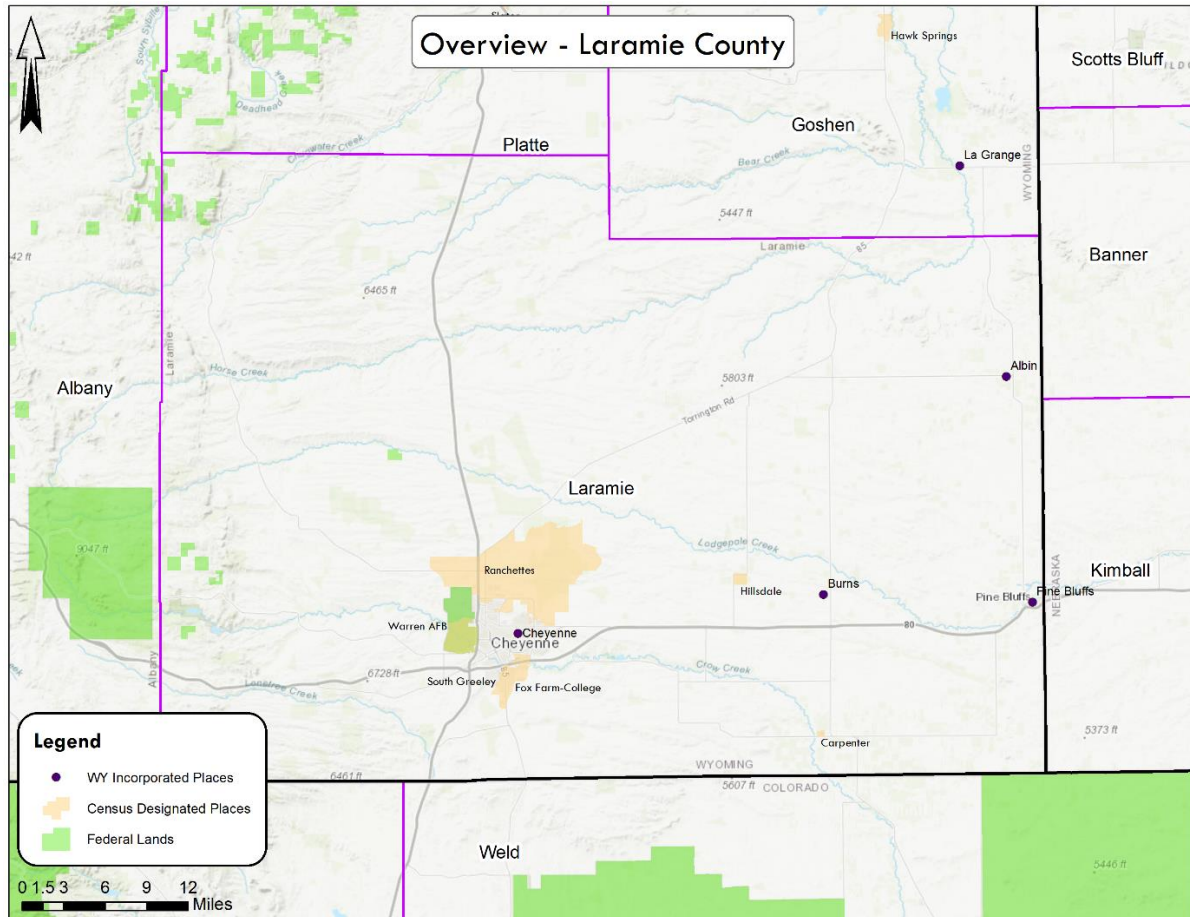


Wyoming Region 7 Hazard Mitigation Plan

Laramie County Annex - 2023 Update



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1 Mitigation Strategy

1.1 Overview

The intent of the Mitigation Strategy is to help organizations identify implementable mitigation actions that will guide future mitigation policy and project administration. The Mitigation Strategy includes a list of proposed actions deemed necessary to meet those mitigation goals and objectives identified in the updated Hazard Mitigation Plan (HMP) and reduce the impact of hazards. The actions identified in this Appendix are specific to Laramie County and its participating organizations.

1.2 Mitigation Action Plan

1.2.1 Progress on Previous Mitigation Actions

As part of the 2023 HMP planning process, Laramie County and participating jurisdictions were tasked with reviewing mitigation projects that were identified in the existing Region 7 Hazard Mitigation Plan. Each jurisdiction reviewed their individual actions and reported on the status of those actions, shown in Table 1.1. Mitigation actions that have not yet been completed at the time of this plan's writing are listed as 'On-Going,' 'In Progress,' or 'No Progress – Continue Action.' Those actions identified as either 'In Progress' or 'No Progress – Continue Action' will be tracked and reported on, along with new actions, as part of future plan maintenance activities.

Recognition of mitigation successes when reviewing the status of the last plan's actions is important for continued progress. In Laramie County, there have been multiple successes moving projects forward. This includes:

- Laramie County
 - secured funding to expand and update the emergency communication systems.
- The City of Cheyenne
 - working on a Master Drainage Plan,
 - constructing a berm to reduce flooding,
 - increasing water detention storage through community partnership,
 - beginning construction on the 26th Street Storm Sewer Interceptor Project,
 - beginning construction on a hydroelectric power generator project.
 - Submission of numerous NOIs to WOHS for assistance in scoping multiple projects.
- The Town of Pine Bluffs
 - partnering with the Laramie County School District to develop community wildfire protections plans.
 - installed a 2nd community alert alarm system and is developing education for the community about hazards.
 - received design approval through working with WYDOT and Union Pacific for the relocation of a railroad crossing and construction of an under / over pass to prevent future accidents.

Wyoming Region 7 Hazard Mitigation Plan – 2023 Update (Laramie County)

Table 1.1 2017 Mitigation Action Status

ID	Lead Jurisdiction	Title	Description	2022 Status	2022 Notes
2017-Laramie County-1	Laramie County	All-Hazards Public Education	Prepare and educate residents and businesses on hazards to improve life safety and minimize property damage.	On-Going	
2017-Laramie County-2	Laramie County	Emergency Communication Systems	Expand current systems, adapting and blending with new systems purposed by the federal government.	In-Progress	Received Funding via 6th Special Purpose Tax for maintenance and new additions
2017-Laramie County-3	Laramie County	Development of Community Wildfire Protection Plan (CWPP)	Complete CWPP for Eastern portion of County	No Progress - Continue Action	Waiting on grant funding to arrive
2017-Laramie County-4	Laramie County	Critical Infrastructure Protection	Complete Risk Assessments and Action Plans to prevent loss of life and mitigate damages	On-Going	
2017-Laramie County-5	Laramie County	Oil & Gas Safe Development Plan	Develop a plan for prevention and mitigation of loss of life and damages to property	On-Going	
2017-Cheyenne-1	Cheyenne	Development of Belvoir Groundwater Pipeline	Develop pipeline that would provide additional water resources to the City of Cheyenne during times of drought.	No Progress - Continue Action	Budgeting for FY23
2017-Cheyenne-2	Cheyenne	Expansion of Reservoir Storage/Collection Capabilities	Expand and increase storage capacity to minimize short-term drought impacts	No Progress - No Longer a Mitigation Priority	Study determined that this is not need at this time
2017-Cheyenne-3	Cheyenne	Reduce Flood Damage Potential in Clear Creek Basin	Implement measures to reduce flood damage	No Progress - No Longer a Mitigation Priority	Study determined that this is not need at this time

Wyoming Region 7 Hazard Mitigation Plan – 2023 Update (Laramie County)

ID	Lead Jurisdiction	Title	Description	2022 Status	2022 Notes
2017-Cheyenne-4	Cheyenne	Reduce Flood Damage Potential in Crow Creek Basin	Implement measures to reduce flood damage	On-Going	An NOI for project scoping for a flood control has been submitted to Homeland Security and has been selected for further review.
2017-Cheyenne-5	Cheyenne	Reduce Flood Damage Potential in Dry Creek Basin	Implement measures to reduce flood damage	On-Going	An NOI for project scoping for a flood control has been submitted to Homeland Security and has been selected for further review.
2017-Cheyenne-6	Cheyenne	Reduce Flood Damage Potential in Henderson and E. Lincoln Basin	Implement measures to reduce flood damage	In-Progress	A grant was award to the City of Cheyenne for an update to the Master Drainage Plan. A consultant has been selected and contracts are being processed.
2017-Cheyenne-7	Cheyenne	Reduce Flood Damage Potential in Holliday Basin	Implement measures to reduce flood damage	On-Going	We have partnered with Laramie County School District No. 1 to increase detention storage near the headwaters of the Henderson Basin.
2017-Cheyenne-8	Cheyenne	Reduce Flood Damage Potential in Upper & Lower Capitol Basin	Implement measures to reduce flood damage	On-Going	We reduced the flood hazard by the reconstruction of a berm.
2017-Cheyenne-9	Cheyenne	Adoption of Mutual Aid Agreements/Participation in WYOWARN	Enhance response capabilities for water and wastewater utilities during disasters.	In-Progress	Submitted an NOI to Homeland Security for project scoping of the 18th Street Storm Sewer Interceptor. Construction of the 26th Street Storm Sewer Interceptor Project is under construction and is expected to be completed in July, 2022.

Wyoming Region 7 Hazard Mitigation Plan – 2023 Update (Laramie County)

ID	Lead Jurisdiction	Title	Description	2022 Status	2022 Notes
2017-Cheyenne-10	Cheyenne	Development of Hydroelectric Power Generation	Develop hydroelectric power generation to decrease operating costs, reliance on external power sources; and reduce disruption costs during power outages.	On-Going	Under Construction
2017-Albin-1	Albin	Fencing And Security for Water Wells and Lagoon	Install fencing and security measures to protect wells and lagoons from contamination	No Progress - No Longer a Mitigation Priority	No longer a needed project
2017-Albin-2	Albin	Tornado Shelters	Build local tornado shelters for life safety and hazard awareness	No Progress - Continue Action	No funding available
2017-Albin-3	Albin	Improve Communication Systems	Update communications system to improve safety and security for community members, and efficiency for emergency response personnel.	No Progress - No Longer a Mitigation Priority	No longer a needed project
2017-Burns-1	Burns	Stormwater Drainage Plan	Develop stormwater drainage plan	On-Going	Still working on plan development
2017-Burns-2	Burns	Hazardous Materials Plan	Development of hazardous materials plan	On-Going	
2017-Pine Bluffs-1	Pine Bluffs	Wildfire Protection Plan & Clean-up Plan (Bluffs)	Create a plan to identify fire-break locations and tree removal needs.	On-Going	New administration will develop plan in partnership with LCFD #5
2017-Pine Bluffs-2	Pine Bluffs	Increased Notification & Education	Improve community education about hazards, including awareness and notifications	On-Going	Second warning alarm installed by Laramie County; education plan in development. Education is ongoing
2017-Pine Bluffs-3	Pine Bluffs	Storm / Tornado Shelter	Establish a shelter to reduce loss of life or injuries	On-Going	Seeking grant funds

ID	Lead Jurisdiction	Title	Description	2022 Status	2022 Notes
2017-Pine Bluffs-4	Pine Bluffs	Up Railroad Crossing Relocation / Over Underpass Construction	Implement measures to prevent future accidents/train collision and possible damages along the tracks and loss of life if chemical spill.	In-Progress	Partnered with WYDOT and the UPRR; engineering designs are approved. Crossing scheduled for relocation in the spring/summer of 2023

1.2.2 Continued Compliance with National Flood Insurance Program (NFIP)

Given the importance of the NFIP in mitigating flood losses and the degree of flood risk in certain parts of Region 7, an emphasis will be placed on continued compliance with the NFIP by participating communities (Laramie County, City of Cheyenne, and the Towns of Burns and Pine Bluffs). As NFIP participants, the county and participating jurisdictions have and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining the floodplain zoning ordinance.

1.2.3 Updated Mitigation Action Plan

Laramie County and participating jurisdictions selected and completed worksheets for a number of mitigation actions for this 2023 HMP. Each action worksheet was completed by a jurisdictional representative, and includes the following information:

- Project ID
- Local Government
- Project Title
- Issue / Background
- Benefits (Losses Avoided by Implementing Action)
- Priority
- Goals Met
- Lead and Support Organization(s)
- Hazard(s) Mitigated
- Potential Funding Source
- Expected Completion Year

Table 1.2 presents a summary of these new and continued mitigation actions that were identified to be included in this updated HMP.

Table 1.2 2023 Mitigation Actions

ID	Local Government	Title	Description	Priority	Goals Met	Lead & Support Org.	Hazard(s) Mitigated	Estimated Project Cost	Potential Funding Source	Expected Complete Year
2023- L Multi-01	Laramie County Albin	Wind Mitigation	Assess waste, wastewater, and electric systems to determine those most at risk from wind losses and mitigate the risk to those most vulnerable components.	M	1, 2	Ft Laramie EM, La Grange	Wind	Unknown	Town Budget, FEMA HMA Grants	2027
2023- Laramie County-01	Laramie County	National Flood Insurance Program (NFIP) - Community Rating System (CRS)	Improved community outreach and education events regarding hazards associated with severe precipitation events including implementation of programs that facilitate advanced warning signage in hazard areas	M	1	Laramie County Planning and Development	Flood, Severe Weather	Unknown	County Budget	2024
2023- Laramie County-02	Laramie County	Emergency Communications Systems	Upgrade current systems to Improve local notifications to hazardous weather, emergencies, and disasters	H	1,2,3	Laramie County EM & Combined Communications Center	All Hazards	Unknown (System Dependent)	County Budget, Special Purpose Tax, FEMA Grants	Continuous
2023- Laramie County-03	Laramie County	Wildland Fire	Complete CWPP for the remaining portion of the county for use as educational tools for creating a more prepared community.	H	1,2,3	Laramie County EMA, Laramie County Fire Warden, Laramie County Fire Districts	Wildfire	\$100,000	FEMA/ Forestry Grants, County Budget, Fire Wise Program	Continuous

Wyoming Region 7 Hazard Mitigation Plan – 2023 Update (Laramie County)

ID	Local Government	Title	Description	Priority	Goals Met	Lead & Support Org.	Hazard(s) Mitigated	Estimated Project Cost	Potential Funding Source	Expected Complete Year
2023- Laramie County-04	Laramie County	Public Education for Critical Infrastructure Protection, Cyber & COOP Hazards	Increased education for the public and local businesses will assist with prevention and mitigation of loss of life and damages to property & infrastructure	H	1,2,3	Laramie County, Cheyenne, Burns, Albin and Pine Bluffs	Cyber Hazards	Unknown	County/ Local Funds, FEMA Grants	2028
2023- Albin-01	Town of Albin	Sewer Holding Ponds	Add additional lagoon to ensure EPA requirements are being met and testing is up to current standards. This will protect the environment and provide proper services for more growth	H	1,2,3	Town of Albin, EPA, DEQ, Laramie County	Public Health Hazards, Hazardous Materials Release	\$300,000	Town Budget, Special Purpose Tax	2025
2023- Burns-01	Town of Burns	Stormwater Drainage	Develop stormwater drainage plan	M	1,2,3	Town of Burns	Flood	Unknown	Sixth Penny, SLIB	On-Going
2023- Burns-02	Town of Burns	Hazardous Materials	Develop hazardous materials plan	M	1,2,3	Town of Burns	Hazardous Materials Release, Public Health Hazards	Unknown	General fund`	On-Going
2023- Burns-03	Town of Burns	Shelter Backup Generation	Install generator at town facility and emergency shelter to provide services for continuity of government	H	1,2,3	Town of Burn, Laramie County EMA	All Hazards	Unknown	Sixth Penny, FEMA Funding, Some general fund	2028

Wyoming Region 7 Hazard Mitigation Plan – 2023 Update (Laramie County)

ID	Local Government	Title	Description	Priority	Goals Met	Lead & Support Org.	Hazard(s) Mitigated	Estimated Project Cost	Potential Funding Source	Expected Complete Year
2023-Cheyenne-01	City of Cheyenne	Community Rating System (CRS) Tracking Software	Improve efficiency, transparency, and create redundancy in tracking and logging of CRS activities.	M	1,2,3	Laramie County EM	Flood	\$1,200,000	City Budget/ ARPA Federal Funding	2028
2023-Cheyenne-02	City of Cheyenne	Storm Water Management Plan Update	Required update to Storm Water Management Plan (SWMP) for MS4 Permit renewal and Municipal Code revisions & amendments	H	1,2,3	Laramie County EM	Flood	\$20,000	City Budget/ ARPA Federal Funding	2028
2023-Cheyenne-03	City of Cheyenne	Storm Water Utility Fee Municipal Code Section	Develop and Implement a Storm Water Utility Fee Municipal code section for adoption.	H	1,2, 3	Laramie County EM	Flood	Unknown	City Budget/ User Fees	2023
2023-Cheyenne-04	City of Cheyenne	Upper Dry Creek Storm Water Basin Flood Control	Mitigation and attenuation to reduce peak discharge and protect public and private property	H	1,2, 3	Laramie County EM	Flood	Unknown	Local, FEMA	2023
2023- Pine Bluffs-01	Town of Pine Bluffs	Critical Infrastructure Protection / Cyber Security Assessment	Assess risks and develop action plan to avoid potential damage / disruption to town electric, water, and wastewater systems. Determine cyber risks around data breach, supervisory control and data acquisition (SCADA) systems, and meter functions	M	1,2,3	Town of Pine Bluffs, Laramie County	Cyber-security	Unknown	Homeland Security; Department of Energy	2028

Wyoming Region 7 Hazard Mitigation Plan – 2023 Update (Laramie County)

ID	Local Government	Title	Description	Priority	Goals Met	Lead & Support Org.	Hazard(s) Mitigated	Estimated Project Cost	Potential Funding Source	Expected Complete Year
2023- Pine Bluffs-02	Town of Pine Bluffs	Generator for Community Center	Equip community center / shelter with generator	H	1,3	Town of Pine Bluffs, Laramie County	Winter Storm, Severe Weather, Fire, Tornado, Lightning	\$150,000	Homeland Security; Capital Improvements	2024-2028
2023- Pine Bluffs-03	Town of Pine Bluffs	Backup Generator for Water Systems	Install generators to keep continuity of potable water system and use of lift stations for wastewater services in power outage event	H	1,2,3	Town of Pine Bluffs, Laramie County	Winter Storm, Severe Weather, Fire, Tornado, Lightning	\$1,350,000	Homeland Security; Capital Improvements	2024-2028
2023- Pine Bluffs-04	Town of Pine Bluffs	Groundwater Management Plan	Create a groundwater model and groundwater management plan using data that would be collected using airborne geophysics equipment. Project will be a “Pilot “ program for larger groundwater characterization projects in Laramie, Platte and Goshen Counties.	M	1,2,3	Town of Pine Bluffs, Cheyenne Board of Public Utilities	Drought	Unknown	Homeland Security; Capital Improvements, FEMA HMA	2027
2023- Eastern Laramie County Sanitation District-01	Eastern Laramie County Sanitation District	New Dumping Facility	New facility for dumping and compacting inside, mitigates windblown debris	M	2,3	Eastern Laramie County Sanitation District (ELC Landfill)	Public Health Hazards, Hazardous Materials Release, Wind	\$3,000,000	State Funding, Agency Budget, Local Tax Levi funding	2024

Wyoming Region 7 Hazard Mitigation Plan – 2023 Update (Laramie County)

ID	Local Government	Title	Description	Priority	Goals Met	Lead & Support Org.	Hazard(s) Mitigated	Estimated Project Cost	Potential Funding Source	Expected Complete Year
2023- Eastern Laramie County Sanitation District-02	Eastern Laramie County Sanitation District	Water Cistern	Addition of a cistern to increase internal fire suppression capabilities and provide water resource for local districts	H	1,2, 3	ELC Landfill, Laramie County Fire District #6, Laramie County EMA/Fire Warden	Public Health Hazards, Hazardous Materials Release, Wildfire	\$500,000	State Funding, Agency Budget, Local Tax Levi funding, LCFD#6 Support	2024
2023- Eastern Laramie County Sanitation District-03	Eastern Laramie County Sanitation District	Property Fencing	Replace aging fencing around the property to protect against flying debris	M	1,2, 3	ELC Landfill, Laramie County Fire District #6, Laramie County EMA/Fire Warden	Public Health Hazards, Hazardous Materials Release, Wind	\$50,000	State Funding, Agency Budget, Local Tax Levi funding	2025
2023- Eastern Laramie County Sanitation District-04	Eastern Laramie County Sanitation District	Fire Suppression System	Install a fire suppression system to help mitigate the risk of facility fires	H	2,3	ELC Landfill, Laramie County Fire District #6, Laramie County EMA/Fire Warden	All Hazards	\$250,000	State Funding, Agency Budget, Local Tax Levi funding	2024

1.3 Mitigation Capabilities Assessment

As part of the plan update, the county and its jurisdictions conducted a mitigation capability assessment. Capabilities are those plans, policies, and procedures currently in place that contribute to reducing hazard losses. There are multiple categories of capabilities and all of them are powerful tools for implementing hazard mitigation. It is crucial that these tools are reviewed regularly and opportunities for further risk reduction efforts are identified.

By collecting information about each jurisdiction's capabilities, the strengths, weaknesses, and resources of each jurisdiction are identified.

Planning and regulatory capabilities are foundational to an informed mitigation strategy and successful implementation of actions. Table 1.3 shows those mitigation capabilities specific to planning and regulatory tools across the county.

Table 1.3 Planning & Regulatory Capabilities

Mitigation Capability	Laramie County	Town of Albin	Town of Burns	City of Cheyenne	Town of Pine Bluffs
Comprehensive, Master, or General Plan	X	X		X	
Capital Improvement Program or Plan (CIP)	X			X	
Floodplain Management Plan	X			X	
Stormwater Program / Plan	X			DEQ-SWPPP	
Community Wildfire Protection Plan (CWPP)	X	X		X	X
Erosion / Sediment Control Program	X			DEQ-SWPPP	
Economic Development Plan	X				
Other: Required Permits					
Building Codes (Year)	2021 IBC			2018 (New code in fall)	
Site Plan Review Requirements	X	X			
Other:					
Zoning Ordinance (Land Use)	X			X	
Subdivision Ordinance	X			X	
National Flood Insurance Program (NFIP) Participant	X			X	
Flood Insurance Study / Flood Insurance Rate Map / DFIRM	X			X	
Floodplain Ordinance	X			X	
Elevation Certificates for Floodplain Development	X				

Wyoming Region 7 Hazard Mitigation Plan – 2023 Update (Laramie County)

Mitigation Capability	Laramie County	Town of Albin	Town of Burns	City of Cheyenne	Town of Pine Bluffs
Community Rating System (CRS) Participant	X				
Open Space / Conservation Program	X			X	
Growth Management Ordinance	X				
Stormwater Ordinance	X				
Other Hazard Ordinance (steep slope, wildfire, snow loads, etc.)	X				
Other:					

Administrative and technical capabilities are all vital for a community to be able to implement hazard mitigation. Table 1.4 provides an overview of these capabilities across the county.

Table 1.4 Administrative & Technical Capabilities

Mitigation Capability	Laramie County	Town of Albin	Town of Burns	City of Cheyenne	Town of Pine Bluffs
Planning Commission	X			X	
Mitigation Planning Committee	X	X	X	X	X
Maintenance Programs (tree trimming, clearing drainage, etc.)	X	X	X	X	
Emergency Manager	X	X	X	X	X
Building Official	X			X	
Floodplain Administrator	X			X	
Community Planner	X			X	
Transportation Planner	X			X	
Civil Engineer	X			X	
GIS Capability	X			X	
Other:					
Warning Systems / Services (flood)	X	X	X	X	X
Warning Systems / Services (other / multi hazard)	X	X	X	X	X
Grant Writing / Management	X	X	X	X	X
Other:					

Wyoming Region 7 Hazard Mitigation Plan – 2023 Update (Laramie County)

The ability of a community to implement a comprehensive mitigation strategy is largely dependent on available funding. These related municipal capabilities are outlined in Table 1.5 and show that the county and jurisdictions utilize a number of these financial tools that can support mitigation activities.

Table 1.5 Financial Capabilities

Mitigation Capability	Laramie County	Town of Albin	Town of Burns	City of Cheyenne	Town of Pine Bluffs
Levy for Specific Purposes with Voter Approval	X	X	X	(5 th & 6 th Penny)	X
Utilities Fees	X	X		X	
System Development / Impact Development Fee	X			X	
General Obligation Bonds to Incur Debt	X	X		X	
Special Tax Bonds to Incur Debt	X	X			
Open Space / Conservation Fund					
Stormwater Utility Fees					
Capital Improvement Project Funding	X	X		X	
Community Development Block Grants (CDBG)		X		X	
Other:					

Education and outreach are important capabilities that allow a community to continue the conversation with their public regarding hazard risk and opportunities to mitigate. Table 1.6 shows that communities leverage these capabilities for their public engagement.

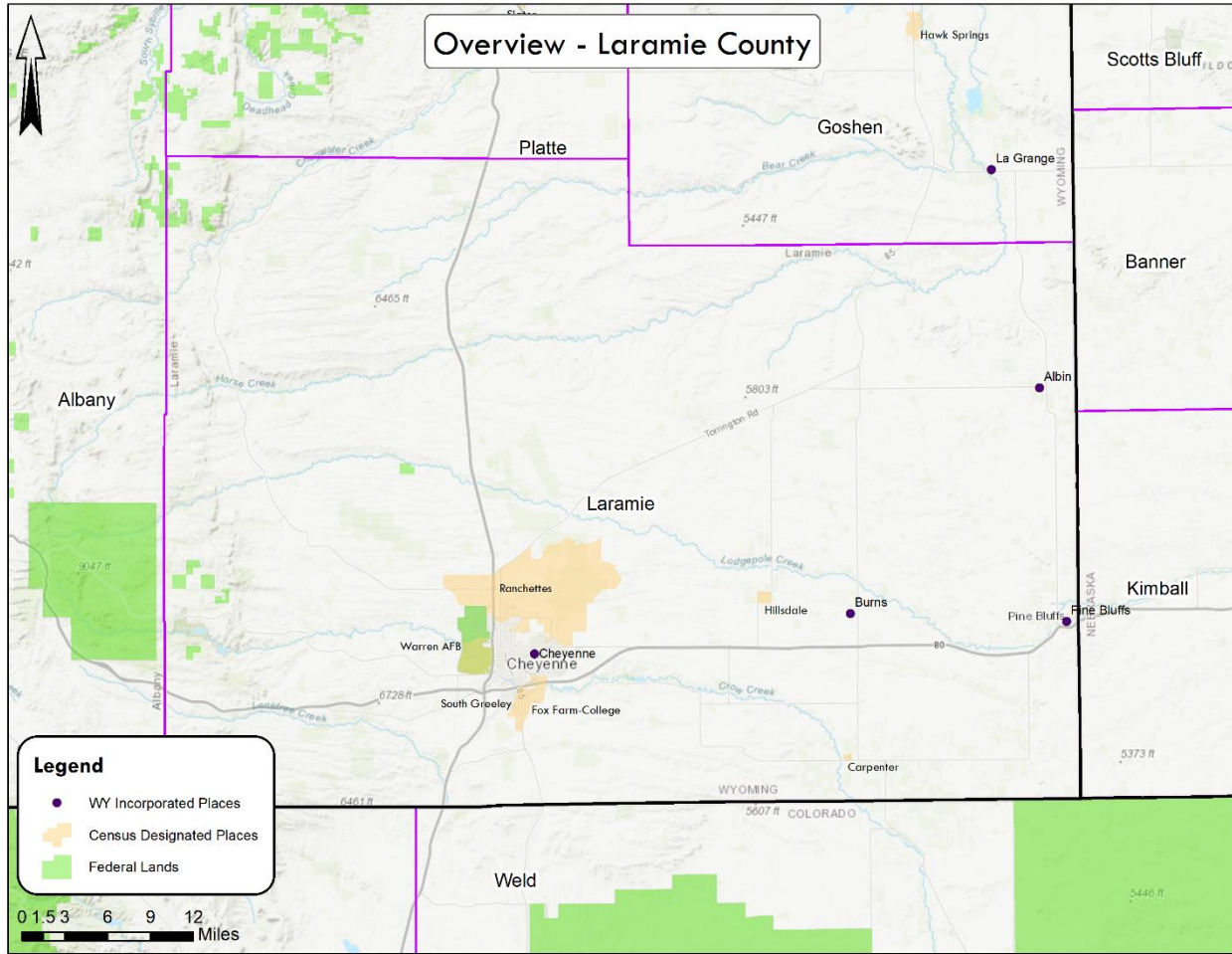
Table 1.6 Education & Outreach Capabilities

Mitigation Capability	Laramie County	Town of Albin	Town of Burns	City of Cheyenne	Town of Pine Bluffs
Public Hazard Education / Outreach Program	X	X		X	X
Local Citizen Groups That Communicate Hazard Risks	X	X		X	X
Firewise	X	X		X	X
StormReady	X	X		X	X
Other:					

2 County Profile

Laramie County is comprised primarily of private land, with approximately 0.9% Federal lands.

