PARK COUNTY HAZARD MITIGATION PLAN

FINAL DRAFT

PREPARED FOR

Park County
City of Livingston
Town of Clyde Park

AUGUST 2018

EXECUTIVE SUMMARY

Disasters can strike at any time in any place. In many cases, actions can be taken before disasters strike to reduce or eliminate the negative impacts. These actions, termed mitigation, often protect life, property, the economy, or other values. The Park County Hazard Mitigation Plan addresses sixteen major hazards with respect to risk and vulnerabilities countywide, including in the City of Livingston and the Town of Clyde Park. Through a collaborative planning process, the Park County hazards were identified, researched, and profiled.

The major hazards are each profiled in terms of their description, history, probability and magnitude, vulnerabilities, and data limitations. The vulnerabilities to critical facilities, critical infrastructure, existing structures, the population, values, and future development are evaluated for each hazard.

Based on the probability and extent of potential impacts identified in the risk assessment, the prioritizations of hazards within Park County are outlined in Table ES-6-1 through Table ES-6-3.

Table ES-6-1. Park County Hazard Prioritizations

Level	Hazard
High Hazard	Flooding Wildfire Earthquake Hazardous Materials Release Wind Winter Storms and Extended Cold
Moderate Hazard	Severe Thunderstorms and Tornadoes Communicable Disease and Bioterrorism Avalanche and Landslide Drought
Low Hazard	Utility Outage Volcano Terrorism, Civil Unrest, and Violence Aviation Accident Railroad Accident

Table ES-6-2. City of Livingston Hazard Prioritizations

Level	Hazard
High Hazard	Flooding Earthquake Hazardous Materials Release Wind Winter Storms and Extended Cold
Moderate Hazard	Communicable Disease and Bioterrorism Severe Thunderstorms and Tornadoes Urban Fire Drought Utility Outage
Low Hazard	Ground Transportation Accident Wildfire Aviation Accident Terrorism, Civil Unrest, and Violence Railroad Accident Volcano

Table ES-6-3. Town of Clyde Park Hazard Prioritizations

Level	Hazard
High Hazard	Flooding Earthquake Hazardous Materials Release Wind Winter Storms and Extended Cold
Moderate Hazard	Communicable Disease and Bioterrorism Severe Thunderstorms and Tornadoes Urban Fire Drought Utility Outage
Low Hazard	Ground Transportation Accident Wildfire Aviation Accident Terrorism, Civil Unrest, and Violence Railroad Accident Volcano

The following goals are outlined in the plan's mitigation strategy, based on the results of the risk assessment:

- Goal 1: *Reduce damages from flooding.*
- Goal 2: *Prevent losses from wildfires.*
- Goal 3: *Reduce potential losses from earthquakes.*
- Goal 4: *Reduce losses from a transportation or hazardous materials accident.*
- Goal 5: *Promote effective multi-hazard mitigation measures.*

Associated with each of the goals are objectives and mitigation projects ranging from updating land use regulations to burying electric infrastructure. The mitigation projects are prioritized based on cost, staff time, feasibility, population benefit, property benefit, values benefit, project maintenance, and the probability and impact of the hazards being mitigated. An implementation plan outlines the suggested course of action, given the limited resources available to Park County, the City of Livingston, and the Town of Clyde Park. Park County Disaster and Emergency Services (DES) and the Park County Local Emergency Planning Committee (LEPC) are responsible for the implementation and maintenance of the plan. Other recommended activities, such integrating this plan into a variety of county, city, and town plans, regulations, and documents, will further the goals of hazard mitigation in Park County.

The Park County Hazard Mitigation Plan exceeds the requirements of a local hazard mitigation plan as outlined in the Interim Final Rule published in the Federal Register on February 26, 2002 at Title 44 of the Code of Federal Regulations, Part 201 as part of the Disaster Mitigation Act of 2000. This plan has been approved by the Federal Emergency Management Agency as a hazard mitigation plan, and therefore, the county, city, and town may be eligible for federal mitigation funds. This plan serves as a guide for understanding the major hazards facing Park County, the City of Livingston, and the Town of Clyde Park and provides a strategy for preventing or reducing some of the impacts.

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1.0 INTRODUCTION

1.1 PURPOSE

Park County, the City of Livingston, and the Town of Clyde Park recognize that hazards, both natural and human-caused, threaten their communities. Rather than wait until disaster strikes, the jurisdictions can take proactive measures to prevent losses and lessen the impact from these hazards. Actions taken to reduce or eliminate the long-term risk from hazards are defined as mitigation. Disaster mitigation is an investment that can save lives and money.

The purpose of this Hazard Mitigation Plan is to:

- Serve as a consolidated, comprehensive source of hazard information
- Educate the communities, including government leaders and the public, on their vulnerabilities
- Fulfill federal, state, and local hazard mitigation planning responsibilities
- Prioritize and promote cost-effective mitigation solutions
- Support requests for grant funding
- Encourage long-term community sustainability

Effective mitigation planning promotes a broader understanding of the hazards that threaten communities and provides a clearer vision and competitive edge for future mitigation grant funding. By integrating mitigation concepts into local thinking, communities find more opportunities for disaster resistance beyond grant funding. For example, the consideration of disaster mitigation when designing new facilities or subdivisions will result in cost-effective solutions and greater disaster resistance, thus saving money in the long-term and contributing to the sustainability of communities.

The intent of the plan is to assist the communities in making financial decisions for mitigation projects and clarify actions that could be taken through additional funding. Through the planning process communities can become more aware of their hazards and can adopt a proactive approach to disaster prevention and mitigation.

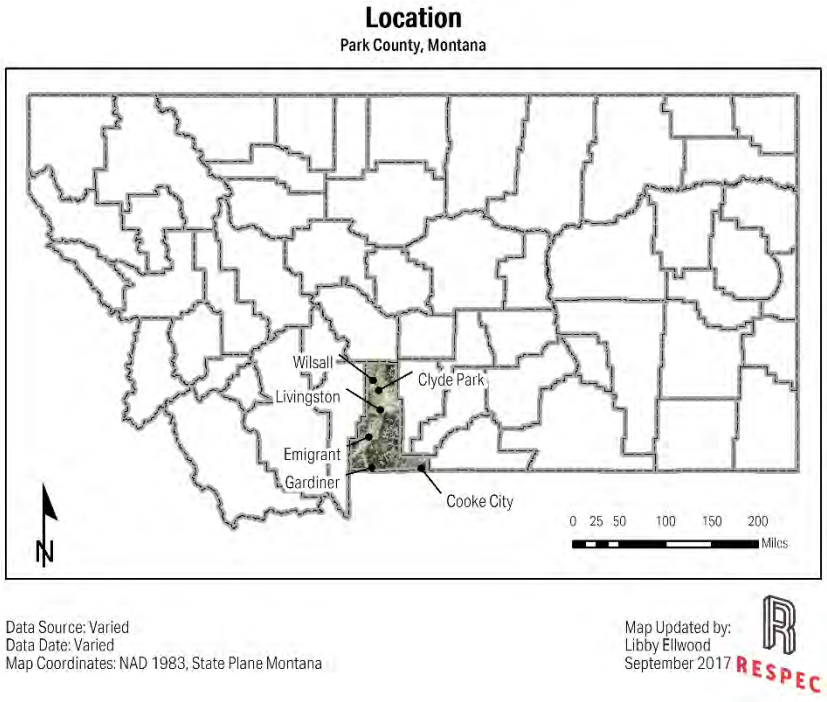
1.2 AUTHORITIES

The Disaster Mitigation Act (DMA) of 2000 amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act by adding a new section, Section 322 – Mitigation Planning. The requirements of such are outlined in the Interim Final Rule published in the Federal Register on February 26, 2002 at 44 CFR Part 201, with some additional amendments. This legislation requires all local governments to have an approved hazard mitigation plan in place to be eligible to receive Hazard Mitigation Grant Program (HMGP) and other types of disaster and mitigation funding.

Park County, the City of Livingston, and the Town of Clyde Park have adopted this Hazard Mitigation Plan by resolution (see Appendix K for copies of the resolutions). These governing bodies have the authority to promote mitigation activities in their jurisdictions.

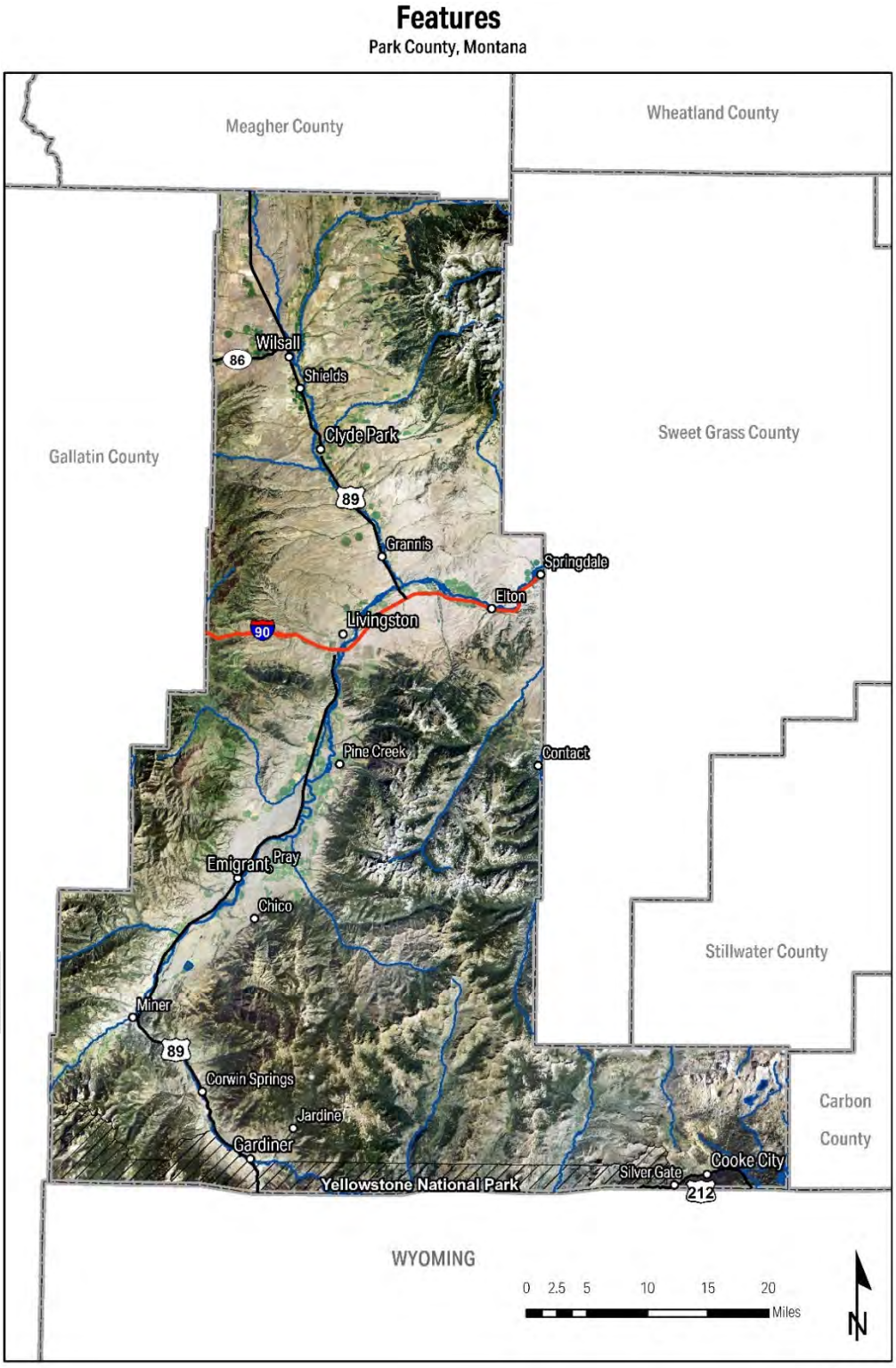
1.3 COUNTY AND JURISDICTIONAL PROFILE

Park County is located in south-central Montana, as shown in Map 1-1, with an area of approximately 2,802 square miles. Park County is bordered on the north by Meagher County, on the east by Sweet Grass County, on the southeast by Carbon and Stillwater Counties, on the west by Gallatin County, and on the south by Yellowstone National Park and Park County, Wyoming. The City of Livingston is the county seat and the only other incorporated community is the Town of Clyde Park.



Map 1-1. Park County Location.

Map 1-2 shows general features in the county. The beautiful and agricultural Paradise and Shields Valleys, within Park County, are surrounded by several mountain ranges and are marked by pristine rivers, creeks, and streams. The Shields River flows from the Crazy Mountain Range in northeastern Park County south to the Yellowstone River east of Livingston, forming the Shields Valley. The Bridger Mountain Range lies to the west of the Shields Valley. The Yellowstone River starts to the south in Yellowstone National Park and flows north to Gardiner and between the Gallatin and Absaroka Mountain Ranges, forming the Paradise Valley. At Livingston, the Yellowstone River flows east to Springdale and Sweet Grass County. Elevations range from about 4,000 feet in the river valleys to over 12,000 feet in the mountains. The region offers a wide variety of sights and outdoor activities including hunting, fishing, cross country skiing, swimming in hot springs, horseback riding, camping, and wildlife viewing. Livingston is known as the Gateway to Yellowstone National Park.



Map 1-2. Park County Features.

1.4 CLIMATE OVERVIEW

Table 1-1 details the climate statistics recorded by the Western Regional Climate Center (WRCC) at the primary Livingston weather station, Mission Field. Climate stations also exist twelve miles south of Livingston, at Gardiner, and eight miles east-northeast of Wilsall. These stations capture different elements and demonstrate regional variations in climate. Figure 1-1 shows the average precipitation by month at Livingston.

Table 1-1. Park County Climate Statistics (Western Regional Climate Center, 2017).

	Livingston, Mission Field 1948 - 2016	Livingston, 12 miles south 1981-2016	Gardiner 1956-2016	Wilsall, 8 miles ENE 1957-2016
Annual Average Maximum Daily Temperature	57.6°F	57.2°F	58.2°F	54.0°F
Annual Average Minimum Daily Temperature	33.0°F	32.9°F	32.2°F	28.3°F
Annual Average Total Precipitation	14.85 inches	16.21 inches	9.73 inches	20.18 inches
Annual Average Total Snowfall	60.6 inches	64.7 inches	25.5 inches	96.7 inches
Highest Temperature Recorded	105°F August 5, 1961	99°F July 13, 2005	103°F July 21, 1960	99°F July 30, 2000
Lowest Temperature Recorded	-41°F December 24,	-36°F December 24,	-31°F February 3,	-42°F February 3,
Annual Average Number of Days Dropping Below Freezing	162.1 days	163.6 days	173.0 days	207.1 days
Annual Average Number of Days Staying Below	39.2 days	36.5 days	38.4 days	45.9 days
Annual Average Number of Days Reaching 90°F or Higher	20.4 days	10.1 days	21.9 days	2.6 days
Highest Annual Precipitation	22.87 inches 1975	23.15 inches 1992	15.19 inches 1992	31.31 inches 1993
Lowest Annual Precipitation	9.01 inches 1954	11.91 inches 2003	6.09 inches 2002	13.89 inches 2001
1 Day Maximum Precipitation	2.90 inches June 16, 1992	3.10 inches May 7, 1988	1.87 inches June 16, 1992	2.82 inches June 25, 1969
Highest Annual Snowfall	113.9 inches 1975	123.8 inches 1975	74.5 inches 1967	210.5 inches 1975

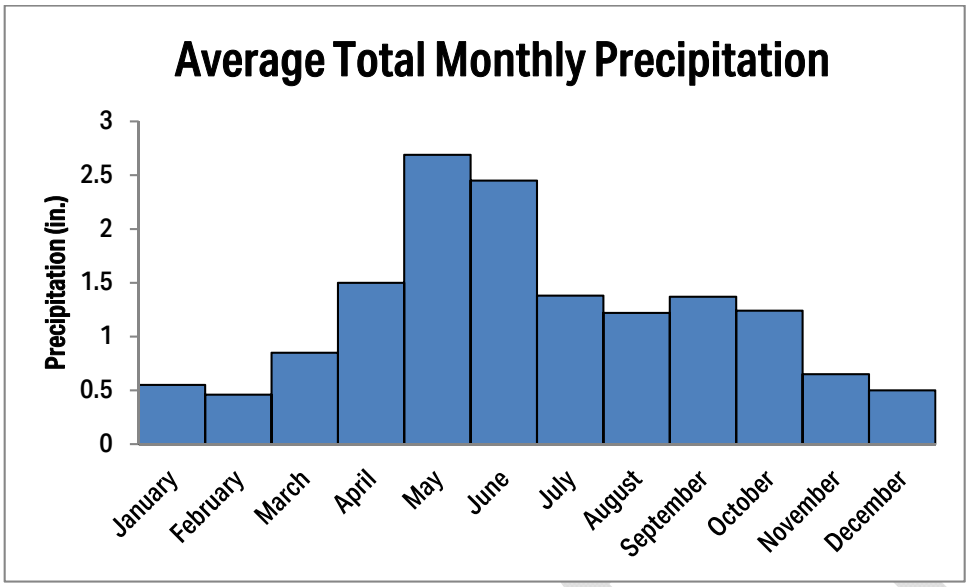


Figure 1-1. Average Total Monthly Precipitation in Livingston, MT from 1948 through 2016 (Western Regional Climate Center, 2017).

1.5 PLAN SCOPE AND ORGANIZATION

The Park County Hazard Mitigation Plan is organized into sections that describe the planning process (Section 2), assets and community inventory (Section 3), risk assessment/hazard profiles (Section 4), mitigation strategies (Section 5), and plan maintenance (Section 6). Appendices containing supporting information are included at the end of the plan.

This plan, particularly the risk assessment section, outlines each hazard and details how it may affect Park County, the City of Livingston, and the Town of Clyde Park. The mitigation strategy outlines long-term solutions to prevent or reduce future damages. Additional hazards may exist that were not apparent to local government or participants through the development of this plan, and certainly, disasters can occur in unexpected ways. Although all hazards cannot be fully mitigated, this plan will help the communities understand the hazards and become more disaster resistant.

2.0 PLANNING PROCESS AND METHODOLOGIES

Mitigation planning is a community effort which takes time and expertise. For Park County, the City of Livingston, and the Town of Clyde Park, an effective hazard mitigation plan requires input from a variety of stakeholders, including elected officials, first responders, emergency management, healthcare providers, public works, road officials, state and federal agencies, businesses, non-profit organizations, schools, and the public. Following a disaster, many of these stakeholders will be overwhelmed with recovery responsibilities; therefore, involving as many stakeholders as possible in mitigation planning before a disaster strikes will make mitigation activities easier following a disaster and may even prevent the disaster in the first place.

2.1 INITIAL PLANNING PROCESS

The planning process used to develop the initial mitigation plan attempted to maximize community input and utilized a wide variety of informational resources. The planning process began in March 2004 with an advertised public meeting that was held in conjunction with the regularly scheduled Local Emergency Planning Committee (LEPC). The LEPC consisted of representatives from emergency management, fire services, medical and health services, law enforcement, media, voluntary organizations, and government administration. This already active committee was determined to be an excellent core group because of its broad representation. The jurisdictions of Park County and Livingston were represented on the LEPC; however, a representative from Clyde Park was not. Therefore, an additional meeting was held in Clyde Park in May 2004. Although not an incorporated community, a meeting was scheduled in Gardiner for May 2004, but little interest was generated.

The initial plan was funded by Montana Disaster and Emergency Services through a Department of Homeland Security, Federal Emergency Management Agency Pre-Disaster Mitigation grant. This grant was used to hire a consultant, Big Sky Hazard Management LLC, based in Bozeman, to assist with the plan's development.

The first public meeting in March 2004 was advertised through public notice in the Livingston Enterprise newspaper and press releases were sent to local radio stations, television stations, print media offices, Chambers of Commerce, and hospitals. Several members attending the first meeting had heard the announcements over the radio. This first public meeting introduced the attendees to the planning process. The group then identified the primary hazards in the county and participants were surveyed on their individual hazard prioritizations.

The second round of public meetings in May 2004 was again advertised through another public notice in the Livingston Enterprise newspaper. Meetings were scheduled in Clyde Park, Livingston, and Gardiner. The Clyde Park meeting was well attended and was held during the regularly scheduled Town Meeting. Attendees identified and prioritized hazards specific to Clyde Park and identified each of the critical facilities. Attendees of the brown bag lunch meeting in Livingston were valuable in identifying critical facilities and hazard experts. Although Gardiner is not an incorporated community, the meeting was designed to gather input from the public residing in the southern part of the county. The Gardiner meeting

was advertised in the Chamber of Commerce newsletter, a well-known community publication, but unfortunately, generated no interest.

Additional meetings were held in January 2005, April 2005 (publicly advertised), and July 2005 with the LEPC for the purposes of identifying critical facilities, reviewing draft sections, and developing mitigation strategies. Once draft sections were completed, they were distributed over e-mail for review. The full draft of the plan was posted on a website to solicit public review and comment. Final public meetings soliciting comments on the full draft plan were held in Livingston in August 2005 and in Clyde Park in September 2005. These meetings were advertised in the Livingston Enterprise newspaper.

2.2 PLAN UPDATE PROCESS

Since its adoption the mitigation plan has been periodically reviewed and updated. The latest update was completed in 2011.

Approaching the latest plan update, Park County applied for and received a FEMA Pre-Disaster Mitigation (PDM) grant to update its plan in 2017. With the funding a consultant, RESPEC, was hired to facilitate the plan update and coordinate the planning process in partnership with the county, city, and town. The contract was managed by the Park County Disaster and Emergency Services Coordinator.

The plan update process consisted of the following basic steps:

1. An initial review of the existing plan was conducted by the consultant.
2. A proposed outline for the updated plan was developed.
3. New stakeholders were identified.
4. Sections related to the Assets and Community Inventory and Risk Assessment were updated.
5. Planning meetings were held in Livingston and Clyde Park to discuss changes to the mitigation strategy. All identified stakeholders and the public were invited.
6. The Mitigation Strategy and remaining sections were updated.
7. Stakeholders were asked to review the draft plan and provide comments.
8. Public meetings (advertised through invitations, press releases, and a newspaper ad) were held in Clyde Park and Livingston to update the communities on the newly revised plan and to solicit comments on the update.
9. Following the public comment period, any comments received were incorporated and the final plan was sent to the state and FEMA for review.
10. The jurisdictions adopted the updated plan, either before or immediately after state and FEMA conditional approval.

2.2.1 PLANNING TEAM

The core planning team consisted of the Local Emergency Planning Committee (LEPC) that meets on a regular basis regarding a variety of emergency management related issues. Additionally, key stakeholders from conservation groups, planning departments/boards, and state and federal agencies were invited. Appendix A lists the invited stakeholders and their level of participation. Major plan issues and discussions were presented to this group and decisions were made through consensus. No significant disagreements or contentious issues were discovered.

2.2.2 COMMUNITY CHANGES

A driving force in updating this type of plan is the changes that have occurred in the community over the past six years. Perhaps the biggest change in Park County has been significant residential growth. The exact number of new developments is difficult to determine; however, the county sanitarian issued 529 new septic permits from 2010 through mid-2017. (Park County Environmental Health, 2017)

A few relatively minor disasters have occurred in the county over the past six years, though none have led to major changes in communities or policies.

2.2.3 PLAN CHANGES

To continue to comply with federal requirements, additions and changes to the plan needed to be made. These types of changes were proposed and made by the consultant and reviewed by the communities. Other changes were proposed by community members and made where applicable. Data, methods, and information used in the initial plan were reviewed by the consultant and changes were made if updated information existed. Other items, such as mitigation actions and plan maintenance procedures, were reviewed by local individuals and the consultant, and changes were made as needed.

The five-year update of the plan featured updates to all sections to improve readability, usability, and methodologies. Specifically, the following major changes were part of the plan's update:

- The planning process was updated to include the five-year revision.
- Evaluations of current land use, new development, and future development were updated.
- More detail was added to each hazard profile, including updated and more detailed descriptions, maps, histories, probabilities, magnitudes, vulnerabilities, and data limitations.
- Ranking of hazards was done for each jurisdiction and was based on the updated risk and probability.
- New mitigation strategies and concepts were added and those completed or no longer relevant were removed.
- Appendices were updated.

More details on plan changes can be found in Appendix F.

2.2.4 JURISDICTION PARTICIPATION

This plan, both the initial 2005 plan and updates, included the following jurisdictions (the updated representative is listed below each jurisdiction):

- Park County
  - Greg Coleman, Park County Disaster and Emergency Services Director
- City of Livingston
  - Michael Kardoes, Livingston City Manager
- Town of Clyde Park
  - Alice Hartman, Clyde Park Mayor

Note: The list above includes only incorporated jurisdictions. Other communities such as Cooke City, Emigrant, Gardiner, Pray, Silver Gate, Springdale, and Wilsall are not incorporated nor do they have governing bodies, and are under the jurisdiction of Park County.

Each jurisdiction participated in a variety of ways depending on the resources available in the community. Park County applied for, received, and managed the funding for the plan's development. Representatives from several county offices were active in all aspects of the plan's update. The City of Livingston and the Town of Clyde Park participated in the plan's update by sending representatives to planning and public meetings, providing data and information, discussing elements of the plan at their regularly scheduled public meetings, and reviewing the draft plan. Each of the jurisdictions adopted the plan through resolution upon completion as shown in Appendix K.

2.2.5 PUBLIC PARTICIPATION

The public was provided with several opportunities to participate in the plan's update. Public meetings were held in May 2017, October 2017, December 2017, and May 2018. Each meeting was advertised to the public through invitations and public website announcements. Additionally, the final meeting was advertised through local newspaper ads. Appendix A shows the list of specific stakeholders identified and invited to the meetings, and Appendix B contains copies of the newspaper ads. Invitations were sent to active participants and those in communities beyond Park County, thus allowing neighboring communities and regional agencies the opportunity to participate. Appendix C contains the sign-in sheets from each meeting and identifies those that actively participated in the plan's update.

In addition to the public meetings, the public was given the opportunity to comment on the plan posted on the Park County website. The completed draft was posted from June 1, 2018 through June 30, 2018. Appendix B contains the Affidavit of Publication for document review. Comments could be made via the mail, phone, or email. The consultant then reviewed the comments, and all were integrated where applicable. Comments were readily accepted throughout the planning process.

Additional opportunities for public comment included county, city commission, town council, and plan-specific public meetings. The jurisdictions advertised these meetings using their usual public notification procedures, typically by posting meeting agendas and newspaper notices.

2.2.6 INCORPORATION OF EXISTING INFORMATION

Information from existing plans, studies, reports, and technical information related to hazards, mitigation, and community planning was gathered by RESPEC by contacting individuals throughout the planning process and reviewing the 2011 plan. Many national and state plans, reports, and studies provided background information. Table 2-1 lists the existing local plans and documents incorporated into this mitigation plan by integrating information into the appropriate sections. Documentation on these sources, plans, studies, reports, and technical information can be found in Appendix E. Mapping for and updating of the plan was done by RESPEC based on information collected from a wide variety of sources. The information was organized into a clear, usable, and maintainable format that also ensured the federal regulations regarding hazard mitigation plans were met.

Table 2-1. Existing Local Plans and Documents Incorporated.

Plan/Report/Study Name	Plan/Document Date
City of Livingston Growth Policy	2017
City of Livingston Subdivision Regulations	2007
City of Livingston Zoning Ordinance	2013
City of Livingston Municipal Code	2017
Cottonwood Dam Emergency Action Plan	2005
Crazy Mountain Dam Emergency Action Plan	2009
Governor's Upper Yellowstone River Task Force Final Report	2003
Northern Rocky Mountain Resource Conservation and Development Area Plan	2007
Paradise Valley Corridor Planning Study	2014
Park County Capital Improvement Plan	2016
Park County Community Wildfire Protection Plan	2014
Park County Comprehensive Economic Development Strategy	2012
Park County Flood Mitigation Plan	1999
Park County Floodplain Hazard Management Regulations	2017
Park County Growth Policy	2017
Park County Rural and Wildland Fire Management Plan	1997
Park County Subdivision Regulations	2010
Prospera 2017 Economic Profile of Gallatin and Park Counties	2017
Sonoran Institute, Park County's Future – It's Our Legacy	
Town of Clyde Park Growth Policy	2009
Yellowstone River Channel Migration Zone Report	2009

2.3 PLAN ADOPTION

This plan has been adopted by Park County, the City of Livingston, and the Town of Clyde Park. Each jurisdiction has a governing body that is authorized to formally adopt plans such as this. The adoption process involved verbal and signatory approval of a resolution accepting the plan by the governing body at a regularly scheduled public meeting/hearing. For the resolution to be approved, a majority of the governing body must agree; for Park County, this is two out of three commissioners, in Livingston, this is three out of five commissioners, and in Clyde Park, this is three out of five councilpersons. The resolution is then also signed by a clerk or recording secretary and the jurisdiction's attorney for form and content. This process occurred shortly after the plan was completed and while the plan was being conditionally approved by the state and FEMA. Copies of the resolutions, including the date signed, are in Appendix K.

The Park County Hazard Mitigation Plan is a living, expandable document that will have new information added and changes made as needed. The plan's purpose is to improve disaster resistance through projects and programs, and therefore, opportunities for changes and public involvement will exist as disasters occur and mitigation continues. Details on the plan's maintenance and continued public involvement are further outlined in Section 6.

2.4 RISK ASSESSMENT METHODOLOGIES

A key step in preventing disaster losses in Park County, the City of Livingston, and the Town of Clyde Park is developing a comprehensive understanding of the hazards that pose risks to the communities. The following terms, defined by FEMA, can be found throughout the plan:

- **Hazard:** A source of danger
- **Risk:** A possibility of loss or injury
- **Vulnerability:** Open to attack or damage

This all-hazard risk assessment and mitigation strategy serves as an initial source of hazard information for those in Park County. The risk assessment identifies and describes the hazards that threaten the communities and determines the values at risk from those hazards. The risk assessment is the cornerstone of the mitigation strategy and provides the basis for many of the mitigation goals, objectives, and potential projects. Other plans may be referenced and remain vital hazard documents, but each hazard has its own profile in this plan. As more data becomes available and disasters occur, the individual hazard profiles and mitigation strategies can be expanded.

The assets and community inventory section includes elements such as critical facilities, critical infrastructure, population, structures, economic values, ecologic values, historic values, social values, current land uses, recent development, and future development potential.

Each hazard or group of related hazards has its own hazard profile. A stand-alone hazard profile allows for the comprehensive analysis of each hazard from many different aspects. Each hazard profile contains a description of the hazard which includes information from specific hazard experts and resources. Mapping was used as was applicable and a record of the hazard history compiled from a wide variety of databases and sources. Note that the data used was more specific and accurate than the data provided by the SHELDUS database recommended by FEMA. Where spatial differences exist, mapping was used for hazard analyses by geographic location. Some hazards can have varying levels of risk based on location (i.e., near the rivers versus far away from the rivers). Other hazards, such as winter storms or drought, cover larger geographic areas and the delineation of hazard areas is not typically available or useful on the county scale.

Using the local historical occurrence, or more specific documentation if available, a probability and magnitude was determined for a specific type of event. In most cases, the number of years recorded was divided by the number of occurrences, resulting in a simple past-determined recurrence interval. If the hazard lacked a definitive historical record, the probability was assessed qualitatively based on regional history or other contributing factors. If the past occurrence was not an accurate representation, general knowledge of the hazard was used to approximate the types of impacts that could be expected. The hazard frequency and impact ranges show the differentiation between high frequency, low impact events and low frequency, high impact events. Table 2-2 provides the basic criteria used to define the "probability of a high impact event." Generally, a "high impact event" is defined as one in which a majority of citizens are affected in some way and state and local resources are exceeded.

Table 2-2. Event Probability Criterion.

Probability of a High Impact Event	Description
High	Occurs nearly annually
Moderate-High	Occurs roughly once every 50 years
Moderate	Occurs roughly once every 100 years
Low-Moderate	Regional history but no local history
Low	No regional or local history

Vulnerabilities were assessed based on a variety of different resources and methodologies. Additional information on the methodology used to determine the vulnerabilities can be found in each hazard profile. Each type of vulnerability (critical facilities, critical infrastructure, structures, population, values, and future development) was assessed based on a probable impact (100-year) event and an extreme impact (500-year) event. Generalizations were made to categorize the types and ranges of impacts that could be seen.

Critical facilities were mapped using data developed by the Park County GIS Office. The mapping of the facilities allowed for the comparison of building locations to the hazard areas where such hazards are spatially recognized. Base maps depicting the critical facility locations were compared to available hazard layers to show the proximity of the buildings to the hazard areas. Given the nature of critical facilities, the functional losses and costs for alternate arrangements typically extend beyond the structural and contents losses. These types of losses can be inferred based on the use and function of the facility. Structure losses were calculated using a combination of point structure data and parcel data used for tax assessment purposes. The structures were assigned the building value of the closest parcel with a building value greater than zero. These values were then used to determine the potential losses to structures. For some hazards, the total dollar exposure was multiplied by a damage factor since many hazard events will not result in a complete loss of all structures. These estimates are general in nature, and therefore, should only be used for planning purposes. The approximations, however, are based on current hazard and exposure data. HAZUS-MH, a loss estimation software program developed by FEMA, approximated losses from earthquakes and floods. Where GIS mapping was unavailable or not useful, estimations and plausible scenarios were used to quantify potential structure losses.

Critical infrastructure for services such as electricity, heating fuels, telephone, water, sewer, and transportation systems was assessed using history and a general understanding of such systems to determine what infrastructure losses may occur. HAZUS-MH was also used to determine the potential losses to critical infrastructure from earthquakes and floods.

Population impacts were qualitatively assessed based on the number of structures estimated to be in the hazard area. Depending on the time of year, population concentrations are likely greater due to non-resident populations. Other factors used in evaluating the population impacts include the ability of people to escape from the incident without casualty and the degree of warning that could be expected for the event. In general, the loss of life and possible injuries are difficult to determine and depend on the time of day, day of the week, time of year, extent of the damage, and other hazard specific conditions.

Qualitative methodologies, such as comparisons to previous disasters, occurrences in nearby communities, and plausible scenarios, helped determine the potential losses to economic, ecologic, historic, and social values. In many cases, a dollar figure cannot be placed on values, particularly those that cannot be replaced.

The assessment on the impact to future development is based on the mechanisms currently in place to limit or regulate development in hazardous areas and the likelihood of development in hazardous areas. Some hazards can be mitigated during development, others cannot.

The impact rating given for each type of vulnerability was generally based on the descriptions shown in Table 2-3. Some adjustments were made where special circumstances exist.

Table 2-3. Impact Rating Criteria.

Impact Rating	Description
High	Causes damages and losses within nearly every aspect of the vulnerability type; community sustainability may be threatened.
Moderate-High	The majority of citizens are affected in some way due to losses in this vulnerability type; state and local resources are likely exceeded.
Moderate	The damages to the vulnerability type are formidable and require a local response.
Low-Moderate	Either a small segment of the vulnerability type is impacted, or damages are sporadic. May require a limited local response.
Low	Impacts to the vulnerability type are negligible or are present in only unique situations.

Many unknown variables limit the ability to quantitatively assess all aspects of a hazard with high accuracy. Therefore, data limitations provide a framework for identifying the missing or variable information. These limitations were determined by hazard through the risk assessment process. In some cases, the limitations may be resolved through research or data collection. If a limitation can be reasonably resolved through a mitigation project, the resolution is included as a potential project in the mitigation strategy.

The overall hazard rating of high, moderate, and low was determined based on the combination of the probability of a high impact event and the vulnerability. These ratings are outlined by jurisdiction in the risk assessment summary and consider the number of hazards that threaten the community.

2.5 HAZARD IDENTIFICATION

In 2005, eighteen (18) hazards were identified and analyzed. Hazards were initially identified by participants in the first public meeting. Participants included government, the private sector, and the public. Then, a history of past events was gathered, and possible future events were recognized through internet research, available GIS data, archives research, public meetings, subject matter experts, and an examination of existing plans. In 2011 and 2017, the planning team reconsidered the hazard list; all hazards remained, and no new hazards were identified. New data sources, plans, and information for several hazards were identified and incorporated into the appropriate hazard profile.

Table 2-4 shows the hazards, jurisdictions, and how and why they were identified. The level of detail for each hazard correlates to the relative risk of each hazard and is limited by the amount of data available. As new hazards are identified, they can be added to the hazard list, profiled, and mitigated.

Table 2-4. Identified Hazards.

Hazard Profile	Jurisdiction(s)	How Identified	Why Identified
Avalanche and Landslide	Park County	/ Avalanche.org / Federal Emergency Management Agency / Gallatin National Forest / Montana Department of Transportation / Montana Disaster and Emergency Services	/ Mountainous terrain exists that is prone to avalanches and landslides / Avalanche deaths occur regularly / Roadway landslide priorities have been identified
Aviation Accident	Park County Livingston Clyde Park	/ National Transportation Safety Board	/ History of aircraft accidents, some with casualties / Potential for commercial aircraft accident
Communicable Disease and Bioterrorism (including human and animal diseases)	Park County Livingston Clyde Park	/ Centers for Disease Control and Prevention / Montana Department of Livestock / Pandemic studies / US Department of Agriculture	/ Global disease threat / History of pandemics / Dependence on agricultural economy
Dam Failure	Park County Clyde Park	/ Cottonwood Dam Emergency Action Plan / Crazy Mountain Dam Emergency Action Plan / Federal Emergency Management Agency / Park County GIS data / US Army Corps of Engineers	/ Potential for a loss of life and property from a dam failure at the Cottonwood or Crazy Mountain Dams or other significant hazard dams
Drought	Park County Livingston Clyde Park	/ Montana Disaster and Emergency Services / National Drought Mitigation Center / National Oceanic and Atmospheric Administration / US Department of Agriculture	/ History of droughts / Importance of agriculture and natural water resources to the local economy / Several USDA disaster declarations

Hazard Profile	Jurisdiction(s)	How Identified	Why Identified
Earthquake	Park County Livingston Clyde Park	/ HAZUS-MH / Montana Bureau of Mines and Geology / Montana Disaster and Emergency Services / National Earthquake Hazards Reduction Program / University of Utah / US Geological Survey	/ History of nearby earthquakes greater than 6.0 magnitude / Proximity to active earthquake areas / Active faults exist within the county
Flooding (including riverine, flash, and ice jam floods)	Park County Livingston Clyde Park	/ HAZUS-MH / Federal Emergency Management Agency / Governor's Upper Yellowstone River Task Force / National Weather Service / Park County GIS data / Yellowstone River Conservation District	/ History of riverine, flash, and ice jam floods, including Presidential disaster declarations / Frequent flood losses, especially to road infrastructure
Ground Transportation Accident	Park County Livingston Clyde Park	/ Montana Highway Patrol	/ Interstate 90 and US Highway 89 traverse the county
Hazardous Materials Release (including fixed, mobile, and pipeline releases)	Park County Livingston Clyde Park	/ National Response Center / Park County GIS data / US Department of Transportation Emergency Response Guidebook	/ Interstate and highway traffic and railroad transport hazardous materials through the county / Several facilities house hazardous materials
Railroad Accident	Park County Livingston	/ Federal Railroad Administration / Montana Rail Link	/ Active railroad passes through Livingston and county areas
Severe Thunderstorms and Tornadoes	Park County Livingston Clyde Park	/ Federal Emergency Management Agency / National Climatic Data Center / National Weather Service / Storm Prediction Center	/ History of severe thunderstorms and tornadoes, including damages

Hazard Profile	Jurisdiction(s)	How Identified	Why Identified
Terrorism, Civil Unrest, and Violence	Park County Livingston Clyde Park	/ Anti-Defamation League / Memorial for the Prevention of Terrorism / Southern Poverty Law Center	/ National indications and foreign threats of future terrorist attacks / Potential for school violence and other domestic attacks / Proximity to national assets such as Yellowstone National Park
Urban Fire	Park County Livingston Clyde Park	/ Park County Rural Fire District / US Fire Administration	/ Economic importance of downtown areas
Utility Outage	Park County Livingston Clyde Park	/ Local utility data	/ Dependence of population on utility and energy services
Volcano	Park County Livingston Clyde Park	/ Cascades Volcano Observatory / US Geological Survey / Yellowstone Volcano Observatory	/ History of volcanic ashfall / Proximity to active geologic areas
Wildfire	Park County Livingston Clyde Park	/ Interagency Fire Coordination Center / Montana Department of Natural Resources and Conservation / Park County Community Wildfire Protection Plan / Park County GIS data / US Forest Service	/ Local history of large wildfires / Large areas of government lands within the county / Numerous areas of wildland urban interface
Wind	Park County Livingston Clyde Park	/ Montana Disaster and Emergency Services / National Climatic Data Center / National Weather Service	/ Frequent occurrence of winds that exceed hurricane force
Winter Storms and Extended Cold (including blizzards, heavy snow, ice storms, and extreme cold)	Park County Livingston Clyde Park	/ National Climatic Data Center / National Weather Service / Western Regional Climate Center	/ History of impacts such as road closures during winter storms / Potential for power outages during an extended cold period

3.0 ASSETS AND COMMUNITY INVENTORY

In addition to identifying and understanding the hazards of the area, an important aspect of mitigation planning is contemplating the effects such hazards may have on the communities. To thoroughly consider the effects, the assets and values at risk must be first identified. Examples of community assets include the population, critical facilities, businesses, residences, critical infrastructure, natural resources, historic places, and the economy. The following sections identify the specific assets and community inventory.

3.1 CRITICAL FACILITIES AND INFRASTRUCTURE

Critical facilities and infrastructure protect the safety of the population, the continuity of government, or the values of the community. In many cases, critical facilities fulfill important public safety, emergency response, and/or disaster recovery functions. In other cases, the critical facility may protect a vulnerable population, such as a school or elder care facility. Examples of critical facilities include: 911 emergency call centers, emergency operations centers, police and fire stations, public works facilities, sewer and water facilities, hospitals, jails, schools, essential businesses, shelters, and public services buildings.

Utilities such as electricity, heating fuel, telephone, water, sewer, and the transportation network rely on established infrastructure to provide services. The providers of these services use a variety of systems to ensure consistent service in the county. Each of these services is important to daily life in Park County, and in some cases, is critical to the protection of life and property.

