, Campbell County has a winter storm of significance approximately every two years. Participants at the planning meetings rated winter storms as high probability events (occurring at least once every five years.) Blizzards in Campbell County generally do moderate damage and affect half or more of the County's population.

Figure 3-2: Severe Winter Storm Events by Month



Source: <http://www.ncdc.noaa.gov>

Since 1995, most severe winter storms in the county have followed a general curve when plotted for the time of year they occur, beginning in September and ending in May (see **Figure 2**). The highest frequency of storms, at least for the last twenty years, has been in the March/April timeframe.

### Vulnerability

All areas of the County are vulnerable to blizzards. Rural areas tend to be more susceptible to power outages in winter storms and power outages in rural areas tend to be of greater duration than those in more populated areas. Rural locations are more likely to have livestock and farming economic factors which can be significantly impacted by winter weather. Blizzards and winter storms have resulted in livestock deaths and livestock rescue efforts including hay drops by helicopter and snow removal efforts to give ranchers access to their livestock to minimize losses.

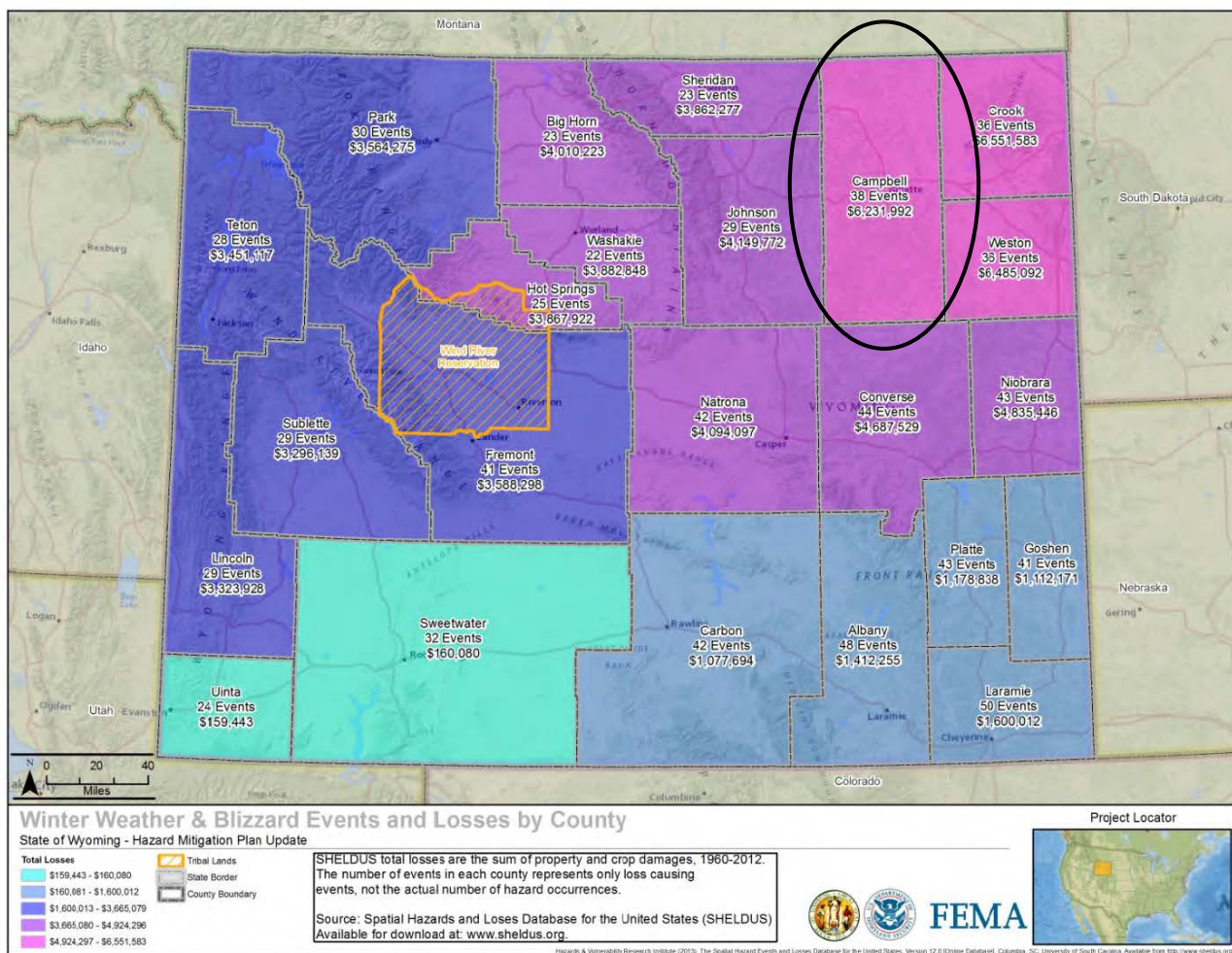
A resident of Wright feeding pets and a rancher near Sundance in Crook County both died of exposure after becoming stranded during the blizzard of 1984. The livestock industry suffered major damage when over 200,000 sheep and cattle perished in the storm. Some ranchers lost up to 95 percent of their sheep and up to 50 percent of their cattle. Contributing factors were the large number of sheep which had recently been shorn during spring lambing and calving

season, and cold rain changing to wet snow. In addition, the weight of the record-breaking snow damaged many roofs and high winds of 50 to 65 mph damaged quite a few structures. In retrospect, the blizzard of '84 will go down in the record books as the worst late spring (April) blizzard ever in Wyoming, incurring over \$100,000,000 in damage (\$227.7 million in 2015 USD) (*Wyoming Multi-Hazard Mitigation Plan, 2010*).

## Potential Losses

According to the Spatial Hazards and Losses Database for the United States (SHELDUS) and the 2014 Wyoming Hazard Mitigation Plan, Campbell County suffered 38 events between 1960 and 2012, and a cumulative \$6,231,992 in damage as a result of these events (\$164,000/storm average, see **Figure 3-3**).

Figure 3-3: Winter Weather Events and Losses by County, State of Wyoming – 2014



Source: Wyoming State Hazard Mitigation Plan 2014

## **Future Development**

Future residential or commercial buildings built to code should be able to withstand snow loads from severe winter storms. Population growth in the county and growth in visitors will increase problems with road, business, and school closures. All increase the need for snow removal and emergency services along with public education and information related to severe winter weather events.

### **Summary:**

|                                   |        |
|-----------------------------------|--------|
| <b>Probability of Occurrence:</b> | High   |
| <b>Population Impacted:</b>       | High   |
| <b>Loss Potential:</b>            | Medium |
| <b>Jurisdictions at Risk:</b>     | All    |

## Tornadoes, Microbursts & Wind

### Tornadoes

#### Narrative

Lying on the west edge of “Tornado Alley,” Wyoming is fortunate to experience fewer intense tornadoes than its neighboring states to the east. However, tornadoes remain a significant hazard in the state. Tornadoes are the most intense storm on earth, having been recorded at velocities exceeding 315 miles per hour (mph). The phenomena, which mimics hurricanes, results in a destructive rotating column of air ranging in diameter from a few yards to greater than a mile, usually associated with a downward extension of cumulonimbus cloud. Up until February 2007, tornadoes were classified by their intensity using the Fujita (F) Scale, with F0 being the least intense and F5 being the most intense (see **Table 3-2**).

*Table 3-2: Fujita (F) Scale of Tornado Intensity*

| Fujita Scale | Wind Speed (MPH) | Potential Damage |
|--------------|------------------|------------------|
| F0           | 40-72            | Light            |
| F1           | 73-112           | Moderate         |
| F2           | 113-157          | Considerable     |
| F3           | 158-206          | Severe           |
| F4           | 207-260          | Devastating      |
| F5           | 261-318          | Incredible       |

The Enhanced Fujita (EF) scale was adopted by the United States in 2007 to better reflect examinations of tornado damage surveys so as to align wind speeds more closely with associated storm damage (see **Table 3-3**).

*Table 3-3: Enhanced Fujita (EF) Scale*

| Enhanced Fujuta Scale | Wind Speed (MPH) | Relative Frequency | Potential Damage               |
|-----------------------|------------------|--------------------|--------------------------------|
| EF0                   | 65-85            | 53.50%             | Minor or No Damage             |
| EF1                   | 86-110           | 31.60%             | Moderate Damage                |
| EF2                   | 111-135          | 10.70%             | Considerable Damage            |
| EF3                   | 136-165          | 3.40%              | Severe Damage                  |
| EF4                   | 166-200          | 0.70%              | Extreme Damage                 |
| EF5                   | >200             | <0.1%              | Total Destruction of Buildings |

Source: <http://www.spc.noaa.gov/efscale/>

According to the Wyoming Climate Atlas, Wyoming ranks 25th in the number of annual tornadoes (10), 33rd in fatalities (six deaths per one million people), 36th in property damage (\$49,339,505) (figure from WSGS), and 37th in injuries, in the U.S. from 1950 to 1994. (Sources: *Wyoming Climate Atlas*, *Wyoming Multi-Hazard Mitigation Plan*, 2014).

### Past Occurrences

Tornado statistics, especially prior to the 1970s, should be viewed as incomplete, since many tornado events were likely to have occurred without being witnessed. Wyoming's open rangelands experience little, if any, damage from these storms, so many go unreported. In the 1990s, the Internet and Doppler radar increased public awareness of tornadoes, with the potential of more being observed and reported. However, the trend in annual tornadoes has decreased by one-third since 1976 and appears to have coincided with a major hemispheric weather pattern shift, despite the increased reporting based on Doppler radar vortex (circulation) signatures (Source: *Wyoming Climate Atlas*).

In a database composed of information derived from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC), the Wyoming Climate Atlas and the Wyoming Office of Homeland Security, there have been 84 tornado events in Campbell County since 1953, with 17 identified as damaging more than \$1,000 of property (see **Table 3-4**).

It is important to note in many cases of an elevated number of incidents, the same storm spawned multiple tornadoes. Since 1964, Campbell County has averaged one reported tornado every other year.

*Table 3-4: Summary of Tornado Events and Impacts*

| Total Events | Number of Days With Event | Deaths | Injuries | Total Property Damage (Non-Adjusted USD) |
|--------------|---------------------------|--------|----------|--|
| 84           | 58                        | 2      | 22       | \$8,882,000                              |

Source: <http://www.ncdc.noaa.gov>

Although not included in the NOAA records cited above, a review of newspaper accounts by Campbell County Emergency Management found one reference to a rancher dying in the 1940's as a result of a tornado in the area of the Middle Prong Road in northwestern Campbell County.

Table 3-5: List of Tornado Events and Impacts

| Location | Date      | F Scale | Fatalities | Injuries | Damage to Property |
|----------|-----------|---------|------------|----------|--------------------|
| N/A      | 6/12/1953 | F2      | 0          | 0        | \$2,500            |
| N/A      | 6/21/1956 | F1      | 0          | 0        | \$25,000           |
| N/A      | 6/3/1958  | F1      | 0          | 0        | \$30               |
| N/A      | 6/3/1958  | F1      | 0          | 0        | \$30               |
| N/A      | 5/27/1959 | F2      | 0          | 0        | \$25,000           |
| N/A      | 5/28/1962 | F0      | 0          | 0        | \$0                |
| N/A      | 6/11/1962 | F1      | 0          | 0        | \$250              |
| N/A      | 7/22/1966 | F2      | 0          | 6        | \$25,000           |
| N/A      | 7/28/1966 |         | 0          | 0        | \$30               |
| N/A      | 4/19/1967 | F1      | 0          | 0        | \$250              |
| N/A      | 6/9/1968  |         | 0          | 0        | \$0                |
| N/A      | 6/24/1969 |         | 0          | 0        | \$0                |
| N/A      | 6/10/1972 | F1      | 0          | 0        | \$0                |
| N/A      | 7/21/1973 | F1      | 0          | 0        | \$0                |
| N/A      | 7/21/1973 | F1      | 0          | 0        | \$0                |
| N/A      | 6/25/1975 | F2      | 0          | 1        | \$0                |
| N/A      | 7/30/1975 | F2      | 0          | 0        | \$0                |
| N/A      | 7/30/1975 | F1      | 0          | 0        | \$0                |
| N/A      | 6/5/1976  | F0      | 0          | 0        | \$30               |
| N/A      | 6/5/1976  | F0      | 0          | 0        | \$30               |
| N/A      | 6/5/1976  | F0      | 0          | 0        | \$30               |
| N/A      | 6/5/1976  | F0      | 0          | 0        | \$30               |
| N/A      | 6/13/1976 | F0      | 0          | 0        | \$30               |
| N/A      | 6/16/1976 | F0      | 0          | 0        | \$30               |
| N/A      | 7/12/1976 | F0      | 0          | 0        | \$0                |
| N/A      | 8/15/1976 | F1      | 0          | 0        | \$250,000          |
| N/A      | 6/25/1977 | F1      | 0          | 0        | \$30               |
| N/A      | 5/22/1978 |         | 0          | 0        | \$250,000          |
| N/A      | 5/23/1978 |         | 0          | 0        | \$250,000          |
| N/A      | 5/29/1978 |         | 0          | 0        | \$0                |
| N/A      | 6/15/1979 | F1      | 0          | 0        | \$0                |
| N/A      | 7/4/1979  | F0      | 0          | 0        | \$0                |
| N/A      | 7/22/1979 | F0      | 0          | 0        | \$0                |
| N/A      | 7/26/1979 | F0      | 0          | 0        | \$0                |
| N/A      | 7/26/1979 | F0      | 0          | 0        | \$0                |



Table 3-6: List of Tornado Events and Impacts

| Location | Date      | F Scale | Fatalities | Injuries | Damage to Property |
|----------|-----------|---------|------------|----------|--------------------|
| N/A      | 7/26/1979 | F0      | 0          | 0        | \$0                |
| N/A      | 7/26/1979 | F0      | 0          | 0        | \$0                |
| N/A      | 7/28/1979 | F0      | 0          | 0        | \$0                |
| N/A      | 7/28/1979 | F0      | 0          | 0        | \$0                |
| N/A      | 6/14/1982 | F0      | 0          | 0        | \$30               |
| N/A      | 6/14/1982 | F1      | 0          | 0        | \$250              |
| N/A      | 7/17/1983 | F1      | 0          | 0        | \$25,000           |
| N/A      | 5/18/1987 | F0      | 0          | 0        | \$0                |
| N/A      | 5/6/1988  | F1      | 0          | 0        | \$0                |
| N/A      | 5/6/1988  | F2      | 0          | 2        | \$2,500,000        |
| N/A      | 7/17/1988 | F0      | 0          | 0        | \$0                |
| N/A      | 7/17/1988 | F0      | 0          | 0        | \$0                |
| N/A      | 7/17/1988 | F0      | 0          | 0        | \$0                |
| N/A      | 5/24/1990 | F1      | 0          | 0        | \$2,500            |
| N/A      | 5/24/1990 | F0      | 0          | 0        | \$0                |
| N/A      | 5/24/1990 | F0      | 0          | 0        | \$2,500            |
| N/A      | 7/23/1992 | F0      | 0          | 0        | \$0                |
| N/A      | 7/23/1992 | F0      | 0          | 0        | \$0                |
| N/A      | 7/23/1992 | F0      | 0          | 0        | \$0                |
| Gillette | 8/19/1993 | F1      | 0          | 0        | \$500,000          |
| N/A      | 6/22/1995 | F0      | 0          | 0        | \$0                |
| RECLUSE  | 6/22/1996 | F0      | 0          | 0        | \$0                |
| WRIGHT   | 6/12/1999 | F0      | 0          | 0        | \$0                |
| WRIGHT   | 6/12/1999 | F0      | 0          | 0        | \$0                |
| WRIGHT   | 6/12/1999 | F0      | 0          | 0        | \$0                |
| GILLETTE | 6/17/1999 | F0      | 0          | 0        | \$0                |
| WRIGHT   | 6/17/1999 | F0      | 0          | 0        | \$0                |
| GILLETTE | 6/12/2001 | F0      | 0          | 0        | \$0                |
| GILLETTE | 6/12/2001 | F0      | 0          | 0        | \$0                |
| GILLETTE | 6/12/2001 | F1      | 0          | 0        | \$0                |
| GILLETTE | 7/26/2001 | F0      | 0          | 0        | \$0                |
| GILLETTE | 7/26/2001 | F0      | 0          | 0        | \$0                |
| GILLETTE | 6/21/2003 | F0      | 0          | 0        | \$0                |
| GILLETTE | 6/21/2003 | F0      | 0          | 0        | \$0                |
| WRIGHT   | 7/13/2004 | F0      | 0          | 0        | \$0                |
| RECLUSE  | 6/7/2005  | F1      | 0          | 0        | \$0                |
| WRIGHT   | 8/12/2005 | F2      | 2          | 13       | \$5,000,000        |

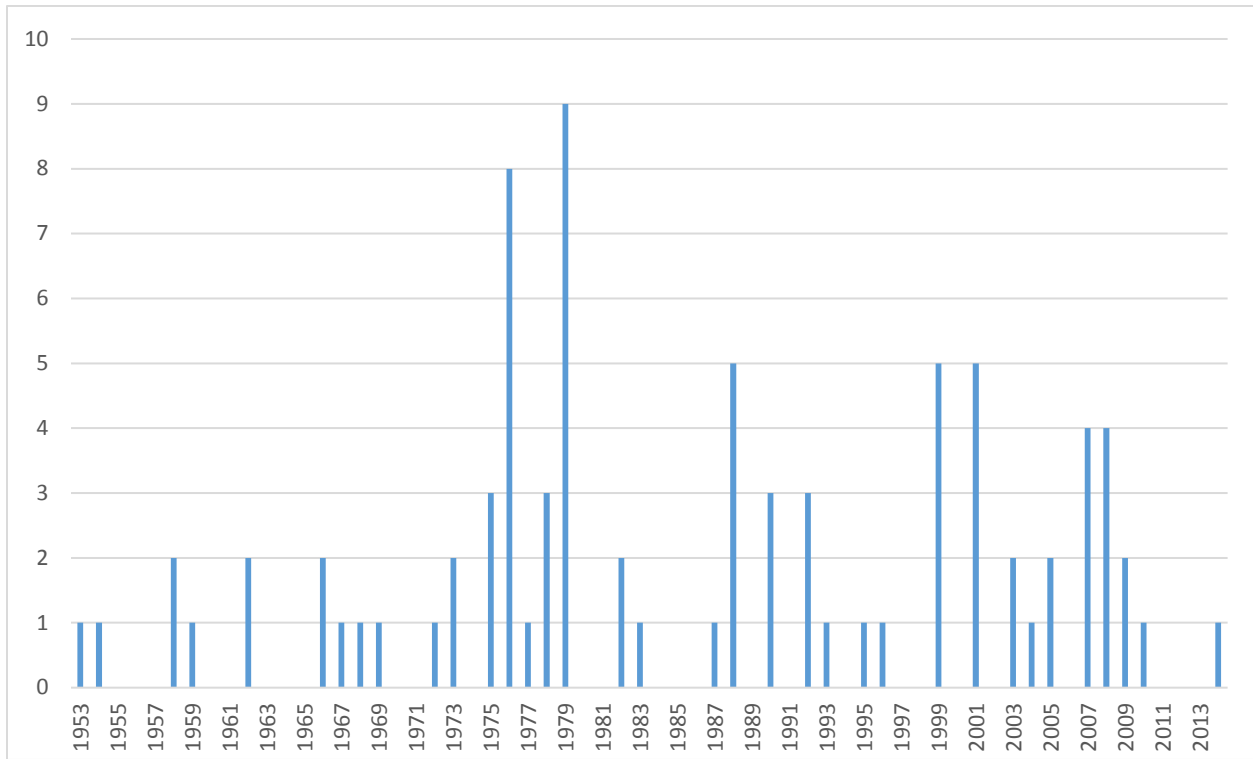
Table 3-7: List of Tornado Events and Impacts

| Location  | Date      | F Scale | Fatalities | Injuries | Damage to Property |
|-----------|-----------|---------|------------|----------|--------------------|
| GILLETTE  | 5/20/2007 | EF1     | 0          | 0        | \$0                |
| WRIGHT    | 5/28/2007 | EF0     | 0          | 0        | \$0                |
| GILLETTE  | 6/6/2007  | EF0     | 0          | 0        | \$0                |
| ROZET     | 6/6/2007  | EF0     | 0          | 0        | \$0                |
| WRIGHT    | 6/1/2008  | EF0     | 0          | 0        | \$0                |
| GILLETTE  | 6/2/2008  | EF0     | 0          | 0        | \$10,000           |
| RECLUSE   | 6/20/2008 | EF0     | 0          | 0        | \$0                |
| SAVAGETON | 9/1/2008  | EF0     | 0          | 0        | \$0                |
| ROZET     | 6/30/2009 | EF0     | 0          | 0        | \$0                |
| SAVAGETON | 7/27/2009 | EF0     | 0          | 0        | \$2,000            |
| ROZET     | 8/3/2010  | EF0     | 0          | 0        | \$1,000            |
| SAVAGETON | 6/26/2014 | EF0     | 0          | 0        | \$10,000           |

Source: <http://www.ncdc.noaa.gov>

Campbell County's worst tornado occurred on August 12<sup>th</sup>, 2005. An F2 tornado touched down in Wright, tearing through a mobile home park, damaging 120 of the approximately 250 homes in the park, completely destroying 91. Two people were killed, and 13 people were injured, all in mobile homes. That storm resulted in Presidential Disaster Declaration #1599.

Figure 3-4: Tornadoes by Year



Source: <http://www.ncdc.noaa.gov>

With incomplete records pre-1970, a pattern or trend of tornado events in Campbell County is unclear (see **Figure 3-4**). There are, however, two outlier years 1975 and 1979 where eight and nine tornadoes were recorded, respectively.

## Impacts

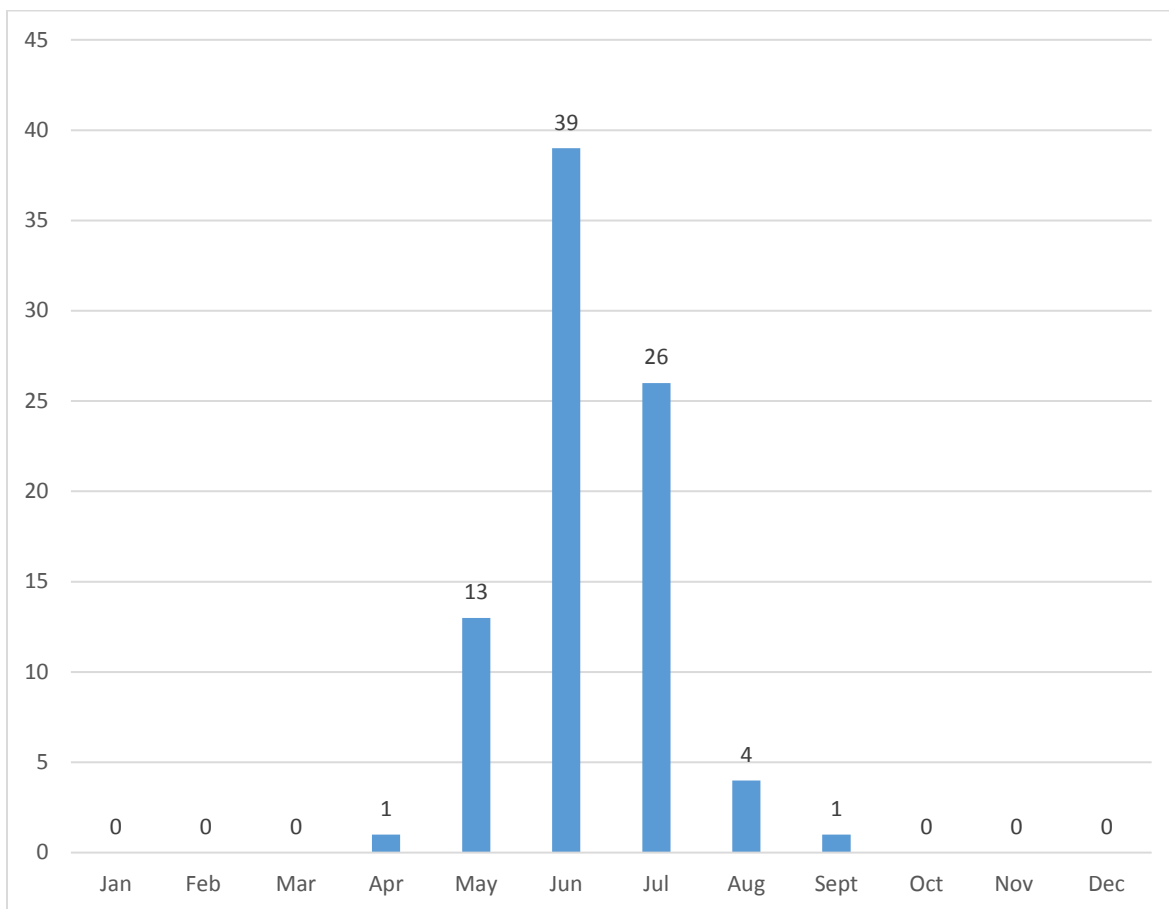
Impacts from tornadoes include the following:

- Loss of life
- Loss of property
- Loss of income/business interruption
- Relocating people
- Injuries
- Large amounts of debris
- Secondary impacts such as fires, damaged infrastructure
- Looting and crimes
- Replacement housing

## Frequency

Tornadoes will continue to occur in Campbell County, which is one of the most tornado prone counties in Wyoming. Based upon the historic record, a tornado will on average occur every one to two years. A damaging tornado occurs in Campbell County every seven years based upon the compiled data. Tornadoes are most likely to occur on average in June and July, but have been recorded in Campbell County April through September (see **Figure 3-5**).

*Figure 3-5: Tornado Distribution by Month*



Source: <http://www.ncdc.noaa.gov>

There is a clear seasonal pattern with regard to tornado events in Campbell County, with a sharp peak in June when a total of 39 tornadoes have been reported since 1953.

According to historical records, the average tornado in Campbell County occurs between May and August, is rated between F0 and F2 on the Fujita Scale, rarely causes reported injuries or fatalities, and causes reportable damage to property in roughly 20% of occurrences.

Figure 3-6: Tornadoes by Fujita Scale

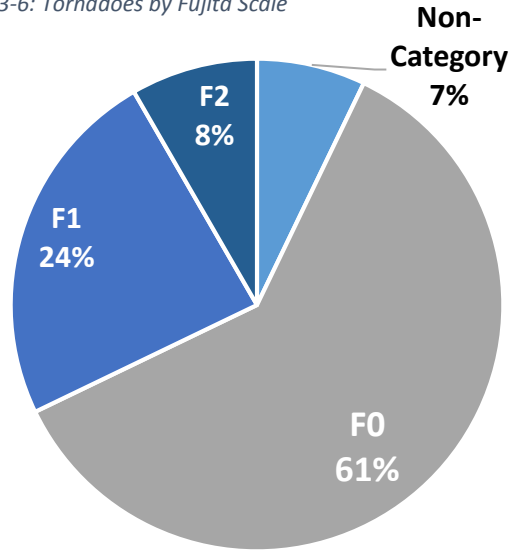


Table 3-8: Tornadoes by Fujita Scale

| Fujita Scale | # of Tornadoes |
|--------------|----------------|
| Non-Category | 6              |
| F0           | 51             |
| F1           | 20             |
| F2           | 7              |
| F3           | 0              |
| F4           | 0              |
| F5           | 0              |
| <b>TOTAL</b> | <b>84</b>      |

Source: <http://www.ncdc.noaa.gov>

Tornado events in Campbell County trend toward the lower end of the Enhanced Fujita Scale, with 92% of all tornadoes registering at F1 or below; the strongest ever recorded in the county was rated as an F2.

## Vulnerability

Tornadoes can occur anywhere in the County and all structures could potentially be at risk. Planning participants rated tornadoes as a high probability event in the County (high means the event is likely to occur at least once every five years). All locations in the County are vulnerable to tornadoes.