Figure 2.1 County Overview



2.1 Population

2.1.1 Projections

According to the 2021 Headwaters Economics Profile, which looks at demographics, economics, and social characteristics of communities, Laramie County grew more than 10% in population between 2010 and 2019. The population of the county, as of the 2020 Census, is 100,512 people.

A 2019 report from the Wyoming Department of Administration & Information, Economic Analysis Division (EAD), shows population projections for all counties and jurisdictions through 2040. The county population projection for 2040 is an almost 12% growth to 112,500 people. Cheyenne will see approximately the same percentage of growth, from the current census of 65,312 people to a projected 72,900. U.S. Census data is not available for the other jurisdictions, as the populations are below the counting threshold of 2,500 people. However, the EAD projected population growth for Albin (11.6%), Burns (11.8%), and Pine Bluffs (11.5%) between 2020 and 2040.

2.1.2 Demographics

The composition of a community is critical information when identifying risks and understanding the demographics creates more holistic planning. Table 2.1 illustrates a high-level overview of some of the characteristics of Laramie County and City of Cheyenne residents. Data for the other municipalities is not available from the U.S. Census Bureau due to collection thresholds.

Table 2.1 is a snapshot of some key demographics in the county and Cheyenne, as well as the state. While most statistics are similar across the board, a demographic to note is the higher percentage of people living in poverty in Cheyenne, 10.4%, than in the county overall, 7.4 %, or in the state, 9.2%. This is an important demographic to be aware of as those with limited financial means are disproportionately affected by disaster. Utilizing data to create an overall understanding of the population and its characteristics is critical to a comprehensive community planning approach, referred to as community inclusion.

Recognition of the differences in demographics across the county allows resources to be directed to the residents with highest need, such as the elderly, children, and those with access and functional needs. Populations vary greatly in communication abilities, financial means to respond on their own, and resource needs.

Table 2.1 Demographic Snapshot

Demographic	Cheyenne	Laramie County	Wyoming
Population (April 2020)	65,132	100,512	576,851
Persons under 5 years of age	6.1%	6.3%	6.0%
Persons under 18 years of age	22.3%	23.0%	23.1%
Persons 65 years of age and older	16.7%	16.5%	17.1%
Persons with a disability, under age 65 years	8.6%	8.9%	8.9%
Persons with a disability	13.4%	12.8%	13.4%
Language other than English spoken at home	5.8%	6.5%	7.4%
Median Household Income	\$64,598	\$66,910	\$64,049
Persons living in poverty	10.4%	7.4%	9.2%

Source: 2019 ACS 5-Year Estimates

2.1.3 Health

Similar to the demographics snapshot, an understanding of the health of communities can inform preparedness and response actions. For example, in Laramie County and Cheyenne, of those who identified as having a disability, the highest percentages of people have ambulatory, hearing, and independent living difficulties. Responders may need training to better assist residents in an event and the public should be educated on what would happen during a potential disaster event, to minimize any additional fears during a stressful situation.

Chronic illness and health condition data may seem unnecessary, but awareness of a community's overall health is important, especially considering potential public health hazards. For example, beyond the risk of pandemics, wildfire smoke can worsen asthma conditions for children and adults, and if sheltering is needed during an event diabetics will likely need insulin provided onsite. Laramie County and Cheyenne have notably higher percentages of those with coronary heart disease than the state, however the majority of other health indicators for the populations align closely to state reporting.

Table 2.2 Health Indicators

Demographic	Cheyenne	Laramie County	Wyoming
Adults with Asthma, over age 18	9%	8.9%	9.2%
Adults with Coronary Heart Disease, over age 18	6.2%	5.5%	3.9%
Adults with Diagnosed Diabetes, over age 18	9.6%	9%	9.1%
Adults with Obesity, over age 18	30.1%	29.9%	30.7%
Disability Type			
Hearing Difficulty	5.1%	5.4%	8.8%
Vision Difficulty	1.8%	1.9%	4.2%
Cognitive Difficulty	4.8%	4.4%	10.1%
Ambulatory Difficulty	6.9%	6.4%	11.3%
Self-care Difficulty	1.7%	1.6%	2.8%
Independent Living Difficulty	5.1%	4.6%	6.2%

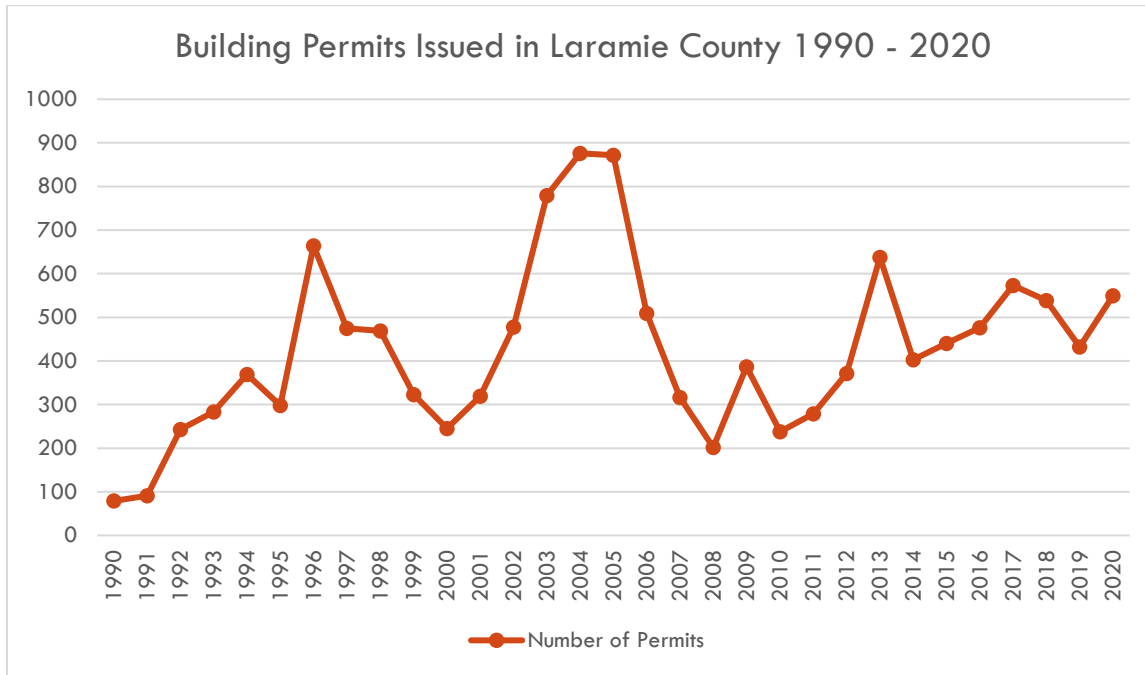
Source: CDC 2018-2021, Behavioral Risk Factor Surveillance System (BRFSS), 2019 American Community Survey (ACS) *Data unavailable

2.2 Development

2.2.1 Land

Laramie County has seen fluctuating periods of growth and development. According to the U.S. Census Bureau between 1990 and 2020, more than 13,000 new private housing structure building permits were issued. The years with the most permits issued were 2004 with 876 and 2005 with 872, while the year with the least number of permits issued was 1990 with 79 permits. Overall, the number of permits issued each year has had a positive trend.

Figure 2.2 Laramie County Building Permits 1990-2020



2.2.2 Economic Overview

According to data from the U.S. Bureau of Economic Analysis, Laramie County's highest gross domestic product since 2000, was in 2019 and was more than \$6.1 billion.

The unemployment rate, as of February 2022, was 3.7%. More than 8,000 jobs were added between 2010 and 2020, a quarter of which are in the finance and insurance sector. Of the almost 70,000 jobs in Laramie County, approximately 37,000 are in the services industry followed by roughly 17,000 in the government sector. The table below shows the industries that hold the highest number of total jobs and the change in growth in number of jobs between 2010 and 2020.

Table 2.3 Top 5 Industries by Number of Jobs

Industry	Number of Jobs (2020)	Change 2010-2020
Government	17,682	1%
Retail Trade	6,387	-4%
Finance and Insurance	5,933	73%
Health Care and Social Assistance	5,280	11%
Construction	4,508	27%

U.S. Department of Commerce. 2021. Bureau of Economic Analysis

3 Hazard Identification and Risk Assessment

3.1 Hazard Ranking

As discussed in Section 3.1.1 in the main body of the HMP, Laramie County conducted a risk ranking exercise. Meeting participants ranked the identified hazards risk to property / environment, people, and the economy, as well as the probability of future damaging events on a scale of high, medium, or low. The table below shows the results of this exercise with a breakdown by community of the perceived level of risk for each identified hazard. It can be seen that Cyber Hazards and Wind scored the highest whereas Landslide and Earthquake scored the lowest.

Table 3.1 Hazard Ranking Exercise Results

Hazard	Laramie County	Albin	Burns	Cheyenne	Pine Bluffs
Cyber Hazards	High	High	Low	Medium	Medium
Dam/Levee Incident	Medium	Medium	Low	Medium	Low
Drought	Medium	Medium	Low	High	High
Earthquake	Low	Low	Low	Low	Low
Flood	Medium	Medium	Low	Medium	Medium
Hail	Medium	Medium	Medium	Medium	Medium
Hazardous Materials	Medium	Medium	Low	Medium	Medium
Landslide	Low	Low	Low	Low	Low
Lightning	Medium	Medium	Low	Low	Medium
Public Health Hazards	Medium	Medium	Low	Low	Medium
Tornado	Medium	Medium	Low	Low	Medium
Wildfire	Medium	Medium	Low	Low	Medium
Wind	High	High	Low	Low	Medium
Winter Storm	Medium	Medium	Low	Low	Medium

The following county-specific hazard profiles each include five subsections that cover; previous occurrences, inventory exposed, potential impacts, probability of future occurrences, and land use and development. The following hazard profiles are specific to Laramie County and their participating communities.

3.2 Lifelines

The Lifelines framework is used in this plan as a base for emergency management planning, preparedness education, and mitigation planning. It is important to consider cascading effects when Lifelines are affected and how those effects will impact the community and other Lifelines. The Lifelines are shown in the following graphic.

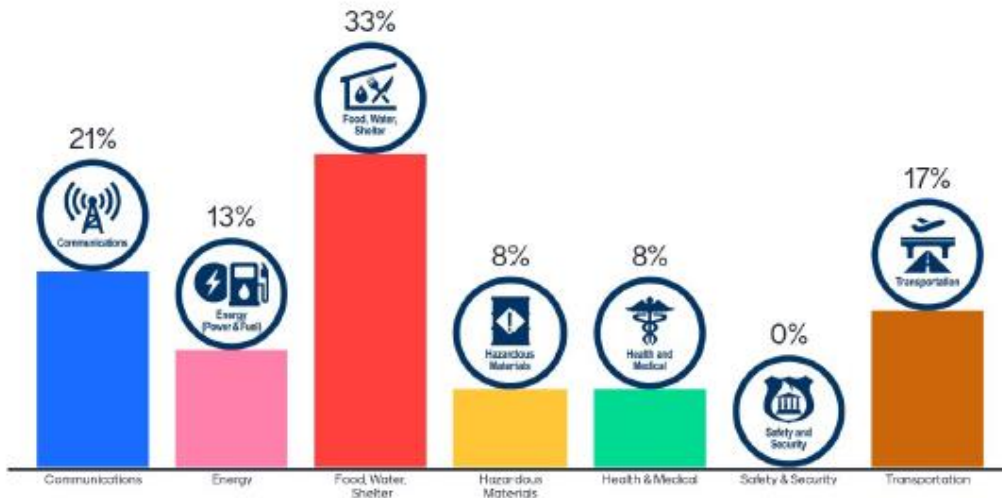


Lifelines are essential to a community's long-term disaster resilience, each one providing diverse critical services and resources. As part of the HMP planning process, the Hazard Mitigation Planning Committee identified Lifelines utilizing the best available data, supplemented by Laramie County geographic information system (GIS) data for the region. Within each hazard profile the specific Lifeline exposure data for Laramie County infrastructure is highlighted, as applicable.

The HMPC was surveyed to determine which Lifelines communities should focus mitigation efforts towards. Figure 3.1 illustrates the results of this poll, showing Food, Water, and Shelter as the priority for mitigation. This is followed by Communications and Transportation.

Figure 3.1 Lifeline Mitigation Efforts

Which Lifelines should your communities focus mitigation efforts towards? (pick 3)



3.3 Hazard Viewers

The rapid evolution of hazards data creates the need for tools which present the most recent data in a useful way. The maps included in this plan are helpful to serve as an overview of the various hazard and risk information, but ultimately are static snapshots of the best available data at the time of this plan's writing. Additionally, the large size of Region 7's counties make it difficult to present many of the maps at a scale useful to the local communities.

With these disclaimers noted and as hazard and risk data is constantly evolving, it is important to utilize the latest and greatest hazard data available. Fortunately, the State of Wyoming and federal government have recently developed a number of hazard data viewers that present much of the same information contained in this plan. When possible, this plan directs readers to these online resources to ensure the most accurate information is being referenced and utilized.

Hazard Data Viewers:

- FEMA's [National Risk Index for Natural Hazards](#)
- FEMA's [Resilience Analysis and Planning Tool](#)
- WY State Geological Survey's [Wyoming Geologic Hazards Map](#)

- WY State Forestry Division's [Wildfire Risk Assessment Portal](#)
- United States Forest Service's [Wildfire Risk to Communities Portal](#)

3.4 Cyber Hazards

3.4.1 Previous Occurrences

In April 2019, Cheyenne Regional Medical Center was compromised through a phishing attack, where a malicious link is used to gain access to a system using unintentionally shared credentials. This phishing attack resulted in a security breach of more than 17,500 patients information. It took eight months, until November 2019, to obtain the list of patient names to notify them of the breach.

According to the 2020 FBI Internet Crime Complaint Center (IC3) crime report, Wyoming residents were victim to more than \$5 million in losses through a variety of cyber crime techniques. The majority of which was lost to victims over the age of 60.

3.4.2 Inventory Exposed

All systems, people, and entities are exposed to cyber hazards, including individuals, small businesses, healthcare facilities, local governments, schools, and large infrastructure. Those perpetrating these attacks are indiscriminate and will take control of whatever they are able to. Those organizations with older technology, hardware or software, and minimal or no information technology (IT) support are especially at risk.

3.4.3 Probability of Future Occurrences

It is possible that Laramie County technology operations may be compromised and community members could fall victims to malicious acts. The majority of technology users, including individuals, businesses, and organizations are using inadequate cyber security and this creates a large pool of potential victims.

3.4.4 Future Development Trends

Cyber hazards are unlikely to affect land use and development.

3.4.5 Climate Change Impacts

Cyber hazards are not likely to be immediately impacted by climate change.

3.5 Dam / Levee Incident

3.5.1 Previous Occurrences

Dam incidents have occurred in the past, in Laramie County, and are detailed below:

- In August 2008, seven miles southeast of Cheyenne, the Hereford Ranch Reservoir No. 2 dam failed due to structural failure. The event did not result in any property damage, but the cost to repair the dam was estimated at \$100,000.
- On May 19, 2010, the Hereford Ranch Reservoir No. 1 failed due to outlet structure and pipe failure. No property damage was recorded for this event.
- According to the Laramie County Flood Insurance Study (2007) these same dams also failed during the 1929 flood. Reservoir No. 1 was subsequently rebuilt and raised during the 1930s.
- On April 30, 1999, waters from Crow Creek overtopped the North Crow Diversion Dam at roughly a foot deep and residents of the Table Mountain development were evacuated. They were allowed to return to their homes the night of May 1, after it became clear the dam was not in danger of failing.

3.5.2 Inventory Exposed

In 1981, the U.S. Army Corps of Engineers (USACE) completed an inspection program for nonfederal dams under the National Dam Inspection Act (P.L. 92-367). This was a four-year work effort and included compiling an inventory of about 50,000 dams and conducting a review of each state's capabilities, practices, and

regulations regarding design, construction, operation, and maintenance of dams. Part of the inspection included evaluating the dams and assigning a hazard potential based on the effects downstream should one of the dams fail. The dams were rated (1) high, (2) significant, and (3) low hazard. The Corps of Engineers based the hazard potential designation on such items as acre-feet capacity of the dam, distance from nearest community downstream, population density of the community, and age of the dam. High hazards dams would, in case of failure of the dam, likely cause loss of life. Significant hazard dams would, in case of failure, likely cause significant property damage, but no loss of life. Failure of a low hazard dam would likely cause only minimal property damage. Hazard potential classification is no guarantee of safety.

The Wyoming State Engineer's Office (SEO) inspects dams more than 20 feet high or with a storage capacity of 50 acre-feet or more, although smaller dams are also regulated if the potential for failure indicates a need. In 2018, the SEO regulated 1,553 dams and of these dams 88 were rated high hazard, 104 were rated significant hazard, and 1,361 were rated low hazard. The SEO inspects these dams once every five years.

According to the National Inventory of Dams maintained by USACE, Laramie County has 38 dams that are regulated by the state, including four high hazard dams and six significant hazard dams

Table 3.2 presents those dam's in the county that have a high or significant hazard ranking. The City of Cheyenne owns all four of the high hazard dams and one of the significant hazard dams. The other significant dams are owned by private entities. The nearest downstream community is also identified, as is the fact that none of these dams currently have Emergency Action Plans (EAPs). Emergency Action Plans are used to create a common understanding of what a response to a dam/levee incident would entail and they are developed by the owner, in collaboration with local response agencies and other key stakeholders.

Table 3.2 High and Significant Hazard Dams in Laramie County

Name	Owner	River	Hazard Class	Nearest Downstream City	Distance to Nearest Downstream City (miles)	E A P
Carey Detention	City of Cheyenne	Dry Creek tributary of Crow Creek	High	Cheyenne	0	Y
Crystal Lake	City of Cheyenne	Middle Crow Creek	High	Cheyenne	25	Y
Granite Springs	City of Cheyenne	Middle Crow Creek	High	Cheyenne	35	Y
Upper Van Tassel (Upper North Crow)	City of Cheyenne	North Crow Creek	High	Cheyenne	46	Y
Lower North Crow	City of Cheyenne	North Fork of Crow Creek	Significant	Cheyenne	20	N
One Mile	Warren Livestock Company	North Lodge Pole Creek Offstream	Significant	U.S. Highway 85	0	N
Polaris	Ron Thiel	Lone Tree Creek Offstream	Significant	Timnath, Colorado	35	N
Swan	Warren Livestock Company	Clear Creek	Significant	Cheyenne	2	N

Name	Owner	River	Hazard Class	Nearest Downstream City	Distance to Nearest Downstream City (miles)	EAP
WY Hereford Ranch No. 1	J. Sloan Hales and Dean Fog	Crow Creek	Significant	Altvan	2	N
WY Hereford Ranch No. 2	Ed Ferguson	Crow Creek	Significant	Hereford, Colorado	20	N

There is one levee in Laramie County, Crow Creek Levee, which is owned by the City of Cheyenne and accredited by FEMA. There is a total of 19 parcels exposed to the Crow Creek Levee inundation area. The total value of these parcels is approximately \$1.4 million. Of the 19 parcels, there are three commercial parcels valued at \$237,000.

Figure 3.2 illustrates where high hazard dams are located in relation to the Laramie County boundary. This map also includes the locations of other, national level inventoried dams. It is important to note that three of the four high hazard dams, as well as two significant hazard dams, in the county are located upstream of the City of Cheyenne.

Figure 3.2 Location of Dams in Laramie County

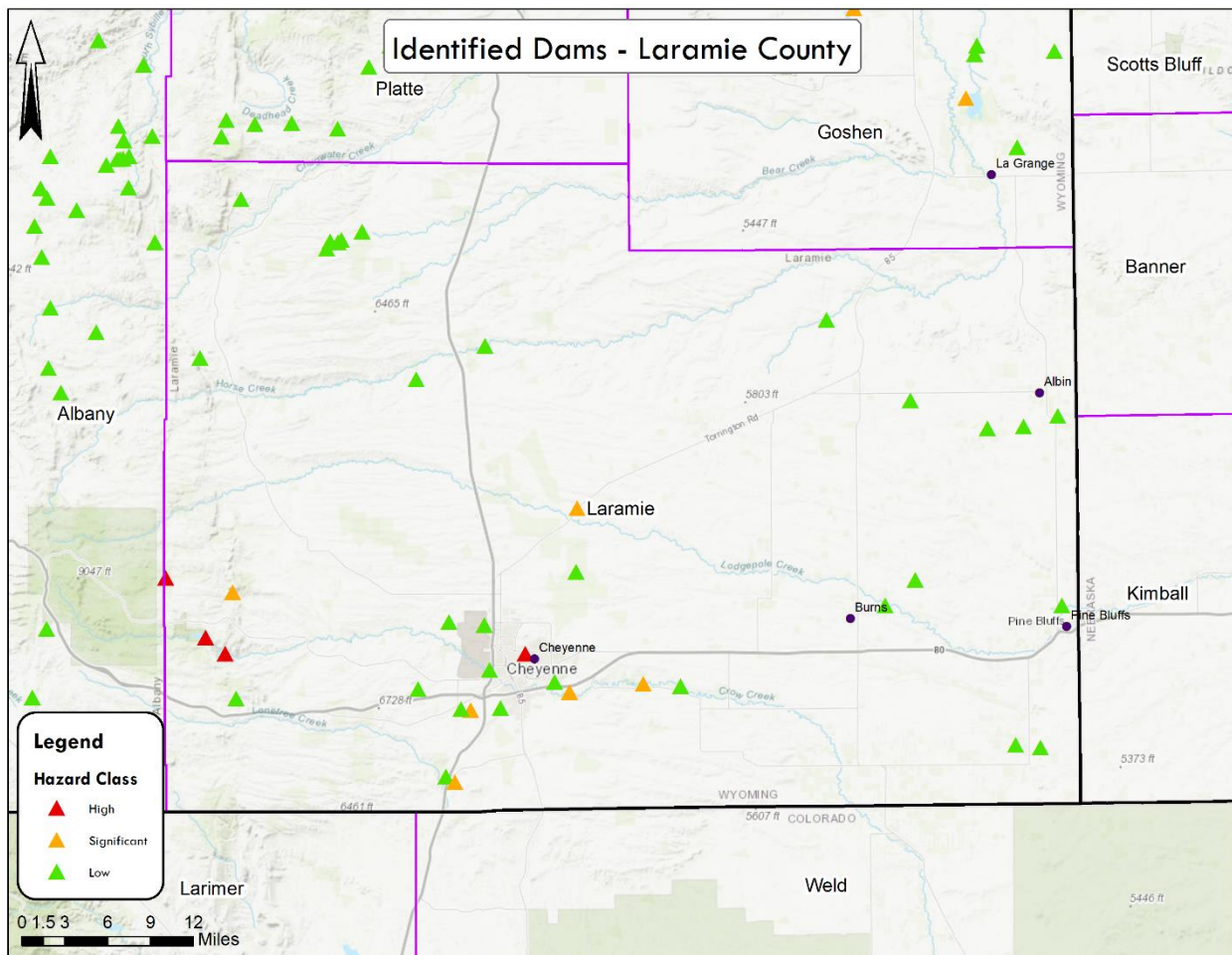


Table 3.3 shows the parcels in Cheyenne and the unincorporated areas of the county with exposure to potential dam inundation areas. More than \$378 million in property (per Wyoming Department of Revenue data) is exposed to the impacts of a dam incident. The majority of properties are residential and located in Cheyenne. The largest number of commercial properties is also within Cheyenne. Although the only agricultural properties exposed to the dam inundation area are located in the unincorporated areas. While the properties are primarily in Cheyenne, the unincorporated areas hold approximately 83% of the total value of property exposed to potential dam inundation areas, but only 9% of the properties are located in the unincorporated areas.

Table 3.3 Parcels Exposed to Potential Dam Inundation Areas

Jurisdiction	Total Count	Residential	Improved Value (\$)	Commercial	Improved Value (\$)	Agricultural	Improved Value (\$)
Cheyenne	503	408	46,322,526	95	17,311,654	-	-
Unincorporated	53	48	314,509,425	2	40,163	3	1,336
County Total	556	456	360,831,951	97	17,351,817	3	1,336

The infrastructure for the energy; food, water, and security; and hazardous materials lifelines are not exposed to dam inundation areas. Other lifelines have minimal exposure of infrastructure, with the largest exposure at 13% for transportation.

Table 3.4 Lifeline Exposure to Dam Inundation Areas

Lifeline	Total Count	Count Exposed	Percent Exposed (%)
Communication	634	11	2 %
Health & Medical	30	2	7 %
Safety & Security	44	1	2 %
Transportation	365	46	13 %

3.5.3 Probability of Future Occurrences

Although the chances of a dam or levee incident are perceived as low, the magnitude of damage could be significant if an incident occurs. The structural integrity of dams and levees depends on regular inspections and maintenance, which do not always happen and could increase the likelihood of an incident. In the past, a number of the dam failures in Wyoming and other Rocky Mountain states have occurred due to snow melt flooding exceeding the capacity and strength of dams. Wyoming's dams and levees will continue to be tested by snow melt, heavy rains, and other types of floods every year. Thus, dam and levee incidents have the potential to threaten Laramie County's communities, especially the City of Cheyenne, in the future.