3.1.1 CRITICAL FACILITIES

Critical facilities and infrastructure were identified throughout the planning process, initially identified for the 2005 plan through public meetings, plan documents, and additional research and then reviewed by planning committee members and updated in 2011 and 2017. The identified facilities are listed below in Table 3-1 through Table 3-11. Most of the facilities have been digitally mapped and analyzed with respect to the hazards.

Table 3-1. Local Government and Emergency Facilities.

Name	Address
City/County Complex (*EOC, Law Enforcement, Jail, Courtrooms, and Government Offices)*	414 East Callender Street
Clyde Park Town Hall	516 Miles Avenue Clyde Park
Gardiner Sheriff's Office	430 Main Street, Unit B Gardiner
Livingston Civic Center	229 River Drive Livingston
Park County Fairgrounds	46 View Vista Drive Livingston
Park County Search and Rescue	70 Vista View Drive Livingston

Table 3-2. Fire and EMS Station Facilities.

Name	Address
Clyde Park Fire Station	514 Miles Avenue Clyde Park
Clyde Park Rural Fire Station	411 Miles Avenue Clyde Park
Cooke City/Silver Gate Fire Hall Cooke City Search and Rescue	202 Main Street West Cooke City
Gardiner Ambulance Service	213 Main Street Gardiner
Gateway Hose Company	118 Highway 89 South Gardiner
Livingston Fire and Rescue	414 East Callender Street Livingston
Mill Creek Fire Station	17 Chicory Road Emigrant
Paradise Valley Fire and EMS	1140 East River Road Emigrant
Park County Rural Fire Station #1	304 East Park Street Livingston
Park County Rural Pine Creek Station	Highway 89 South and Pine Creek Road Livingston
Wilsall Fire Station	207 Elliot Street Wilsall

Table 3-3. Hospital and Clinic Facilities.

Name	Address
Community Health Partners	126 South Main Street Livingston
Livingston Health and Rehabilitation	510 South 14th Street Livingston
Livingston Healthcare Urgent Care	104 Centennial Drive #103 Livingston
Livingston HealthCare Hospital	320 Alpenglow Lane Livingston
Mammoth Clinic	Mammoth Hot Springs Yellowstone National Park
Shields Valley Health Center	309 Elliot Street Wilsall

Table 3-4. Transportation Facilities.

Name	Address	Replacement
Angel Line Transportation	206 South Main Street Livingston	

Name	Address	Replacement
Gardiner Airport	Airport Road Gardiner	$10,517
Mission Field Airport	84 Airport Road Livingston	$868,868
Montana Rail Link Yard and Shop Complex	710 East Gallatin Street Livingston	
Paradise Valley Flying Y Ranch Airport	55 Runway Lane Livingston	
School Bus Barn	View Vista Drive Livingston	
Wilsall Airport	4 miles Northwest of Wilsall	

Table 3-5. Utility and Infrastructure Facilities.

Name	Address	Replacement
Clyde Park Pumphouse	12 Brackett Creek Road Clyde Park	$78,924
Cooke City Compactor	11 Forest Service Woody Creek Road Cooke City	$197,926
Cooke City Water	282 US Highway 212 West Cooke City	
Cottonwood / Clyde Park Reservoir	10 Upper Cottonwood Road Clyde Park	$568,000
County Road Shop	107 First Avenue South Clyde Park	$79,769
County Road Shop	16 Airport Road Gardiner	$73,375
County Road Shop	23 Chicken Creek Road Livingston	$829,415
County Road Shop	302 Elliot Street North Wilsall	$126,879
Gardiner Water and Sewer	17 Airport Road Gardiner	
Landfill	26 Chicken Creek Road Livingston	$80,248
Livingston City Streets Shop	406 Bennett Street Livingston	
Livingston Incinerator	24 Chicken Creek Lane Livingston	
Livingston Sewage Treatment Plant	316 Bennett Street Livingston	
Livingston Wells and Water Storage	615 South 10th Street Livingston	
Meyers Hill Communications Tower	853 Above Paradise Trail Livingston	$209,105

Name	Address	Replacement
Northern Energy Propane	4 Merrill Lane Livingston	
North Hill Radio Towers	52 Water Tower Avenue Livingston	
Park Electric Cooperative Offices	5706 US Highway 89 South Livingston	
Qwest	302 West Callender Street Livingston	
Silver Gate Water	US Highway 212 West Silver Gate	
Transfer Station	408 Bennett Street Livingston	$954,600
Wilsall Water	Darling Street Wilsall	

Table 3-6. State Government Facilities.

Name	Address
Montana Department of Health and Human Services	200 East Park Street Livingston
Montana Department of Transportation	1668 US Highway 89 South Gardiner
Montana Department of Transportation	1101 US Highway 10 West Livingston
Montana Department of Transportation	2308 US Highway 89 North Wilsall
Montana Highway Patrol	45 Business Park Road Suite B Livingston
Montana National Guard Armory	24 Fleshman Creek Road Livingston

Table 3-7. Federal Government Facilities.

Name	Address
National Park Service North Entrance of Yellowstone National	US Highway 89 South Gardiner
National Park Service Northeast Entrance of Yellowstone National Park	US Highway 212 West Silver Gate
US Department of Agriculture *US Forest Service, Farm Service*	5242 US Highway 89 South Livingston
US Department of Agriculture *US Forest Service*	805 Scott Street West Gardiner
US Post Office – Clyde Park	103 1st Avenue North Clyde Park

Name	Address
US Post Office – Cooke City	208 Main Street East Cooke City
US Post Office – Emigrant	305 Story Road Emigrant
US Post Office – Gardiner	707 Scott Street West Gardiner
US Post Office – Livingston	105 North 2nd Street Livingston
US Post Office – Livingston Annex	230 Jefferson Street Livingston
US Post Office – Pray	8 Pray Road Pray
US Post Office - Wilsall	310 Elliot Street North Wilsall

Table 3-8. Vulnerable Populations - Assisted Living, Senior, and Low Income Housing Facilities.

Name	Address
Caslen Living Centers	1301 Wineglass Lane Livingston
Diamond K Lodge	1200 West Montana Street Livingston
Evergreen Health and Rehabilitation Center	510 South 14th Street Livingston
Frontier Personal Care Center	121 South 3rd Street Livingston
Miles Building Apartments	107 South 2nd Street Livingston
Park County Senior Center	206 South Main Street Livingston
Seeds of Love	14 Coulee Drive Livingston
Sherwood Inn Apartments	325 South Main Street Livingston
Summit Place Apartments	1102 Summit Place Livingston
Timberline Apartments	1302 East Montana Street Livingston

Table 3-9. Vulnerable Populations – Schools.

Name	Address
Arrowhead School	1489 East River Road Pray
Cooke City School	101 Broadway Cooke City

Name	Address
East Side Elementary School	401 View Vista Drive Livingston
Gardiner School	510 Stone Street Gardiner
Rural School District Administrative Offices	414 East Callender Street Livingston
Livingston Public Schools Administrative Offices	132 South B Street Livingston
Montessori Island School	160 Miller Drive Livingston
Park County Special Education Cooperative	102 View Vista Drive Livingston
Park High School	102 View Vista Drive Livingston
Pine Creek School	2575 East River Road Livingston
Saint Mary's School	511 South F Street Livingston
Shields Valley Elementary School	308 South Hannaford Street Wilsall
Shields Valley High School	405 1st Street East Clyde Park
Sleeping Giant Middle School	301 View Vista Drive Livingston
Springdale School	102 1st Street Springdale
Thomas Moore School	30 Sirius Drive Emigrant
Twin Pines Montessori	319 East Montana Street Livingston
Washington School (after school programs)	315 North 8th Street Livingston
Winans Elementary School	1015 West Clark Street Livingston

Table 3-10. Vulnerable Populations - Child Care Facilities.

Name	Address
Head Start	201 South F Street Livingston
St. Mary's Preschool	511 South F Street Livingston
Dawn Tyburski	1500 East Park Street Livingston

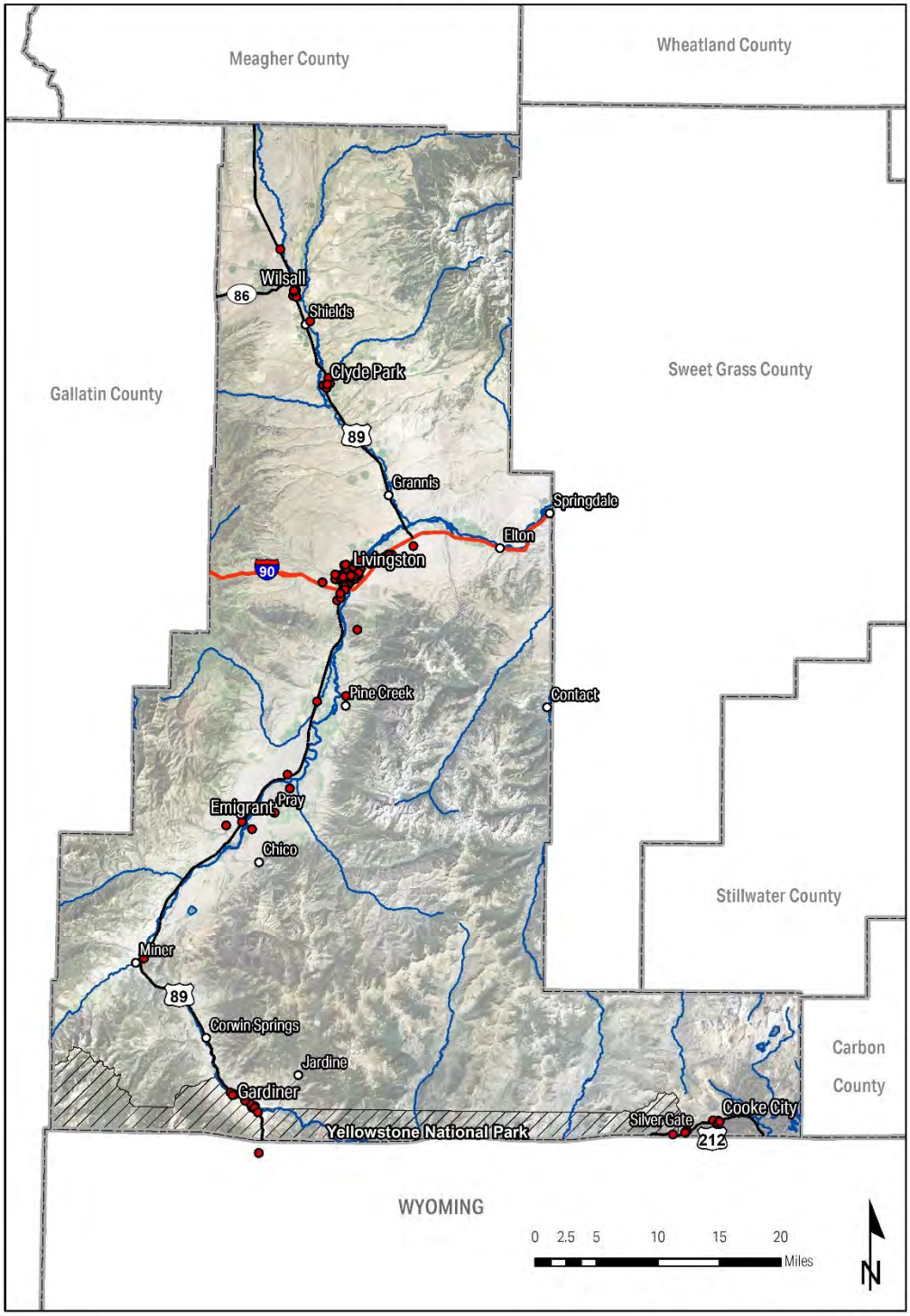
Name	Address
Front Street School	622 West Front Street Livingston
Blessings Abound	701 Quasar Lane Livingston
Christikon	4661 Boulder Road McLeod
Gwynne Moore	622 Meadowlark Lane Livingston
Little Tree Preschool	712 North D Street
Little Kinders	516 North L Street Livingston
Little Einsteins Preschool	326 South Main Street, Suite B Livingston
Little Bird Preschool	47 Indian Creek Road Wilsall
Let Them Bee Little Childcare	502 North 8th Street Livingston
Little Feet Preschool	424 West Lewis Street Livingston
Ms. Patti's Pitter Patter Child Care	421 North 8th Street Livingston
PrintingForLess.com Child Care	100 Printing For Less Way Livingston
Safe Haven Childcare	224 South G Street Livingston
Snoopy Cooperative Preschool	556 Lower Mammoth Gardiner
Wiggles N Giggles	501 East Geyser Livingston
Yellowstone Bible Camp	27 Mill Creek Road Pray

Table 3-11. Vulnerable Populations - Group Homes and Activity Centers.

Name	Address
Counterpoint - Ninth Street Group Home	629 North 9th Street Livingston
Counterpoint - Milky Way Group Home	603 East Milky Way Livingston
Counterpoint – Lewis Street Activity Center	116 East Lewis Street Livingston

Critical Facilities

Park County, Montana



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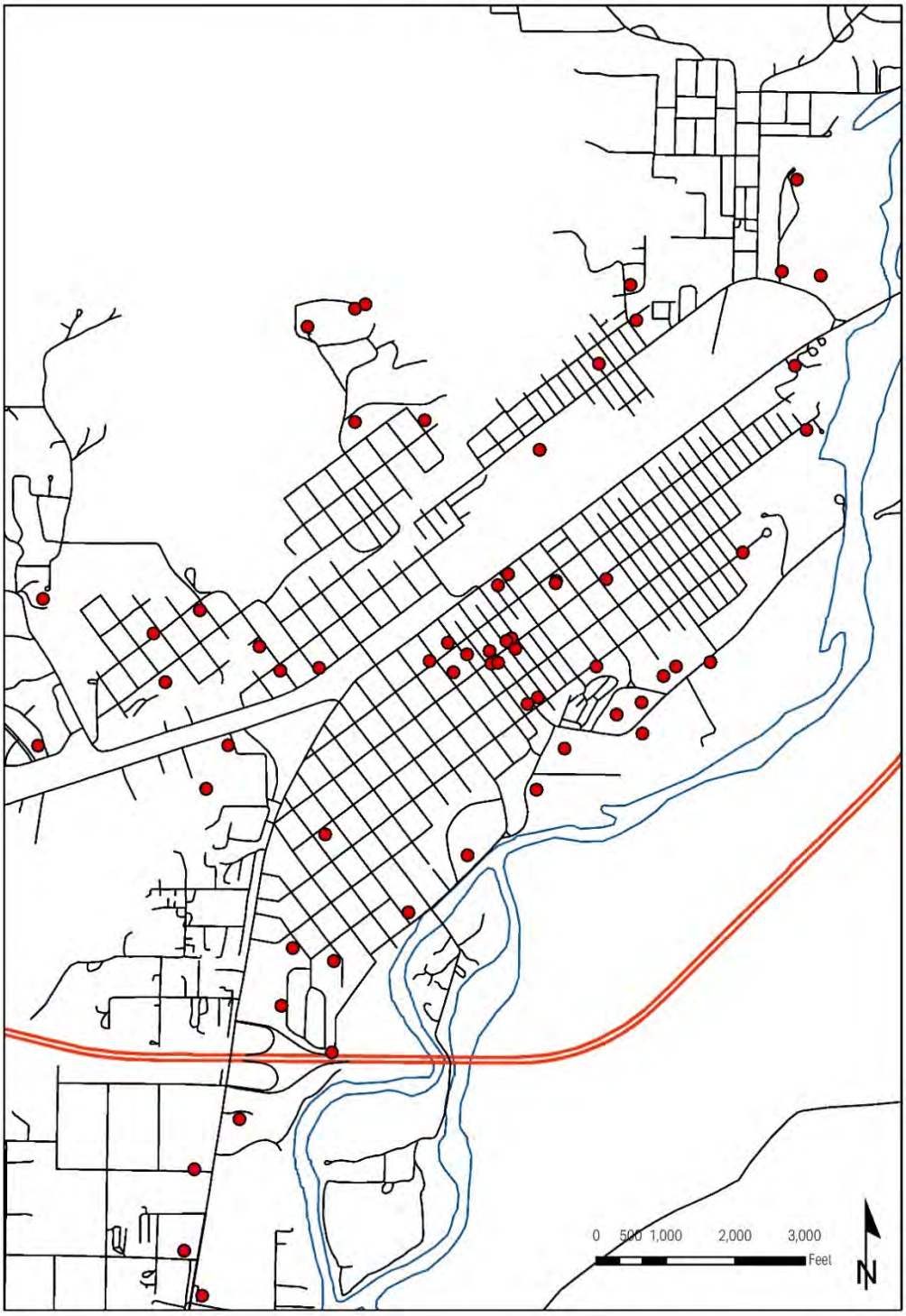
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
January 2018

Map 3-1. Critical Facilities in Park County.

Critical Facilities

Livingston, Montana

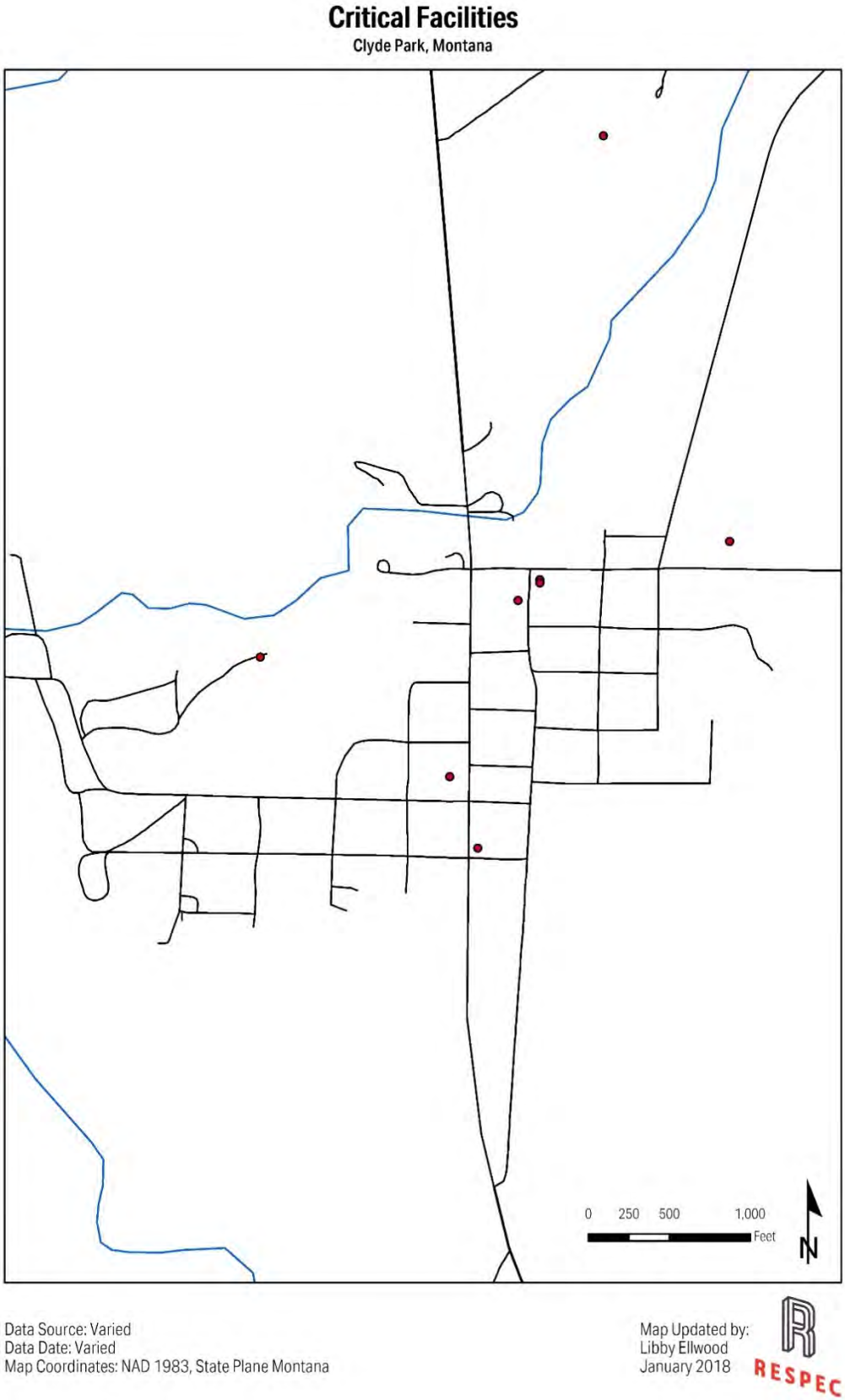


Data Source: Varied
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
January 2018

RESPEC

Map 3-2. Critical Facilities in Livingston.



Map 3-3. Critical Facilities in Clyde Park.

3.1.2 CRITICAL INFRASTRUCTURE

Utilities such as electricity, heating fuel, telephone, water, and sewer rely on established infrastructure to provide services. Each of these services is important to daily life in Park County and, in some cases, is critical to protecting life and property.

3.1.2.1 ELECTRICITY

Electricity is used to power lights, computers, medical equipment, water pumps, heating system fans, refrigerators, freezers, televisions, and many other types of equipment. Electric providers in Park County include Park Electric Cooperative, headquartered in Livingston, and NorthWestern Energy, headquartered in Sioux Falls, SD. Much of the electric service is run through overhead lines. These lines are supported by poles and have key components such as transformers and substations. Two significant Northwestern Energy electric transmission lines pass through northern Park County. A third electric transmission line traverses north-south along western Park County.

3.1.2.2 ENERGY / HEATING FUEL

During the cold winter months, the heating of homes and businesses is a necessity. The primary heating fuel used in Park County is natural gas. Overall, a variety of fuels are used as shown in Table 3-12. Most systems ultimately require electricity to run their thermostats and blowers.

Table 3-12. House Heating Fuel (US Census, 2015a).

	Park County (TOTAL)	City of Livingston	Town of Clyde Park	Unincorporated Park County
Utility Gas	2,770	2,136	4	630
Bottled, Tank, or LP Gas	1,431	98	36	1,297
Electricity	1,213	675	37	501
Fuel Oil, Kerosene, etc.	76	20	6	50
Coal or Coke	12	0	0	12
Wood	1,092	193	25	874
Solar Energy	0	0	0	0
Other Fuel	161	58	2	101
No Fuel Used	38	35	0	3

Natural gas in portions of Park County is provided by NorthWestern Energy through underground pipeline infrastructure. A large natural gas distribution pipeline passes through central Park County. The HAZUS-MH replacement value for the natural gas system is estimated at $57,000,000. Buildings heated with propane and fuel oil typically have a nearby tank that is refilled regularly by a local vendor.

The Yellowstone Pipeline, a major pipeline transporting refined petroleum products from Billings, Montana to Spokane, Washington crosses the northern half of the county.

3.1.2.3 TELEPHONE

Local telephone services in the county are provided by Qwest Telephone. Similar to electric infrastructure, telephone can be run through overhead or underground lines. Much of the telephone infrastructure in Park County lies within the road rights-of-way. A number of cell towers exist within Park County to provide cellular telephone service, but several areas in the county lack reliable coverage. Internet phone service is another option available to many residents.

3.1.2.4 WATER AND WASTEWATER

Municipal water systems exist within the incorporated communities and in several unincorporated communities in the county such as Cooke City, Gardiner, Silver Gate, and Wilsall. Many subdivisions and housing developments additionally have their own systems based on demand and water quality control needs. The water systems typically consist of groundwater wells and/or springs. The HAZUS-MH replacement value for the potable water systems is estimated at $139,000,000.

Municipal wastewater systems exist in Livingston and Gardiner; Livingston has a wastewater treatment plant, and Gardiner has a lagoon system. Both water and wastewater systems use underground pipes to service customers. The HAZUS-MH replacement value for the wastewater systems is estimated at $215,000,000. County residents outside of the water and sewer districts generally rely on individual well and septic systems.

3.1.2.5 TRANSPORTATION

The transportation infrastructure within Park County includes the road, rail, and air networks. The primary road transportation routes in Park County are Interstate 90, US Highways 89 and 212, and Montana Highway 86. The major roadways in Park County as well as most of the roads and bridges within Livingston are paved. Outside roads, however, are frequently gravel. The HAZUS-MH replacement value for the highway system is estimated at $1,050,000,000.

Montana Rail Link operates a main railroad line in an east-west direction through the county, including a rail yard at Livingston. The railroad transports goods and raw materials along this line. The HAZUS-MH replacement value for the railway system is estimated at $47,000,000.

Park County has four small airports serving private, charter, and/or government aircraft: Mission Field (LVM) five miles east of Livingston, Gardiner Airport (29S) two miles northwest of Gardiner, Wilsall Airport (9U1) four miles northwest of Wilsall, and Paradise Valley Flying Y Ranch Airport (MT48) twelve miles south of Livingston. Livingston Memorial Hospital (MT66) has a heliport. The closest commercial service airport is in Bozeman/Belgrade (BZN). The HAZUS-MH replacement value for the airport system is estimated at $124,000,000.

3.2 POPULATION AND STRUCTURES

The citizens, visitors, and their property are at all risk from various disasters. In all incidents, the top priority is the protection of life and property. Table 3-13 lists population statistics taken from the most recent US Census data.

Table 3-13. Population Statistics (US Census, 2010; US Census, 2000).

Location	Type	2010 Population	Change Since 2000 Census (people)	Change Since 2000 Census (percent)
Park County (total)	County	15,636	-58	-0.4%
Clyde Park	Incorporated	310	-22	-7%
Cooke City	Unincorporated	75	n/a	n/a
Corwin Springs	Unincorporated	109	n/a	n/a

Location	Type	2010 Population	Change Since 2000 Census (people)	Change Since 2000 Census (percent)
Emigrant	Unincorporated	488	n/a	n/a
Gardiner	Unincorporated	875	+24	+3%
Jardine	Unincorporated	57	n/a	n/a
Livingston	Incorporated	7,044	+193	+3%
Pray	Unincorporated	681	n/a	n/a
Silver Gate	Unincorporated	20	n/a	n/a
South Glastonbury	Unincorporated	284	n/a	n/a
Springdale	Unincorporated	42	n/a	n/a
Wilsall	Unincorporated	178	-59	-25%
Wineglass	Unincorporated	256	n/a	n/a

Like critical and special needs facilities, structures such as residences and businesses are also vulnerable to hazards. Some of the structure statistics for Park County are detailed in Table 3-14 through Table 3-17. Much of the data was derived from FEMA's HAZUS-MH loss-estimation modeling software.

Table 3-14. Number of Buildings by Type.

Building Type (HAZUS code)	Number
Single Family Dwelling (RES1)	7,249
Mobile Home (RES2)	1,163
Duplex (RES3A)	85
3-4 Units (RES3B)	64
5-9 Units (RES3C)	14
10-19 Units (RES3D)	18
20-49 Units (RES3E)	4
50+ Units (RES3F)	0
Temporary Lodging (RES4)	78
Institutional Dormitory (RES5)	10
Nursing Home (RES6)	7
Retail Trade (COM1)	124
Wholesale Trade (COM2)	62
Personal and Repair Services (COM3)	87
Professional/Technical Services (COM4)	153
Banks (COM5)	16
Hospital (COM6)	1
Medical Office/Clinic (COM7)	21
Entertainment and Recreation (COM8)	95
Theaters (COM9)	3
Parking (COM10)	0
Heavy Industrial (IND1)	26
Light Industrial (IND2)	20
Food/Drugs/Chemicals Industrial (IND3)	2

Building Type (HAZUS code)	Number
Metals/Mining Processing (IND4)	6
High Technology (IND5)	0
Construction (IND6)	100
Agriculture (AGR1)	96
Church/Non-Profit (REL1)	49
Government – General Services (GOV1)	17
Government – Emergency Response (GOV2)	2
Grade Schools (EDU1)	21
Colleges/Universities (EDU2)	0

Table 3-15. Number of Buildings by Structural Classification Type.

Description (HAZUS code)	Number
Wood, Light Frame ≤ 5,000 sq. ft. (W1)	7,344
Wood, Commercial and Industrial (W2)	157
Steel Moment Frame, Low-Rise (S1L)	81
Steel Braced Frame, Low-Rise (S2L)	46
Steel Light Frame (S3)	36
Steel Frame with Cast-in-Place Concrete Shear	31
Concrete Moment Frame, Low-Rise (C1L)	26
Concrete Shear Walls, Low-Rise (C2L)	135
Concrete Frame with Unreinforced Masonry Infill	3
Precast Concrete Tilt-Up Walls (PC1)	119
Precast Concrete Frames with Concrete Shear	32
Reinforced Masonry Bearing Walls with Wood or	307
Reinforced Masonry Bearing Walls with Precast	17
Unreinforced Masonry Bearing Walls, Low-Rise	78
Mobile Homes (MH)	1,179

Table 3-16. Housing Data for Park County (US Census, 2015b).

	Park County (TOTAL)	City of Livingston	Town of Clyde Park	Unincorporated Park County
Number of Housing Units	9,367	3,736	140	5,491
Median Value of Specified Owner-Occupied Housing	$216,900	$170,400	$158,100	$250,100
Number of Mobile Homes	784	149	29	606

Table 3-17. Age of Structures (US Census, 2015b).

	Park County (TOTAL)	City of Livingston	Town of Clyde Park	Unincorporated Park County
2014 or later	4	0	0	4
2010 to 2013	160	62	0	98
2000 to 2009	1,356	300	14	1,042

1990 to 1999	1,423	161	30	1,232
1980 to 1989	962	200	14	748
1970 to 1979	1,321	516	23	782
1960 to 1969	782	301	4	477
1950 to 1959	777	512	15	250
1940 to 1949	440	302	2	136
1939 or earlier	2,142	1,382	38	722

The total value of residential structures in Park County can be estimated as shown in Table 3-18. Census values were estimated by multiplying the number of housing units in 2015 by the median unit value in 2015. The residential building replacement value in Park County was estimated using the Federal Emergency Management Agency's HAZUS-MH loss estimation software. Table 3-19 lists the non-residential building stock replacement values by structure type.

Table 3-18. Estimated Value of Residential Structures.

	Census Estimated Residential Value	HAZUS-MH Residential Building Replacement Value
Park County, total	$2,031,702,300	$1,597,151,000
City of Livingston	$636,614,400	not applicable
Town of Clyde Park	$22,134,000	not applicable
Park County, unincorporated	$1,392,874,500	not applicable

[1]Includes non-residential buildings

Table 3-19. HAZUS-MH Estimated Non-Residential Building Stock Replacement Value.

Type	Replacement Value
Commercial	$257,892,000
Industrial	$44,148,000
Agriculture	$20,233,000
Religion	$25,303,000
Government	$7,331,000
Education	$21,731,000
TOTAL	*$376,638,000*

3.3 ECONOMIC, ECOLOGIC, HISTORIC, AND SOCIAL VALUES

Park County has an abundance of natural resources and scenic beauty. Surrounded by mountain ranges, scenic river valleys, and home to a main entrance of Yellowstone National Park, the county's economy depends on tourism, recreation, and related services, as well as agriculture, healthcare, and internet-based businesses. As of 2015, the county's largest non-government employer was Livingston HealthCare, owner and operator of the primary hospital and two clinic locations in Park County. (Bureau of Labor Statistics, 2015)

Disasters of any magnitude can threaten the fragile economies and well-being of residents. Basic economic statistics follow of Park County include (US Census, 2015c):

- Median household income: $43,932
- Persons below poverty: 12.3%
- Total number of companies/firms: 2,212

The ten top private employers (excluding railroad and government) in the county include (Prospera, 2017):

- Livingston HealthCare
- Chico Hot Springs
- Church Universal and Triumphant
- PrintingForLess.com
- Albertson's
- Montana's Rib and Chop House
- R-Y Timber
- The Murray Hotel
- Town & County Foods
- Yellowstone Association

Agricultural assets in Park County include (US Department of Agriculture, 2012):

- Number of farms: 564 farms
- Acres in farmland: 774,057 acres
- Total market value of agricultural products sold: $38,487,000
- Market value of livestock, poultry, and their products sold: $27,704,000
- Number of cattle and calves: 44,397
- Number of sheep and lambs: 2,578
- Number of poultry (layers): 849
- Market value of crops sold: $13,126,000
- Primary crops (based on number of farms): Forage/hay and wheat

The ecologic, historic, and social values of Park County each tie in to the quality of life for residents and visitors. Without these values, lives and property may not be threatened, but the way of life and connections to history and the environment could be disrupted. These values can have deep emotional meaning and investment.

Ecologic values represent the relationship between organisms and their environment. For humans, these values include clean air, clean water, a sustainable way of life, and a healthy, natural environment including a diversity of species. Natural hazards, such as floods and wildfires, are usually part of a healthy ecosystem but often human-caused hazards damage ecologic values. Ecologic values in Park County include Yellowstone National Park, Gallatin National Forest, Absaroka-Beartooth Wilderness, rivers, creeks, and wildlife. Park County does not have any generally known listed endangered species, however, the Canada Lynx is listed as a threatened species in the county, and the North American wolverine is listed as a proposed threatened species. (US Fish and Wildlife Service, 2017)

Historic values capture a piece of history and maintain a point in time. Historic values can include sites, buildings, documents, and other pieces that preserve times past and have value to people. Park County has 26 resources listed in the National Register of Historic Places. (National Park Service, 2017)

Social values often cannot be quantified but are an important aspect of quality of life and interpersonal relationships. Examples of social values in Park County may include gatherings to promote community building, personal achievement, freedom from tyranny, the ability to communicate with others, pride in making the world a better place, and friendships. The realm of social values is only limited by the human imagination and usually relates to how a person feels. Disasters, both natural and human-caused, can disrupt important social activities and sometimes have lasting effects on society.

3.4 CURRENT LAND USE

Park County has varied land use but is primarily rural with most of the land use devoted to agriculture, forest uses, residential, undeveloped areas, and government ownership. The City of Livingston is the most developed urban area. Small communities and individual homes and farms are interspersed throughout the valleys. Conservation easements have been widely used in Park County as a tool for voluntary land conservation and preservation of natural resources, productive agricultural lands, and wildlife habitat. Map 3-4 shows the federal, state, and local government ownership areas in the county.

The following are brief descriptions of the community areas in Park County, as derived from the Park County Growth Policy:

3.4.1 CLYDE PARK AREA

The Clyde Park area, north of Livingston, has mostly agricultural and residential land use.

3.4.2 COOKE CITY AREA

The Cooke City / Silver Gate area is in an isolated part of the county in a narrow valley. The area has two access points, both through Wyoming. Two hours from the county seat, the year-round access is through Yellowstone National Park. The scenic Beartooth Highway to Red Lodge is only open during the summer when the population expands by 300-400%.

3.4.3 JOE BROWN TO GARDINER AREA

The Joe Brown to Gardiner Area, including Jardine, is the rural area south of Yankee Jim Canyon and is a mountainous area bisected by the Yellowstone River. Nearly 80% of the land is in public ownership.

3.4.4 GARDINER AREA

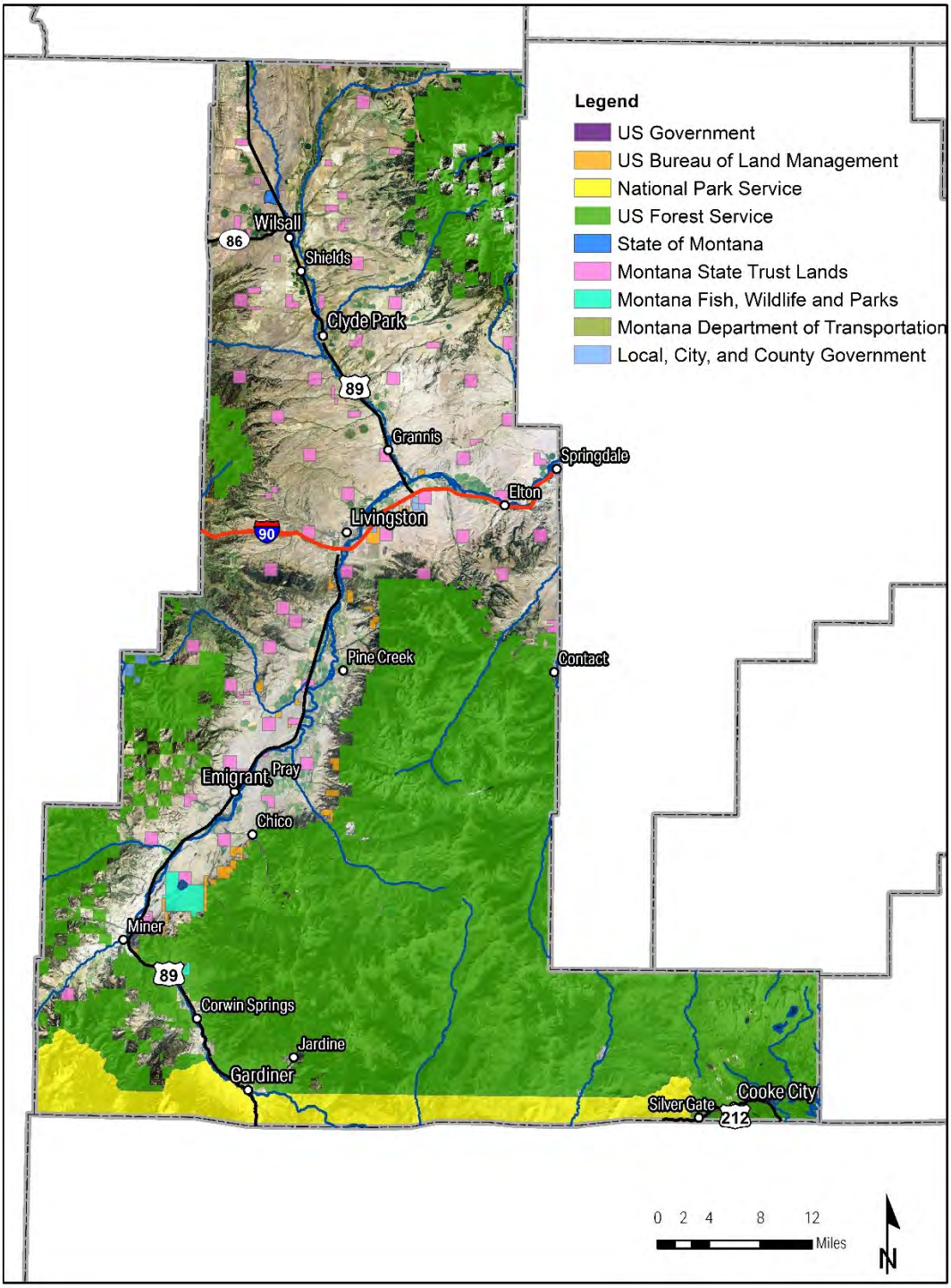
Gardiner is the gateway community to the very popular North Entrance of Yellowstone National Park and is home to roughly 2,400 seasonal employees. The majority of the land in this area is publicly owned. Private land availability is sparse with conservation easements on many land holdings.

3.4.5 LIVINGSTON AREA

Livingston is the largest city and serves as the county seat. The city itself is a mix of residential, industrial, and commercial land use. The area outside the city limits is more agricultural in nature but has experienced growth in recent years.

Public Lands

Park County, Montana



Data Source: Montana NRIS
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
December 2017

Map 3-4. Public Lands in Park County.

3.4.6 MISSION CREEK / WEST BOULDER AREA

The Mission Creek / West Boulder area to the east and south of Livingston is largely dominated by ranches with very little residential development.

3.4.7 PARADISE VALLEY AREA

The Paradise Valley area, located south of Livingston, has transitioned somewhat from mostly agriculture to more residential. Much of the growth is seasonal in nature.

3.4.8 SHEEP MOUNTAIN TO CLYDE PARK AREA

The Sheep Mountain to Clyde Park area north of Livingston, west of Springdale, and south of Clyde Park is 90% privately owned with most of the housing concentrated in the Clyde Park area.

3.4.9 SHEEP MOUNTAIN TO SPRINGDALE AREA

The Sheep Mountain to Springdale area, east of Livingston, is primarily used for agriculture. Approximately 44% of the land is privately owned and 56% is publicly owned. Most of the public land is south of Interstate 90.

3.4.10 WILSALL AREA

Wilsall, north of Clyde Park, is primarily agricultural land use with 75% under private ownership.

3.5 RECENT DEVELOPMENT

Population growth has occurred within the City of Livingston and surrounding areas in recent years. Although a population decline was seen in unincorporated parts of Park County and the Town of Clyde Park, development did occur. The exact number of new developments is difficult to determine; however, the county sanitarian issued 529 new septic permits from 2010 through mid-2017. (Park County Environmental Health, 2017) As has been the historical trend, rural growth was concentrated along the Yellowstone River Valley south from Gardiner to the northeast of Livingston. A second area of growth has been along the Interstate 90 corridor from Livingston to just east of Bozeman Pass. Scattered pockets of population growth occurred in the Shields River Valley, especially in the Wilsall area.

3.6 FUTURE DEVELOPMENT

Future development is so dependent on economic and regulatory conditions that predicting growth, particularly in a quantitative manner, is difficult. In 2008, the Sonoran Institute projected more than 2,100 new homes and 5,000 new residents in Park County by 2025. (Sonoran Institute, 2008) This projection was based on development figures during the construction boom of the mid 2000s and may represent a highest case scenario. The population in Park County has remained stable since the mid 1990's and is expected to experience little growth between the present and 2060, with some short periods of negative growth (Montana Department of Commerce, 2013).

3.7 EXISTING PLANS, POLICIES, AND CAPABILITIES

Hazard mitigation is most effective when it is developed with the existing capabilities and regulatory framework of a community in mind. Existing policy and planning documents can be an effective method of gauging the capabilities of jurisdictions and are an efficient and cost-effective means by which to

implement mitigation projects. The following sections outline some of the existing regulatory, administrative, financial, and outreach capabilities of the jurisdictions.

3.7.1 GROWTH POLICIES

Park County, the City of Livingston, and the Town of Clyde Park have growth policies, as required by state law. These policies do not provide regulatory authority but rather outline the future of growth in the jurisdictions. Regulatory authorities such as subdivision regulations and zoning are then guided by the growth policies. These growth policies are essentially the new version of comprehensive plans.