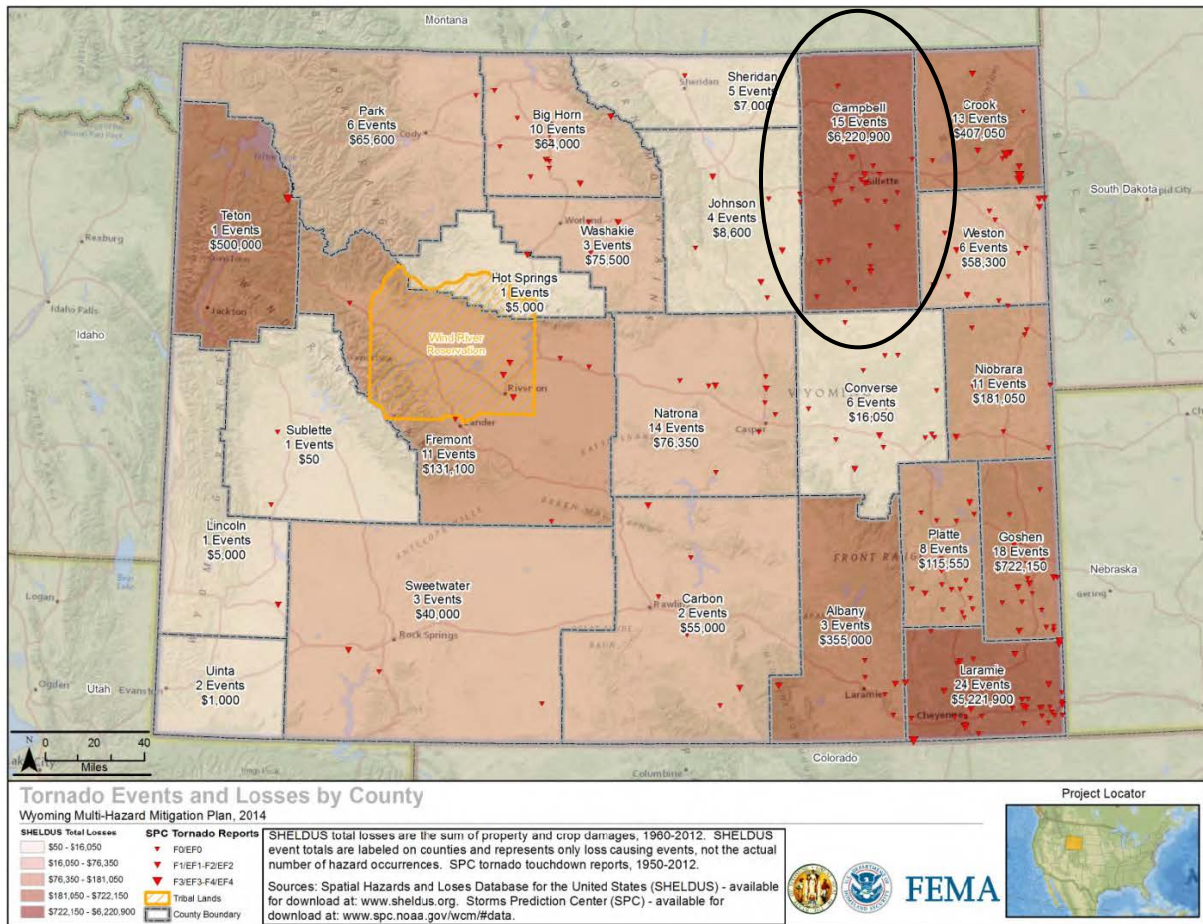
Each county in the state of Wyoming has ranked tornado risk within their borders. Information was gathered from local mitigation plans and extrapolates, based on population impacted, probability of occurrence within their borders, property impacted, and the risk perceived by each county relative to tornado hazards. Campbell County has been ranked at **high** risk based on the last statewide multi hazard mitigation plan (*Source: Wyoming Multi-Hazard Mitigation Plan, 2014*).

The Wright tornado, an F2 Category storm, should be considered near the upper limit for damage for a future event, but the potential for more damaging tornadoes does exist. Because of the random nature of tornados, it is difficult to predict where the next one will hit, or how damaging it will be. Participants rated tornadoes as moderate for “affected population”. A rating of moderate means a significant impact could be expected locally. One specific issue which needs to be addressed in the future is the lack of quality radar coverage for the Campbell County area. Increased ability to monitor storms and alert citizens could significantly reduce the level of population impact.

## Potential Losses

According to the Spatial Hazards and Losses Database for the United States (SHELDUS) and the 2014 Wyoming Hazard Mitigation Plan, Campbell County suffered 15 events between 1960 and 2012, and a cumulative \$6,220,900 in damage as a result of these events (\$414,000/storm average, see **Figure 3-9**).

Table 3-9: Tornado Events and Losses by County, State of Wyoming – 2014



Source: Wyoming State Hazard Mitigation Plan 2014

## Future Development

Historical data demonstrates the most critical area of the state for tornado hazard is the eastern one third, with the five most threatened counties being Laramie, Campbell, Goshen, Converse, and Platte. Because of Campbell County's location, thunderstorms build along the east face of the Big Horn Mountains near the Campbell/Johnson County Line, mature as they move eastward across the western side of the county, and tend to spawn tornadoes as they approach Gillette or Wright. New development will expose more people and property to tornado and wind hazards. Future residential or commercial buildings built to code should be able to withstand wind speeds of at least 150 miles per hour. Wyoming's wind is being utilized through development of renewable energy around the state.

## Summary

**Probability of Occurrence:** High  
**Population Impacted:** Medium  
**Loss Potential:** High  
**Jurisdictions at Risk:** All



## **Microbursts**

### **Narrative**

Campbell County experiences strong winds as a result of weather systems which both pass through and build up over the County. Summer thunderstorms create the potential for microburst and downburst winds as they dissipate, and strong updrafts become strong downdrafts (Hazard/Risk Assessment and Mitigation Plan, 2001). A microburst occurs when rain evaporates before hitting the ground, cooling the air as it drops. The cooler air plummets to the ground at great speeds similar to that of a tornado and upon reaching the ground will travel as a river of air for significant distances, creating the potential for wind damage. Every decaying thunderstorm has the potential to create a microburst, making them impossible to forecast or provide advance warning.

### **Past Occurrences**

Thunderstorm winds: 83 days with thunderstorm wind gusts greater than 58 mph (50 knots). There are five thunderstorms on record which caused significant damage (greater than \$100,000) in Campbell County. Most other reports of property damage were to mobile homes and seemed to be isolated—more indicative of microbursts, small scale downburst winds. Some thunderstorm wind gusts combined with large hail can cause more extensive damage.

Three recorded microbursts which created significant damage have been reported by the Campbell County Emergency Management Agency.

- Northern Campbell County experienced a damaging microburst in the late 1980s which left a path of damage to trees, fences and fields nearly a mile long.
- In August of 1998, damage from one to two microbursts occurred simultaneously in the Antelope Valley, Sleepy Hollow and Freedom Hills subdivisions south and east of Gillette. Winds for the two events ranged from 70 to 120 mph based upon on-scene damage. Five mobile homes were destroyed, five additional mobile homes suffered major damage. Four people inside of one of the mobile homes sustained injuries.
- In June 2000, a microburst spawned by a thunderstorm destroyed a mobile home 14 miles north of Rozet.

### **Impacts**

Impacts which could occur from a microburst include the following:

- Loss of life
- Loss of and damage to property

- Injuries
- Loss of income/business interruption
- Large amounts of debris requiring disposal
- Secondary impacts such as fires and damaged infrastructure

### **Frequency**

The frequency of these events based upon a history of 68 events, in 50 years, is greater than one event per year.

### **Vulnerability**

The entire County is vulnerable to microbursts. The most vulnerable structures are mobile homes not anchored to the ground with either hurricane straps or tie down straps. Mobile homes are found in both communities (Gillette and Wright) and in rural areas across the County. Additional damage can result from unsecured objects around all types of structures that can become wind-borne debris. Following the 1998 microbursts in Antelope Valley/Sleepy Hollow/Freedom Hills, insurance agents told Campbell County Emergency Management there would have been significantly less damage if trampolines had been secured and unable to become “flying saucers,” banging off of vehicles and structures.

### **Potential Losses**

From 1953 to 2014, eight storms have caused damage totaling \$317,000. Most of the damage from these storms was localized, such as mobile homes tipped over. Damage from microbursts is generally confined to small areas (*Source: Campbell County Hazard Mitigation Plan 2011*).

|                                   |        |
|-----------------------------------|--------|
| <b>Property Affected:</b>         | Low    |
| <b>Population Affected:</b>       | Medium |
| <b>Probability of Occurrence:</b> | High   |
| <b>Jurisdictions Affected:</b>    | All    |

## Wind

### Narrative

Wind is the movement of air from areas of high pressure to areas of low pressure, or can be the result of microbursts associated with temperature variations in the atmosphere, or inflow/outflow usually associated with thunderstorms or dry thunderstorms. Wind, because of its constant presence in Wyoming, is taken in stride by the population and often overlooked as a hazard when in actuality wind is a damage-causing hazard and warrants review in Campbell County's hazard mitigation plan.

Wind was not a separately included hazard in Campbell County's previous plan (2011) but because the State of Wyoming considers wind to be a significant risk to private and government property, and 16 Wyoming counties have included wind in their hazard mitigation plans, it is now included in this plan (*Source: Wyoming Multi-Hazard Mitigation Plan, 2014*).

### Past Occurrences

Included in **Table 3-11** are the all the high wind events recorded in Campbell County from 1996 (the earliest recorded data available) to 2014, as recorded by the NCDC. **Table 3-10** summarizes this data, while **Table 3-11** provides a comprehensive list of incidents as recorded in the NCDC database. In this instance, NCDC data is used because access to SHELDUS data has a cost associated with it.

*Table 3-10: Summary of High Wind Events and Impacts*

| Number of Events | Number of Days With Event | Total Property Damage | Total Crop Damage | Total Deaths and Injuries |
|------------------|---------------------------|-----------------------|-------------------|---------------------------|
| 61               | 42                        | \$125,000             | \$0               | 0                         |

*Source: <http://www.ncdc.noaa.gov>*

Table 3-11: List of High Wind Events and Impacts Campbell County 1996 – 2014

| Location                     | Date       | Magnitude (MPH) | Property Damage |
|------------------------------|------------|-----------------|-----------------|
| NORTHERN CAMPBELL (ZONE)     | 4/24/1996  | 52              | \$15,000        |
| SOUTH CAMPBELL (ZONE)        | 4/24/1996  | 48              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 7/1/1997   | 50              | \$0             |
| GILLETTE (ZONE)              | 7/1/1997   | 50              | \$0             |
| GILLETTE / N CAMPBELL (ZONE) | 11/22/1998 | 50              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 2/2/1999   | 52              | \$0             |
| GILLETTE / N CAMPBELL (ZONE) | 2/3/1999   | 56              | \$0             |
| GILLETTE / N CAMPBELL (ZONE) | 3/16/1999  | 57              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 3/16/1999  | 57              | \$0             |
| GILLETTE (ZONE)              | 5/5/1999   | 52              | \$0             |
| GILLETTE (ZONE)              | 11/1/2000  | 57              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 12/17/2000 | 56              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 12/1/2001  | 53              | \$0             |
| GILLETTE / N CAMPBELL (ZONE) | 12/1/2001  | 50              | \$0             |
| GILLETTE (ZONE)              | 1/13/2002  | 65              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 1/13/2002  | 52              | \$0             |
| GILLETTE / N CAMPBELL (ZONE) | 3/27/2002  | 50              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 3/27/2002  | 52              | \$0             |
| NORTHERN CAMPBELL (ZONE)     | 8/16/2002  | 64              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 8/16/2002  | 58              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 12/29/2002 | 50              | \$0             |
| NORTHERN CAMPBELL (ZONE)     | 12/17/2003 | 53              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 1/1/2004   | 50              | \$0             |
| NORTHERN CAMPBELL (ZONE)     | 1/1/2004   | 51              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 2/16/2007  | 52              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 3/27/2007  | 36              | \$0             |
| NORTHERN CAMPBELL (ZONE)     | 3/27/2007  | 51              | \$0             |
| SOUTH CAMPBELL (ZONE)        | 11/12/2007 | 62              | \$0             |
| NORTHERN CAMPBELL (ZONE)     | 11/13/2007 | 55              | \$0             |
| NORTHERN CAMPBELL (ZONE)     | 1/4/2008   | 67              | \$10,000        |

Table 3-12: List of High Wind Events and Impacts Campbell County 1996 – 2014 (cont'd)

| Location                 | Date       | Magnitude (MPH) | Property Damage |
|--------------------------|------------|-----------------|-----------------|
| SOUTH CAMPBELL (ZONE)    | 1/5/2008   | 70              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 1/27/2008  | 61              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 1/27/2008  | 56              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 5/13/2009  | 57              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 4/13/2010  | 56              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 4/13/2010  | 54              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 5/4/2010   | 35              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 5/24/2010  | 54              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 3/11/2011  | 66              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 3/11/2011  | 51              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 4/30/2011  | 52              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 4/30/2011  | 57              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 9/19/2011  | 63              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 12/31/2011 | 37              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 12/31/2011 | 40              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 3/26/2012  | 63              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 3/26/2012  | 69              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 4/12/2012  | 54              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 4/12/2012  | 52              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 6/5/2012   | 52              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 10/17/2012 | 50              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 10/17/2012 | 52              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 12/2/2012  | 59              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 12/2/2012  | 61              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 3/3/2013   | 59              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 5/23/2013  | 52              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 5/23/2013  | 55              | \$100,000       |
| NORTHERN CAMPBELL (ZONE) | 1/13/2014  | 54              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 1/26/2014  | 55              | \$0             |
| SOUTH CAMPBELL (ZONE)    | 4/29/2014  | 55              | \$0             |
| NORTHERN CAMPBELL (ZONE) | 3/28/2015  | 59              | \$0             |
|                          |            |                 |                 |

Source: <http://www.ncdc.noaa.gov>

## Impacts

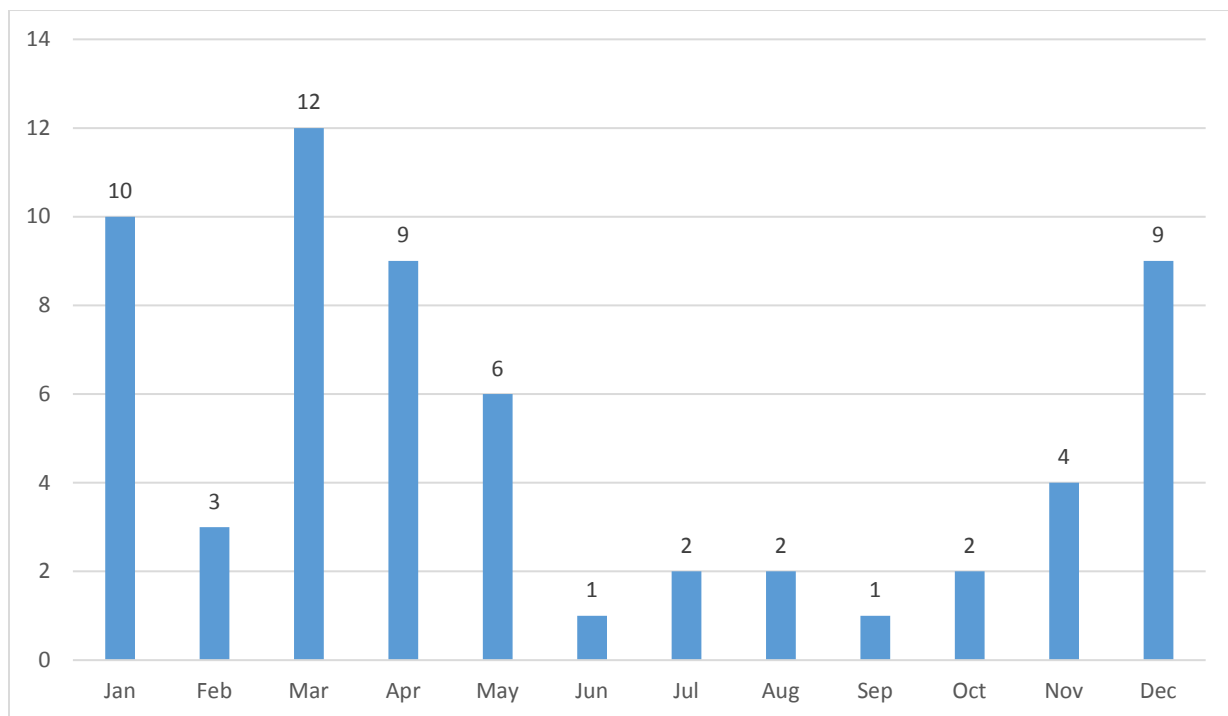
Impacts which could occur from high wind include the following:

- Loss of life
- Loss of and damage to property
- Injuries
- Loss of income/business interruption
- Large amounts of debris which require disposal
- Secondary impacts such as fires and damaged infrastructure

## Frequency

High wind events are most likely to happen in the spring months in Campbell County, but events have been recorded at all times of the year (see **Figure 3-7**).

*Figure 3-7: Wind Events by Month*



Source: <http://www.ncdc.noaa.gov>

## Potential Losses

According to the NCDC, Campbell County suffered 61 high wind events over 42 days between 1996 and 2014, with a cumulative \$125,000 in reported damage to property, and no reported damage to crops as a result of these events. The vast majority of hail storms recorded in NCDC didn't have any recorded property or crop damage in the system, though this is more likely due to unreported damage than the storm having no impact. The storm of record caused \$100,000 in property damage on May 13, 2013 in Gillette; this damage included roofs being torn off, damage to outbuildings and downed tree limbs across the city.

## Future Development

High winds will likely continue to occur in Campbell County and will likely result in isolated property damage in developed areas. Wyoming's high winds is being utilized through development of renewable energy around the state. Future development such as buildings and infrastructure will need to continue to follow building codes and design criteria for high winds.

## Summary

|                                   |        |
|-----------------------------------|--------|
| <b>Property Affected:</b>         | Low    |
| <b>Population Affected:</b>       | Low    |
| <b>Probability of Occurrence:</b> | Medium |
| <b>Jurisdictions Affected:</b>    | All    |

## Wildland Fire

### Narrative

Campbell County contains approximately 5,000 square miles of rolling prairie, river breaks and two main population centers, Wright and Gillette. Vegetation across the County consists of grasses, sagebrush, juniper, and some forested areas. According to the U.S.D.A. Farm Service Agency; there are 17,474.4 acres of land in the County enrolled in the Conservation Reserve Program. These lands may have heavier fuels than those which are regularly grazed. Large-scale, active energy development, agriculture, and rural residential growth create a unique wildland/urban interface situation in the County. 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 defined by the National Interagency Fire Center (NIFC), a "wildland fire" is any non-prescribed, non-structure fire which occurs in the wildland.

### Past Occurrences

The past 100 years of wildland fire suppression in Campbell County and across the west has led to heavy vegetation growth, greatly increasing the potential fuel-load for a wildfire to burn. As the wildland/urban interface (WUI) has grown into these densely packed forests and more oil and gas development occurs in rural areas, the potential for catastrophic wildland fires has increased as well.

Table 3-13: Summary of Wildland Fire Events

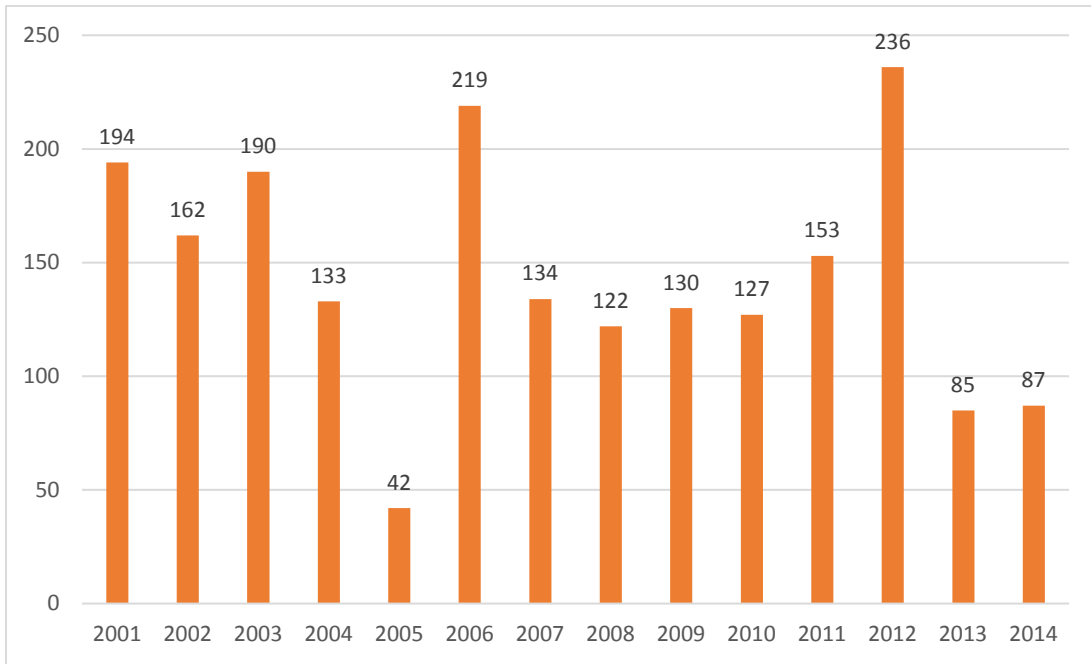
| Total Acres Burned | Total Number of Fires | Natural Cause | Human Cause | Unknown |
|--------------------|-----------------------|---------------|-------------|---------|
| 101,767            | 2,014                 | 32.65%        | 48.06%      | 19.30%  |

Source: Campbell County Fire Department

A total of 2,014 fires have been recorded by the Campbell County Fire Department between 2001 and 2014 (a list of these fires with a threshold of at least 200 acres burned can be found in **Appendix C**). Almost half of these fires were ignited by human activity. **Figure 3-8** shows the distribution of these fires by year. As can be seen in Figure 3-8 and Figure 3-9, both the number of acres burned and the number of wildfires per year can vacillate dramatically from year to year, with a quiet year followed by an active year. The chart shows the increased number of fires associated with drought years in 2012, 2006, and early 2000's.

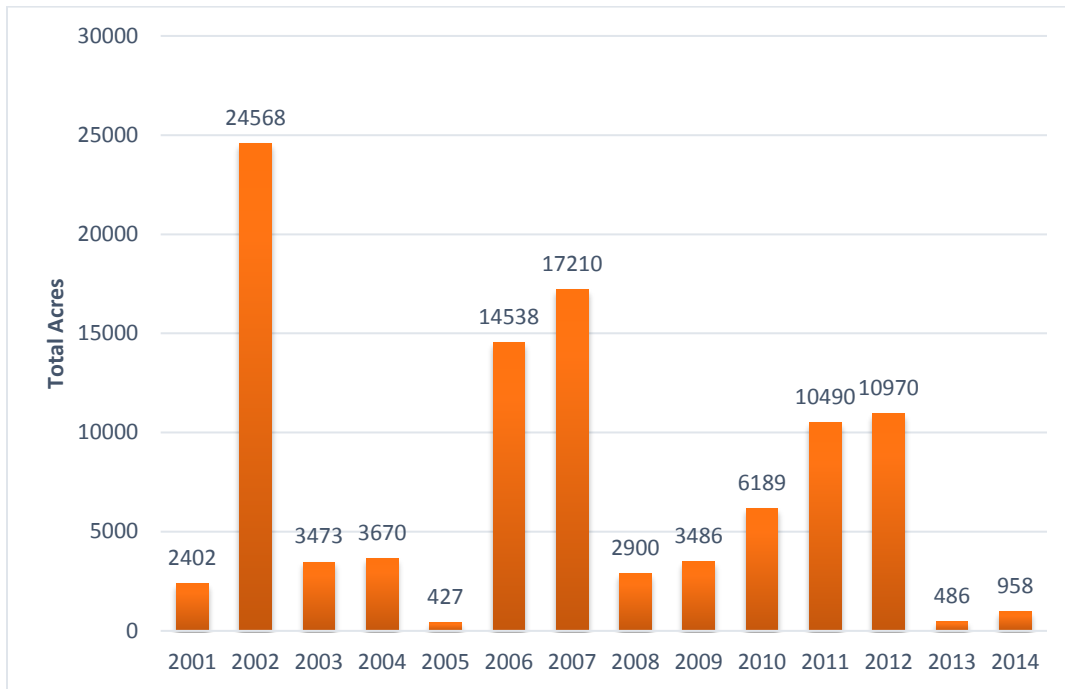


Figure 3-8: Number of Wildfires per Year



Source: Campbell County Fire Department

Figure 3-9: Total Acres Burned by Year

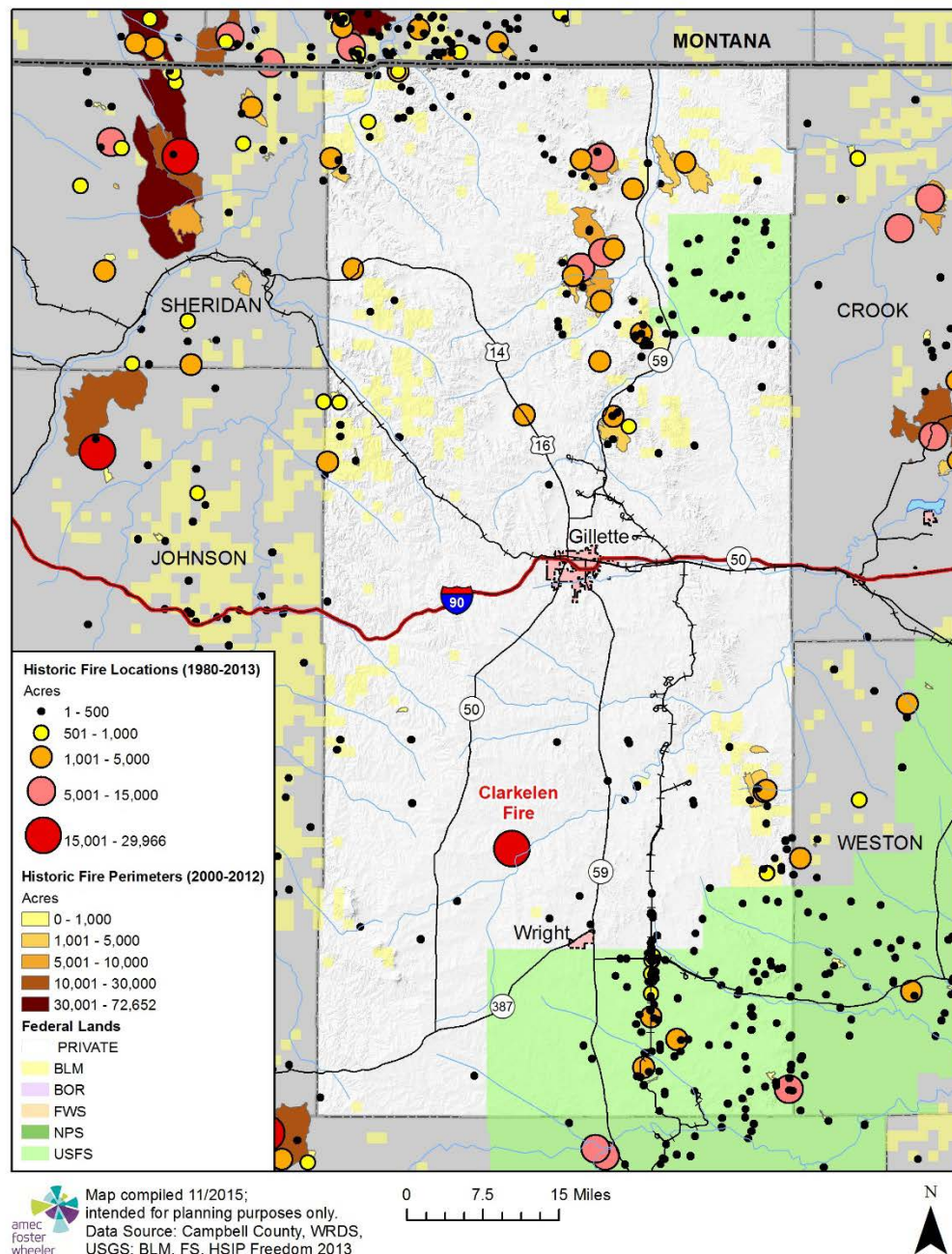


Source: Campbell County Fire Department

Figure 3-10 shows historical fire locations from wildfires based on the federal wildland fire occurrence database (includes BLM and USFS reports). Historic fire perimeters are from the

Homeland Security Infrastructure Program database. Due to its source, the data is weighted towards wildfires on federal lands and may not represent private land wildfires. The local fire history information was not available with complete latitude/longitude references and thus could not be displayed on this map. According to the map, fire activity on federal lands in the county is focused around three distinct areas: in the northwest corner of the county, in the northeast near Highway 59, and to the southeast on USFS lands.