3.5.4 Future Development Trends

As growth in Laramie County continues there is greater potential for communities located closer to the dam to be unaware of the risk and impacts of a dam incident, as well as uneducated about emergency notifications, such as evacuations if necessary. Communities with higher population densities and large numbers of structures, utilities, and critical facilities, are expected to experience greater damage and loss. As populations expand

and new structures are built, it is important for jurisdictions to enforce building codes and standards that will help prevent future loss should a dam incident event occur.

3.5.5 Climate Change Impacts

The lack of predictability in weather patterns, due to climate change, is a concern in the possibility of future dam incidents. As seasons change rapidly, snow melt flooding can exceed the capacity and strength of dams, as well as increase water levels in waterways testing levees. The expected increased size and intensity of future severe storms pose a risk as well, as prolonged precipitation is a major factor in incidents, especially overtopping and spillway discharges.

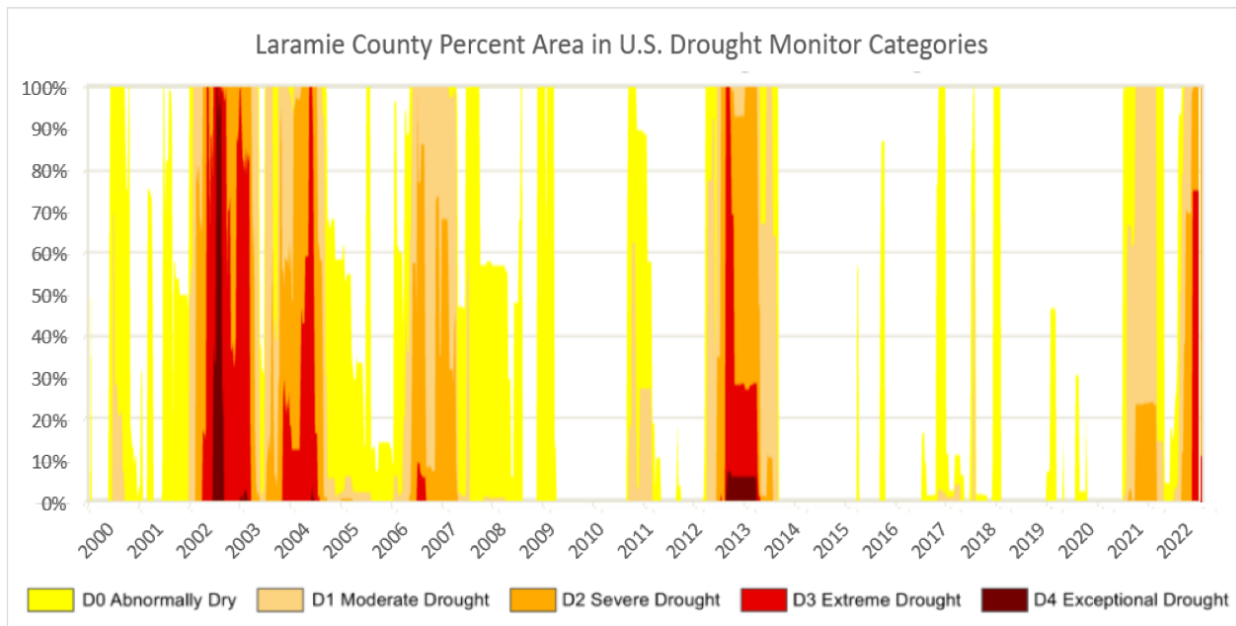
3.6 Drought

3.6.1 Previous Occurrences

Laramie County has experienced several multi-year droughts over the past several decades. Most recently, the county has been included in several regional United States Department of Agriculture (USDA) disaster declarations for droughts and designated as a primary county in declarations in 2007, 2012, 2013, 2020 and most recently in 2021.

Figure 3.3 illustrates drought type, by time and exposure of Laramie County from 2000 to 2021. Based on data from the U.S. Drought Monitor, in 2002 100% of Laramie County was in drought for weeks to months, with a portion of that time being categorized as Exceptional Drought. Another period in 2004 is shown as having 100% of the county in Extreme Drought which is similar to an event in 2012. However, saw approximately 6% of the county experience Exceptional Drought.

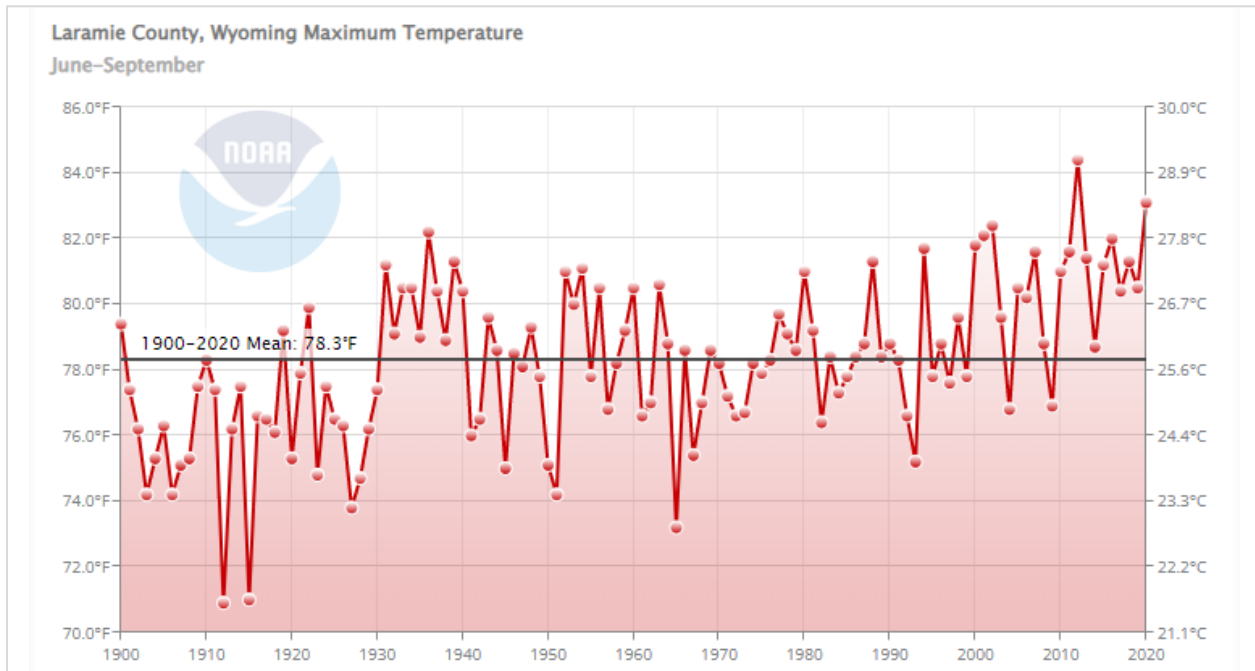
Figure 3.3 Laramie County Percent Area in Drought 2000-2021



Source: U.S. Drought Monitor

High heat and drought often occur simultaneously, and heat can increase the impacts of drought. Figure 3.4 shows the average maximum temperature between June and September from 1900-2020 and illustrates a trend of overall increasing temperatures during that timeframe over recent decades.

Figure 3.4 Average Maximum Temperature between June and September 1900-2020



Source: National Oceanic and Atmospheric Administration (NOAA)

3.6.2 Inventory Exposed

In Laramie County, data from the USDA shows disaster assistance payments have totaled more than \$15.1 million dollars between 1995 and 2020. The majority of this, more than \$8.5 million, were payments issued for livestock disaster assistance, and another \$5.7 million was issued for crop disaster and non-insured assistance. While these numbers seem substantial, it is likely that not all producers took advantage of these programs after a USDA declared disaster and designation for a multitude of reasons. Approximately one third (\$5 million) of the overall total was paid out in 2014 alone, which is reflective of the impact of back-to-back drought declarations, both contiguous and primary, in 2012 and 2013.

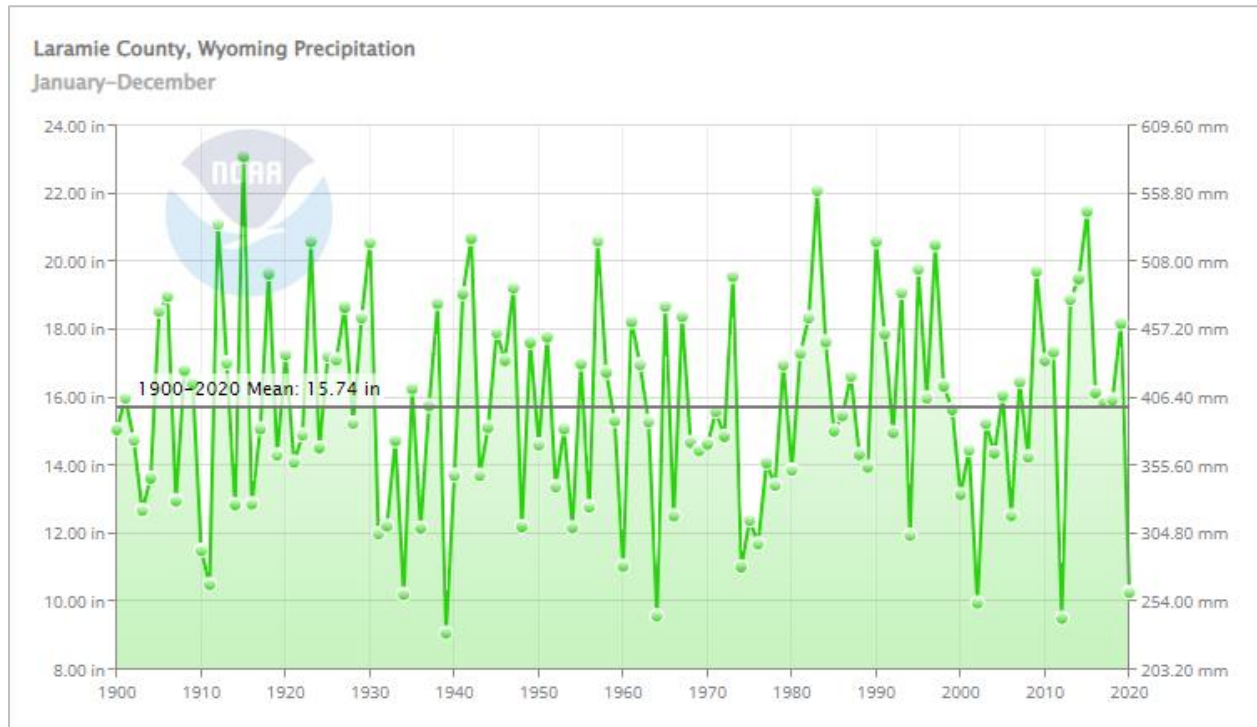
The USDA issues declarations for a number of other disasters and the available data does not distinguish between the cause of declaration for the payments in this time period. However, it is likely that a considerable portion of these payments were necessary due to the effects of multiple drought specific declarations.

From an agricultural perspective all crops, grazing lands, and livestock in the county are exposed to drought. The population and properties of the county are also exposed and the economic impact of drought, rather than any direct impacts, can be difficult for community members to cope with long term.

3.6.3 Probability of Future Occurrences

Drought is difficult to predict, but based on historical records, it is reasonable that Laramie County will be impacted by drought conditions in the future. The county is located in an arid region and based on National Oceanic and Atmospheric Administration (NOAA) data since 1900, shown in Figure 3.5, receives approximately 15.74 inches of precipitation annually. Droughts are typically regional events, impacting multiple counties and states simultaneously. Drought is expected to be a normal occurrence due to the county's natural climate and therefore will likely continue to occur.

Figure 3.5. Average Annual Precipitation 1900-2020



Source: National Oceanic and Atmospheric Administration (NOAA)

3.6.4 Future Development Trends

A community's vulnerability to drought is affected largely by population growth, urbanization, demographic characteristics, technology, water use trends, government policy, social behavior, and environmental awareness. These factors are continually changing, and society's vulnerability to drought may rise or fall in response to these changes. In scenarios where a community's population is increasing or shifting, increased pressure on water and other natural resources can be seen causing a shortage of water availability. Laramie County is expected to experience consistent growth over the next two decades, increasing the risk and impacts of an extended drought period year over year.

Any future growth will greatly impact drought hazards by stressing both surface and ground water resources. Agricultural and industrial water users consume large amounts of water and expansion of existing water services is limited when a drought occurs. In rapidly growing communities, new water and sewer systems or significant well and septic sites could use up more of the available water, particularly during periods of drought. Public water systems are monitored, but individual wells and septic systems are not as strictly regulated.

Related to both current land use and future development trends, the use of turf grass affects the available water supplies. Urban lawn watering is the single largest water demand for many municipal supplies.

Future water use regulations may be able to mitigate this trend. As Laramie County grows, it is recommended that staff revisit existing standards for determining the impacts of drought.

3.6.5 Climate Change Impacts

The presence of droughts across the nation is due to the changing climate, which affects weather patterns and temperature fluctuations. As hotter weather increases in duration and precipitation is less predictable, droughts will likely continue to be a common occurrence, potentially being experienced more regularly.

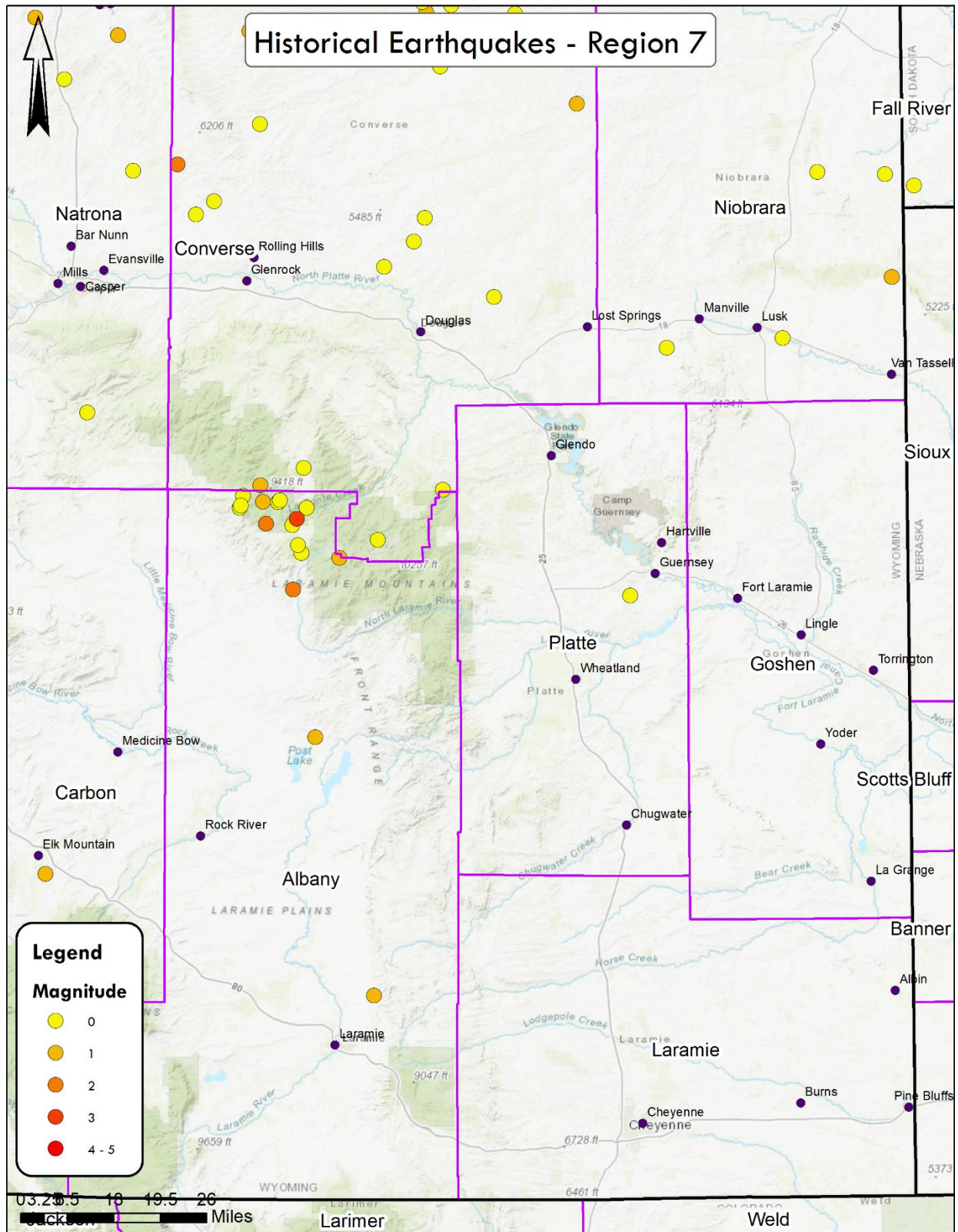
3.7 Earthquake

3.7.1 Previous Occurrences

Historically, earthquakes have occurred across much of Wyoming. The first reported event was in Yellowstone National Park in 1871. Yellowstone National Park is one of the more seismically active areas in the United States but is on the opposite corner of the state from Laramie County. Figure 3.6 shows the location of seismic events identified, with a magnitude of 0 or higher, within Region 7.

It is important to note that while no earthquakes have been recorded in the county, several historical earthquakes epicenters have occurred in neighboring counties

Figure 3.6 Region 7 Historical Earthquake Hazards



3.7.2 Inventory Exposed

For this risk assessment, a 2,500-year, magnitude 5.0 earthquake scenario was modeled in FEMA's Hazus v5.0 software. This scenario was used to represent the "worst case scenario" for the county and loss estimates were gathered through analysis of the modeled earthquake data at the census tract level.

In Laramie County, there are an estimated total of 37,000 buildings, with a total building replacement value of more than \$9.6 billion. This value represents the estimated costs to repair or replace the damage caused to a building and does not include building contents.

The total economic loss estimated for this modeled earthquake event is more than \$131 billion, which includes building and Lifeline related losses. Building-losses include both the direct loss of a building and its contents and business interruption costs. These costs of business interruption are the losses from the inability to operate a business due to earthquake damages.

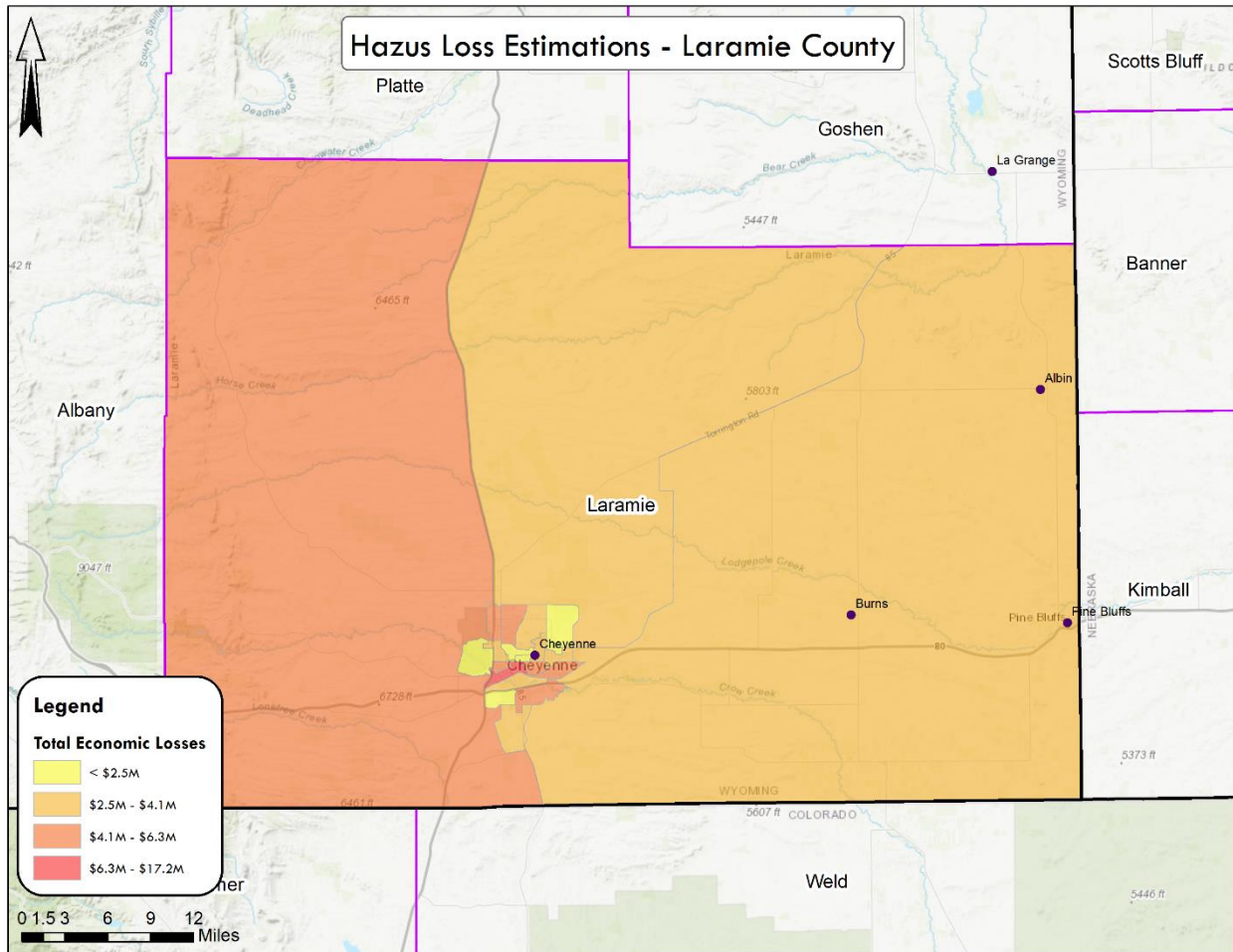
Further notable loss estimations from Hazus include:

- \$ 4.6 billion – Transportation Lifeline system replacement value, 251 bridges and 265 miles of highway
- \$ 2.7 billion – Utility Lifeline system replacement value, 13,000 miles of pipeline (water, wastewater, natural gas, oil systems, electrical power, communications)
- 27 – Utilities Lifeline system pipeline breaks
- \$92 million – estimated total building-related losses, including business interruption which makes up 20% of the total building related losses
- 56% – percent of total build-related losses that were residential properties
- 1,054 – buildings at least moderately damaged, 2 buildings estimated to be damaged beyond repair
- 98% – percent of essential facilities operational by 30 days after incident (hospitals, police and fire stations, EOC, and schools)

Figure 3.7 illustrates the breakdown of Hazus economic loss estimation by census tract.

For more detailed information from the Hazus scenario model, see the [Earthquake Hazus Risk Report](#).

Figure 3.7 Hazus Loss Estimations



3.7.3 Probability of Future Occurrences

The likelihood of a future occurrence of an earthquake is very low, but not impossible. Since the historic record is limited, it is not feasible to determine when a 2,500-year event last occurred in the county. This type of event was used for loss estimation analysis because of the uncertainty involved and based upon the fact that the International Building Code utilizes 2,500-year events for building design. This conservative approach is in the interest of public safety.

3.7.4 Future Development Trends

While Laramie County is seeing steady growth, the risk and impacts of an earthquake are still prevalent to existing infrastructure, as well as new development. With the unpredictable nature of earthquake epicenter locations, there is potential for significant structural damage to occur anywhere in the county. Due to the nature of earthquake hazards, communities in the county with higher population densities and larger numbers of structures and critical facilities are expected to experience greater damage and loss from an earthquake event. If population and development should occur, continued enforcement of the unified construction code has great potential to mitigate increasing vulnerability and development pressure.

3.7.5 Climate Change Impacts

There is no evidence currently that climate change will influence earthquake activity.

3.8 Flood

3.8.1 Previous Occurrences

The Spatial Hazard Events and Losses Database for the United States (SHELDUS) data between 1966 and 2019 shows 13 flood events, totaling approximately \$78.9 million in property damages and more than \$100,000 in crop damages. One event in 1985 accounts for roughly \$78.2 million of the total property damages, resulted in 35 injuries, and 6 deaths. This event is cross-listed with the Hail hazard and it is an important example of damage reporting redundancies in which multiple hazards contribute to the total damage figures.

Table 3.5 Flood Damages - SHELDUS 1966-2019 (2019 USD)

Year	Property Damage (\$)	Crop Damage (\$)	Injuries	Deaths
1966	86,941	0	0	0
1970	417,452	0	0	0
1983	43,366	434	0	0
1984	104	103,928	0	0
1985*	78,276,214	0	35	6
1990	991	0	0	0
1996	82,586	0	0	0
1997	1,615	0	0	0
1999	15,555	0	0	0
2000	30,099	0	0	0
2006	25,710	0	0	0
2007	2,500	0	0	0
2010	8,201	0	0	0
TOTAL	78,991,334	104,362	35	6

*Data cross-listed with Hail Hazard

Past flood events in Laramie County indicate that many of the most damaging floods have occurred on Dry Creek and Crow Creek.

While the City of Cheyenne has suffered the most damage, major flood events have also struck Albin, Meriden, Pine Bluffs, Carpenter, and unincorporated parts of the county.

Laramie County has an extensive flood history with recorded floods dating back to the 1880s. Most of these floods were attributed to severe localized thunderstorms that typically occurred between late spring and the fall. Many of these floods caused extensive damage due to a combination of significant development in the floodplain, and poor drainage. Damages were most often related to flooded basements and washed out roads, bridges, or railroads.

The flood on August 1, 1985, is considered to be the flood of record for Laramie County. This flood, which occurred along Crow Creek, is estimated to have had a peak flow rate of 8,000 cubic feet per second (cfs). The recurrence interval for that magnitude of discharge on Crow Creek is roughly 0.2 percent annual chance; in other words, this was a 500-year flood. The 1985 flood caused widespread damage, dozens of injuries, and several deaths. This was the costliest flood in Laramie County's history, not only in terms of property damage, but also regarding human life and safety.

Table 3.6 summarizes several of the most severe floods in Cheyenne. Three of these floods are described as being similar in magnitude to the 1985 event, showing that devastating floods are not atypical in the Cheyenne area. High magnitude flood events generally occur in the summer months and are caused by intense localized rainstorms. Flash floods and urban small stream floods are the most common types of floods. Table 3.7 shows county flood events and the data for both was obtained from the NCEI Storm Database.

When reviewing data and narratives of weather events, including flooding, it should be kept in mind that no central reporting location exists for event details. In some cases, databases may have differing details regarding an event or an event narrative is based on firsthand experience without confirmation of details. However, presenting the best available data allows for a holistic understanding of the impacts of an event.