3.7.1.1 PARK COUNTY GROWTH POLICY, MAY 2017

The Park County Growth Policy is "a guiding document for Park County decision," and includes a measure to "protect the health and safety of residents and visitors." (Park County, 2017)

Goals and objectives in the Park County Growth Policy complimentary to this mitigation plan include (Park County, 2017):

- Goal 3: Support efforts of fire managers to manage fuels on public and private lands.
- Goal 4: Protect the health and safety of residents and visitors.
- Objective 8.2: Conduct water resource studies that analyze sources, long term availability, potential conflicts and drought, and include recommendations for management.
- Goal 11: Provide for a safe and efficient County road network.
- Objective 16.7: Protect air quality, important soils and water quality during and after development.

3.7.1.2 CITY OF LIVINGSTON GROWTH POLICY, 2017

The primary purpose of the City of Livingston Growth Policy is to "be a useful tool that the City can rely upon as it reviews land use and development decisions." Many of the policies stated in the Livingston Growth policy are complimentary to this plan. The plan includes three major goals, one of which is to "Develop infrastructure to enhance community services and improve public safety for Livingston residents." The growth policy also outlines the considerations that must be included in subdivision review, as noted in the next section. (City of Livingston, 2017)

3.7.1.3 TOWN OF CLYDE PARK GROWTH POLICY, OCTOBER 2009

The Clyde Park Growth Policy outlines the process for development in and within one mile of Clyde Park. Subdivisions are to be reviewed based on their material effect on the following, as provided in state law: agriculture, agriculture water user's facilities, local services, natural environment, wildlife, wildlife habitat, and public health and safety. Specific to hazard mitigation, the policy states:

- "The Shields River and Cottonwood and Brackett Creeks are the dominant water features in the Clyde Park planning area. Land adjacent to and within these riparian areas can experience high water tables and periodic flooding, and for these reasons, building in these areas should be carefully monitored." Strategies of the policy related to flooding include:
  - "Establish appropriate setbacks to buffer watercourses and wetlands, so an appropriate amount of buffers are left in natural vegetation."
  - "Require riparian buffer zones in new subdivisions and encourage them elsewhere for habitat preservation and to prevent property damage from potential flooding."
  - "Through historic and other existing information, identify areas of potential flooding, wetlands and hydric soils and discourage development in these areas."

- An example of a consideration for subdivision development in Clyde Park is, "Would the subdivision be subject to natural hazards such as flooding, rock, snow or landslides, high winds, severe wildfires or difficulties such as shallow bedrock, high water table, unstable or expansive soils, or excessive slopes?"
- The future land use categories assigned to areas within town limits include: agricultural residential, central business, gateway commercial, industrial, neighborhood commercial, and residential.

Source: Town of Clyde Park, 2009

3.7.2 SUBDIVISION REGULATIONS

Park County and the City of Livingston have subdivision regulations that apply to all divisions of land in which one or more parcels are 160 acres or less, with some exemptions. Proposed subdivisions within two miles of the City of Livingston or one mile of the Town of Clyde Park must also be submitted to the city or town for review and comment.

Purposes of both the Park County and the City of Livingston Subdivision Regulations include, among others:

- Promote the public health, safety, and general welfare by regulating the subdivision of land.
- To require development in harmony with the natural environment.
- The avoidance of danger or injury by reason of natural hazard. (Park County specifically mentions fire and wildland fire.)

3.7.2.1 PARK COUNTY SUBDIVISION REGULATIONS, JUNE 2010

The Park County Subdivision Regulations require considerations, such as (Park County, 2010):

- Floodplain regulations
- Effect on groundwater quality and quantity
- Effect on surface water features
- Effect on wetlands
- Effect of exposure to natural or man-made hazards

The design and improvement standards include provisions, such as:

- Lands that may be considered unsuitable for subdivision because of natural or human caused hazards include areas of potential hazard such as flooding, swelling soils, snow avalanches, rock falls, landslides, steep slopes in excess of 25% grade, subsidence, high water table, polluted or non-potable water supply, high voltage lines, high pressure gas lines, air or vehicular traffic hazards or congestion, because of unreasonable burdens on the general public such as requirements for the excessive expenditure of public funds, environmental degradation, or other features which may be detrimental to the health, safety, or general welfare of existing or future residents.
- Minimum construction setback along the Yellowstone, Shields, and Boulder Rivers is 150 feet from the mean high-water mark or outside the 100-year floodplain, whichever is greater. The minimum construction setback from all other perennial rivers and lakes is 100 feet or outside the 100-year floodplain, whichever is greater. These minimums may be increased to protect ecologic or historic values.

- Evaluation of the flood hazard if the subdivision is within 2,000 horizontal feet and 20 vertical feet of a live watercourse draining an area of 25 square miles or more and is lacking an official floodway study.
- Each parcel must have at least one acre of buildable land outside the 100-year floodplain.
- Culverts and other drainage facilities must be large enough to accommodate potential run-off from upstream drainage areas.
- Utilities must be placed underground where practical.
- A Fire Protection Plan that meets minimum fire protection requirements for access, water supply for structure and wildland fires, defensible and/or survivable space, including covenants as required.
- Subdivisions in the wildland-urban interface area, as identified by the US Forest Service, Montana DNRC, a local fire protection authority, a local growth policy, or a Community Wildfire Protection Plan, will be denied unless construction techniques or other mitigation measures acceptable to the fire protection authority and the Board of Commissioners are proposed.

3.7.2.2 CITY OF LIVINGSTON SUBDIVISION REGULATIONS, DECEMBER 2007

The City of Livingston Subdivision Regulations require considerations regarding the impacts on the natural environment and public health and safety, such as (City of Livingston, 2007):

- How would the subdivision affect surface and groundwater soils, slopes, vegetation, historical or archaeological features, and visual features within the subdivision or on adjacent lands?
- Would the subdivision be subject to natural hazards such as flooding, rock, snow or landslides, high winds, severe wildfires or difficulties such as shallow bedrock, high water table, unstable or expansive soils, or excessive slopes?
- What public health or safety hazards, such as dangerous traffic or fire conditions, would be created by the subdivision?

The design and improvement standards include provisions such as:

- The governing body may determine that land is unsuitable for subdivision because of natural or human caused hazards, unless the hazards are eliminated or overcome by approved design and construction techniques.
- Land in the floodway of a 100-year flood event as defined in state law, or other land determined by the governing body to be subject to flooding, may not be subdivided for building or residential purposes or other uses that may increase flood hazards.
- Utilities must be placed underground where practical.
- Culverts and other drainage facilities must be large enough to accommodate potential run-off from upstream drainage areas.
- Areas identified as wildfire hazard areas by the US Forest Service, Montana DNRC, a local fire protection authority, or a local growth policy must have a Fire Prevention and Control Plan that includes an analysis of the site wildfire hazards, mapping of proposed fuel reductions, sufficient roads, driveways, and bridges, two entrances/exits, and building sites that are not located on slopes greater than twenty-five percent or at the apex of "fire chimneys." Maintenance of the Fire Prevention and Control Plan is to be included in the covenants, conditions, and restrictions for the development through a property owners' association. Subdivisions in these areas must also have an adequate water supply for fire control, as outlined in the regulations.

3.7.3 ZONING

Zoning regulations generally dictate the type of development that can occur in a geographic location and establishes building design standards for some areas. In Park County, several unincorporated areas have zoning regulations that are enforced through a permit system. Each area has its own set of regulations. These areas include (Park County, 2017):

- City-County Donut
- Cokedale
- Cokedale West
- Cooke City – Silvergate – Coulter Pass
- East Yellowstone
- O'Rea Creek
- Paradise Valley

Within the City of Livingston, the types of zoning districts include (City of Livingston, 2008):

- Low Density Residential
- Medium Density Residential (dominant land use in Livingston)
- Medium Density Residential, Mobile Home
- High Density Residential
- Mobile Home Residential
- Public
- Industrial
- Light Industrial
- Highway Commercial
- Neighborhood Commercial
- Central Business District
- Preservation Zoning District

3.7.4 BUILDING CODES

The City of Livingston has adopted and enforces the International Code Council's International Building Code and International Residential Code. Updated codes are adopted about every three years. A building permit process is used in the city to track new development and enforce the codes.

3.7.5 CAPITAL IMPROVEMENTS PLANS

Park County developed a Capital Improvements Plan in 2015, which was designed to be amended annually to reflect changing conditions within the County. The purpose of the plan is to assist county leaders in project planning, and to establish long-term goals for maintaining, improving, or financing new capital improvement projects and/or capital equipment. (Park County, 2017d)

3.7.6 ADMINISTRATIVE CAPABILITIES

Park County, the City of Livingston, and the Town of Clyde Park are all limited in admirative capabilities, due to a relatively small population and limited tax base. Clyde Park, with a 2010 Census population of 310, is particularly limited. The County and City of Livingston are endowed with somewhat better administrative and technical resources, though many of staff members report a low capacity for additional work tasks.

3.7.7 FINANCIAL CAPABILITIES

While the City of Livingston and Town of Clyde Park are limited in existing financial capabilities, the County is extremely adept at identifying and securing funding from private, State, and Federal sources for mitigation projects. Local funding is limited in all the jurisdictions due to a relatively small tax base, and lack of revenue sources beyond property taxes.

3.7.8 EDUCATION AND OUTREACH CAPABILITIES

Park County and the City of Livingston have developed and implemented several outreach and education programs which focus primarily on public health and wildfire hazards. Clyde Park has not been able to dedicate many of its resources toward education and outreach, though programs through Park County could be potentially utilized by the public in Clyde Park.

4.0 HAZARD PROFILES

4.1 AVALANCHE AND LANDSLIDE

Table 4-1. Avalanche and Landslide Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

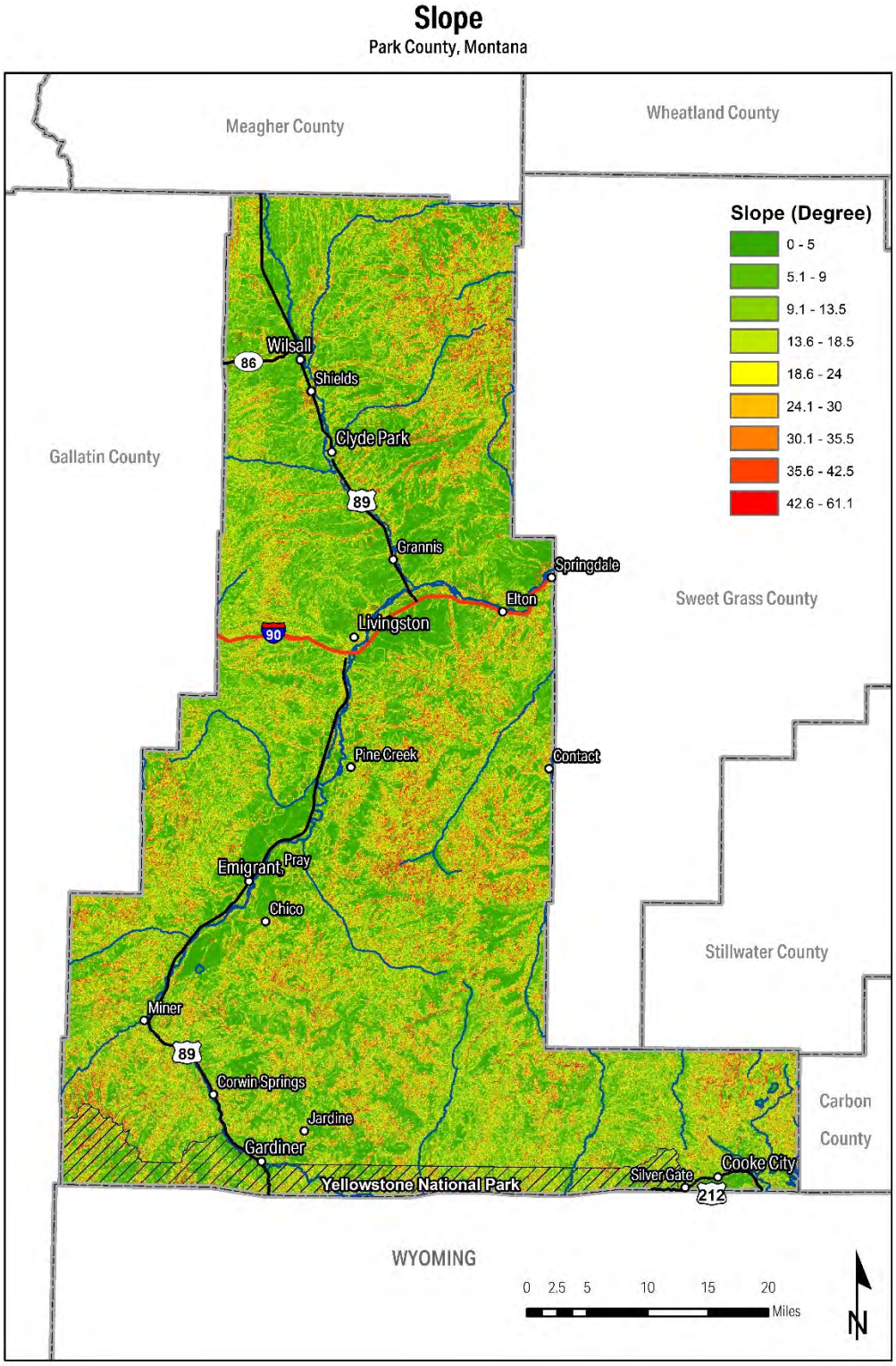
4.1.1 DESCRIPTION

Avalanches and landslides occur when a material on the surface of the earth cannot be supported any longer and gives way to gravity. In the case of an avalanche, the substance is snow, and for a landslide, the substance is mud, rock, or other geologic material. Both can occur rapidly with little warning.

When snow accumulations on a slope cannot be supported any longer, the snow support structure may break and fall creating an avalanche. The subsequent rush of unsupported snow can bury and move things in its path. The majority of avalanches do not cause any damage; however, occasionally people and property may fall in their path.

According to the Montana Disaster and Emergency Services website, "If it is assumed that an accumulation of snow is possible anywhere in Montana, then we can evaluate the potential for hazard solely based on terrain characteristics. The most important factor by far is terrain steepness. Wet snow avalanches can start on slopes of 20 degrees or less, but the optimum slope angle for avalanche starting zones is 25-45 degrees. Slopes steeper than 45 degrees will not normally retain enough snow to generate large avalanches, but they may produce small sluffs that trigger major avalanches on the slopes below. Therefore, all slopes of 20 degrees and greater should be considered as potential avalanche sites." (Montana Disaster and Emergency Services, 2011a)

For an avalanche to occur, factors such as slope, snow cover, a weak layer in the snow, and a trigger must be present. Avalanche danger increases with major snowstorms and periods of thaw. Approximately 90% of avalanches start on slopes of 30-45 degrees, most often on slopes above the timberline facing away from prevailing winds. Most avalanches occur in the backcountry. (Utah Department of Public Safety, 2011) Map 4-1 shows the slope throughout Park County.



Data Source: Varied
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
January 2018

Map 4-1. Ground Slope throughout Park County.

In the case of landslides, some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth material to landslide movement include: storms, earthquakes, volcanic eruptions, fires, alternate freezing or thawing, and steepening of slopes by erosion or human modification. Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. (Federal Emergency Management Agency, 2011a)

The Montana Department of Transportation, District 2 has mapped the priority areas for landslide vulnerability. The determination of priorities was based on an inventory of landslides and their proximity to state highways. Park County, the southeastern section of District 2 in Figure 4-1, has several Priority 2 and 3 areas. The Park County Sheriff's Office has also noted that landslide problems occur on Convict Grade and Interstate 90, mile post 350 and mile post 353.5, during heavy rains.

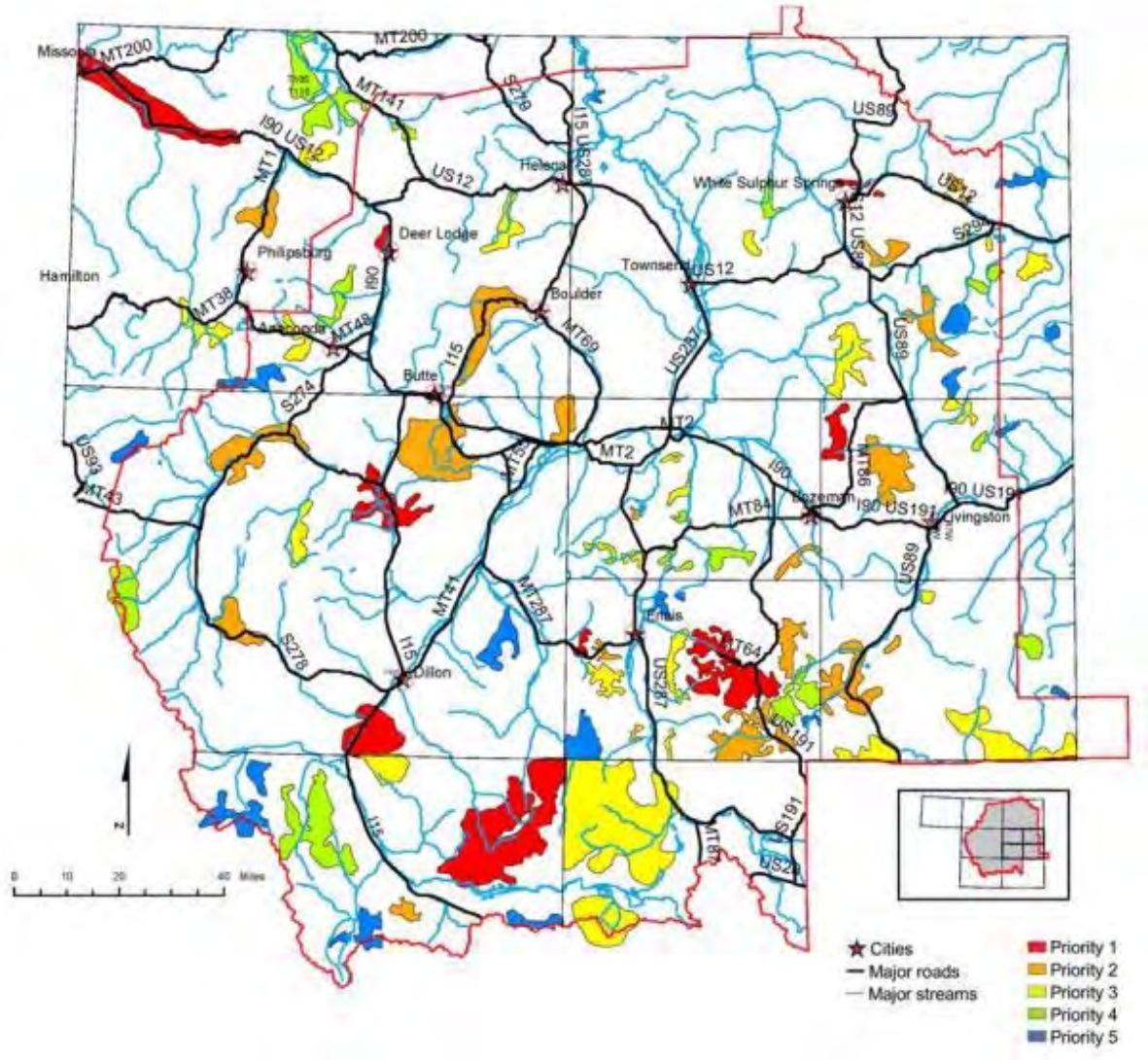


Figure 4-1. District 2 Priority Landslide Areas (Montana Department of Transportation, 2002).

4.1.2 HISTORY

The history of avalanches in Park County is much more pronounced than that of landslides. Both, however, have occurred. Table 4-2 outlines the impacts of avalanches since 1998. Note that avalanches are a normal occurrence in Park County and typically do not cause any damages. The only concerns here are when people or property lie in the path.

Table 4-2. Park County Avalanches Impacting the Population 1998-2017 (Avalanche.org, 2017).

Date and Location	Result
January 11, 1998 Rock Creek, 35 miles South of Livingston	One snowmobiler completely buried but rescued
January 19, 1998 Scotch Bonnet Mountain near Cooke City	Three snowmobilers killed and one injured
March 26, 1998 Scotch Bonnet Mountain near Cooke City	One snowmobiler completely buried but rescued
December 26, 2000 Daisy Pass near Cooke City	One snowmobiler caught but rescued
December 31, 2000 Emigrant Peak, Absaroka Range	Two hikers killed and one injured
January 27, 2002 Miller Creek, outside of Cooke City	One snowmobiler injured after being completely buried
February 16, 2002 Mount Abundance, north of Cooke City	Two snowmobilers killed
December 28-29, 2002 Cooke City Area	Four separate snowmobile avalanche incidents, one with a serious injury
January 22, 2003 North Side of Wolverine Peak near Cooke City	One snowmobiler killed
February 2, 2003 Elk Creek Drainage of Crazy Mountains near Livingston	One snowmobiler killed
March 9, 2003 Mount Abundance, 10 miles Northwest of Cooke City	One snowmobiler killed
January 5, 2006 Mount Abundance, 10 miles Northwest of Cooke City	One snowmobiler killed and one buried and rescued
January 6, 2006 Miller Mountain, Sheep Creek, near Cooke City	One snowmobiler killed and two partially buried and rescued
December 16, 2006 Scotch Bonnet Mountain near Cooke City	One snowmobiler killed
January 17, 2009 Crown Butte north of Daisy Pass near Cooke City	One snowmobiler killed
January 3, 2010 Scotch Bonnet Mountain near Cooke City	One snowmobiler killed
December 31, 2011 Henderson Mountain near Cooke City	One snowmobiler killed

Date and Location	Result
February 21, 2012 Daisy Pass near Cooke City	One snowmobiler killed and one buried and rescued
March 11, 2014 Crown Butte near Cooke City	One snowmobiler killed and one injured
November 26, 2014 Henderson Mountain near Cooke City	One snowmobiler killed
December 19, 2015 Sheep Mountain near Cooke City	One snowmobiler killed
December 11, 2016 Henderson Mountain near Cooke City	One skier killed

Significant landslides have not been documented in Park County; however, small ones are generally known to have occurred in Yankee Jim Canyon. The 1935 Helena earthquakes triggered a landslide 24 miles south of Livingston on the east side of the Yellowstone River burying the roadway and telephone lines. The road was cleared the following day. (Helena Independent, 1935) The massive Hebgen Lake landslide in nearby Madison County, which resulted in the creation of a new lake and killed 26 people, was triggered by a strong earthquake; this potential also exists in Park County.

4.1.3 PROBABILITY AND MAGNITUDE

The Colorado Avalanche Information Center has compiled statistics on a statewide basis on avalanche fatalities. Montana ranks second in the nation with 38 fatalities over the last 10 years. Looking at the activities the individuals were undertaking at the time of the avalanche, snowmobiling, skiing, and climbing rank as the top three. Ratings have not been complied for counties within Montana; however, the historical databases show that Park County is one of the more vulnerable counties in the state from avalanche, particularly in the Cooke City area. Based on the statistics from 1998-2017, an average 1.1 people (21 fatalities/19 years) are killed in Park County from avalanches each year. The history of significant incidents noted in Table 4-2 demonstrates that the population is most vulnerable to avalanches during the months of December, January, February, and March.

Landslides have an even lower probability of creating a disaster based on a very limited history of events. Should landslides occur in this area, they typically do not affect life or property. The probability of a damaging landslide could greatly increase if development were to occur in landslide prone areas. Wildfire burn areas also greatly increase the probability of a landslide triggered by precipitation.

4.1.4 VULNERABILITIES

Given a limited history of avalanches or landslides causing losses, with the exception of population losses, loss estimates were generally figured based on a scenario in which a landslide or avalanche impacts a rural interface area of three homes. Since the primary avalanche and landslide hazard areas are outside the City of Livingston and the Town of Clyde Park, the analysis applies only to unincorporated area of Park County.

4.1.4.1 CRITICAL FACILITIES AND INFASTRUCTURE

Critical facilities in Park County historically have not suffered losses or been threatened by avalanches or landslides. Critical facilities could potentially be impacted, but the probability is very low. Most facilities are located outside of steep slope areas. The primary exceptions are roadways and communications equipment. Many communities in Park County are accessible only by Highway 89. Communities such as Gardiner would be severely impacted should a landslide or avalanche make the highway impassible, particularly in a scenario in which removing debris and repairing the highway would occur over a long-term period. Typically, communications equipment, such as radio towers, are located on mountain peaks and are somewhat protected due to their locations near the peaks but not immune to avalanches and landslides. Potential losses to roadways and communications equipment could easily total into the hundreds of thousands of dollars, and the probability of such an event is considered moderate.

4.1.4.2 EXISTING STRUCTURES

Most avalanche and landslide prone areas are located on federal or state lands and do not have many structures. An avalanche or landslide impacting three rural homes in the interface areas would result in losses of around $750,300 (3 homes x $250,100 median value of homes in unincorporated Park County).

4.1.4.3 POPULATION

Based on records from the past 19 years, an average of 1.1 people are killed by avalanches in Park County each year. This figure shows that the greatest losses from avalanches are to human life. If an avalanche or landslide impacted Highway 89, the losses would likely be even greater as emergency and critical services could be severely interrupted. Fortunately, with advisories being issued by centers—such as the Gallatin National Forest Avalanche Center—some warning does exist as to the potential for avalanches. Training also educates outdoor enthusiasts on the signs of avalanche danger. The potential for population impacts from avalanches is considered moderate.

Related to landslides, the National Weather Service issues flash flood warnings during periods of rainfall or snow melt that have a high likelihood of causing flash flooding. Such flooding and rapid runoff may trigger land and mud slides. Without any documentation supporting any deaths or injuries from landslides in Park County, this potential is considered low.

4.1.4.4 VALUES

The potential for economic losses is more likely yet still not significant. An avalanche or landslide could destroy an area designated for logging; however, such an event may also create fallen timber for harvesting. With tourism being a large part of the regional economy, severe avalanche seasons could have an impact on the snowmobiling economy. Additional losses would be likely if an avalanche or landslide disrupted transportation along Highway 89, which serves as one of the primary entrances to Yellowstone National Park.

4.1.4.5 FUTURE DEVELOPMENT

Some undeveloped parcels of land in unincorporated parts of Park County do coincide with the areas at greatest risk for avalanche and landslide losses. Development of these lands could result in more structures in the hazard areas. Fortunately, the subdivision review process prohibits structures on slopes of more than 25% grade. Therefore, the development potential in these areas is limited by these regulations. The most likely type of future development in hazard areas is residential. Given the large tracts of land in the hazard areas and common-sense building practices, the number of future structures in the hazard areas is probably less than 10.

4.1.4.6 VULNERABILITIES AND IMPACTS

Table 4-3. Avalanche and Landslide Hazard Vulnerabilities and Impacts.

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	Park County		/ $100,000 losses / Structural losses / Contents losses / Critical functional losses / Critical data losses / Clean-up/debris removal costs	Moderate
Critical Infrastructure	Park County	/ $200,000 losses / Road closures	/ Loss of electricity / Loss of telephone service	Low-Moderate
Existing Structures	Park County		/ $750,300 losses / Structural losses / Contents losses / Displacement/ functional losses / Clean-up/debris removal costs	Low-Moderate
Population	Park County	/ Injuries / Fatalities		Moderate
Values	Park County		/ Service industry losses / Cancellation of activities	Low-Moderate
Future Structures	Park County		/ Unlikely to occur in hazard areas / Up to 10 residential structures estimated	Low-Moderate

[1] In addition to probable (100-year) impacts

4.1.5 DATA LIMITATIONS

Data limitations include:

- Limited studies of the landslide and avalanche hazards in Park County.
- Difficulties quantifying vulnerabilities due to the site-specific nature of landslides and avalanches.

4.2 AVIATION ACCIDENT

Table 4-4. Aviation Accident Federal Major Disaster Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

4.2.1 DESCRIPTION

Aviation accidents can occur for a multitude of reasons from mechanical failure to poor weather conditions to intentional causes. Accidents can vary from small single engine aircraft to large commercial jets. The location of the accident, such as a remote area versus a populated location, also plays an important role in the amount of destruction caused.

Park County has four small airports – Mission Field (LVM), 5 miles east of Livingston; Gardiner Airport (29S), 2 miles northwest of Gardiner; Wilsall Airport (9U1), 4 miles northwest of Wilsall; and Paradise Valley Flying Y Ranch Airport (MT48), 12 miles south of Livingston. Chico Hot Springs formerly used the roadway leading to the resort as a runway but is no longer using it in this capacity. These airports serve non-commercial, private commuter, and recreational aircraft. Mission Field, owned by the City of Livingston and Park County, has one paved runway and two turf runways. The airport serves an average of 42 aircraft operations/day. Gardiner Airport has one paved runway and conducts an average of 78 aircraft operations/month. Wilsall Airport has one turf runway and averages about 60 aircraft operations/year. The Paradise Valley Flying Y Ranch Airport is a private airport with one turf runway. (AirNav.com, 2017)

Commercial service is provided by a number of area airports including Bozeman/Belgrade, West Yellowstone, Billings, and Helena. Large passenger aircraft serving these airports often fly over Park County. Small aircraft accidents may be relatively minor in nature involving none or few casualties, whereas, a large commercial aircraft could create a mass casualty incident requiring outside assistance.

In addition to established airports and fixed wing traffic, helicopters and other aircraft can be found in most other areas of the county. An active wildfire season increases spotting and suppression activities by air, and heliports may be set up in many locations. Other locations, such as Livingston Memorial Hospital, may have helicopter traffic conducting medical transports. Several Park County residents also have their own personal aircraft operating to and from their property.

The hazard of aviation accidents can involve multiple factors. The two most significant include the location of the accident and the cargo on board. The location of an aviation accident will determine the significance of ground casualties and damages. An aircraft accident in a populated downtown area has a much greater potential for additional casualties and property damage than one that occurs in a remote part of the county. The location also affects the ability of responders to get to the crash site. The mountainous terrain in Park County can make rescues and recovery difficult, particularly during inclement weather. The statistics show that incidents occur both on and off airport facilities. Therefore, determining hazard areas by airport locations would be minimally beneficial and would not show all hazard areas.

Aircraft cargo is an important factor if such cargo would create a hazardous material release or increase fire hazard. Should the contents of the aircraft be hazardous, the situation would need to be treated not only as an aviation accident but also as a contaminated site. The possibility of an aviation accident as an intentional act cannot be ruled out, in which case, the accident site would also become a crime scene and possibly involve mass casualties.

4.2.2 HISTORY

Table 4-5 briefly summarizes the accident reports filed by the National Transportation Safety Board (NTSB) as occurring in Park County.

Table 4-5. Incident Report Summary 1964 – 2017 for Park County, Montana (National Transportation Safety Board, 2017).

Date	Location	Casualties	Additional Information
May 17, 1964	Mission Field	None	Student pilot went nose down during takeoff in windy conditions.
July 25, 1965	Near Livingston	None	Aircraft collided with a rock during an off-airport landing.
August 22, 1965	Mission Field	None	A ground loop occurred during landing due to inadequate maintenance of landing gear.
June 30, 1966	Mill Creek	None	Aircraft was destroyed when it crashed during a turbulent final approach.
August 10, 1967	Near Livingston	None	Student pilot stole the aircraft and crashed while attempting to hover.
April 14, 1968	Mission Field	None	Aircraft went nose down during takeoff during windy conditions.
July 1, 1968	Wilsall Airport	None	Plane collided with a fence while trying to take off on a muddy runway.
May 27, 1969	Mission Field	None	A ground loop and landing gear failure occurred during a landing in windy conditions.
August 2, 1969	Mission Field	3 fatal	Aircraft crashed during an emergency landing after complete engine failure while enroute to Rapid City, SD from Butte, MT.
October 31, 1970	Mission Field	None	Student pilot collided with a fence while attempting to land.
August 19, 1971	Mission Field	None	A hard landing with landing gear collapse caused substantial damage to the small aircraft.
September 14, 1972	Near Livingston	None	An aircraft collided with a fence after attempting an emergency landing due to partial power loss in an engine.
March 30, 1974	Mission Field	None	The nose of the small aircraft toppled over after landing in windy conditions.
June 25, 1975	Mission Field	None	An aircraft overturned while taxiing after landing in windy conditions.
March 26, 1977	Near Gardiner	None	Aircraft rolled into a ditch while trying to land on a road after becoming lost.
December 23, 1977	Near Livingston	None	Emergency landing enroute to Big Timber from Bozeman after the inability to clear a ridge due to downdraft weather conditions and the resulting power failure in the engine.

Date	Location	Casualties	Additional Information
May 29, 1978	Pray	2 fatal	The plane crashed after flying into a thunderstorm.
June 25, 1979	Near Emigrant	None	Aircraft landed in a swamp during an emergency landing after engine failure.
March 8, 1982	6 miles west of Livingston	1 fatal	The accident occurred near a ridge obscured by clouds. The pilot was not instrument rated.
April 16, 1982	Gardiner Airport	None	Landing gear sank in the mud during landing. Another aircraft was also stuck on the other runway.
May 25, 1984	Near Crazy Peak	None	Aircraft was damaged after experiencing extreme turbulence while enroute to Lewistown, MT. The plane landed in Lewistown safely but substantially damaged.
October 18, 1984	Mission Field	None	Left side of aircraft struck the ground during takeoff in gusty winds. The pilot did not take off on the preferred runway.
July 29, 1985	Near Wilsall	1 fatal, 1 seriously injured	Plane crashed after flying into poor weather conditions while enroute to Powell, WY from Polson, MT. The pilot was not instrument rated.
June 30, 1987	Near Crazy Mountain	None	During a search and rescue flight, a downdraft caused an engine stall and a collision with trees near the ridge line.
May 6, 1989	South of Livingston	2 seriously injured	Aircraft was "buzzing" the tree line near military units conducting training exercises when it crashed.
July 27, 1993	Flying Y Airport	None	Pilot swerved off of runway into a ditch during takeoff in windy conditions.
September 15, 1995	Pray	None	Equipment malfunction and possible winds caused plane to slide off the runway and collapse landing gear.
June 27, 1996	Chico Hot Springs	2 fatal	Plane crashed while trying to abort a landing in gusty winds.
July 12, 1998	Chico Hot Springs	None	While taking off from the north (non-standard direction), the aircraft struck a fence and crashed into the hilly terrain.
November 27, 1998	Near Jardine	None	During an elk spotting flight, wind conditions and resulting altitude problems resulted in impacting trees, however, the plane was able to return and land in Gardiner.
July 12, 2000	Chico Hot Springs	None	Aircraft collided with a fence while attempting to land in gusty winds.

Date	Location	Casualties	Additional Information
May 30, 2001	Gardiner Airport	None	Pilot error during takeoff resulted in rotor blades stalling, hitting the ground, and the tail to be cut off.
August 31, 2001	3 miles south of Emigrant	3 fatal	Firefighting helicopter test flight for equipment maintenance in which a bucket line tangled in a rotor causing the aircraft to crash.
June 2, 2014	Gardiner Airport	None	Airplane was unable to maintain a positive climb rate and was forced to undertake an emergency landing in a field. The airplane exceeded its maximum weight limit.

4.2.3 PROBABILITY AND MAGNITUDE

As the historical record demonstrates, the probability for a private, small aircraft accident is much greater than one involving a large commercial jet in Park County. Although an incident involving a commercial passenger flight and mass casualties cannot be ruled out, the probability is considered low. Statistics compiled based on NTSB incident reports can be found in Table 4-6. Table 4-7 shows the number of incidents by 10-year periods.

Table 4-6. Summary by Location of NTSB Reported Accidents for Park County.

Location	Number of Incidents	Fatalities
Mission Field	10	3
Gardiner Airport	3	0
Chico Hot Springs/Pray	4	2
Wilsall Airport	1	0
Flying Y Airport	1	0
Off Airport	15	7
Total	33	12

Table 4-7. Summary by 10-Year Periods of NTSB Reported Accidents for Park County.

Period	Number of Incidents	Fatalities
1971-1980	8	2
1981-1990	7	2
1991-2000	6	2
2001-2010	2	3
2011-present	1	0
Average	5.22	1.96

Based on these statistics for Park County over a forty-six year period (1971-2017), a ten-year average can be derived. In an average ten-year period, 5.22 incidents causing damage can be expected involving 1.96 fatalities. Fortunately, the number of both incidents and fatalities seem to be decreasing.

4.2.4 VULNERABILITIES

Since the location and probability of a significant aviation accident is extremely difficult to determine, two scenarios were used to determine potential losses. The first is a small aircraft accident that impacts two homes. The second is a large commercial aircraft impacting an entire city block.

4.2.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

All critical facilities in Park County are considered to be at risk from aircraft accidents. Given the nature of historic events and the probability of a specific facility being hit, the overall vulnerability of any given critical facility is considered very low. Livingston Memorial Hospital, however, has been identified as a facility at an increased risk because of the helicopter medical transport operations that may be conducted there. The landing pad for the helicopters is very close to active patient areas of the hospital and the potential for an accident damaging the hospital is somewhat greater. The only infrastructure that can be considered at a slightly higher risk are the tall communications towers and power lines.

4.2.4.2 EXISTING STRUCTURES

In most aviation accidents in Park County, the losses are limited to the people on board and the aircraft itself. Should an accident occur in a developed area, structural losses in the neighborhood of $433,800 (2 homes x $216,900/average home) plus ground casualties could be found. A large commercial jet in a developed area could potentially destroy an entire city block for a loss of roughly $2,169,000 (assuming 10 or so structures were destroyed).

4.2.4.3 POPULATION

The population impacts will be directly related to the type of aircraft involved, the number of people on board, the location of the accident, and the number of people around the crash site. Typically, with aircraft accidents, very little warning exists so the population would be unaware until after the event occurred.

4.2.4.4 VALUES

In the case of an entire city block being destroyed, several local businesses could experience significant losses related to the destruction of their storefront and business facility. More likely, the emotional impacts of such an event would be significant and impact the community for many years.

4.2.4.5 FUTURE DEVELOPMENT

Due to the somewhat random location of aircraft accidents, the impact of future development is generally the same wherever development occurs, except for areas in the immediate vicinities of the airports.

4.2.4.6 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	Park County, Livingston, Clyde Park		/ $250,000 losses / Structural losses / Contents losses / Critical functional losses / Critical data losses / Clean-up/debris removal costs	Low-Moderate

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Infrastructure	Park County, Livingston, Clyde Park		/ $200,000 losses / Road closures / Loss of electricity / Loss of telephone service	Low-Moderate
Existing Structures	Park County, Livingston, Clyde Park		/ $2,000,000 losses / Structural losses / Contents losses / Displacement/functional losses / Clean-up/debris removal costs	Low-Moderate
Population	Park County, Livingston, Clyde Park	/ Injuries / Fatalities		Moderate
Values	Park County, Livingston, Clyde Park	/ Emotional impacts	/ Business disruption losses / Service industry losses / Agricultural losses / Habitat damages / Reduced water quality / Soil contamination / Historic structure losses / Historic site losses / Historic item losses / Aesthetic value losses	Low-Moderate
Future Structures	Park County, Livingston, Clyde Park		/ Increases the total hazard exposure / All types of future structures are at risk	Low-Moderate

4.2.5 DATA LIMITATIONS

Data limitations include:

- Difficulties in predicting the location and magnitude of future accidents. The National Transportation Safety Board keeps very detailed records of damaging aircraft incidents. These records allow for in-depth analysis of individual accidents. The randomness of aircraft accidents, however, limits the usefulness of such information in determining the potential for losses and areas of greatest hazard.
- Lack of data outlining the number of aircraft passing over Park County and the areas they typically traverse to quantify the potential for major accidents.

4.3 COMMUNICABLE DISEASE AND BIOTERRORISM

Table 4-8. Communicable Disease Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

4.3.1 DESCRIPTION

Diseases affect humans and animals continuously. Each species has its own natural immune system to ward off most diseases. The causes and significance of diseases vary. Of significance in the disaster mitigation realm are communicable diseases with the potential for high infection rates in humans or those which might necessitate the destruction of livestock. Such diseases can devastate human populations and the economy.

Disease transmission may occur naturally or intentionally, as in the case of bioterrorism, and infect populations rapidly with little notice. New diseases regularly emerge or mutate. Known diseases, such as influenza, can be particularly severe in any given season. Terrorism experts also theorize the possibility of attacks using biological agents.

4.3.1.1 HUMAN DISEASE

Human epidemics may lead to quarantines, large-scale medical needs, and mass fatalities. Typically, the elderly, young children, and those with suppressed immune systems are at greatest risk from communicable diseases. The following biologic agents are considered the highest bioterrorism threats (Category A) due to their ease of dissemination or person-to-person transmission, high mortality rate with potential for major public health impacts, potential for public panic and social disruption, and the necessity for special public health preparedness (Centers for Disease Control and Prevention, 2017):

- Anthrax
- Botulism
- Plague
- Smallpox
- Tularemia
- Viral Hemorrhagic Fevers

In addition to global disease and bioterrorism concerns, naturally occurring diseases can threaten communities. Natural illnesses of concern, among others, include:

- Food-borne illnesses, such as E. coli and Salmonella
- Influenza
- Meningitis
- Pertussis/Whooping Cough
- Measles
- Norwalk Virus
- Severe Acute Respiratory Syndrome (SARS)

These diseases can infect populations rapidly, particularly through groups of people in close proximity such as schools, assisted living facilities, and workplaces.

Medical advances over the past fifty years have prevented many disease outbreaks, yet the potential remains. Much of the county is in a rural setting, and therefore, is somewhat isolated from the rapid spread of global diseases; however, frequent air travel by many citizens has increased the likelihood of disease transfer to rural communities. In addition, Park County's gateway location to Yellowstone National Park

increases the probability of disease transmission from national and international travelers. The schools and assisted living settings are also prime situations for the rapid spread of disease.

4.3.1.2 ANIMAL DISEASE

Park County has a broad agricultural and ranching economic base. Animal diseases, particularly those that infect livestock, can distress the agricultural community. Such diseases could lead to food shortages and negative economic impacts, depending on the types of animals infected and the geographic extent of the disease.

Montana has numerous reportable and quarantine-able animal diseases. Some of the more commonly known diseases include bovine spongiform encephalopathy (mad cow disease), brucellosis, foot and mouth disease, anthrax, plague, rabies, and West Nile virus. (Montana Department of Livestock, 2017) Most global livestock diseases have been confined to specific countries due to strict import regulations.