Figure 3-10: Campbell County Wildfires on Federal Lands 1980 - 2013



## Impacts

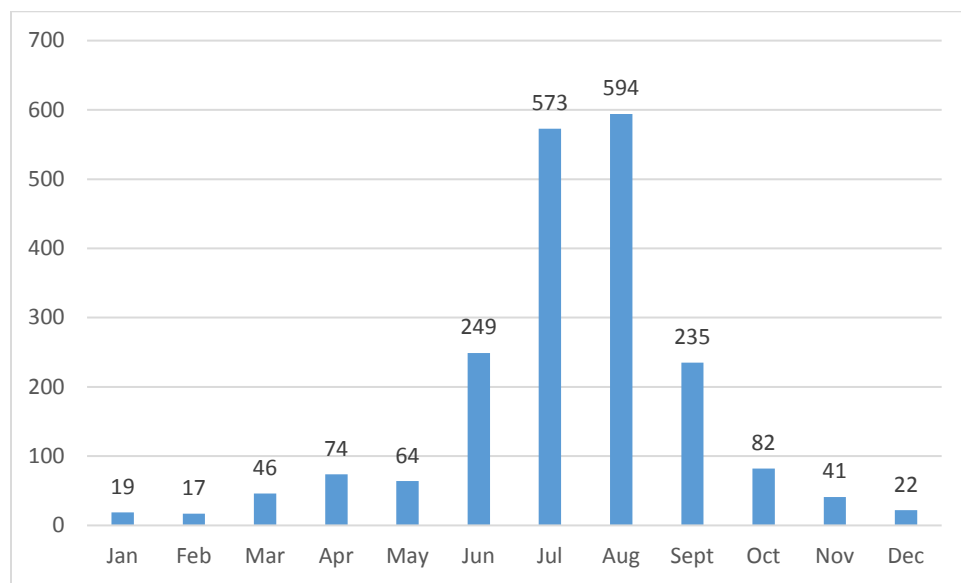
Impacts from wildland fires include the following:

- Loss of life (human, livestock, wildlife)
- Loss of property
- Evacuations
- Resource damage such as soil erosion, water quality, and flooding
- Health consequences from smoke inhalation

## Frequency

There is a clear ‘fire season’ in Campbell County, with the majority of events taking place in the June to September timeframe. Dry conditions in the summer increases the risk of fuel ignition in grass and forest land, but fires can and do occur year-round.

*Figure 3-11: Total Wildfires per Month*



*Source: Campbell County Fire Department*

## Vulnerability

During the past few decades, population growth in the wildland/urban interface has increased greatly. Subdivisions and other high-density developments have created a situation where wildland fires can involve more buildings than any amount of fire equipment can possibly protect. In a wildland/urban interface, residential or commercial developments are in proximity to natural vegetation (*Source: Wyoming Hazard/Risk Assessment and Mitigation Plan, 2014*).

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. As the population and the wildland/urban interface in Wyoming increases, the more significant the risk of wildland fire hazard.

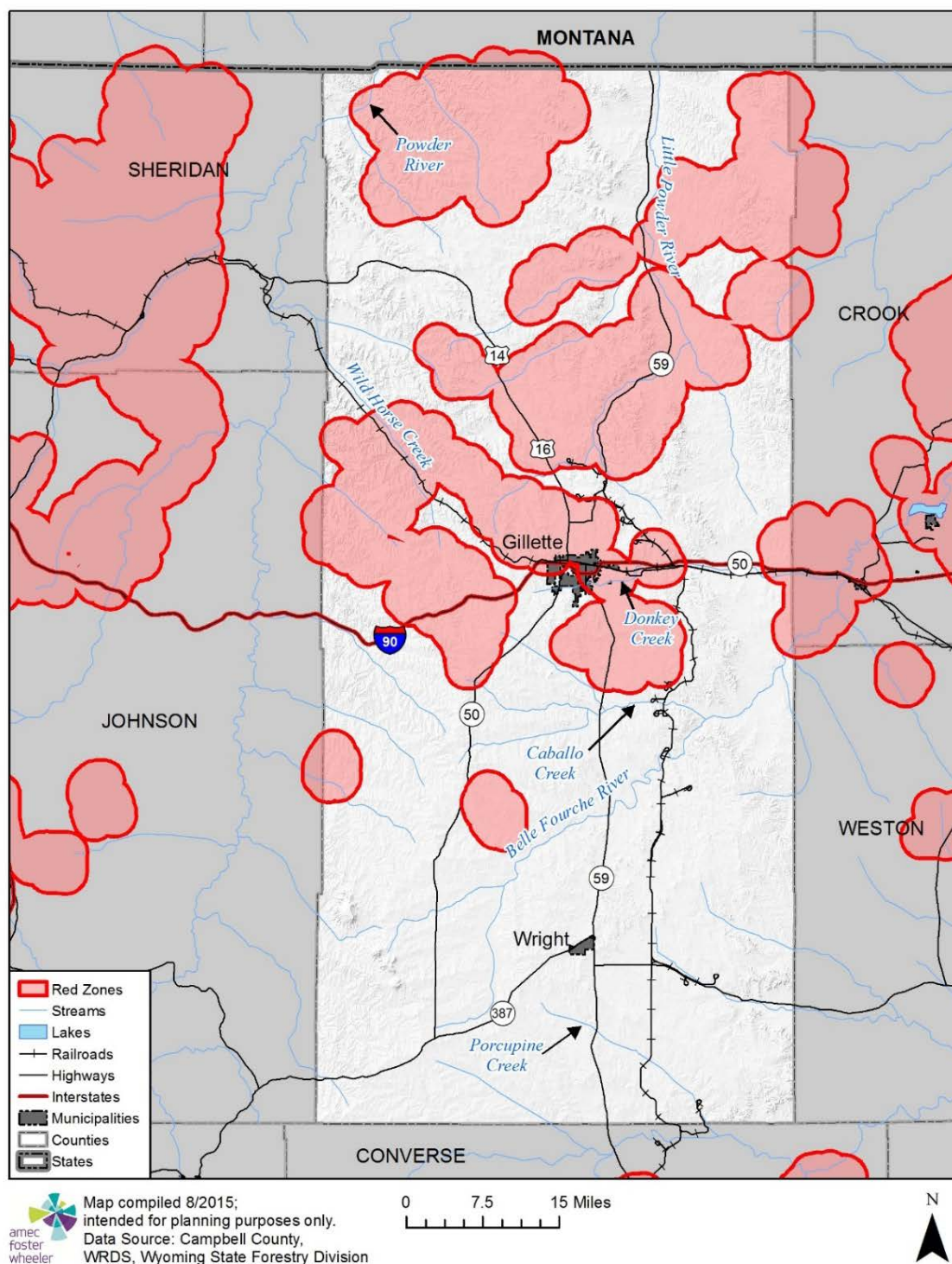
The principal action plan for the State is the Wyoming Wildland Urban Interface Hazard Assessment produced by a joint venture of the Wyoming State Forestry Division, USFS, BLM, NPS, and other interested parties, with the BLM hosting the data. This is a Geographic Information System (GIS)-based mapping mission building 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 will result in a Risk, Hazard, and Value (RHV) map displaying areas of concern (Redzones) for catastrophic wildland fires. The Wyoming Wildland Urban Interface Hazard Assessment builds on the work of earlier hazard methodologies and provides new and updated data to further enhance accuracy and scale.

**Figure 3-12** represents the result of the Redzone mapping. A significant portion of Campbell County falls within the Redzone, with nearly all of the incorporated area of Gillette, the most populous city in the County, having a wildland-urban interface. Based upon a review of the mapping during the 2015 update to this plan the planning committee noted there is much more exposure to fire hazards, and an increased potential for ignitions, in the southern portion of the County due to more recent oil and gas development. This fire potential is also illustrated by the number of historic fires shown in Figure 19.

Fuel types in Wyoming’s WUI include many grasses, forbs, shrubs, trees, and forest residues. All of these types of vegetation can provide increased fire hazard near structures. Mitigating the risk of fire in the WUI can involve different practices depending on the fuels in the vicinity. It is also important to be aware of other fuels, such as firewood piles or other items in close proximity to a structure, which can contribute to the risk fire poses to a structure. Similarly, certain construction materials such as wood shingles can make a home more vulnerable to fire in the vicinity.

As of 2014, Campbell County was one of the eight Wyoming counties not participating in the state cost-share grant program (WSWUI) for fire mitigation activities on private lands (*Source: Wyoming State Hazard Mitigation Plan, 2014*).

Figure 3-12: Campbell County "Redzones"





## Potential Losses

Because of the limitations of the Redzone data an exposure analysis was utilized to provide an order of magnitude estimate on the potential losses from wildfire. Based on 2015 Campbell County Assessor data, the county has an estimated total asset exposure of \$3,651,674,674 including building value plus content value (see **Table 3-14**). Much of this inventory is exposed to potential wildfires.

*Table 3-14: Asset Exposure, Campbell County 2015*

| Jurisdiction   | Building Count | Improved Value         | Est. Content Value     | Total Exposure         |
|----------------|----------------|------------------------|------------------------|------------------------|
| Gillette       | 9,405          | \$1,692,406,694        | \$1,051,939,917        | \$2,744,346,611        |
| Wright         | 446            | \$56,883,430           | \$34,811,015           | \$91,694,445           |
| Unincorporated | 4,854          | \$511,014,089          | \$304,619,529          | \$815,633,618          |
| <b>Total</b>   | <b>14,705</b>  | <b>\$2,260,304,213</b> | <b>\$1,391,370,461</b> | <b>\$3,651,674,674</b> |

*Source: Campbell County Assessor, 2015*

In terms of the statewide risk context the 'Local Risk Assessment' conducted in the 2014 Wyoming Multi-Hazard Mitigation Plan found Campbell County to be at high risk of losses based on population impacted, probability of occurrence within the county, property impacted, and risk perceived by each county relative to wildland fire hazards.

The total estimated damage for the entire state of Wyoming is more than \$8.5 billion. The five counties with the most potential damage are Teton, Sheridan, Laramie, Natrona, and Campbell totaling an estimated damage of over \$5.8 billion (*Source: Wyoming Multi-Hazard Mitigation Plan, 2014*).

## Future Development

Recent population and infrastructure growth both increases the risk of ignitions and the consequences of wildfires. Oil and gas development in rural areas in the southern portion of the unincorporated county is potentially at risk from wildfires.

## Summary

**Probability of Occurrence:** High  
**Population Impacted:** Medium  
**Loss Potential:** High  
**Jurisdictions at Risk:** Gillette, Wright and Unincorporated Areas

## Hazardous Materials

### Narrative

A general definition of a hazardous material is a substance or combination of substances which, because of its 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 (*Source: Wyoming Multi-Hazard Mitigation Plan, 2010*). Hazardous material incidents can occur from a fixed facility or during transportation.

The U.S. Department of Transportation has 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

### Past Occurrences

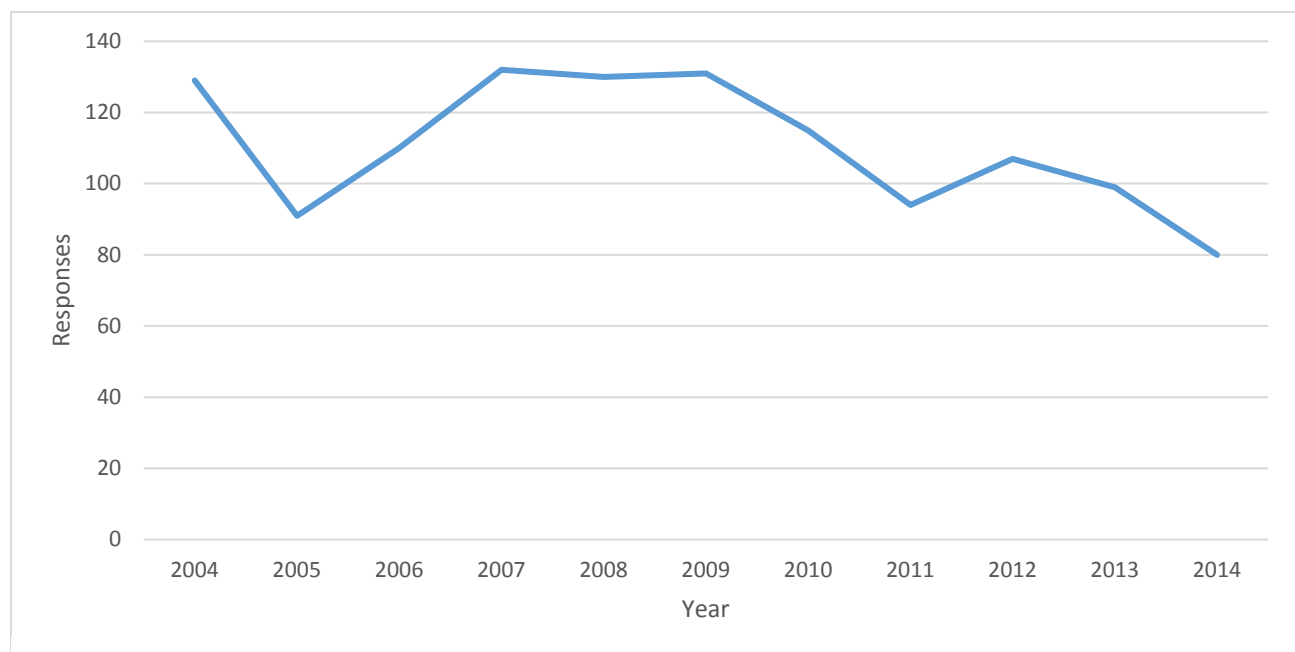
Campbell County is usually in the top three counties in the state for numbers of spills. Reviewing current data reported by the Campbell County Fire Department, the total number of occurrences has decreased from a ten-year high of 132 calls in 2007 to 80 calls in 2014 (see **Table 3-15**). Gas leaks (409 incidents) made up the highest percentage of total calls over the data period, followed by oil or combustible liquid spills (230 incidents), carbon monoxide incidents (168 incidents) and gasoline or flammable liquid spills (167 incidents). Different types of incidents see spikes in occurrence from year to year.

Table 3-15: Hazardous Materials Incidents Campbell County 2004 to 2014

| Incident Description                              | 2004       | 2005      | 2006       | 2007       | 2008       | 2009       | 2010       | 2011      | 2012       | 2013      | 2014      | Total        |
|---|------------|-----------|------------|------------|------------|------------|------------|-----------|------------|-----------|-----------|--------------|
| Hazardous Condition, Other                        | 0          | 3         | 5          | 10         | 6          | 10         | 10         | 3         | 2          | 10        | 3         | <b>62</b>    |
| Combustible/Flammable/Gas/Condition               | 0          | 2         | 3          | 3          | 6          | 5          | 3          | 4         | 4          | 4         | 3         | <b>37</b>    |
| Gasoline or Flammable Liquid Spill                | 24         | 17        | 19         | 12         | 16         | 10         | 18         | 11        | 16         | 10        | 14        | <b>167</b>   |
| Gas Leak  | 25         | 20        | 32         | 52         | 52         | 44         | 39         | 38        | 40         | 40        | 27        | <b>409</b>   |
| Oil or Combustible Liquid Spill                   | 39         | 22        | 23         | 30         | 20         | 21         | 21         | 14        | 9          | 11        | 20        | <b>230</b>   |
| Toxic Condition                                   | 0          | 0         | 0          | 0          | 1          | 0          | 0          | 0         | 0          | 1         | 2         | <b>4</b>     |
| Chemical Hazard (No Spill or Leak)                | 3          | 0         | 3          | 3          | 1          | 3          | 1          | 2         | 0          | 2         | 1         | <b>19</b>    |
| Chemical Spill or Leak                            | 21         | 18        | 12         | 10         | 11         | 10         | 7          | 8         | 6          | 6         | 6         | <b>115</b>   |
| Refrigeration Leak                                | 0          | 1         | 2          | 0          | 1          | 0          | 0          | 0         | 0          | 0         | 0         | <b>4</b>     |
| Carbon Monoxide Incident                          | 16         | 8         | 11         | 12         | 16         | 28         | 15         | 14        | 29         | 15        | 4         | <b>168</b>   |
| Radiation Leak, Radioactive Material              | 1          | 0         | 0          | 0          | 0          | 0          | 1          | 0         | 1          | 0         | 0         | <b>3</b>     |
| <b>Annual Total Hazardous Materials Responses</b> | <b>129</b> | <b>91</b> | <b>110</b> | <b>132</b> | <b>130</b> | <b>131</b> | <b>115</b> | <b>94</b> | <b>107</b> | <b>99</b> | <b>80</b> | <b>1,218</b> |

Source: Campbell County Fire Department

Figure 3 13: Total Hazmat Responses by Year Campbell County 2004 to 2014





## Impacts

Impacts which 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
- Interruption of commerce and transportation

## Frequency

Between 2009 and 2014, the number of annual hazardous material incidents in the County has ranged from 131 to 80. Hazardous material spills and releases, both from fixed facilities and during transport, will continue to occur in Campbell County.

## Vulnerability

There are some facilities, however, which contain extremely hazardous substances. These facilities are required to generate Risk Management Plans (RMPs). Six RMP facilities are located in Campbell County, as noted in **Table 3-16** below.

*Table 3-16: RMP Facilities in Campbell County*

| SITE                                   | CHEMICAL                      |
|--|-------------------------------|
| Bitter Creek BG                        | Mix Tank Flammable            |
| Dry Fork Station                       | Anhydrous Ammonia             |
| Gillette Wastewater Treatment Facility | Chlorine 1                    |
| Hilight Gas Plant /Reno Jct.           | Isomerization Plant Flammable |
| Kitty Gas Plant                        | Flammable                     |
| Pump Station 1                         | Chlorine                      |
| Wygen 1                                | Ammonia                       |

Campbell County also has several large energy pipelines, railroad tracks which carry many types of hazardous materials, state highways and an Interstate Highway (1-90). A variety of hazardous materials originating in the County and elsewhere are transported along these routes, and could be vulnerable to accidental spills.

The 2014 Wyoming Multi-Hazard Mitigation Plan lists the following hazardous chemicals as present in Campbell County:

- Butane
- Ammonia
- Carbon tetrachloride
- Chlorine
- Condensate
- Diesel
- Digester gas (CH<sub>4</sub> 70%) (CO<sub>2</sub> 30%)
- Ethylene glycol
- Isobutane
- Lube oil
- Pentane
- Propane
- Sodium hydroxide
- Y-grade (ethane-propane/de-ethanized mix)
- Natural gas condensate
- Natural gasoline

In May 2015, the Wyoming Emergency Response Commission contracted with the University of Wyoming's College of Engineering to conduct a Commodity Flow Study. According to the study, its objectives were to "identify what, where and when hazardous materials are being transported in Campbell and Converse Counties, identify most likely hazard scenarios which may be expected in the two counties, provide information about the amount of HAZMAT being transported, and provide responders, community planners and organizations information which enhances emergency planning." The study was conducted along two intersections on Wyoming Highway 59. Key findings of the study include:

- The most common HAZMAT class being transported across Campbell County is class 3 (flammable liquids);
- The most common placard ID being transported across Campbell County is 1267 (petroleum crude oil);
- The most likely HAZMAT incident in Campbell County would involve a class 3 HAZMAT (flammable liquid); this class represents more than 69% of the different classes.

Recognizing many loads are placarded as to a class and the specifics of the load are not always reflected by the placards, or some loads might include more than one type of chemical, some of the specific placards in Campbell County identified by the study included:

- Pyridine
- Sodium Hydroxide solution (commonly known as Lye or Caustic Soda)
- Sulfuric Acid with more than 51% acid

- Acrylonitrile, inhibited (used in insecticides and to make plastics, fibers and other chemicals)
- Potassium Hydroxide, solution (strongly exothermic, giving off significant heat when combined with water. Sometimes known as potassium lyes)
- Ammonia, Anhydrous (Commonly used in fertilizers, also used in emission scrubbers)
- Tinctures, Medicinal (often an alcohol concentration or ethanol)
- Phenolsulfonic Acid (used as a reagent, in water analysis or manufacture of pharmaceuticals)
- Cyclohexyltrichlorosilane (Used in preparing aqueous resins, aqueous paints, electrophotographic developers and producing olefin polymers)
- Silane, Compressed (A pyrophoric gas, often ignites explosively in contact with the air, originally used by the semiconductor industry,)
- Nitroglycerin, solution in alcohol
- Zirconium Scrap (very resistant to corrosion and extremely resistant to heat, used in the nuclear industry, the chemical industry, and used in catalytic converters, percussion caps and furnace bricks)
- Dichlorophenyltrichlorosilane (used to make silicones, corrosive)
- Hydrogen Selenide, Adsorbed (commonly used in the synthesis of selenium containing compounds, it ads across alkenes. Often used to dope semiconductors with selenium)

## Potential Losses

Potential losses can vary greatly for hazardous material incidents. For even a small incident, there are cleanup and disposal costs. Per the Campbell County Fire Department, a six-person equipped hazmat team with a vehicle costs approximately \$1,400 per hour to operate, and Hazmat suits can cost \$2,700 each. 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.

## Summary

|                                   |        |
|-----------------------------------|--------|
| <b>Probability of Occurrence:</b> | High   |
| <b>Population Impacted:</b>       | Medium |
| <b>Loss Potential:</b>            | High   |
| <b>Jurisdictions at Risk:</b>     | All    |

## Toxic Gas Seeps

### **Narrative**

Campbell County is rich in energy resources, so rich in fact that natural or methane gas seeps out of the ground. The abundance of this natural resource has spawned the methane gas industry, producing approximately 70,000 coalbed methane wells.

Residents attempting to drill water wells have in some cases encountered natural gas instead. This phenomenon creates serious risk of fire and explosion.

### **Past Occurrences**

In the summer and fall of 1987, residents of the Rawhide Subdivision north of Gillette were evacuated when poisonous hydrogen sulfide and methane gases were detected seeping from the ground. Much of the subdivision was subsequently found to be uninhabitable and residents were permanently relocated.

There have been a small undocumented number of mobile home fires and explosions from natural gas seepage. Due to water line leaks, gases escaped from water and have accumulated in the skirted areas beneath mobile homes and then been ignited by the pilot light on the water heater.

A number of fires and explosions necessitating emergency response have already occurred with development of new wells and the operation of existing coalbed methane wells. Water well pits have experienced explosions as collected gases were ignited when electric pump motors started up. (Hazard/Risk Assessment and Mitigation Plan, 2001).

### **Impacts**

Potential impacts from toxic gas seeps include:

- Illness
- Injury or loss of life from explosions and fires
- Property and infrastructure damage

### **Frequency**

Wells are distributed across the County. Full field development of as many as 50,000 coalbed methane wells in the future means that additional incidents involving fires and/or explosions are anticipated. The frequency of these types of incidents is difficult to predict because past occurrences have not been well documented.

## **Vulnerability**

Workers, emergency responders, and residents may all be at some risk. Any future disaster is likely to be relatively small-scale in terms of geographic area.

## **Potential Losses**

Based on past experience, losses have been limited to localized areas. In the case of the Rawhide Subdivision, associated expenses and losses included emergency response, evacuation of the subdivision, and assisting residents in financing and relocating to new homes. The dollar loss for this incident was in the hundreds of thousands of dollars. Loss of life and property due to an explosion or fire is possible, though not highly likely in the future.

## **Summary**

|                                   |      |
|-----------------------------------|------|
| <b>Probability of Occurrence:</b> | High |
| <b>Population Impacted:</b>       | Low  |
| <b>Loss Potential:</b>            | Low  |
| <b>Jurisdictions Affected:</b>    | All  |

## Flooding

### Narrative

Floods have caused significant damage in Wyoming and are one of the more significant natural hazards in the state. They can cause millions of dollars in damage in just a few hours or days. Every County and many communities in the state have experienced some kind of flooding after spring rains, heavy thunderstorms, winter snow thaws or ice jams. A flood, as defined by the National Flood Insurance Program (NFIP), 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.

With only two “rivers” within the county and no mountain runoff of concern, Campbell County is somewhat unique within the State of Wyoming as it has little population or structural exposure to the typical “spring thaw” or ice-jam flooding which threatens most of the rest of the state’s counties. The approximately seven miles of the Powder River cutting across the northwest corner of Campbell County poses few flood problems within the county. And, although the county is home to the headwaters of the Belle Fourche River, it also poses little danger from spring thaws or ice jams. The significant flooding experienced within the county has generally resulted from slow moving or stalled thunderstorms, which overwhelm the capacity of a drainage or series of drainages.

Floods generally fall into one of these three categories:

**Riverine Flooding:** Riverine flooding occurs on rivers, creeks, and streams as water levels rise, either from excessive precipitation, rapid snowmelt, dam failure, or ice jams. These types of floods can be slow or fast rising, but generally develop over a period of many hours or days.

**Flash Floods:** Unlike riverine flooding, flash flooding can happen anywhere. Flash floods occur with little or no warning and can reach full peak in only a few minutes. A flash flood usually results from intense storms dropping large amounts of rain within a brief period.

**Urban Flooding:** Urban flooding is the result of the construction of impervious surfaces (roads, parking lots, building footprints, etc.) and the ground’s decreased ability to absorb rainfall. Urban flooding is the result of sustained periods of rainfall and the inability of urban storm water systems to effectively drain the water. This can result in anything from minor flooding in basements and crawlspaces to entire streets being inundated with flowing water.

## Past Occurrences

According to the National Climate Data Center (NCDC) at the National Oceanic and Atmospheric Administration (NOAA), Campbell County has experienced 27 significant flood events resulting in two direct fatalities and \$4,640,500 in total property damage for the period 1966 to 2014 (See **Table 3-17**, **Figure 3-13** and **Appendix D**). The most damaging flood occurred north of Rozet in 1993 when a flash flood inundated a dry creek bed, destroyed an oil rig and took the life of a technician on the rig. A rancher inspecting cattle on July 23<sup>rd</sup>, 2008 following a severe thunderstorm died in a traffic accident when the pickup truck in which he was a passenger drove into the void created by a washed out four foot diameter storm culvert on the Trail Creek County Road in northeastern Campbell County. The rancher was killed by the impact as he was an unrestrained passenger in the night-time accident. Three others in the vehicle were unharmed. On August 2<sup>nd</sup>, 2013, a 20-year old Gillette man was killed when swept into a drain culvert near Providence Park in Gillette following a thunderstorm.

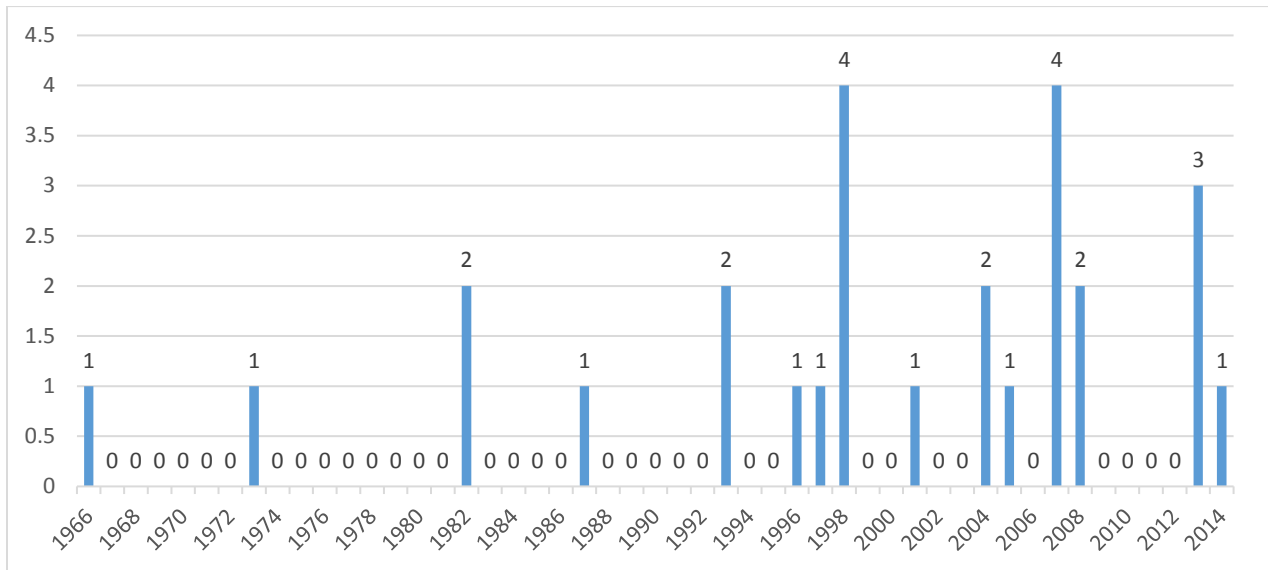
Average annual precipitation ranges from approximately 11 inches in the southern portion of the county to 18 inches in the northeast. More than two-thirds of the average annual precipitation occurs between March and August, with June being the wettest month. Rainfalls are most frequently associated with thunderstorms of high intensity and short duration which cause flash flood conditions, extensive erosion, and other damage.