Table 3.6 City of Cheyenne Flood History

Date	Event Details
1883	Significant flood along Crow Creek.
July 15, 1896	Precipitation of 4.7 inches in 3 hours and 4.86 inches in 24 hours produced significant flood along Crow Creek.
May 20, 1904	The night of May 19 th precipitation of 0.63 inches was recorded. On the 20 th , 1.10 inches of rain and hail fell in 1 hour. Precipitation was likely more intense along the upstream reach of Crow Creek. Maximum discharge was estimated to be 8,500 cubic feet per second (CFS).
1918	Large flood occurred along downstream reaches of Dry Creek, approximately the same magnitude as the August 1, 1985, flood event.
June 14, 1926	Severe hail storm lasting from 10:20pm to 11:05pm concentrated in a 1 - by 6-mile area and produced 2.51 inches of precipitation.
April 23, 1929	Storm produced 3.20 inches of precipitation in a 24 hour period.
1929	Large flood event along Dry Creek.
June 2, 1929	Flood in Crow Creek was caused by precipitation near the headwaters west of town, where the ground was already saturated and tributaries were full from melting snow. Maximum discharge was estimated to be 8,200 cubic feet per second.
June 1935	Large flood event along downstream reaches of Dry Creek, approximately the same magnitude at the August 1, 1985, event. Precipitation was greatest in the Roundtop area at the headwaters of Dry Creek. Flooding also occurred along Crow Creek.
August 1946	Severe storm produced 1 inch of precipitation in 10 minutes caused flooding along Dry Creek.
June 1955	Intense rains occurred in the afternoon of June 14 th and continued into the next day producing 2.68 inches of precipitation. This produced a large flood along the downstream reaches of Dry Creek at approximately the same magnitude as the August 1, 1985, flood.
1972	Flood occurred along the downstream reaches of Dry Creek. Water surface elevations were slightly lower than those for the 1955 flood event.
August 1985	On August 1 st , intense thunderstorm produced 7 inches of precipitation in the downtown area between 6:20pm and 9:45pm. The storm was accompanied by hail, drifting up to 3 feet in areas. A new 24-hour Wyoming rainfall record was set. Flooding occurred along Dry Creek, Crow Creek, and their tributaries in the City of Cheyenne.
August 29, 1996	Heavy rainfall from thunderstorms caused flooding in and near Cheyenne. Some roads had up to a foot of water on them and some intersections were closed. Basements in the north part of town were flooded. The storm caused \$30,000 in property damage.
August 15, 2000	Heavy rains fell west of Cheyenne, with estimates of 4 to 6 inches over an area southwest of Federal, WY. Some flooding was reported on Happy Jack Road, with parts of county road 109 washed out. This storm caused \$20,000 in property damage.

Date	Event Details
July 1, 2006	A thunderstorm produced very heavy rain over far western Laramie county. Floodwaters produced severe wash-away damage to county roads 110 and 110-A near Happy Jack Road with water reported to have flowed almost a foot deep over Happy Jack Road. This storm caused \$20,000 in property damage.

Table 3.7 Laramie County Flood History

Location	Start Date	Information
Cheyenne, Crow Creek, Dry Creek	July 15, 1896	Heavy rain (4.78 inches in 3 hours) caused flooding resulting in extensive damage to buildings, transportation facilities, and utilities.
Cheyenne, Crow Creek	May 20, 1904	A 500-year flood from heavy rain created a 20-25 foot wall of water down Crow Creek. Damage to buildings, transportation facilities, utilities, bridges and houses washed from foundations; large numbers of people caught in houses. There were 1.10 inches of rain in one hour and estimated discharge of 7,000 CFS. Two children killed.
Cheyenne, Crow Creek	April 23, 1929	A 500-year flood was caused by heavy rain producing 3.20 inches in 24 hours. The flood damaged buildings, transportation facilities, and utilities. The event resulted in one death. Crow Creek had a discharge of 8,000 CFS.
Cheyenne, Crow Creek	June 1, 1929	Flooding was produced by showers near headwaters, ground saturation, and tributaries full of melting snow. Flooding was also caused by rainfall combined with snowmelt runoff (Wyoming Floods and Droughts, National Weather Summary 1988-89). The flooding led to bridges, dams, highways, crops, and railroads being damaged at a cost of an estimated \$500,000. There was one death because the individual did not hear warnings to evacuate the area. According to FEMA Flood Insurance Study for March 2, 1994, it was a 500-year flood and Crow Creek had a discharge of 8,000 CFS.
Dry Creek Basin	August 26, 1949	A severe storm producing 1 inch of rain in 10 minutes led to widespread street and basement flooding at an estimated cost of \$100,000.
Cheyenne, Dry Creek, Crow Creek	June 15, 1955	Heavy rain causing flooding washed out railroad tracks, flooded parts of the city, basements, streets crumbled, estimated cost \$105,000 according to WEMA, Laramie Boomerang, and NOAA. Also, according to these agencies 2.4 inches of rain fell during the storm. According to FEMA Flood Insurance Study March 2, 1994, Dry Creek had a discharge of 5,800 CFS. \$105,000 property damage reported.
Cheyenne	July 22, 1966	Heavy rains up to 2 inches with hail measuring up to ¾ inch caused flash flooding. Damage mostly in the central and eastern portion of Cheyenne. \$22,500 in property damage reported
Meriden	August 9, 1966	Heavy rain with some small hail damaged crops and flash flooding destroyed small bridges. \$22,500 in property damage reported
Cheyenne	July 19, 1973	On the 19 th , Cheyenne and part of Laramie County received heavy rains which resulted in swollen creeks and flooded basements. For Cheyenne, it was the second greatest 24-hour rainfall on record and totaled 3.42 inches. The rains occurred over much of the state but seemed heaviest over the southeast corner. \$2,250 in property damage reported
Cheyenne	September 8, 1973	A nearly 3 inch downpour of rain with small hail caused flash flooding mainly in downtown Cheyenne. Hail caused damage to trees, shrubs, and flowers. \$225,000 in property damage reported

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Location	Start Date	Information
Cheyenne	May 23, 1982	Brief heavy rains from 1.43 inches at the weather office to 2.8 inches on the east side of the city and soft hail caused local flooding and evacuation of several homes. \$22,500 in property damage reported
Cheyenne, Crow Creek	July 22, 1983	Heavy rain amounting to 3 inches caused a flood where a mobile home park was evacuated and ranches, bridges, roads, and an irrigation system had damage. Estimated damage to bridges was \$25,000. The flooding made a new channel and basements flooded.
Albin	July 31, 1985	Five inches of rain and marble sized hail fell at Albin. Basements were flooded and there was extensive flooding of low-lying areas. Estimated property damage of \$225,000.
Cheyenne, Crow Creek, Dry Creek	August 1, 1985	A nearly stationary severe thunderstorm, or storms, produced the most damaging flash flood on record in Cheyenne and the State of Wyoming. 12 people lost their lives, 70 were injured, and damage to homes, cars, and businesses were estimated at \$65 million, \$61.1 million (Wyoming Floods and Droughts, National Weather Summary, 1988-89), and \$40 million (WEMA). At the NWS Forecast Office near the airport, 6.06 inches of rain fell in just over 3 hours. Three and a half inches fell in just one hour. Elsewhere in and around Cheyenne, rainfall from the storm totaled between 2 and 6 inches. Around 1900 MST cars and trucks were reported floating down Dry Creek in northwest Cheyenne. By 1930 MST, in addition to blinding rain, hail up to 2 inches in diameter and winds up to 70 mph were occurring in the Cheyenne area. Flood waters in the city were at their height from 1900 to 2200 MST. Dry Creek became a raging torrent through north Cheyenne.
25 W Cheyenne	May 17, 1987	A thunderstorm developed over the west section of Laramie County during the morning of the 17 th of May. This thunderstorm marched through Laramie County with locally heavy rain and hail. Rains of over an inch were reported west and north of Cheyenne with 0.82 inches of rain reported at the Cheyenne airport. Water got as deep as 3 to 4 feet in areas of Cheyenne. This flooded some parked cars and made a few roads temporarily impassible. Numerous reports of 0.25 to 0.75 inch diameter hail were noted around Cheyenne. Drifts of hail 6 to 8 inches deep were observed about 1.5 miles north of the airport.
Pine Bluffs	July 29, 1990	A thunderstorm produced 3 to 4 inches of rain in the Pine Bluffs area. Minor flooding of streets occurred in the city, with some basements flooded. \$2,250 in property damage reported
Near Cheyenne	July 12, 1991	Heavy rains with thunderstorms brought 1.70 inches of rain 4 miles west of Cheyenne and 1.95 inches of rain 3 miles north of the airport. Street and some basement flooding was reported in Cheyenne.
3 W Cheyenne	July 22, 1991	A thunderstorm brought 0.56 inches of rain in 45 minutes with some street and basement flooding.
Cheyenne Airport	August 13, 1994	A thunderstorm moved north out of Colorado into southwest Laramie County. This storm produced flash flooding in a few small streams in extreme southwest Laramie County, washing out a couple of roads. Rainfall totaled 3.26 inches in an hour and 0.65 inches in 10 minutes. \$20,000 in crop damage reported.
Cheyenne	July 31, 1996	Heavy rain caused by thunderstorms caused urban flooding in Cheyenne. \$10,000 in property damage reported.
8 NE Cheyenne	August 15, 1996	Heavy rainfall from thunderstorms caused some flooding of creeks in the area. \$10,000 in property damage reported.
Cheyenne	August 29, 1996	30kp Heavy rainfall from thunderstorms caused flooding in and near Cheyenne. Some roads had up to a foot of water on them and some intersections were closed for a time. Some basements in the north part of town became flooded.

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Location	Start Date	Information
Cheyenne	August 16, 1997	Two to three feet of water flooded intersections in southern Cheyenne. \$1,000 in property damage reported.
9 ESE Cheyenne to 12 SE Cheyenne	July 9, 1998	A thunderstorm produced rainfall amounts of up to 3.5 inches 9 miles east of Cheyenne. Water was flowing over Campstool Road, which runs along Crow Creek.
West Portion of Laramie County	August 15, 2000	Heavy rains fell over parts of western Laramie County west of Cheyenne, with estimates of 4 to 6 inches over an area southwest of Federal. Flooding was reported on Happy Jack Road, with parts of County Road 109 washed out. \$20,000 in property damage reported.
Laramie	June 30, 2004	Heavy rain fell over Orchard Valley resulting in flooding of low-lying areas. U.S. Highway 85 was closed for a time just south of Cheyenne, WY due to flooding.
Carpenter	June 3, 2005	Water up to a foot deep covered roads in and near Carpenter, WY.
Cheyenne	July 1, 2006	A thunderstorm produced very heavy rain over far western Laramie county. Floodwaters produced severe wash-away damage to county roads 110 and 110-A near Happy Jack Road with water reported to have flowed almost a foot deep over Happy Jack Road. \$20,000 in property damage reported.
Cheyenne	July 2, 2006	Heavy rain resulted in water flowing 12 feet wide and 1 foot deep over County Road 128.
Cheyenne	July 3, 2006	A large, slow moving thunderstorm moved over western and central Laramie county and produced significant flash flooding. Cheyenne recorded nearly 2 inches of rain resulting in widespread street flooding, and flooded the hospital emergency room parking lot. Dry creek was reported flowing over its banks at Dell Range Blvd and Prairie Rd.
Cheyenne	July 12, 2006	Strong to severe thunderstorms produced some hail and flash flooding over southern Platte and western Laramie counties. County road 109 washed out in 2 places with up to a foot of water across the road. 2kp
Cheyenne	July 26, 2006	A slow moving thunderstorm produced very heavy rains over parts of Cheyenne, resulting in some flash flooding of streets and drainages.
Carpenter	July 27, 2007	Slow moving thunderstorms produced very heavy rain which produced some flash flooding in and near Carpenter. Flooding in Carpenter and along parts of Cottonwood Creek with some county roads flooded.
Pine Bluffs	August 3, 2007	Heavy rains produced flash flooding in Pine Bluffs, WY. Market Street was closed for a time with 3.10 inches of rain reported.
Cheyenne	August 17, 2007	Heavy rain produced minor flooding on US Highway 85, mile marker 26.
Cheyenne	August 22, 2007	Upslope flow behind a cold front produced strong to severe thunderstorms over parts of southeast Wyoming. Large hail, strong winds, and some minor flooding was reported. Some flooding reported on streets, lawns and sidewalks at 17th and Logan Avenue.
Pine Bluffs	May 18, 2010	Southeast low level wind flow increased ahead of a low pressure system over northern Colorado the afternoon of May 18, 2010. A strong low level southeast jet combined with dynamics of the low to create a favorable environment for severe thunderstorms. By midafternoon thunderstorms over northern Colorado began to rotate, producing a tornado just south of the Wyoming state line south of Cheyenne. Severe thunderstorms continued into the evening hours of the 18th producing severe weather across the Nebraska panhandle and extreme southeast Wyoming. Flash flooding of low lying areas. 1.53 inches total rainfall. \$300 in property damage reported.

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Location	Start Date	Information
Burns	May 18, 2010	Southeast low level wind flow increased ahead of a low pressure system over northern Colorado the afternoon of May 18, 2010. A strong low level southeast jet combined with dynamics of the low to create a favorable environment for severe thunderstorms. By midafternoon thunderstorms over northern Colorado began to rotate, producing a tornado just south of the Wyoming state line south of Cheyenne. Severe thunderstorms continued into the evening hours of the 18th producing severe weather across the Nebraska panhandle and extreme southeast Wyoming. Flash flooding reported by spotter at Burns exit off of Interstate 80. \$5,000 in property damage reported
Carpenter	May 18, 2010	Southeast low level wind flow increased ahead of a low pressure system over northern Colorado the afternoon of May 18, 2010. A strong low level southeast jet combined with dynamics of the low to create a favorable environment for severe thunderstorms. By midafternoon thunderstorms over northern Colorado began to rotate, producing a tornado just south of the Wyoming state line south of Cheyenne. Severe thunderstorms continued into the evening hours of the 18th producing severe weather across the Nebraska panhandle and extreme southeast Wyoming. Heavy rain lasted 45 minutes. Total of 1.19 inches of rain fell in 45 minutes. \$500 in property damage reported
Cheyenne	May 18, 2010	Southeast low level wind flow increased ahead of a low pressure system over northern Colorado on May 18, 2010. A strong low level southeast jet combined with dynamics of the low to create a favorable environment for severe thunderstorms. By midafternoon thunderstorms over northern Colorado began to rotate, producing a tornado just south of the Wyoming state line south of Cheyenne. Severe thunderstorms continued into the evening hours of the 18th producing severe weather across the Nebraska panhandle and extreme southeast Wyoming. Flooding on access roads between Archer and Hillsdale at exits 370 and 377 of Interstate 80. \$1,000 in property damage reported.
Cheyenne	June 19, 2011	Thunderstorm with heavy rain caused flash flooding across Laramie County. Flooding was reported at the Ames Underpass, the 2200 block of E 16th Street and Hynds Blvd and 2nd Ave. The Murdoch's parking lot along E Lincolnway was flooded. The public reported basement flooding in northwest Cheyenne.
Cheyenne	July 12, 2011	Intense afternoon and evening thunderstorms produced numerous reports of large hail and flash flooding throughout Laramie County in southeast Wyoming. Six inches of water flowing over the intersection of 19th Street and Carey Avenue in Cheyenne.
Cheyenne Airport/ Archer/ Hillsdale/ Carpenter	July 12, 2011	Intense afternoon and evening thunderstorms produced numerous reports of large hail and flash flooding throughout Laramie County. Swiftly moving water was flowing over the intersection of Pershing and Evans Avenue. Water was flowing over Whitney Road approximately 6 to 8 inches deep and 15 feet wide. Flooding over the access road between Interstate 80 mile markers 380 and 381, as well as the intersection of Highway 142 and the access road. About six inches of swiftly flowing water over Carpenter Road from flooding in nearby farm fields.
Archer	July 14, 2011	Afternoon and early evening thunderstorms produced hail the size of quarters over the county. Flash flooding was observed just northeast of Cheyenne. Street flooding with 1.25 inches of rain in 30 minutes.
Albin	July 14, 2011	Afternoon and early evening thunderstorms produced hail to the size of quarters over Laramie County. Flash flooding was observed just northeast of Cheyenne. More than six inches of water was observed over Highway 215 between County Roads 222 and 223.
Orchard Valley	July 24, 2011	Late afternoon and early evening thunderstorms produced numerous reports of large hail, as well as isolated strong winds and flash flooding across extreme

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Location	Start Date	Information
		southeast Wyoming. One lane was closed due to high water along South Greeley Highway and Williams Road.
Cheyenne Airport	August 3, 2011	Strong, slow moving thunderstorms produced one to three inches of rain within a two-hour period during the late afternoon, resulting in flash flooding on the north side of Cheyenne.
Cheyenne Airport	June 6, 2012	Afternoon and evening thunderstorms produced hail and heavy rain in portions of southeast Wyoming, with Laramie County receiving the brunt of the severe weather. WYDOT officials closed U.S. Highway 85 from north of Cheyenne to the Goshen County line due to high water.
Little Bear	July 24, 2013	Afternoon and early evening thunderstorms produced large hail, strong winds and very heavy rainfall over much of southeast Wyoming. Flash flooding was observed north of Cheyenne. Several county roads, including Iron Mountain Road, were washed out. Railroad workers were stranded on the tracks. Chugwater Creek overflowed its banks.
Cheyenne Airport	September 13, 2013	Heavy rainfall from thunderstorms caused flash flooding over parts of the southern Laramie Range foothills west of Cheyenne. Two to four inches of rain in a two-hour period caused flash flooding west of Cheyenne and Warren AFB. Roads that were impassable from high water included Roundtop, Otto and Happy Jack. There was considerable ponding of water on Interstate 80 between mile markers 348 and 358.
Archer	September 14, 2013	Two to three inches of rain in a two-hour period resulted in flash flooding across north and northeast Cheyenne. Several roads and intersections were flooded. Flash flooding was reported on portions of Christiansen Road, Gardenia Road, Powderhouse Road and Legacy Parkway. Mylar and Smalley Parks in Cheyenne were flooded. Dry Creek overran its banks flooding a greenway.
Skyview Airpark	September 14, 2013	Two to three inches of rain in a two-hour period resulted in flash flooding across north and northeast Cheyenne. Several roads and intersections were flooded. Dry Creek overflowed its banks. U.S. Highway 85 was flooded from County Road 227 to 149.
Pine Bluffs	May 26, 2014	Intense slow moving thunderstorms produced two to three inches of rain in less than two hours. The torrential rainfall resulted in flash flooding near Pine Bluffs. Flash flooding was observed along Chivington Draw northwest of Pine Bluffs. Water was running over the Pine Bluffs-Albin Road bridge.
Carpenter	June 8, 2014	Slow moving thunderstorms produced torrential rainfall that led to flash flooding in eastern Laramie County. A EF0 tornado was reported east of Carpenter. Water six to 12 inches deep was running over County Roads 156 and 203 eight to nine miles east of Carpenter.
Pine Bluffs	June 8, 2014	Slow moving thunderstorms produced torrential rainfall that led to flash flooding in eastern Laramie County. A EF0 tornado was reported east of Carpenter. Up to five inches of rain in an area three miles northwest to five miles north of Pine Bluffs caused flash flooding. Water a foot deep and 30 yards wide flowed across the 1600 block of County Road 215.
Gun Barrel	June 27, 2014	Thunderstorms produced large hail and locally heavy rainfall over portions of Laramie County. Three to four inches of rain in less than two hours resulted in flash flooding over a two square mile area including Gun Barrel. Water over six inches deep covered U.S. Highway 85 and County Road 213.
Cheyenne	July 13, 2014	Thunderstorms produced several reports of large hail, strong winds, a tornado and very heavy rainfall across portions of southeast Wyoming. One to two inches of rain in less than 30 minutes resulted in numerous reports of flash flooding in and around Cheyenne. Water was 6 to 12 inches high in many areas. Dry Creek was bankfull.

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Location	Start Date	Information
Federal	July 5, 2015	Afternoon thunderstorms in western Laramie County produced up to four inches of rain in less than two hours. Flash flooding occurred a few miles south and southwest of Federal. Flash flooding was reported between Federal and Spring Creek ranches. Highway 109 North near North Table Mountain Loop was covered by six inches of water.
Albin	July 21, 2015	Four to six inches of rain in three hours caused flash flooding in extreme northeast Laramie County. Torrential rainfall from thunderstorms produced up to six inches of rain in three hours, resulting in flash flooding. County Road 162 and Highway 216 were closed by high water. Highway 216 was closed between Albin and Pine Bluffs with a foot of water over the highway. Several roads in and surrounding Albin were closed.
Cheyenne Airport	June 12, 2016	Thunderstorms produced very large hail, damaging winds and torrential rainfall across portions of south central and southeast Wyoming. Flash flooding was reported in and around Torrington and Cheyenne. Flash flooding was reported in Cheyenne and East Cheyenne. Several city streets were flooding with two to three feet of water, including East Lincolnway and Pershing. Several cars were stranded and garbage cans floated down residential streets.
Pine Bluffs	July 1, 2016	Thunderstorms produced damaging winds in eastern Converse County and flash flooding in parts of Goshen and Laramie counties. At least six inches of rapidly flowing water closed several county roads south of Pine Bluffs, as well as some streets in Pine Bluffs.
Pine Bluffs	July 27, 2016	Thunderstorms produced large to very large hail and damaging winds across portions of southeast Wyoming. Golf ball size hail driven straight-line winds estimated as high as 90 mph caused extensive damage to homes and businesses at Pine Bluffs. Many trees and power lines were toppled throughout the town. Clogged drains from hail and stripped leaves with torrential rainfall flooded many roads and intersections in town. Two to four inches of rain combined with extensive hail drifts and clogged drains from stripped leaves caused flash flooding throughout Pine Bluffs. Many streets were inundated by one to two feet of water.

Other sources of flood events within the county can be used to create the most comprehensive record possible. Table 3.8 shows flood event details obtained from unpublished reports from the Wyoming Office of Homeland Security, newspaper accounts, and periodicals from public libraries.

Table 3.8 Additional Notable Flood Events

Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Crow Creek, Cheyenne	6/1/1929	1	0	\$500,000	-
The flooding was caused by a combination of rain showers, ground saturation, and snowmelt runoff. Bridges, roads, dams, crops, and railroads were damaged by floodwaters. FEMA estimated that this was a 0.2% annual chance flood, also known as the 500-year event. The 1929 flood is believed to be one of the most significant floods in Laramie County's history.					
Cheyenne	8/26/1946	0	0	\$100,000	-
A severe thunderstorm flooded Cheyenne. Damaging basements and low-elevation apartments resulted in an estimated \$100,000 in property damages.					

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Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Dry Creek Basin	8/26/1949	0	0	\$100,000	-
A severe storm produced one inch of rain in a mere 10 minutes, flooding streets and basements.					
Northern Larimer County	6/26/1955	0	0	\$0	\$100,000
A flood \$100,000 in crop damage in northern Laramie County, roughly 18 miles south of Chugwater. The flood washed out roads and train tracks and filled basements with water and hail. The National Guard was called in to help direct traffic and maintain security in the area.					
Cheyenne	9/8/1973	0	0	\$225,000	-
Three inches of rain and hail caused flash flooding, primarily located in the downtown area. The hail damaged trees, shrubs, and flowers in the city.					
Albin	7/31/1985	0	0	\$225,000	-
An estimated five inches of rain and marble-sized hail fell over the town. Damages were most attributable to flood damage in basements.					
Laramie County, Cheyenne	8/1/1985	12	70	\$65,000,000	-
<p>The most damaging flood in Wyoming's history occurred in Laramie County on August 1, 1985. A severe thunderstorm stalled over Cheyenne and dropped six inches of rain over the city in less than four hours.</p> <p>The storm was also notable for lightning strikes that ignited several fires, three tornadoes, and several inches of hail that piled into drifts. The estimated property loss was roughly \$136,167,242 million in 2011 dollars.</p> <p>70 people were injured in the flood, and 12 others lost their lives. In one instance, an elderly woman took shelter in her basement after hearing the tornado sirens sound off. Flood waters trapped her in the basement where she ultimately drowned. Most of the deaths resulted from people becoming trapped in their cars by rushing flood waters. Emergency communications systems were washed out in the police department and county courthouse, slowing response times. The Cheyenne Memorial Hospital emergency room was flooded, forcing doctors to relocate to the cafeteria to work on patients. Several areas of the city lost power.</p> <p>An outcome of this event is that Laramie County and the City of Cheyenne have implemented several flood control and stormwater drainage projects, including stormwater basins and channels to divert floodwaters away from people and critical facilities in future floods.</p>					

3.8.2 Inventory Exposed

Magnitude and severity can be described or evaluated as a combination of the different levels of impact that a community sustains from a hazard event. Specific examples of negative impacts from flooding on Laramie County span a comprehensive range. Flooding causes:

- damage to private property that often creates financial hardship for individuals and families;
- damage to public infrastructure resulting in increased public expenditures and demand for tax dollars;
- loss of personal income for agricultural producers that experience flood damages;
- loss of income to businesses relying on recreational uses of county waterways;
- emotional distress on individuals and families; and

- harm to people and animals.

The magnitude and severity of the flood hazard is usually determined by not only the extent of impact it has on the overall geographic area, but also by identifying the most catastrophic event in the previous flood history. Sometimes it is referred to as the “event of record.” The flood of record is almost always correlated to a peak discharge at a gage, but that event may not necessarily have caused the worst historic flood impact in terms of property damage, loss of life,

The extent of the damage of flooding ranges from very narrow to widespread based on the type of flooding and other circumstances such as previous rainfall, rate of precipitation accumulation, and the time of year. Emergency management protocols, public emergency notification improvements, and development/land use codes will all help mitigate future impacts of floods.

Table 3.9 shows the parcels that are exposed to the 1% annual chance floodplain, also called the 100-year floodplain. The 1% annual chance flood has a one in 100 chance of being equaled or exceeded in any one year. While the recurrence interval is 100 years, this is an average and a flood of that magnitude may occur more than once within 100 years.

Table 3.10 shows the exposure of parcels to the 500-year floodplain, also called the 0.2% annual chance floodplain, which has a one in 500 chance of being equaled or exceeded in a given year. This summary includes those same parcels exposed to the 1% Annual Chance Floodplain.

The floodplains used for this vulnerability assessment are currently a preliminary product (as of May 2022) mapped by FEMA. Figure 3.8 illustrates this floodplain, which determined the parcels exposed to the 1% annual chance floodplain.

Parcels exposed to the 1% Annual Chance Floodplain are approximately 86% residential with an overall value of more than \$390 million. Approximately 68% of the residential parcels are located in the unincorporated areas of the county and are worth almost \$376 million. Cheyenne has the largest number of impacted parcels across the municipalities, with almost three times as many residential parcels as commercial. The 54 commercial parcels exposed in Cheyenne are valued at more than \$9.2 million. In contrast, the 24 commercial parcels in the unincorporated county areas are valued more than \$12 million.