Bison in Yellowstone National Park that are infected with brucellosis are an ongoing concern. These bison regularly migrate out of the Park onto private lands in Park County. Should livestock become infected, the economic losses could be significant. Humans can also contract brucellosis in the form of undulant fever, causing a public health threat.

The communicable disease and bioterrorism hazard is somewhat uniform across the county. The urban areas may be slightly more vulnerable to the rapid spread of disease in humans; however, the more rural areas are more vulnerable to animal diseases.

4.3.2 HISTORY

Park County has not experienced any significant disease outbreaks within its population in recent years. Approximately three human influenza pandemics have occurred over the past 100 years, one severely affecting the United States. Following World War I, the Spanish influenza pandemic of 1918 killed 20-40 million people worldwide, including 675,000 Americans. (Billings, 1997) In the State of Montana, the Spanish influenza caused 9.9 deaths per 1,000 people from 1918-1919. (Brainerd and Siegler, 2003) The local impacts of the 2009 H1N1 influenza pandemic were not especially significant. In 1988, a statewide measles outbreak was noted by local health department officials.

4.3.3 PROBABILITY AND MAGNITUDE

The probability of an epidemic in Park County is rather difficult to assess based on history and current data. Medicine has improved significantly over the past 50 years and continues to do so every day. Given the urban and tourism-based nature of Livingston, the probability of rapid infection is somewhat greater than more rural parts of the county and state. Given relatively rapid worldwide airline travel and the large influx of tourists to Yellowstone National Park through Park County, a disease originating in another part of the world could easily travel unknowingly to Park County, thus increasing the probability of new diseases in this region as compared to other parts of the state.

4.3.4 VULNERABILITIES

Vulnerabilities were calculated based on estimates derived from a severe strain of influenza impacting the communities. With the exception of population losses, qualitative methodologies were the most logical way to estimate losses.

4.3.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

Critical facilities are not structurally threatened by communicable disease and bioterrorism; however, their accessibility and functionality can be lost. Contamination of a critical facility could render the facility non-functional until decontamination or the threat has passed. For this reason, all critical facilities are assumed to be at risk from communicable disease and bioterrorism. As with any human biological event, the hospitals and health service providers would most likely discover a threat and possibly become the first contaminated. Clean up and decontamination costs could be significant. For example, the cleanup of anthrax in several congressional offices on Capitol Hill in September and October of 2001 cost the Environmental Protection Agency about $27 million. (US General Accounting Office, 2003)

Should an epidemic necessitate a quarantine or incapacitate a significant portion of the population, support of and physical repairs to infrastructure may be delayed, and services may be disrupted for a time due to limitations in getting affected employees to work.

4.3.4.2 EXISTING STRUCTURES

In most plausible communicable disease scenarios, existing structures would not be impacted.

4.3.4.3 POPULATION

The entire county population of 15,972 (US Census, 2015) plus non-residents are at risk for contracting a communicable disease. The number of infections and fatalities in the communities would depend on the transmission and mortality rates. Using a general estimate of 30% for the infection rate and a conservative mortality rate (once infected) of 2.5%, as can be the case in an influenza pandemic, approximately 4,792 residents of Park County would be infected with about 120 fatal infections. (World Health Organization, 2010)

As with any disease, age and other health conditions can be a contributing factor. The ability to control the spread of disease depends on the virulence of the disease, the time lapse before the onset of symptoms, the movement of the population, and the warning time involved. Vaccinations, anti-viral medication, quarantines, and other protective measures may prevent the spread and impact of disease. Besides human diseases, animal diseases could negatively affect agriculture and limit food supplies.

4.3.4.4 VALUES

In addition to the obvious population impacts, human or animal diseases may have a significant impact on the Park County economy, particularly tourism or agriculture. A human quarantine or highly publicized event may affect sales in the community through tourism and resident services, resulting in long term economic impacts. Animal diseases nationwide could have an overarching effect on the national economy. More directly, however, Park County has 564 farms totaling about 774,057 acres. In 2012, total cash receipts from agriculture were $38,487,000 with $27,704,000 from livestock sales. At the start of 2012, Park County had 44,397 head of cattle and calves, 2,578 sheep and lambs, and hundreds of chickens for agriculture purposes. (US Department of Agriculture, 2012) This income and livestock could be lost in a severe animal disease outbreak.

4.3.4.5 FUTURE DEVELOPMENT

In most plausible communicable disease scenarios, future development would not be impacted, but any additional residents would be at risk for disease and increase the overall exposure.

4.3.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	All		/ $100,000 losses / Critical functional losses / Clean-up costs	Low
Critical Infrastructure	All		/ $500,000 losses / Loss of electricity / Loss of utility gas / Loss of potable water / Loss of sanitary sewers / Loss of telephone service / Loss of internet service / Fuel/energy shortages	Low-Moderate
Existing Structures	All		/ $0 losses / Clean-up costs	Low
Population	All	/ Hundreds of cases / Some fatalities	/ 4,691 estimated cases / 117 estimated fatalities	High
Values	All	/ Agricultural losses / Emotional impacts / Cancellation of activities	/ Business disruption losses / Service industry losses / Biodiversity losses	Moderate-High
Future Structures	All		/ Increases the total hazard exposure / All types of future structures are at risk	Low

[1] In addition to probable (100-year) impacts

4.3.6 DATA LIMITATIONS

Data limitations include:

- / Uncertainties related to how and when a disease will spread through a population
- / Unknowns with the emergence of new, unstudied diseases

4.4 DAM FAILURE

Table 4-9. Dam Failure Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

4.4.1 DESCRIPTION

Dams, which are generally defined as barriers created with the purpose of retaining water, have been placed in strategic locations across the county, state, and nation for a wide variety of uses including flood control, hydroelectricity generation, irrigation, public water supplies, and recreation. Dams exist in a wide variety of shapes, sizes, and materials. They are constructed, operated, and maintained by entities such as private individuals, businesses, and government.

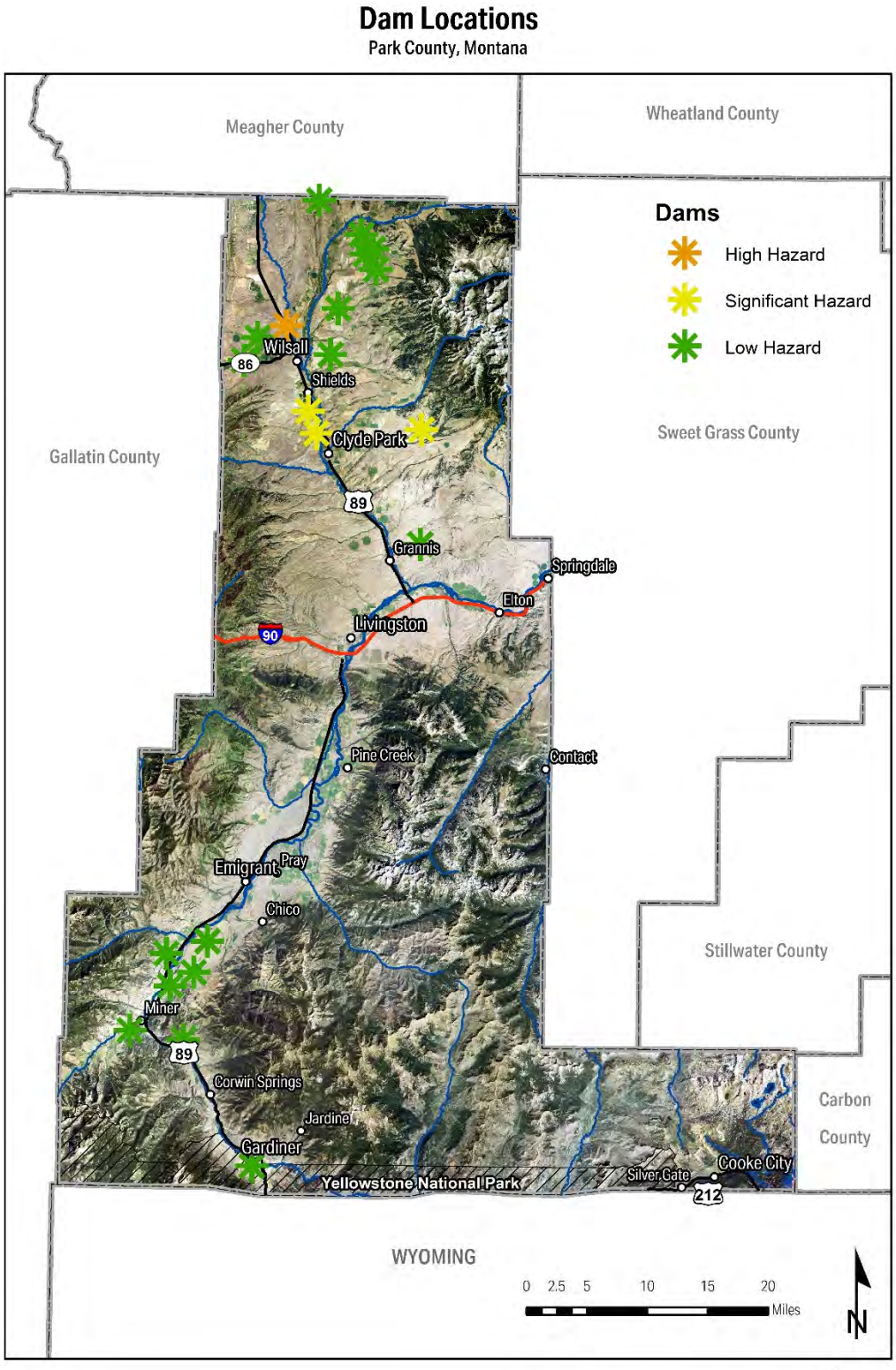
The structural integrity of a dam depends on its design, maintenance, and ambient conditions. Should a dam fail, the consequences can be devastating or minimal depending on the dam's characteristics and regional attributes. Although not particularly likely, seismic activity, poor maintenance, overwhelming flow conditions, and terrorist activities can all lead to the catastrophic failure of a dam. The result is the rush of water contained by the dam downstream at a rapid pace. Problems arise when a dam fails, and people and/or property lie in its inundation area. Dam failure can be compared to riverine or flash flooding in the area downstream from the dam, and sometimes for long distances from the dam, depending on the amount of water retained and the drainage area. Others may be located in areas that result in little if any damages during a failure.

Most dams are classified based on the potential hazard to life and property should the dam suddenly fail. Note the hazard rating is not an indicator of the condition of the dam or its probability of failure. Definitions, as accepted by the Interagency Committee on Dam Safety, are as follows (Federal Emergency Management Agency, 2004):

- **Low Hazard Potential:** Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.
- **Significant Hazard Potential:** Dams assigned the significant hazard potential classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- **High Hazard Potential:** Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life.

Park County has one high hazard dam, four significant hazard dams, and nineteen low hazard dams as shown in Table 4-10. The locations and hazard assignment of dams in Park County can be found on Map 4-2. The high and significant hazard dams can be found in the northern half of the county.

Inundation mapping for the Cottonwood and Crazy Mountain Dams (also known as the Nauharodney Dam) exist in their Emergency Action Plans. These maps can be found in the Park County Disaster and Emergency Services office.



Data Source: Varied
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
January 2018

RESPEC

Map 4-2. Dam Locations.

Table 4-10. Dams Located in Park County, Montana (US Army Corps of Engineers, 2017).

Dam Name	River	NID Height (feet)	NID Storage (acre-ft)	Year Finished	Hazard	Owner
Cottonwood	Cottonwood Creek	51	3,670	1953	High	State of Montana
Arthun	Antelope Creek Tributary	23	186	1956	Significant	Len Arthun
Kaiser	Muddy Creek Tributary	20	201	1964	Significant	Park Swandal
Crazy Mountain / Nauharodney	Hammond Creek	25	175	1960	Significant	Crazy Mountain Ranch
O'Halloran (Lower)	Looking Glass Creek	23	149	1960	Significant	Loyce O'Halloran
Anderson	Kavanaugh Creek	30	70	1959	Low	State of Montana
Banana Peel	Slip and Slide Creek	8	63	1952	Low	Franklin Rigler
Bonhomme	Bull Run Creek	26	65	1954	Low	Pete
Dailey Lake	Diffused Surface Water	10	959	1945	Low	State of Montana
D'Ewart	Canal from Flathead Creek	10	52	1951	Low	D'Ewart Ranch Inc.
John Ragsdale	Offstream	19	100	1980	Low	John Ragsdale
Jordan	Antelope Creek Tributary	38	1,260	1961	Low	Arthun Bros.
Kelly	Shields River Tributary	15	60	1955	Low	Duane Nollmeyer
Landers #1	Muddy Creek Tributary	15	93	1949	Low	Landers Hereford
Merrell	Tom Miner Creek Tributary	15	275	1966	Low	James Hubbard
Nollmeyer #1	Elk Creek Tributary	25	86	1975	Low	Nollmeyer Farms
O'Halloran #1 (Upper)	Looking Glass Creek	23	149	1958	Low	Gene Marelius
Pepper	Porcupine Creek	20	82	1954	Low	Freda Largent
Pepper #1	North Fork Lena Creek	30	139	1953	Low	Westling Ranch
Pepper #2	North Fork Lena Creek	30	52	1954	Low	Westling Ranch

Dam Name	River	NID Height (feet)	NID Storage (acre-ft)	Year Finished	Hazard	Owner
Thelma #1	Yellowstone River Tributary	19	106	1962	Low	Thelma Gray
Walton	Porcupine Creek Tributary	27	40	1957	Low	Walton Estate
Westling	Porcupine Creek Tributary	30	39	1954	Low	Westling Ranch
Yastremski	Diffused Surface Water	10	77	1950	Low	Alan Glen

4.4.2 HISTORY

The only known dam break in Park County occurred in June 1950 on Soda Butte Creek near Cooke City. Heavy rain and flash flooding caused a dam failure at the McLaren Mine tailings pond spilling contaminated tailings into the creek flowing into Yellowstone National Park. (US Geological Survey, 2011a) This dam failure did not result in casualties or property damage but had significant ecological impacts. Remediation work was done by the Environmental Protection Agency.

4.4.3 PROBABILITY AND MAGNITUDE

The probability of dam failure in Park County is considered low. Most dams in the county are designated as low hazard. Tailings ponds and high or significant hazard dams are the most probable to cause damages, and none are known to be unstable.

4.4.4 VULNERABILITIES

Since the dam inundation areas for the dams that threaten Park County are not available digitally, general estimates for losses were based on visual comparisons between the critical facilities and infrastructure and structures and the paper inundation maps contained in the Cottonwood Dam and Crazy Mountain Dam Emergency Action Plans. To estimate the losses from a dam break, the average damage to the structures and critical facilities impacted was estimated to be 30% since many structures may have little damage while other may be a complete loss. A loss ratio specific to dam failure would allow for a more accurate loss estimation.

Following a break at the Cottonwood Dam, the flood waters would be in the valley south of Wilsall within a half hour, at the Indian Creek Road Bridge in an hour and a half, at the Highway 89 bridge near Looking Glass Creek in 2.5 hours, near Clyde Park in 3.3 hours, at the Highway 89 bridge over the Shields River near Gibson Ranch in 4.7 hours, and at the Yellowstone River in 8.3 hours. (Montana Department of Natural Resources and Conservation, 2005)

4.4.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

None of the Park County critical facilities are located within the dam failure inundation areas. During a failure, these facilities could be expected to remain functional barring any other conditions. Some roadways may become impassible and damages to road infrastructure should be expected. Damages to

road infrastructure throughout the Shields River basin would be expected downstream of the Cottonwood Dam. Downstream of the dam are 12 road crossings, including three by US Highway 89, before the confluence with the Yellowstone River. At a rough estimate of $50,000 per bridge, damages could total about $600,000. Damages to road infrastructure from a failure of the Crazy Mountain Dam would likely include Hammond Creek Road and US Highway 89. (Crazy Mountain Ranch, 2002)

4.4.4.2 EXISTING STRUCTURES

Given the projected inundation area of the Cottonwood Dam, approximately 25 residences would be affected with a total exposure of roughly $5,422,500. Using an average damage factor of 30%, the structure losses would total about $1,626,750.

Projected structures losses from a failure of the Crazy Mountain Dam include four structures - one structure on the dam owner's property, one house on Cooper Road, one house on Rock Creek Road, and one house on Aspen Lane. Given this scenario, approximately $850,000 in building stock is exposed. Estimating an average damage factor of 30%, the losses would total about $255,000. (Crazy Mountain Ranch, 2002)

4.4.4.3 POPULATION

With any dam failure event, the loss of life is always possible. The warning time for a dam failure can be fairly short, but some warning may exist. The Cottonwood Dam, of all the dams in Park County, poses the greatest risk to lives. With 25 residences in the approximate inundation area, most of those residences could be evacuated if residents were notified in a timely fashion. In the case of the Crazy Mountain Dam, six locations would be evacuated. With some warning time, the potential for the loss of life from dam failure could be reduced.

4.4.4.4 VALUES

Since most dam failures would not impact downtown areas, the economic impacts would likely be limited to agriculture and the usual emotional impacts that result from disasters, especially if lives are lost.

4.4.4.5 FUTURE DEVELOPMENT

The areas of Wilsall and Clyde Park, near where the high and significant hazard dams are located in northern Park County, are rural, agricultural areas. Growth can be expected in these areas, particularly closer to Livingston and Interstate 90. About 50 undeveloped parcels exist in the dam inundation areas between the Cottonwood Dam and the Yellowstone River. Eventually, without consideration of dam failure during the planning process, future development could place residences and business in the hazard areas. Development, in these areas, however, is not expected in the short term.

4.4.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	Park County, Clyde Park		/ $0 losses	Low
Critical Infrastructure	Park County		/ $600,000 losses / Road closures	Moderate

Critical Infrastructure	Clyde Park		/ Road closures / Loss of potable water	Low-Moderate
Existing Structures	Park County		/ $1,626,750 losses / Structural losses / Contents losses / Displacement/functional losses	Moderate
Existing Structures	Clyde Park		/ $0 losses	Low
Population	Park County, Clyde Park		/ Injuries / Fatalities	Low-Moderate
Values	Park County, Clyde Park		/ Agricultural losses / Emotional impacts / Aesthetic value losses	Low-Moderate
Future Structures	Park County		/ Somewhat likely to occur in hazard areas / 50 undeveloped parcels within the Cottonwood Dam inundation area	Moderate
Future Structures	Clyde Park		/ Unlikely to occur in hazard areas, but given the proximity to Clyde Park, future annexation of hazard areas is possible	Low-Moderate

[1] In addition to probable (100-year) impacts

4.4.6 DATA LIMITATIONS

Data limitations include:

- / Lack of digital dam inundation area mapping.
- / Difficulties in quantifying the probability of a dam failure.
- / Uncertainties regarding reservoir levels at the time of a break.
- / Uncertainties regarding the warning time and capabilities that would be involved with a break.

4.5 DROUGHT

Table 4-11. Drought Federal Major Disaster and Emergency Declarations

Declaration	Year	Casualties	Damages	Comments
None				

4.5.1 DESCRIPTION

A drought is an extended period of unusually dry weather. The following is an excerpt from the National Drought Mitigation Center: *"Drought is an insidious hazard of nature. Although it has scores of definitions, it originates from a deficiency of precipitation over an extended period of time, usually a season or more.*

This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e., evaporation + transpiration) in a particular area, a condition often perceived as "normal". It is also related to the timing (i.e., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e., rainfall intensity, number of rainfall events) of the rains. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity." (National Drought Mitigation Center, 2011)

Droughts can range from minor to severe, short-term to long-term with a variety of determining factors such as precipitation, soil moisture, river levels, and tree moisture. A minor, short-term drought can slip by unnoticed while a long-term severe drought can impact the agricultural economy, natural resources, and even public water supplies. In Montana, drought conditions have also been associated with grasshopper infestations and blight. Drought is a unique hazard in that it does not strike suddenly, but rather, slowly impacts lives and property without a clear beginning or end, and the impacts tend to persist over long periods of time. Often the question of whether an extended dry spell is, in fact, a drought causes considerable debate among meteorologists, farmers, public officials, and other agriculture experts. The amount, duration, and extent of moisture deficiency necessary to establish a drought threshold vary considerably.

For the purposes of this plan, drought is a condition of climatic dryness which is severe enough to reduce soil moisture and water below the minimum necessary for sustaining plant, animal, and human life systems. In addition to severe damage to vegetation, soil in a drought area can become dry and crumble. Often, topsoil is blown away by hot, dry winds. Streams, ponds, and wells can also dry up during a drought, thus wildlife and livestock may suffer and even die. Although agriculture production is the most obvious recipient of drought losses, this hazard can impact communities by reducing domestic water supplies and increasing the fire danger. Water problems caused by drought can range from reduced recreation opportunities to reduction in quantity and quality of municipal water supplies. Losses do not usually include direct structural damage or traumatic loss of human life.

Drought is most commonly associated with wildfire in Park County. Dry conditions contribute to lower moisture content in the trees and plants that provide fuel for wildfires. An initial look at the driest years show that they do not directly coincide with severe wildfire seasons; however, the effects of drought can carry into the long term. One season of severely low precipitation may not be enough for extreme fire behavior; however, followed by several seasons of below normal precipitation, the conditions can contribute to an increased probability for significant wildfires. Drought often kills trees and plants that then become very dry fuels for wildfires years later. Short-term drought conditions can prime grasses on non-irrigated lands for grass fires and long-term drought conditions can additionally impact the heavier timber fuels for forest fires.

Counter intuitively, in mountainous areas, such as those found in Park County, drought can quickly be followed by flash flooding. Dry soils are not as permeable to water, particularly if the vegetation has been killed, and therefore, heavy rains run off faster than on moist soils with green vegetation and can more easily lead to flash flooding.

Blight and grasshopper infestations have a greater probability of occurring in drought conditions. Besides the hydrologic and agricultural impacts, drought can also lead to severe dust storms and soil erosion affecting the population and non-agriculture economies. Additional concerns include the water temperatures for fish populations, wildlife health, changes in plant ecology, hydroelectric power supplies, and public water sources.

Monitoring of drought conditions occurs nationally, and various indices, such as the Palmer Index, indicate the level of drought. Mapping of the current drought status is published by the US Drought Monitor each Thursday.

4.5.2 HISTORY

Paleoclimate studies show extreme periods of drought hundreds of years ago in the northern Great Plains including 200-370 A.D., 700-850 A.D., and 1000-1200 A.D. Compared to these periods over the past 2,000 years, the droughts since 1200 A.D. have been relatively wet and minor. (Laird et al, 1996) Droughts cannot be defined with certainty as extremely dry periods often alternate with wetter than normal periods.

1930s – The 1930s Dust Bowl remains the most highly publicized of past droughts in Montana. This nationwide drought produced erosion problems in the creation of dust storms throughout Montana. (Montana Disaster and Emergency Services, 2001)

1950s – Montana, especially eastern and central portions, had an extended period of reduced rainfall that impacted agricultural and local economies. (Montana Disaster and Emergency Services, 2001)

1960s - Montana saw another significant drought period beginning in 1961. By the end of June 1961, 17 counties had requested federal disaster designations due to a lack of moisture, higher than normal temperatures, and grasshopper infestation. Small grain crops died before maturing, and range grass and dryland hay crops were deteriorating rapidly. Livestock water supplies were at critical levels. In July of 1961, the State's Crop and Livestock Reporting Service called it the worst drought since the 1930s. In 1966, the entire state experienced another episode of drought. (Montana Disaster and Emergency Services, 2001)

1970s – Over 250,000 acres of Montana farmland was damaged by winds in the western and southern parts of the state over a 7-month period in 1977. Excessive tillage and inadequate crop cover during years of little moisture caused exaggerated soil damage. In June of 1977, Montana officials worked with officials from Washington, Idaho, and Oregon on the Northwest Utility Coordination Committee to lessen the potential for hydroelectricity shortages. On June 23, Governor Judge ordered a 10% electric use reduction in state and county governments. (Montana Disaster and Emergency Services, 2001)

1980s - Drought-related economic losses in Montana in 1980 were estimated to be $380 million. Drought continued to plague the state in 1985, and all 56 counties received agricultural disaster declarations. The continued lack of moisture in 1985 resulted in a wheat crop that was the smallest in 45 years. Grain farmers received more in government deficiency payments and insurance money than they did for their crops. For a typical 2,500 acre Montana farm/ranch, the operator lost more than $100,000 in equity over the course of that year. The state's agriculture industry lost nearly $3 billion in equity. The extended effects of this drought included the loss of thousands of off-farm jobs and the closing of many implement

dealerships and Production Credit Associations. (Montana Disaster and Emergency Services, 2001) On July 24, 1988, Park County Resolution #270 declared a disaster from drought. Within the county, 526 farmers sustained crop losses, with 350 of those farms sustaining losses 50% or greater and 126 sustaining losses of 20-49%.

1990s – Drought emergencies were declared in a number of Montana counties with 83% of the state reported under drought conditions by mid-August 1994. Impacts included stress to stream fisheries (low water levels, high temperatures), reduced crop yields, and wildfires. (Montana Disaster and Emergency Services, 2001)

2000s – Severe drought and persistent heat caused significant losses to agriculture and related industries. The US Department of Agriculture (USDA) issued Natural Disaster Determinations for drought for the entire state of Montana for the years 2000, 2001, 2002, and 2003. This designation entitled counties to low interest loans for producers, small business administration loans, and an Internal Revenue Service provision deferring capital gains. In 2004, Park County was given a USDA Secretarial Disaster Designation. Most protective measures were conducted at the county level. February 2005 was a particularly dry month; it was the driest February on record across the State of Montana. (Montana Disaster and Emergency Services, 2001)

2010s –The US Department of Agriculture (USDA) issued Disaster Designations for drought for the entire state of Montana for the years 2012, 2013, 2014, 2015, 2016, and 2017. (US Department of Agriculture, 2018) In late August of 2017, the US Drought Monitor classified all of Montana in some stage of drought, with 65% of the state in 'extreme' or 'exceptional' stages of drought. (US Drought Monitor, 2017)

4.5.3 PROBABILITY AND MAGNITUDE

The National Oceanic and Atmospheric Administration Paleoclimatology Program studies drought by analyzing records from tree rings, lake and dune sediments, archaeological remains, historical documents, and other environmental indicators to obtain a broader picture of the frequency of droughts in the United States. According to their research, "…paleoclimatic data suggest that droughts as severe as the 1950s drought have occurred in central North America several times a century over the past 300-400 years, and thus we should expect (and plan for) similar droughts in the future. The paleoclimatic record also indicates that droughts of a much greater duration than any in the 20th century have occurred in parts of North America as recently as 500 years ago." Based on this research, the 1950s drought situation could be expected approximately once every 50 years or a 20% chance every ten years. An extreme drought, worse than the 1930s "Dust Bowl," has an approximate probability of occurring once every 500 years or a 2% chance of occurring each decade. (National Oceanic and Atmospheric Administration, 2003)

4.5.4 VULNERABILITIES

Vulnerabilities were calculated based on estimates derived from a severe drought that impacts public water supplies. Qualitative methodologies are the most logical way to estimate losses given the uncertainties related to and wide variety of drought impacts.

4.5.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

Generally, critical facilities are not affected directly by drought. Infrastructure relying on the water supply is the primary exception. If the water supply for public drinking water and sewer systems was threatened, those losses could total millions of dollars should equipment be damaged or outside water need to be shipped into the county.

4.5.4.2 EXISTING STRUCTURES

In most plausible drought scenarios, existing structures would not be impacted.

4.5.4.3 POPULATION

Since drought evolves slowly over time, the population has ample time to prepare for its effects and is warned accordingly. The greatest direct threat to the population from drought is through the drinking water supply. Should a drought affect the water available for public water systems or individual wells, the availability of clean drinking water could be compromised. This situation would require emergency actions and could possibly overwhelm the local government and financial resources.

4.5.4.4 VALUES

The most probable losses from drought are to the economy. The agriculture industry can be severely threatened by drought due to a loss of forage, feed, and water supplies. Crops may not reach maturity or may provide minimal yields in significant droughts. Given the dependence of the local economy on agriculture, the impacts can extend to other industries. In 2012, Park County had 564 farms covering 774,057 acres. The total market value of agricultural products sold in 2012 was $27,704,000 for livestock, poultry, and their products and $13,126,000 for crops. (US Department of Agriculture, 2012)

Natural resources, and therefore recreation and tourism, are influenced by drought. As river and stream levels drop, fish populations and other natural resources are impacted. With fishing and river recreational activities a very important part of the tourism industry in Park County, those aspects of the economy can be threatened during extended periods of drought.

4.5.4.5 FUTURE DEVELOPMENT

Future development's greatest impact on the drought hazard would possibly be to ground water resources. New water and sewer systems or significant well and septic sites could use up more of the water available, particularly during periods of drought. Fortunately, public water systems are monitored by the Montana Department of Environmental Quality, but individual wells and septic systems are not as strictly regulated. Therefore, future development could have an impact on the drought vulnerabilities.

4.5.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	All		/ $0 losses / Critical functional losses	Low
Critical Infrastructure	All		/ $1,000,000 losses / Loss of potable	Low-Moderate

Existing Structures	All		/ $0 losses	Low
Population	All		/ Increased illness	Low
Values	All	/ Agricultural losses / Biodiversity losses / Habitat damages / Reduced water quality / Restrictions on	/ Service industry losses / Emotional impacts / Cancellation of activities	High
Future Structures	All		/ Increases the total hazard exposure / May increase the strain on public water systems and individual wells	Low-Moderate

[1] In addition to probable (100-year) impacts

4.5.6 DATA LIMITATIONS

Data limitations include:

- / Difficulties in pinpointing the start and end of drought periods.
- / Limitations in quantifying economic losses from drought.
- / Lack of a publicly available database listing historical/archived US Department of Agriculture (USDA) Secretarial disaster declarations and the associated losses.

4.6 EARTHQUAKE

Table 4-12. Earthquake Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

4.6.1 DESCRIPTION

One of the most frightening and destructive phenomena of nature is a severe earthquake and its terrible aftereffects. An earthquake is the sudden movement of the Earth, caused by the abrupt release of strain that has accumulated over a long time. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth's surface. Huge plates slowly move over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free, producing an earthquake. (US Geological Survey, 1997)

Montana is the fourth ranked state in the United States for seismicity and has many faults, primarily in the mountainous parts of the state. Yellowstone National Park, within and to the south of Park County, is an active geothermal area with approximately 2,000 earthquakes each year. The Intermountain Seismic Belt,

shown in Figure 4-2, demonstrates the active seismic areas of the state. Park County lies just to the east and north of the most active areas and has been in close proximity to many significant earthquakes. Earthquakes can damage property and infrastructure very rapidly and significantly with little warning, severely impacting those close to the epicenter and being felt for hundreds of miles.

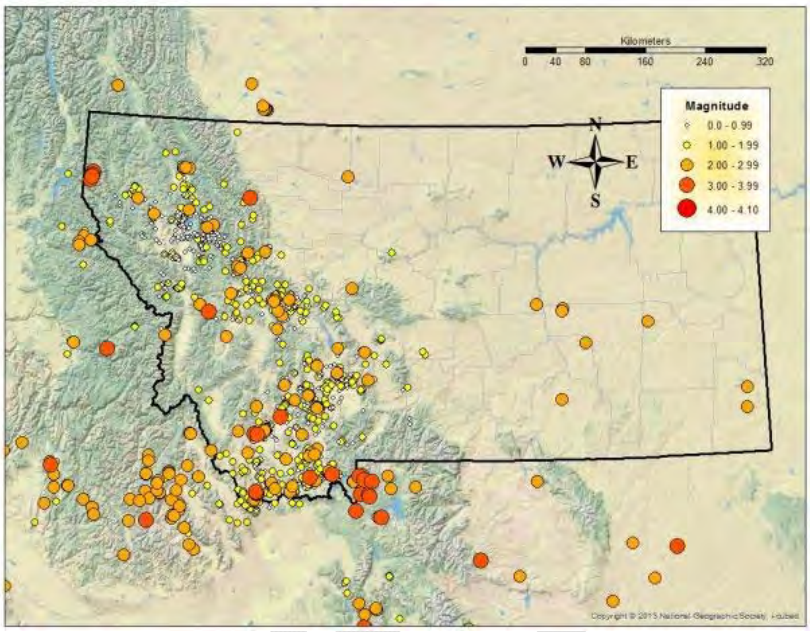
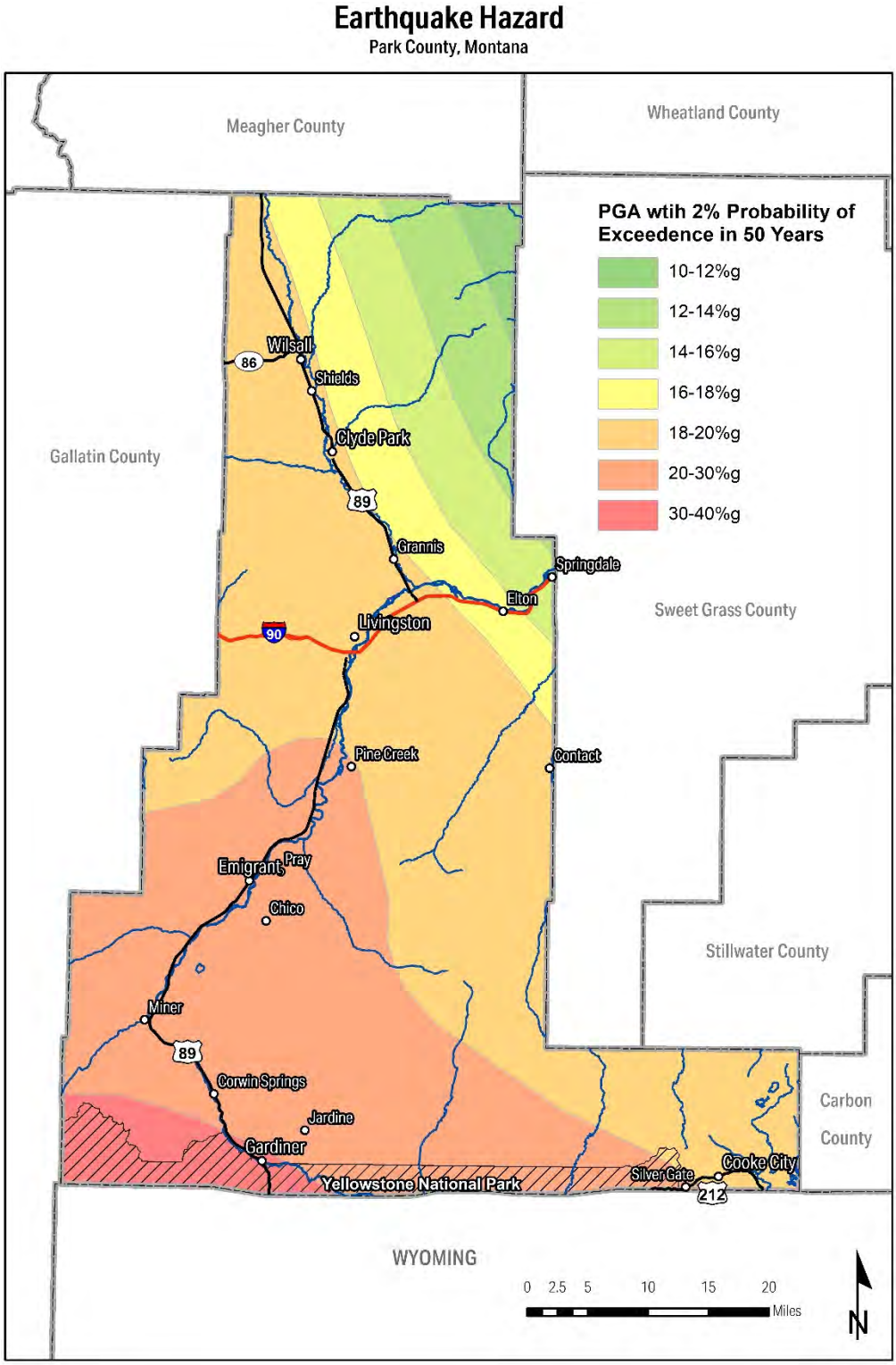


Figure 4-2. Earthquakes from 2012-2013 in Intermountain Seismic Belt in Montana (Western States Seismic Policy Council, 2014).

Geologists primarily measure earthquake severity in two ways: by magnitude and by intensity. Magnitude is based on the area of the fault plane and the amount of slip. The intensity is based on how strong the shock is felt and the degree of damage at a given location. The most commonly used scales are the Richter magnitude scale, moment magnitude scale, and modified Mercalli intensity scale. (National Earthquake Hazards Reduction Program, 2011)

History has shown that significant earthquakes (up to magnitude 6.5) may occur anywhere throughout the Intermountain Seismic Belt, even in areas where young faults are not recognized. Examples of damaging earthquakes for which no known surface fault was recognized include the 1925 Clarkston earthquake (magnitude 6.6) and the 1935 Helena earthquakes (magnitude 6.3-5.9).

Research through the US Geological Survey's National Seismic Hazard Mapping Project has resulted in peak ground acceleration (PGA) maps related to the probability of seismic shaking. The map for Park County, Map 4-3, shows the strength of seismic shaking that has a 2% probability of being exceeded in a 50-year period. The strength of the shaking is measured as a percentage of the acceleration of gravity (%g). Generally, a PGA of 20%g would result in major damage and a PGA of 10%g would result in slight damage. As Map 4-3 shows, the earthquake hazard in Park County is greater to the south and west and less to the north and east. The unincorporated communities of Gardiner and Corwin Springs are at greatest risk.



Map 4-3. Earthquake Hazard.

4.6.2 HISTORY

Since 1900, sixteen earthquakes of magnitude 5.5 or greater have occurred within 100 miles of Park County. Table 4-13 shows the list of these earthquakes. The closest of these earthquakes to southern Park County were the Hebgen Lake and Yellowstone Park earthquakes, and to northern Park County, the Clarkston and Lombard earthquakes.

Table 4-13. Park County Earthquakes Magnitude 5.5 or Greater within 100 Miles of Park County (US Geological Survey 2017).

Date	Name/Location	Location	Magnitude
June 27, 1925	Clarkston Valley Earthquake	8 miles north of Three Forks	6.6
February 15, 1929	Lombard Earthquake	20 miles north of Manhattan	5.6
October 12-31, 1935	Helena Earthquakes	15 miles north of Helena	6.3
November 23, 1947	Virginia City Earthquake	25 miles west-northwest of West Yellowstone	6.3
August 17-18, 1959	Hebgen Lake Earthquake and aftershocks	15 miles north of West Yellowstone	7.5
October 21, 1964	Hebgen Lake Earthquake	30 miles west-northwest of West Yellowstone	5.8
June 30, 1975	Yellowstone Earthquake	5 miles east-northeast of Norris Junction, WY	6.1
December 8, 1976	Yellowstone Earthquake	5 miles west of Norris Junction, WY	5.5
July 25, 2005	Dillon Earthquake	10 miles north of Dillon	5.6
July 6, 2017	Lincoln Earthquake	7 miles southeast of Lincoln	5.8

The Clarkston earthquake, in neighboring Gallatin County, caused relatively light damages due to the rural nature of the area at that time. Most of the damages were confined to Manhattan, Logan, Three Forks, and Lombard in Gallatin and Broadwater Counties. The earthquake was felt from the North Dakota line to Washington and from the Canadian border to central Wyoming, including Park County. Unreinforced brick structures suffered the greatest damages. Livingston felt five distinct shocks. Pavement and buildings sustained cracks up to an inch wide. Mines in Jardine were feared to have been damaged. Livingston police reported the tower of a high building swaying with many people fainting and rushing to the streets. A train from Livingston was sent to rescue passengers from trains trapped by landslides near Lombard. In Clyde Park, the stock of tinware at Jack O'Leary's store fell off the shelves. (University of Utah, 2011)

The 1935 earthquakes in Helena triggered a landslide 24 miles south of Livingston on the east side of the Yellowstone River. Telephone wires and the roadway were buried. The roadway was cleared by the next day. (Helena Independent, 1935) The Wilsall School also sustained considerable damages from this series of earthquakes. The 1947 Virginia City earthquake caused "very light" shaking in Livingston. (Daily Missoulian, 1947) The 2005 Dillon earthquake was felt throughout Park County, but no damages were reported. (US Geological Survey, 2011b)

The initial Hebgen Lake earthquake on August 18, 1959 is the most significant earthquake to have occurred in the region over the past 100 years. This magnitude 7.5 earthquake occurred about 30 miles from Gardiner and about 70 miles from Livingston. This surface rupturing earthquake changed the geology of the Hebgen Lake area and triggered a major landslide (80 million tons of rock) in nearby Madison County. The result was the creation of a new lake, Earthquake Lake, on the Madison River and State Highway 287 was buried. Twenty-eight people were killed, and roadway and timber damages totaled over $11 million. The quake was felt in 8 states and 3 Canadian provinces. (US Geological Survey, 2011b) The North Entrance to Yellowstone National Park did have some landslides blocking roadways, but all were cleared within 2 days. Also damaged was the Golden Gate just above Mammoth Hot Springs near Park County. Damages in Yellowstone National Park were estimated at about $2 million. Despite the proximity of this major earthquake, the damages were not significant in Park County.

4.6.3 PROBABILITY AND MAGNITUDE

Earthquakes when large and damaging are infrequent events. Park County experiences many small earthquakes every month, but they are undetectable except by instrumentation. The geography of Park County is such that it lies within several categories of seismic source zones, the most active of which is the Northern Intermountain Seismic Belt to the north and west. This region is estimated to recurrence rate of 3.84 years for a magnitude 5 or greater earthquake, 22.6 years for a magnitude 6 or greater earthquake, and 133 years for a magnitude 7 or greater earthquake. (Montana Disaster and Emergency Services, 2004)

4.6.4 VULNERABILITIES

General losses from earthquakes can be estimated using HAZUS-MH, a loss estimation model developed by the Federal Emergency Management Agency. This model uses national datasets and hazard information to estimate the earthquake losses from a particular event at the census tract or count level. Although the default data and methods provided with the HAZUS-MH model contain many generalizations that could lead to inaccuracies, the model provides a ballpark estimate of what earthquake losses may occur and the magnitude of such. A structural engineer can make specific determinations on individual structures. Two simulations were run through the model, the 100-year probabilistic hazard with a 5.5 moment magnitude and the 500-year probabilistic hazard with a 7.5 moment magnitude.