*Table 3-17: Summary of Flood Events in Campbell County, 1966 – 2014*

|   |           |
|---|-----------|
| <b>Number of Days with Flood Event:</b>               | <b>27</b> |
| <b>Total Direct Fatalities</b>                        | <b>3</b>  |
| <b>Total Direct Injuries</b>                          | <b>3</b>  |
| <b>Number of Days with Event and Property Damage:</b> | <b>11</b> |
| <b>Number of Days with Event and Crop Damage:</b>     | <b>0</b>  |

Source: <http://www.ncdc.noaa.gov>

Figure 3-13: Flood Events by Year in Campbell County, 1966 – 2014



Source: <http://www.ncdc.noaa.gov>

## Impacts

Impacts which could occur from flooding include:

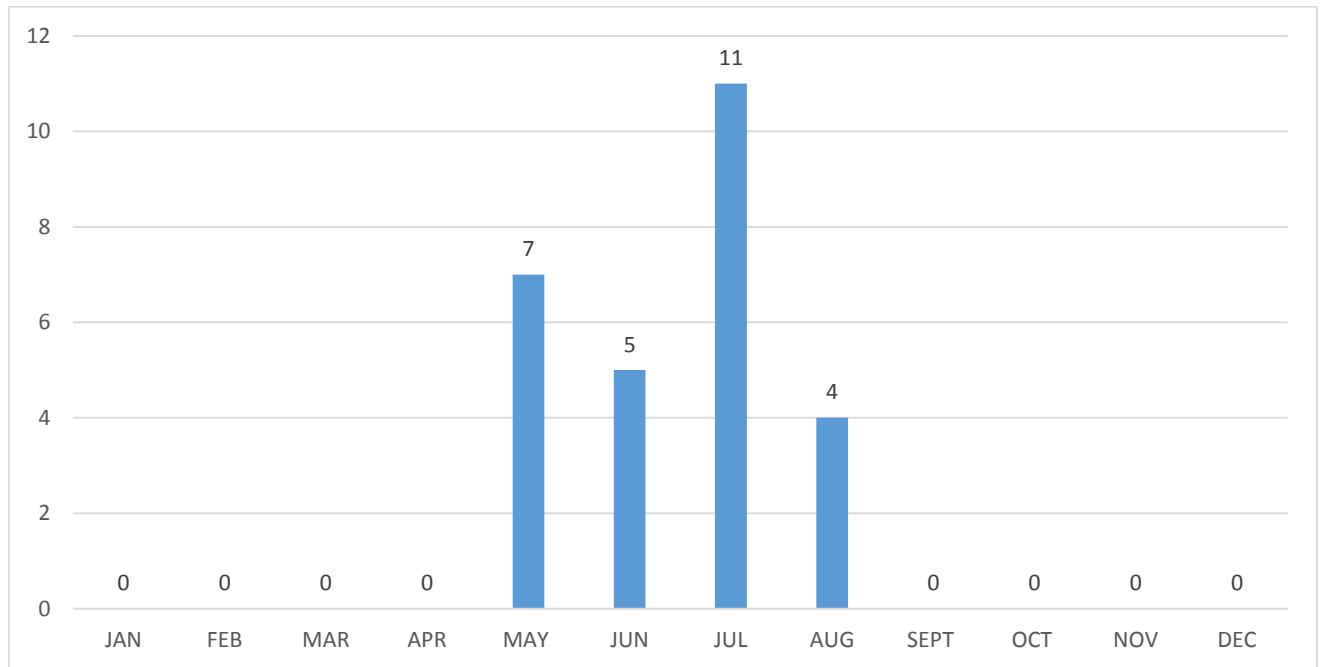
- Injury
- Loss of life
- Injury and loss of life to livestock, pets, fish and wildlife
- Damage to and loss of property and infrastructure
- Interruption of transportation and commerce
- Contamination of surface and ground waters

## Frequency

A clear trend of flood events over the time period of analysis is indeterminate. The data suggests more frequent flooding in the years after 1994 (see **Figure 3-13**), but this could be due to a lack of reliable information and/or reporting prior to that time. The data does suggest the bulk of the flood events occur between May and August (See **Figure 3-14**), with a sharp peak in July. This indicates a clear pattern which can be attributed to the seasonal rainfall cycle.



Figure 3-14: Flood Events by Month in Campbell County, 1966 – 2014



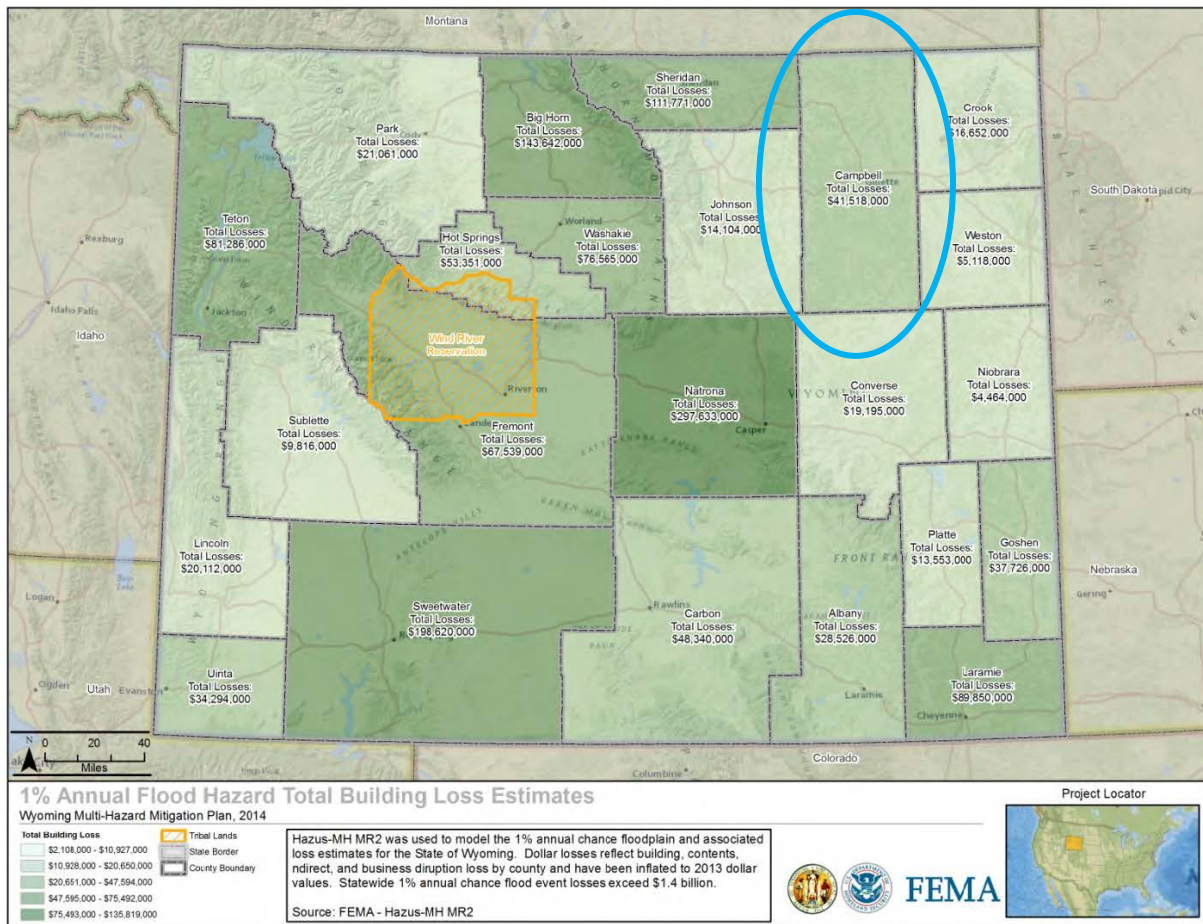
Source: Campbell County Flood Insurance Study, 2008

Based on documented historical events including estimates of reported infrastructure and agricultural losses to Campbell County, the County experiences a flood event approximately once every two years. These events can usually be attributed to high intensity spring thunderstorms which cause flash flooding.

### Vulnerability

HAZUS is a regional multi-hazard loss estimation model developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery (see **Figure 3-15**).

Figure 3-15: Potential Losses due to 1% Annual Chance Flood, State of Wyoming



Source: Wyoming Multi-Hazard Mitigation Plan 2014

Planning level flood loss estimates were made available for every county in Wyoming with the 2014 update to the Wyoming Hazard Mitigation Plan. FEMA used HAZUS-MH MR2 to model the 100-year floodplain and perform associated building and population risk assessments. Using the HAZUS program there are several projections for buildings located with the 100-year floodplain. In addition to the attached map book in **Appendix A**, this analysis gives an excellent visual reference, geographically, where those buildings facing the most damage are located.

Summary of Vulnerabilities:

- According to the HAZUS model output, Campbell County would suffer a total of \$41,518,000 in total direct economic loss to buildings and 1,029 people would be displaced in the event of a County-wide 1% annual chance flood (see Figure 28).
- There would be a total of 85 damaged buildings, 25 of which would be substantially damaged (>50% damaged).

- Sources of flooding include the Belle Fourche River, which flows northeast through Campbell County and into Crook County. Donkey Creek flows through Gillette and drains into the Belle Fourche River and adjacent Crook County.
- Stonepile Creek runs through the City of Gillette and drains into Donkey Creek.
- Although Hay Creek runs through the Town of Wright, the most significant flood concerns arise from unnamed drainages within the town's boundaries.
- The City of Gillette would suffer the most damage between the City and Town covered in this plan, with a total direct economic loss for buildings of \$17,444,000 and 646 displaced people.
- The Town of Wright has the greatest Percent Building Loss (1.4%) and Per Capita Loss (\$1,146) and shares with the City of Gillette the greatest Percent Contents Loss (1.9%) of the jurisdictions in the County. The total County, incorporated and unincorporated, would suffer 0.7% Building Loss, 1.5% Contents Loss, and \$814 Per Capita Loss.
- There are critical or non-critical state owned or operated assets in Campbell County vulnerable to the 1% annual chance flood, including the Highway 59 bridge over Donkey Creek and parts of Highway 397 where it exits Campbell County to the west

## **Potential Losses**

Flooding is different from most other hazards in that riverine flooding problems are managed through a national insurance system called the National Flood Insurance Program (NFIP) under the Federal Emergency Management Agency (FEMA).

The Town of Gillette entered into the emergency NFIP on April 15, 1975 and entered into the regular NFIP May 15, 1978. As of 4/16/2015, there were 18 policies in force totaling \$6,165,000 with 12 losses paid out totaling \$30,779.68. As of 4/16/2015, there were no repetitive losses and no substantial damage losses reported.

Campbell County entered into the emergency NFIP on December 8, 1975 and entered into the regular NFIP on May 15, 1984. As of 4/16/2015, there were five policies in force totaling \$1,189,800 with one loss paid out at \$5,985.60. As of 4/16/2015, there were no repetitive losses and no substantial damage losses reported. The county's effective NFIP date is February 19, 2014.

The Town of Wright entered into the emergency NFIP on December 2, 2002 and into the regular NFIP on January 2, 2008. As of 4/16/2015, there was one policy in force totaling \$350,000 with one loss paid out at \$1,350.57. As of 4/16/2015, there were no repetitive losses and no substantial losses reported.

The Town of Wright is working on National Flood Insurance Program mapping to update specific areas of concern (*Source: Lyle Murdock 2010*).

The town zoning ordinance provides specific guidance for flood damage prevention. Title 12, Flood Control, provides definitions, methods, guidance and general provisions for the mitigation of periodic inundation due to flooding. The code also appoints the Town of Wright Building Official (in charge of permitting and regulation of construction) as the floodplain administrator to implement the provisions of the National Flood Insurance Program (NFIP) regulations (44 C.F.R.).

FEMA conducts a Flood Insurance Study (FIS) of a region to identify the community's flood hazards. The FIS includes statistical data for river flow, rainfall, topographic surveys, as well as hydrologic and hydraulic analyses. After examining the FIS data, FEMA creates Flood Insurance Rate Maps (FIRMs) delineating the different areas of flood risk. Land areas with have a 1% Annual Chance for flooding are called Special Flood Hazard Areas (SFHAs), or the 100 year floodplain. The most recent FIS (January 2008) and the FEMA Community Status Book (accessed September 2015) for Campbell County were used to inform this section during the 2015 plan update.

According to FIS and Community Status Book data, only the Town of Wright has FIRM maps which have been updated in the past 10 years, yet all communities as well as the unincorporated parts of the county participate in the NFIP. See **Table 3-18** below.

*Table 3-18: FEMA FIRM Map Data, Campbell County*

| Community Name                 | Initial Identification Date | FIRM Effective Date | FIRM Revision Date | NFIP Participation |
|--------------------------------|-----------------------------|---------------------|--------------------|--------------------|
| Unincorporated Campbell County | Jul 18, 1978                | May 15, 1984        | Jan 2, 2008        | Yes                |
| Gillette, City of              | Jun 28, 1974                | May 15, 1978        | Jan 2, 2008        | Yes                |
| Wright, Town of                | Jan 2, 2008                 | Jan 2, 2008         | NONE               | Yes                |

*Source: Campbell County Flood Insurance Study, 2008 and FEMA Flood Insurance Status Book*

The DFIRM 1% Annual Chance and .2% Annual Chance are represented on the Flood Hazards map at both the county scale and for each of the municipalities in the included map book. In the Town of Wright and the City of Gillette, the DFIRM 1% annual chance boundary is narrower and less extensive than the HAZUS 1% annual chance boundary; if the DFIRM were used for analysis, loss estimates would likely be lower in those municipalities. HAZUS and DFIRM floodplain extent is similar in the unincorporated county.

## Future Development

The study area is mostly undeveloped. Approximately 10 percent of the unincorporated areas of the county were reported as developed land in 1977, with 63 percent of this developed land in residential use. Most of the undeveloped land can be categorized as agricultural use, such as ranch land or potential grazing land. Energy production is also an important land use in the County which is home to a number of large surface coal mines,

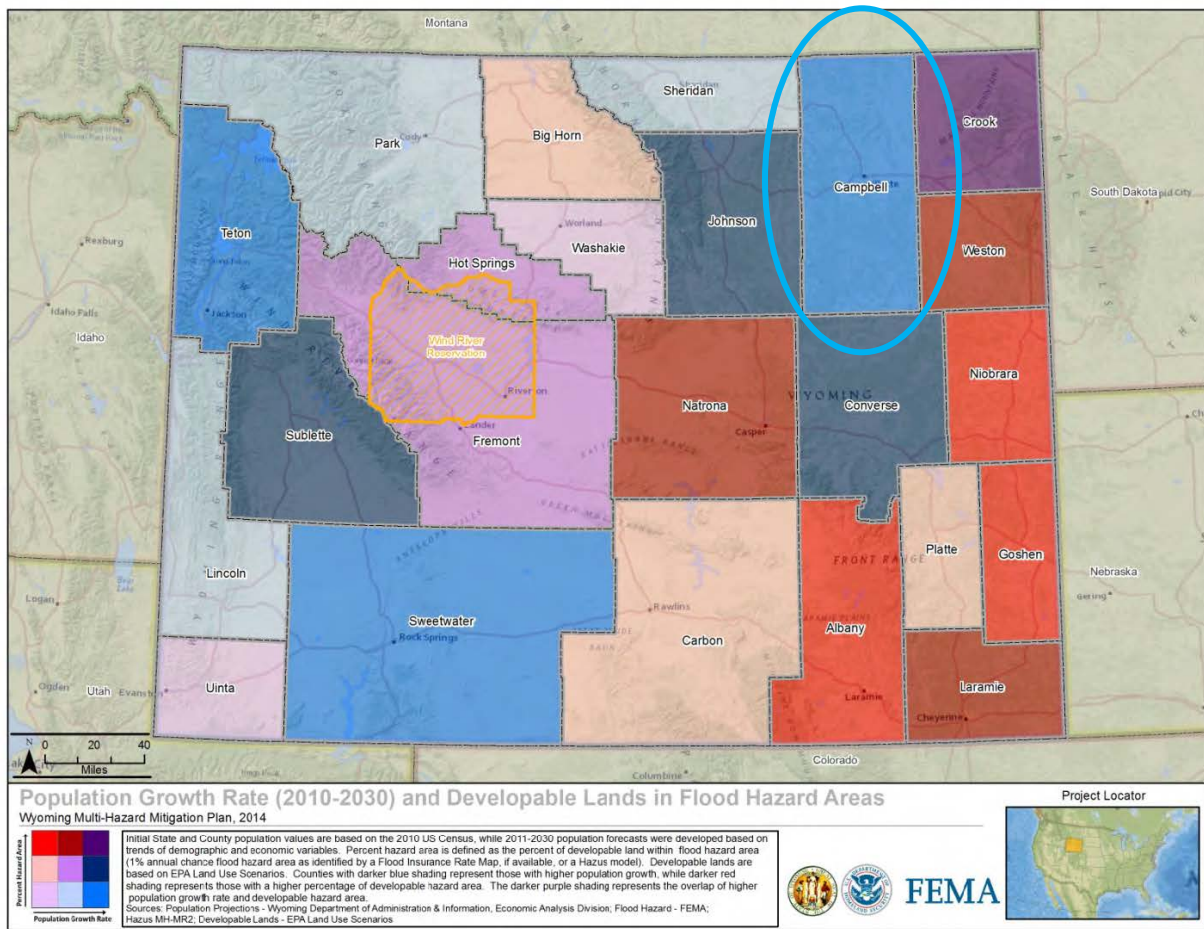
Most of the floodplain in Gillette along Stonepile Creek has been developed. The western, or upstream, portion contains light industrial and residential development. The area north of the Burlington Northern Railroad is partially residential and partially parkland. South of the Burlington Northern Railroad, between Douglas and Gurley Avenues, the development is mostly commercial. For the portion of the floodplain between Gurley Avenue and Interstate Route 90, the development is mostly residential, containing both mobile homes and conventional housing. In addition, there is a residential subdivision along Donkey Creek Tributary.

With increased residential development within the City of Gillette, some channel improvements have been implemented. These improvements are along Stonepile Creek, Little Rawhide Creek, Donkey Creek, and the Donkey Creek Tributary. The improvements generally consist of new culverts and straightening, deepening and improving the cross-section area along the stream channels through developed areas. The 1 % annual-chance flood will be contained along the improved channel reach of Stonepile Creek between Interstate Highway 90 and U.S. Highways 14/16. Along Little Rawhide Creek, the 1 % annual-chance flood will be contained in the channel between Little Powder River Road and Kluver Road.

The 2004 topography indicated channelization of Stonepile Creek and its tributaries in the vicinity of West Warlow Drive and North Burma Avenue. Similarly, channelization along the railroad and East 2nd Street on Stonepile Creek is reflected in the 2004 topography redelineation. Culvert improvements in these areas were not addressed by the redelineation efforts. *(Source: Campbell County Flood Insurance Study, 2008)*

Growth in the Gillette area is expected to result in development of the unincorporated areas with residential and related commercial land use. This trend has been exhibited with a growing number of residential developments outside of the Gillette corporate limits. Floodplain land in the unincorporated areas is essentially undeveloped. A strong trend toward residential development in the area surrounding the City of Gillette could result in the development of floodplain areas unless sound floodplain management measures are utilized.

Figure 3-16: Future Flood Hazard in Future Growth Area Wyoming, 2014



Source: Wyoming Multi-Hazard Mitigation Plan, 2014

The 2014 Wyoming Multi Hazard Mitigation Plan published an analysis of future flood hazard risk by developing a matrix which synthesized population growth projections with developable lands in flood hazard areas (see **Figure 3-16**).

With this matrix approach, counties with darker blue shading represent those with higher population growth rates, while dark red shading represents those with a higher percentage of developable hazard area. The purple shading represents overlap of high population growth rates and developable hazard areas.

Campbell County, while projected to have significant population growth to 2030, does not have a significant amount of developable land in high flood hazard areas. This means flood hazard risks in Campbell County are unlikely to change significantly in the next 15 years.



## Stormwater Flooding and Management

### Gillette

The City of Gillette adopted a drainage plan in the early 1980s which addressed storm water concerns. Since then, the plan has been implemented in phases. Implementation of the plan resulted in a significant reduction of the area in the City falling within the 100-year floodplain. The storm drainage plan has been updated as development has occurred, with the most recent version of the plan being approved in October, 2011:

<http://www.gillettewy.gov/Home/ShowDocument.aspx?documentid=9083>

The stated objectives of the plan are as follows:

- Update the stormwater infrastructure inventory performed in 2005.
- Develop a comprehensive Stormwater Master Plan with a focus on regional detention and major drainage conveyance improvements.
- Integrate drainageways into parks and open spaces to create public amenities.
- Develop a GIS based computer model of the stormwater system for the city's 'stormwater district' service area.
- Develop capital improvement projects and a capital plan to reduce or eliminate drainage and/or flooding problems with available resources.

The City also developed and approved a Storm Drainage Design Manual which is part of the design criteria for storm water management for new subdivision and commercial development:

<http://www.gillettewy.gov/Home/ShowDocument.aspx?documentid=6340>

Both plans are part of the comprehensive planning process and are represented in The Gillette Plan, the 2013 comprehensive plan update:

<http://www.gillettewy.gov/Home/ShowDocument.aspx?documentid=498>

### Summary

|                                   |        |
|-----------------------------------|--------|
| <b>Probability of Occurrence:</b> | Medium |
| <b>Population Impacted:</b>       | Medium |
| <b>Loss Potential:</b>            | High   |
| <b>Jurisdictions at Risk:</b>     | All    |

## Lightning

### Narrative

Although not as significant in relation to other natural hazards, lightning remains a certain danger in Wyoming. Lightning is a sudden electrical discharge released from the atmosphere which 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 caught outside without cover is vulnerable.

### Past Occurrences

From 1962 to 2014, lightning has been responsible for 28 deaths, 137 injuries, over \$2.8 million in property damage, and \$102,500 in crop damage in Wyoming (Wyoming Multi-hazard Mitigation Plan, 2014). Campbell County suffered six total events, with one direct injury, three indirect injuries and no fatalities from 1962 to present day (see **Table 3-19**, **Table 3-20** and **Figure 3-17**). Most of the impacts from lightning strikes were wildfire ignitions. However on June 30, 2010, a man was struck by lightning while working on his truck on the side of the road; he was not seriously injured. On May 29<sup>th</sup>, 2014, lightning struck a coal mine, causing a tire to explode and smash through the wall of a nearby building, which struck and indirectly injured three people. While there are reports of lightning striking objects and causing explosions and structure fires, the typical recorded lightning incident in Campbell County causes most of its impacts by igniting wildfires.

*Table 3-19: NCDC Recorded Lightning Events in Campbell County, 1999-2014*

| Location        | Date      | Time  | Fatalities | Injuries | Property Damage | Crop Damage |
|-----------------|-----------|-------|------------|----------|-----------------|-------------|
| Campbell County | 7/21/1999 | 17:00 | 0          | 0        | \$0             | \$0         |
| Wright          | 8/4/2001  | 10:47 | 0          | 0        | \$0             | \$0         |
| Wright          | 6/30/2010 | 18:38 | 0          | 1        | \$0             | \$0         |
| Wright          | 5/29/2014 | 15:36 | 0          | 0        | \$0             | \$0         |
| <b>Total</b>    |           |       | <b>0</b>   | <b>1</b> | <b>\$0</b>      | <b>\$0</b>  |

*Source: <http://www.ncdc.noaa.gov>*

In their September 17<sup>th</sup>, 2015 meeting, the planning team noted three homes struck by lightning in summer 2015; the county also experienced lightning damage to communications infrastructure. These incidents were too recent to be included in NCDC data. No data was available on dates or damages.

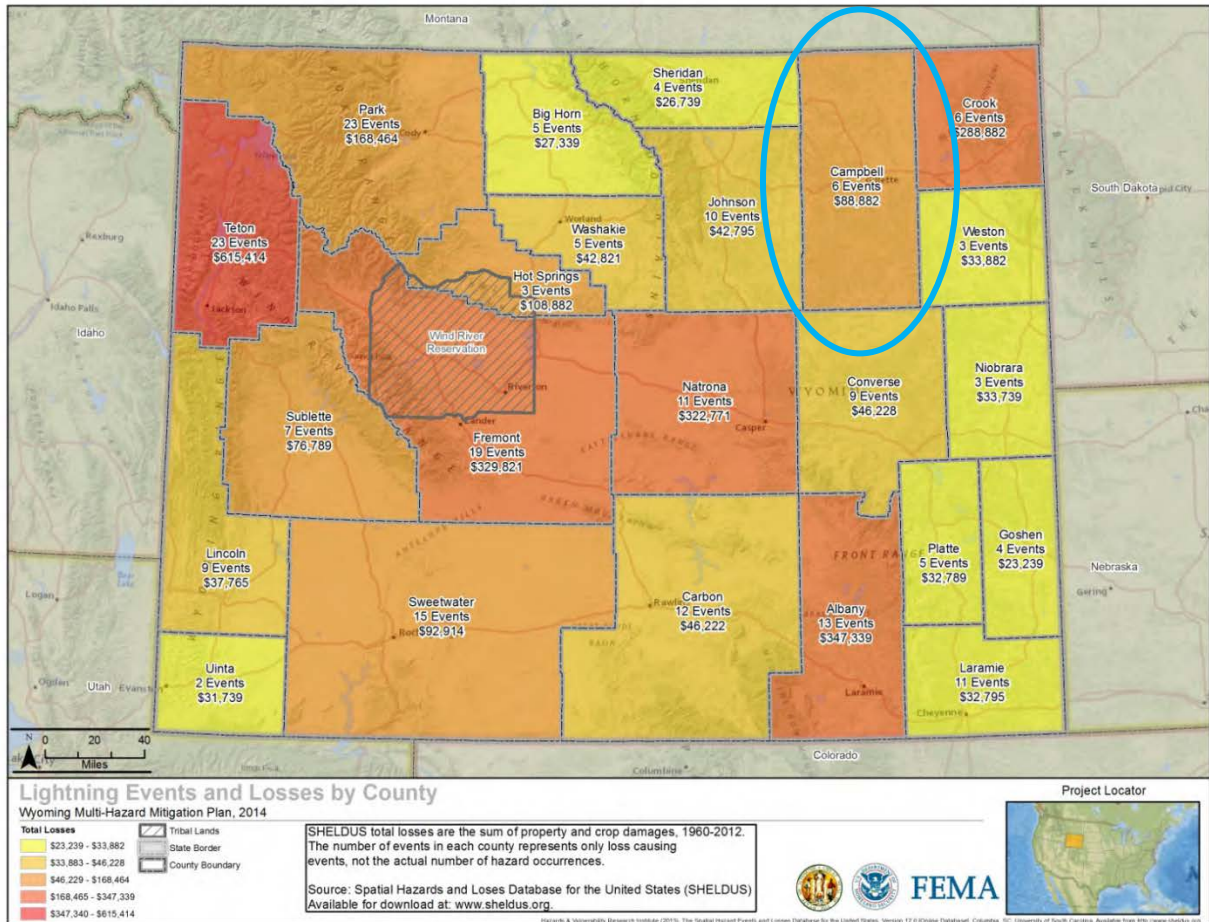


Table 3-20: Lightning Impacts in Campbell County, 1962-2014

| County   | Total Events | Total Injuries | Total Fatalities | Total Property Damage | Total Crop Damage | Total Damage |
|----------|--------------|----------------|------------------|-----------------------|-------------------|--------------|
| Campbell | 6            | 1              | 0                | \$88,882              | \$0               | \$88,882     |

Source: Wyoming Multi-Hazard Mitigation Plan, 2014 and SHELUDS

Figure 3-17: Lightning Events and Losses, Wyoming 2014



Source: Wyoming Multi-Hazard Mitigation Plan, 2014

## Impacts

Because lightning is associated with thunderstorms, damage can be caused by hail, precipitation, and winds in association with lightning. Potential impacts solely from lightning include:

- Injury or death
- Injury or death of livestock
- Damage to communication/electronic equipment and household appliances
- Property damage and structure fires
- Wildland fire and associated property damage and threat to life
- Interruption of power and communications

## Frequency

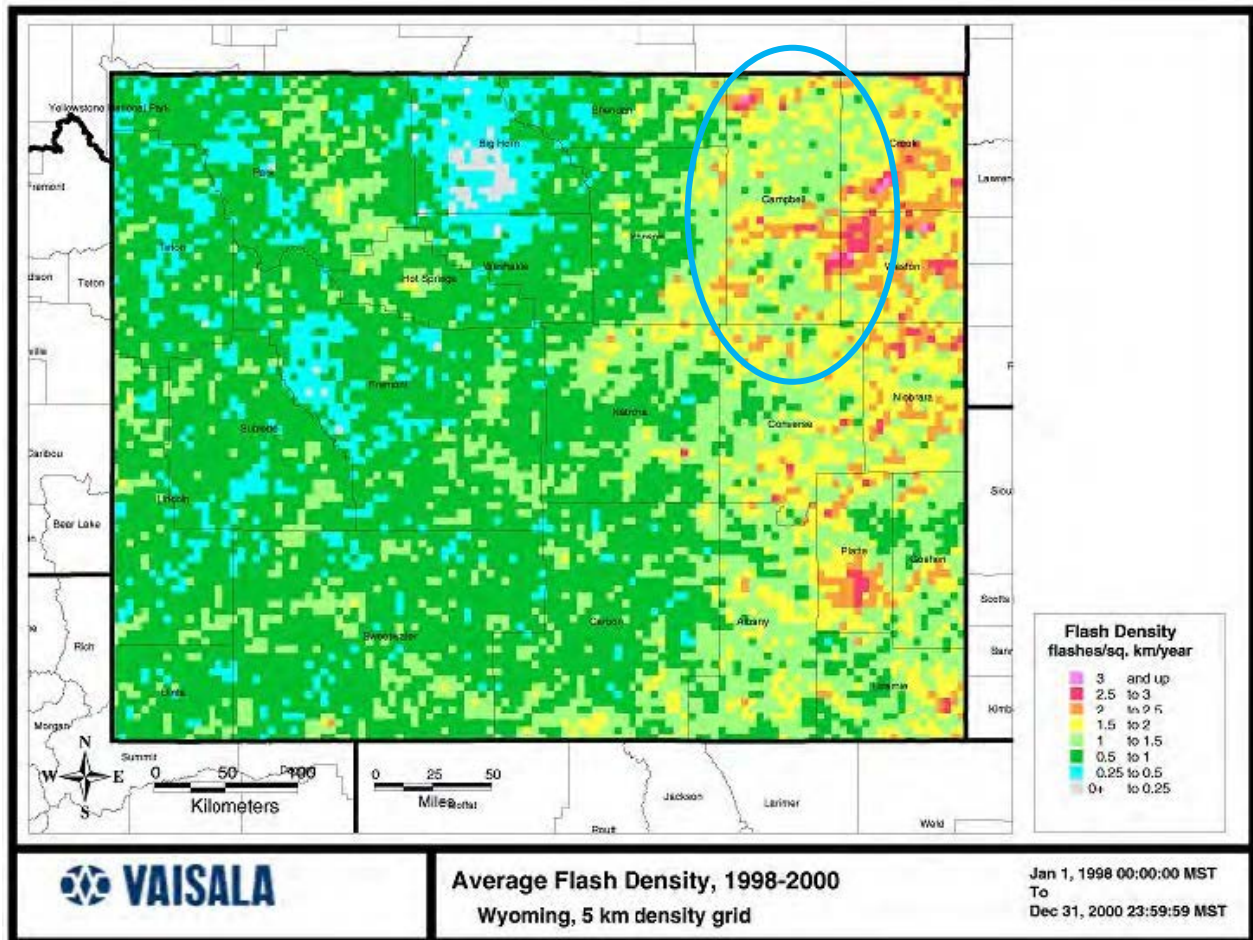
Lightning occurs in almost every thunderstorm. Most of the time, the lightning is harmless and causes no damage. However, the State of Wyoming Hazard Mitigation Plan notes six significant lightning events in Campbell County between 1959 and 2014. Based on this information, a damaging lightning event can be expected to occur in the County approximately every nine years.