Table 3.9 Parcels Exposed to 1% Annual Chance (100-year) Floodplain

Jurisdiction	Total Count	Residential	Improved Value (\$)	Commercial	Improved Value (\$)	Agricultural	Improved Value (\$)
Burns	2	1	9,918	1	90,128	-	-
Cheyenne	202	148	14,821,352	54	9,214,958	-	-
Pine Bluffs	3	3	121,281	-	-	-	-
Unincorporated	454	419	375,969,953	24	12,025,438	11	323,961
County Total	661	571	390,922,504	79	21,330,524	11	323,961

The parcels exposed in the 0.2% Annual Chance Floodplain include those in the 1% Annual Chance Floodplain, which is reflected in the values in Table 3.10 All of the exposed parcels are valued at more than \$572 million and are 82% residential. Cheyenne holds the highest number of commercial parcels exposed to the 0.2%

Annual Chance Floodplain, while the unincorporated areas hold the highest number of residential parcels exposed. The value of the residential parcels exposed in the unincorporated areas is approximately 73% of the total value of all parcels in the county overall.

Table 3.10 Parcels Exposed to 0.2% Annual Chance (500-year) Floodplain

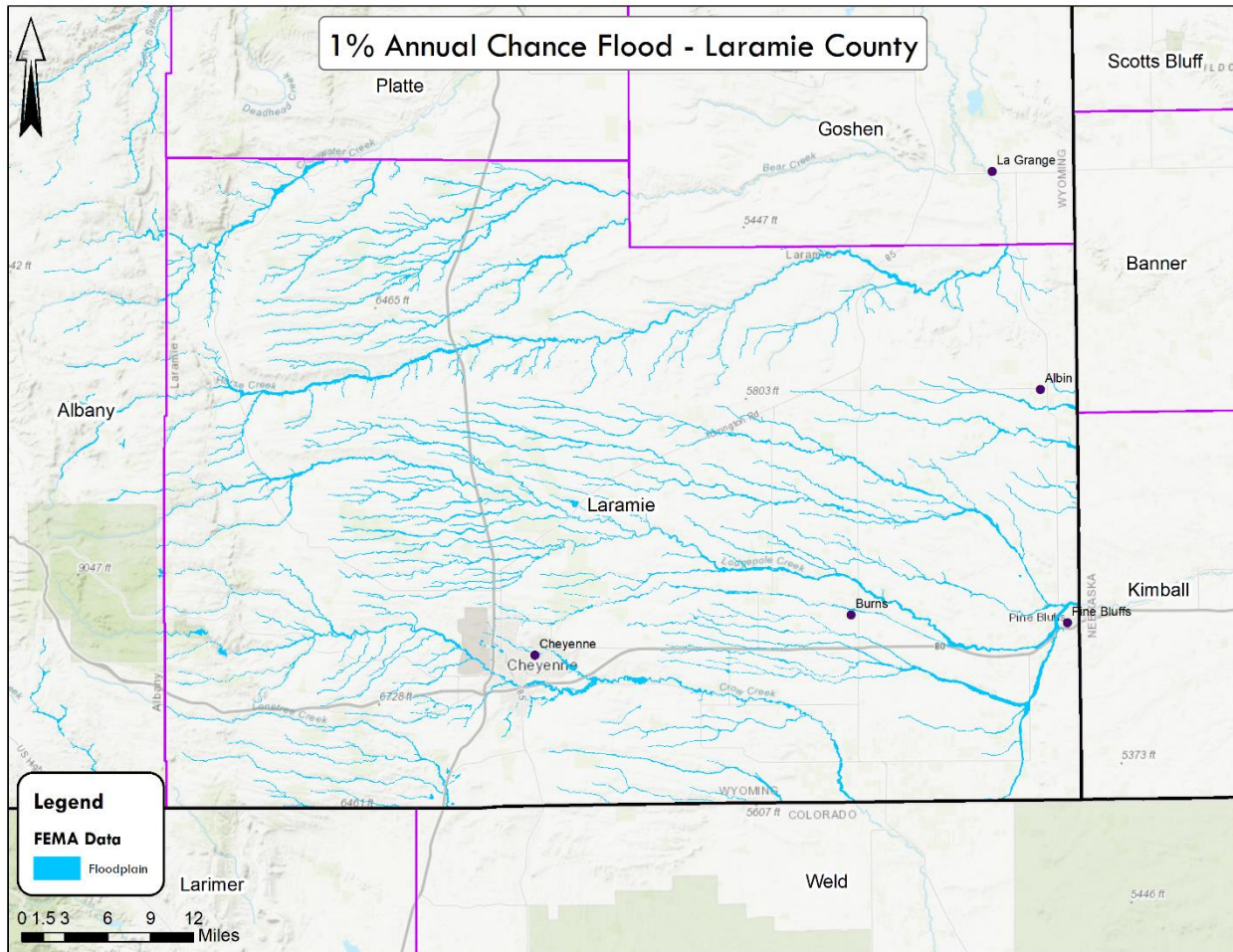
Jurisdiction	Total Count	Residential	Improved Value (\$)	Commercial	Improved Value (\$)	Agricultural	Improved Value (\$)
Burns	2	1	9,918	1	90,128	-	-
Cheyenne	716	527	94,520,152	188	39,867,032	1	1,832
Pine Bluffs	3	3	121,281	-	-	-	-
Unincorporated	678	630	418,403,808	37	18,881,905	11	323,961
County Total	1,399	1,161	513,055,159	226	58,839,065	12	325,793

Communication, energy, and transportation are the only lifelines with exposure to the 1% Annual Chance Floodplain in the county. While exposure is minimal for energy and communication, transportation has 38% of infrastructure exposed.

Table 3.11 Lifeline Exposure to 1% Annual Chance (100-year) Floodplain

Lifeline	Total Count	Count Exposed	Percent Exposed (%)
Communication	634	6	1 %
Energy	102	4	4 %
Energy (miles)	1,478	75	5 %
Transportation	365	138	38 %

Figure 3.8 1% Annual Chance Floodplain



3.8.3 Probability of Future Occurrences

While the probability that the county will experience a flood event can be difficult to predict or quantify, the frequency of previously reported flood events in Laramie County shows that localized flooding will likely be experienced yearly. Flooding in general has the potential to cause moderate property and crop damage within the county and severe flooding has the potential to inflict significant damage to people and property. Mitigating flood damage requires that communities remain diligent and notify local officials of potential flood (and flash flood) prone areas near infrastructure such as roads, bridges, and buildings.

3.8.4 Participation in National Flood Insurance Program (NFIP)

According to the NFIP's Community Information System (CIS) all jurisdictions, except for the Town of Albin, participate in NFIP. The City of Cheyenne and Laramie County participate in the Community Rating System (CRS), which is a program within NFIP that can discount insurance rates of participating jurisdictions. The county currently has a CRS class rating of 8, and Cheyenne has a rating of 7. These classes determine the discount available and run from 9 to 1, with 9 having the lowest discount.

Details of local jurisdiction NFIP participation, including current policies in force, are shown in Table 3.1.2. The table also includes the date the initial Flood Insurance Rate Map (FIRM) and initial Flood Hazard Boundary Map (FHBM) were identified.

The current effective map for the county is dated 1/17/2007 and the Towns of Albin and Burns have never been mapped. The Town of Burns is a participant in the program, however there are no policies currently in force.

Table 3.12 NFIP Participation

Jurisdiction	Date of Entry	Initial FIRM ID	Initial FHBM ID	Policies in Force	Number of Paid Claims since 1978	Total Coverage	Claims Paid since 1978
Laramie County	5/21/1980	5/21/1980	11/15/1977	56	17	\$14,836,200	\$221,140
Town of Burns	1/13/2008	1/17/2007	4/12/1974	0	0	0	\$0
City of Cheyenne	9/30/1977	9/30/1977	6/28/1974	194	175	\$53,615,400	\$717,907
Town of Pine Bluffs	5/01/1986	5/01/1986	1/17/2007	1	0	\$350,000	\$0

The county and the City of Cheyenne are the only jurisdictions with repetitive loss properties. A repetitive loss property is an NFIP-insured structure that has had at least 2 paid flood losses of more than \$1,000 each in any 10-year period since 1978.

Table 3.13 Repetitive Loss Data

Jurisdiction	RL Losses (Total)	RL Losses (Insured)	RL Payments (Total)	RL Payments (Insured)
Laramie County	4	0	\$33,971	\$0
City of Cheyenne	23	0	\$183,952	\$0

3.8.5 Future Development Trends

Laramie County is experiencing steady growth and the risk and impacts of a flooding event to existing infrastructure and new development requires critical attention to address safety and security. Any development, whether new or redevelopment, must take into account which parcels are within the 100-year floodplain. Floodplain management ordinances, zoning and subdivision ordinances, and state regulations address methods and practices to minimize flood damage to new and substantial home improvement projects. Quality construction and compliance with local ordinances, which exceed National Flood Insurance Program (NFIP) requirements, are the greatest protection against flooding. The county along with the City of Cheyenne, and Towns of Burns and Pine Bluffs participate in the NFIP and support floodplain management activity at the local scale. Code adoption by local jurisdictions, compliance by builders, and local government inspection of new homes can greatly reduce the risk of flooding. Laramie County and its municipalities should continue to look into monitoring, analysis, modeling, and the development of decision-support systems and geographic information applications for floodplain management activities.

In addition to land-use planning, zoning, and codes applicable to new development, flood mitigation measures include structural and non-structural measures to address susceptibility of existing structures. Flood mitigation measures such as acquisition, relocation, elevation-in-place, wet/dry flood proofing, and enhanced storm drainage systems all have the potential to effectively reduce the impact of flood in the county.

The emphasis on pre-disaster flood mitigation in Laramie County centers on Crow Creek and its tributaries: Dry Creek, Allison Draw, and Clear Creek. The City of Cheyenne is responsible for Crow Creek as it passes through the incorporated boundaries. Laramie County and Cheyenne share Dry Creek, with City responsibility until the channel passes into the county owned Dry Creek Parkway.

3.8.6 Climate Change Impacts

The impacts of climate change on weather patterns and temperature fluctuations and these impacts contribute to the potential for increased extent and frequency of floods in the future. The unpredictable nature of precipitation patterns and drought creates conditions conducive for flooding from heavy rains and/or rapid snowmelt. Wildfires are occurring more often due to drier conditions and the effects of these fires on the landscape also lead to more severe and frequent flooding.

3.9 Hail

3.9.1 Previous Occurrences

According to the NCEI database, 1030 hail events have occurred in Laramie County between 1955 and 2021. These events resulted in no deaths, 3 injuries, more than \$41 million in property damage, and more than \$500k in crop damage. The SHELDUS database provided property damage totaling more than \$183 million in 2019 USD, as well as approximately \$6.9 million in crop damages. SHELDUS lists 38 injuries total, 35 of which along with 6 deaths occurred in 1985.

Data can vary from one database to another due to access and reporting criteria of the sources of information used to compile the database. Presenting both NCEI and SHELDUS data for Laramie County gives a better overall picture of the hazard and impacts it can have. SHELDUS specifically only reports the events which resulted in damages or loss of life, while NCEI reports events regardless of these figures.

Table 3.14 SHELDUS Reported Hail Damage by Year 1960 – 2019 (2019 USD)

Year	Property Damage (\$)	Crop Damage (\$)	Injuries	Deaths
1960	0	438	0	0
1962	237,272	429	0	0
1964	41,799	417,991	0	0
1965	411	0	0	0
1966	20,396	0	0	0
1967	39,184	0	0	0
1968	409,583	0	0	0
1969	35,307	0	0	0
1970	33,396	0	0	0
1972	3,130,933	0	0	0
1973	145,920	0	0	0
1974	26,283	2,628	0	0
1975	401,416	0	0	0
1977	4,714,815	0	0	0
1978	19,893,684	39,946	0	0
1979	196,329	178	0	0
1981	14,255	4,894,190	0	0
1982	0	14,770	0	0
1983	65,049	6,505	0	0

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Year	Property Damage (\$)	Crop Damage (\$)	Injuries	Deaths
1984	173	103,928	0	0
1985*	78,717,772	401,416	35	6
1986	131,232	130,050	0	0
1987	13,745,910	115,205	3	0
1988	43,813	0	0	0
1990	1,586	1,289	0	0
1991	9,514	9,514	0	0
1995	1,700	0	0	0
1996	18,064,835	513,684	0	0
1997	113,027	71,045	0	0
1998	38,158	238,009	0	0
1999	15,555	1,556	0	0
2001	43,900	0	0	0
2002	43,216,423	0	0	0
2003	45,070	0	0	0
2006	643	0	0	0
2007	31,247	0	0	0
2009	24,159	0	0	0
2010	7,012	357	0	0
TOTAL	183,657,765	6,963,129	38	6

*Data is cross-listed with Flood Hazard

Details of notable historical hail events are shown in Table 3.15. Historical hail events for the county are illustrated in Figure 3.9, as well as the diameter of hailstones reported. It is worth noting reports of hail are typically higher near populations centers, which can be seen in the clustering of events near the jurisdictions, shown on the map. Based on this trend, it is likely that many hail events go unreported and records of events may be considerably lower than what is actually occurring in the county.

Table 3.15 Notable Historical Hail Events

Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Cheyenne, Archer	6/11/1944	0	0	\$500,000	\$20,000
In the afternoon and evening a hail storm struck the City of Cheyenne resulting in considerable property damages. Stones in the city reported as larger than baseballs, and up to 6in in Archer. Damage resulted to windows, roofs, automobile tops and glass, and neon signs. One large stone was cut into halves that showed 18 concentric circles.					
Cheyenne	6/10/1972	0	0	\$500,000	\$0
A heavy thunderstorm with 0.75-inch diameter hail and 1.5-inch hail damaged roofs, cars, windows, trees, shrubbery, gardens, and signs. This total is approximately \$3 million in 2019 USD					
Cheyenne	6/16/1977	0	0	\$1,000,000	\$0

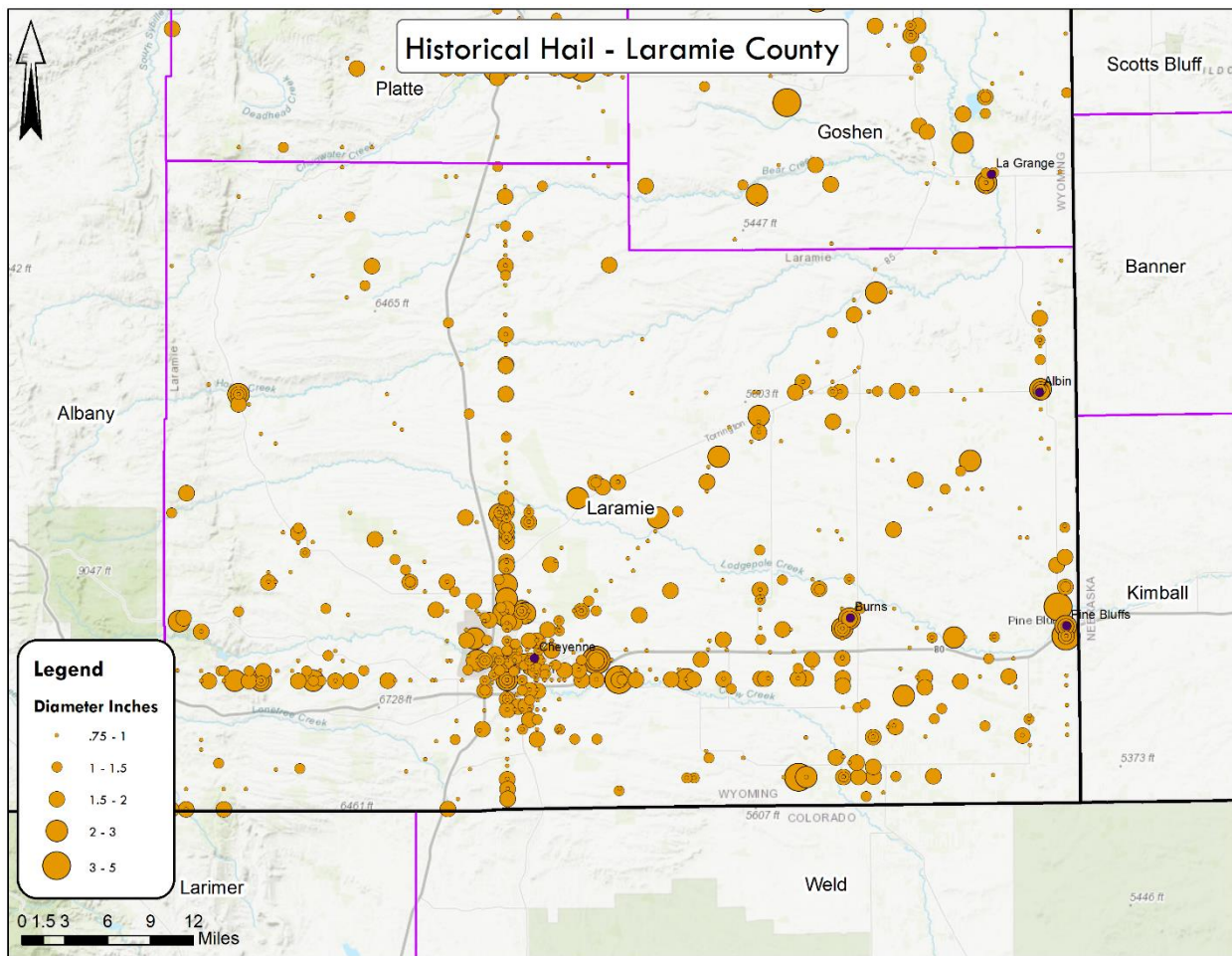
Wyoming Region 7 Hazard Mitigation Plan – 2023 Update (Laramie County)

Location	Date	Deaths	Injuries	Property Damage	Crop Damage
A mile wide strip of hail 1-2 inches in diameter cut across Cheyenne from northwest to southeast with damage along the center of the strip to houses, cars, trees, gardens, etc. This resulted in more than \$4 million 2019 USD in damages					
Cheyenne	7/31/1978	0	0	\$5,000,000	\$0
Two thunderstorms brought hail up to three inches in diameter resulting in damage to homes, property, and vehicles. Estimated damages of \$20 million (in 2019 USD)					
Cheyenne	7/30/1979	0	0	\$3,200,000	\$0
An extremely large and intense thunderstorm moved through the Cheyenne area, causing extensive damage to cars, homes, and city buildings. Hail up to two inches in diameter was verified in town with reports of baseball-sized hail south of the city.					
Cheyenne	8/1/1985	12	70	\$65,000,000	\$0
A nearly stationary severe thunderstorm produced the most damaging flash flood on record for Cheyenne and the state. Twelve people lost their lives, 70 were injured, and damage to homes, cars, and businesses was estimated at \$65 million (\$154.4 million in 2019 USD). At the NWS Forecast Office near the airport, 6.06 inches of rain fell in just over three hours. Hail up to two inches in diameter and winds up to 70 mph occurred in the Cheyenne area. Streets turned into 2 to 4 inch deep rivers with large amounts of hail floating on top. Basements of homes and businesses filled with water and hail. Some basements equipped with drains were flooded with 2 to 5 feet of hail after the water drained away. In some areas of Cheyenne the hail had piled up into 4 to 8 foot drifts. (SHELDUS data states there were 6 fatalities and 35 injuries in 1985, as well as approximately \$80 million (2019 USD) in crop and property damages)					
Cheyenne, Warren Air Force Base	8/3/1987	0	0	\$6,000,000	\$0
A hail storm hit Cheyenne with 0.5- to 2-inch diameter hail. This storm heavily damaged cars at three major car dealerships west of downtown. Many of the cars were severely dented, with numerous broken or cracked windshields. Another area with damages was F.E. Warren Air Force Base, where numerous vehicles were dented and windows shattered or broken. Three people were slightly injured during the hail storm. The damage was estimated at almost \$13.8 million in 2019 USD.					
Cheyenne	7/13/1996	0	0	\$4,000,000	\$0
A hail storm caused damages to windows, roofs, and trees in the Cheyenne area. Estimated at \$4,000,000					

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Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Cheyenne	7/31/1996	0	0	\$3,400,000	\$0
Hail between 1 to 2.5 inches fell in Cheyenne causing \$3.4 million in property damage.					
Cheyenne	8/29/1996	0	0	-	-
A hail storm produced large hail that broke some car windows in Cheyenne and damaged numerous roofs.					
Cheyenne	8/26/2002	0	0	\$30,000,000	\$0
Hail from 1- 2.75 inches in diameter fell over the central and western parts of Cheyenne, causing \$30 million (\$43.2 million in 2019 USD) in damages. Significant wind damage to automobiles and roofs was reported.					

Figure 3.9 Historical Hail Events



3.9.2 Inventory Exposed

Laramie County has the highest number of loss-causing hail storm events (215) across the state, per the Wyoming State Hazard Mitigation Plan (2021-2026). The entire county is exposed to hail events, as they are regional and travel. All structures, infrastructure, property, people, crops, and livestock could be damaged or harmed by a hail storm

3.9.3 Probability of Future Occurrences

The frequency of previously reported hail events in Laramie County provides an acceptable framework for determining the probability of future hail storm occurrence in the area. The probability that the county will experience a damaging hail event can be difficult to predict or quantify, but it is expected that hail events will be experienced yearly and may result in damage. Severe hail storms have the potential to inflict significant damage to people and property in the county. Mitigating damage requires that communities remain diligent about building structures that meet current building codes in order to be able to withstand damage.

3.9.4 Future Development Trends

As Laramie County experiences steady growth, the risk and impacts of a hail event are still prevalent to existing infrastructure, as well as new development. All structures in Laramie County will likely be exposed to hail storm events. Because these events are not typically isolated to one geographical area, the location does not increase or reduce the risk necessarily. Laramie County must continue to adhere to building codes and development should be built to current standards in case of adverse weather.

3.9.5 Climate Change Impacts

As humidity is lowered, due to rising temperatures, extended drought, and extreme heat events, convective instability increases. The movement of dry air into thunderstorms can increase the likelihood and size of hail due to evaporate cooling which lowers the elevation of the freezing level in thunderstorm clouds. This creates an opportunity for hailstones to grow larger and become more dangerous, as well as appear in areas where hail was uncommon previously, due to unpredictable weather patterns.

3.10 Hazardous Material Release

3.10.1 Previous Occurrences

Hazardous materials incidents are likely to occur in Laramie County each year, due in part to the transportation routes for both railroad and highways that traverse the county. The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) records hazardous material transportation incidents based on reports submitted by businesses and responders. Between 1990 and 2020, there have been 452 transportation incidents reported in Laramie County. Total damages for these incidents are approximately \$1.8 million, which includes the cost of the material lost, carrier damage, property damage, response costs, and remediation clean-up costs. Of these incidents, 316 involved rail transport, 134 were on roadways, and 2 were related to air transport.

PHMSA categorizes incidents as ‘serious’ based on multiple criteria, including if there are fatalities or injuries, evacuations, bulk release of material, main artery closures, and the type of material involved in the incident. There have been no fatalities as a result of a hazardous material incident. Table 3.16 shows the number and type of serious incidents on record with PHMSA. The number of derailments and rollover/vehicle accidents is included as well. Table 3.17 shows the type and quantity of material released for the top four bulk releases.

Table 3.16 Serious Hazardous Material Transportation Incidents 1990-2020

Injuries	Artery Closure	Evacuations	Bulk Releases	Derailments	Rollover /Vehicle Accident
5	5	5	19	3	14

Table 3.17 Top 4 Bulk Release Details

Date	Hazardous Material	Quantity Released	Cost
6/15/1996	Fuel Oil	11,074 gallons	\$34,000
12/9/1994	Liquified Petroleum Gas	7,634 gallons	\$10,000
8/13/1994	Tars, Liquid	6,840 gallons	\$170,000
6/12/1999	Hydrocarbons, Liquid	4,900 gallons	\$93,000

3.10.2 Inventory Exposed

A significant portion of the county is affected by hazardous materials risk. Most communities and some unincorporated areas of Laramie County are exposed to potential hazardous material release incidents due to proximity to major roadway transportation corridors, such as Interstates 26 and 85. Union Pacific Railroad and Burlington Northern Santa Fe (BNSF) both have railroad lines that run through the county, which also provides risk for communities located near the tracks.

A fixed-facility incident is an uncontrolled release of chemicals or other potentially hazardous materials from a single location. Fixed facilities include companies that store hazardous waste at their facility and also all hazardous waste sites. Some of these facilities contain extremely hazardous substances. Those are the facilities that are required to generate Risk Management Plans (RMP). An accident resulting in the release of chemicals from those facilities could pose a significant problem to Laramie County.

The hazardous materials release exposure data was calculated based using a 1-mile buffer from major highways and rail. This captures the infrastructure along transportation routes throughout the county that are exposed to, and could be impacted by, a transportation related hazardous materials release.

All lifeline infrastructure has high exposure in the county. As infrastructure is typically located in populated areas, the large percentages of exposure are reasonable and with the majority of infrastructure is exposed it is important to acknowledge that hazardous materials release incidents vary drastically in severity and impacts. For example, high exposure to communication infrastructure has much less consequence than exposure to health and medical or food, water, and safety. The data in Table 3.18 illustrates the importance of public education regarding hazardous materials release incident risks and how widespread the effects could be.

Table 3.18 Lifeline Exposure to Hazardous Materials Transportation Routes

Lifeline	Total Count	Count Exposed	Percent Exposed (%)
Communication	634	455	72 %
Energy	102	80	78 %
Food, Water, & Shelter	18	17	94 %
Hazardous Materials	5	5	100 %
Health & Medical	30	26	87 %
Safety & Security	44	38	86 %

Lifeline	Total Count	Count Exposed	Percent Exposed (%)
Transportation	365	326	89 %

3.10.3 Probability of Future Occurrences

Predicting hazardous material release incidents in Laramie County is difficult due to the numerous variables of any given event, such as location, weather conditions, type and amount of chemical, quantity released, and whether the incident happens in transit or stationary. Based on those variables, the potential impacts and losses that could be incurred are extremely varied.

There is potential for an incident to occur, however with the low number of previous occurrences over approximately two decades the probability is likely low. It should be noted that even a single event could have devastating effects and possible consequences to life safety. Any possible future occurrences will be minimized through proper supervision, protocols, inspections, and procedures.

3.10.4 Future Development Trends

Proximity to identified hazardous material sites or major transportation corridors within Laramie County should be considered in the development of all future structures. The risk and impacts of a hazardous materials incident are concerns for infrastructure and public safety. Those located near transportation corridors and hazardous material handling sites are especially at risk of being impacted by a hazardous material release incident.

3.10.5 Climate Change Impacts

Climate change effects on transport and handling of hazardous materials could manifest in multiple ways. The U.S. DOT Climate Action Plan published in 2021, explains the effects of climate change are increasing over time and this climate variability and change pose threats to transportation systems. Highlights in the report of potential notable impacts include increased risk of vehicle crashes in severe weather, increased temperatures damaging infrastructure (asphalt degradation, expansion of paved surfaces, and railroad tracks buckling), and more frequent / severe flooding due to more intense precipitation damaging drainage infrastructure.