4.6.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

Since the probability and likely strength of an earthquake varies across the county, the threat to critical facilities can be assessed based on their geographic locations. Structural assessments of the individual facilities would further determine the seismic stability of that structure. Based on geography, however, the critical facilities and vulnerable populations in and around Gardiner can be considered the most vulnerable. The critical facilities north on Highway 89 to Emigrant are the next most vulnerable, followed by those north of Emigrant on Highway 89, and then those in the Livingston, Cooke City, Clyde Park and Wilsall areas. All critical facilities are at risk from earthquakes in Park County, but those to the southwest can be considered the most vulnerable. In addition, unreinforced masonry construction is particularly vulnerable to seismic shaking. Therefore, any critical facilities with, or within close proximity to, unreinforced masonry can be considered at greatest risk. Based on the results of the HAZUS-MH runs, Table 4-14 shows the functionality of critical facilities included in the inventory.

Table 4-14. Critical Facility Functionality Following an Earthquake.

Critical Facility Type	100-Year Event Functionality	500-Year Event Functionality
Hospital	98% on Day 1	85% on Day 1 97% on Day 7
Fire Stations	98% on Day 1	81% on Day 1
Law Enforcement Stations	98% on Day 1	84% on Day 1
Schools	97% on Day 1 Range: 90-99%	79% on Day 1 Range: 62-91%

The HAZUS-MH database contains over 150 miles of highway, 103 bridges, and 8,650 miles of pipeline valued at over $1.6 billion. Infrastructure, as quantified in the default HAZUS-MH database, suffers damages during the 100-year and 500-year earthquakes as shown in Table 4-15.

Table 4-15. HAZUS-MH Estimated Infrastructure Losses.

Infrastructure System	100-Year Economic Losses	100-Year Damages	500-Year Economic Losses	500-Year Damages
Highway	$12,500		$483,700	
Bus	$29,000		$121,000	
Airport	$270,000		$1,025,000	
Potable Water	$155,000	34 leaks 9 breaks	$1,167,000	259 leaks 65 breaks 4 households without service
Waste Water	$2,500,000	17 leaks 4 breaks	$12,870,000	130 leaks 33 breaks
Natural Gas	$32,300	6 leaks 1 break	$260,600	45 leaks 11 breaks
Total	*$2,998,800*		*$15,927,300*	

4.6.4.2 EXISTING STRUCUTRES

The results of a HAZUS-MH model with a 5.5 magnitude earthquake in Park County are shown below in Table 4-16.

Table 4-16. Expected Building Damage by Occupancy for a 5.5 Magnitude Earthquake.

Type	Slight Damage	Moderate	Extensive	Complete
Agriculture	3	1	0	0
Commercial	22	8	1	0
Industrial	6	2	0	0
Other Residential	107	49	3	0
Religion	1	0	0	0
Single Family	161	9	0	0
Total	*300*	*69*	*4*	*0*

The results of a HAZUS-MH model with a 7.5 magnitude earthquake in Park County are shown below in Table 4-17.

Table 4-17. Expected Building Damage by Occupancy for a 7.5 Magnitude Earthquake.

Type	Slight Damage	Moderate	Extensive Damage	Complete
Agriculture	15	7	2	0
Commercial	88	51	12	2
Industrial	25	15	4	0
Other Residential	305	250	60	5
Religion	7	3	1	0
Single Family	1,156	150	5	1
Total	*1,596*	*476*	*84*	*8*

Losses from capital stock (structural, non-structural, contents, and inventory) and income (relocation, capital related, wages, and rental income): $7,940,000 (100 year)

4.6.4.3 POPULATION

The population would have little or mostly likely no warning prior to an earthquake. Most casualties in a large earthquake in Park County would be anticipated with building collapse, roadway failures, falling objects, and landslides. The HAZUS runs estimate 1 person with minor injuries in the 100-year event and 22 injuries (19 minor, 3 hospitalized, and 0 killed) in a 500-year event. The number of actual casualties will be dependent on a variety of factors including proximity to the epicenter, time of day, and magnitude, among others.

4.6.4.4 VALUES

The impacts of a strong earthquake in Park County could be far reaching. Economically, physical and functional damages to businesses, particularly downtown businesses in unreinforced masonry structures, could be substantial. Industries such as construction, however, may see a recovery related boom following an earthquake. Since many historic structures were not built to earthquake resistant standards, the losses to those historical values could be significant. Social losses could include fear of aftershocks, emotional impacts from casualties, and cancellation of activities.

4.6.4.5 FUTURE DEVELOPMENT

Any future development in Park County is at risk for earthquake damages. Fortunately, construction standards for seismic stability have improved over the past 100 years. Livingston is the only jurisdiction within Park County that has a building code and inspection program. Other areas of the county are under the state building code, which for most single-family homes is only subject to electrical, plumbing, and septic inspections. Much of the new Paradise Valley construction is taking place in the areas near the identified and active Emigrant Fault. Should an earthquake occur on that fault, the future development that occurs will be in the highest hazard area.

4.6.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	All	/ $4,000,000 losses	/ Structural losses	High

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
		/ Critical functional losses / Clean-up/debris removal costs	/ Contents losses / Critical data losses	
Critical Infrastructure	All	/ $3,000,000 losses / Physical losses / Road closures / Loss of utility gas	/ $13,000,000 losses / Loss of electricity / Loss of potable water / Loss of sanitary sewers / Loss of telephone service / Loss of internet service / Fuel/energy shortages	High
Existing Structures	All	/ $8,130,000 losses / Structural losses / Contents losses / Displacement/functional losses / Clean-up/debris removal costs	/ $43,780,000 losses	High
Population	All	/ 1 Injuries	/ 19 Injuries	Moderate
Values	All	/ Business disruption losses / Historic structure losses / Aesthetic value losses	/ Service industry losses / Historic item losses / Emotional impacts / Cancellation of activities / Restrictions on activities	Moderate
Future Structures	Park County, Clyde Park	/ Likely to occur in hazard areas	/ Future structures may not be constructed to seismic standards	Moderate
Future Structures	Livingston	/ Likely to occur in hazard areas	/ Future structures are not constructed to current building code standards	Moderate

[1] Impact in addition to probable (100-year) impacts

4.6.6 DATA LIMITATIONS

Data limitations include:

- Estimating the probability and possible damages associated with this low frequency, high impact hazard.
- Lack of improved digital data for use in the HAZUS module.
- Lack of individual facility assessments by a structural engineer.

4.7 FLOODING

Table 4-18. Flooding Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
FEMA-DR-1105	1996	None	$146,379 state/local share (Park County) $36,287 state/local share	Public Assistance
FEMA-DR-1183	1997	None	Total damages estimated over $616,000	Public Assistance
FEMA-DR-1996	2011	None	Unknown	Public Assistance Individual
FEMA-DR-4172	2014	None	Total damages estimated over $66,200	Flood Public Assistance

4.7.1 DESCRIPTION

A flood is a natural event for rivers and streams and occurs when a normally dry area is inundated with water. Excess water from snowmelt and rainfall accumulates and overflows onto the banks and adjacent floodplains. Floodplains are lowlands, adjacent to rivers and streams, which are subject to recurring floods. Flash floods, usually resulting from heavy rains or rapid snowmelt, can flood areas not typically subject to flooding, including urban areas. Extreme cold temperatures can cause streams and rivers to freeze, causing ice jams and creating flood conditions.

Hundreds of significant floods occur in the United States each year and kill an average of about 100 people annually. Flooding is one of the deadliest hazards nationwide and in Montana. Most injuries and deaths occur when people are swept away by flood currents, and most property damage results from inundation by sediment-laden water. Fast-moving water can wash buildings off their foundations and sweep vehicles downstream. Pipelines, bridges, and other infrastructure can be damaged when high water combines with flood debris. Basement flooding can cause extensive damage.

4.7.1.1 RIVERINE FLOOD

Riverine flooding originates from a body of water, typically a river, creek, or stream, as water levels rise onto normally dry land. Flooding on the rivers generally occurs during the spring and early summer when snow rapidly melts in the higher elevations. Smaller streams are more susceptible to flooding in the summer with peak flows resulting from thunderstorms.

Flooding in Park County normally occurs during periods of rapid snowmelt almost exclusively during the months of May and June. The mountainous areas in the upper reaches of the Yellowstone River keep the snowpack into the early summer months, and as temperatures warm, the mountain snowpack melts rapidly. Fleshman Creek through west portions of the City of Livingston floods primarily from intense rainfall in the hills south and west of the city. (Federal Emergency Management Agency, 2011b)

The Yellowstone River in Park County is approximately 84 miles long, running from the Yellowstone Park boundary through the Paradise Valley and Livingston to Springdale. The Yellowstone has two river gauges in Park County at Corwin Springs and near Livingston at Carter's Bridge. The flood stage for the Yellowstone River is 11 feet at Corwin Springs. At 11 feet, brushland and adjacent prairie are in flood. At 12 feet, waters reach trailers along the river. In 1918, this location crested at 11.5 feet. In 1996, this location crested at 10.92 feet. The flood stage for the Yellowstone River is 9 feet at Carter's Bridge. At 9 feet, some minor overflow occurs along the lowest areas throughout the reach of the river and across the road to Ninth Street Island. At 9.21 feet, the roads to Mill Creek, Cinnabar Basin, and Trail Creek are covered with water with water reaching some homes on Ninth Street Island and a few farms. In 1997, this location crested at 10.72 feet. (National Weather Service, 2011a)

A unique developed floodplain feature is a river island called Ninth Street Island just outside of Livingston. This inhabited island is entirely within the 100-year floodplain and presents unique access challenges due to its island properties within the Yellowstone River.

The Shields River in Park County is approximately 44 miles long, running from the north end of the county by Wilsall to the Yellowstone River. Flood stage is 5.5 feet at the gauge 7 miles northeast of Livingston. In 1948, this location crested at 7.39 feet. (National Weather Service, 2011a)

4.7.1.2 IDENTIFICATION AND MAPPING

The riverine hazard areas may be mapped as part of the National Flood Insurance Program (NFIP). Under this program, an area is broken into zones to depict the level of flood hazard. Most commonly, the areas within the 100-year floodplain are considered the greatest risk. The 100-year floodplain has a 1% chance of exceedance in any given year. Over a 30-year period, a flood of this magnitude or greater has a 26% chance of occurring, compared to a 9% chance of fire for buildings in high-risk flood areas. (Federal Emergency Management Agency, 2009) Locations outside the 100-year floodplain may also experience flood conditions during greater magnitude floods, localized events, or along unmapped creeks, streams, and ditches.

The Flood Insurance Rate Maps (FIRMs) depicting flood-prone areas and Flood Insurance Studies for Park County, the City of Livingston, and the Town of Clyde Park have an effective date of October 18, 2011. The previous maps and studies were dated 1987.

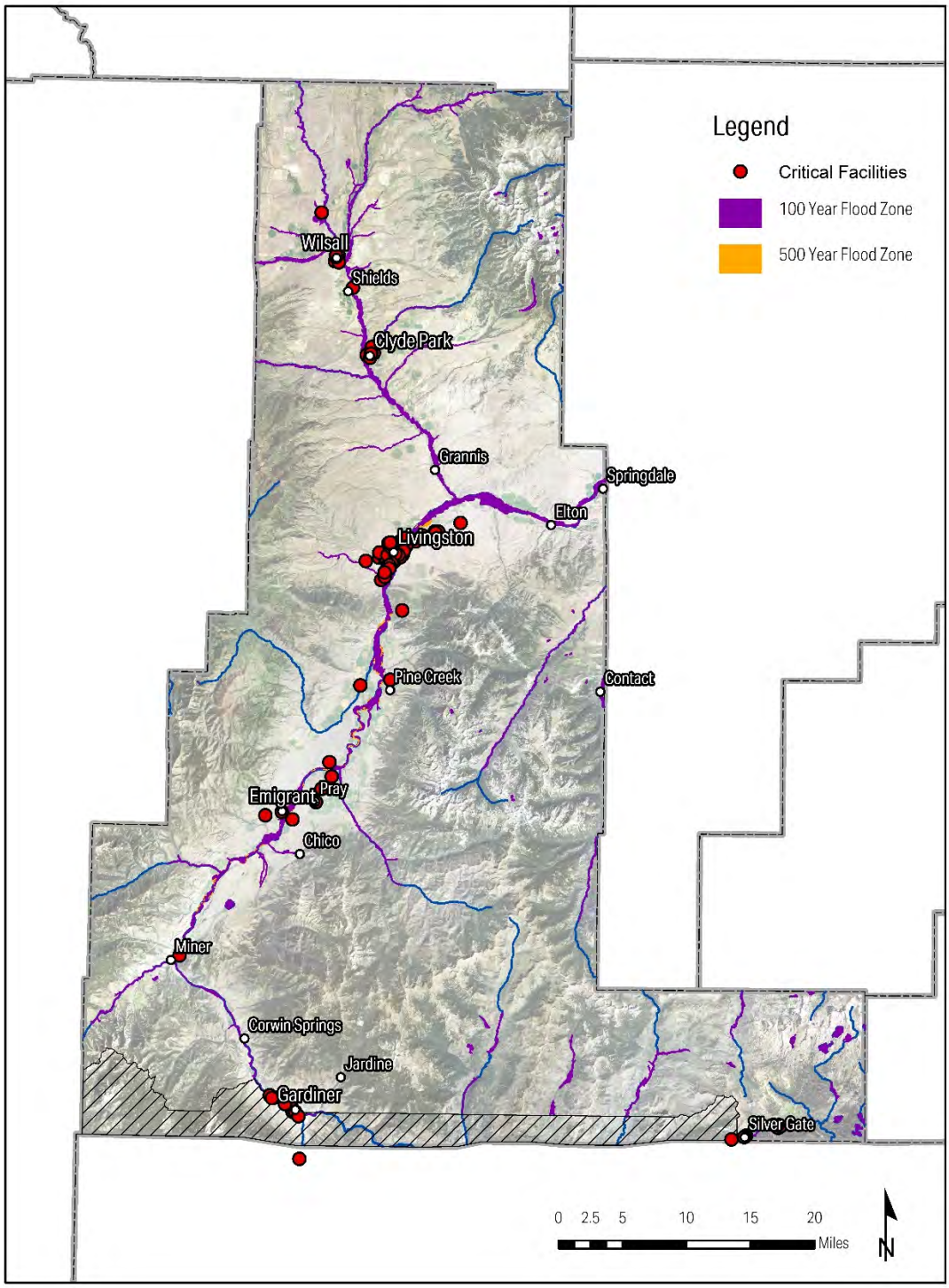
The primary waterways in Park County are the Yellowstone and Shields Rivers and short stretches of the West Boulder and Boulder Rivers. Stretches of the 100-year floodplain have been mapped for the rivers and several additional creeks. Map 4-4 through Map 4-6 show the designated 100-year and 500-year floodplain areas of Park County, Livingston, and Clyde Park. Development in the 100-year floodplain must meet floodplain construction requirements adopted by Park County and the City of Livingston, and most borrowers must purchase flood insurance.

Flooding and mitigation on the Yellowstone River in Park County has been such an important community issue that based on a request from the citizens of Park County, Governor Marc Racicot established an Upper Yellowstone River Task Force in November 1997. The purpose of the task force was "to provide a forum for the discussion of issues that impact the Upper Yellowstone River Basin, particularly, to bring together landowners, sportsmen and sportswomen, and community leaders to develop a shared understanding of the issues and competing values and uses that impact the upper Yellowstone River." (Governor's Upper Yellowstone River Task Force, 2003) This task force developed 43 consensus-based river management recommendations and presented them to Governor Judy Martz on October 20, 2003. Many of their recommendations have been implemented and others can be found in the mitigation strategy of this plan.

In 2009, a Channel Migration study was completed on the Yellowstone River by the Yellowstone River Conservation District Council. The Channel Migration Zone maps depict the current and historic river channel locations and the potential for migration into other areas. The maps are intended to be a basic screening tool for guiding management decisions and are not regulatory. (Yellowstone River Conservation District Council, 2009)

Flood Hazard Areas

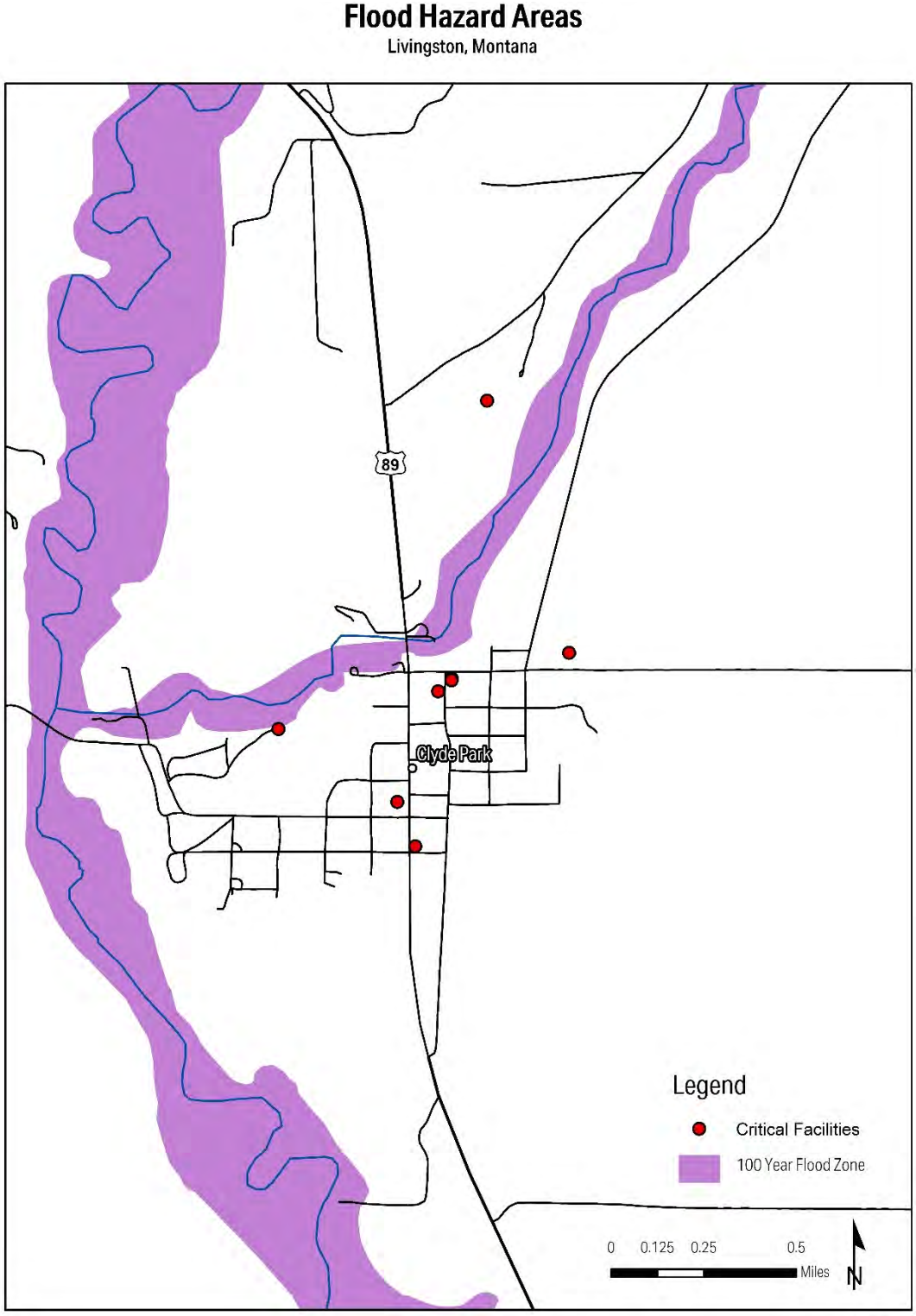
Park County, Montana



Data Source: Montana NRIS, FEMA
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
November 2017

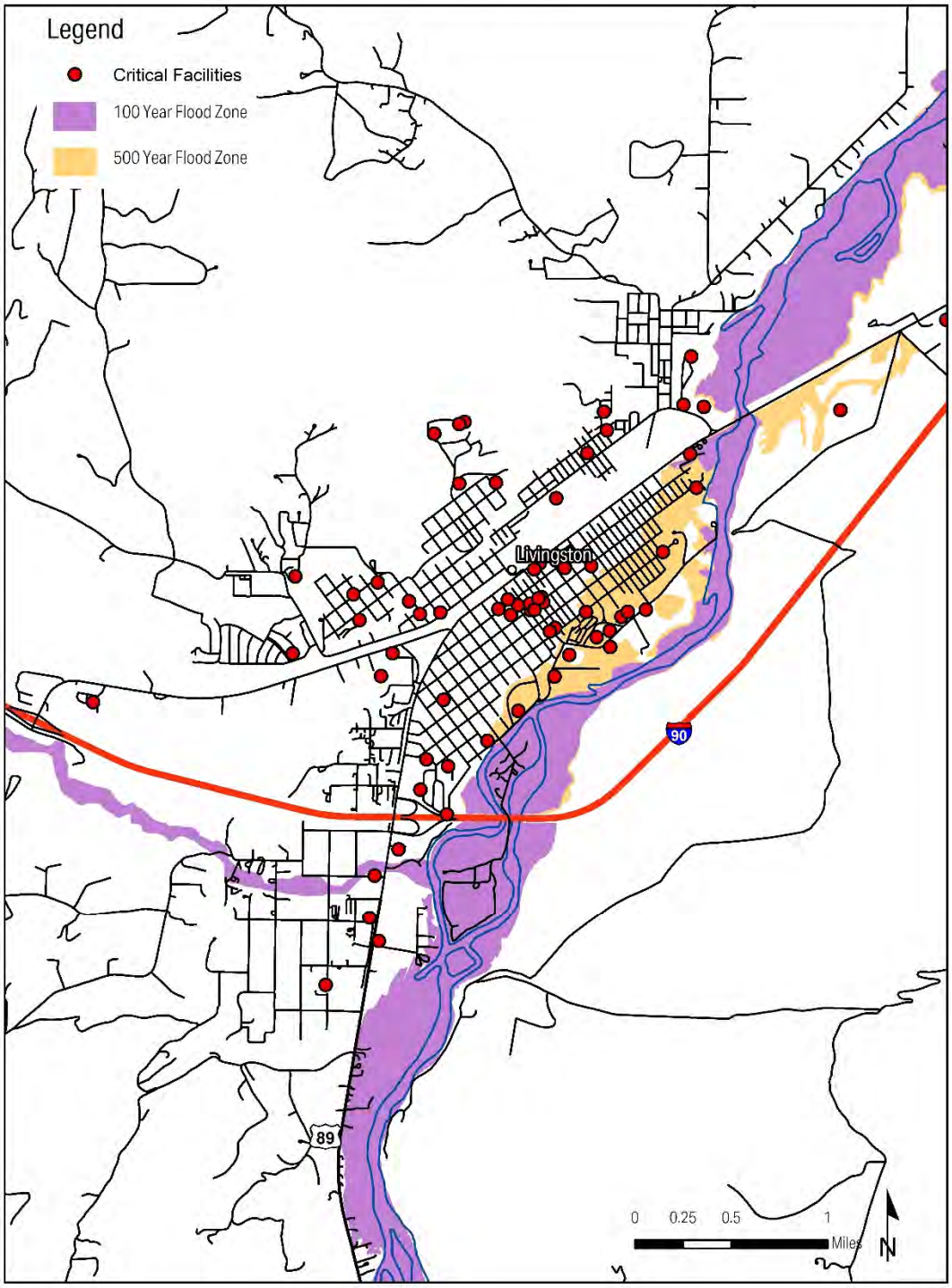
Map 4-4. Flood Hazard Areas in Park County.



Map 4-5. Flood Hazard Areas in Clyde Park

Flood Hazard Areas

Livingston, Montana



Data Source: Montana NRIS, FEMA
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
November 2017

Map 4-6. Flood Hazard Areas in Livingston.

4.7.1.3 FLOODPLAIN MANAGEMENT

The floodplain in Park County, the City of Livingston, and the Town of Clyde Park is managed through floodplain ordinances in compliance with the National Flood Insurance Program (NFIP). A designated floodplain administrator for each of the jurisdictions issues and reviews permits for development in the floodplain. In March of 2017, Park County updated the floodplain regulations, which ensure continued compliance with the NFIP. Additionally, both the City of Livingston and the Town of Clyde Park have adopted floodplain regulations which meet minimum NFIP requirements.

A factor making a difference in flood prevention is the community. Park County has applied various mitigation techniques over the years to try to prevent impacts from flooding. The US Army Corps of Engineers constructed an emergency bank protection on the left bank of the Yellowstone River between 11th and 12th Streets in 1955. A temporary levee constructed around the City of Livingston in 1996 still exists. Rip rap and other streambank stabilization projects have been conducted on private and public property along the Yellowstone River, particularly after the 1996 and 1997 events. The non-construction projects mitigating flood impacts include the establishment of floodplain development regulations in Park County and the City of Livingston including the restriction of septic and drain fields within 100 horizontal feet or 4 vertical feet of the 100-year floodplain. Real estate disclosures are also required for properties in the 100-year floodplain.

4.7.1.4 FLOOD INSURANCE

Residents of Park County, the City of Livingston, and Clyde Park have the opportunity to purchase flood insurance through the National Flood Insurance Program (NFIP). As of September 30, 2017, 90 policies covering over $20 million in property were in force in unincorporated parts of Park County and 22 policies covering over $5 million were in force in the City of Livingston. (Federal Emergency Management Agency, 2017) Clyde Park entered the NFIP on September 24, 2012, but as of 2017 had no policies in force. As of October 31, 2012, Park County has 15 repetitive loss properties through the NFIP with a total of fifteen claims. (FEMA, 2012). A repetitive loss property is defined as "An NFIP-insured structure that has had at least 2 paid losses of more than $1,00 each in any 10-year period since 1987." (FEMA, 2017)

4.7.1.5 FLASH FLOOD

Flash floods can occur anywhere when a large volume of water falls or melts over a short time period, usually from slow moving thunderstorms or rapid snowmelt. Because of the localized nature of flash floods, clear definitions of hazard areas do not exist. These types of floods often occur rapidly with significant impacts. Rapidly moving water, only a few inches deep, can lift people off their feet, and only a depth of a foot or two is needed to sweep cars away. Most flood deaths result from flash floods. Many areas of Park County contain mountainous and hilly terrain, and therefore, are more prone to flash flooding. Recent wildfire burn areas and downstream areas are also more prone to flash floods.

4.7.1.6 ICE JAM FLOOD

An ice jam is a stationary accumulation of ice that restricts flow. Ice jams can cause considerable increases in upstream water levels, while at the same time, downstream water levels may drop. Types of ice jams include freeze-up jams, breakup jams, or combinations of both. When an ice jam releases, the effects downstream can be similar to that of a flash flood or dam failure.

4.7.2 HISTORY

Park County has an extensive history of riverine flooding. The first major documented flood occurred in June 1894 with the most recent one in March 2014. The historical record has been compiled from the 1987 Livingston Flood Insurance Study, notes in a Park County Disaster and Emergency Services notebook, and the Park County Flood Mitigation Plan. The damages listed are assumed to be losses paid out by the government due to infrastructure damages, not including private losses. The data sources did not specify how the losses were calculated.

Table 4-19. FEMA Flood Assistance in Park County.

Declaration	Year	Additional	Casualties	Damages/Assistance
FEMA-DR-1105	1996	Public Assistance	None	$146,379 state/local share (Park County) $36,287 state/local share
FEMA-DR-1183	1997	Public Assistance	None	Total damages estimated over $616,000
FEMA-DR-1996	2011	Public Assistance Individual	None	Unknown
FEMA-DR-4172	2014	Flood Public Assistance	None	Total damages estimated over $66,200

Yellowstone River, June 4-8, 1894 - Rapidly melting snows supplemented by rainfall caused the Yellowstone River to flow from its banks. The flood crest reached Livingston on June 4 and floodwaters did not begin to recede until June 8. Ninth Street Island, which was uninhabited at the time, was inundated. Livingston Island was flooded to a depth of 3 feet. Thirty-two homes in Riverside Addition were flooded on the first floor, and many city streets were damaged. Damages were estimated at $11,300 in 1894 dollars ($295,000 in 2010 dollars).

Yellowstone River, June 16-17, 1918 - Rapidly melting snows caused flooding at Livingston on June 16 and 17. Ninth Street Island and Livingston Island were covered to a depth of 2 feet, and the bridge between Livingston and Ninth Street Island collapsed. Twelve homes and three sheds in the Riverside Addition were flooded with 1 to 3 feet of water, and many streets were damaged. Damages were estimated at $8,000 in 1918 dollars ($116,000 in 2010 dollars).

Yellowstone River, June 10, 1921 - The flood crest reached Livingston on June 10 and receded the same night. A major portion of Ninth Street Island was inundated, damaging gardens and roads. The upstream end of Livingston Island, including a tourist camp, was flooded. The dam at the upstream end of Sacajawea Lagoon prevented major damage. Damages were estimated at $1,200 in 1921 dollars ($14,600 in 2010 dollars).

Yellowstone River, May 27-29, 1928 - Rapidly melting snows in the upstream basin caused flooding at Livingston on May 27, and floodwaters began to recede on May 29. Six homes on Ninth Street Island had first-floor flooding and four homes had their grounds flooded. The upstream end of Livingston Island was flooded. Floodwaters filled Sacajawea Lagoon. One section of the bridge spanning the old channel at Sacajawea Park was destroyed by floodwaters. Damages were estimated at $6,900 in 1928 dollars ($87,800 in 2010 dollars).

Fleshman Creek, June 1937 - The June 1937 flood, the most damaging on record for Fleshman Creek, resulted from heavy rains in the upstream drainage area. The creek overtopped its banks upstream from the Northern Pacific Railway tracks, and floodwaters followed the railroad northeastward, overtopping the tracks and flooding several blocks in the business district of Livingston. Damages were estimated at $80,000 in 1937 dollars ($1,210,000 in 2010 dollars).

Yellowstone River, June 14-20, 1943 - The Yellowstone River began to rise at Livingston on June 14, and the flood reached its peak on June 20. Ninth Street Island was covered with 2 to 3 feet of water with damage to eight homes, a gravel plant, and roads. The golf course and a barn were flooded on Livingston Island. Water came within 2 inches of overtopping the levee. The maximum discharge at Livingston was 30,600 cfs and the stage was 9.34 feet. Damages were estimated at $2,600 in 1943 dollars ($32,800 in 2010 dollars).

Yellowstone River, June 4, 1948 - Rapidly melting snows caused flooding at Livingston on June 4 with a stage of 9.10 feet. On Ninth Street Island, several residences were surrounded by water, and on Livingston Island the golf course had minor damage. The maximum discharge was 26,800 cfs. Damages were estimated at $200 in 1948 dollars ($1,810 in 2010 dollars).

Fleshman Creek, June 1950 - The June 1950 Fleshman Creek flood, which covered nine city blocks, resulted from heavy rains. House foundations, city streets, sewage facilities, and lawns were damaged. Damages were estimated at $60,000 ($543,000 in 2010 dollars).

Fleshman Creek, May 1951 - The May 1951 flood, which covered about the same area as the June 1950 flood, was caused by rapid melting of late snowfall. Damages were estimated at $60,000 ($504,000 in 2010 dollars).

Yellowstone River, June 22, 1971 - Unseasonably warm weather caused melting of heavy snow cover upstream from Livingston. Heavy runoff caused the Yellowstone River to rise to a peak flow and stage of 29,200 cfs and 8.45 feet, respectively. Ninth Street Island was flooded to a depth of approximately 1 foot.

Yellowstone River, June 17-21, 1974 - Warm temperatures, coupled with an exceptionally heavy mountain snowpack, caused flooding in the Livingston vicinity that reached a peak stage of 9.21 feet on June 17 at the US Geological Survey (USGS) gauge near Livingston. The National Weather Service called it the worst flooding in Livingston since 1943. The Ninth Street Island bridge and Vista View Road from the Main Street bridge to the golf course were closed. The school football and track fields were inundated. Much of Ninth Street Island was flooded, even though valiant attempts were made to keep out the floodwaters by dike construction and sandbagging. The Burlington-Northern Railroad bridge near Riverside Addition was damaged by the floodwaters.

Yellowstone River, June 6-18, 1996 - The Yellowstone River rose to 9.97 feet on June 10 and peaked at approximately 33,000 cfs at Livingston. The flood was the result of rapid snow melt and heavy rains. Approximately 150 homes from Cooke City to Fleshman Creek were evacuated. One house on Ninth Street Island was partially destroyed and another sustained flood damage. Many residences on Highway 89 South also sustained significant flood damage. Approximately 200 homes in all were reported have sustained some sort of damage with additional agricultural losses. Erosion along the river was significant,

and there were numerous bridge, road, and culvert washouts. Sacajawea Park was flooded for nearly four days with damages to the Livingston Civic Center. Phone service was lost for a time, and dikes were reported to be failing. County Resolution # 562 designated an emergency mil levy of 2 mils be used for the repair of bridges, roads and homes damaged from June 6-18, 1996. Montana Disaster Declaration (Executive Order 12-96), dated June 10, 1996, claimed $175,870 in personnel costs. Montana Executive Order 13-96 then closed the Yellowstone River to recreation. County records showed the emergency response cost Livingston $24,000 and Park County $40,000. Damages to public infrastructure were estimated at $849,456 and $425,728 for private property, and therefore, totaled over $1,275,000.

Yellowstone River, June 1997 - A record snowpack with record water content melted resulting in a stage of 10.72 feet on June 6 and peak flow of approximately 36,000 cfs recorded at the river gauge station near Livingston. The flood event caused serious erosion to many stream banks and major gravel deposits in some sections of the Yellowstone River channel. Flood waters also damaged many county roads and washed out culverts. The majority of residential damage was south of the city of Livingston. Damage included flooded basements, first floors, and the total loss of one house due to bank erosion. County Resolution # 591 declared a flood emergency on the Yellowstone River. Recreational use from Point of Rocks to Springdale was prohibited. Damages to public infrastructure were estimated at $411,421 and $205,210 for private property, therefore, totaling over $616,000.

The following creeks and rivers caused various forms of damage in the 1996 and 1997 floods: Yellowstone River, Shields River, Six Mile Creek, Tom Minor Creek, Soda Butte Creek, Cottonwood Creek, Fleshman Creek, Mill Creek, Big Creek, Eight Mile Creek, Cinnabar Creek, Rock Creek, Billman Creek, and Bear Creek.

Yellowstone River Ice Jam, January 17, 2007 – An ice jam on the Yellowstone River, 13 miles south of Livingston, caused water to back up and flood one house. (Yellowstone River Conservation District Council, 2008)

Yellowstone River, June 25, 2008 – High water on the Yellowstone River crested at 9.52 feet on June 25 and led to the collapse of the Ninth Street Island bridge. The cost to construct a permanent replacement bridge in 2010 was about $1.1 million.

Shields, Yellowstone, and Boulder Rivers, May 25 – July 9, 2011 – Extraordinary snowpack and a wet spring contributed to flooding along the Shields, Boulder, and Yellowstone Rivers in Park County. The Shields River crested first at 6.6 feet in late May. The Yellowstone River at Livingston crested at 9.99 feet on June 30. Many roads and bridges were damaged by floodwaters throughout Park County. Several campgrounds and fishing access points were flooded and closed. A power line providing electricity to Ninth Street Island residents was damaged and power was lost for a time. The City of Livingston and Park County constructed an emergency flood berm at a cost of approximately $108,000 and Park County sustained approximately $63,000 in damages, mostly to roads and bridges. Damages to private property are still being evaluated.

Yellowstone River, March 1 – 17, 2014 – Greater than normal snowpack combined with warm temperatures and a wet spring caused significant flooding throughout Park County. Many streets in Livingston were inundated, and several basements were flooded. The flood was declared a state-wide emergency.

Historically, the two primary sources of damaging floods for Park County are the Yellowstone River and Fleshman Creek. All floods have been associated with rapidly melting mountain snowpack or heavy rains over key drainages. Flooding by Fleshman Creek is usually in the west portion of the City of Livingston. This tributary to the Yellowstone River floods primarily from intense rainfall in the hills north and west of Livingston. Some of the heaviest damage to Livingston has been due to the floods from Fleshman Creek. Table 4-20 gives a summary of flood events and the associated damages.

Table 4-20. Flood Event Damages

Date	Location	Damages	Damages in 2017 dollars
June 4, 1894	Yellowstone River	$11,300	$325,000
June 16, 1918	Yellowstone River	$8,000	$141,000
June 10, 1921	Yellowstone River	$1,200	$16,000
May 27, 1928	Yellowstone River	$6,900	$98,000
June 1937	Fleshman Creek	$80,000	$1,399,000
June 20, 1943	Yellowstone River	$2,600	$38,000
June 4, 1948	Yellowstone River	$200	$2,000
June 1950	Fleshman Creek	$60,000	$630,000
May 1951	Fleshman Creek	$60,000	$582,000
June 22, 1971	Yellowstone River	Unknown	Unknown
June 21, 1974	Yellowstone River	Unknown	Unknown
June 1996	Yellowstone River	$1,275,000	$2,036,000
June 1997	Yellowstone River	$616,000	$954,000
June 25, 2008	Yellowstone River	$1,100,000	$1,285,000
January 17, 2009	Yellowstone River	Unknown	Unknown
May 25 – July 9, 2011	Shields River, Yellowstone River, and Boulder River	$171,000	$191,000
March 2014	Yellowstone River	$66,200	$70,000
Total			$7,767,000

Riverine flooding has historically caused the most damages; however, some urban flash flooding has also occurred. On August 5, 1993, heavy rains caused street flooding throughout the City of Livingston. On July 12, 2001, a similar event occurred, and four feet of water was reported in the B Street underpass with several inches of water running through the area roadways.

4.7.3 PROBABILITY AND MAGNITUDE

Flooding probabilities are shown through the mapping of the floodplain. The 100-year floodplain has a 1% probability of being exceeded in any given year. Flooding has been noted 16 times since 1894 in Park County with approximately $7,767,000 in damages (2017 dollars). Based on the historical record over the past 130 years, a damaging flood occurs on average once every 7-8 years (130 years / 17 events) at a cost of approximately $456,882 ($7,767,000 / 17 events) or $59,746 per year ($7,767,000 / 130 years).

4.7.4 VULNERABILITIES

Two methods were used to identify vulnerabilities to flood. First, digital floodplain mapping, effective October 2011, was compared to mapped critical facilities. In most cases, this mapping depicts the 100-year flood hazard areas; the City of Livingston also had 500-year flood areas mapped. HAZUS-MH, FEMA's loss estimation software was also used to estimate 100-year and 500-year flood losses on the larger rivers in Park County.

4.7.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

Comparing the locations of critical facilities and infrastructure to the 100-year and 500-year flood hazard areas, the following facilities are estimated to have the greatest risk:

- 100-year event, digital flood map comparison:
  - Clyde Park Pumphouse
  - Cooke City Compactor
  - Yellowstone Bible Camp
  - Approximately 280 miles of roadway
- 500-year event (in addition to those at risk during the 100-year event), digital flood map comparison:
  - Livingston Civic Center
  - Approximately 30 miles of roadway, 11 miles within the City of Livingston

Note: these results should only be used for planning purposes and are not actual flood zone determinations.

- 500-year event, HAZUS-MH flood boundary comparison, excluding Livingston:
  - US Post Office - Emigrant

Note: the HAZUS-MH generated flood hazard boundary is considered less accurate in and around the City of Livingston than the actual digital flood hazard maps. Other areas of the county do not have 500-year flood hazard areas identified otherwise.

Park County has six critical scour potential bridge structures at the following locations (Montana Disaster and Emergency Services, 2013):

- Yellowstone River, 6 miles northeast of Livingston (state-owned)
- Ferry Creek, 1 mile north of Livingston (county-owned)
- Shields River, 4 miles northeast of Livingston (county-owned)
- Shields River, 3 miles northeast of Wilsall (county-owned)
- Shields River, 8 miles northeast of Wilsall (county-owned)
- Shields River, 12 miles northeast of Wilsall (county-owned)

The vulnerabilities to flash flooding are harder to quantify without specific hazard data. In Montana, however, flash flooding has been known to be most problematic to public infrastructure such as roads. As history has shown, flood events frequently wash out roadways in Park County. Specific critical facilities have not been identified as more susceptible to flash flooding.

4.7.4.2 EXISTING STRUCTURES

The type of property damage caused by flood events depends on the depth and velocity of the floodwaters. Flooding can wash away supporting fill, infiltrate basements, damage contents, and in worst cases, wash structures off their foundations. Most flood damage is caused by water saturating materials susceptible to loss such as wood, insulation, wallboard, fabric, furnishings, floor coverings, and appliances.

FEMA's Benefit-Cost Analysis Module determines damage percentages for various building types. Table 4-21 shows the estimated percentages of building and contents losses from flooding at depths of one foot, three feet, and six feet.

Table 4-21. Estimated Flood Content Losses.

Structure Type	Flood Depth		
	1 foot	3 feet	6 feet
One Story No Basement	14% Building Damage 21% Contents Damage	27% Building Damage 40.5% Contents	40% Building Damage 60% Contents Damage
Two Story No Basement	9% Building Damage 13.5% Contents	18% Building Damage 27% Contents Damage	24% Building Damage 36% Contents Damage
One or Two Story with Basement	15% Building Damage 22.5% Contents	23% Building Damage 34.5% Contents	38% Building Damage 57% Contents Damage
Manufactured Unit	44% Building Damage 66% Contents Damage	73% Building Damage 90% Contents Damage	81% Building Damage 90% Contents Damage

Table 4-22 through Table 4-25 show the estimated number of structures within the hazard areas and their associated building values. Potential losses were estimated by using a damage factor of 30%. Total 500-year estimated losses for the City of Livingston are $9,845,214; 500-year data does not fully exist for the other jurisdictions.

Table 4-22. Estimated 100-Year Flood Exposure using FIRM Floodplain Mapping.