## Vulnerability

Lightning can strike anywhere in the County, and all individuals and structures are vulnerable to lightning strikes.

Nationwide, lightning strikes are routinely monitored by Vaisala, Inc. with accuracies to within a 1 kilometer resolution. For the period of 1998 through 2000, the Wyoming annual lightning strike frequency is depicted in **Figure 3-18** below. Clearly the eastern plains have more than three times the cloud to ground lightning strikes as does the western half of the state. Platte, Weston, Crook, and parts of Campbell, Niobrara, and Laramie counties are the most active in the state. These values probably vary by 50% in a year depending on whether there is a drought or enhanced monsoonal flow. However, the locations of maximum and minimum strikes do not change much from year to year.

Figure 3-18: Recorded Lightning Strikes in Wyoming, 1998-2000

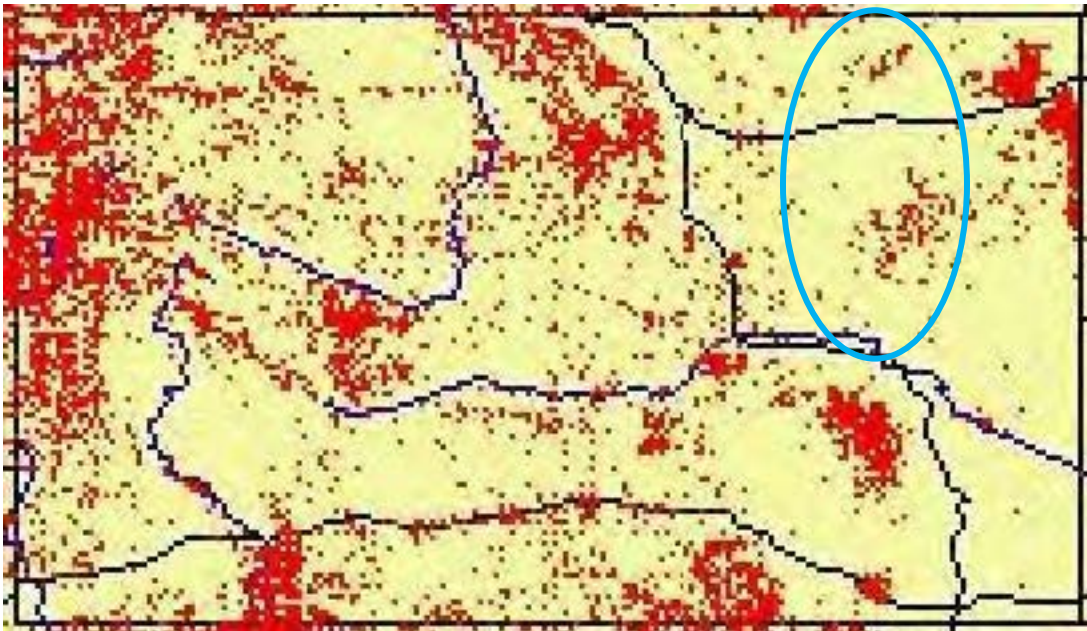


Source: Wyoming Multi-Hazard Mitigation Plan 2014

## Potential Losses

Lightning is the leading cause of wildland fires in Wyoming, and is indirectly responsible for millions of dollars of fire damage. Whether in a drought or wet period, Wyoming's hot and windy summers can cause rapid changes to the fire risk over grasslands and forests. The worst events occurred in July and August 1988, when, according to the U.S. Bureau of Land Management, lightning ignited 29 fires in the state, setting 4,159 acres ablaze. These fires resulted in a total of \$780,330 in damage.

Figure 3-19: Lightning Induced Fire Source Points, 1970-2000



Source: Wyoming Climate Atlas

Based on data from the Wyoming Climate Atlas, Campbell County has a low density of lightning induced fire source points when compared to more heavily forested regions of the state (see **Figure 3-19**).

### Future Development

Lightning caused wildland fires may result in more extensive damage. Additional impacts exist to property located in areas susceptible to wildland fire, which is addressed in the “Wildland Fire” chapter in this plan. While Wyoming’s population continues to grow, as documented by the 2010 census, development has no impact on locations where lightning may strike, but potentially increases the exposure of people and property to lightning impacts.

### Summary

|                                   |      |
|-----------------------------------|------|
| <b>Probability of Occurrence:</b> | High |
| <b>Population Impacted:</b>       | Low  |
| <b>Loss Potential:</b>            | Low  |
| <b>Jurisdictions at Risk:</b>     | All  |

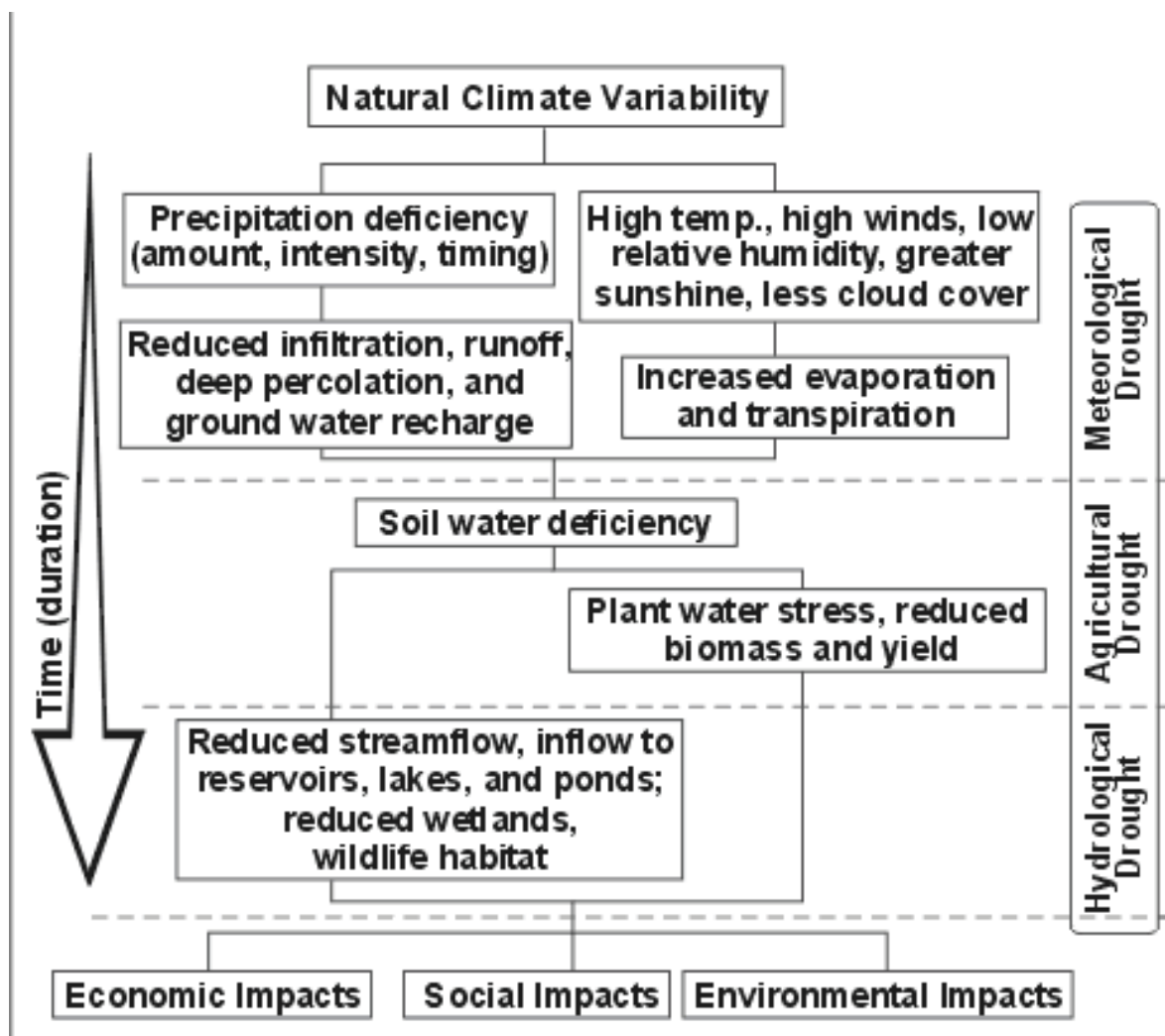


## Drought

### Narrative

Drought is human society's most costly, natural weather-related disaster by far. It indirectly kills more people and animals than the combined effects of hurricanes, floods, tornadoes, blizzards, and wildfires. Unlike other disasters which quickly come and go, drought's long-term unrelenting destruction has been responsible for mass migrations and lost civilizations. On a lesser scale, 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 extent. Severity, the most commonly used term for measuring drought, is a combination of magnitude and duration.

Figure 3-20: Drought Progression Chart



Source: [www.nws.noaa.gov](http://www.nws.noaa.gov)

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. This criterion can be misleading if all the precipitation falls in a very short time period resulting in floods.

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 hydrological drought. Reduced stream flow (inflow) to reservoirs and lakes is the most obvious sign a serious drought is in progress.

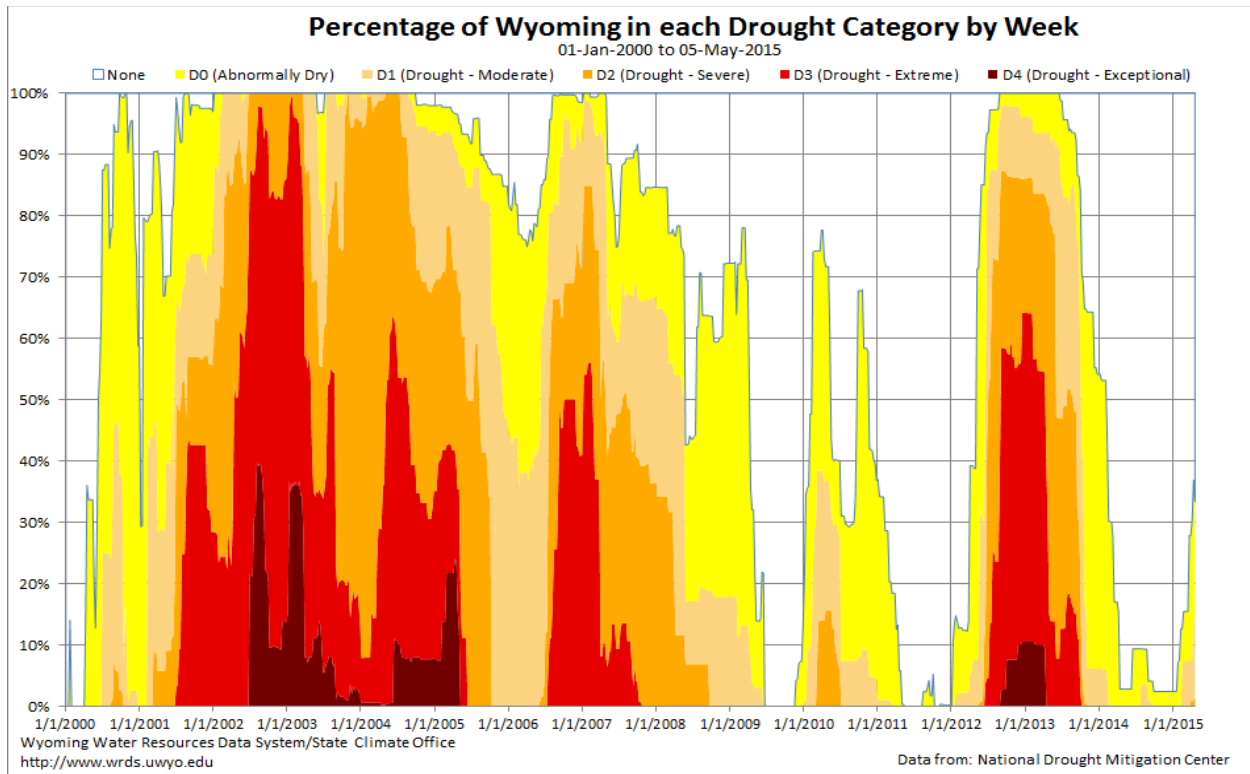
The fourth stage is the socioeconomic drought. This final stage refers to the situation which occurs when physical water shortage begins to affect people (see **Figure 3-20**).

### **Past Occurrences**

Winter precipitation in the state of Wyoming is usually two to six times less than summer precipitation and these seasonal changes are normal in Wyoming's semi-arid climate. Conditions are often made worse with high temperatures, high winds, low humidity, and greater sunshine. All of these contribute to increased evaporation and transpiration and result in reduced soil infiltration, runoff, deep percolation, and groundwater recharge (*Source: Wyoming Multi-Hazard Mitigation Plan, 2014*).

The nation's fifth driest state, Wyoming was gripped by a drought cycle described as moderate to severe from 1999 until conditions eased in mid-2008, according to the State Climate Office. The Dust Bowl era of the 1930s affected 50,000,000 acres of land across the West, including most of Wyoming. In the 1950s, the Great Plains again suffered a severe water shortage. The worst drought in 50 years occurred in 1988 and affected 35 states including Wyoming. As direct result of this, large fires burned across large parts of the American West in 1988, including the conflagration in Yellowstone Park (*Source: National Weather Service*). Campbell County was part of the larger area affected by these earlier droughts.

Figure 3-21: Percentage of Wyoming in Drought by Category, 2000 - 2015



Source: National Drought Mitigation Center

**Figure 3-21** from the National Drought Mitigation Center shows at the peak of the most recent (2012-2013) drought, more than 10% of Wyoming fell in the ‘Exceptional Drought’ (D4 or dark red) category, and 100% of Wyoming experienced at least ‘Abnormally Dry’ conditions.

The U.S. Drought Monitor also provides maps of historic drought conditions by state. 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 maps. The image is color-coded for four levels of drought intensity. An additional category, ‘Abnormally Dry,’ (D0 or yellow) is used to show areas which might be moving into a drought, as well as those which have recently come out of one. USDM map data dating from 2000 reveals Campbell County experienced drought conditions at least as severe as the rest of the State of Wyoming for the past 3 drought periods in 2013, 2007 and 2003, including all of the county being classified during those years as either experiencing Severe Drought, Extreme Drought or Exceptional Drought. (**Figure 3-22**, **Figure 3-23** and **Figure 3-24**, respectively).

Figure 3-22: State of Wyoming Drought Conditions, January 2013

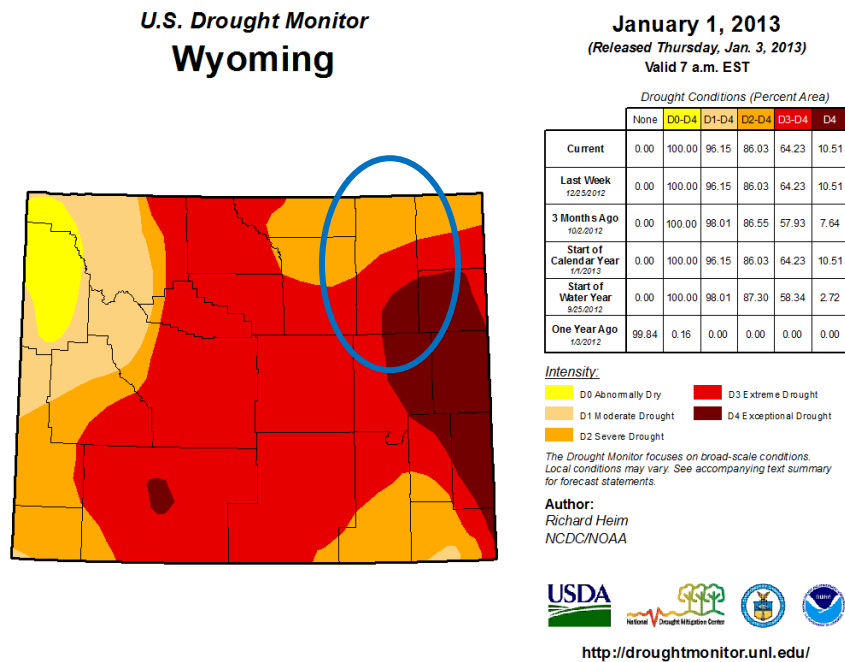


Figure 3-23: State of Wyoming Drought Conditions, January 2007

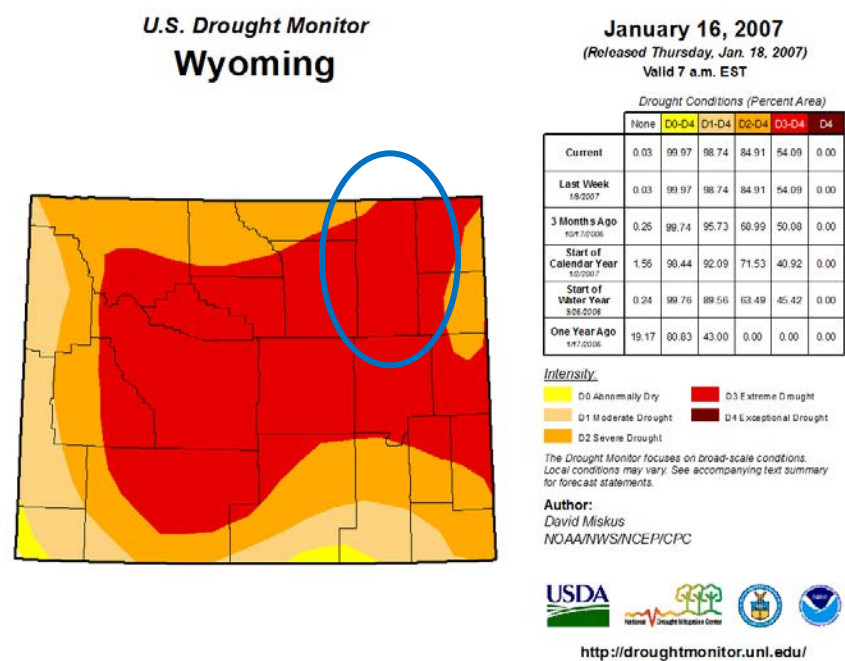




Figure 3-24: State of Wyoming Drought Conditions, January 2003

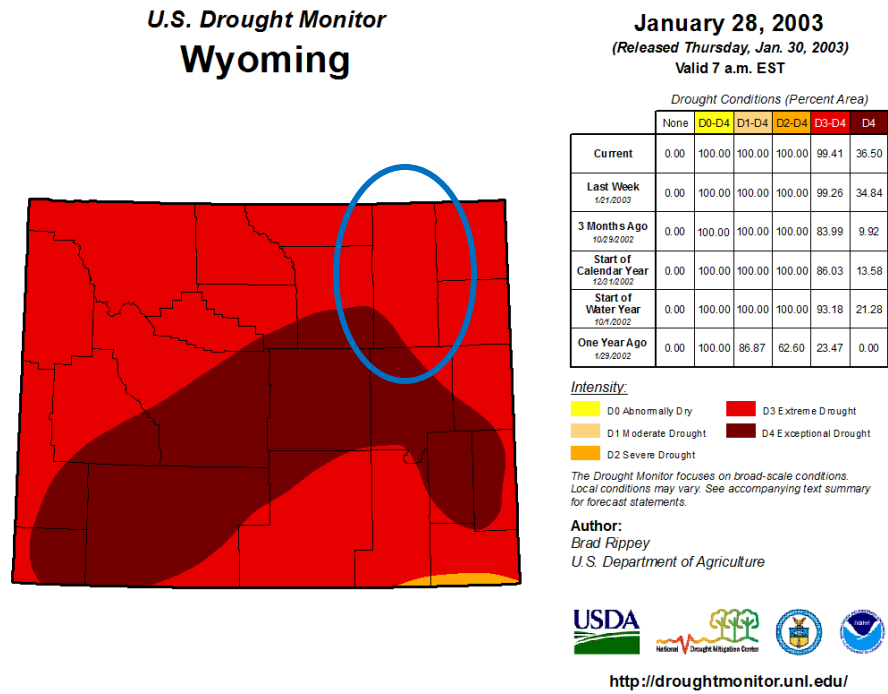
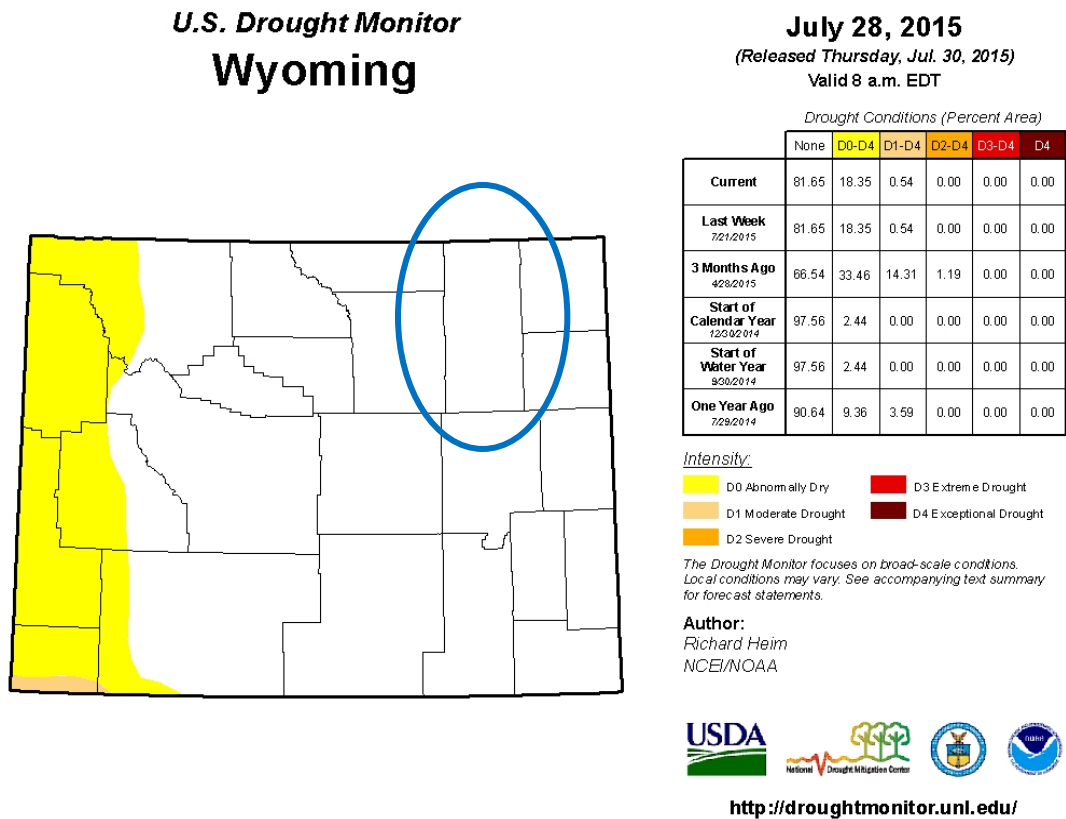


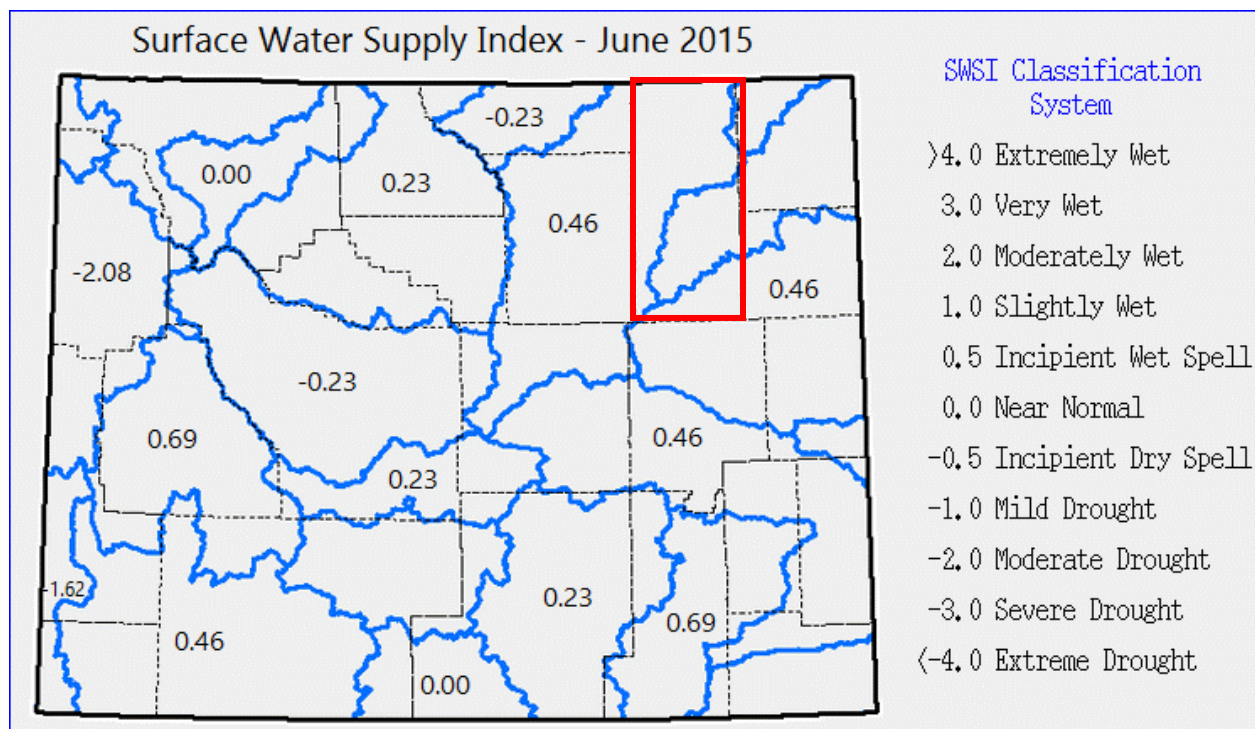
Figure 3-25: State of Wyoming Drought Conditions, July 2015



Source: US Drought Monitor

As of July 28<sup>th</sup>, 2015 approximately 18% of the State of Wyoming qualifies as 'Abnormally Dry' (D0 or yellow) with less than 1% in the 'Moderate Drought' (D1 or light orange) category. As of this same timeframe, none of Campbell County is in drought conditions (see **Figure 3-25**).