In 2022, the U.S. Government Accountability Office (GAO) released a report informing the U.S. Environmental Protection Agency (EPA) of the importance for the Risk Management Plan (RMP) rule to receive an update to include the consideration of facility risks due to climate change and natural hazards. The GAO report concluded:

Climate change may exacerbate natural hazards, such as flooding, storm surge, and wildfires, which could potentially lead to accidental releases at RMP facilities. EPA has the opportunity to reduce the risk of accidental releases and minimize the consequences of such releases by ensuring that RMP facilities are managing risks from natural hazards and climate change.

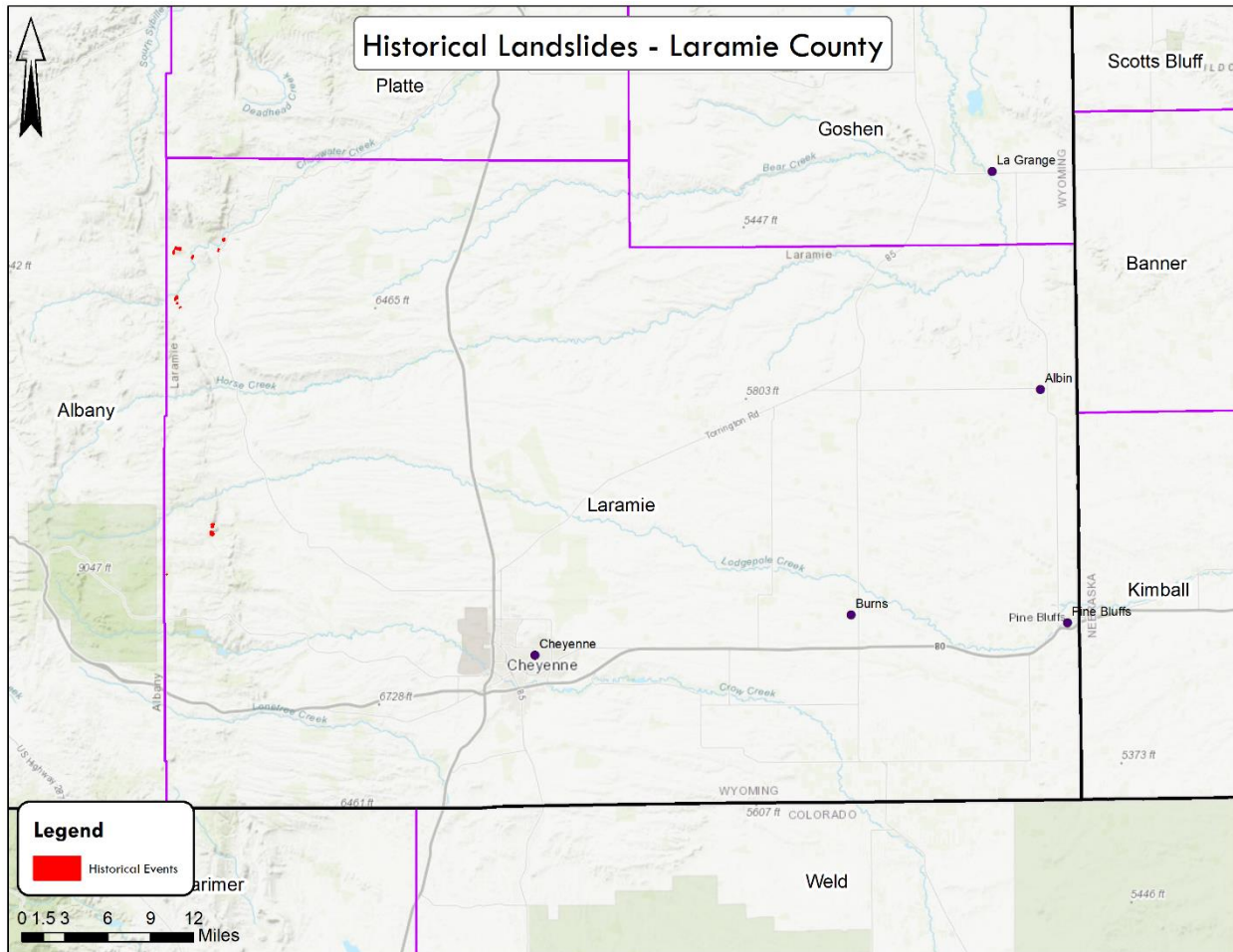
Many hazardous materials are unsafe if not within specific temperature ranges. Extreme temperatures can therefore pose a risk during transport and handling.

3.11 Landslide

3.11.1 Previous Occurrences

Landslides in Laramie County have potentially occurred, however there are no recorded incidents. Landslides often happen in unpopulated areas and therefore go unnoticed.

Figure 3.10 Historical Landslides



3.1.1.2 Inventory Exposed

Exposure in a landslide incident is localized and the risk to life safety and property is dependent on the proximity of people, structures, and infrastructure to an event. Landslides have the potential to be very large and a large landslide near a populated area or near Lifeline infrastructure, such as transportation, power, or communications, could cause significant economic losses, damages, injuries, and deaths. Rockfalls are also localized and present a risk primarily to those on transportation corridors, as a rockfall could harm motorists, economic impacts from closed roads, or in some cases cause extended damage to the roadway.

Debris flows are less localized and capable of moving trees and boulders considerable distances. The rapid nature and immediate impacts of a debris flow create considerable risk to public safety and any property in its path. Lifelines have the potential to be affected if a debris flow damages roads or bridges, and power or communications systems. Water quality and delivery systems could be impacted by a debris flow.

Table 3.19 accounts for the exposure of parcels to the highest landslide susceptibility areas (highest 30% of risk statewide). These areas are where landslides are most likely to happen and therefore pose the highest risk to people and property. The parcels exposed to the highest risk are worth more than \$4.1 million and all but three are residential properties.

Table 3.19 Parcels Exposed to Areas of High Landslide Susceptibility

Jurisdiction	Total Count	Residential	Improved Value (\$)	Agricultural	Improved Value (\$)
Cheyenne	7	7	166,172	-	-
Pine Bluffs	3	3	387,321	-	-
Unincorporated	35	32	3,559,957	3	52,208
County Total	45	42	4,113,450	3	52,208

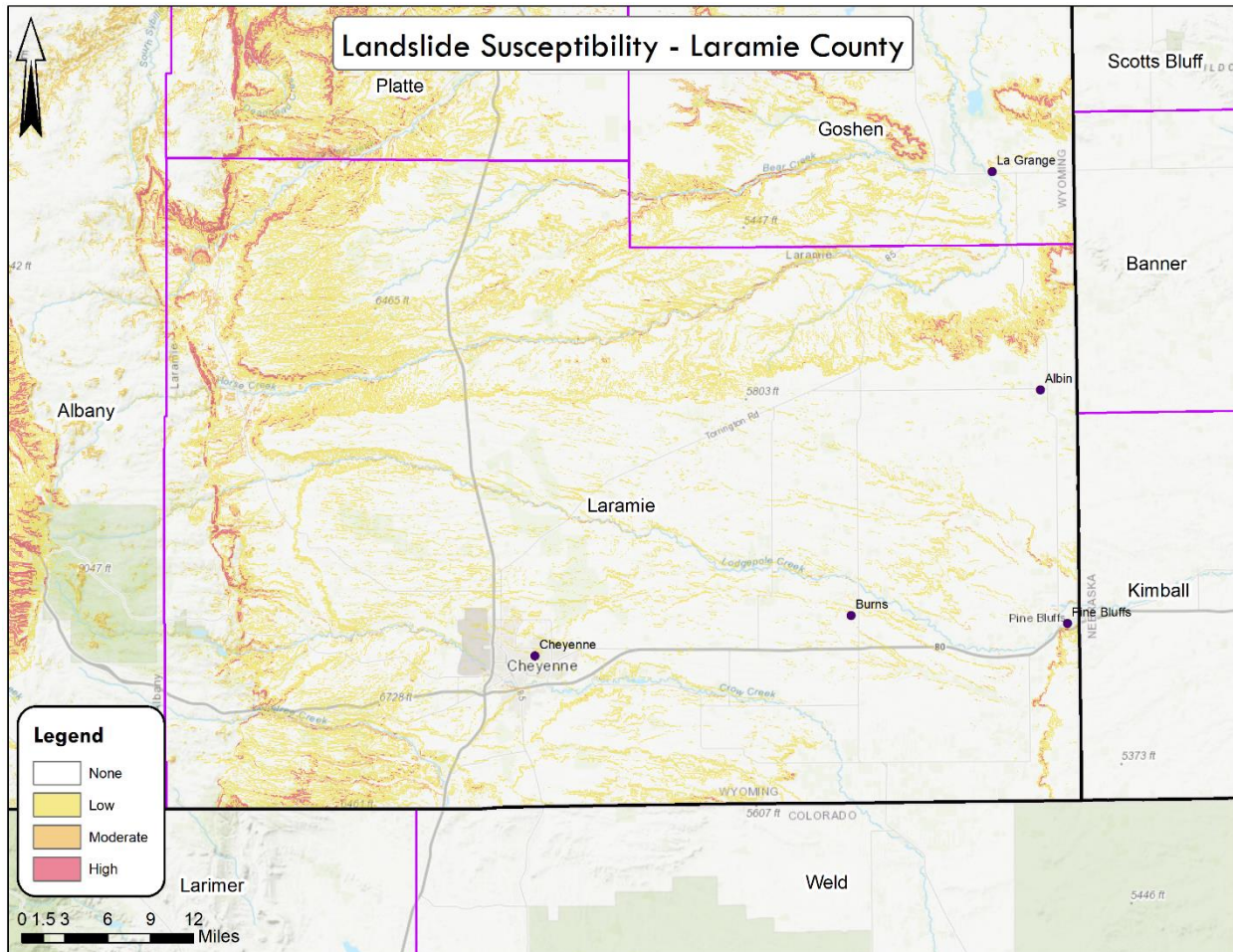
Communications lifeline infrastructure is the only infrastructure exposed to landslide susceptible areas in the county. Approximately, 10% is exposed.

Table 3.20 Lifeline Exposure to Landslide Susceptible Areas

Lifeline	Total Count	Count Exposed	Percent Exposed (%)
Communication	634	6	10 %

Figure 3.11 shows all areas of landslide susceptibility across Laramie County. Note that the high susceptibility areas in the county are primarily away from municipalities and transportation routes.

Figure 3.11 Landslide Susceptibility



3.1.1.3 Probability of Future Occurrences

Landslides occur in potential areas often, however the majority are not witnessed and therefore not reported. Landslides are most common in areas with previous landslide activity.

3.1.1.4 Future Development Trends

Development should be monitored to ensure no construction is occurring in potential landslide areas.

3.1.1.5 Climate Change Impacts

The conditions required for landslides and debris flows are greatly affected by climate, including the melt speed and level of snowpack, rapid temperature fluctuations, and erratic amounts of precipitation. The integrity of the soil and rock is affected with each freeze and thaw cycle, which are occurring more often and more rapidly due to unseasonable temperature swings. As landslides are more likely to occur after heavy precipitation and rapid snowpack melt, the unpredictable weather leads to dangerous conditions more frequently. The increased climate variability being experienced is expected to continue and with that the trend toward landslide and debris flow conducive situations will also.

3.12 Lightning

3.12.1 Previous Occurrences

According to NCEI data, only one lightning event has occurred in Laramie County, in 1996 in Cheyenne, since 1950. While there were no injuries or deaths reported, records show a chimney was knocked off a house and a tree was split. Records do not always paint a full picture of hazards within an area and community members of Laramie County will likely say that a number of significant lightning events happen each year.

Data from the SHELDS database shows 10 incidents of damaging lightning events in Laramie County from 1960 to 2019. These events combined caused 7 injuries, 1 death, and more than \$128,000 (2019 USD) in property damages.

Thunderstorm wind events records from NCEI were also analyzed to give a better picture of potential lightning events. According to NCEI, 184 thunderstorm wind events have occurred within Laramie County between 1950 and 2021 causing 1 recorded injury and more than \$120,600 in property damage. These statistics are related to wind, but it is important to note that thunderstorms often cause lightning events and are not reported as separate events.

3.12.2 Inventory Exposed

Property, structures, crops, people, and livestock outside during a thunderstorm is at risk of being struck by lightning. The unpredictability of lightning and the recorded instances of lightning strikes occurring miles away from an active thunderstorm illustrate the risk this hazard poses indiscriminately across the county. Lightning has the potential to cause deaths, injuries, and property damage, including damage to buildings, communications systems, power lines, and electrical systems. It can also cause forest, brush, and structural fires. Damage from lightning typically occurs in four ways:

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

3.12.3 Probability of Future Occurrences

Past events in Laramie County indicate that the potential magnitude of lightning events will likely be limited but may occur often with thunderstorm and wind events. Future events will likely occur in any given year. While losses are dependent on each particular incident, damage to structures and potential loss of life and injury may occur. Also, adverse effects due to lightning, such as wildfires, have the potential to occur within Laramie County in the future. Wildfire impacts to Laramie County are described in described in further detail in the Wildfire profile section.

3.12.4 Future Development Trends

As Laramie County experiences steady growth, the risk and impacts of a lightning event are prevalent to existing infrastructure and new development. Because these events cannot be predicted, it is hard to determine which particular structures and areas will be impacted. Laramie County should continue to adhere to building codes and development to mitigate future damage to structures should a lightning event occur.

3.12.5 Climate Change Impacts

The effects of climate change are seen across many hazards and lightning is not an exception. The unpredictable number of storms and their characteristics indicate the amount of lightning they bring could change significantly. With the changing weather patterns, the potential increase in thunderstorms events can result in increased lightning occurrences.

3.13 Public Health Hazards

3.13.1 Previous Occurrences

The first case of COVID in Laramie County was identified on March 17, 2020, and was followed by a second the same day. Laramie County, at the time of this plan's writing, had 26,166 cases and 290 deaths.

Laramie County was also affected by the H1N1 outbreak in 2009, as the state saw more than 700 cases. Data discrepancies at the county level make it difficult to give an exact number of cases and deaths. However, there were numerous cases in the county, at least 50, and multiple deaths. The rollout of the vaccine for H1N1 was swift and effective, with thousands of people receiving vaccines at clinics across the state.

In September 2020, the Mullen fire potentially contaminated a reservoir used by the City of Cheyenne. The Board of Public Utilities monitored the situation and educated the public on the Water Treatment Plants methods to address any ash or sediment in the water source from the wildfire.

Air quality has been noted as a concern in the county as an increase in oil drilling could potentially have an effect and this was monitored by Wyoming Department of Environmental Quality since 2018.

3.13.2 Inventory Exposed

The whole population of Laramie County is at risk to public health hazards, especially those with chronic health conditions or other risk factors including access and functional needs. The residents are exposed to public health hazards in multiple ways, whether it is illness through contagious pathogens, harm from poor air quality, or the dangers of poor water quality.

Mental and behavioral health are critical to include when discussing public health hazards and the whole population can be affected by an event.

See Table 2.1 and Table 2.2 for the demographics and health indicators of the population of Laramie County, which help to keep a holistic view of needs in the communities when planning for potential events.

3.13.3 Probability of Future Occurrences

Laramie County will likely have a public health hazard incident in the future, whether it is water quality, potential disease transmission, or the occurrence of a traumatic event in the community. Air quality is also an example of a prevalent hazard, as wildfire smoke can travel great distances and affect large populations.

The potential for an epidemic or pandemic outbreak is probable, as more novel pathogens are discovered around the world and infectious diseases evolve rapidly. Climate change can contribute to the spread of illness as the increased number of disaster events leads to more mass evacuations and the need for more disaster sheltering, increasing person-to-person interactions.

Mental and behavioral health will continue to be impacted after an incident and as a result of any future incidents. The assistance and support should not stop once the response or even recovery from an incident is over but should be considered for the community consistently going forward.

3.13.4 Future Development Trends

Future planning for land use and development should include review of water and sewer systems with public health partners in addition to typical entities. This ensures that should a water quality or environmental safety issue arise all partners are informed and prepared to address the issue.

Consideration of shelters is important when thinking of public health hazards and prioritizing access and functional needs populations is critical. Developing adequate sheltering where residents can be healthy and have hygienic accommodations can assist in slowing the effects of a public health hazard.

3.13.5 Climate Change Impacts

Climate change has affected disease transmission globally, according to the World Health Organization. Temperature fluctuations and extreme weather events create conducive conditions for diseases to manifest and spread. Around the world the movement of people out of cities, heat centers, into the rural areas leads to more interactions between humans and animals. These interactions will lead to the continued discovery of never-before-seen disease and will continue to be a concern. Climate change can also contribute to an increase of person-to-person interactions, as the increased number of disaster events leads to more mass evacuations and need for more disaster sheltering.

The impacts of climate change on wildfire and drought create indirect public health issues related to air and water quality. Research has shown exposure to wildfire smoke, even from great distances, has a long-term effect on people's health and drought can contribute to heavy metal concentration increases in water sources. The indirect impacts of climate change on public health are being studied around the world and as climate change continues, the negative effects on public health will likely increase rapidly.

3.14 Tornado

3.14.1 Previous Occurrences

NCEI records for Laramie County include 123 tornado events reported from 1950 to 2021. The highest ranking tornadoes seen in Laramie County were two F3 events in 1960 and 1979, as well as multiple F2 and EF2 tornadoes between 1976 and 2018.

The most devastating tornado in Laramie County occurred on July 16, 1979. This event caused extensive damages as it moved through the north portion of Cheyenne. The tornado was reported to have injured 40 people, killing one, and destroyed or damaged aircraft, National Guard equipment, airport hangars, municipal buildings, and residential structures. A Department of Commerce report from July 1979 stated an estimated \$18 million in private homes and \$10 million in city-owned structure damage, however these figures may have been overestimated, not reported, or any claims may have not been shared outside of private databases.

Based on SHELUS data, Table 3.21 shows the years with reported tornado damages, injuries, and deaths from 1960 to 2019. It is important to note that data can vary from one database to another based on multiple factors, such as reporting gaps and differing information sources. SHELUS presents the overall picture of best available data for reported tornado damages, which are adjusted to 2019 USD.

Tornadoes are an important example of best available data constraints, as multiple databases have highly differing information due to a lack of centralized, standardized reporting. Laramie County is located near "tornado alley" making tornadoes an understandable risk, with any number of tornadoes posing significant hazard to the public and property. Figure 3.12 shows the identified historical tornadoes in the county

Table 3.21 Tornado Event Damages per Year, 1950-2019 (2019 USD)

Year	Property Damage (\$)	Crop Damage (\$)	Injuries	Deaths
1960	43,776	0	3	0
1962	0	4,291	0	0
1965	411	0	0	0
1968	37,235	0	0	0
1971	3,199	0	0	0
1974	26,283	0	0	0
1976	0	455	0	0

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Year	Property Damage (\$)	Crop Damage (\$)	Injuries	Deaths
1977	0	428	0	0
1979	17,850,068	0	40	1
1986	118	0	0	0
1990	2,082	0	0	0
1991	104,651	95,137	0	0
1997	3,229	0	0	0
1999	3,111	0	0	0
2002	43,216	0	0	0
2008	24,073	0	0	0
2010	59,424	0	0	0
TOTAL	18,200,879	100,311	43	1

Figure 3.12 Historical Tornado Events, Laramie County

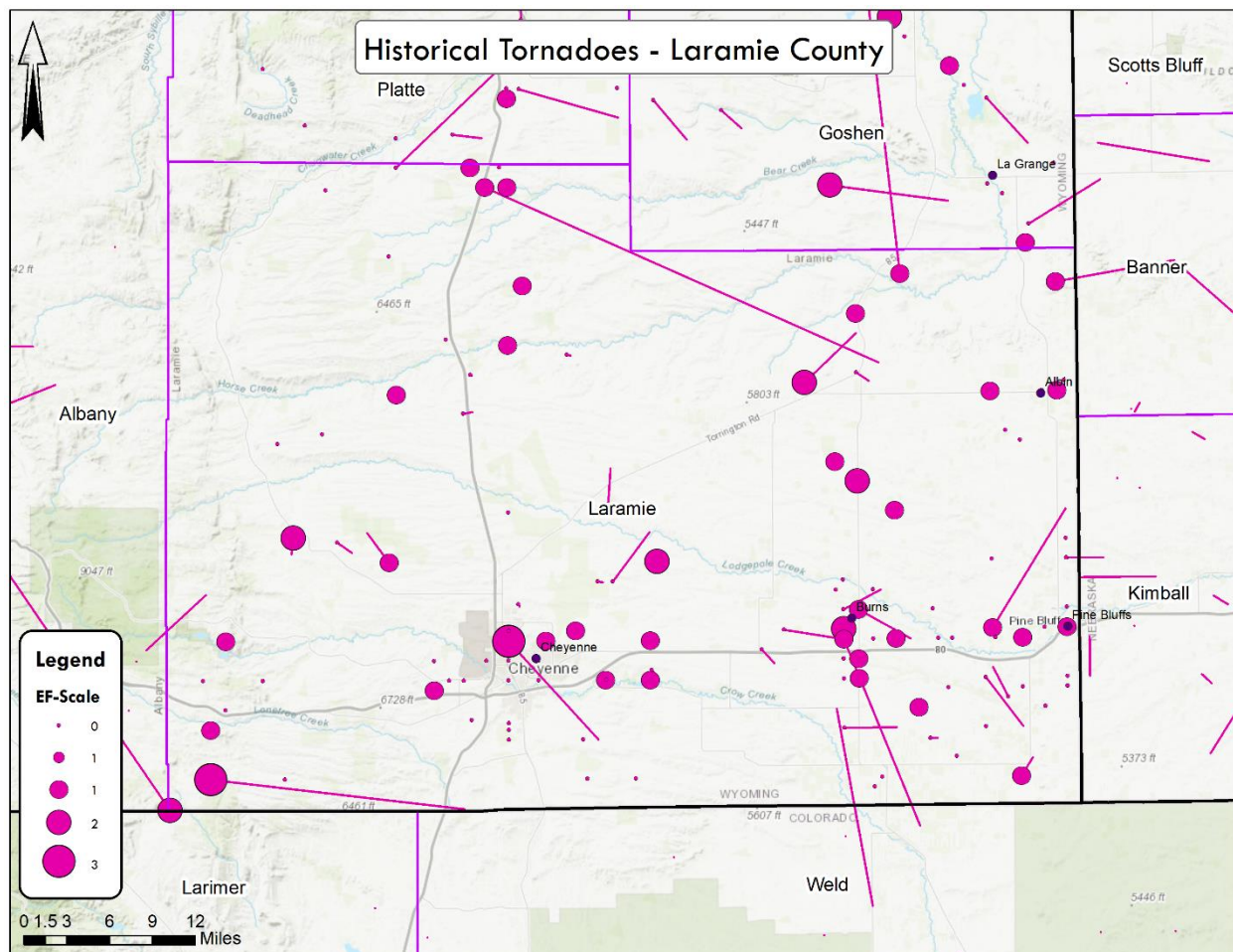


Table 3.22 details notable tornado events in and around Cheyenne.

Table 3.22 Notable Historical Tornado Events - Cheyenne

Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Cheyenne	5/29/1948	0	0	\$10,000	\$0
A tornado occurred about 10 miles north of Cheyenne. The tornado destroyed some farm buildings, causing about \$10,000 in damage. There was no loss of life.					
Cheyenne	4/19/1971	0	0	\$2,750	\$0
A tornado moved from southeast to northwest, damaged roofs, outbuildings, and toppled one house trailer. Damages were estimated at \$2,750					
Cheyenne	7/16/1979	0	0	\$5,000,000	\$0
An F3 tornado rapidly developed from a moderate thunderstorm and moved through the north part of Cheyenne housing and airport areas. Damage included four C-130 aircraft and National Guard ground equipment, city-owned airport hangars and buildings damaged, 40 homes destroyed, 100 homes with major damage, 225 homes with lesser damage, and 17 trailer homes destroyed. One destroyed trailer home contained a family, killing a 14-month old boy and severely injuring the mother and a second child. The Cheyenne area received an estimated \$5 million worth of damage.					
Cheyenne	7/30/1979	0	0	-	\$0
Two tornadoes and several funnel clouds were seen just west of town. One tornado damaged buildings on a ranch 8 miles west of Cheyenne. The second tornado caused no damage					
Cheyenne	6/18/1997	0	0	\$2,000	\$0
A tornado touched down near the intersection of Four Mile Road and College Drive, destroying a storage shed. The tornado caused \$2,000 in damages.					
Cheyenne	5/30/1999	0	0	\$2,000	\$0
A tornado briefly touched down on the extreme north edge of Cheyenne, blowing out two windows and causing minor roof damage to a house. Damages were estimated at \$2,000					
Cheyenne	6/13/2017	0	0	-	\$0
Multiple tornadoes touched down in Laramie County and surrounding counties. These tornadoes caused a variety of damage, including at least nine homes or agricultural structures in the community of Carpenter, as well as northeast of Cheyenne near County Road 222 and U.S. Highway 85. The tornadoes downed power lines and damaged a gas line. No injuries or deaths were reported					
Cheyenne	5/18/2018	0	0	-	\$0
A tornado touched down and approximately 10 homes were damaged. Three of these homes had to be torn down and re-built.					

3.1.4.2 Inventory Exposed

Exposure to tornadoes is the same for the whole county, as tornadoes can touch down randomly throughout. Therefore, all assets are exposed but the potential damages are dependent on the characteristics of the tornado and its location as well as: the age and type of buildings, construction material used, and condition of the structure.

Lifelines could potentially be impacted based on the location of the tornado, including damage to infrastructure leading to power and communications disruption, water and fuel shortages, transportation issues and damage to services such as hospitals, water treatment, and wastewater facilities.

The availability of sheltered locations such as basements, buildings constructed using tornado-resistant materials and methods, and public storm shelters, all reduce the exposure of the population. The population needs to be aware of how to seek shelter during a tornado and avoid behaviors or decisions that place them in greater danger.

3.1.4.3 Probability of Future Occurrences

Although tornadoes are difficult to predict, based on previous occurrences, Laramie County could anticipate significant property damages from a single tornado event in the future. Historical frequency suggests that there is a likely chance that a tornado will occur somewhere in the county each year.

The likelihood of a tornado occurring changes according to the time of year. Based on historical records, tornadoes occur most frequently in May and June with some occurring as early as April. Community members should maintain awareness of tornado watches and warnings throughout the year.

3.1.4.4 Future Development Trends

All future structures built in Laramie County are exposed to tornado and severe wind damage. As with other large extent hazards, increased development will increase the vulnerability of these areas. Laramie County must continue to adhere and enforce building codes and facilitate new development that is built to the highest design standards to account for tornadoes and severe wind.

Due to the sporadic nature and characteristics of tornadoes, the county is not expected to be impacted equally. Older, non-code compliant homes and mobile homes are especially dangerous places during a tornado. Growth in Laramie County should include local agencies monitor the inventory and locations of mobile homes, particularly in areas of high tornado risk. Mitigation action discussion for severe winds and tornadoes in the county should have a focus on communities and geographic locations with large numbers of mobile homes.