Jurisdiction	Estimated Number of Structures in the Flood Hazard Area	Estimated Total Building Value	Estimated Losses
Park County, unincorporated	361 structures	$81,735,922	$24,520,777
City of Livingston	2 structures	$224,860	$67,458
Town of Clyde Park	3 structures	$345,622	$103,687
Total	*366 structures*	*$82,306,404*	*$24,691,921*

Table 4-23. Estimated 500-Year Flood Exposure using FIRM Floodplain Mapping.

Jurisdiction	Estimated Number of Structures in the Flood Hazard Area	Estimated Total Building Value	Estimated Losses
Park County, unincorporated	81 structures	$25,557,005	$7,667,102
City of Livingston	304 structures	$32,592,521	$9,777,756
Total	*385 structures*	*$58,149,526*	*$17,444,858*

Table 4-24. Estimated 100-Year Exposure using HAZUS-MH.

Study Area	Estimated Number of Structures in the Flood Hazard Area	Estimated Total Building Value	Estimated Building and Content Losses	Estimated Total Loss
Yellowstone River	1,037 structures	$214,650,000	$9,709,000	$17,614,000
Shields River	275 structures	$51,662,000	$406,000	$999,000
Boulder and West Rivers	163 structures	$25,567,000	$1,019,000	$1,540,000
Total	*1,475 structures*	*$291,879,000*	*$11,134,000*	*$20,153,000*

Table 4-25. Estimated 500-Year Exposure using HAZUS-MH.

Study Area	Estimated Number of Structures in the	Estimated Total Building Value	Estimated Building and Content Losses	Estimated Total Loss
Yellowstone River	1,037 structures	$214,650,000	$10,631,000	$19,029,000
Shields River	275 structures	$51,662,000	$870,000	$1,743,000
Boulder and West Rivers	163 structures	$25,567,000	$1,155,000	$1,715,000
Total	*1,475 structures*	*$291,879,000*	*$12,656,000*	*$22,487,000*

Table 4-26 shows the results generated by HAZUS-MH. HAZUS-MH used census block data to estimate damages to structures for the 500-year floods on the reaches indicated.

Table 4-26. HAZUS Estimated Flood Damage.

Study Area	Estimated Building Damage	Building-Related Economic
Yellowstone River, north of confluence with Mill Creek	3 substantially damaged residences, 73 moderately damaged residences, 67 slightly damaged residences	$10,950,000
Shields River	3 slightly damaged residences	$3,530,000
Boulder and West Boulder Rivers	2 slightly damaged residences	$280,000

Table 4-27 provides National Flood Insurance Program data, as of September 30, 2017.

Table 4-27. NFIP Statistics for Park County.

Location	Policies	Insurance In-Force	Total Loss Payments 1978 – September 2017
Park County, unincorporated areas	90	$20,680,800	$718,644

City of Livingston	22	$5,043,000	$76,721
Total	112	$25,723,800	$795,365

4.7.4.3 POPULATION

Due to the terrain and hazard areas in Park County, the population is considered to be at moderate risk for riverine and flash flooding. Some warning does exist, particularly with riverine flooding, but rapidly occurring events may leave the population unprepared and in a dangerous situation. The impacts from flash flooding could be even greater in areas downstream of wildfire burn areas. Flash flooding often occurs without warning. The population estimated in the 100-year floodplain is 600 people (366 structures x 1.71 people/structure). The population in flash flood areas is unknown as flash flood can occur almost anywhere.

4.7.4.4 VALUES

Economic values can be negatively affected by floods. Agriculture losses may occur due to reduced profits, damaged crops, livestock drownings, and delays in planting. Physical losses to businesses and historic properties may also occur. Damages to the road transportation network may slow commerce. Flooding often benefits ecologic values in the riparian areas, but socially, emotional impacts related to losses can be significant.

4.7.4.5 FUTURE DEVELOPMENT

As of 2017, all jurisdictions within Park County adhere to National Flood Insurance Program (NFIP) requirements for new and improved developments in the mapped floodplain. These requirements do not prohibit development in the floodplain; rather, they require the development to meet certain standards. Future development of lands within the floodplain is possible. About 638 private, undeveloped parcels of land coincide with the 100-year floodplain; however, these parcels may also contain possible building sites outside the 100-year floodplain boundaries. Similarly, 132 private, undeveloped parcels of land coincide with the mapped 500-year floodplain in and around Livingston.

4.7.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	Park County	/ $100,000 losses / Structural losses / Contents losses / Critical functional losses / Critical data losses / Clean-up/debris removal costs	/ $500,000 losses	Moderate

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	Livingston		/ $100,000 losses / Structural losses / Contents losses / Critical functional losses / Critical data losses / Clean-up/debris removal costs	Low-Moderate
Critical Facilities	Clyde Park	/ $100,000 losses / Structural losses / Contents losses / Critical functional losses / Critical data losses / Clean-up/debris removal costs		Moderate
Critical Infrastructure	Park County	/ $2,000,000 losses / Road closures	/ $5,000,000 losses / Loss of electricity / Loss of potable water / Loss of sanitary sewers	Moderate-High
Critical Infrastructure	Livingston		/ $2,000,000 losses / Road closures / Loss of electricity / Loss of potable water / Loss of sanitary sewers	Moderate
Critical Infrastructure	Clyde Park		/ $1,000,000 losses / Road closures / Loss of electricity / Loss of potable water / Loss of sanitary sewers	Moderate

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Existing Structures	Park County	/ $24,500,000 losses / Structural losses / Contents losses / Displacement/functional losses / Clean-up/debris removal costs	/ $40,000,000 losses	High
Existing Structures	Livingston	/ $67,000 losses / Structural losses / Contents losses / Displacement/functional losses / Clean-up/debris removal costs	/ $10,000,000 losses	Rating
Existing Structures	Livingston	/ $104,000 losses / Structural losses / Contents losses / Displacement/functional losses / Clean-up/debris removal costs	/ $1,000,000 losses	Moderate
Existing Structures	Clyde Park		/ Injuries / Fatalities	Moderate
Population	All	/ Agricultural losses / Aesthetic value losses	/ Business disruption losses / Service industry losses / Reduced water quality / Historic structure losses / Historic site losses / Historic item losses / Emotional impacts / Cancellation of activities / Restrictions on activities	Moderate

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Values	All	/ Somewhat likely to occur in hazard areas / 638 undeveloped parcels in the 100-year floodplain	/ 132 additional undeveloped parcels in the 500-year floodplain in and around Livingston	Moderate
Future Structures	All	/ $67,000 losses / Structural losses / Contents losses / Displacement/ functional losses / Clean-up/debris removal costs	/ $10,000,000 losses	Moderate

[1] Impact in addition to probable (100-year) impacts

4.7.6 DATA LIMITATIONS

Data limitations include:

- / Difficulty in quantifying all losses that occur during major floods, especially when some are covered by insurance and government assistance and others are not.

4.8 GROUND TRANSPORTATION ACCIDENT

Table 4-28. Ground Transportation Accident Federal Major Disaster and Emergency Declarations.

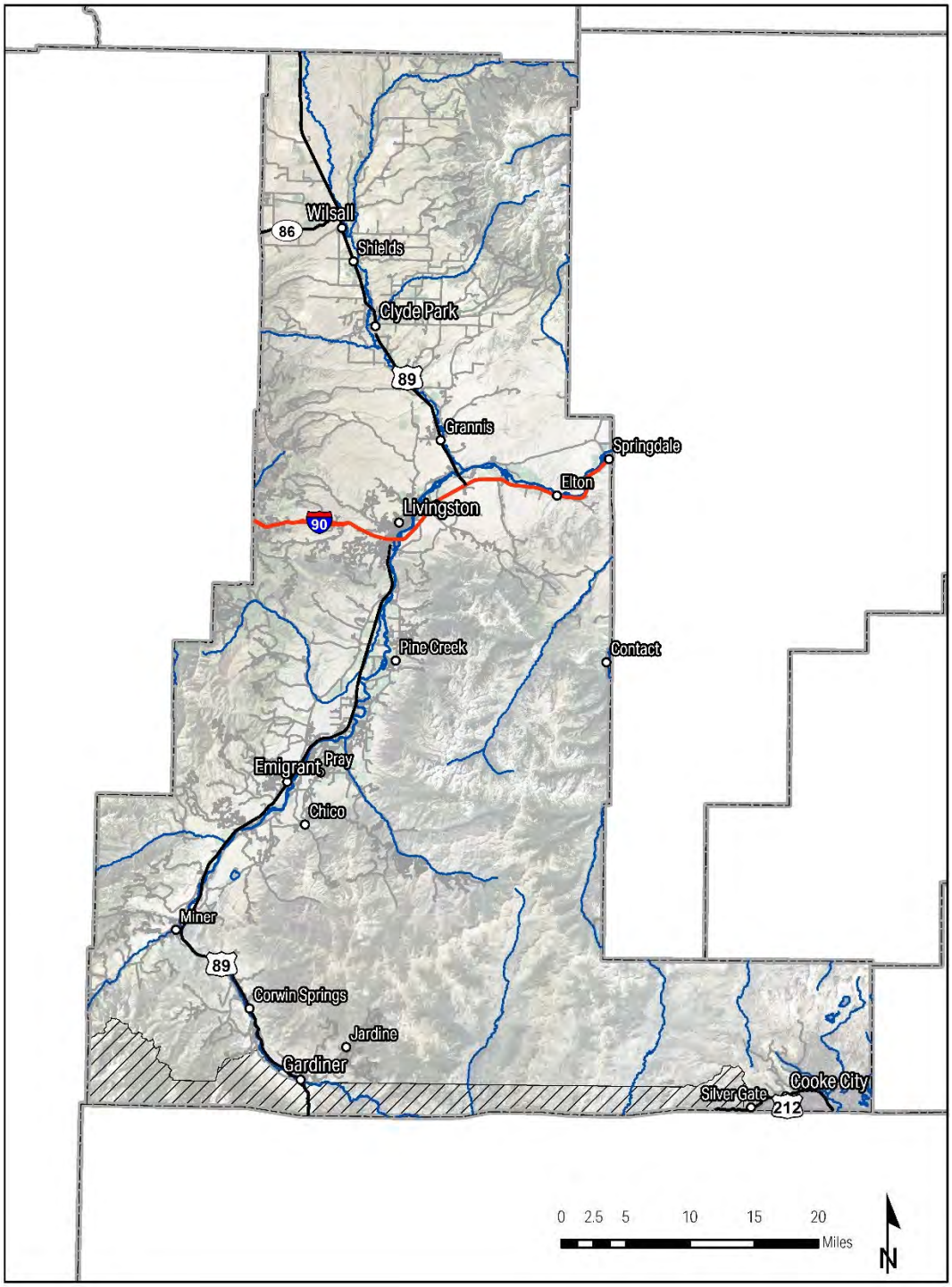
Declaration	Year	Casualties	Damages	Comments
None				

4.8.1 DESCRIPTION

A ground transportation accident, for the purposes of this plan, is any large-scale vehicular accident involving mass casualties. The most likely locations for an incident of this magnitude would be on Interstate 90 or on Highway 89. Interstate 90 crosses central Park County in an east-west direction. This Interstate is widely used by large trucks, area residents, and distance travelers. Highway 89, south of the Interstate, connects Interstate 90 to Yellowstone National Park and is used by tourists visiting the Park, residents, and as a shipping route to the Park and points south into Wyoming. Highway 89, north of the Interstate, serves as the primary route for many rural communities in northern Park County and beyond. Map 4-7 shows the roadways in Park County.

Road Network

Park County, Montana



Data Source: Montana NRIS
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
November 2017

Map 4-7. Road Locations in Park County.

A significant concern in ground transportation accidents is the release of hazardous materials. This hazard is addressed in the hazardous materials release profile.

A unique problem linked to ground transportation accidents is that of wildlife. Wildlife collisions, particularly deer and elk, are another common cause of transportation accidents in the county. Deceased animals left on the roadside often attract other animals, such as grizzly bears, into the populated areas. This has been a specific problem in the Cooke City area as these animals can then threaten humans.

4.8.2 HISTORY

The history of ground transportation accidents in Park County consists primarily of small magnitude incidents, some with fatalities, but most with very little effect on the entire community. Traffic accidents along the roadways occur regularly, usually inconveniencing travelers, overwhelming local emergency resources, and occasionally causing delays. Table 4-29 shows the traffic fatalities in Park County from 1980-2016.

Table 4-29. Traffic Fatalities (Montana Highway Patrol, 2017).

Year	Fatalities	Year	Fatalities	Year	Fatalities	Year	Fatalities
1980	6	1990	1	2000	5	2010	1
1981	3	1991	3	2001	7	2011	4
1982	7	1992	6	2002	6	2012	5
1983	6	1993	1	2003	9	2013	1
1984	3	1994	4	2004	5	2014	4
1985	3	1995	1	2005	5	2015	4
1986	3	1996	8	2006	5	2016	2
1987	3	1997	7	2007	6		
1988	4	1998	5	2008	1		
1989	3	1999	5	2009	3		
Annual Average	*4.1*		*4.1*		*5.2*		*3.0*

In the early 1980s, local firefighters recall a four-car accident on Highway 89 south of Livingston, in which 14 people were treated, many of whom were deaf. Then, on June 17, 1999, 12 miles south of Livingston on Highway 89, a truck and tourist bus accident killed one person and injured 26 others. That accident involved many foreign, non-English speaking tourists.

4.8.3 PROBABILITY AND MAGNITUDE

Park County has a relatively low history of major ground transportation accidents. Though the period from 2000 to 2009 showed an increase in fatal traffic accidents, the period from 2010 to the present has shown a decrease. The probability of a large wreck with mass casualties increases during snow storms, periods of poor visibility with blowing snow or smoke, and during times of heavy tourist traffic.

4.8.4 VULNERABILITIES

Since the location and probability of a significant ground transportation accident is extremely difficult to determine, two scenarios were used to determine potential losses. The first is an accident involving a bus and resulting in 10-15 casualties. The second is a multi-vehicle accident resulting in 20-25 casualties, damage to electric infrastructure, and damage to two structures.

4.8.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

Critical facilities are not anticipated to be impacted by a ground transportation accident. A critical facility could be damaged in or made inaccessible from the impact of an accident, but the likelihood is considered low and uniform throughout the county. Should the incident be large enough, the largest expenditures would probably be in responding agency costs.

4.8.4.2 EXISTING STRUCTURES

Typically, most losses from a ground transportation accident are covered by insurance. Losses of two structures would be about $433,800 (2 homes x $216,900/average home).

4.8.4.3 POPULATION

Population losses are highly likely in ground transportation accidents. A ground transportation accident has the potential to kill and injure large numbers of people. Any accident involving a bus or many vehicles has the potential for casualties numbering from 10 to 100.

4.8.4.4 VALUES

Should vehicle fluids or hazardous materials seep into a water supply, the quality of that water body could be threatened.

4.8.4.5 FUTURE DEVELOPMENT

Future development, except for the associated increase in vehicles in the area, will not impact or will just slightly increase the probability of a large ground transportation accident. Otherwise, the specific locations of where development occurs should not significantly affect the vulnerabilities from this hazard, especially since appropriate road improvements are usually required with new development per subdivision regulations.

4.8.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	All		/ $0 losses	Low
Critical Infrastructure	All	/ Road closures	/ $100,000 losses / Loss of electricity / Loss of telephone service / Loss of internet	Low-Moderate

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Existing Structures	All		/ $200,000 losses / Structural losses / Contents losses / Displacement/functional losses / Clean-up/debris removal costs	Low-Moderate
Population	All	/ Injuries / Fatalities		Moderate-High
Values	All	/ Emotional impacts	/ Business disruption losses / Service industry losses / Agricultural losses / Habitat damages / Reduced water quality / Soil contamination / Historic structure	Low-Moderate
Future Structures	All		/ Unlikely to occur in hazard areas / Increases the total hazard exposure	Low-Moderate

[1] Impact in addition to probable (100-year) impacts

4.8.6 DATA LIMITATIONS

Data limitations include:

- Difficulties in predicting the location and magnitude of future accidents.

4.9 HAZARDOUS MATERIALS RELEASE

Table 4-30. Hazardous Materials Release Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

4.9.1 DESCRIPTION

A hazardous material release is the contamination of the environment (i.e. air, water, soil) by any material that because of its quantity, concentration, physical characteristics, or chemical characteristics threatens human, animal, or plant health, the environment, or property. An accidental or intentional release of materials could produce a health hazard to those in the area, downwind, and/or downstream with immediate, prolonged, and/or delayed effects. The spread of the material may additionally be defined by weather conditions and topography of the area. A hazardous material release can come from a fixed facility, via its transportation, or intentionally in the case of terrorism.

Fixed facilities housing hazardous substances in Park County include facilities within communities such as water and sewer treatment plants, swimming pools, hospitals, gas stations, bulk plants, and supply stores containing substances such as fuel, farm and weed chemicals, propane, fuel oil, paint, and small amounts of chlorine and low-level nuclear wastes.

A major fuel pipeline, the Yellowstone Pipeline, runs through central Park County, just north of Livingston and Interstate 90. This pipeline transports refined petroleum products between Billings, MT and Spokane, WA. Should an explosion or leak occur on this pipeline, a large hazardous material release of the fuel and/or fumes could result and threaten the population, property, and/or the environment.

A hazardous material release may also occur due to a transportation accident. The most likely locations for a transportation-related hazardous material release are along the interstate, highways, and the railroad. Interstate 90 crosses central Park County in an east-west direction. This Interstate is widely used by vehicles transporting hazardous materials. Highway 89, south of the Interstate, connects Interstate 90 to Yellowstone National Park and is used as a shipping route to the Park and points south into Wyoming. Highway 89, north of the Interstate, serves as the primary route for many rural communities in northern Park County and beyond. For the most part, the railroad parallels Interstate 90, except where it goes through the City of Livingston. Only the east-west railroad sections are currently active with an additional short section used south through Livingston. The railroad is owned and operated by Montana Rail Link. Hazardous materials and wastes are continually present on these corridors.

A hazardous material release can occur anywhere; however, buffer zones around the primary hazardous materials transportation routes show the areas that would most likely be affected by a transportation-related hazardous material incident. Table 4-31 lists the evacuation radii for a few common hazardous materials. This list is generalized for planning purposes and is certainly not all-inclusive. Emergency responders should rely on other sources for more detailed information. Over 18,000 materials are covered under the US Department of Transportation regulations.

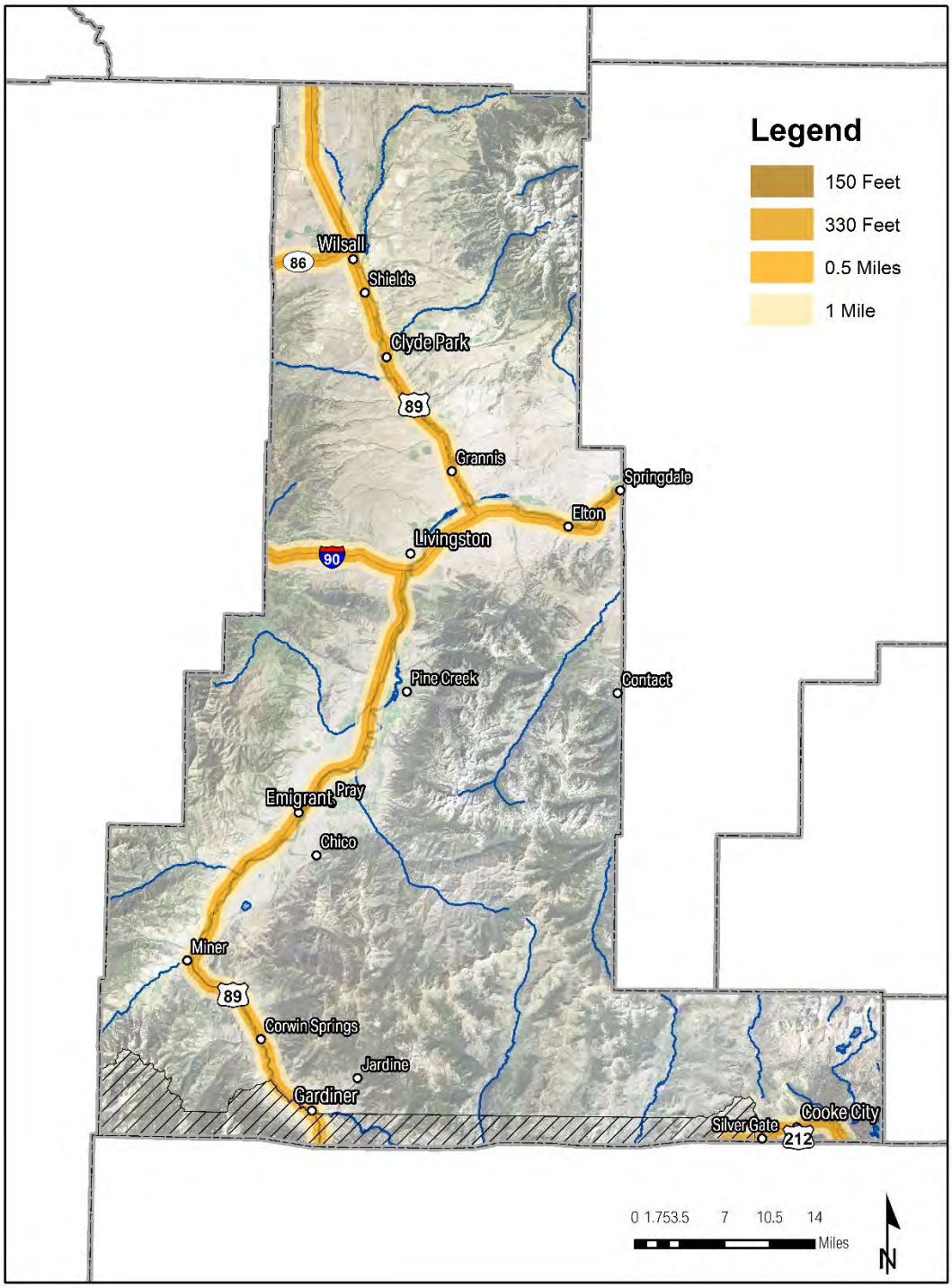
Table 4-31. Evacuation Radii for Common Hazardous Materials.

Material	Potential Hazard	Initial Isolation	Evacuation
Diesel Fuel/Gasoline	Highly Flammable	150 feet	Up to ½ mile
Ammonium Nitrate Fertilizers	Oxidizer	150 feet	Up to ½ mile
Propane	Extremely Flammable	330 feet	Up to 1 mile
Anhydrous Ammonia	Toxic by Inhalation	500 feet	Up to 1.4 miles
Chlorine	Toxic by Inhalation	2,000 feet	Up to 5 miles

The buffers around the interstate and railroad shown in Map 4-8 and Map 4-9, respectively, represent those areas with an enhanced risk from a hazardous materials release based on their proximity to regular hazardous materials transportation routes. Along the interstate and Highway 89, buffer zones of 150 feet, 330 feet, ½ mile, and 1 mile were established based on the initial isolation and evacuation radii for diesel fuel/gasoline and propane releases, as shown in Table 4-31. For the railroad, the buffers were 500 feet and 1.4 miles for anhydrous ammonia and 2,000 feet and 5 miles for chlorine. Note that the actual evacuation zones are highly dependent on factors such as wind speed, wind direction, material released, and quantity released. Like most other hazards, in an actual event, the entire risk area likely won't be affected, but a small section surrounding the spill location may.

Hazardous Materials Release

Park County, Montana



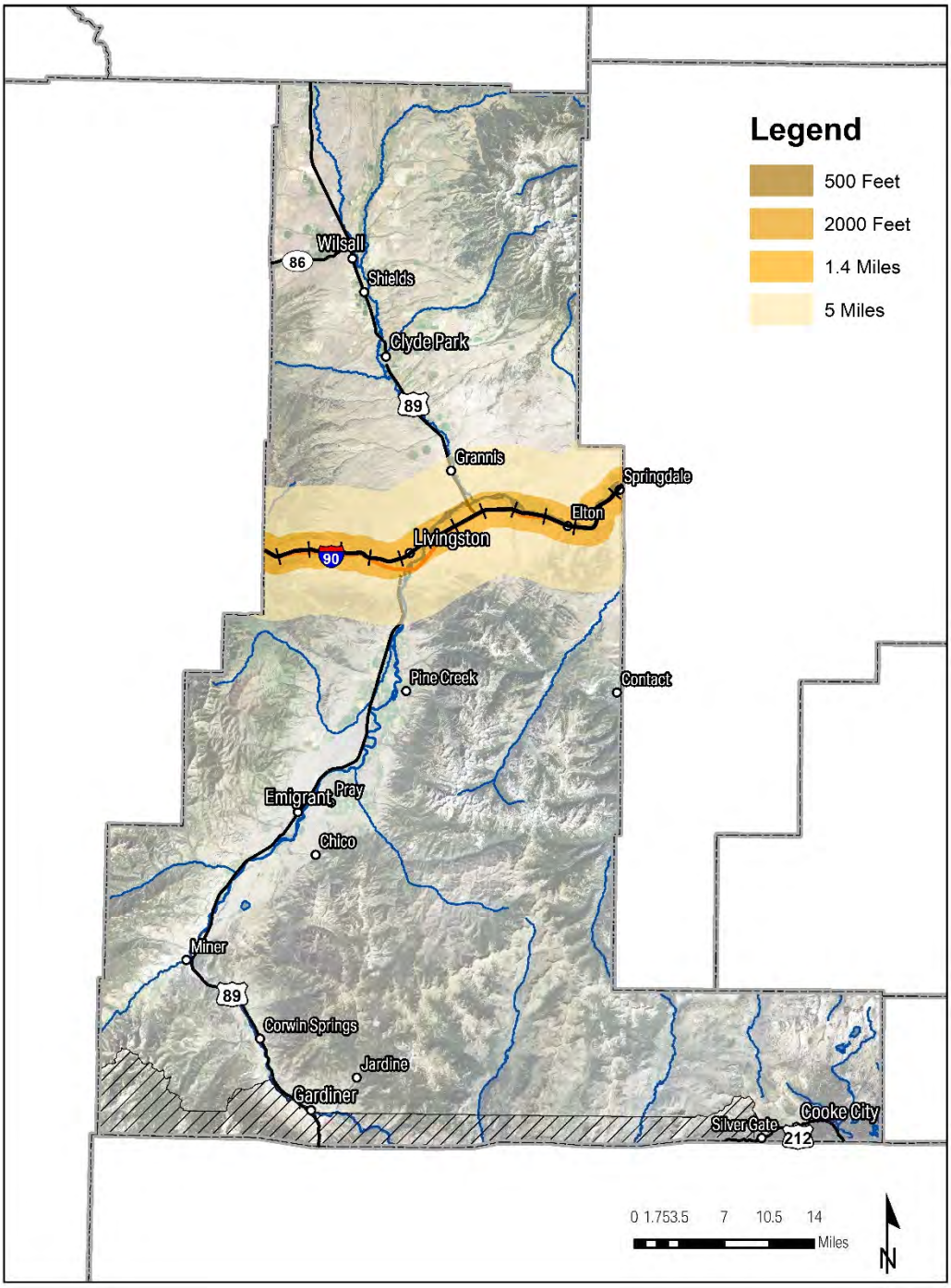
Data Source: Montana NRIS
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
December 2017

Map 4-8. Hazardous Material Release from Transportation Network.

Hazardous Materials Release

Park County, Montana



Data Source: Montana NRIS
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
December 2017

Map 4-9. Hazardous Material Release from Railroad.

4.9.2 HISTORY

Historically, incidents have been small enough to prevent a large evacuation and long-term impacts, however, hazardous materials incidents do occur in Park County. The incidents logged with the National Response Center are shown in Table 4-32. Note this database likely does not contain all incidents.

Table 4-32. Hazardous Material Releases from 1990-2017 (National Response Center, 2017).

Date	Location	Material	Cause/Impacts
09/08/1990	East End of Wilsall	Transformer Oil, 30 gallons	Pole was knocked over by the wind.
04/10-14/1990	Corwin Springs	Fuel Oil, 4,000 gallons Gasoline, 12,000 gallons	Underground storage tank leak. Approximately 300 gallons entered the Mol Huron Creek drainage.
02/22/1994	Springdale	Unleaded Gasoline, 1,500 barrels	Failed cooling line.
06/21/1996	Near Cooke City	Diesel Oil, 350 gallons	Portable diesel fuel tank leaked and then ruptured.
01/19/1997	TVX Mineral Hill Mine, Jardine	Ferric Chloride, 100 gallons	Storage tank leaked.
11/20/1998	Livingston Rebuild Center	Oil, 1,500 gallons	Open storage tank valve.
04/07/2000	North C Street, Livingston	Raw Sewage	Backed up into a trailer.
07/01/2001	High Ground Avenue, Livingston	Transformer Oil, 40 gallons	Transformer was struck by a vehicle.
02/18/2002	Interstate 90, between Mission Creek and	Diesel, 125 gallons	Tractor trailer truck overturned on icy road conditions and spilled fuel from a saddle tank.
07/14/2003	Near Corwin Springs	Fuel Oil	Spilled onto the ground by a tanker truck.
09/15/2005	Callender Street, Livingston	Natural Gas	Pipeline leak led to an explosion that destroyed two houses and injured four.
08/23/2007	Fleshman Creek between B and N Streets, Livingston	Chlorinated Pool Water	White sheen reported in the creek to be killing species in the water. Municipal pool water was approved to be
12/24/2007	5284 US Highway 89 South, Livingston	Transformer Oil, PCBs, 45 gallons	Wind knocked down a transformer.
12/13/2013	Near Cooke City at Round Lake	Diesel Fuel	Grooming vehicle crashed into lake.
10/29/2014	Pray	Fuel Oil	Abandoned drum found in muddy river bed.

Date	Location	Material	Cause/Impacts
7/28/2015	Clyde Park	Fargo (Herbicide)	Abandoned 55-gallon drum found.
7/28/2015	Livingston	Animal Fat/Unknown Oil	Leaking abandoned drum found.

4.9.3 PROBABILITY AND MAGNITUDE

The probability of a hazardous materials release can only be realistically assessed qualitatively. The history of events in Park County is 17 events over the past 27 years, none of which have resulted in a disaster declaration. The exposure, however, is high with Interstate 90, a petroleum pipeline, and an active railroad passing within close proximity to critical facilities and Livingston. The probability of a significant release is considered greater along the railroad since the US Department of Transportation regulates hazardous materials on commercial vehicles, has specific regulations regarding mixed loads and amounts, and provides enforcement, whereas, the railroad system does not have as extensive control measures.

4.9.4 VULNERABILITIES

To assess the vulnerabilities to hazardous material releases, GIS data for critical facilities, structures, and undeveloped parcels were compared to the enhanced risk areas depicted by the buffer zones around the interstate, US Highway 89, the railroad, and the Yellowstone Pipeline. For population estimates, the 2015 county population of 15,971 was divided by the total number of structures in the Park County of 9,367 for an estimate of 1.71 people per structure.

4.9.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

Based on the estimated buffer zones, the highest risk critical facilities can be identified. Should a hazardous material release affect one of the critical facilities, the level of emergency services available could be reduced. A release near a special needs facility may present unique evacuation challenges. Structural and contents losses may only be seen if an explosion and/or fire are present. Table 4-33 shows the critical facility exposure to the various hazardous material risk areas.

Table 4-33. Hazardous Material Incident Exposure to Critical Facilities.

Within Buffer Zone	Exposure	Specific Facilities
150 feet of Interstate 90	None	
330 feet of Interstate 90	None	
½ mile of Interstate 90	11 critical facilities	
1 mile of Interstate 90	41 critical facilities	
150 feet of US Highway 89	10 critical facilities	/ County Road Shop, Clyde Park County Road Shop, Wilsall Gateway Hose Company North Entrance of YNP Shields Valley Health Center / US Dept. of Agriculture, Gardiner US Dept. of Agriculture, Livingston US Post Office, Clyde Park / US Post Office, Wilsall Fire Station

Within Buffer Zone	Exposure	Specific Facilities
330 feet of US Highway 89	16 critical facilities	
½ mile of US Highway 89	36 critical facilities	
1 mile of US Highway 89	45 critical facilities	
500 feet of the Railroad	7 critical facilities	/ Montana DPHHS, Livingston / MDT, Livingston / Park County Rural Fire Station #1 US Post Office, Springdale Washington School
2,000 feet of the Railroad	40 critical facilities	
1.4 miles of the Railroad	60 critical facilities	
5 miles of the Railroad	62 critical facilities	
150 feet of the Yellowstone Pipeline	None	
½ mile of the Yellowstone Pipeline	None	

4.9.4.2 EXISTING STRUCTURES

Comparing the structure database to the buffer zones, Table 4-34 shows the estimated number of structures within the enhanced hazard areas. Fortunately, unless an explosion is present with the release, structures are typically not damaged in a hazardous materials release. Structure losses in an explosion would likely total in the millions of dollars.

Table 4-34. Structure Vulnerabilities to Hazardous Material Releases.

Within Buffer Zone	Estimated Number of Structures
150 feet of Interstate 90	4 structures
330 feet of Interstate 90	23 structures
½ mile of Interstate 90	739 structures
1 mile of Interstate 90	2,882 structures
150 feet of US Highway 89	260 structures
330 feet of US Highway 89	602 structures
½ mile of US Highway 89	2,337 structures
1 mile of US Highway 89	3,626 structures
500 feet of the Railroad	446 structures
2,000 feet of the Railroad	2,730 structures
1.4 miles of the Railroad	4,577 structures
5 miles of the Railroad	5,303 structures
150 feet of the Yellowstone Pipeline	25 structures
½ mile of the Yellowstone Pipeline	165 structures

4.9.4.3 POPULATION

Table 4-35 shows the estimated population within each of the buffer zones. These estimates are based on 1.71 people per structure. Greater population concentrations may be found in communities, special needs facilities, and businesses. Generally, an incident will affect only a subset of the total population at risk. In a hazardous material release, those in the immediate isolation area would have little to no warning, whereas, the population further away in the dispersion path may have some time to evacuate, depending on the weather conditions, material released, and public notification.

Table 4-35. Population Vulnerabilities to Hazardous Material Releases.

Within Buffer Zone	Estimated Number of Structures	Estimated Population
150 feet of Interstate 90	4 structures	7 people
330 feet of Interstate 90	23 structures	40 people
½ mile of Interstate 90	739 structures	1,264 people
1 mile of Interstate 90	2,882 structures	4,929 people
150 feet of US Highway 89	260 structures	445 people
330 feet of US Highway 89	602 structures	1,030 people
½ mile of US Highway 89	2,337 structures	3,997 people
1 mile of US Highway 89	3,626 structures	6,201 people
500 feet of the Railroad	446 structures	763 people
2,000 feet of the Railroad	2,730 structures	4,669 people
1.4 miles of the Railroad	4,577 structures	7,827 people
5 miles of the Railroad	5,303 structures	9,069 people
150 feet of the Yellowstone Pipeline	25 structures	43 people
½ mile of the Yellowstone Pipeline	165 structures	283 people

Many factors will determine the true hazard area in a transportation related hazardous material release. The worst-case scenario would be a release along the railroad near downtown Livingston. Given this scenario, a conservative estimate of 1,000 structures could be directly affected and/or evacuated. With an estimated 1.71 people per structures (and possibly higher for downtown Livingston), approximately 1,710 people would be at greatest risk in such an event.

4.9.4.4 VALUES

Temporary business closures and associated business disruption losses may occur with a hazardous material release and losses may be more extensive to include physical losses when explosions are present. Often, the most significant losses occur to ecologic values when such releases occur. Releases that impact a body of water can be especially difficult to manage. Social values such as cancelled activities and emotional impacts related to significant population losses or associated illness are also possible.

4.9.4.5 FUTURE DEVELOPMENT

Much of the future development currently occurring is off the major road and rail networks in the county. The potential, however, does exist for development of agricultural lands bordering the highways and railroad, particularly in the unincorporated parts of Park County. Very few restrictions are in place to prevent development in these areas.

4.9.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	All	/ Critical functional losses	/ $100,000 losses / Structural losses / Contents losses / Critical data losses / Clean-up/debris removal costs	Low-Moderate
Critical Infrastructure	All	/ Road closures	/ $500,000 losses / Loss of electricity / Loss of utility gas / Loss of potable	Low-Moderate
Existing Structures	All	/ Displacement/functional losses	/ $500,000 losses / Structural losses / Contents losses / Clean-up/debris removal costs	Low-Moderate
Population	All	/ Illness / Injuries / Fatalities		High
Values	All	/ Business disruption losses / Agricultural losses / Habitat damages / Reduced air quality / Reduced water quality / Soil contamination / Cancellation of activities	/ Service industry losses / Biodiversity losses / Historic structure losses / Historic site losses / Historic item losses / Emotional impacts / Aesthetic value losses	Moderate-High
Future Structures	All	/ Likely to occur in hazard areas / Nearly 2,000 parcels available for development / Increases the total hazard exposure		Moderate

[1] Impact in addition to probable (100-year) impacts

4.9.6 DATA LIMITATIONS

Data limitations include:

- Estimating what substances and the quantity that may be released in any given location.
- Lack of a study with the numbers and types of hazardous materials being hauled on the interstate, railroad, and highways in the county.
- Digital mapping of fixed facilities housing significant amounts of hazardous materials would allow for more detailed analysis of impacts related to releases at those facilities.

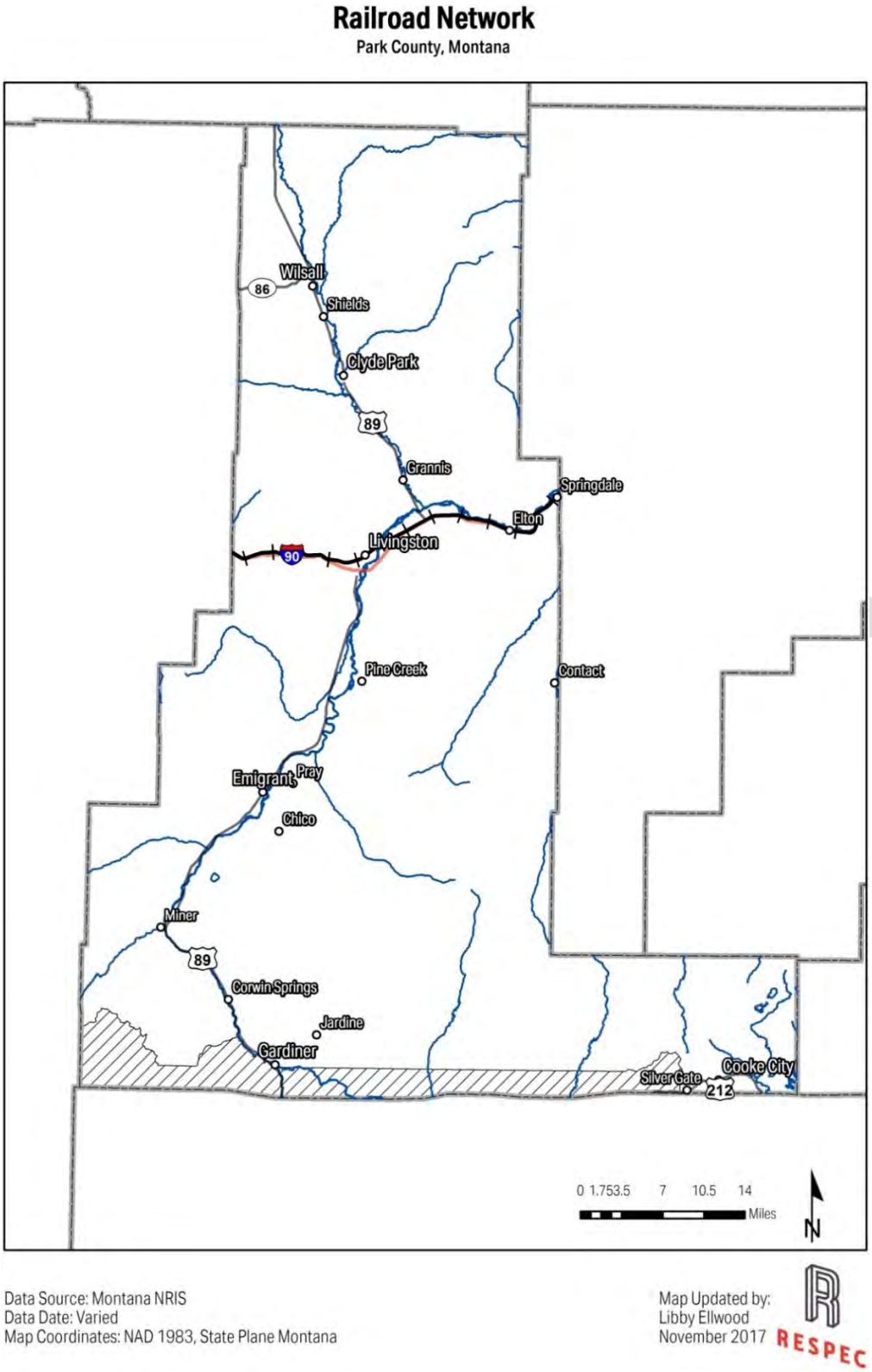
4.10 RAILROAD ACCIDENT

Table 4-36. Railroad Accident Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

4.10.1 DESCRIPTION

Goods, including hazardous materials, are transported by Montana Rail Link (MRL) via the rail network across Park County in an east-west direction, roughly parallel to Interstate 90 and passing through the City of Livingston. A very short segment runs from RY Timber to this main line. MRL is a Federal Railroad Administration Class II regional railroad with more than 900 miles of track serving 100 stations in the states of Montana, Idaho and Washington, and employs approximately 900 people. MRL connects with Spokane, Washington, the Burlington Northern & Santa Fe Railway (BNSF) at Laurel and Garrison, and the Union Pacific Railroad at Sandpoint, Idaho. (Montana Rail Link, 2011) Map 4-3 shows the active railroad sections in Park County.



Map 4-3. Railroad Network in Park County.

A railroad accident is hazardous to those near and inside the train due to physical impacts, but others may be threatened by associated hazards. A hazardous material release is the most probable associated hazard. Those effects are described in detail in the hazardous materials release profile.

4.10.2 HISTORY

The railroads in Park County were operated by Burlington Northern Railroad from 1970 to 1987 until Montana Rail Link assumed control of the route through Southern Montana. Table 4-37 outlines the accidents in Park County documented by the Federal Railroad Administration since 1975.