Figure 3-26: State of Wyoming Drought Conditions by Surface Water Supply



Source: <http://www.wrds.uwyo.edu/wrds/nrcs/swsimap/swsimap.html>

The data from the US Drought Monitor is corroborated by data from the Surface Water Supply Index (SWSI) from the Water Resources Data System (WRDS) at the University of Wyoming (see **Figure 3-26**). The Surface Water Supply Index is computed using only surface water supplies for the drainage (shown in blue). The computation includes reservoir storage, if applicable, plus the forecast runoff. The index is purposely created to mirror the Palmer Drought Index (PHDI, see **Figure 3-27**), with near normal conditions centered at zero.

Adequate and excessive supply has a positive number and deficit water supply has a negative values. Soil moisture and forecast precipitation are not considered as such, but the forecast runoff may consider these values. The watershed basins within and around Campbell County are all in positive territory, describing near normal conditions.

## Impacts

Impacts from drought can include the following:

- Economic losses to agricultural producers (crops and livestock)
- Physical and mental health issues in those suffering losses
- Water supply interruption for business and industry
- Water quality problems
- Reduced soil and vegetation moisture
- Vegetation mortality, insect infestations
- Impacts to fish and wildlife populations
- Increase in wildland fires and associated losses

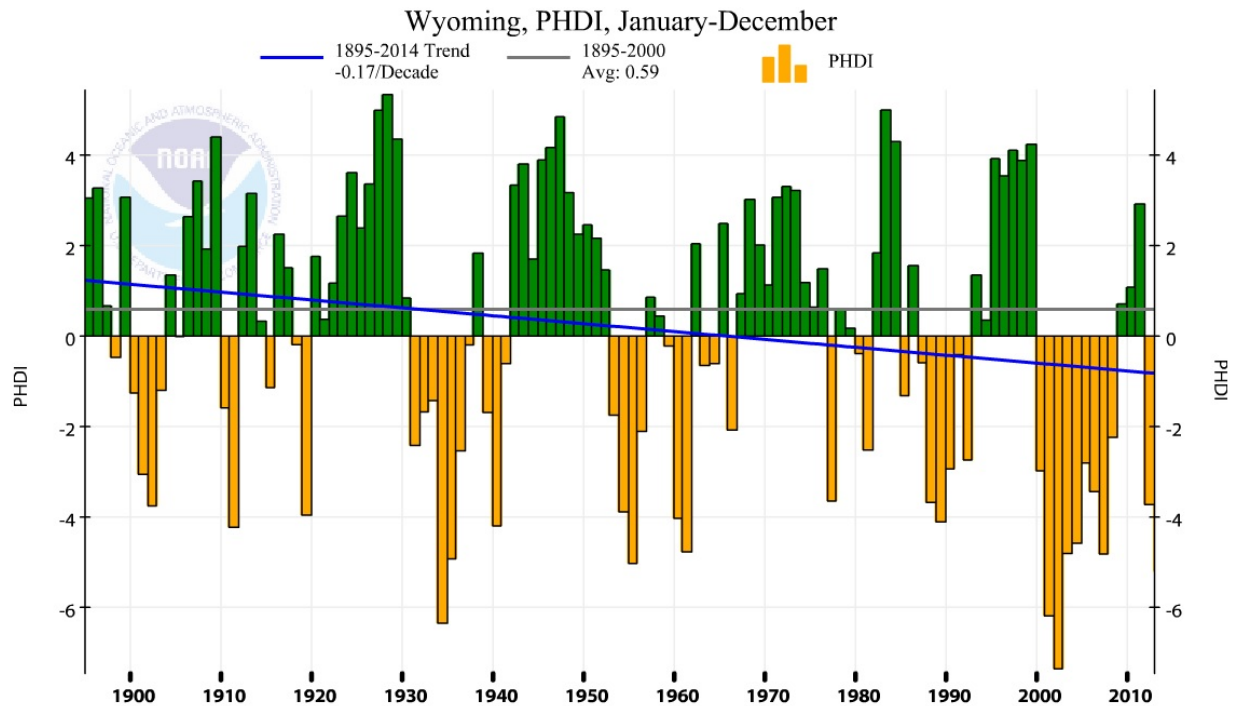
## Frequency

Despite the near normal current conditions in Campbell County, the American West (including all of the State of Wyoming) remains extremely vulnerable to cyclical drought conditions.

*Figure 3-27: Palmer Drought Index*

|                     |               |                  |                |                     |
|---------------------|---------------|------------------|----------------|---------------------|
| 4.00 to 6.00        | 3.00 to 3.99  | 2.00 to 2.99     | 1.00 to 1.99   | 0.50 to 0.99        |
| Extremely wet       | Very wet      | Moderately wet   | Slightly wet   | Incipient wet spell |
| 0.49 to -0.49       |               |                  |                |                     |
| Near normal         |               |                  |                |                     |
| -0.50 to -0.99      | -1.00 to 1.99 | -2.00 to -2.99   | -3.00 to 3.99  | -4.00 to -6.00      |
| Incipient dry spell | Mild drought  | Moderate drought | Severe drought | Extreme drought     |

Figure 3-28: Wyoming Palmer Hydrological Drought Index 1895-2014



Source: [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

According to over 100 years of precipitation data from the National Climate Data Center (NCDC) the State of Wyoming experiences negative Palmer Hydrological Drought Index years at least once every decade and, in some decades (like 2000 through 2010), negative years outnumber positive years.

The average PHDI in Wyoming from 1895-2000 was calculated at 0.59, or slightly wetter than normal conditions (the grey trend line in **Figure 3-28**). However, when accounting for the years between 2000 and 2014, the average PHDI is shown to be decreasing at a rate of 0.17 PHDI points per decade (the blue trend line in **Figure 3-28**). If this trend continues, Campbell County must be prepared for dryer conditions in the future.

## Vulnerability

Agricultural data is generally used as a measure of negative economic impacts to drought, however this model is incomplete at best because it does not take into account the potential dollar losses caused by wildfires due to drought or losses in tourism revenue. In addition, there are limitations in determining agricultural losses. These limitations include:

- USDA Agricultural Survey Statistics rely entirely on the willingness and availability of producers within a county to respond to quarterly surveys. Participation can be unreliable.

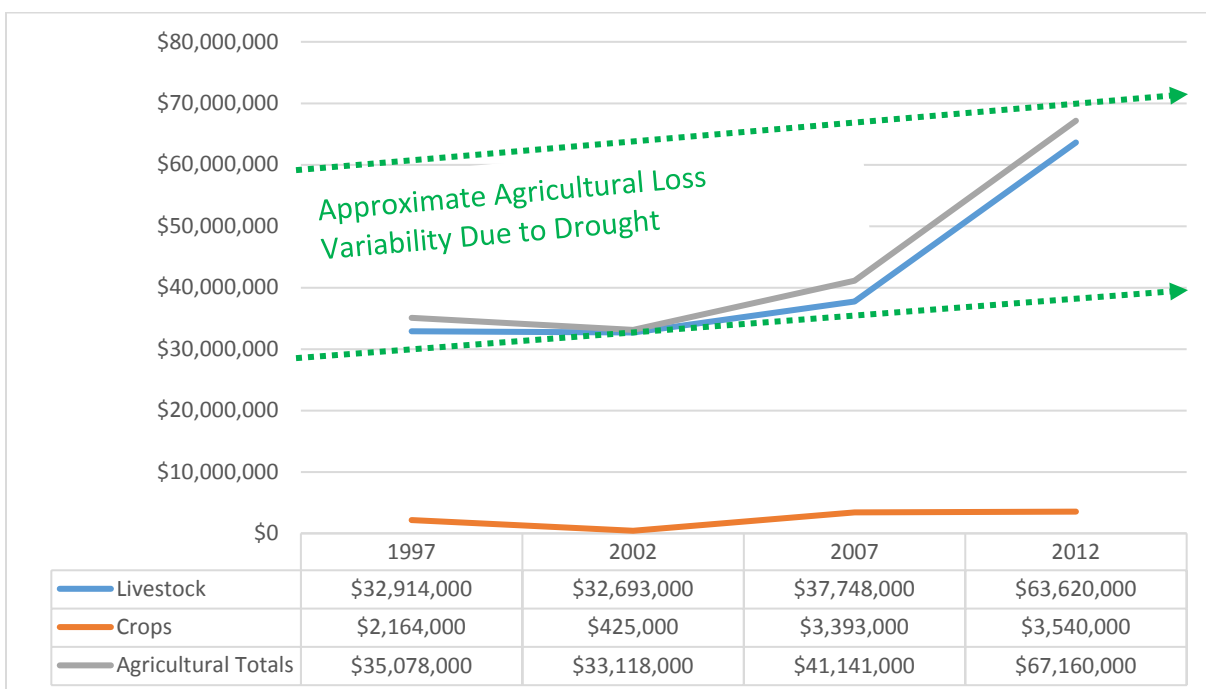
- Federal crop disaster declarations are most often multi-county, multi-hazard declarations, covering a variety of events in any given year, (i.e., grasshoppers, hail, drought, etc.) thus these agencies cannot provide drought-attributed losses directly to each county.
- Policies have changed drastically regarding requirements by the USDA. Producers are now required to carry some level of crop disaster coverage in order to be eligible for future federal disaster dollars.

## Potential Losses

The 2014 Wyoming Multi Hazard Mitigation Plan estimated potential agricultural losses in Campbell County to be approximately \$27.7M in 2012 (the year of the last Agricultural Census). In 2012, Campbell County produced a total of \$67.1M in total agricultural goods, up from an average of \$36.4M in the three Census years prior (2007, 2002 and 1997).

Since the State of Wyoming was in drought conditions for the majority of the period between 1997 and 2007, after 2007 the state has returned to 'near normal' PHDI conditions so this model predicts agricultural capacity in 2012 was at or near peak production. This corroborates the potential loss number quoted in the Wyoming Multi Hazard Mitigation Plan as the three year total agricultural production average from 1997 to 2007, plus the potential loss calculation, roughly equals total agricultural production in 2012. Therefore, this model calculates Campbell County's potential maximum agricultural loss ratio due to drought is -41% from peak production (see **Figure 3-29**).

Figure 3-29: Campbell County Agricultural Production



Source: <http://quickstats.nass.usda.gov>

## **Future Development**

Drought vulnerability will increase with future development as there will be increased demands for limited water resources. Since the projected population growth rate in Campbell County is +43.1% (to 2030), future development may exacerbate drought conditions. While agribusiness is a relatively small part of the County's overall economy, this sector relies on consistent water supplies. Drought has the potential to negatively impact ranchers growing grass pasture and forage crops (which comprises 95% of agricultural activity in Campbell County) putting this industry at greater risk compared to less water-intensive economic industries.

### **Summary:**

|                                   |        |
|-----------------------------------|--------|
| <b>Probability of Occurrence:</b> | High   |
| <b>Population Impacted:</b>       | Medium |
| <b>Loss Potential:</b>            | Medium |
| <b>Jurisdictions at Risk:</b>     | All    |

## Earthquake

### Narrative

An earthquake (also known as a quake, tremor or temblor) is the perceptible shaking of the surface of the Earth which can be violent enough to cause loss of life and property. They result from the sudden release of energy in the Earth's crust which creates seismic waves. The most common types of earthquakes are caused by movements along faults or by volcanic forces, although they can also result from explosions, cavern collapse, and other minor causes not related to slowly accumulated strains. The seismicity, or seismic activity of an area refers to the frequency, type and size of earthquakes experienced over a period of time.

Table 3-21: Modified Mercalli Scale

| Modified Mercalli Scale | Perceived Shaking | Potential Damage  | Description   |
|-------------------------|-------------------|-------------------|---|
| I                       | Not Felt          | None              | Not felt except by a very few under especially favorable circumstances  |
| II                      | Weak              | None              | Felt only by a few persons at rest, especially on upper floors of buildings; delicately suspended objects may swing   |
| III                     | Weak              | None              | Felt quite noticeably indoors, especially on upper floors of buildings, but many don't recognize it as an earthquake; standing automobiles may rock slightly; vibration like truck passing; duration estimated  |
| IV                      | Light             | None              | During the day felt indoors by many, outdoors by few; some awakened at night; dishes, windows, doors disturbed; walls make creaking sound; sensation like heavy truck striking building; standing automobiles rocked noticeably   |
| V                       | Moderate          | Very Light        | Felt by nearly everyone, many awakened; some dishes, windows, and so broken; cracked plaster in a few places; unstable objects overturned; disturbances of trees, poles, and other tall objects sometimes noticed; pendulum clocks may stop   |
| VI                      | Strong            | Light             | Felt by all, many frightened and run outdoors; some heavy furniture moved; a few instances of fallen plaster and damaged chimneys; damage slight  |
| VII                     | Very Strong       | Moderate          | Everybody runs outdoors; damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken; noticed by persons driving cars   |
| VIII                    | Severe            | Moderate to Heavy | Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures; panel walls thrown out of frame structures; fall of chimneys, factory stacks, columns, monuments, walls; heavy furniture overturned; sand and mud ejected in small amounts; changes in well water; persons driving cars disturbed |
| IX                      | Violent           | Heavy             | Damage considerable in specially-designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse; buildings shifted off foundations; ground cracked conspicuously; underground pipes broken  |



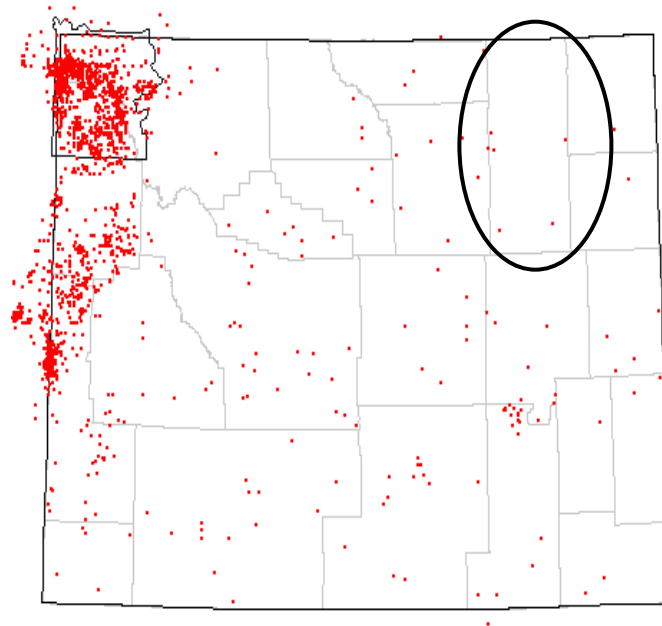
|     |         |            |  |
|-----|---------|------------|--|
| X   | Extreme | Very Heavy | Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked; rails bent; landslides considerable from river banks and steep slopes; shifted sand and mud; water splashed, slopped over banks |
| XI  | Extreme | Very Heavy | Few, if any, masonry structures remain standing; bridges destroyed; broad fissures in ground; underground pipelines completely out of service; earth slumps and land slips in soft ground; rails bent greatly  |
| XII | Extreme | Very Heavy | Damage total; waves seen on ground surface; lines of sight and level distorted; objects thrown into the air  |

Earthquake intensity is measured by the Modified Mercalli Scale (see **Table 3-21**) which quantifies effects felt by an earthquake, and is different than moment magnitude, which is measured by the Richter Scale.

### Past Occurrences

Earthquakes are common in Wyoming and are likely to continue to impact the state into the future. The first recorded earthquake in Wyoming was documented by personal accounts in 1894 in the town of Casper. The first instrumentally recorded earthquake occurred in 1971, with an epicenter in Yellowstone National Park, the most seismically active region of the state. (Sources: Case and Green, USGS.gov) 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 where the majority of the active faults are identified. **Figure 3-30** shows statewide epicenters, as recorded by the University of Wyoming.

Figure 3-30: Wyoming Earthquake Epicenters > 2.5 Magnitude, 1871 to 2015



Source: <http://www.wrds.uwyo.edu>

There are approximately 80 Quaternary faults mapped in Wyoming, with 26 considered active. None are located in Campbell County. (Source: [www.wsgs.wyo.gov](http://www.wsgs.wyo.gov))

Many of the exposed active faults, including the Teton fault, Star Valley fault, Greys River fault, Rock Creek fault, and the Bear River fault system in western Wyoming are capable of generating magnitude 7.0 to 7.5 earthquakes, and are considered to be overdue for reactivation. Despite the lack of faults in the eastern part of the state, it is estimated an earthquake of 6.5 magnitude is possible anywhere in the state, including Campbell County (Source: *Wyoming Multi-Hazard Mitigation Plan, 2014*).

There have been eleven USGS-recorded earthquakes in Campbell County since 1967 (see **Table 3- 22**) however the USGS records include over 300 events of greater than 3.0 magnitude attributable to mining explosions and quarry blasts.

*Table 3-22: List of Seismic Events, Campbell County 1967 - Present*

| Location               | Date     | Magnitude | Damage or Injuries |
|------------------------|----------|-----------|--------------------|
| SW CAMPBELL COUNTY     | 5/11/67  | 4.8       | NO                 |
| 18 MI EAST OF GILLETTE | 2/18/72  | 4.3       | NO                 |
| 33 MI NE OF KAYCEE     | 9/2/76   | 4.8       | NO                 |
| 24 MI SW OF GILLETTE   | 5/29/84  | 5         | NO                 |
| 25 MI NW OF GILLETTE   | 10/29/84 | 2.5       | NO                 |
| 27 MI WEST OF GILLETTE | 9/7/84   | 5.1       | NO                 |
| SE CAMPBELL COUNTY     | 2/24/93  | 3.6       | NO                 |
| 10 MI EAST OF WESTON   | 9/4/04   | 2.8       | NO                 |
| 40 MI WEST OF GILLETTE | 12/6/08  | 2.5       | NO                 |
| NORTH CAMPBELL COUNTY  | 3/31/09  | 2.6       | NO                 |
| 7 MI NE OF WRIGHT      | 1/20/11  | 3.2       | NO                 |

Source: <http://earthquake.usgs.gov>

## Impacts

Impacts from earthquakes identified include the following:

- Injury/loss of life
- Loss of utilities (gas, electric, water, wastewater, etc.)
- Increased risks to emergency responders
- Injuries associated with loss of utilities
- Transportation interruption
- Damage to buildings/structures

## Frequency

Based on past occurrences, Campbell County is likely to experience one earthquake approximately every ten years, however also based on past occurrences, the earthquakes are likely to cause little to no damage.

The U.S. Geological Survey identified tectonic provinces in the report “Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States” (*Source: Algermissen and et al, 1982*). In that report, Campbell County was classified as being in a tectonic province with a “floating earthquake” maximum magnitude of 6.1.

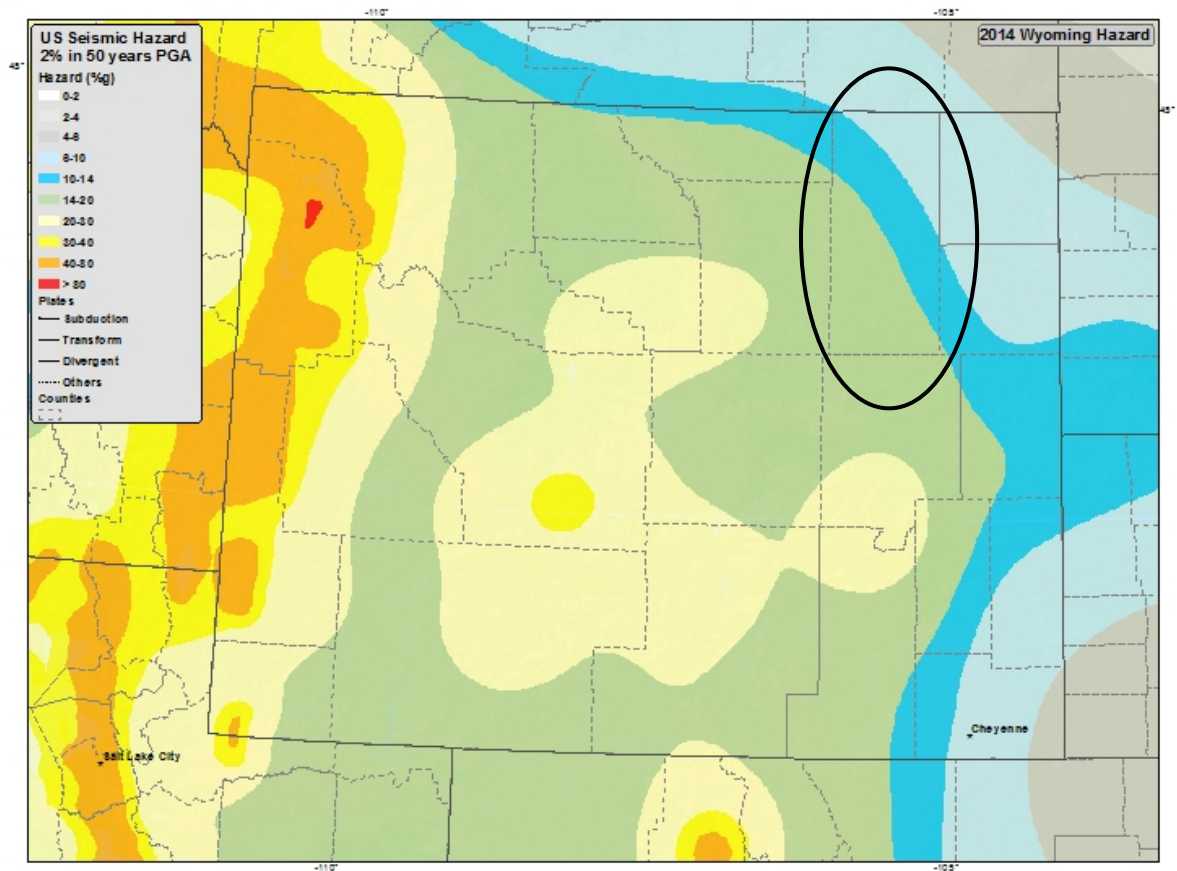
Geomatrix (1988b) suggested using a more extensive regional tectonic province, called the “Wyoming Foreland Structural Province,” which is approximately defined by the Idaho-Wyoming Thrust Belt on the west, 104° West longitude on the east, 40° North latitude on the south, and 45° North latitude on the north.

Geomatrix (1988b) estimated the largest “floating” earthquake in the “Wyoming Foreland Structural Province” would have a magnitude in the 6.0 — 6.5 range, with an average value of magnitude 6.25. A magnitude 6.25 “floating” earthquake, placed 15 kilometers from any structure in Campbell County, would generate horizontal accelerations of approximately 15% at the site. Placing a magnitude 6.25 earthquake at 15 kilometers from a site will provide a fairly reasonable estimate of design ground accelerations in the northeastern and eastern parts of Campbell County, but will be inadequate in the southwestern part of the County.

## Vulnerability

There are no known exposed active faults with a surficial expression in Campbell County. Because of this fact, no fault-specific analysis can be generated for Campbell County. According to the United States Geological Survey, a 2,500 year seismic event in Campbell County would produce between 6% to 20% of g (gravity) force at Peak Ground Acceleration (PGA, see **Figure 3-31**).

Figure 3-31: 2,500 Year Seismic Hazard Measured in Peak Ground Acceleration (M/s)



Source: USGS.gov

## Potential Losses

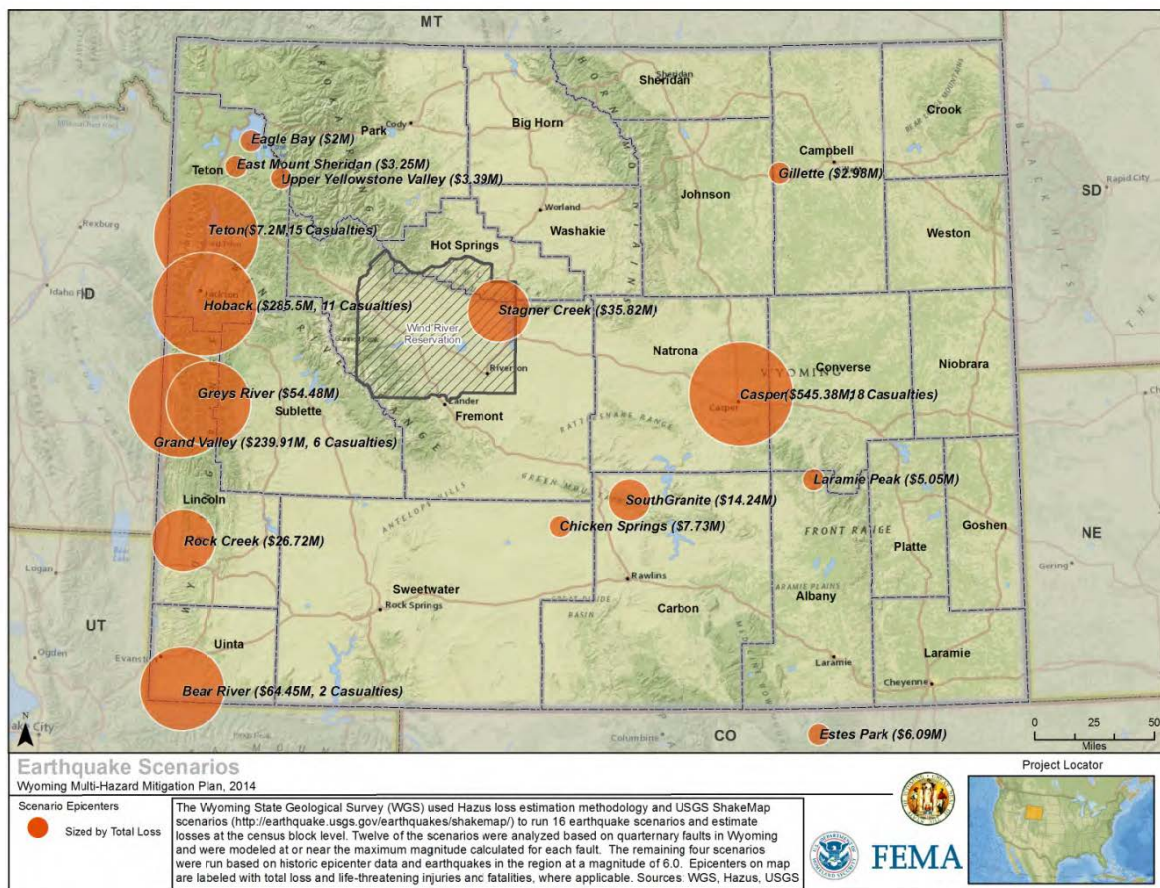
Earthquake activity in Wyoming has prompted the Wyoming State Geological Survey to undertake a study (2011) modeling loss estimations for 16 earthquake scenarios. The scenarios included four random event scenarios run on the basis of data from historic earthquakes placed near Casper, Gillette (in Campbell County), 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 originally designed in 1997 to provide the user with an estimate of the type, extent, and cost of damages and losses which 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 2.2 (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 3-32** 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 3-32: HAZUS-MH Earthquake Scenarios for Wyoming, 2014



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

Based on this exercise, total losses in Campbell County would equal \$2.9M with \$2,347,000 damage to the Town of Gillette.