3.1.4.5 Climate Change Impacts

The effect of climate change on frequency and intensity of tornadoes is being studied by scientists across the country. Tornadoes last for short durations, seconds to hours, and have a relatively small footprint compared to other weather-related hazards, making it difficult to model them. Scientists are using predictions of weather components that contribute to tornado occurrence and as weather shifts they can see trends in these components. The changes in weather patterns include increases in warm, moist air and wind shear, as well as an unstable atmosphere which create more favorable environments for tornadoes. These trends can possibly increase future occurrences and as climate change effects continue that likelihood grows.

3.1.5 Wildfire

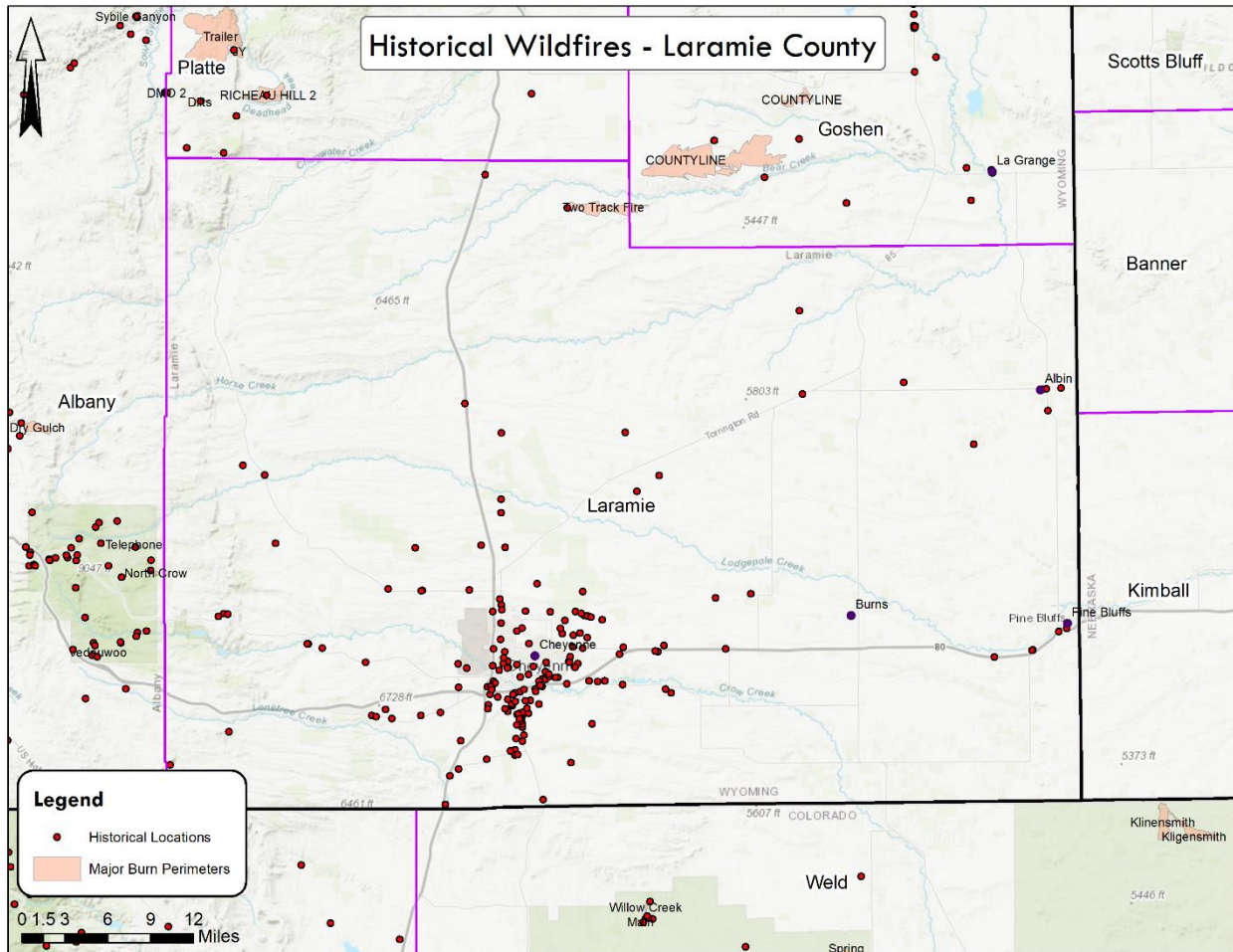
3.1.5.1 Previous Occurrences

The Federal Wildland Fire Occurrence Database recorded five wildland fires in Laramie County between 1980 and 2021. Two of those fires were false alarms and burned zero acres. The Herrick Creek Cabin #2 fire burned a tenth of an acre on July 4, 1999, and the Little Bear fire burned 3,125 acres on September 15, 2005.

Wyoming State Forestry GPS mapping determined details for a wildland fire that occurred on January 27, 2004, which started from a spark from a residential wood-burning stove and caused a grass fire five miles southeast of Cheyenne. High wind (50-60 mph) and an abnormally high ambient temperature (60 degrees Fahrenheit), helped the fire spread rapidly. The actual burn area covered 3,014 acres. Overall, the fire “ran” a linear distance of seven miles. The fire destroyed rangeland grasses, a large tree row, and an abandoned building.

The Otto Road fire on October 11, 2015, burned more than 1,000 acres including hundreds of acres of his private grazing lands. It is believed to have started due to a man in the area shooting recreationally at exploding targets.

Figure 3.13 Historical Wildfires



3.15.2 Inventory Exposed

All structures, infrastructure, people, and exposed utilities are potentially vulnerable to damages from a wildfire event. Figure 3.14 presents the wildfire risk across Laramie County. Structures that have not proactively mitigated wildfires are most at risk. Table 3.23 summarizes those parcels that are located within the highest (top 20% statewide). Readers are directed to the [WY State Forestry Division's Wildfire Risk Assessment Portal](#) to best review this information at a more user-friendly community scale.

Unincorporated areas of the county and all municipalities have some exposure to the highest wildfire risk areas. The unincorporated areas have the largest amount of parcels exposed, approximately half of the total in the county, and valued at more than \$695 million. Residential properties make up the vast majority of the total

exposed parcels in Cheyenne and value at more than \$608 million. Of the properties exposed in the county, approximately 96% are residential. The unincorporated areas have the highest number of commercial properties exposed with a value more than \$95.8 million. Within the county, commercial properties are approximately 4% of the total number of parcels exposed in the highest wildfire risk areas and hold approximately 7% of total parcel value. There are 18 exposed agricultural parcels, the highest number of which are in the incorporated areas and combined are worth approximately \$168,000.

Table 3.23 Parcel Exposure to Areas with Highest Wildfire Risk

Jurisdiction	Total Count	Residential	Improved Value (\$)	Commercial	Improved Value (\$)	Agricultural	Improved Value (\$)
Albin	51	48	3,737,444	3	550,227	-	-
Burns	138	135	9,791,546	3	255,674	2	2,343
Cheyenne	2,501	2,403	608,028,111	98	78,347,074	4	59,974
Pine Bluffs	232	220	14,347,838	12	619,321	1	937
Un-incorporated	2,968	2,861	599,427,206	107	95,858,340	11	104,816
County Total	5,908	5,667	1,235,332,145	223	175,630,636	18	168,070

All lifelines, with the exception of hazardous materials, have infrastructure exposed to areas with the highest wildfire risk in the county. The lifelines with the greatest exposure are communication and food, water, and shelter which both have 28% of infrastructure exposed. This is followed by safety and security, with 25% of infrastructure exposed and energy with 21% of the infrastructure exposed. The remaining lifelines have infrastructure exposure below 20% and can be seen in Table 3.24.

Table 3.24 Lifeline Exposure to Areas with Highest Wildfire Risk

Lifeline	Total Count	Count Exposed	Percent Exposed (%)
Communication	634	177	28 %
Energy	102	21	21 %
Energy (miles)	1,478	191	13 %
Food, Water, & Shelter	18	5	28 %
Health & Medical	30	5	17 %
Safety & Security	44	11	25 %
Transportation	365	61	17 %

There are no parcels or lifeline infrastructure exposed to the highest risk (top 33% statewide) Wildland Urban Interface (WUI) areas.

The areas covered by the Fire Protection Districts in Laramie County are shown in Figure 3.15.

Figure 3.14 Wildfire Risk

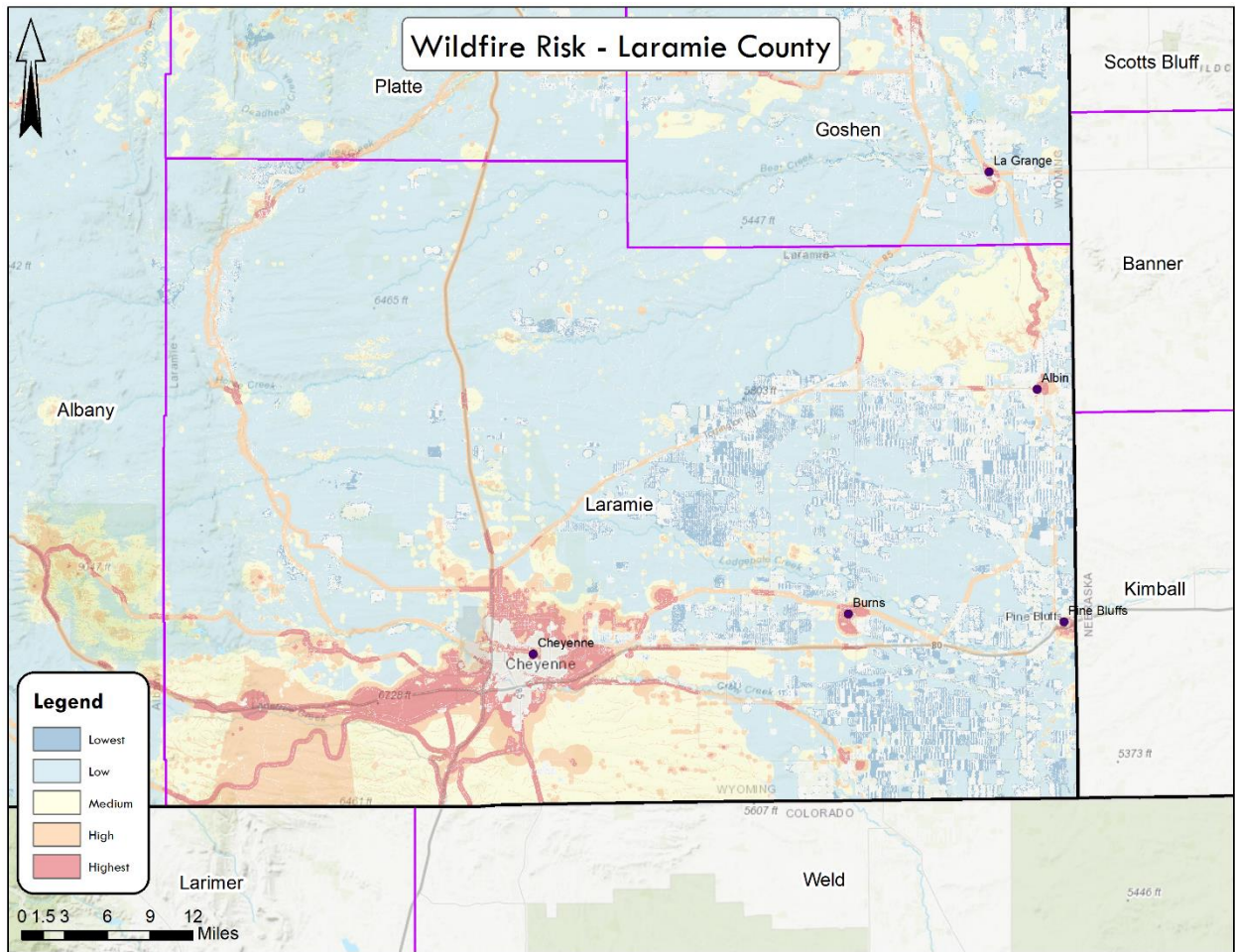
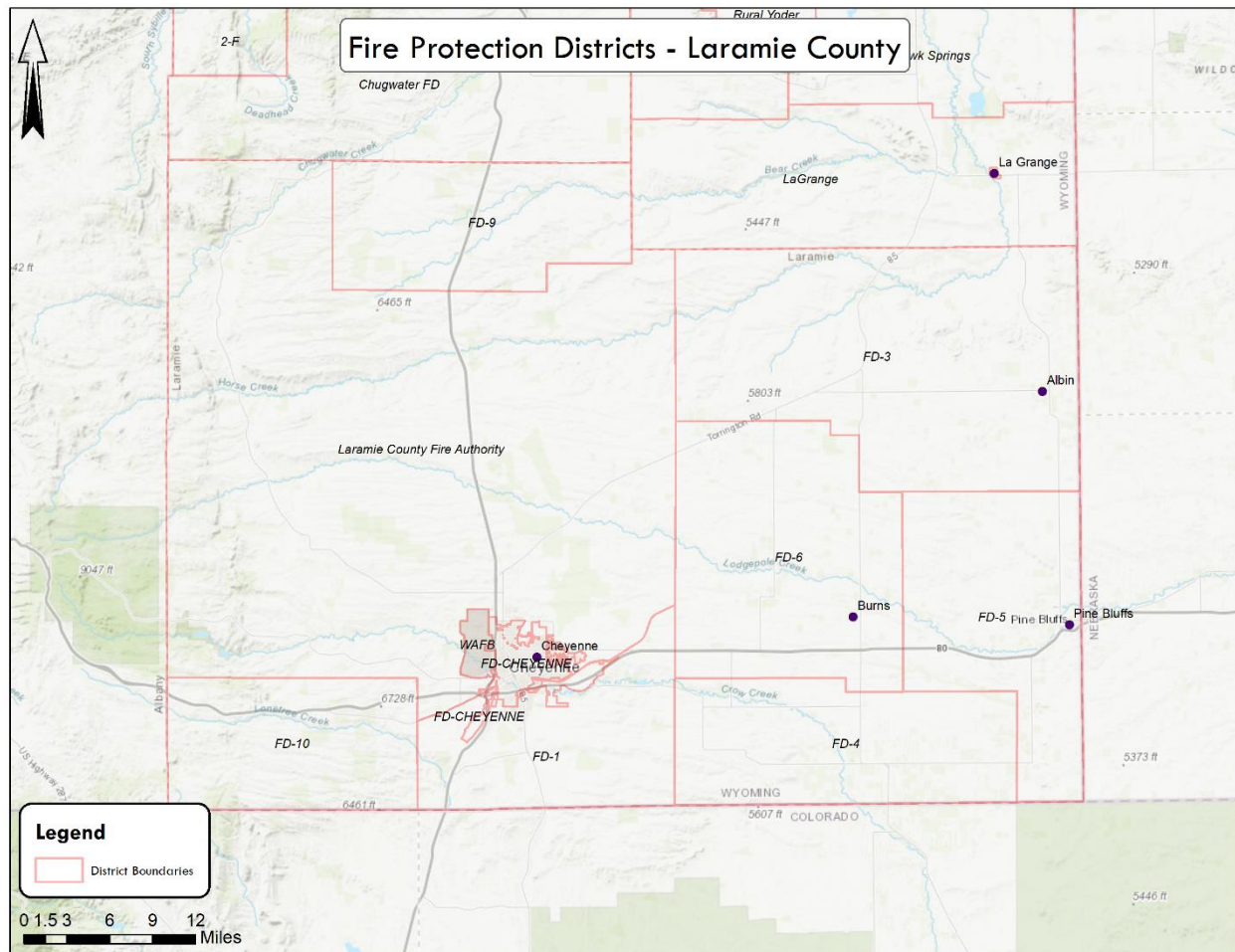


Figure 3.15 Fire Protection Districts



In Figure 3.16 and Figure 3.17, the United States Forest Service's (USFS) Wildfire Risk to Communities overview of risk to homes in Laramie County and its communities can be seen. The portal allows for a closer look down to the community level and comparison of risk against other counties or communities. The risk to homes in the county, which is determined based on the likelihood and consequences of wildfire is illustrated in the portal snapshot. According to the assessment of data in the portal the populated areas in Laramie County have, on average, greater risk to homes than 32% of the counties in Wyoming. Using the portal at the community level, the assessment of data shows that populated areas in Cheyenne have, on average, greater risk to homes than 10% of the communities in Wyoming.

Figure 3.16 Wildfire Risk to Communities Portal – Laramie County Level

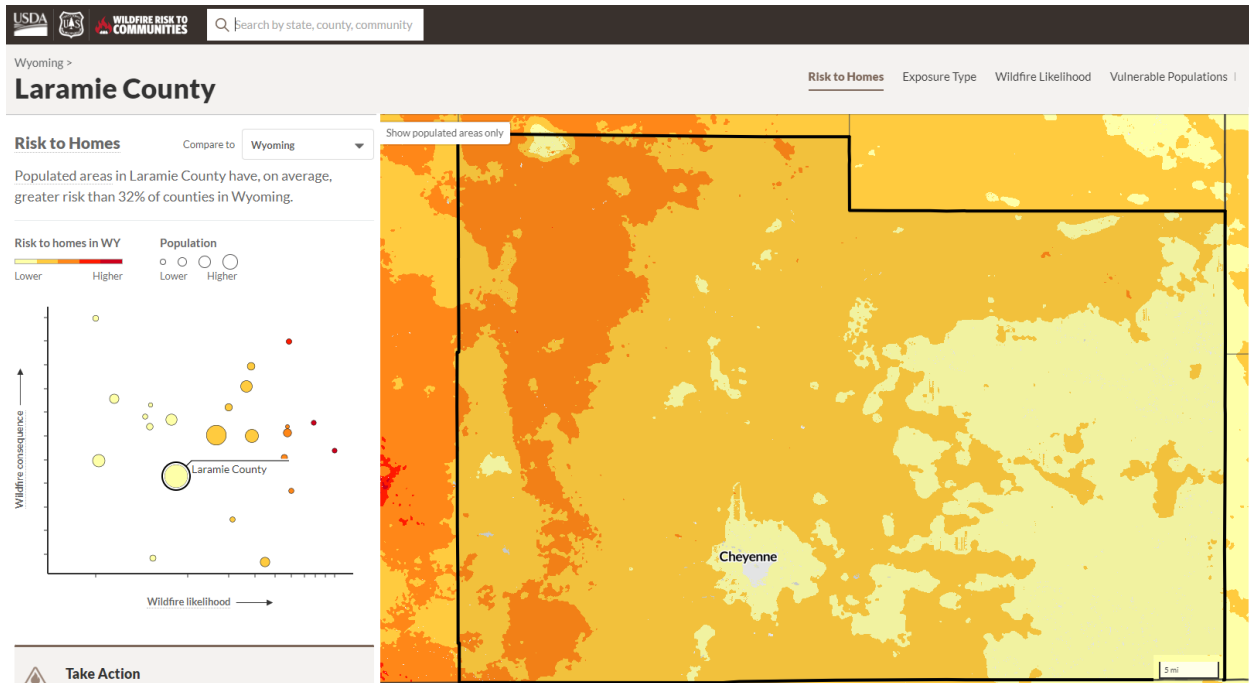
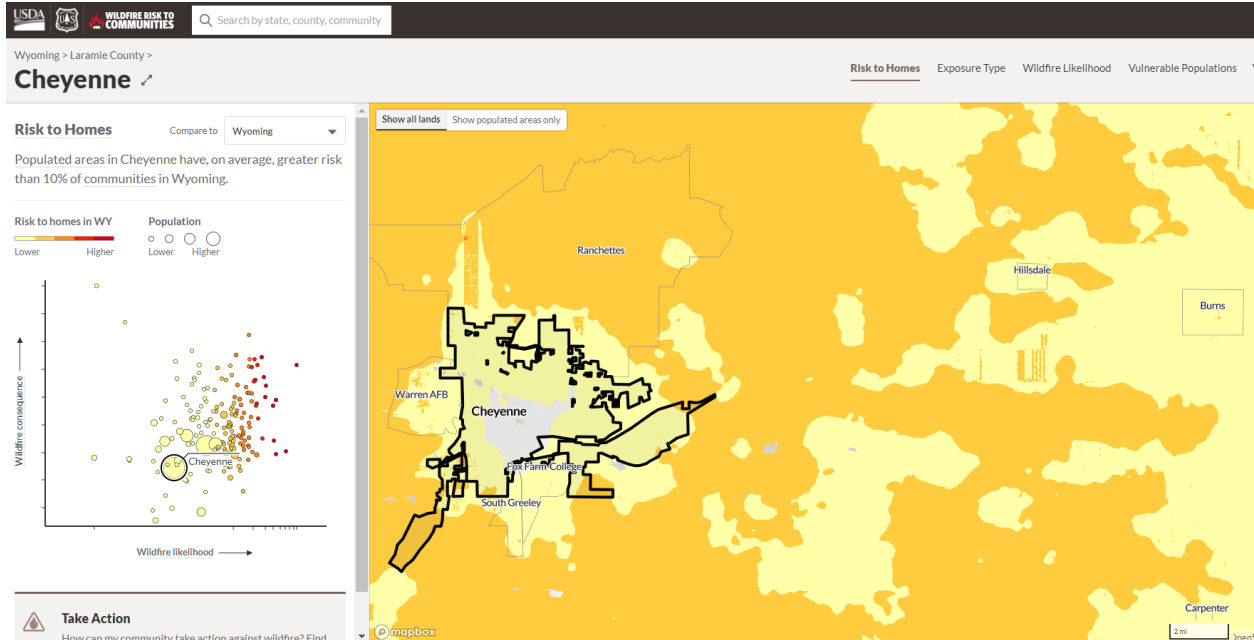


Figure 3.17 Wildfire Risk to Communities Portal – Community Level



3.1.5.3 Probability of Future Occurrences

Given Laramie County's previous records of wildfire occurrences, it can be assumed that future wildfire events will occur within the county. Wildfires can occur year-round and that the risk of wildfires occurring may increase

during times of drought, especially prolonged droughts. Most events are quickly contained and do not burn a large number of acres.

According to research by the National Park Service, 85% of wildfires are human-caused, primarily due to campfires left unattended, the burning of debris, equipment use and malfunctions, negligently discarded cigarettes, and intentional acts of arson. Ultimately, the occurrence of future wildfire events will strongly depend on patterns of human activity. Events are more likely to occur in wildfire-prone areas experiencing new or additional development.

3.1.5.4 Future Development Trends

As Laramie County experiences steady growth, the risk and impacts of a wildfire event are prevalent to both existing infrastructure and future development. Subdivisions and other high-density developments can create a situation where wildland fires can involve more buildings than any amount of fire equipment can possibly protect. By identifying areas of higher density in high-risk areas, communities can identify areas of mitigation interest and reduce hazard risks associated with increased exposure.

Development and population growth in the WUI contributes to increased exposure of people and property and can exacerbate the potential magnitude of a wildland fire. By identifying areas with significant potential for population growth and/or future development in high-risk areas, communities can identify areas of mitigation interest and reduce hazard risks associated with increased exposure. Some land use and building codes include and/or focus on mandatory mitigation measures. As a mitigation strategy, Laramie County and its jurisdictions should continue to regulate building and future development in the WUI.

Laramie County has a Community Wildfire Protection Plan (CWPP) for the Laramie County Fire Authority (LCFA), developed in 2022, and Fire District 10, which was developed in 2016. These were created to better understand and address the risk presented by wildfires. The CWPP was created to help reduce the threat of devastating wildfires to the watersheds that feed the lakes, especially in Curt Gowdy State Park, and to protect the numerous homes in the area. The CWPPs developed recommended actions to address ways for residents, fire districts, and agencies to reduce their collective risk.

Continuous public education is crucial to implementing actions and preparing homeowners. Safety zones can be created around structures by reducing or eliminating brush, trees, and vegetation around a home or facility. FEMA recommends using a 30-foot safety zone; including keeping grass below two feet tall and clearing all fallen leaves and branches promptly. Additionally, only fire-resistant or non-combustible materials should be used on roofs and exterior surfaces. Firebreaks-areas of inflammable materials that create a fuel break and reduce the ability for fires to spread and roads and pathways-can be planned and designed to serve as wildfire mitigation.

3.1.5.5 Climate Change Impacts

Climate change has steadily increased the frequency and intensity of wildfires around the nation. Continued unpredictable precipitation and weather patterns will lead to increased occurrence, extended durations, and magnified severity. The patterns of drought, brought by drier and hotter climate, create conditions that wildfires thrive in, and these fires have begun to consistently spread faster and farther. Wildfires will continue to thrive on the lack of humidity and dry vegetation created by drought, often perpetual. Hotter conditions fuel fires, the extreme temperature fluctuations and unseasonable increases in heat have and will continue to create a longer wildfire season.

3.16 Wind

3.1.6.1 Previous Occurrences

Between 2009 and 2021, NCEI recorded more than 618 high wind events in Laramie County. These events resulted in the reports of one death, seven injuries, and \$2,000 in property damage. Damages due to high

wind events usually include damaged roofs, toppled trees, broken branches, and blown-out windows. It is also common for semi-tractor trailers to be blown over, as was the case with the event with reported damages.

Thunderstorm winds impact Laramie County as well and are associated with 58mph winds or greater related to a thunderstorm event. Damages from these events may be due to hail or lightning and not wind in particular, but the best available data from NCEI extends further in the past than for high wind events. From 1950 to 2017, 180 thunderstorm wind events were recorded in Laramie County. These events caused 1 injury and more than \$119,000 in property damage.

The highest wind speed measured was 81mph, recorded in November of 2020 by a Union Pacific Railroad sensor in the South Laramie Range Foothills, approximately 14 miles from Cheyenne.

The SHELDUS database has damages reported for 41 out of the 58 years between the period of 1961-2019. The total property damages reported due to high wind events in that time period is more than \$6.5 million (2019 USD), while crops damages were more than \$5.3 million (2019 USD). A total of 29 injuries and zero fatalities were reported. Not all damages get reported and it is possible the losses and number of event years is higher.

Table 3.25 shows historical damaging wind events across the county. The two most notable events for property and crop losses were in 1981 and 1984. In 1981, there was a report \$4.8 million in crop losses and in 1984, property damages of more than \$3.1 million were reported.

Best available data is used for these figures. SHELDUS utilizes multiple sources for determining damaging events and loss figures, but does not report on events without recorded damages. If damages are not reported, the data cannot represent the actual losses caused by an event. The information below is based on the best available data from reported damaging events.

Windblown deposits, also called loess, are common in some parts of Wyoming. There are no recorded events in Laramie County of windblown deposits causing structural damage, however it is possible such instances go unreported. Identified windblown deposit areas can be seen in Figure 3.19.