Table 4-37. Railroad Accidents in Park County (Federal Railroad Administration, 2017).

Date	Reportable Damage	Casualties	Cause/Effect
07/05/1975	$5,500	None	Human cause, 1 car derailed
10/24/1976	$5,235	None	Human caused switch problem, 3 cars derailed
02/16/1977	$3,900	None	Switch point worn, 3 locomotives derailed
07/22/1978	$4,125	None	Worn flange, 2 cars derailed
10/31/1978	$71,000	1 injury	Highway/rail collision
08/09/1979	$105,000	None	Human caused, head-on collision
07/15/1980	$13,420	None	Switch point worn, 3 cars derailed
08/16/1980	$4,582	None	Roadbed settled, 3 locomotives derailed
12/20/1980	$6,350	None	Horizontal split head, 5 cars derailed
06/01/1981	$15,550	None	Damaged switch, 5 cars derailed
09/07/1981	$9,000	None	Track vandalism, 4 cars derailed
11/24/1981	$5,850	None	Human caused train handling, 5 cars derailed
02/04/1982	$8,050	None	Movement with air hose uncoupled, 14 cars derailed
12/07/1985	$201,500	None	Engine improperly secured, 1 locomotive derailed
12/28/1988	$17,500	None	Head and web separation, 5 cars derailed, 2 carrying hazardous materials, both derailed, one released 10-20 gallons of No. 5 fuel oil
04/01/1989	$21,000	None	Soft track, 3 cars derailed
05/02/1989	$6,000	None	Human caused improper run through switch, 3 locomotives derailed
02/20/1990	$7,000	None	Wide gauge from poor tie condition, 2 locomotives
09/22/1990	$11,600	None	Brake not set, loaded coal train rolled backwards, 1 car derailed
11/29/1990	$526,000	None	High winds blew trailers and containers off the track, 13 cars derailed
05/04/1992	$7,615	None	Use of out-of-service track, 3 cars derailed
11/12/1992	$7,200	None	Wide gauge at joint and soft track, 2 cars derailed, 5 cars carrying hazardous materials, none derailed
11/14/1992	$13,800	None	Broken angle bar at switch point, 4 cars derailed
09/09/1993	$23,500	None	Wide gauge, 5 cars derailed
10/29/1993	$30,000	1 injury	Rear-end collision of single cars
08/07/1995	$7,000	None	Human error, collision while switching

Date	Reportable Damage	Casualties	Cause/Effect
04/12/1996	$19,500	None	Wide gauge, 8 cars derailed
10/22/1996	$16,000	None	Switch point defect, 2 cars derailed, 14 cars carrying
09/11/1997	$10,200	None	Yard overloaded, cars collided
12/05/1998	$12,650	None	Wide gauge, 3 locomotives derailed
05/25/2002	$12,000	None	Brakes released by vandals, 3 cars derailed
08/07/2003	$18,000	None	Worn switch point, 2 cars derailed
01/07/2004	$18,091	None	Snow and ice raised rubber material at Fifth Street
12/11/2004	$320,000	None	Worn switch point, empty grain car derailed and
09/21/2008	$36,102	None	Hand brake not secured, 1 car containing hazardous
10/08/2008	$27,000	None	Grain train doubled back together, 3 cars derailed
02/13/2011	$48,500	None	Excessive horsepower, 4 cars derailed
12/18/2011	$104,000	None	Crew operation mistake, 5 cars derailed
02/18/2012	$17,400	None	Log car rolled off track, 1 car derailed
02/07/2013	$152,000	None	Grain train car derailed
01/27/2015	$50,000	None	Human error, locomotives derailed one set of trucks

4.10.3 PROBABILITY AND MAGNITUDE

Since 1975, 41 railroad accidents have occurred resulting in $1,998,720 in track and equipment damages and 2 injuries. Using this historical record, on average, a railroad accident occurs about once per year (41 accidents / 43 years) in Park County. The average accident causes $48,750 ($1,998,720 / 41 accidents) in damage; however, the range over the past 43 years has been from $3,900 to $526,000. Another important consideration in a railroad accident is the release of hazardous materials. The historical record shows this has only occurred once in the past 43 years, but the potential certainly exists as demonstrated by the number of hazardous material cars involved, but not damaged, in railroad accidents.

4.10.4 VULNERABILITIES

Since the location and probability of a significant railroad accident is extremely difficult to determine, two scenarios were used to determine potential losses. The first is a large derailment causing road closures and extended clean-up efforts. The second is a derailment and collision with two structures, resulting in casualties and structural losses.

4.10.4.1 CRITICAL FACILITIES AND INFASTRUCTURE

Park County critical facilities are not to be considered at enhanced risk from a railroad accident. All critical facilities and vulnerable populations are more than 250 feet from the tracks.

Most of the losses from a railroad accident are paid for by Montana Rail Link or their insurance. Potential community losses are most probable to infrastructure such as roadways. Should a derailment occur on a state, county, or city road, that road could be unusable for several days or weeks. Staff time in coordinating the clean up or response could be considered additional railroad accident losses.

4.10.4.2 EXISTING STRUCTURES

In terms of structures that could be impacted by a derailment, 107 structures are within 250 feet of the railroad. Most accidents would probably only impact one or two structures. Damages could vary in the hundreds of thousands of dollars depending on the structure or structures impacted.

4.10.4.3 POPULATION

Since the active railroad in Park County no longer serves passengers, the potential for high casualties from the impact of a railroad accident is low. The potential certainly exists, however, for casualties to railroad workers and those in the general vicinity, especially since the trains pass by community parks and near downtown Livingston.

4.10.4.4 VALUES

Economic losses due to a train derailment are possible. Emotional impacts, such as a fear of trains, may occur should an accident result in the loss of life.

4.10.4.5 FUTURE DEVELOPMENT

Future development should have little to no impact on the railroad accident hazard. Most development is occurring in areas away from the railroad's immediate impact area. Little restrictions are in place, however, to prevent such development.

4.10.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	Park County, Livingston		/ $0 losses	Low
Critical Infrastructure	Park County, Livingston	/ Road closures		Low
Existing Structures	Park County, Livingston		/ $200,000 losses / Structural losses / Contents losses / Displacement/functional losses / Clean-up/debris removal costs	Low-Moderate
Population	Park County, Livingston		/ Injuries / Fatalities	Low-Moderate

Values	Park County, Livingston		/ Business disruption losses / Historic structure losses / Historic site losses / Historic item losses / Emotional impacts / Cancellation of activities	Low-Moderate
Future Structures	Park County, Livingston		/ Somewhat likely to occur in hazard areas / Increases the total hazard exposure	Low-Moderate

[1] Impact in addition to probable (100-year) impacts

4.10.6 DATA LIMITATIONS

Data limitations include:

- / Difficulties in predicting the location and magnitude of future accidents.

4.11 SEVERE THUNDERSTORMS AND TORNADOES

Table 4-38. Severe Thunderstorms and Tornadoes Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

4.11.1 DESCRIPTION

Severe thunderstorms and tornadoes can be hazardous under the right conditions and locations. Thunderstorms in Montana develop when moisture in the air rises, often from daytime ground heating, an unstable atmospheric condition, synoptic front, or by terrain uplift which cools higher in the atmosphere and condenses into rain droplets or ice crystals. The cloud grows as these conditions continue and the atmospheric instability allows. Lightning can be produced, with or without rain, as a charge builds up in the cloud. With the right atmospheric conditions, updrafts and downdrafts form in the thunderstorm structure. These strong updrafts and downdrafts can produce hail, strong straight-line winds, and even tornadoes. Strong thunderstorm winds and tornadoes can take down trees, damage structures, tip high profile vehicles, and create high velocity flying debris. Large hail can damage crops, dent vehicles, break windows, and injure or kill livestock, pets, and people.

4.11.1.1 TORNADOES

Tornadoes form when the right amount of shear is present in the atmosphere and causes the updraft and downdraft of a thunderstorm to rotate. A funnel cloud is the rotating column of air extending out of a cloud base, but not yet touching the ground. The funnel cloud does not become a tornado until it touches the ground. Once in contact with the surface, it can create great damage over a small area. In 1971, Dr. Theodore Fujita developed the Fujita tornado damage scale to categorize various levels of tornado damage. In 2006, enhancements to this scale resulted in more accurate categorizations of damage and the associated wind speeds. Both scales are shown in Table 4-39.

Table 4-39. Tornado Scales.

Scale	Fujita Scale Estimated Wind Speed	Scale	Enhanced Fujita Scale Estimated Wind Speed
F0	<73 mph	EF0	65-85 mph
F1	73-112 mph	EF1	86-110 mph
F2	113-157 mph	EF2	111-135 mph
F3	158-206 mph	EF3	136-165 mph
F4	207-260 mph	EF4	166-200 mph
F5	261-318 mph	EF5	>200 mph

4.11.1.2 HAIL

Hail develops when a supercooled droplet collects a layer of ice and continues to grow, sustained by the updraft. Once the hail stone cannot be held up any longer by the updraft, it falls to the ground. Hail one inch or greater in diameter is considered "severe" by the National Weather Service. Hail up to 1.75 inches in diameter, as big as a golf ball, has been reported in Park County. Nationally, hailstorms cause nearly $1 billion in property and crop damage annually, as peak activity coincides with peak agricultural seasons. Major hailstorms also cause considerable damage to buildings and automobiles, but rarely result in loss of life.

4.11.1.3 DOWNBURSTS

Downburst winds, which can cause more widespread damage than a tornado, occur when air is carried into a storm's updraft, cools rapidly, and comes rushing to the ground. Cold air is denser than warm air, and therefore, wants to fall to the surface. On warm summer days, when the cold air can no longer be supported up by the storm's updraft, or an exceptional downdraft develops, the air crashes to the ground in the form of strong winds. These winds are forced horizontally when they reach the ground and can cause significant damage. These types of strong winds can also be referred to as straight-line winds. Thunderstorm winds of 58 miles per hour (mph) or greater are considered "severe" by the National Weather Service. Downbursts with a diameter of less than 2.5 miles are called microbursts and those with a diameter of 2.5 miles or greater are called macrobursts. A derecho, or bow echo, is a series of downbursts associated with a line of thunderstorms. This type of phenomenon can extend for hundreds of miles and contain wind speeds in excess of 100 mph.

4.11.1.4 LIGHTNING

Although not considered severe by National Weather Service definition, lightning and heavy rain can also accompany thunderstorms. Lightning develops when ice particles in a cloud move around, colliding with other particles. These collisions cause a separation of electrical charges. Positively charged ice particles rise to the top of the cloud and negatively charged ones fall to the middle and lower sections of the cloud. The negative charges at the base of the cloud attract positive charges at the surface of the Earth. Invisible to the human eye, the negatively charged area of the cloud sends a charge called a stepped leader toward the ground. Once it gets close enough, a channel develops between the cloud and the ground. Lightning is the electrical transfer through this channel. The channel rapidly heats to 50,000 degrees Fahrenheit and contains approximately 100 million electrical volts. The rapid expansion of the heated air causes thunder. (National Weather Service, 2011b)

4.11.2 HISTORY

Severe weather reports are collected from weather observing stations and trained spotters by the National Weather Service (NWS) office in Billings. These records are archived by the National Climatic Data Center. Since official records can only indicate events that have been reported to the National Weather Service, events are often underreported in rural areas and areas lacking trained spotters.

4.11.2.1 TORNADOES

Since 1950, only one tornado has been reported in Park County, but the tornado was strong, an EF2 with winds to 120 mph and caused significant damage northeast of Wilsall. The tornado touched down on July 2, 2010 at about 3:45 p.m. and traveled about 2 miles from 14 miles northeast of the Wilsall Airport to 16 miles northeast and had a width of about 150 yards. Much of the damage occurred from a surrounding microburst and large hail in the foothills of the Crazy Mountains. Thousands of trees were damaged, uprooted, or snapped off at the base. Property damage was estimated at $32.5 million. (National Climatic Data Center, 2011)

Although tornadoes are not common in Park County, in nearby Yellowstone National Park just to the south, an F4 tornado (207-260 mph) formed on July 21, 1987. The Teton-Yellowstone Tornado, as it was named, was 1.5 miles wide and traveled for 24 miles. The tornado crossed the Continental Divide at an elevation of 10,072 feet. (Fujita, 1989)

4.11.2.2 HAIL

Since 1950, 22 severe hail reports (1 inch or greater) have been recorded in Park County with a recurrence interval of about 3 years. Using only data from 2000-2017, since severe weather reporting and documentation has improved over time, 19 severe hail reports (1 inch or greater) have been recorded in Park County with an annual average of about one severe hail events per year. Table 4-40 lists the severe hail events of 1 inch in diameter or greater.

Table 4-40. Severe Hail Reports (National Centers for Environmental Information, 2017).

Location	Date	Size	Impacts
Park County	07/29/1973	1.00 inch	
Livingston	07/18/1997	1.75 inches	
Livingston, 12 miles SW	08/18/1997	1.00 inch	
Emigrant, 3 miles N	06/29/2002	1.00 inch	
Livingston, 5 miles W	06/27/2005	1.00 inch	
Livingston, 1 mile S	08/16/2006	1.00 inch	
Pine Creek, 3 miles S	08/17/2006	1.00 inch	
Livingston Airport, 4 miles ESE	05/13/2007	1.00 inch	
Hunter Hot Springs, 7 miles NW	06/30/2010	1.75 inches	
Clyde Park	06/30/2010	1.00 inch	
Clyde Park, 4 miles SE	06/30/2010	1.50 inches	Windows broken
Grannis, 3 miles N	06/30/2010	1.00 inch	
Grannis, 4 miles N	06/30/2010	1.50 inches	
Clyde Park, 4 miles SE	07/01/2010	1.50 inches	
Wilsall	08/03/2010	1.50 inches	
Hunter's Hot Springs	06/13/2013	1.00 inch	

Location	Date	Size	Impacts
Wilsall	06/13/2013	1.00 inch	
Hunter's Hot Springs	06/13/2013	1.00 inch	
Livingston	08/01/2013	1.00 inch	
Livingston	05/18/2014	1.00 inch	
Pine Creek	07/10/2017	1.50 inches	
Chico	07/16/2017	1.00 inch	

4.11.3 DOWNBURSTS

Since 1950, 85 severe thunderstorm wind reports (58 mph or greater) have been recorded in Park County with an annual average of 1-2 severe thunderstorm wind events per year. Using only data from 2000-2017, since severe weather reporting and documentation has improved over time, 33 severe thunderstorm wind reports (58 mph or greater) have been recorded in Park County with an annual average of two severe thunderstorm wind events per year. Table 4-41 lists the severe thunderstorm wind events of 75 mph or greater or causing damages.

Table 4-41. Severe Thunderstorm Wind Reports of 75 mph or Greater (National Centers for Environmental Information, 2017).

Location	Date	Speed	Impacts
Park County	07/31/1967	78 mph	
Park County	07/11/1973	79 mph	
Park County	07/06/1983	100 mph	
Park County	05/13/1988	81 mph	
Livingston, 18 miles S	06/25/1994	Unknown	Trees blown down at Pine Creek Camp Ground. One vehicle damaged by a falling tree. $5,000 estimated property damage.
Livingston, 6 miles S	08/24/1995	Unknown	Large trees blown down. One person injured by falling tree. Campers trapped by fallen trees across the road.
Wilsall, 8 miles ENE	07/17/1997	61 mph	Power lines knocked down.
Livingston	06/22/2005	78 mph	Extensive damage to roofs, semi-trailers blown over, and power outages.
Livingston, 2 miles NE	06/22/2005	92 mph	
Livingston, 12 miles SW	08/17/2005	81 mph	Large tree knocked down across a driveway.
Wilsall, 8 miles ENE	07/22/2008	70 mph	Wooden shed and tree blown onto a
Clyde Park	07/22/2008	70 mph	Scattered power outages.
Pine Creek, 3 miles SSW	07/31/2010	75 mph	Large tree hit part of a home roof. Two large treetops broken, one landed on power lines, another on a camper.
Livingston	06/12/2013	75 mph	
Grannis	08/23/2013	75 mph	

4.11.4 PROBABILITY AND MAGNITUDE

Generally, June, July, and August are the months when the probability of severe thunderstorms in Park County is highest, but some have been recorded as early as April and as late as September. Table 4-42 shows a summary of the severe thunderstorm and tornado events.

Table 4-42. Severe Thunderstorm and Tornado Summary 2000-2017 (National Centers for Environmental Information, 2017).

Event Type	Park County
Reported Tornadoes	2 events Highest Magnitude: EF2 1 damaging event $32,500,000 property damage
Reported Severe Hail	13 events Highest Magnitude: 1.75” 1 damaging event Unknown property damage
Reported Severe Thunderstorm Winds	33 events Highest Magnitude: 92 mph 5 damaging events Unknown property damage

Based on the historical record, the following can be expected on average:

- In an average 10-year period, 1 tornado (perhaps less given the broader historical record).
- In an average year, 1 severe hail event.
- In an average year, 2 severe thunderstorm wind events.
- The Federal Emergency Management Agency places this region in Zone II (160 mph) for structural wind design. (Federal Emergency Management Agency, 2008)

4.11.5 VULNERABILITIES

Severe thunderstorms and tornadoes are a threat to all areas of the county, and therefore, specific hazard areas are not applicable. Therefore, for the purposes of assessing the vulnerabilities, a 100-year event of large hail and strong winds damaging property was used as a scenario for each jurisdiction. For a 500-year event, a tornado in a populated area was considered.

4.11.5.1 CRITICAL FACILITIES AND INFRASTRUCTURE

All critical facilities and vulnerable populations are considered to have the same vulnerability to severe thunderstorms and tornadoes, unless specific reinforcements have been made to protect them from strong winds. Many of the critical facilities, although adequate for most events, may not be able to withstand 160 mph winds, as recommended by the Federal Emergency Management Agency. (Federal Emergency Management Agency, 2008) Most structures should be able to provide adequate protection from hail, but the structures could suffer broken windows, damaged roofs, and dented exteriors.

The Storm Prediction Center has developed damage indicators to be used with the Enhanced Fujita Scale for different types of buildings. Table 4-43 shows the indicators for institutional buildings.

Table 4-43. Expected Damage to Institutional Buildings (Storm Prediction Center, 2011).

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	59-88 mph (72 mph)

Damage Description	Wind Speed Range (expected in parentheses)
Loss of roof covering (<20%)	72-109 mph (86 mph)
Damage to penthouse roof and walls, loss of rooftop HVAC equipment	75-111 mph (92 mph)
Broken glass in windows or doors	78-115 mph (95 mph)
Damage Description	Wind Speed Range
Uplift of lightweight roof deck and insulation, significant loss of roofing material (>20%)	95-136 mph (114 mph)
Façade components torn from structure	97-140 mph (118 mph)
Damage to curtain walls or other wall cladding	110-152 mph (131 mph)
Uplift of pre-cast concrete roof slabs	119-163 mph (142 mph)
Uplift of metal deck with concrete fill slab	118-170 mph (146 mph)
Collapse of some top story exterior walls	127-172 mph (148 mph)
Significant damage to building envelope	178-268 mph (210 mph)

Above ground infrastructure, namely overhead power lines, communications towers and lines, and structures, are very susceptible to severe thunderstorms and tornadoes. High winds and falling trees can damage this type of infrastructure and disrupt services. Table 4-44 shows the Enhanced Fujita Scale Damage Indicators for electric transmission lines.

Table 4-44. Expected Damage to Electrical Transmission Lines (Storm Prediction Center, 2011).

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	70-98 mph (83 mph)
Broken wood cross member	80-114 mph (99 mph)
Wood poles leaning	85-130 mph (108 mph)
Broken wood poles	98-142 mph (118 mph)
Broken or bent steel or concrete poles	115-149 mph (138 mph)
Collapsed metal truss towers	116-165 mph (141 mph)

4.11.5.2 EXISTING STRUCTURES

With the entire county at risk from severe thunderstorms and tornadoes, estimates of damages are hard to determine. Realistically, an event involving a tornado or severe thunderstorm would most likely significantly affect only a small area. A large hail and strong wind event damaging the roofs, siding, and windows of 100 homes, estimating a loss of approximately 25% of the structure's value, losses would be about $5,422,500 (100 homes x $216,900/home x 25% damage). A tornado through the same community causing structural damage with a loss of approximately 50% of the structure's value, losses would be about $10,845,00 (100 homes x $216,900/home x 50% damage).

Table 4-45 and Table 4-46 show the damage indicators for various types of residential and ranch structures.

Table 4-45. Expected Damage to One- and Two-Family Residences.

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	53-80 mph (65 mph)
Loss of roof covering material (<20%), gutters, and/or awning; loss of vinyl or metal siding	63-97 mph (79 mph)
Broken glass in doors and windows	79-114 mph (96 mph)
Uplift of roof deck and loss of significant roof covering material (>20%); collapse of chimney; garage doors collapse inward; failure of porch or carport	81-116 mph (97 mph)
Entire house shifts off foundation	103-141 mph (121 mph)
Large sections of roof structure removed, most walls remain standing	104-142 mph (122 mph)
Top floor exterior walls collapsed	113-153 mph (132 mph)
Most interior walls of top story collapsed	128-173 mph (148 mph)
Most walls collapsed in bottom floor, except small interior rooms	127-178 mph (152 mph)
Total destruction of entire building	142-198 mph (170 mph)

Table 4-46. Expected Damage to Single Wide Manufactured Homes.

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	51-76 mph (61 mph)
Loss of shingles or partial uplift of one-piece metal roof covering	61-92 mph (74 mph)
Unit slides off block piers but remains upright	72-103 mph (87 mph)
Complete uplift of roof, most walls remain standing	73-112 mph (89 mph)
Unit rolls on its side or upside down, remains essentially intact	84-114 mph (98 mph)
Destruction of roof and walls leaving floor and undercarriage in place	87-123 mph (105 mph)
Unit rolls or vaults, roof and walls separate from floor and undercarriage	96-128 mph (109 mph)
Undercarriage separates from unit, rolls, tumbles, and is badly bent	101-136 mph (118 mph)
Complete destruction of unit, debris blown away	110-148 mph (127 mph)

4.11.5.3 POPULATION

The National Weather Service in Billings warns for severe thunderstorms and tornadoes when recognized on Doppler radar or by other means. The warnings are broadcast over NOAA weather radio and may be transmitted over television scrolls and cable networks such as the Weather Channel. Some events have 15-20 minutes warning time and others have little to no warning. Depending on the effectiveness of the warning reaching the population, those at greatest risk may or may not receive the warning and take precautionary measures. NOAA weather radio transmitters are located in Livingston and Mammoth, and those with specially built receivers can be alerted to weather hazards rapidly. The numerous campgrounds in the National Forests become particularly vulnerable if the warnings are not received. Depending on the significance of the storm, much of the population can be at risk if they do not take appropriate action.

Mobile homes—even if tied down—and automobiles are not safe places to be during a tornado. Besides structure failure, wind-driven projectiles and shattered glass can injure or kill occupants. Lightning strikes can occur with little to no warning, causing injury or death to those in the area.

4.11.5.4 VALUES

Severe thunderstorms and tornadoes can cause economic losses such as business closures and associated disruption losses and crop and livestock losses. Often, the agriculture losses can be the most significant. Historic values may also be lost if a historic structure is damaged. Population losses may also lead to lasting emotional impacts.

4.11.5.5 FUTURE DEVELOPMENT

The severe thunderstorm and tornado risk is assumed to be uniform countywide. Therefore, the location of development does not increase or reduce the risk necessarily. Park County and the Town of Clyde Park lack building codes, and therefore, new development might not be built to current standards for wind resistance. Building codes adopted and enforced within the City of Livingston decrease the threat to future development from severe thunderstorms and tornadoes.

4.11.6 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	All	/ $250,000 losses	/ $500,000 losses / Structural losses / Contents losses / Critical functional losses / Critical data losses	Moderate
Critical Infrastructure	All	/ $500,000 losses / Loss of electricity	/ $1,000,000 losses / Road closures / Loss of potable water / Loss of sanitary sewers / Loss of telephone	Moderate-High
Existing Structures	All	/ $2,500,000 losses	/ $5,000,000 losses / Structural losses / Contents losses / Displacement/functional losses	Moderate-High
Population	All	/ Injuries	/ Fatalities	Moderate

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Values	All	/ Agricultural losses / Cancellation of activities / Restrictions on activities / Aesthetic value losses	/ Business disruption losses / Service industry losses / Habitat damages / Historic structure losses	Moderate-High
Future Structures	Park County, Clyde Park		/ Likely to occur in hazard areas / Increases the total hazard exposure / Lacking building codes to minimize	Moderate
Future Structures	Livingston		/ Likely to occur in hazard areas / Increases the total hazard exposure / Enforces building codes to minimize	Low-Moderate

[1] Impact in addition to probable (100-year) impacts

4.11.7 DATA LIMITATIONS

Data limitations include:

- Severe weather events are only recorded if observed and reported to the National Weather Service; the rural nature of the area leaves many areas without weather spotters.
- Only a limited number of weather observation stations are located in the county.

4.12 TERRORISM, CIVIL UNREST, AND VIOLENCE

Table 4-47. Terrorism, Civil Unrest, and Violence Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

4.12.1 DESCRIPTION

Terrorism, civil unrest, and violence are human caused hazards that are intentional and often planned. Terrorism, both domestic and international, is a violent act done to try and influence government or the population of some political or social objective. Terrorist acts can come in many recognized forms or may be more subtle using untraditional methods. The primary recognized forms of terrorism are chemical, explosive, biological, radiological, nuclear, and cyber; however, terrorism's only limitation is the human imagination.

Chemical terrorism is the use of chemical agents to poison, kill, or incapacitate the population or animals, destroy crops or natural resources, or deny access to certain areas. Chemical agents can be broken into five different categories: nerve agents, vesicants, cyanide, pulmonary agents, and incapacitating agents.

Terrorism using explosive and incendiary devices includes bombs and any other technique that creates an explosive, destructive effect. Bombs can take many forms from a car bomb to a mail bomb. They can be remotely detonated using a variety of devices or directly detonated in the case of a suicide bomb.

Bioterrorism is the use of biological agents, such as Anthrax, Ricin, and Smallpox, to infect the population, plants, or animals with disease.

Radiological terrorism involves the use of radiological dispersal devices or nuclear facilities to attack the population. Exposure to radiation can cause radiation sickness, long-term illness, and even death. Terrorism experts fear the use of explosive and radiological devices in the form of a "dirty bomb" to attack the population. A "dirty bomb" is a low-tech, easily assembled and transported device made up of simple explosives combined with a suitable radioactive agent.

Nuclear weapons have the potential for causing catastrophic damage through an explosion and subsequent radiation exposure. Many countries have nuclear capabilities. Such weapons at the control of terrorists could cause significant devastation, particularly in an urban area. Most nuclear threats have been related to international unrest.

Cyberterrorism is the attack or hijack of the information technology infrastructure that is critical to the US economy through financial networks, government systems, mass media, or other systems. Any cyberattack that creates national unrest or instability would be considered cyberterrorism.

Civil unrest and violence typically occur on a smaller scale than terrorism when large groups, organizations, or distraught individuals act with potentially disastrous or disruptive results. Civil unrest can result following a disaster that creates panic in the community. Forms of civil unrest can range from groups blocking sidewalks, roadways, and buildings to mobs rioting and looting. Civil unrest may be spontaneous, as when a mob erupts into violence, or they may be planned, as when a demonstration or protest intentionally interferes with another individual's or group's lawful business. Violence can occur separately from civil unrest, as is the case with violence against police officers, or school shootings.

Most times, terrorist acts, both domestic and international, are driven by a group or hate organization. Occasionally, individuals, as was the case in the Oklahoma City bombing, perform independent acts. Usually, the perpetrators have an underlying belief that drives the act. Table 4-48 lists several, but not all, types of organizations existing in the United States that could initiate a terrorist incident.

Table 4-48. Hate Groups (Southern Poverty Law Center, 2017).

Type	Description
Alt-Right	The group believes the 'white identity' is under attack by multicultural forces, and in general combine traditional racism with ultra-conservative political ideology.

Type	Description
Anti-Immigrant	These groups generally attack immigrants as individuals, rather than merely disagreeing with immigration policy. Some have close ties to white supremacist ideas, groups, and individuals.
Anti-LBGT	These groups go beyond mere disagreement with homosexuality by subjecting lesbian, bisexual, gay, and transgender persons to campaigns of personal vilification.
Anti-Muslim	These groups exhibit extreme hostility toward Muslims and people from Middle Eastern descent.
Antigovernment Movement	Antigovernment groups define themselves as opposed to the modern modes of government, engage in conspiracy theorizing, and advocate extreme antigovernment doctrines. Some groups advocate violence as a means of disrupting current government.
Black Separatists	The group typically opposes integration and racial intermarriage, and want separate institutions, or even a separate nation, for black persons. Most forms of black separatism are strongly anti-white and anti-Semitic.
Christian Identity	This religion asserts that whites, not Jews are the true Israelites favored by God in the Bible. For decades, Christian Identity has been one of the most influential ideologies for the white supremacist movement.
General Hate	These groups espouse a variety of hateful doctrines, and generally capture those groups which do not fit in to other categories.
Hate Music	These groups are typically white power music labels that record, publish, and distribute racist music in a variety of genres.
Holocaust Denial	These groups insist that Nazi Germany did not engage in a conscious attempt to commit genocide against European Jews.
Ku Klux Klan	The organization, with its long history of violence, is the most infamous and oldest American hate group. Although black Americans have typically been the Klan's primary target, it has also attacked Jews, immigrants, homosexuals, and, until recently, Catholics.
Militia	This movement consists of right-wing extremist, armed, paramilitary groups with an anti-government, conspiracy-oriented ideology, often with a prominent focus on firearms.
Neo-Confederate	These groups embrace racist attitudes towards blacks, and in some cases, white separatism. Additionally, they are known for being hostile towards democracy, homosexuality, and women.
Neo-Nazi	These groups share a hatred for Jews and a love for Adolf Hitler and Nazi Germany. While they also hate other minorities, homosexuals, and even sometimes Christians, they perceive "the Jew" as their cardinal enemy and trace social problems to a Jewish conspiracy that supposedly controls governments, financial institutions, and the media.
Phineas Priesthood	The Priesthood is characterized by individuals, as opposed to organized groups, who glorify and promote violence against minorities and interracial couples.

Type	Description
Racist Skinhead	These groups form a particularly violent element of the white supremacist movement. Racist skinheads often operate in small "crews" that move from city to city with some regularity.
Radical Traditional Catholicism	These organizations embrace anti-Semitism ideals and theology which is typically rejected by the Vatican and mainstream Catholicism.
Sovereign Citizens Movement	These groups embrace anti-government ideologies, and some have white supremacist elements. They often believe existing government in the United States is illegitimate, and seek to restore a fictional idealized, minimalist government.
White Nationalist	These groups espouse white supremacist or white separatist ideologies, often focusing on the alleged inferiority of non-whites.

Montana has traditionally attracted activist/extremist individuals and groups because of its low population and large geographic area. Groups active in Montana vary from white supremacists to single issue groups. According to the Southern Poverty Law Center Intelligence Project, Alt-Right, antigovernment, white nationalist, and anti-Muslim groups exist in Montana, but none are present in Park County. (Southern Poverty Law Center, 2017)

The City of Livingston is the most populous part of Park County. This area, with its proximity to hazardous material facilities and government buildings, could be considered the area at greatest risk for terrorism. Domestic and international terrorism can be hard to predict, and therefore, specific targets are not easily identified.

4.12.2 HISTORY

Fortunately, Park County has no history of modern terrorism or a civil unrest incident.

4.12.3 PROBABILITY AND MAGNITUDE

With very little experience and data locally on this hazard, a specific probability for future terrorism, civil unrest, and violence is hard to determine. Based on the historical record and the terrorism threat present for the area, the probability of a large-scale terrorism, civil unrest, or violence event is considered very low.

4.12.4 VULNERABILITIES

Since the location and probability of terrorism, civil unrest, or violence is extremely difficult to determine, two scenarios were used to determine potential losses. The first is the bombing of a critical facility. The second is a major terrorist attack with direct impact on the county.

4.12.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

Critical facilities in Park County are at greatest risk from terrorism, civil unrest, and violence. Often, terrorists target facilities that are highly important for government services and community stability or are particularly vulnerable. Threat data is not specific enough to identify what facilities are most vulnerable, and therefore, all critical facilities are considered to have the same risk countywide. Those facilities with

barriers, security, and other forms of protection could be at lower risk. Most facilities in Park County, however, do not have those protections.

Critical infrastructure often relies on complex and interdependent systems. A major system failure usually has widespread consequences.

4.12.4.2 EXISTING STRUCTURES

Residential structure losses are possible from terrorism, civil unrest, and violence but are not likely. Often the losses are at critical facilities or to the population. Looting, however, can be commonly found in association with these types of events. Therefore, this hazard places both the population and property at risk. Urban areas, places of public gathering, and important government or economic assets are generally going to be the areas of greatest risk.

4.12.4.3 POPULATION

The effects of terrorism, civil unrest, and violence are usually felt by the population. The greatest risk is to human lives during times of unrest. Terrorists typically try to make a dramatic impact that will generate media interest. Attacking the population through a large loss of life is a common tactic. Depending on the type of attack, casualties could be light or involve much of the Park County population.

4.12.4.4 VALUES

Depending on the type and location of the incident, economic losses could range from general national economic slowdowns to the destruction of local businesses. Livestock and the environment are additionally at risk from biological, chemical, and radiological attacks.

4.12.4.5 FUTURE DEVELOPMENT

Development should have little to no impact on the terrorism, civil unrest, and violence threat. The exception would be the increase in population and the associated increase of potential losses to life and property within the county. With larger communities around, however, development should have little effect in this regard.

4.12.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	All	/ $100,000 losses / Critical functional losses / Clean-up/debris removal costs	/ $500,000 losses / Structural losses / Contents losses / Critical data losses	Moderate-High

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Infrastructure	All	/ Road closures	/ $1,000,000 losses / Loss of electricity / Loss of utility gas / Loss of potable water / Loss of sanitary sewers / Loss of telephone service / Loss of internet service / Fuel/energy shortages	Moderate-High
Existing Structures	All	/ Displacement/functional losses / Clean-up/debris removal costs	/ $1,000,000 losses / Structural losses / Contents losses	Low-Moderate
Population	All	/ Illness / Injuries / Fatalities		High
Values	Park County, Clyde Park	/ Business disruption losses / Emotional impacts / Cancellation of activities / Restrictions on activities	/ Service industry losses / Agricultural losses / Reduced air quality / Reduced water quality / Soil contamination / Historic structure losses / Historic site losses / Historic item losses / Aesthetic value losses	Moderate-High
Future Structures	Livingston		/ Somewhat likely to occur in hazard areas / Increases the total hazard exposure	Low-Moderate

[1] Impact in addition to probable (100-year) impacts

4.12.6 DATA LIMITATIONS

Data limitations include:

- Inability to quantify the probability and magnitude of a terrorist, civil unrest, or violence incident.
- General uncertainties related to how and when future terrorist, civil unrest, and violence incidents may occur.

4.13 URBAN FIRE

Table 4-49. Urban Fire Federal Major Disaster and Emergency Declarations

Declaration	Year	Casualties	Damages	Comments
None				

4.13.1 DESCRIPTION

Fire is the result of three components: a heat source, a fuel source, and an oxygen source. When combined, these three sustaining factors will allow a fire to ignite and spread. Within a structure, a small flame can get completely out of control and turn into a major fire within seconds. Thick black smoke can fill a structure within minutes. The heat from a fire can be 100°F at floor level and rise to 600°F at eye level. In five minutes, a room can get so hot that everything in it ignites at once; this is called flashover. (US Fire Administration, 2011)

Fires classified as urban fires generally occur in cities or towns. These fires can spread quite rapidly to adjoining buildings or structures. Urban fires damage and destroy a great number of schools, homes, commercial buildings, and vehicles across the nation every year.

Although structure fires are usually individual disasters and not community-wide ones, the potential exists for widespread structure fires that displace several businesses or families. Communities with buildings relatively close together, such as Livingston and Gardiner, are especially vulnerable. Clyde Park, although not particularly dense, has primarily older wood construction and is also vulnerable. Fires that rage uncontrollably despite firefighting efforts and burn several structures or an important community facility could have significant economic and quality of life impacts. Strong winds common to the area are known to carry fire easily. Large fires of this nature have also been known to require significant community resources if lives are lost.

Smoke detectors, automatic fire alarm systems, automatic sprinkler systems, fire doors, and fire extinguishers can all prevent deaths, injuries, and damages from fire. Automatic sprinkler systems are especially important in preventing a small fire from becoming a conflagration. Some downtown buildings have been retrofitted with sprinklers while others have not. Other older structures in the county such as the buildings at Chico Hot Springs Resort also threaten to be large fire hazards. Businesses with special inventory, such as Golden Ratio Woodworks, south of Emigrant, could also potentially have large fires. Newer resort areas, such as the Crazy Mountain Ranch, still present fire hazards but fortunately have been mitigated significantly through the installation of sprinkler systems.

4.13.2 HISTORY

Park County, the City of Livingston, and the Town of Clyde Park have experienced devastating fires for individuals and businesses. Table 4-50 lists some of the more disastrous urban fires based on fire department records. None of these fires have resulted in a major loss of life. The fire departments were not able to provide updated records.

Table 4-50. Large Structure Fires (Park County Rural Fire District, 2005).

Date	Location
February 29, 1904	"Post Office Block" in Livingston was destroyed.

Date	Location
August 10, 1969	Grand Hotel Block in Livingston was destroyed. Damages were estimated at $1 million.
October 26, 1975	Cave Supper Club in downtown Livingston destroyed the city block.
July 14, 1979	A fire at the Chico Hot Springs Resort resulted in approximately $10,000 in damage.
April 1, 1980	Sumner's Warehouse Carpet and Supply fire caused approximately $110,000 in damages.
March 22, 1981	Calamity Jane's Gambling Parlour and Saloon in downtown Livingston destroyed that city block.
September 7, 1985	Arsonists destroyed the Livingston Middle School.
November 17, 1985	Gardiner High School was destroyed.
Spring 1995	A propane leak at Chico Hot Springs led to an explosion at the resort. Fortunately, due to the time of the explosion, no one was hurt.
April 2004	An underground liquid propane line at the Crazy Mountain Ranch caught fire, flashed, and continued to burn for two days until all the propane burned off. Fortunately, no buildings were damaged, and losses were confined to just the underground tanks and the liquid to gas converter.

4.13.3 PROBABILITY AND MAGNITUDE

Several important structures exist that could have significant impacts to community members should they be lost. Estimating the probability of fires in these buildings is difficult to determine. The structures lacking automatic sprinkler systems have a greater probability of a major structure fire. The fire death rate in 2014 was 15.8 deaths and 28.1 injuries per 1,000 residential structure fires. (US Fire Administration, 2014)

A realistic yet devastating scenario for Park County is the destruction of several buildings or critical facilities. The county, city, and town do carry insurance for their buildings for fire. Of even greater magnitude would be a structure fire in which several people were trapped and killed.

4.13.4 VULNERABILITIES

Since the location and probability of a significant urban fire is extremely difficult to determine, two scenarios were used to determine potential losses. The first is the loss of a critical or important business facility. The second is the loss of several downtown blocks in a Park County community.

4.13.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

All critical facilities are at risk from fire. Structure fires at a critical facility could lead to losses in critical functions, records, and supplies or temporary delays in emergency response. Facilities housing vulnerable populations present building evacuation challenges, depending on the type of facility, and may result in special needs sheltering or school cancellations. Most critical facilities within the downtown areas of Livingston and Gardiner have fire suppression sprinkler systems, and therefore, should not be affected by a large urban fire.

Depending on the type of infrastructure, an urban fire could result in short-term disruptions while services are rerouted. In the case of a supporting facility, such as the water treatment plant or a sewer lift station, long-term disruptions could be seen. For example, a fire at an electric substation may leave an area without power for several hours or days. A fire at the water treatment plant may leave the community without water for days or weeks.

4.13.4.2 EXISTING STRUCTURES

Fire losses to residential and commercial structures are usually covered by insurance, but can be devastating to the building occupants, particularly for primary residences. These types of events often do not result in community-wide disasters, unless the structure is critically important to the economy or many structures are lost.

4.13.4.3 POPULATION

Depending on the time and location, a major urban fire could result in the loss of life either to firefighters or building occupants. The potential for this type of loss is difficult to determine due to advances in firefighter safety and the installation of sprinkler and alarm systems in some structures. Those structures lacking smoke detectors or adequate exits are especially dangerous to the population. Should lives be lost, significant resources could be needed to manage the recovery.

4.13.4.4 VALUES

Urban fires often result in significant business disruption losses. Historic values are also frequently lost in urban fires. The loss of life may result in lasting emotional impacts.

4.13.4.5 FUTURE DEVELOPMENT

Most development, unless urban or industrial in nature, will have little impact on the potential for a significant urban fire. All structures, including new development, will continue to be at risk for fire, but development that includes fire suppression and alerting systems will better protect contents and occupants. In Park County and Clyde Park, some commercial and multi-residential development is regulated with respect to fire regulations, but most new development is not. In the City of Livingston, new development must meet current fire building codes.

4.13.4.6 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	All	/ $100,000 losses / Structural losses / Contents losses / Critical functional losses / Critical data losses / Clean-up/debris removal costs	/ $500,000 losses	Moderate

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Infrastructure	All		/ $500,000 losses / Physical losses / Road closures / Loss of electricity / Loss of utility gas / Loss of potable water / Loss of sanitary sewers / Loss of telephone	Low-Moderate
Existing Structures	All		/ $3,000,000 losses / Structural losses / Contents losses / Displacement and functional losses	Moderate
Population	All	/ Injuries / Fatalities		Moderate
Values	All	/ Business disruption losses / Reduced air quality / Historic structure losses / Historic site losses	/ Emotional impacts / Cancellation of activities / Restrictions on activities	Moderate
Future Structures	Park County, Clyde Park		/ Likely to occur in hazard areas / Increases the total hazard exposure / Lacking building	Moderate
Future Structures	Livingston		/ Likely to occur in hazard areas / Increases the total hazard exposure / Enforces building codes to	Low-Moderate

[1] Impact in addition to probable (100-year) impacts

4.13.5 DATA LIMITATIONS

Data limitations include:

- Quantifying the risk of urban fires given the unique fire hazards of each structure.