In the Wyoming Multi-Hazard Mitigation Plan, HAZUS 2.1 was used to develop losses associated with a 2,500 year probabilistic earthquake scenario for 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. Total losses include building, contents, inventory, and income-related losses.

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.

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

In this model, Campbell County ranked 10<sup>th</sup> (out of 23 counties) in potential losses (see **Table 3-23**).

*Table 3-23: HAZUS 2.1 Model, Campbell County Potential Losses*

| Rank | Total Losses | Loss Ratio | Level 1 | Level 2 | Level 3 | Level 4 |
|------|--------------|------------|---------|---------|---------|---------|
| 10th | \$77.0M      | 14%        | 20      | 0       | 0       | 0       |

*Wyoming Multi-Hazard Mitigation Plan, 2014*

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 this scenario, Campbell County Memorial Hospital located at 501 South Burma Avenue in Gillette is the only critical facility at risk. With a capacity of 90 beds, it is estimated that the facility would remain at 75% functionality on day 1 after the disaster, and would reach 96% functionality by day 14. It should be noted since this projection was run, the hospital has completed some expansion and the damage projections could be low.

In summary, it is estimated if a worse case event occurred in Campbell County, \$77M in building related damage could occur. The probability of such an event is 2% in 50 years. Though the probability is low, WSGS studies indicate the possibility of a 6.5 magnitude could occur anywhere in the state.

### **Future Development**

Growth in the County in recent years is exposing more buildings, infrastructure, and people to the earthquake hazard, though buildings built to modern codes and standards should, in general, be more resilient. Future development and in particular critical facilities should consider seismic hazards during construction.

### **Summary:**

|                                   |   |
|-----------------------------------|---|
| <b>Probability of Occurrence:</b> | Low   |
| <b>Population Impacted:</b>       | Medium  |
| <b>Loss Potential:</b>            | High  |
| <b>Jurisdictions Affected:</b>    | All, with slightly higher risk in the southern region and in Gillette |



## Landslides

### **Narrative**

Landslides are one of the most common geologic hazards in Wyoming. Some of the highest landslide densities in the country are found within the state. One of the largest landslide complexes in the country, the Carter Mountain landslide southwest of Cody in northwestern Wyoming, is more than five miles wide and twenty miles long. Landslides cause damage every year in Wyoming, but because many occur in remote areas, public awareness of their dangers is low.

There are many types of landslides present in Wyoming. In order to properly describe landslide type, the Geologic Hazards Section of the Wyoming State Geological Survey (WSGS) developed a landslide classification modified from Varnes (1978) and Campbell (1985). There are five basic types of landslides which 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 (*Source: Wyoming Multi-Hazard Mitigation Plan, 2014*).

### **Past Occurrences**

Past landslides in Campbell County mapped by the state are shown in the GIS Map Book in **Appendix A**.

### **Impacts**

Impacts possible from a landslide include:

- Property damage to structures and vehicles
- Damage to infrastructure to roads, railroad track, and pipelines
- Injury
- Loss of life
- Flash flooding when creeks are dammed by landslides followed by subsequent landslide-dam bursts
- Impacts to water quality and fisheries



## Frequency

The probability of a landslide causing damage in Campbell County is difficult to determine because of the poor historical data, however the State of Wyoming has recognized a **Medium** landslide risk for Campbell County based on population impacted, probability of occurrence and property impacted (*Source: Wyoming Multi-Hazard Mitigation Plan, 2014*). Typically landslide incidence coincides with wet or freeze/thaw cycles during the spring months, but can happen at any time of year.

## Vulnerability

Landslide risk in Campbell County is generally isolated to less populated areas, with most significant risk to transportation facilities, namely roads, highways, bridges and railroad infrastructure, rather than life and property. The most significant impact tends to be when no alternative route exists between populated areas and access is blocked by the presence of a landslide. Highway 59, located in the Moyer Springs Quadrangle, is infrastructure which, if blocked by a landslide, would cause significant disruption of mobility between Gillette and the community of Weston.

The following analysis by quadrangle addresses site-specific vulnerability and was taken from the Wyoming Multi-hazard Mitigation Plan and the Wyoming State Geological Survey. Fortunately, neither of the two incorporated communities in the County are located in areas most vulnerable to landslides, although Gillette has had several soil slippage/landslide incidents causing damage to homes, with some litigation as a result. As a result of these incidents, both the City of Gillette and Campbell County both require developers to conduct soil testing prior to the approval of development plans.

All quadrangles were examined by the Wyoming State Geological Survey and Campbell County Emergency Management, and the following areas were determined to pose a potential hazard to homes, roads, or other facilities.

**Appel Butte Quadrangle:** A blockslide/flow complex is present in the northern portion of the quadrangle (T49N R72W Section 7). If the landslide destabilizes, damage could occur to nearby State Highway 50. A flow complex is also present in T49N R73W Section 25. If this landslide destabilizes, possible damage could occur to a nearby pipeline. Heavy periods of precipitation or significant development could have an effect on slope stability.

**Black Draw Quadrangle:** Several blockslides and a debris flow/alluvial cone complex are present along Fence Creek and the Powder River (T58N R76W Section 36, T58N R75W Section 31, and T57N R76W Sections 12 and 13). The road paralleling the Powder River actually crosses through the southern-most blockslide. If these landslides destabilize, damage could occur to nearby roads. If the blockslides or debris flow/alluvial cone complexes destabilize along Fence Creek, there is a remote chance the creek could be dammed. Heavy periods of precipitation or significant development could affect slope stability.

**Calf Creek Quadrangle:** Several blockslide/flow complexes are present in the northeastern quarter of the quadrangle (T54N R72W Section 32 and 33 and T53N R72W Section 3, 4, 5, 7, 9, and 10). If these landslides destabilize, damage could occur to local roads and oil or gas facilities. Pipelines, wells, or storage facilities could be damaged or destroyed if a nearby landslide destabilizes. Heavy periods of precipitation or significant development could affect slope stability.

**Croton Quadrangle:** A blockslide is located on the western side of the quadrangle in T76W R53N Section 10. If this landslide destabilizes, damage could occur to nearby Echeta Road. Heavy periods of precipitation or significant development affect slope stability.

**Dead Horse Lake Quadrangle:** Several blockslide/flow complexes, a blockslide, and a blockslide/slump/flow complex are present along the southwestern side of Bitter Creek (T58N R75W Section 25 and T57N R74W Sections 6, 7, and 8). If these landslides destabilize, damage could occur to the nearby road. In T57N R74W Sections 5, 8, 9 there are a series of blockslide/flow and blockslide/slump/flow complexes on the east side of Bitter Creek. Oil and gas wells and storage facilities could be affected. Heavy periods of precipitation or significant development could affect slope stability.

**Fortin Draw Quadrangle:** A series of blockslide/flow, blockslide/slump/flow, and slump/flow complexes are present in T50N R70W Sections 18 and 19. A slump/flow complex in Section 18 abuts the eastern edge of a small dam and reservoir. If the landslide destabilizes, it could damage or destroy the dam, resulting in localized flooding. In Section 19, if the blockslide/flow, slump/flow, or blockslide/slump/flow complexes destabilize, they could potentially damage or block the rail spur serving the mines north of Gillette. Such a blockage would be significant for the rail line and the mines it serves, because there are no other rail outlets. Heavy periods of precipitation or significant development could affect slope stability.

**Gillette West Quadrangle:** There are a series of development-related slump, slump/flow, and creep complexes in or near Gillette. Further refinement in mapping and hazard identification

are required in this area. Heavy periods of precipitation or significant development could affect slope stability.

***Homestead Draw Quadrangle:*** A blockslide/flow complex in T57N R72W Section 21 is present next to a pipeline. If the landslide destabilizes, it could damage the pipeline. There are oil and gas wells and storage facilities scattered throughout the quadrangle. If they are near a landslide, they could potentially be affected. Heavy periods of precipitation or significant development could affect slope stability.

***Larey Quadrangle:*** There are a series of blockslides, slump/blockslides, and slump/flows in T54N R75W which are near recently installed coal bed methane wells. The area will have to be examined more carefully to determine the proximity of the wells to landslides.

***Moyer Springs Quadrangle:*** Several slump/flow complexes, blockslide/slump/flow complexes, and slumps are present along State Highway 59 and the Little Powder River corridor (T52N R72W Sections 12, 13, 14, 23, 24, 25, 26, 35, and 36, T51N R72W Section 1, and T51 N R71W Section 6). It is possible if some of these landslides destabilize, they could block Highway 59, and there is a remote chance the Little Powder River could be blocked. Pipelines cross or are adjacent to landslides in a number of localities, most notably in T52N R71W Section 30, T52N R72W Sections 11, 14, 24, and 25. Heavy periods of precipitation or significant development affect slope stability.

***Oliver Draw Quadrangle:*** Two slump/blockslide complexes and a slump/blockslide/flow complex are located along the north side of Horse Creek (T55N R72W Sections 25 and 26). If these landslides destabilize, damage could occur to nearby roads. If the roads became entirely blocked, traffic could be rerouted. Heavy periods of precipitation or significant development could affect slope stability.

***Oriva Quadrangle:*** A blockslide is present on the north side of Montgomery Road in T50N R74W Section 25. If this landslide destabilizes, damage could occur to nearby Montgomery Road. If the road became entirely blocked, access out of the area would still be possible in the direction opposite the landslide. In the north half of T50N R73W there are a few blockslides and blockslide/slump/flow and slump/flow complexes. The landslides are present in the Kitty Oil and Gas Field. The area needs to be examined more carefully to determine the proximity of wells to landslides. Heavy periods of precipitation or significant development could affect slope stability.

**Oriva NW Quadrangle:** There are scattered landslides in the north half of the quadrangle, most of which are in the Kitty Oil and Gas field. The area needs to be examined more carefully to determine the proximity of wells to landslides.

**Piney Canyon SE Quadrangle:** Several landslide deposits, including slump/flow and blockslide/slump complexes, and a slump are located along Rochelle Hills Road (T41N R69W Section 12). Rochelle Hills Road even crosses through the slump. If these landslides destabilize, damage could occur to the nearby road. Heavy periods of precipitation or significant development could have an effect on slope stability.

**Pitch Draw Quadrangle:** Two debris flow/alluvial cone complexes are present along the northeastern side of Spring Creek (T55N R72W Section 32). A road actually crosses through both of the landslides. If these landslides destabilize, damage could occur to the nearby road. Heavy periods of precipitation or significant development could affect slope stability.

**Reservoir Creek Quadrangle:** There are scattered landslides in or near the Recluse Oil Field in T56N R74W. The area will have to be examined more carefully to determine the proximity of the wells to landslides.

**Rocky Butte SW Quadrangle:** A blockslide/flow complex and a flow deposit exist along the south side of Elk Creek in T56N R72W Sections 26, 35, and 36. If these landslides destabilize, damage could occur to the nearby road. If completely blocked, the road could be easily relocated. In T55N R72W Section 14, there is a small reservoir and dam which abut against a slump/blockslide complex. If the landslide destabilizes, it could damage or destroy the dam. Heavy periods of precipitation or significant development could affect slope stability.

**Saddle Horse Butte Quadrangle:** A blockslide/flow complex is present north of Bishop Road (T48N R70W Section 32) and two slump/flow complexes are present near Basin Oil Field in T47N R70W Section 9. If these landslides destabilize, damage could occur to the nearby roads. Heavy periods of precipitation or significant development could affect slope stability.

**Truman Draw Quadrangle:** There are numerous landslides throughout the quadrangle. The area will have to be examined more carefully to determine the proximity of oil and gas wells to landslides. Heavy periods of precipitation or significant development could affect slope stability.

**Weston SW Quadrangle:** A blockslide/slump/flow complex and several slump/flow complexes are present on the southeastern side of State Highway 59 (T52N R72W Section 12). If these landslides destabilize, damage could occur to State Highway 59. A pipeline crosses several

landslides in the southwestern part of the quadrangle, specifically in T53N R72W Section 23 and 35 and in T52N R72W Sections 2 and 11. If the landslides destabilize, the pipeline could be damaged. Heavy periods of precipitation or significant development could affect slope stability.

***White Tail Butte Quadrangle:*** A blockslide in the eastern portion of the quadrangle (T56N R72W Sections 21 and 28) and a slump along Elk Creek Road (173W R56N Section 25) are potential hazards to nearby roads. Elk Creek Road even cuts through the slump deposit. If these landslides destabilize, damage could occur to the nearby roads. Heavy periods of precipitation or significant development could affect slope stability.

### **Potential Losses**

According to the Wyoming Multi-Hazard Mitigation Plan 2010, the exposure of Campbell County buildings to landslides is \$1,358,830. Damage from any given landslide is likely to be highly localized and less costly than the total figure of vulnerable buildings. The GIS Map Book in **Appendix A** displays the locations of the values at risk. However, in addition to buildings, other infrastructure could be at risk, and, if affected, cause indirect losses associated with interruption of business and transportation. Although unlikely, if railroad operations are affected, losses could be significant.

### **Future Development**

Future development around the Gillette area and in areas of the northern unincorporated County should take into account the landslide hazards in the region.

### **Summary**

|                                   |                                  |
|-----------------------------------|----------------------------------|
| <b>Probability of Occurrence:</b> | High                             |
| <b>Population Low:</b>            | Low                              |
| <b>Loss Potential:</b>            | Medium                           |
| <b>Jurisdictions Affected:</b>    | Gillette and Unincorporated Area |

## Dam Failures

### Narrative

Wyoming has over 30,000 dams and reservoirs, ranging in size from over one million acre-feet in Pathfinder and Seminoe reservoirs above Casper to small coalbed methane and stock reservoirs scattered throughout the state. Only 1,518 within the State rise to the 'Safety of Dam' (SOD) size which is defined, generally, as either greater than 20 feet tall or holding more than 50 acre feet of water. Of these dams, 192 are "regulated" and located within Campbell County. The dams and reservoirs serve an important role for Wyoming residents and industry.

Dams rarely fail, either completely or partially, but when they do they may become an immediate life and safety hazard for those downstream. Wyoming State Statutes 41-3-307 through 41-3-317 legislate the safety of dams and the role the state plays in ensuring their safety.

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.

Dam failures can result from any one or a combination of the following causes:

- 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
- Deformation of the foundation or settling of the embankment
- Improper design
- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway

Approximately 70% of failures are from floods and overtopping. Older dams are most susceptible to overtopping failure. Foundation and structural failures are usually tied to seepage through the foundation of the main structure of the dam. Seepage or piping accounts for about 12% of dam failures, with the remaining 18% being attributed to other factors. (Source: [www.damsafety.org](http://www.damsafety.org)).

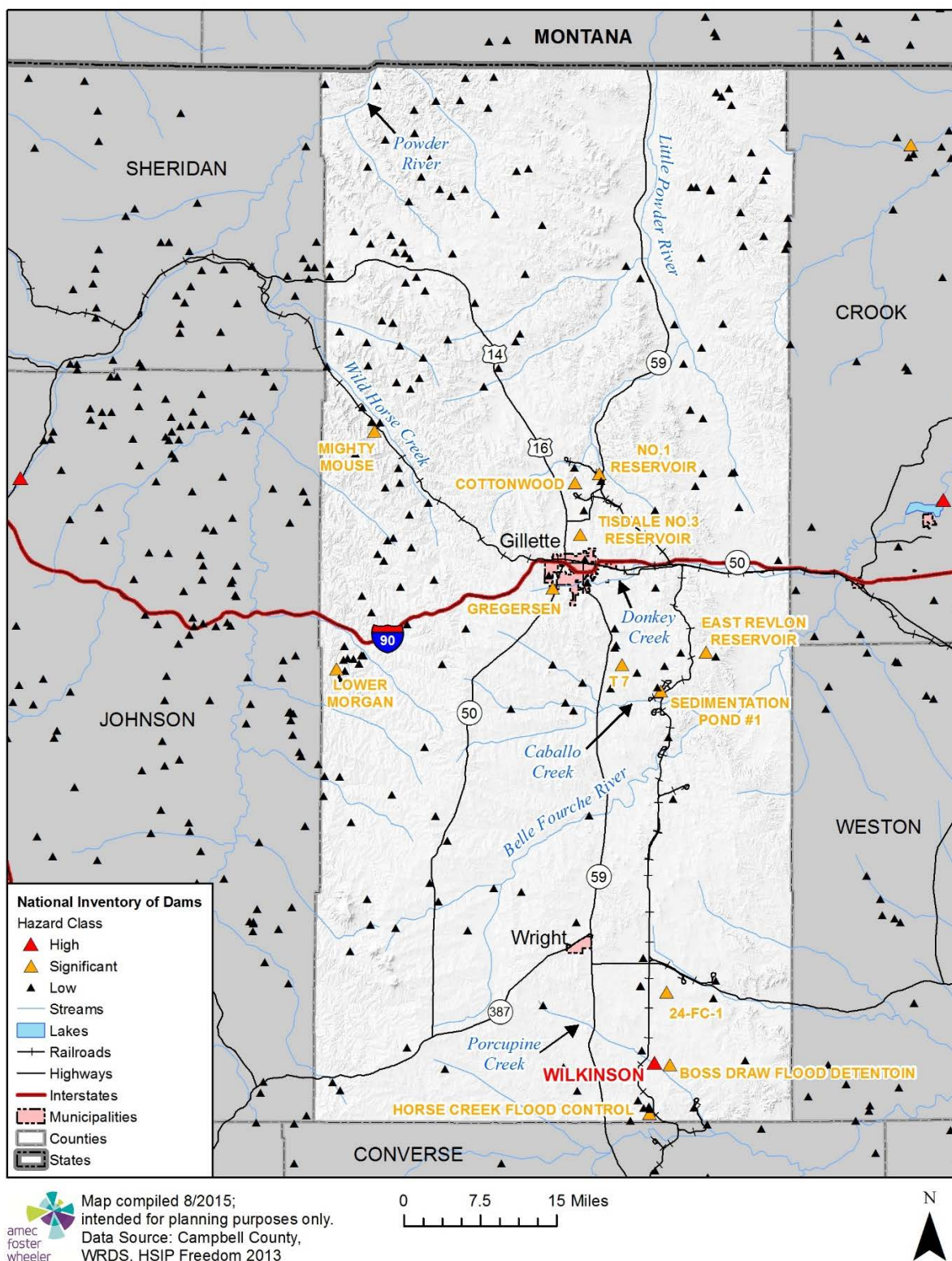
In 1981, the U.S. Army Corps of Engineers completed an inspection program for nonfederal dams under the National Dam Inspection Act (P.L. 92-367). This was a four-year effort and included compiling an inventory of about 50,000 dams nationwide. While the design,

construction, operation and maintenance data for this effort is now outdated, the classification scheme for hazard potential remains valid.

This classification scheme is based on the consequences if a dam were to fail, not on the potential of failure or the existing condition of the dam. Dam classifications include: (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, structures and population in the inundation zone, population density of the community, and age of the dam. High hazard dam failures would involve property losses over \$1 million and likely cause loss of life. Significant hazard dam failures would likely cause significant property damage but no loss of life. Failure of a low hazard dam would likely cause only minimal property damage and no loss of life. Hazard potential classification is no guarantee of safety. Hazard classifications can also change over time due to development within the inundation zone.

The Wyoming State Engineer's Office (WSEO) regulates dams over 20 feet high of with a storage capacity of 50 acre-feet or more, although smaller dams are also regulated if the potential for failure indicates a need. According to the Water Resources Data System (WRDS) at the University of Wyoming, the WSEO regulates 192 dams in Campbell County. Only one of those dams (the Wilkinson Dam) is classified as **high** hazard due to its size and location upstream from the North Antelope Mine. 12 other dams in the county are classified as **significant** hazard (see **Figure 3-33**). **Figure 3-34** summarizes the high and significant hazard dams located in Campbell County.

Figure 3-33: Campbell County Dams, 2015



Sources: Campbell County, WRDS, HSIP Freedom 2013



| Hazard Class | Dam Name                  | River                | Nearest Downstream City      | Owner Name                               | Year Complete | Emergency Action Plan | Latest Inspection Date |
|--------------|---------------------------|----------------------|------------------------------|--|---------------|-----------------------|------------------------|
| HIGH         | WILKINSON                 | PORCUPINE CREEK      | ROCHELLE NORTH ANTELOPE MINE | POWDER RIVER COAL CO.(DALYN CHERVENKA)   | 2002          | Y                     | 9/26/2007              |
| SIGNIFICANT  | 24-FC-1                   | LITTLE THUNDER CREEK | BLACK THUNDER MINE           | THUNDER BASIN COAL COMPANY - LECIA CRAFT | 2000          | N                     | 7/28/2010              |
| SIGNIFICANT  | BOSS DRAW FLOOD DETENTION | BOSS DRAW            | NORTH ANTELOPE ROCHELLE MINE | POWDER RIVER COAL COMPANY                | 2003          | Y                     | 7/21/2008              |
| SIGNIFICANT  | COTTONWOOD                | LITTLE RAWHIDE CREEK | BROADUS, MT                  | POWDER RIVER COAL CO.                    | 1994          | N                     | 7/21/2008              |
| SIGNIFICANT  | EAST REVLON RESERVOIR     |                      | GILLETTE                     | AMAX COAL CO.                            | 0             | N                     | 12/6/2007              |
| SIGNIFICANT  | GREGERSEN                 | DONKEY CREEK         | GILLETTE                     | OLUF GREGERSEN                           | 1967          | NR                    |                        |
| SIGNIFICANT  | HORSE CREEK FLOOD CONTROL | HORSE CREEK          | ANTELOPE MINE                | ANTELOPE COAL COMPANY                    | 2002          | Y                     | 9/26/2007              |
| SIGNIFICANT  | LOWER MORGAN              | MORGAN DRAW          | 1-90                         | WILLIAMS PRODUCTION, RMT                 | 2001          | N                     | 9/1/2011               |
| SIGNIFICANT  | MIGHTY MOUSE              | TRAP DRAW            | BN RR & CO. RD               | FLOYD LAND & LIVESTOCK                   | 2005          | N                     | 9/13/2010              |
| SIGNIFICANT  | NO. 1 RESERVOIR           |                      | GILLETTE                     | THE CARTER MINING CO.                    | 0             | N                     | 2/3/2011               |
| SIGNIFICANT  | SEDIMENTATION POND #1     |                      | GILLETTE                     | POWDER RIVER COAL COMPANY                | 0             | N                     | 6/24/2011              |
| SIGNIFICANT  | T 7                       | TISDALE CREEK        | CABALLO MINE                 | CABALLO COAL COMPANY                     | 2005          | Y                     | 9/13/2010              |
| SIGNIFICANT  | TISDALE NO. 3 RESERVOIR   |                      | GILLETTE                     | POWDER RIVER COAL COMPANY                | 0             | N                     | 1/10/2008              |

Table 3-24: List of Campbell County Dams with 'High' or 'Significant' Hazard Class

Source: WRDS, HSIP Freedom 2013

## Past Occurrences

There have been three recorded dam breaches in Campbell County since 1978, none of which have caused loss of life or property (see **Table 3-25**). Some of the smaller dams in the County have likely experienced breaches or flooding in the past, yet were not recorded.

*Table 3-25: Historic Dam Breaches, Campbell County*

| Date      | Narrative  |
|-----------|--|
| 1/1/1978  | Durham Dam 1 was an earthen dam with its base keyed into the foundation constructed in 1973. During the spring of 1978, this dam was overtopped and erosion resulted in a complete failure of the structure with a peak discharge of 5630 CFS. No damage was reported.   |
| 5/19/1978 | The Caballo Dam was voluntarily breached. The structure, constructed in 1948, was built of earthen material, but its base was not keyed into the foundation. The dam had saturated and started to overtop, so it was voluntarily breached to save as much of the structure as possible. The peak discharge was 2170 CFS. |
| 7/1/1998  | Heavy rains caused a stock dam to breach on the Iberlin Ranch, flooding Wyoming Highway 387.   |

*Sources: Campbell County, WRDS, HSIP Freedom 2013*

To date there have been no Presidential Emergency Declarations in the state of Wyoming as the result of a dam failure. Additionally, there have been no state-level emergency declarations in Wyoming as the result of a dam failure (*Source: Wyoming Multi Hazard Mitigation Plan, 2014*).

## Impacts

Impacts which could occur from dam failure include:

- Inundation of populated areas or agricultural areas
- Injury
- Loss of life
- Damage to and loss of property and infrastructure
- Interruption of transportation and commerce
- Contamination of surface and ground waters

## **Frequency**

The three recorded dam breaches in Campbell County did not result in any loss of life or property, but there are significant hazard dams within the unincorporated throughout the County.

## **Vulnerability**

With thirteen high or significant hazard class dams within the County, there is the possibility of dam failure flooding in the future, with the potential for \$1 million or more in flood damages and/or loss of life. Failure of the one high hazard dam would impact the southeastern portion of the County but would likely have its initial impact upon the North Antelope Coal Mine, owned by the same company, or other impacts downstream and outside of the County. There are two significant hazard dams in the vicinity of Gillette.

## **Future Development**

Future development around the Gillette area should take into account the few significant hazard dams in the region, namely the Gregersen and Tisdale Dams.

## **Summary:**

|                                   |                                   |
|-----------------------------------|-----------------------------------|
| <b>Probability of Occurrence:</b> | Low                               |
| <b>Population Impacted:</b>       | Low                               |
| <b>Loss Potential:</b>            | Medium                            |
| <b>Jurisdictions at Risk:</b>     | Gillette and Unincorporated Areas |

## Hail

### Narrative

Hail causes more than a billion dollars of property damage nationally each year, mostly to crops. The southeast corner of Wyoming lies within the nations “Hail Alley.” Together with adjacent portions of Colorado and Nebraska, this region of Wyoming is battered by more hailstorms than any other part of the United States. Climatological data shows this area of Wyoming averaging five to nine days annually when hail is reported. While Campbell County is not in “Hail Alley,” damaging hail storms have still occurred and it is considered a significant recurring threat by local residents.

### Past Occurrences

NOAA defines “damaging hail” as hailstones of one inch or more in diameter. NCDC recorded 246 hail events with hail which meet this criteria in Campbell since 1974, occurring on 139 separate days. Using this data, Campbell County has averaged hail over one inch in diameter just under 3.5 times per year since 1974.

*Table 3-26: Number of Hail Events by Hail Diameter*

| Diameter          |          |          |          |          |
|-------------------|----------|----------|----------|----------|
| 0”-.99”           | 1”-1.99” | 2”-2.99” | 3”-3.99” | 4”-4.99” |
| 124               | 241      | 23       | 1        | 2        |
| TOTAL EVENTS: 391 |          |          |          |          |

*Source: National Climactic Data Center NCDC*

Of these storms, 20 have caused property damage, and none have caused reported crop damage. No reported injuries or fatalities have been caused by storms with hail over one inch in diameter; however, a hailstorm with hail less than one inch in diameter did cause two reported injuries at an outdoor rodeo in Gillette in 1995.

NCDC records hail storm data from 1958; since that time, Campbell has suffered 22 separate damaging storms. Since 1980, Campbell County averages a damaging hail storm every 1.8 years.