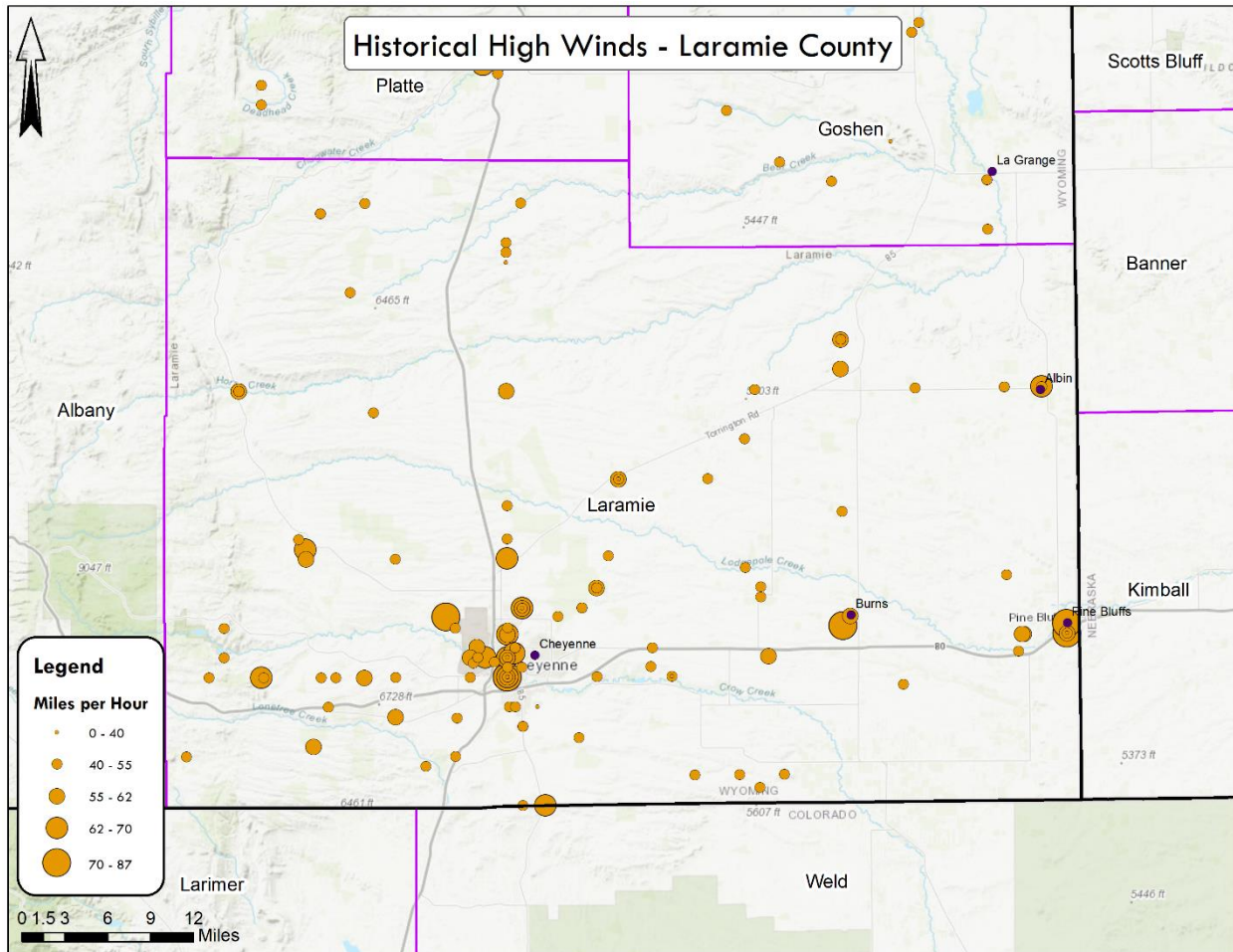
Table 3.25 Wind Damages per Year 1961-20194 (2019 USD)

Year	Property Damage (\$)	Crop Damage (\$)	Injuries	Deaths
1961	6,630	54,171	0	0
1964	72,694	0	0	0
1966	44,437	0	0	0
1972	283,037	0	0	0
1973	222,053	0	0	0
1974	80,476	0	0	0
1975	261,793	0	0	0
1976	227,728	0	0	0
1977	4,648	0	0	0
1978	203,923	0	0	0
1979	77,600	0	0	0
1981	0	4,751,641	0	0
1982	14,905	0	0	0
1983	5,979	0	0	0

Wyoming Region 7 Hazard Mitigation Plan – 2023 Update (Laramie County)

Year	Property Damage (\$)	Crop Damage (\$)	Injuries	Deaths
1984	3,120,087	103,928	0	0
1985	414,663	401,416	1	0
1986	20,510	0	2	0
1987	3,526	0	0	0
1988	73,095	13,570	0	0
1989	9,804	0	0	0
1990	13,098	0	0	0
1992	4,618	0	0	0
1993	896,728	0	7	0
1994	43,717	0	7	0
1995	5,668	0	0	0
1996	6,273	0	0	0
1997	2,402	1,998	0	0
1998	7,022	0	0	0
1999	79,685	0	0	0
2000	82,773	0	3	0
2002	36,014	0	0	0
2003	28,169	0	0	0
2004	68,596	0	0	0
2006	6,749	0	0	0
2007	28,747	0	1	0
2008	48,147	0	0	0
2009	4,832	0	1	0
2010	40,071	0	0	0
2011	0	0	7	0
2014	0	0	1	0
TOTAL	6,550,897	5,326,724	29	0

Figure 3.18. Historical High Wind Events, Laramie County



3.16.2 Inventory Exposed

Laramie County's topography can exacerbate high wind conditions. Laramie County lies in the eastern plains of Wyoming, marked by miles of prairie without natural windbreaks. High winds can speed across the plains without any obstacles, adding to the velocity and force of the wind. Wind speeds of 60mph are not uncommon in the county. High winds that occur in combination with severe winter storms can be especially damaging.

All of Laramie County may be affected by high wind events and events could potentially impact Lifeline function, such as damaging power and communications infrastructure.

According to the Wyoming State Geological Survey, windblown deposits are considered a hazard because they may damage property. These deposits may also impact infrastructure, crops, and water supplies. Table 3.26 shows the parcel exposure of properties in areas identified as locations of windblown deposits.

There are 19 parcels in unincorporated areas of the county that are exposed to areas identified as having windblown deposits. The total value for all exposed parcels is approximately \$800,000 and except for one are all residential. The remaining is an agricultural parcel valued at more than \$5,500.

Table 3.26 Parcels Exposed to Identified Windblown Deposit Areas

Jurisdiction	Total Count	Residential	Improved Value (\$)	Agricultural	Improved Value (\$)
Unincorporated	19	18	793,054	1	5,544
County Total	19	18	793,054	1	5,544

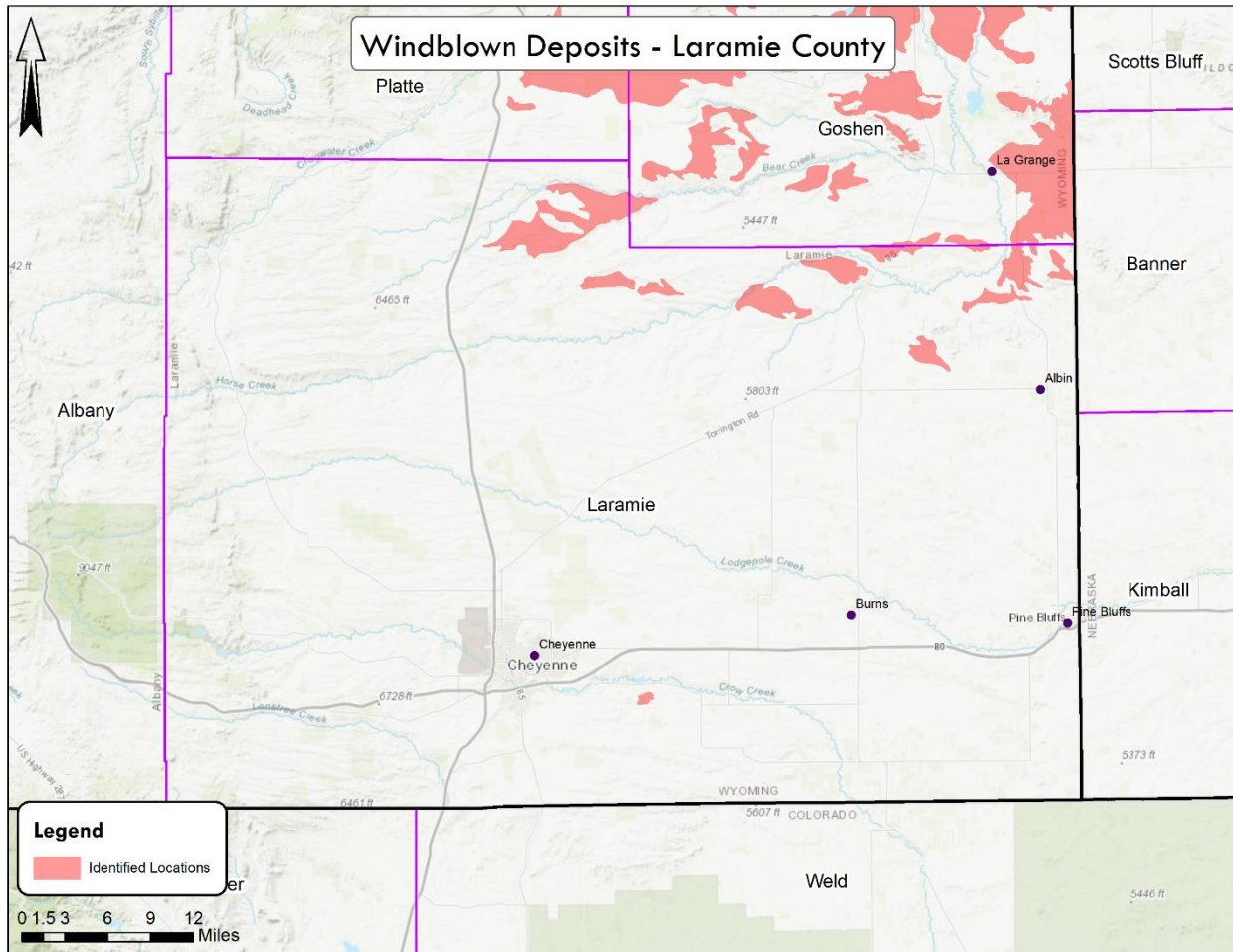
Only two lifelines have infrastructure exposed to windblown deposits areas, however the exposure is minimal.

Table 3.27 Lifeline Exposure to Windblown Deposits Areas

Lifeline	Total Count	Count Exposed	Percent Exposed (%)
Communication	634	2	<1 %
Energy	102	1	1 %

Figure 3.19 shows the areas identified as having windblown deposits, which are located predominantly in the northeastern portion of the county.

Figure 3.19 Identified Windblown Deposit Areas



3.16.3 Probability of Future Occurrences

Historical records and the frequency of previously reported high wind events in Laramie County indicate that high winds are likely to occur in any given year and have the potential to inflict costly damage to people and property. Mitigating damage requires that communities remain diligent about building structures that meet current building codes in order to be able to withstand damage.

Windblown deposits are consistently being carried to different areas and will likely continue for the foreseeable future.

3.16.4 Future Development Trends

As Laramie County experiences steady growth, the risk and impacts of a wind storm are prevalent to both existing infrastructure and future development. Because these events are not typically isolated to one geographical area, the location of structures does not increase or reduce the risk necessarily. Laramie County should adhere to building codes and development should be built to current standards in case of adverse weather.

Consideration of windblown deposit locations should be taken into account for any potential development sites. Destabilizing deposits can have longer term impacts on health, property, and infrastructure.

3.16.5 Climate Change Impacts

Climate change has increased global wind speeds according to a study in the journal *Nature Climate Change*. Analyzing data from 1978 to 2017 from more than 1,400 stations, revealed increasing wind speeds since

2010. This trend is expected to continue, as fluctuations in temperatures and unpredictable weather patterns will continue to alter the natural climate cycle. It is unknown whether this will impact the occurrence or severity of high wind events. It is unknown if climate change will affect windblown deposits.

3.17 Winter Storm

3.17.1 Previous Occurrences

According to NCEI storm events database, 520 blizzard/heavy snow/winter storm/winter weather events have occurred in Laramie County since records began in 2009 and continued through 2021. No injuries, property, or crop damage were reported due to these events, however one death has occurred. These events include the storms in which Laramie County and its jurisdictions were primarily impacted, however numerous other regional storms have been recorded as affecting the county, including extended road closures.

According to the SHELATUS database, 35 injuries, 4 deaths, more than \$3.1 million in property damages, and more than \$600,000 in crop damage resulted from winter weather events in Laramie County between 1960 and 2019. These figures are adjusted to the value of 2019 U.S. dollars.

Roughly one third of the property damages reported in SHELATUS occurred in 1997, with \$1.1 million reported. Based on a 1997 NOAA Storm Data Report, the event occurred between December 8-11, 1997, and contributed to 76 accidents between Laramie and Albany counties. On December 10th, a bus was rear-ended by a semi-truck 14 miles west of Cheyenne resulting in 21 passengers being injured and on December 11th a woman died of exposure after leaving her disabled vehicle. The temperature at the time was approximately 20 degrees below zero Fahrenheit and the wind chills in the vicinity were 70 degrees below zero.

Details for a recent significant winter storm event, which occurred between March 12th and 15th 2021, have been provided by the NWS Cheyenne. The storm brought high snowfall totals, thundersnow, and increased windspeeds up to 55mph. The windspeeds and intense snowfall led to snow drifts, up to three feet high, which closed roads for up to three days and segments of I-25 and I-80 were closed for extended periods over multiple days. It was reported by the planning committee as resulting in \$1.5 million damages in Laramie County alone. There were widespread power outages and it was reported multiple roofs collapsed. There was one reported fatality due to exposure and the official snow total was almost 31 inches.

According to NCEI storm events database, nine extreme cold or wind chill events have occurred in Laramie County between 2009 and 2021. Although these events take place as a result of winter weather, their primary feature was extreme cold. No deaths, injuries, or damages were reported as a result of these events.

3.17.2 Inventory Exposed

Winter storms can cover a large geographic area, as the event travels. Therefore, all of Laramie County is exposed to this hazard and could be impacted. However, the severity of these impacts on the people, property, crops, and livestock in the county is not uniform and is dependent upon numerous variables.

Damaged power lines and dangerous or impassable roadways may hinder the delivery of critical services such as medical and emergency assistance, the delivery of food supplies and medications, or the provision of basic utilities, such as heat and running water.

Extreme cold poses a risk to all assets and the population located in Laramie County. Most structures should be able to provide adequate protection if an extreme cold event occurs. Extreme cold can disrupt communications facilities and utility transmission lines, as well as the potential for water pipes to freeze. Extreme cold has the ability to impact livestock and crops if the event occurs during certain times of the year.

3.17.3 Probability of Future Occurrences

Severe winter storms and blizzards can be predicted with a reasonable level of certainty. Through the identification of various indicators of weather systems, and by tracking these indicators, warning time for snow

storms can be as much as a week in advance. Understanding the historical frequency, duration, and spatial extent of severe winter weather assists in determining the likelihood and potential severity of future occurrences. The characteristics of past severe winter storms provide benchmarks for projecting similar conditions into the future. The probability that participating communities will experience a severe winter storm event, based on historical records and frequencies, is highly likely and expected to occur at least once every year.

The probability that Laramie County will experience another extreme cold event can be difficult to quantify. It is important to note that the limited amount of historical accounts for extreme cold temperatures does not necessarily indicate a low frequency of occurrence. Certain hazards occur more frequently in specific areas. Therefore, the residents of these areas are less likely to report events that seem commonplace, even though the events may be considered extreme in other locations.

3.17.4 Future Development Trends

As Laramie County continues to see steady growth, the risk and impacts of a winter storm event are prevalent to both existing infrastructure and future development. Since the previous statement is assumed to be uniform for the county, the location of structures does not increase or reduce the risk necessarily. Participating communities should adhere to building codes, and therefore, new development can be built to current standards to account for adverse weather. Additionally, as homes go up in more remote parts of the county, accessing those rural residents may become impossible should sheltering or emergency services be needed in an extreme event.

3.17.5 Climate Change Impacts

As climate change unpredictably affects weather patterns, the types and numbers of winter storms is being impacted. The intensity and frequency of storms has been notably different in recent history, from unexpectedly heavy precipitation and extreme cold temperatures, to unseasonable temperatures and minimal precipitation. These drastic fluctuations are indicative of the impacts from climate change and are likely to create more dangerous and damaging winter storms. The limited ability to consistently predict accurate conditions for winter storms can leave people exposed and infrastructure unprotected.

4 Plan Adoption, Implementation, and Maintenance

Having a plan for monitoring, evaluating, maintaining, and implementing this HMP is critical to maintaining its value and success. Ensuring effective implementation of mitigation activities paves the way for continued momentum in the planning process and gives direction for the future. This section explains who will be responsible for maintenance activities and what those responsibilities entail. It also provides a methodology and schedule of maintenance activities including a description of how the public will be involved on a continual basis.

4.1 Role of Hazard Mitigation Planning Committee in Implementation and Maintenance

With adoption of this plan, the HMPC will be tasked with the plan's implementation and maintenance and will be led by the Laramie County Emergency Management Department. The HMPC will act as an advisory body. Its primary duties will be to see the plan successfully carried out and to report to the community governing boards and the public on the status of plan implementation and mitigation opportunities. With the adoption of this plan, the HMPC agrees to:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high-priority, low/no-cost recommended actions;
- Keep the concept of mitigation in the forefront of community decision-making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;
- Maintain a vigilant monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions;
- Monitor and assist in implementation and update of this plan;
- Report on plan progress and recommended changes to the County Commissioners; and
- Inform and solicit input from the public.

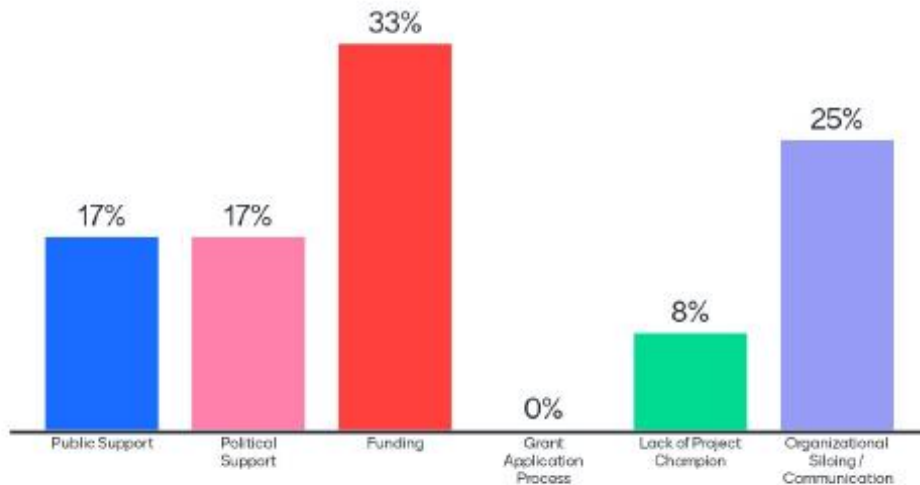
Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, coordinating with appropriate entities, and updating relevant information on the county's and Emergency Management Department's website, along with local newspapers and Emergency Management social media accounts.

4.2 Implementation

Upon updating and adopting this plan, it is intended to be implemented to reduce Laramie County's vulnerability to natural hazards over time. Implementation is informed by multiple factors, including funding, project schedule, available personnel, and priority of completion. Figure 4.1 shows the barriers Laramie County's HMPC see as impacting implementation, with the greatest identified as funding, and organizational silo-ing / communication. A large part of implementing this plan is utilizing it to promote mitigation and educate other stakeholders, government agencies, and potential partners to assist in accomplishing mutually beneficial mitigation projects. These identified obstacles have the potential to increase capabilities, as communication across agencies, organizations, and the public can often lead to funding opportunities that were unknown previously. Leveraging the contributions of people across sectors is the most effective way to develop, progress, and implement mitigation projects for a community.

Figure 4.1 Implementation Obstacles

What are the biggest obstacles to implementing mitigation (pick 2)?



Continuous, cooperative, and informed efforts to network and highlight the multi-objective benefits of each project to the community and its stakeholders is crucial to implementation. These efforts include the promotion of mitigation, collaboration, and the value to the community overall.

Simultaneous to these efforts, the HMPC will consistently monitor funding opportunities that could be leveraged to implement actions. Coordinating ahead of time on how to meet local match for grants, or to adapt projects to fit grant requirements are important proactive steps to obtain funding. When funding does become available, the HMPC will then be in a position to capitalize on the opportunity.

Funding opportunities to be monitored include special pre- and post-disaster funds, special district budgeted funds, state and federal earmarked funds, and other grant programs, including those that can serve or support multi-objective projects.

While grant funding allows for many mitigation action projects to be funded, Laramie County intends to diversify funding opportunities in an effort to be less reliant on grant monies. This allows for greater flexibility in implementation of projects that are important to communities.

4.3 Maintenance

Plan maintenance implies an ongoing effort to monitor and evaluate plan implementation and to update the plan as required or as progress, roadblocks, or changing circumstances are recognized.

4.3.1 Maintenance Schedule

In order to track progress and update the mitigation strategies identified in the action plan, the HMPC will revisit this plan annually or after a significant hazard event or disaster declaration has occurred. The Laramie County Emergency Management Agency is responsible for initiating this review and convening members of the HMPC on a once yearly basis, or more frequently as needed. The annual review is recommended to occur in the month of January.

This plan will be updated, approved, and adopted within a five-year cycle as per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000. The county will inquire with the Wyoming Office of Homeland Security (WOHS) and FEMA for funds to assist with the update. Funding sources may include the Emergency Management Performance Grants, Hazard Mitigation Grant Program (if a presidential disaster has been declared), Building Resilient Infrastructure and Communities grants, and Flood Mitigation Assistance grant funds.

4.3.2 Maintenance Evaluation Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Such changes in vulnerability may include:

- Decreased vulnerability as a result of implementing recommended actions;
- Increased vulnerability as a result of failed or ineffective mitigation actions; and/or
- Increased vulnerability as a result of new development (and/or annexation).

Based on plan implementation, the HMPC will use the following process to evaluate progress, note changes in vulnerability, and consider changes in priorities:

- A representative from the responsible entity identified in each mitigation measure will track and report on project status to the HMPC annually. The representative will provide input on whether the project meets the defined goals and objectives and is likely to be successful in reducing vulnerabilities.
- If the project does not meet identified goals and objectives, the HMPC will select alternative projects for implementation.
- New projects identified will require that an individual be assigned as responsible for defining the scope, implementation, and monitoring success of the project.
- Projects not ranked high priority but were identified as potential mitigation strategies will be reviewed during the monitoring and update of this plan to determine feasibility of future implementation.
- Changes will be made to accommodate for projects that have failed or are not considered feasible after review of the established criteria, the time frame, priorities, and/or funding resources.

Updates to this plan will follow the most current FEMA and WOHS planning guidance and will consider the following:

- Changes in vulnerability due to project implementation;
- Documentation of
 - success stories where mitigation efforts have proven effective;
 - areas where mitigation actions were not effective;
 - any new hazards that may arise or were previously overlooked;
 - hazard events and impacts that occurred within the five-year period;
 - continued public involvement; and
 - changes to the planning process, which may include new or additional stakeholder involvement;
- Incorporation of
 - new data or studies on hazards and risks;
 - new capabilities or changes in capabilities;
 - growth and development-related changes to building inventories;
 - projected development that could be vulnerable to hazards;
 - new project recommendations or changes in project prioritization;
- Include a public involvement process to receive public comment on the updated plan prior to submitting the updated plan to WOHS/FEMA; and
- Include re-adoption by all participating entities following WOHS/FEMA approval.

4.3.3 Plan Integration

Laramie County maintains a comprehensive set of emergency management plans, developed in a multidisciplinary environment where county departments, jurisdictional agencies and representatives, nonprofit

and community organizations, and the private sector are included in the planning process. This set of plans encompass all phases of emergency management and the work done on the Wyoming Region 7 HMP update will be integrated into these efforts moving forward.

By integrating the HMP with the county's comprehensive set of emergency management plans, a strong foundation for resilience can be set through smart emergency preparedness, mitigation, response, and recovery; before, during, and after an emergency or disaster event.

Additionally, considering hazard mitigation during all applicable future county, municipal, and regional planning efforts is crucial. Some of the larger opportunities for impactful integration involve comprehensive plans, transportation plans, building codes, community wildfire protection (and implementation) plans, and annual capital expenditure planning. The greater the investment of hazard mitigation planning into other plans, the more likely the success of implementation and achieving common goals across departments and jurisdictions.

HMPC members are responsible for promoting and advocating for integration of the findings and recommendations of this plan with other plans, policies, and studies, as appropriate. This plan will be considered a core document that will help provide a plan and process for the county to mitigate against future hazard events. This plan may also initiate more in-depth analysis and reports (i.e. Wildfire Study) should funding become available.

Plans are only as informed and stable as the energy and knowledge put into them, which is why plan integration involves an intersectional approach to be successful. Identifying relevant and relatable plans to integrate is the first step, however the right people need to come to the table to coordinate, problem solve for any possible issues, and most importantly celebrate the strengths and progress of each plan.

There are a number of other community plans that will benefit from strategies and content within this updated HMP. Integrating components of this plan across other community planning efforts will be an ongoing effort and will help to ensure no strategic conflicts are created through other planning processes, and most critically that areas of mutual interests are identified.

This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs. Wherever possible it is recommended that project implementation be achieved through collaborative and collectively beneficial work with other programs, planning, and policy development.

4.3.4 Continued Public Involvement

The plan maintenance and update process will include continued public and stakeholder involvement and input through participation in designated committee meetings, Local Emergency Planning Committee LEPC meetings, web postings, and press releases to local media.

It is important to share success stories with the community as mitigation actions are completed, to ensure the public understands the value of the plan and their input going forward. Sharing the plan with the communities often and consistently, throughout the planning cycle, provides opportunities to seek additional public comment.

A public hearing(s) to receive comment on plan maintenance and updating from residents will be held during the maintenance period and information will be taken into account for formal updates. When the HMPC reconvenes for the plan update, they will coordinate with all stakeholders participating in the planning process. This includes those that joined the committee during the maintenance period, those that were a part of the last planning process, and those who are new additions to the roster, to update and revise the plan.

Public awareness of the plan and outreach was thoroughly discussed by the planning committee and it was determined that outreach specific to flood and wildfire would be best to hand out seasonally. There is already some wildfire outreach, which was created through the regional meeting of fire wardens. The brochure has wildfire awareness information and also information about Firewise and how to strengthen the program. These

fire warden meetings are closed, however there was discussion on how to potentially make the wardens and information available to the public through some open meetings.

Community health was particularly active in ideas for public involvement and education, including drafting a handout for property developers and potential new residents wanting to move out to more rural areas. The importance of educating new residents, who may not have exposure to aspects like unimproved roads and weather event isolation, cannot be underestimated in the value to life safety. Outreach regarding how rural living impacts availability of services and emergency responders, could be a deciding factor for those potential residents.

The community health department also educates on water quality issues due to silt run-off from fire scars, which can be an issue for those without alternate water sources.

Further discussion involved how to leverage existing community outreach methods for other hazards, and just as importantly education about the plan.

5 Earthquake Hazus Risk Report

6 Meeting Agendas and Invites

7 Adoptions