Table 3-27: Hail Events with Recorded Damage

| LOCATION      | DATE      | TIME  | HAIL DIAMETER | PROPERTY DAMAGE  | CROP DAMAGE | TOTAL DAMAGE     |
|---------------|-----------|-------|---------------|------------------|-------------|------------------|
| Gillette      | 7/15/1995 | 18:18 | 1.00 in.      | \$500            | \$0         | \$500            |
| Gillette      | 6/21/2003 | 13:09 | 2.75 in.      | \$17M            | \$0         | \$17M            |
| Rozet         | 8/12/2005 | 15:45 | 1.75 in.      | \$5,000          | \$0         | \$5,000          |
| Gillette      | 8/17/2006 | 23:25 | 1.75 in.      | \$5,000          | \$0         | \$5,000          |
| Weston        | 6/25/2007 | 16:50 | 3.50 in.      | \$15,000         | \$0         | \$15,000         |
| Weston        | 6/2/2008  | 21:45 | 2.75 in.      | \$25,000         | \$0         | \$25,000         |
| Gillette      | 8/7/2009  | 22:59 | 1.75 in.      | \$200,000        | \$0         | \$200,000        |
| Gillette      | 5/26/2010 | 19:26 | 1.75 in.      | \$46M            | \$0         | \$46M            |
| Weston        | 6/30/2010 | 16:16 | 2.50 in.      | \$10,000         | \$0         | \$10,000         |
| Rozet         | 7/19/2010 | 13:55 | 2.75 in.      | \$10,000         | \$0         | \$10,000         |
| Rozet         | 7/19/2010 | 14:00 | 4.25 in.      | \$100,000        | \$0         | \$100,000        |
| Gillette      | 6/12/2011 | 15:03 | 1.25 in.      | \$100,000        | \$0         | \$100,000        |
| Rocky Point   | 8/5/2011  | 17:00 | 1.00 in.      | \$7,000          | \$0         | \$7,000          |
| Savageton     | 8/1/2013  | 19:00 | 1.75 in.      | \$5,000          | \$0         | \$5,000          |
| Wright        | 8/1/2013  | 19:29 | 1.75 in.      | \$10M            | \$0         | \$10M            |
| Gillette      | 8/2/2013  | 16:40 | 1.50 in.      | \$50,000         | \$0         | \$50,000         |
| Rozet         | 8/3/2013  | 18:38 | 1.75 in.      | \$10,000         | \$0         | \$10,000         |
| Weston        | 8/7/2013  | 15:30 | 1.75 in.      | \$5,000          | \$0         | \$5,000          |
| Rozet         | 9/8/2013  | 17:28 | 1.50 in.      | \$5,000          | \$0         | \$5,000          |
| Rozet         | 9/8/2013  | 17:30 | 4.25 in.      | \$5,000          | \$0         | \$5,000          |
| Weston        | 7/22/2014 | 21:35 | 1.00 in.      | \$2,000          | \$0         | \$2,000          |
| <b>TOTALS</b> |           |       |               | <b>\$73.559M</b> | <b>\$0</b>  | <b>\$73.559M</b> |

Source: National Climactic Data Center NCDC

NCDC records of hail events contain a few extremely damaging storms that can be used as a historical indicator of the high levels of damage possible during a hail storm in the county, with damages in the millions of dollars:

- On June 21, 2003, golf ball size hail fell over Gillette. Extensive damages were reported, specifically to auto dealerships, automobiles and roofs. Damage was estimated at \$17 million;
- On May 26, 2010, 1.75" hail fell over Gillette, causing the same types of damage as the 2003 storm. The hail damaged the roofs and windows of several thousand homes and buildings, damaged unsheltered vehicles, and damaged entire inventories at automobile dealerships. Damage was estimated at \$46 million;
- On August 1, 2013, ping pong to golf ball sized hail fell over Wright, causing extensive damage in community, with many homes and vehicles affected. Damage was estimated at \$10 million.

## **Impacts**

Impacts that could occur from hail include:

- Injury to people and livestock
- Damage to rooftops, windows, siding, and vehicles
- Damage to trees and vegetation
- Crop damage

## **Frequency**

Campbell County is in a hail-prone region of Wyoming, and will continue to experience damaging events, based on a recurrence interval of 1.8 damaging storms every year. An average damaging hail incident in Campbell County occurs in the evening hours during the summer, and drops hail with a diameter a little bigger than 2 inches.

## **Vulnerability**

Hail has the potential to damage property that is unprotected; however, a vast majority of the hail events recorded by the NCDC in Campbell County have no recorded damage, and no injuries or fatalities. This is likely due to incomplete damage records and a lack of dryland or irrigated crops within the county. As noted in the previous section, Campbell County is susceptible to hailstorms that can cause damage in the millions of dollars.

## **Potential Losses**

A hail event generally does not cause injuries or fatalities in Campbell County, but a typical storm can be expected to cause \$32,882 of damage on average (excluding the 3 multi-million dollar outlier events). Most of that damage is done to exposed automobiles and roofs.

Based on the past documented storm damage from the event of record (May 26, 2010) converted to 2015 dollars, it is suggested that \$50 million be used as the potential cost of the worst-case future hail storm in Campbell County. Future hail storms will impact private and public property such as cars, roofs, equipment, buildings and agricultural crops and livestock.

## **Future Development**

Recent growth and development in Campbell County will increase exposure to hail damage. Insurance will be an important tool to offset the potentially substantial dollar losses associated with hail.

**Summary:**

**Probability of Occurrence:** High  
**Population Impacted:** Medium  
**Loss Potential:** Medium  
**Jurisdictions at Risk:** All

## Terrorism

### **Narrative**

Terrorism is defined as the use or threat 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 their government is powerless to prevent terrorism, and to get immediate publicity for their cause. Throughout history terrorism has been used to intimidate, coerce, and bring harm to populations. Terrorism can be propagated by foreigners as well as U.S. citizens hostile towards the government or other entities.

There are many different types of terrorism, and the United States has experienced 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.

### **Past Occurrences**

New York's World Trade Center have 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 prevented or 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. None of these types of attacks has occurred in Campbell County. However, infrastructure and/or individuals who live in or frequent the county could be potential targets for terrorism.

### **Impacts**

Impacts of a terrorist attack in Campbell 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



## **Frequency**

There is no history upon which to develop a frequency estimate for Campbell County.

## **Vulnerability**

Campbell County has certain natural and built assets and infrastructure critical to the daily life of county residents and to others across the nation; the targeting or loss of one or more of these assets could have severe consequences, depending on the specifics of an attack. As a major energy producer, successful attacks within the county could have long-term national consequences, and anti-energy/development organizations exist within the nation and region. Campbell County frequently is host to national events which could be desirable targets for adversarial acts. And, the county has significant agricultural and hunting economic elements which could be targeted.

## **Potential Losses**

There is no history upon which to develop a dollar loss estimate for Campbell County. Losses would depend on the type, location and severity of the terrorist action.

## **Future Development**

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. The attack may also have a cascading effect - if a dam was targeted for example, flooding could also occur.

## **Summary**

|                                   |        |
|-----------------------------------|--------|
| <b>Probability of Occurrence:</b> | Low    |
| <b>Population Impacted:</b>       | Medium |
| <b>Loss Potential:</b>            | Medium |
| <b>Jurisdictions at Risk:</b>     | All    |

## Critical Infrastructure and Vulnerable Populations

### Narrative

This section assesses the population, structures, critical facilities and infrastructure, and other important assets in Campbell County at risk to hazards identified in this plan. It begins with an inventory of vulnerable populations and buildings (total exposure) in the County to provide a baseline for evaluating vulnerability by hazard. At a public meeting for the previous version of this plan, held on October 12, 2010, participants developed a list of populations in the County which could be vulnerable in the event of a natural disaster. These populations include daycare attendees, school children, the developmentally disabled, the chronically ill, the homebound, seniors, library patrons, clinic patrons, detainees/prisoners, people living in poor quality housing, people attending outdoor recreation events, and patients or residents at a number of facilities.

### Child Care

According to the Department of Family Services, there are 70 child care facilities within the jurisdictions the county (see **Figure 57**). Combined, the jurisdictions have a total capacity of 1,930 children.

*Table 3-28: Childcare Facilities in Campbell County, 2015*

| Community    | Number of Facilities | Maximum Children |
|--------------|----------------------|------------------|
| Gillette     | 67                   | 1,886            |
| Wright       | 3                    | 44               |
| Other Areas  | 0                    | 0                |
| <b>TOTAL</b> | <b>70</b>            | <b>1,930</b>     |

*Source: Department of Family Services*

### Senior Citizens

Both the disabled and senior citizens are a concern when reviewing vulnerability (for the purposes of this assessment, a “senior citizen” is anyone over the age of 65, see **Figure 58**). The following facilities provide live-in care for senior citizens and disabled residents, or serve as meeting areas:

- The Beehive Home in Gillette
- The Pioneer Manor apartments
- Sol -Domus
- Primrose Retirement Center
- Senior Citizens’ Center (over lunch)

Table 3-29: Senior Citizens in Campbell County, 2010

| Age Range    | Number of Citizens | Percentage of Total Population |
|--------------|--------------------|--------------------------------|
| 65-69        | 995                | 2.2                            |
| 70-74        | 626                | 1.4                            |
| 75-79        | 463                | 1.0                            |
| 80-84        | 317                | .7                             |
| 85<          | 215                | .5                             |
| <b>Total</b> | <b>2616</b>        | <b>5.8</b>                     |

Source: US Census 2010

## Libraries

The Campbell County Public Library System has two libraries:

- Gillette
- Wright

## Detainees/Transient

Detainees and half-way house residents may also be vulnerable to natural disasters. The Campbell County Detention Center and the VOA Community Corrections Center both house inmates/residents. The Youth Emergency Services facilities provide 24/7 services to its youth residents. Homeless individuals and families are housed at the Way Station.

## Event Venues

Other potentially vulnerable individuals include those attending large outdoor events. The venues for such outdoor events include; the

- CAM-PLEX in Gillette
- Little League/Youth Football Complexes
- American Legion Ball field
- Bicentennial Park (soccer, softball fields)
- Thunder Speedway

Indoor recreation venues include:

- Recreation Center in Gillette
- Recreation Center in Wright
- Hockey rink (outdoor facility)
- Campbell County School District Aquatic Center

The locations of the schools where there could be large congregations of people for sporting events include:

- Campbell County High School
- Sage Valley Junior High
- Twin Spruce Junior High
- Wright Junior/Senior High School
- Campbell County Recreation Center Field House
- Gillette College

### Risks for Each Jurisdiction

Three jurisdictions are covered by this plan, the Town of Wright, the City of Gillette, and Campbell County. Table 3-30 provides a snapshot of value and potential property loss in Campbell County, grouped by jurisdiction and property type. This is provided as a baseline estimate of property exposure. While it is not likely any hazards in the plan would have widespread impacts on the building stock of the County, the table below could be used as an initial estimate of potential loss in the event a tornado, for example, impacted the Town of Wright again. Contents exposure is estimated as a percent of the improvement value (specifically, 50% of the improvement value for residential structures and 100% for non-residential structures), based on standard FEMA methodologies. Land values are not included in this analysis, because land remains following disasters, and subsequent market devaluations are frequently short-term and difficult to quantify. Additionally, state and federal disaster assistance programs generally do not address loss of land or its associated value.

Table 3-30: Campbell County Property Exposure by Jurisdiction

| Jurisdiction   | Property Type | Building Count | Improved Value  | Est. Content Value | Total Exposure  |
|----------------|---------------|----------------|-----------------|--------------------|-----------------|
| Gillette       | Commercial    | 1,122          | \$394,366,746   | \$394,366,746      | \$788,733,492   |
|                | Industrial    | 4              | \$8,553,197     | \$12,829,796       | \$21,382,993    |
|                | Residential   | 8,279          | \$1,289,486,751 | \$644,743,376      | \$1,934,230,127 |
|                | Total         | 9,405          | \$1,692,406,694 | \$1,051,939,917    | \$2,744,346,611 |
| Wright         | Commercial    | 39             | \$11,988,466    | \$11,988,466       | \$23,976,932    |
|                | Industrial    | 1              | \$375,067       | \$562,601          | \$937,668       |
|                | Residential   | 406            | \$44,519,897    | \$22,259,949       | \$66,779,846    |
|                | Total         | 446            | \$56,883,430    | \$34,811,015       | \$91,694,445    |
| Unincorporated | Agriculture   | 13             | \$647,511       | \$647,511          | \$1,295,022     |
|                | Commercial    | 410            | \$90,772,372    | \$90,772,372       | \$181,544,744   |
|                | Exempt        | 4              | \$52,564        | \$52,564           | \$105,128       |
|                | Industrial    | 2              | \$3,376,261     | \$5,064,392        | \$8,440,653     |
|                | Residential   | 4,425          | \$416,165,381   | \$208,082,691      | \$624,248,072   |
|                | Total         | 4,854          | \$511,014,089   | \$304,619,529      | \$815,633,618   |
| Countywide     | Total         | 14,705         | \$2,260,304,213 | \$1,391,370,461    | \$3,651,674,674 |

Source: Query from Wyoming CAMA database, 2015

The table that follows (Table 3-31) outlines critical facilities and infrastructure identified in each community. This list includes facilities that provide essential services that would prove detrimental if impacted by a hazard event.

*Table 3-31: Campbell County Critical Facilities*

| Facility                                | Location              | Replacement   | Comments  |
|---|-----------------------|---------------|---|
| Madison Pipeline                        | Moorcroft to Gillette | \$217,600,000 | 42 miles across the county. Cost to replace \$1000/foot.                                |
| Water System                            | Gillette              | \$51,304,786  | Includes well houses, reservoirs, pump stations, wells                                  |
| Water Mains                             | Gillette              | \$64,838,400  | 307 miles; \$40/foot replacement cost   |
| Wastewater System                       | Gillette              | \$27,614,221  | Includes treatment plant, lift station and metering station                             |
| Sewer Mains                             | Gillette              | \$57,024,000  | 180 miles; \$316,800/mile replacement cost  |
| City Hall / Police Station              | Gillette              | \$21,766,541  |   |
| City West                               | Gillette              | \$5,967,910   |   |
| City Streets                            | Gillette              | \$99,268,675  | 224 miles; \$442,571/mile   |
| Electrical Utility System               | Gillette              | \$59,730,690  | System consists of conductors (\$41,373,795), switches, six substations, and equipment. |
| Public Health Building                  | Gillette              | \$3,466,698   |   |
| CAMPLEX                                 | Gillette              | \$52,618,944  |   |
| Gillette College Student Housing Unit 1 | Gillette              | \$1,627,202   |   |
| Gillette College Student Housing Unit 2 | Gillette              | \$1,064,589   |   |
| Gillette College Student Housing Unit 3 | Gillette              | \$1,627,000   |   |

| Facility                                | Location | Replacement  | Comments                                      |
|---|----------|--------------|---|
| Gillette College Student Housing Unit 4 | Gillette | \$705,000    |   |
| Warehouse--City                         | Gillette | \$3,254,252  |   |
| PT Building--City                       | Gillette | \$713,829    |   |
| Equipment Storage Building "A" --City   | Gillette | \$904,963    |   |
| Electrical Storage Shed "B" --City      | Gillette | \$684,134    |   |
| City of Gillette Animal Shelter         | Gillette | \$1,106,148  |   |
| City of Gillette Parks/Streets Shop     | Gillette | \$80,309     |   |
| City West                               | Gillette | \$3,226,688  |   |
| Agriculture Complex                     | Wright   | \$2,500,000  |   |
| Animal Shelter                          | Wright   | \$80,000     |   |
| Southern Campbell County Medical Clinic | Wright   | \$9,000,000  | Managed by Campbell County Memorial Hospital. |
| Public Safety Building                  | Wright   | \$1,895,463  | Owned by county (insured value)               |
| Town of Wright Multi-purpose building   | Wright   | \$488,572    |   |
| Rec Center                              | Wright   | \$8,879,262  | Owned by county (insured value)               |
| Town Hall                               | Wright   | \$3,900,000  |   |
| Town Maintenance Shop                   | Wright   | \$727,740    |   |
| Town Streets                            | Wright   | \$15,864,108 |   |
| Visitor Center                          | Wright   | \$711,000    |   |

| Facility  | Location          | Replacement                  | Comments   |
|---|-------------------|------------------------------|--|
| Water and wastewater system                           | Wright            | \$25,000,000                 | taps, wells, storage tanks, water lines, chlorinators, cell lagoon, 3 lift stations, sewer line  |
| Qwest facility  | Wright            | \$1,500,000                  |  |
| Fire Station #9                                       | Wright            | \$3,649,959                  |  |
| Gillette/Campbell County Airport                      | NW of Gillette    | \$5,500,000                  | Terminal building. Other facilities at the airport valued at an additional \$5,307,629   |
| Campbell County Health (Hospital)                     | Gillette          | \$142,000,000                | Not included in figure at left is \$26 million for contents. Pioneer Manor also managed by the hospital and valued at \$36 million plus \$3.5 million contents.. |
| County Courthouse                                     | Gillette          | \$30,470,982                 | Includes courthouse, parking garage and George Amos building   |
| Campbell County Sheriff's Office and Detention Center | Gillette          | \$43,205,900                 | Includes office and jail, evidence vault, boiler bldg, storage facility, animal control, radio buildings (5), radio towers (5)                                   |
| County Road and Bridge Building                       | Gillette          | \$3,103,275                  |  |
| County Weed and Pest                                  | North of Gillette | \$10,450,000                 |  |
| County Roads  | Campbell County   | \$42,000,000<br>\$28,000,000 | Rebuild gravel road (Co. has 840 miles) \$50,000/mile, paved road (County has 160 miles) \$175,000/mile. County has 14 major bridges.                            |

| Facility  | Location                     | Replacement  | Comments  |
|---|------------------------------|--------------|---|
| Campbell County Fire Station #1, modular office, maintenance shop | Gillette                     | \$12,000,000 | Campbell County has 10 fire stations. The #1 station in Gillette is the most critical. The total replacement value for additional fire department offices and facilities is \$2,421,475. Training center buildings valued at \$805,229. |
| Radio Stations  | Campbell County and Gillette | N/A          | There is not a replacement value provided for each station. They are privately owned, but are vital to emergency communication.   |

Table 3-32: Campbell County School Values as of July 1, 2014

| Bldg name                       | Location | Total Replacement Value |
|---------------------------------|----------|-------------------------|
| Cottonwood Elementary           | Wright   | \$10,824,780            |
| Wright Junior HS                | Wright   | \$17,540,385            |
| Campbell Co HS North Campus     | Gillette | \$47,650,435            |
| Campbell Co HS South Campus     | Gillette | \$35,432,602            |
| G Building Vo-Tech              | Gillette | \$4,597,554             |
| Westwood HS                     | Gillette | \$2,863,629             |
| Lakeway Learning Center         | Gillette | \$9,582,274             |
| Aqua Center Indoor Pool         | Gillette | \$5,578,454             |
| Educational Services Center     | Gillette | \$4,991,584             |
| Main Warehouse Central Services | Gillette | \$2,004,698             |
| Hillcrest Elementary            | Gillette | \$14,750,000            |
| Prairie Wind Elementary         | Gillette | \$14,750,000            |
| Buffalo Ridge Elementary        | Gillette | \$14,750,000            |
| Lakeview Elementary             | Gillette | \$14,750,000            |
| Westwood Alternative HS         | Gillette | \$9,200,000             |
| Ready 4 Learning Center         | Gillette | \$6,799,394             |
| Meadowlark Elementary           | Gillette | \$6,464,658             |
| Wagonwheel Elementary           | Gillette | \$8,849,797             |
| Conestoga Elementary            | Gillette | \$10,149,849            |
| Rawhide Elementary              | Gillette | \$9,157,479             |
| Paintbrush Elementary           | Gillette | \$11,261,464            |
| Pronghorn Elementary            | Gillette | \$12,114,573            |
| Little Powder Elementary        | Weston   | \$2,359,326             |



|                       |          |              |
|-----------------------|----------|--------------|
| Recluse Elementary    | Recluse  | \$2,998,960  |
| Rozet Elementary      | Rozet    | \$12,016,623 |
| Stocktrail Elementary | Gillette | \$16,035,699 |
| Sunflower Elementary  | Gillette | \$11,074,759 |
| 4-J Elementary        | Gillette | \$3,254,072  |
| Sage Valley Jr HS     | Gillette | \$27,545,485 |
| Twin Spruce Jr HS     | Gillette | \$26,009,085 |

Source: Wyoming School Risk Retention Program

Note: Modulares, storage buildings, and support buildings valued at less than \$2 million not included in above figures.

### Vulnerability Summary

The following table summarizes hazard vulnerability in the county by jurisdiction, based on past occurrences, probability of future occurrences and the extent of direct and/or indirect impacts that could occur in the future.

Table 3-33: Summary Hazard Vulnerability by Jurisdiction

| Hazard                    | Gillette | Wright | Campbell County |
|---------------------------|----------|--------|-----------------|
| Dam Failure               | Low      | N/A    | Low             |
| Drought                   | Medium   | Medium | Medium          |
| Earthquakes*              | High     | Medium | Medium          |
| Flooding                  | Medium   | Medium | Medium          |
| Hail                      | Medium   | Medium | Medium          |
| Hazardous Materials       | High     | High   | High            |
| Landslides                | Medium   | Medium | Medium          |
| Lightning                 | Medium   | Medium | Medium          |
| Terrorism                 | Medium   | Medium | Medium          |
| Tornadoes and Microbursts | High     | High   | High            |
| Toxic Gas Seeps           | Medium   | Medium | Medium          |
| Wildland Fire             | High     | N/A    | High            |
| Winter Storms             | High     | High   | High            |

\*Earthquakes pose a slightly higher risk to Gillette and the southern region of the county

## Chapter 4 GOALS, OBJECTIVES, AND MITIGATION ACTIONS

### How the goals and projects were developed

This plan contains six goals to help protect people and property in Campbell County from natural and human-caused disasters. The Town of Wright, City of Gillette, and Campbell County each have a variety of projects under the six goals.

A total of 60 mitigation projects were identified as follows;

- Projects from the 2010 plan were reviewed for status and carried forward as appropriate,
- Campbell County Emergency Management suggested project ideas,
- The contractor reviewed other local plans and brought forward needs and projects in those plans that related to hazard mitigation,
- Town/County staff suggested project ideas,
- The Local Planning Team suggested project ideas,
- The public was queried for project ideas.

The project list was finalized and incorporated into the draft plan. The draft was made available for public comment. Public comments were summarized and brought back to the Local Planning Team with recommendations for addressing. The Local Planning Team validated how the public comments were addressed.

### Project Costs

Costs for mitigation actions will fall within three ranges Low, Medium, or high.

- Low Cost Projects: from \$0 to \$5,000
- Medium Cost Projects: from \$5,001 to \$50,000
- High Cost Projects: Over \$50,000

### Project Priorities

Priority rankings of High, Medium, or Low were assigned. The County Coordinator and the contractor did the initial prioritization of projects. The Local Planning Team review and validated the priorities.

Generally, the jurisdictions will initiate and depending on the complexity, try to accomplish the High priority projects within two years, the time frame for Medium priority projects will be three to four years, and Low priority projects will be accomplished by the five-year anniversary of this plan--if feasible. Projects will be undertaken by the local jurisdictions dependent on the availability of resources—funding, staff, and/or technical expertise.

The projects were ranked informally based on the following criteria;

- Level of risk to life and property posed by hazard which project addresses,
- Reasonableness of project and extent to which it provides a long-term solution,
- Potential consequences of not implementing,
- Likely support from the elected officials, and
- Compatibility with other plans and policies.

The county commissioners, the mayors and elected bodies have the ability to adopt additional plans, policies, ordinances and regulations as needed within state statutes.

### Project Types

A range of types of mitigation actions or projects were identified by the participants in the planning process. Examples of a range of types of projects from other counties were provided to the LPT and elected officials to illustrate a variety of project types and to stimulate ideas for each local jurisdiction. The types of projects considered included; Coordination, Education and Awareness, Emergency Response, Natural Resource Protection, Prevention, Property Protection, and Structural.

*Table 0-1: Project Types by Goal/Jurisdiction*

| <b>Goal</b> | <b>Project Types</b>   |
|-------------|--|
| Goal One    | Coordination, Education and Awareness, Prevention, Property Protection, Structural |
| Goal Two    | Coordination, Education and Awareness  |
| Goal Three  | Coordination, Prevention, Structural   |
| Goal Four   | Coordination, Education and Awareness, Prevention                                  |
| Goal Five   | Coordination, Emergency Response, Prevention, Property Protection                  |
| Goal Six    | Coordination, Education and Awareness, Prevention                                  |

## Goal 1: Reduce the impact of severe weather on people, property or natural resources.

### Objective 1: Improve severe weather detection and tracking capabilities.

1. Enhance local weather spotter capabilities.
2. Develop additional real-time atmospheric sensors to provide weather data sources.
3. Obtain additional weather cameras—develop observational real-time video capabilities for severe weather.
4. Continue to seek improvements in technology for weather coverage and forecasting

| Project | Priority | Cost   | Lead | Jurisdiction(s)          | Hazard Addressed |
|---------|----------|--------|------|--------------------------|------------------|
| 1.1.1   | High     | Low    | CCEM | Gillette, Wright, County | Weather hazards  |
| 1.1.2   | High     | Medium | CCEM | County                   | Weather hazards  |
| 1.1.3   | Medium   | Medium | CCEM | County                   | Weather hazards  |
| 1.1.4   | Low      | Medium | CCEM | County                   | Weather hazards  |

### Objective 2: Improve warning and communication capabilities.

1. Identify and utilize appropriate new technology, (i.e.: Social Media) which can enhance local warning capabilities.
2. Update the local warning plan.
3. Coordinate with local broadcast media on distribution of warnings.
4. Develop a coordinated public facilities severe weather closure plan.

| Project | Priority | Cost   | Lead                               | Jurisdiction(s)             | Hazard Addressed |
|---------|----------|--------|------------------------------------|-----------------------------|------------------|
| 1.2.1   | High     | Low    | CCEM,<br>County IT                 | County                      | Weather hazards  |
| 1.2.2   | Medium   | Low    | CCEM                               | County                      | Weather hazards  |
| 1.2.3   | Medium   | Low    | CCEM                               | County                      | Weather hazards  |
| 1.2.4   | Medium   | Medium | CCEM,<br>County Road<br>and Bridge | Gillette, Wright,<br>County | Weather hazards  |

**Objective 3: Provide public education on personal preparation and appropriate response to severe weather events.**

1. Provide on-going public education on how to recognize, prepare for and actions to take during severe weather events.
2. Develop on-going education on where to obtain information about the weather.
3. Distribute appropriate printed educational materials on severe weather.
4. Develop and utilize a traveling educational display.

| Project | Priority | Cost | Lead      | Jurisdiction(s)          | Hazard Addressed |
|---------|----------|------|-----------|--------------------------|------------------|
| 1.3.1   | High     | Low  | CCEM, NWS | County                   | Weather hazards  |
| 1.3.2   | Medium   | Low  | CCEM, NWS | County                   | Weather hazards  |
| 1.3.3   | Medium   | Low  | CCEM, NWS | Gillette, Wright, County | Weather hazards  |
| 1.3.4   | Low      | Low  | CCEM      | Gillette, Wright, County | Weather hazards  |

**Objective 4: Promote appropriate shelter during severe weather.**

1. Promote public education on sheltering
2. Make information (technical specifications) available to people interested in creation of a “safe room” for private and public structures.
3. Develop an education program for day care and adult care providers in development of “safe zones” and appropriate shelter.
4. Encourage development of new codes and zoning to require “safe zones” for new construction of congregate facilities such as day care facilities, adult care facilities, apartments, group homes, assisted living and retirement centers, etc.

| Project | Priority | Cost | Lead   | Jurisdiction(s)          | Hazard Addressed |
|---------|----------|------|--|--------------------------|------------------|
| 1.4.1   | High     | Low  | CCEM   | County                   | Weather hazards  |
| 1.4.2   | High     | Low  | CCEM, Wright Building Inspector, Gillette Public Works | Gillette, Wright, County | Weather hazards  |
| 1.4.3   | Medium   | Low  | CCEM   | Gillette, Wright, County | Weather hazards  |
| 1.4.4   | Low      | Low  | Gillette, Wright Building Depts.                       | Gillette, Wright, County | Weather hazards  |

**Objective 5: Increase the local capacity to deal with psychological effects of emergency and disaster events.**

1. Provide public education and training on the effects of stress and the psychological impact caused by emergency and disaster events.
2. Provide for appropriate critical incident stress management capacity.

| Project | Priority | Cost   | Lead                | Jurisdiction(s) | Hazards Addressed |
|---------|----------|--------|---------------------|-----------------|-------------------|
| 1.5.1   | Medium   | Medium | CCEM, Public Health | County          | All               |
| 1.5.2   | Medium   | Medium | CCEM, Public Health | County          | All               |

**Objective 6: Reduce Flood Damage.**

1. Continue to participate in the National Flood Insurance Program (NFIP)
2. Conduct public education on the need for flood insurance.
3. Identify and create projects which contribute to eliminating or reducing flood damage or loss.
4. Identify and map any potentially hazardous dams within the County and ensure appropriate notification systems are in place and functioning.
5. Prevent/mitigate flash flooding in Lower Foothills Subdivision.
6. Address flooding by Donkey Creek.

| Project | Priority | Cost   | Lead                            | Jurisdiction(s)          | Hazards Addressed |
|---------|----------|--------|---------------------------------|--------------------------|-------------------|
| 1.6.1   | High     | Low    | Commissioners, Mayors           | Gillette, Wright, County | Flood             |
| 1.6.2   | High     | Low    | CCEM, Floodplain Administrators | County                   | Flood             |
| 1.6.3   | Medium   | Medium | CCEM                            | Gillette, Wright, County | Flood             |
| 1.6.4   | Medium   | Medium | CCEM                            | County                   | Flood             |
| 1.6.5   | Low      | Medium | CCEM                            | County                   | Flood             |
| 1.6.6   | Low      | Medium | Gillette                        | Gillette                 | Flood             |