4.14 UTILITY OUTAGE

Table 4-51. Utility Outage Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

4.14.1 DESCRIPTION

A utility outage is an interruption in the distribution of services or supplies or interruption in the collection of waste materials. Utilities include, but are not limited to, potable water supplies, electricity, propane, sewage treatment/disposal, natural gas, gasoline/diesel fuels, telephone and internet services, and garbage disposal. Normal activities usually cannot be sustained in a specific area or region because of the failure.

The public has come to rely upon utility, communication, energy, and fuel services for everyday life and basic survival. Many in Park County depend on the typical utility, energy, and communication infrastructure such as water, sewer, electricity, propane, natural gas, telephone, internet, and gasoline. Water and sewer services are either provided through a public system or through individual wells and septic systems. Electricity is primarily provided by regional electric companies through overhead or buried lines. Homes and businesses are heated with fuels such as natural gas, propane, and electricity. Those buildings heated with propane typically have a nearby tank that is refilled regularly by a local vendor but still rely on electricity to power their heating systems. Natural gas is provided through underground piping. Telephone, cellular telephone, and internet services are provided by several local and national companies. Privately-owned gas stations are located throughout the county.

Almost any hazard can cause a utility outage, but disruptions can also occur due to human error, equipment failures, global markets, or low supplies. The most common hazards that interrupt electric services are heavy snow, ice, and wind. Water supplies may be threatened by drought. Sewer services can be disrupted by flood. Often these types of outages are short lived. Crews quickly respond and resolve the problem causing the failure. During a widespread or complicated outage, services may be down for days or even weeks. Most problems arise during these longer-term outages. For example, electricity is needed to maintain water supplies and sewer systems, but also to run blowers for heating systems. Essentially, without electricity, most facilities are without heat, water, fuel, or other appliances during a long-term outage. This problem becomes particularly significant during the cold winter months. Telephone services are important for day-to-day business but are most important for 911 communications in an emergency. Without telephone service, emergency services can be severely delayed. In most cases, a long-term utility failure would force many businesses to close until the services were restored. Gasoline shortages are also common during times of disaster. Oil embargos, wars, and world politics are all events that could affect the availability of petroleum products in Park County.

Park County and its communities could experience several different types of utility outages. The most likely failures are in the distribution of electricity, natural gas, and gasoline/diesel. These types of outages

could prove to be most devastating during the winter months. Winters can be long and very cold. Homes and businesses need heating fuels, while the agriculture industry must have diesel and gasoline to keep the farm or ranch operating. During summer months, the agriculture industry again requires large quantities of fuel to complete their farming operations.

Electrical service is provided by two power companies. Park Electric Cooperative supplies the county with electricity while NorthWestern Energy is responsible for supplying electricity and natural gas. NorthWestern Energy has two transmission lines crossing the county. Park Electric primarily serves the outlying areas and rural communities of Park County. NorthWestern Energy is responsible for supplying Livingston and areas near Livingston. Along with above ground electrical utility lines, Park Electric and NorthWestern Energy have numerous substations. NorthWestern Energy also has a network of underground natural gas lines. Each jurisdiction and/or business is responsible for the care and operation of other utilities including water treatment plants, wastewater treatment plants, and gasoline, diesel, and propane bulk plants.

4.14.2 HISTORY

Residents of Park County regularly experience short-term utility and energy outages for a variety of reasons. Typically, these short-term outages do not cause significant problems.

On October 17, 1973, the Organization of the Petroleum Exporting Countries (OPEC) imposed an oil embargo on the United States. The embargo came at a time when 85% of American workers drove to their places of employment each day. President Nixon set the nation on a course of voluntary rationing. He called upon homeowners to turn down their thermostats and for companies to trim work hours. Gas stations were asked to hold their sales to a maximum of ten gallons per customer. In the month of November 1973, Nixon proposed an extension of Daylight Savings Time and a total ban on the sale of gasoline on Sundays. The price at the pump rose from 30 cents a gallon to about $1.20 at the height of the crisis.

Park County has not experienced gasoline shortages like large metropolitan areas, however, drastic price fluctuations have occurred, thus affecting travel, availability of fuels, and the economics of the county. Increases in gasoline and diesel prices create hardships on consumers, especially those in the agriculture industry.

4.14.3 PROBABILITY AND MAGNITUDE

With a limited history of events, the probability of utility outages can only be theorized. Generally, electric power outages are the most common and are often short-lived, though electric outages do have the potential to cause significant problems. Gasoline shortages have also been problems in the past but have been limited to economic and social losses. Natural gas, propane, and water shortages are possible, but given a limited history of such, are somewhat less likely.

Possibly the most significant utility outage scenario for Park County is the loss of electricity for a week or more during a particularly cold winter spell. Without generators, an extended power outage could additionally lead to the loss of running water, sewer services, and the ability to heat buildings, which in turn may lead to pipe ruptures. Any equipment such as medical equipment, computers, and cell phones

requiring power to run would eventually be incapacitated. Those facilities with generators would still be able to use appliances, equipment, and heating systems, however, community water and sewer services may not be available. Such a long-term outage could lead to emergency sheltering and necessitate the activation of other emergency resources.

4.14.4 VULNERABILITIES

Since the extent and impacts of a significant utility outage is extremely difficult to determine, two scenarios were used to determine potential losses. The first is the loss of a public water supply for an extended period. The second is a long-term electric outage during the winter.

4.14.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

Most utility outages do not directly impact structures; however, an electric outage during winter could result in frozen and burst water pipes, causing water damage within the interiors of structures. A natural gas, propane, or fuel oil shortage could produce similar results.

Electricity and gasoline disruptions could also limit the ability to provide emergency services. Some critical facilities do have back-up generators in case of an electricity outage. These facilities include the Livingston City/County Complex which serves as an EOC during times of disaster and provides 911 services. Others, however, may have limited functionality following an event due to a utility failure. For example, medical and special needs facilities require electricity for certain types of medical equipment to work. Gas station pumps may not operate without electricity, and therefore, emergency vehicles may not have enough fuel during long term outages. Gasoline shortages could also limit the fuel available for emergency responders.

Energy providers typically rely on established infrastructure to provide services and materials. Therefore, energy failures are often related to problems with the infrastructure. Minor damages or problems may indicate a short-term outage whereas large scale damages may suggest a long-term outage. Many services rely on other utilities to operate. For example, the water supply pumps and sewer lift stations both require electricity to continue operations. One or both may go down during long-term electric outages. Propane and gasoline refills require the transportation network to be open since deliveries are done by truck. This interdependency can lead to more complex utility outage problems.

4.14.4.2 EXISTING STRUCTURES

Similar to critical facilities, structures across the county could be without heat during an electric, natural gas, propane, or fuel failure. During cold weather, structures without heat may be uninhabitable for a time. Generally, structures are not directly affected by utility outages, but in some cases, direct damages may result.

4.14.4.3 POPULATION

Over the past 100 years, the population has become more and more dependent on the nation's critical infrastructure and systems. Heat, running water, sanitation, communications, grocery stores, and pharmacies all require electricity, and without these services in the long term, the population may suffer. Natural gas, propane, fuel oil, and electricity are critical for heat, especially during the cold winter months. Approximately, 2,770 homes in Park County rely on natural gas for heat, 1,431 rely on propane, and 1,213 rely on electric heat. Personal and commercial food supplies may spoil during extended power outages.

Water is needed for cooking, cleaning, and drinking, and sewer is needed for sanitation. Each is important for the health and safety of humans. Without these services, emergency resources may be needed. Emergency supplies can often hold the populations over temporarily but may take some time before arriving, in which case, individuals may need to rely on their own personal supplies.

4.14.4.4 VALUES

Utility outages often result in business disruption losses as most businesses rely on utilities for production, sanitation, or employee wellbeing.

4.14.4.5 FUTURE DEVELOPMENT

Where future development occurs is not directly tied to increased utility and energy failures. Increased populations add to the challenges of managing a long-term failure but would not increase the damages necessarily.

4.14.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	All	/ Critical functional losses	/ $0 losses	Low-Moderate
Critical Infrastructure	All	/ Loss of electricity / Loss of utility gas / Loss of potable water / Loss of sanitary sewers / Loss of telephone service / Loss of internet service / Fuel/energy shortages	/ $0 losses	Moderate-High
Existing Structures	All		/ $0 losses / Displacement/ functional losses	Low-Moderate
Population	All		/ Illness / Injuries / Fatalities	Moderate
Values	All	/ Business disruption losses / Service industry losses / Restrictions on activities	/ Agricultural losses / Emotional impacts / Cancellation of activities	Moderate

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Future Structures	All		/ Likely to occur in hazard areas / Increases the total hazard exposure	Low-Moderate

[1] Impact in addition to probable (100-year) impacts

4.14.6 DATA LIMITATIONS

Data limitations include:

- / Quantifying the type and length of failures that begin to cause significant problems.
- / Limited historical occurrence and related data prevents accurately estimating potential losses.

4.15 VOLCANO

Table 4-52. Volcano Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

4.15.1 DESCRIPTION

Park County does not have any known active volcanoes; however, the Yellowstone Caldera within Yellowstone National Park is just south of Park County, and dense volcanic ash can travel hundreds of miles. The last non-hydrothermal eruption in the Yellowstone Caldera was thousands of years ago. Currently, the most active region in the continental United States is the Cascade Range to the west in Washington and Oregon, about 500 miles away. This region includes the volcanoes at Mount St. Helens, Mount Rainer, and Mount Hood. Park County lies within reasonable range of ashfall from these volcanoes under normal upper atmospheric wind and stability conditions. In addition to ashfall and other effects, large eruptions have been known to change weather patterns globally.

The Yellowstone Caldera, one of the world's largest active volcanic systems, has produced several giant volcanic eruptions in the past few million years, as well as many smaller eruptions and steam explosions. Although no eruptions of lava or volcanic ash have occurred for many thousands of years, future eruptions are likely. Over the next few hundred years, hazards will most likely be limited to ongoing geyser and hot-spring activity, occasional steam explosions, and moderate to large earthquakes. To better understand Yellowstone's volcano and earthquake hazards and to help protect the public, the US Geological Survey, the University of Utah, and Yellowstone National Park formed the Yellowstone Volcano Observatory, which continuously monitors activity in the region. (US Geological Survey, 2005)

If a large caldera-forming eruption were to occur at Yellowstone, its effects would be felt worldwide. Thick ash deposits would bury vast areas of the United States, and the injection of huge volumes of volcanic gases into the atmosphere could drastically affect global climate. Fortunately, the Yellowstone volcanic system shows no signs that it is headed toward such an eruption. The probability of a large caldera-forming eruption within the next few thousand years is exceedingly low. Any renewed volcanic activity at Yellowstone would most likely take the form of non-explosive lava eruptions. (US Geological Survey, 2005)

An eruption of lava could cause widespread havoc in the Park, including fires and the loss of roads and facilities, but more distant areas such as Livingston would probably remain largely unaffected.

The Cascade Region does not have the same caldera-forming potential as Yellowstone but has been much more active in recent years. The volcanoes in this region can drop and have dropped measurable ash over Montana. Volcanic ashfall may not sound harmful hundreds of miles away, but depending on the volume of ash that falls, it can create problems. Ash in the air can affect those with respiratory sensitivities, reduce visibilities, and clog air intakes. Its corrosive properties can damage vehicles and other machinery. When wet, ash becomes glue-like and hard to remove. Even relatively small amounts of airborne ash can disrupt air travel.

The areas affected by volcanic eruptions are dependent on the type of eruption and the prevailing wind direction. In an actual event, models would be used to predict the areas that would receive ash and other effects from the volcano. Lacking specific eruption data, the county is assumed to have the same risk countywide for a Cascade Range eruption and decreasing risk from south to north for a Yellowstone eruption.

4.15.2 HISTORY

On May 18, 1980, Mount St. Helens in the Cascade Range of Washington erupted, sending ash high into the atmosphere. Over the course of several days, the ash fell from the sky, primarily over eleven states, including Montana. Less than a half inch fell over Park County, as shown in Figure 4-4. The Montana Governor asked businesses to close and individuals with breathing problems to stay indoors until the threat was assessed. No reports of structure damage were received, and the health concerns lasted for a three-day period.

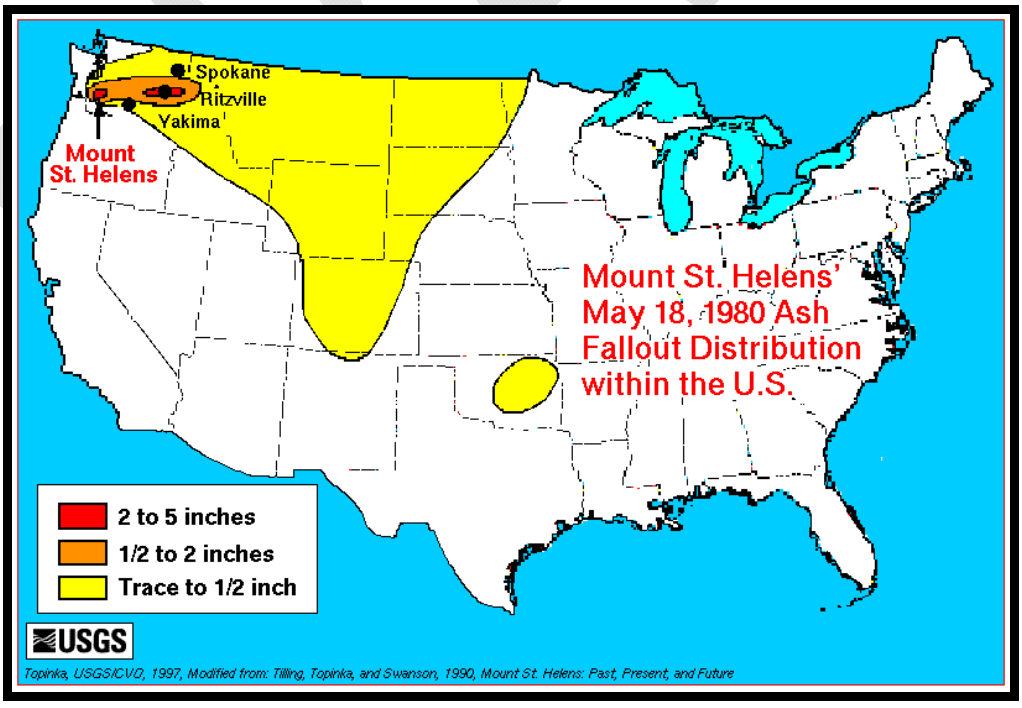


Figure 4-4. Ashfall from Mount St. Helens (Cascades Volcano Observatory, 2011)

The Yellowstone region has produced three exceedingly large volcanic eruptions in the past 2.1 million years. In each of these cataclysmic events, enormous volumes of magma erupted at the surface and into the atmosphere as mixtures of red-hot pumice, volcanic ash (small, jagged fragments of volcanic glass and rock), and gas that spread as pyroclastic ("fire-broken") flows in all directions. Rapid withdrawal of such large volumes of magma from the subsurface then caused the ground to collapse, swallowing overlying mountains and creating broad cauldron-shaped volcanic depressions called "calderas." (US Geological Survey, 2005) Studies have shown that ash from each of these eruptions fell where Park County now sits.

4.15.3 PROBABILITY AND MAGNITUDE

Volcanic eruptions are rare events when compared to other hazards. Scientists evaluate natural hazards by combining their knowledge of the frequency and the severity of hazardous events. In the Yellowstone region, damaging hydrothermal explosions and earthquakes can occur several times a century. Lava flows and small volcanic eruptions occur only rarely - none in the past 70,000 years. Massive caldera-forming eruptions, the most potentially devastating of Yellowstone's hazards, are extremely rare - only three have occurred in the past several million years. U.S. Geological Survey, University of Utah, and National Park Service scientists with the Yellowstone Volcano Observatory (YVO) see no evidence that another such cataclysmic eruption will occur at Yellowstone in the foreseeable future. Recurrence intervals of these events are neither regular nor predictable. (US Geological Survey, 2005) Figure 4-5 shows the probability of the various events that can occur in Yellowstone National Park.

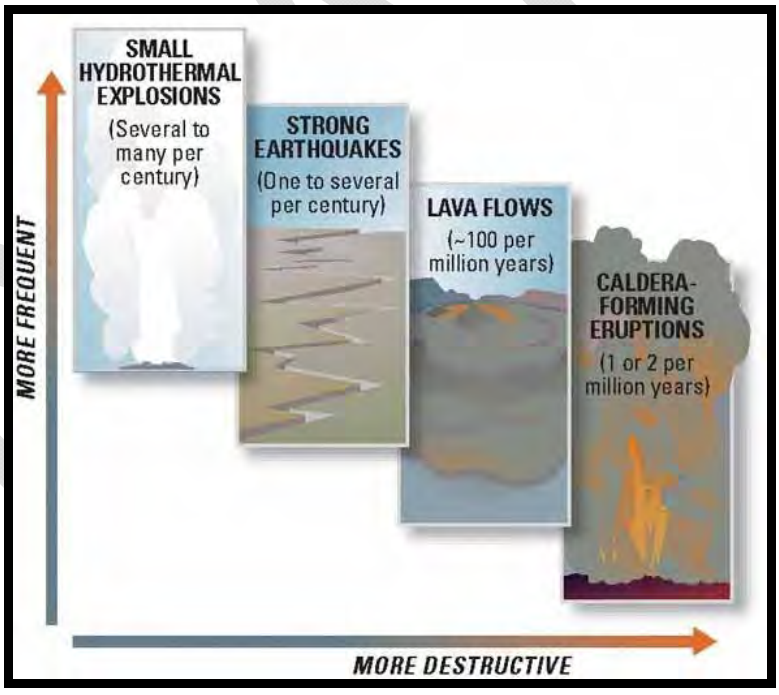


Figure 4-5. Recurrence Intervals (US Geological Survey, 2005)

The Cascade region, being more active, has a higher probability of eruptions over the next 100 years. Based on eruptions in the Cascade region over the past 4,000 years, the probability of an eruption is about 1.25% in any given year or approximately 1-2 eruptions per 100 years within the Cascade Range.

4.15.4 VULNERABILITIES

Given that volcanic eruptions are such infrequent events, two scenarios were used to determine potential losses. The first is an eruption in the Cascade Region that drops about an inch of ash over Park County. The second is an eruption of the Yellowstone Caldera causing catastrophic damage.

4.15.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

All critical facilities are at risk from volcanic eruptions. The impact on the facilities will depend on the amount of ash that falls and the ability to remove it. Significant amounts of ash have the potential to clog air systems and shut down facilities. Given enough wet, heavy ash, the potential exists for roofs to fail. Infrastructure exposed to the ash fall, such as power systems, could be brought down by the ash as well. The removal of ash from government facilities and infrastructure could potentially create costs beyond the community's capabilities. With the reduced visibilities and volcanic ash in the air, aircraft may not be able to fly to the affected area to provide medical or emergency supplies. Therefore, all critical facilities and vulnerable populations are vulnerable to ash fall.

4.15.4.2 EXISTING STRUCTURES

During Mount St. Helens' 1980 eruption, the greatest costs came from the difficult task of removing volcanic ash. The greatest threat is not necessarily to people or residences but to property such as vehicles and equipment. The volcanic dust is corrosive to metals and without proper removal can cause damages to property. In a Yellowstone eruption, the potential for heavy, wet ash could threaten structures by collapsing roofs. The probability of an event of this magnitude is very low.

4.15.4.3 POPULATION

Light ash fall does not significantly impact the population if those with respiratory sensitivities remain indoors. Ash fall conditions that exist for several days, however, could lead to significant health problems for many in Park County. The extremely rare major Yellowstone eruption could lead to deaths to those close to the Park from pyroclastic flows and extreme amounts of falling ash. The degree of population impacts will greatly vary depending on the type of event.

4.15.4.4 VALUES

The economy, particularly the tourist economy, could be severely affected should an eruption occur or be imminent.

4.15.4.5 FUTURE DEVELOPMENT

Future development will have little to no effect on the volcano hazard. Any new development will be exposed to the volcano hazards of Park County and increase the population and property values at risk. Building codes in the City of Livingston may decrease the probability of structure failures.

4.15.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	All	/ Critical functional losses / Clean-up/debris removal costs	/ $1,000,000 losses / Structural losses / Contents losses / Critical data losses	Low-Moderate
Critical Infrastructure	All		/ $5,000,000 losses / Road closures / Loss of electricity / Loss of potable water / Loss of telephone service	Moderate
Existing Structures	All	/ Clean-up/debris removal costs	/ $1,000,000 losses / Structural losses / Contents losses / Displacement/functional losses	Low-Moderate
Population	All	/ Illness	/ Injuries / Fatalities	Moderate
Values	All	/ Agricultural losses / Habitat damages / Reduced air quality / Reduced water quality / Soil contamination / Restrictions on activities / Aesthetic value losses	/ Business disruption losses / Service industry losses / Biodiversity losses / Historic structure losses / Historic site losses / Historic item losses / Emotional impacts / Cancellation of activities	Moderate-High
Future Structures	Park County, Clyde Park		/ Likely to occur in hazard areas / Increases the total hazard exposure / Lacking building codes to minimize	Low-Moderate

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Future Structures	All		/ Likely to occur in hazard areas / Increases the total hazard exposure / Enforces building codes to minimize losses	Low

[1] Impact in addition to probable (100-year) impacts

4.15.6 DATA LIMITATIONS

Data limitations include:

- / Difficulties in predicting future volcanic activity and the associated impacts due to the low frequency of eruptions.

4.16 WILDFIRE

Table 4-53. Wildfire Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
FEMA-DR-1340	2000	None	$11,579,000	Individual Assistance was received for most of state
FEMA-FSA-2321	2000	None	$110,723	Fire Suppression Assistance

Note: Some information for this hazard profile was summarized from the Park County Community Wildfire Protection Plan adopted in 2014. The Park County Community Wildfire Protection Plan remains an important stand-alone document and provides additional detail regarding the wildfire hazard and response capabilities in the county.

4.16.1 DESCRIPTION

A wildfire is an uncontrolled fire in a vegetated area. Wildfires are a natural part of the ecosystem. They have a purpose in nature, and following years of fire suppression, many areas have built up fuels that can lead to larger, more intense fires. Fuels in Park County range from dense timber stands in varying terrain to native grasslands. Douglas fir, lodgepole pine, Engelmann spruce, sagebrush, rough fescue, and other grasses make up many of the wildland fuels in the county. Periods of drought, disease, insect infestations, and low fire activity may all lead to an increase in hazardous fuels. These fuels burn rapidly and readily when cured. These types of fires have the potential to destroy structures and natural resources while producing heavy amounts of smoke, particularly when spread by strong winds.

Any flame source can trigger a wildfire, but they are most often triggered by lightning, human carelessness, arson, or train sparks. Once ignited, ambient conditions dictate whether the fire will spread or not. Moist, cool, and calm conditions or a lack of fuels will suppress the fire, whereas, dry, warm, and

windy conditions and dry fuels will contribute to fire spread. The terrain, accessibility, and capabilities of the fire agencies are also factors in the fire's growth potential. Problems with wildfire occur when combined with the human environment. People and structures near wildfires can be threatened unless adequately protected through evacuation, mitigation, or suppression.

Wildfire occurrence is weather dependent and highly variable from year to year. Fire season generally runs from March through November, but wildfires can occur at any time of year. The light, flashy fuels and the heavy, fire-sustaining timber present in the region can produce large, fast moving wildfires. Forest fires can travel quickly through the crowns of trees or spread along the forest floor. Grass fires are common in non-irrigated fields and open areas scattered with sage brush and native grasses due to the arid climate during almost any season but winter. Both types of wildfires are often aggravated by the exceptionally windy conditions in parts of the county. The Gallatin National Forest, Lewis and Clark National Forest, Custer National Forest, Absaroka-Beartooth Wilderness, Yellowstone National Park, and other state and federal lands regularly experience wildfires, and the mixed fuels and rugged terrain of those areas make firefighting especially difficult. The privately-owned timber, shrub, native grass, and non-irrigated lands in the remainder of the county also present significant wildfire hazards.

Park County has large areas of government owned lands. The national forests and Absaroka-Beartooth Wilderness are managed by the US Forest Service. Yellowstone National Park is managed by the National Park Services. Scattered across the county are tracts of land managed by the US Bureau of Land Management and state government. This scattering of government and private ownership can present unique firefighting challenges and opportunities. Map 3-4 in the Current Land Use section shows the government land ownership in the county.

Problems with wildfire occur when combined with the human environment. Most structures are flammable, and therefore, are threatened when wildfire approaches. In addition, a significant loss of life could occur with residents who do not evacuate, firefighters, and others who are in the wildfire area. Infrastructure such as electric transmission lines, fuel tanks, and radio transmission towers are not often equipped to withstand the heat from a wildfire. Timber resources, animal habitats, and waterways can all be damaged leading to negative economic and environmental impacts. The area where human development meets undeveloped, vegetative lands is called the wildland urban interface (WUI). The most extreme situation with respect to fuel conditions and values at risk occurs in rural subdivisions where numerous high-value individual homes and subdivisions are located in the wildland urban interface area near the National Forest boundary.

Wildland urban interface areas include subdivision and private lands with structures in the following locations (Park County, 2014):

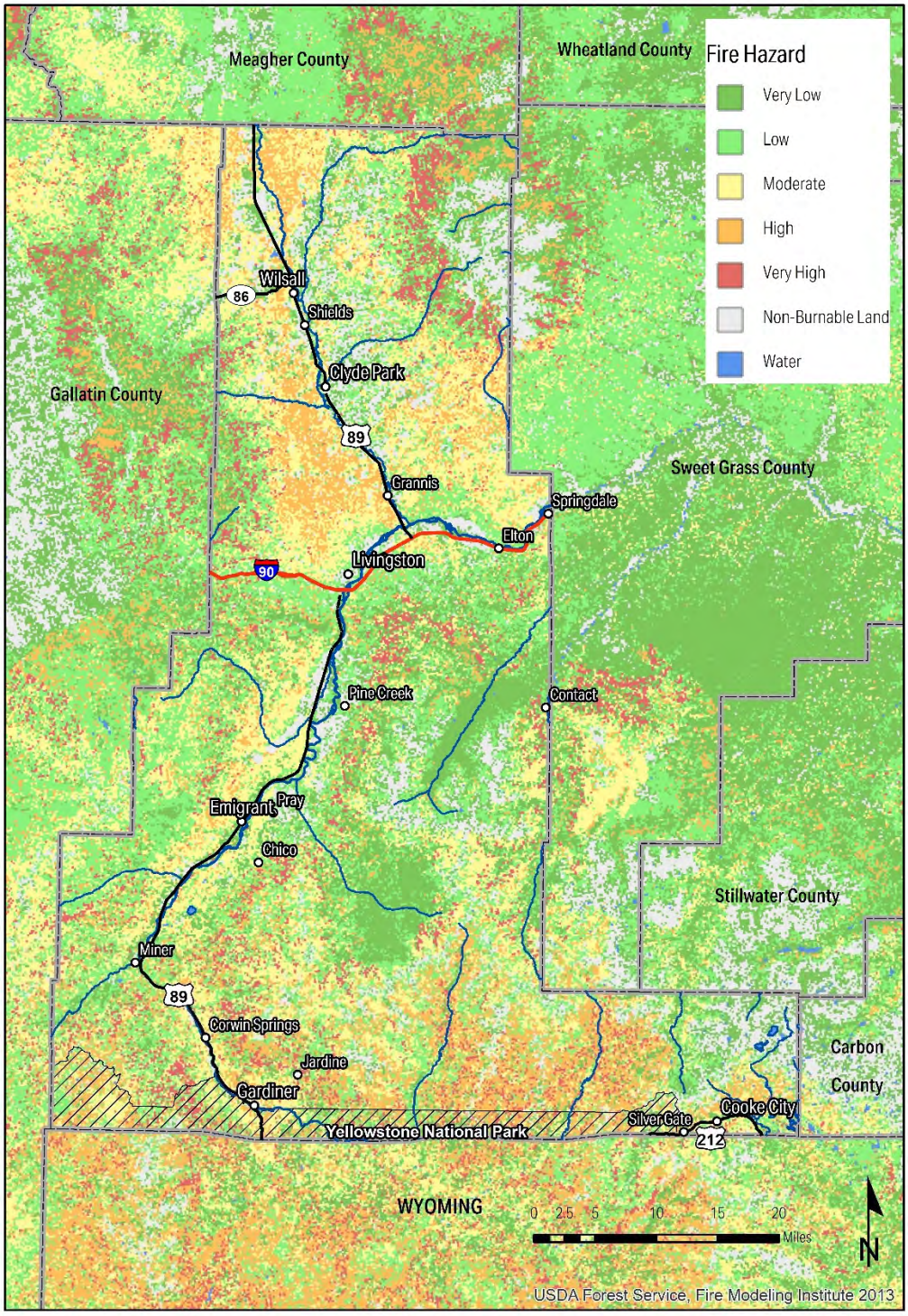
- Cooke City
- Gardiner
- Chico
- Old Chico
- Glastonbury area
- Rock Creek South

- Cottonwood Creek
- Jardine
- Livingston Peak
- Ninth Street Island
- Pine Creek
- Silver Gate
- Mill Creek
- Deep Creek
- Big Creek
- Mission Creek
- West Boulder
- Wine Glass area

Wildfire potential is mapped in a variety of ways. Since many factors play into wildfire risk, components are often mapped individually. Vegetation type outlines the type of fuels available for wildfires. In the case of agriculture, the flammability depends on the crop and its condition at that point in the growing season. Grasslands and shrublands are not usually managed significantly and may contain a build-up of flashy fuels year-round. Dense, evergreen, timber areas are usually at risk for crown fires. Areas within the general proximity of evergreen trees were categorized as "high" hazard. Areas within the general proximity of shrublands, prairie grasses, and agricultural fields, essentially the remainder of the county with the exception of the City of Livingston, were categorized as "moderate" hazard. The City of Livingston was categorized as "low" hazard due to its urbanized setting and local fire protection. These generalizations allow for planning estimations. The actual wildfire hazard for a particular structure can only be determined based on a site evaluation or other assessment tool such as that found on the Park County website. Map 4-10 displays the wildfire potential throughout the county and in surrounding areas, as determined by the USDA Forest Service. (Fire, Fuel, Smoke Science Program, 2013)

Wildfire Potential

Park County, Montana



Data Source: Varied
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
September 2017

Map 4-10. Wildfire Hazard.

The heavy smoke produced by a wildfire, often trapped in the valleys of Park County due to inversions, can cause unhealthy air conditions that may affect those with respiratory problems and otherwise healthy people. Smoky conditions can also lead to poor visibility and an increased probability of ground transportation or aircraft accidents. Besides air pollution, water pollution may also occur during and after a wildfire. Many watersheds in wildland areas serve as the public water supplies for area communities. Should a significant wildfire pass through the area, pollution of the watershed can occur. With vegetation removed and the ground seared from a wildfire, the area also becomes more prone to flash floods and landslides because of the ground's reduced ability to hold water.

4.16.2 HISTORY

Park County has a long history of wildfires from small to large. Some have caused damages and others have not. The extent of damages often depends on the proximity to the wildland urban interface, fire spread rates, and the effectiveness of suppression and mitigation measures. The history of wildfires can be difficult to compile because the various firefighting entities involved and a variety of recordkeeping measures over the years. The following events have been complied based on fire department records, firefighters' memories, a National Forest database, and other miscellaneous sources.

1983 - In April 1983, a large grass fire burned west of Livingston and south of Interstate 90. The Wan-I-Gan Fire near Emigrant that year destroyed 6 cabins.

July 1985 - A lightning sparked fire at the base of Sheep Mountain threatened 5 homes and burned 1,000 acres.

1988 - The Greater Yellowstone Fires of 1988, including some areas extending into Park County as shown in Map 4.16.2A, covered 2.3 million acres, employed an estimated 25,000 firefighters, and cost nearly $120 million for fire suppression. Park County Resolution # 274, issued on September 6, 1988, ordered the evacuation of Cooke City and Silver Gate. One firefighter and one pilot were killed and structure losses were estimated at $3 million, mostly within Yellowstone National Park. The Hellroaring and Storm Creek Fires were the largest ones to go through Park County.

1991 - The Thompson Creek Fire, starting on July 16, 1991, threatened two youth church camps. Two hundred-fifty campers were evacuated and sheltered in Livingston. The Area Creek region also experienced a fire from July 31 through August 1. On August 7, a railroad sparked fire quickly spread between Billman and Fleshman Creeks. Six homes were threatened.

1994 - 1994 was a busy year for fires in Park County. The Deckard Flats Fire, Smith Creek Fire, Wineglass Fire, and Yak Fire were the largest fires. The Smith Creek Fire burned in a subdivision, but no structures were lost. Fires also burned in Paradise Valley in August including the Dry Creek Fire (40 acres), Eightmile Creek Fire (33 acres), and South Glastonbury Fire (30-50 acres).

1996 - The Trowbridge Fire burned on Livingston Peak. In September and October, notable grass fires were sparked along Interstate 90. The Wineglass Fire on October 11, 1996 injured two people.

August 1999 - The Six Mile fire in Paradise Valley, 3 miles east of Dailey Lake, burned 1,100 acres.

2000 - During this particularly severe fire season for Montana, the only large fire in Park County was one that burned in the north Crazy Mountains but did not threaten structures or infrastructure.

August 2001 - Lightning ignited the Fridley Fire on August 19 near Fridley Creek in the Gallatin National Forest. Park County Resolution # 727, issued on August 20, 2001, ordered evacuations of threatened areas. The fire doubled in size on August 22 and displayed "extreme" behavior on August 23 when high winds caused it to double in size again. Then on August 25, 2001, Park County Resolution # 728 closed roads near the Fridley Fire. Montana Executive Order 20-01, issued on August 25, 2001, declared a state of emergency in Park County and other locations across the state and mobilized state resources and the National Guard to fight the wildfires. On Wednesday, August 29, the fire threatened a privately-owned cabin southwest of Emigrant on the fire's southeast edge. The cabin was on a ridge top, making it difficult to protect. On August 31, three members of a firefighting helicopter crew were killed on a maintenance flight when a bucket line tangled with a rotor causing the helicopter to crash three miles south of Emigrant. The Fridley Fire was contained on September 13, 2001. In all, 26,373 acres burned from this fire and firefighting costs totaled over $11 million with 1,261 personnel, 50 pieces of heavy equipment, and 14 helicopters used. Fortunately, no structures were lost. (Pacific Biodiversity Institute, 2001)

Although the Fridley Fire was the largest in Park County in 2001, it was preceded by two other fires, the Hoppe and Monitor Fires, in late July and early August. The Monument Wilderness and Little Joe Fires also burned in Park County during August 2001. Both fires started on August 24 by lightning and were contained by September 3, 2001. The Monument Wilderness Fire started 10 miles northwest of Cooke City, burned 1,660 acres, with $417,000 in suppression costs. The Little Joe Fire was 20 miles east of Gardiner and burned 860 acres with suppression costs of $3 million. (National Climatic Data Center, 2011)

August 2003 - The Rough Draw Complex Fires started on August 10 by lightning. Park County Resolution # 806, issued on August 14, 2003, declared an emergency to exist in Park County from wildfires. Then, the following resolution # 807 on that same day closed roads near the Rough Draw Fire in Mission Creek on the northern boundary of the Absaroka-Beartooth Wilderness and the Slippery Fire in Cottonwood Creek near the Crazy Mountains. These fires, contained by September 5, 2003, were part of the larger Rough Draw Complex that burned over 3,000 acres and cost nearly $7 million. The Small Business Administration declared a disaster (#9W74) in Park County and offered loans to small business that suffered financial losses from the fires. Additionally, the Brundage Fire, started on August 15, by lightning, burned 3,200 acres in all. This fire, although ultimately larger than the Rough Draw Complex, was in a more remote part of the county and did not require as many resources.

Big Creek Fire, August-September 2006 – The lightning-caused Big Creek Fire burned about 14,000 acres, destroyed two homes and four outbuildings in a rural subdivision near Emigrant. (Park County, 2014) Suppression efforts totaled nearly $10 million for the Paradise Valley Complex, including the Big Creek Fire, Passage Falls Fire, and South Pine Fire. (National Interagency Fire Center, 2011)

Jungle Fire, September 2006 – The Jungle Fire burned about 37,000 acres and destroyed three outbuildings in the West Boulder drainage (Park County, 2009). Suppression costs totaled about $824,000. (National Interagency Fire Center, 2011)

WH Complex, August-September 2007 – These fires, consisting of the Wicked Creek Fire and Hicks Fire, burned about 30,500 acres in the upper Mill Creek drainage, destroyed one bridge, and threatened rural residences, church camps, and homes in a 54-acre inholding above Passage Falls. (Park County, 2014) Suppression costs totaled about $5.4 million. (National Interagency Fire Center, 2011)

Willow Creek Fire, July 2012 – The brush fire occurred over a small area on private and county land, nearby the Kindsfather subdivision. Though the fire initially spread rapidly due to strong winds, the fire died out within five days of ignition. (Park County, 2017c)

Pine Creek Fire, August-September 2012 — The Pine Creek Fire started near the community of Pine Creek, and due to strong winds grew to an estimated 4,000 acres within 24 hours of ignition. The fire required extensive evacuation efforts, which quickly overwhelmed local fire and law enforcement staff and required assistance from the Montana National Guard. The fire burned a total of five homes and ten outbuildings, and resulted in five burn injuries. (Park County, 2017c)

Minor Paradise Complex, August 2013 — A controlled fire was started in the 6-mile drainage area, which quickly burned out of the controlled area due to fire conditions. Minor evacuation activities were undertaken as required. Though the fire initially spread rapidly, the fire decreased in scale relatively quickly. (Park County, 2017c)

Willow Fire, August-September 2015 — A fire was started in a small patch of trees near Upper Willow Creek. The fire was relatively contained and died out quickly due to rain and favorable weather conditions. (Park County, 2017c)

4.16.3 PROBABILITY AND MAGNITUDE

A study by the Montana Department of Natural Resources and Conservation in 1997 reports that approximately 80-100 fire starts per year occur in Park County. About 35-40% of those fire starts occur on US Forest Service (USFS) land and 60-65% occur on county protected lands. On the USFS lands, approximately 50% are natural and 50% human-caused, but on county lands, approximately 85% are human-caused and 15% are natural with debris/field burning, trains, and campfires being top three human caused ignition sources. This same study also found that a belt running from southwest to northeast through the Paradise Valley, Gardiner, and the Wineglass areas have the highest concentration of lightning strikes in the county. (Montana Department of Natural Resources and Conservation, 1997)

4.16.4 VULNERABILITIES

To assess the vulnerabilities from wildfires in Park County, assets were visually compared to the US Forest Service's Fire Hazard rankings. For population estimates, the 2015 county population of 15,971 was divided by the total number of structures in the Park County of 9,367 for an estimate of 1.71 people per structure.

4.16.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

Critical facilities near forested areas or constructed with especially flammable materials are more likely to suffer losses from a wildfire. Since a wildfire is possible in essentially all areas of Park County, all critical facilities are assumed to have some risk. Those critical facilities outside the City of Livingston in more

rural areas are at greater risk due to increased distances from fire suppression assets and closer proximity to wildland areas. Nine critical facilities are within the high hazard areas including:

- Christikon Camp
- Cooke City Compactor
- Cooke City School
- Cooke City Water
- Cooke City/Silver Gate Fire Hall and Cooke City Search and Rescue
- Northeast Entrance of Yellowstone National Park
- Silver Gate Water
- US Post Office – Cooke City
- Yellowstone Bible Camp

Fifty-one critical facilities are within the Moderate Hazard Area.

Electric and communications infrastructure, including the major regional electric transmission lines, can be found in wildland areas. This infrastructure is highly vulnerable to wildland fire without mitigation. Wooden bridges in wildland areas are also quite vulnerable.

4.16.4.2 EXISTING STRUCTURES

Wildfires have the greatest potential to substantially burn National Forests and National Parks acreage; however, private residences become threatened when the fire enters the wildland urban interface. Park County has many wildland urban interface areas that may be threatened should a wildfire encroach. Using the Fire Characteristics map in conjunction with structure data, an estimate of the number of structures in the High Hazard Areas was derived. Approximately 1,073 structures are located in the High Hazard Areas. Using the state tax assessment data, the total value of these structures is estimated at $316,987,646. Approximately 4,965 structures with a total building value of $270,577,696 are located in the Moderate Hazard Areas. Note that the structures within the High Hazard Areas generally have a much higher building value than those that are not.

A wildfire damage factor is rather difficult to determine because any actual losses will be highly dependent on the fire characteristics and its location. Not all areas will be affected by one wildfire. Losses in the area of the WUI fire, however, could have a high loss rate. Given the assumption that 10% of the structures in the total High-Risk Areas could be lost in a probable wildfire, the structure losses from that fire would roughly total $31.7 million dollars with 107 structures affected.

History has shown that personal property losses can be much greater than just that of residences. Outbuildings, fences, equipment, livestock, pastures, and crops are often additional losses. Suppression costs, particularly due to the efforts needed for structure protection, can easily total in the millions of dollars.

4.16.4.3 POPULATION

Using the estimate of 107 structures affected in a major wildfire, roughly 183 people would live in the affected area (107 structures x 1.71 people/structure). The total High-Risk Area population exposure is about 1,835 people (1,073 structures x 1.71 people/structure). In many cases, residents can be evacuated

before the fire moves into their area. Some residents, however, may choose to remain in the evacuated area or a rapidly spreading fire may not allow enough time for a formal evacuation. Firefighters can also be particularly threatened during wildfires. Advances in firefighter safety and technology have improved firefighting efforts; however, the potential for loss of life and injuries still exists.

4.16.4.4 VALUES

Although the primary concern is to structures and the interface residents, most of the costs associated with fires, come from firefighting efforts in suppression costs. Additional losses to natural resources, water supplies, air quality, and the economy are also typically found. Wildfire's impact on the regional economy can be significant with the loss of timber, natural resources, recreational opportunities, and tourism, all of which are of particular importance in Park County. The economic dependency on the tourist population through Yellowstone National Park is such that even a fire outside of Park County can have very substantial economic impacts.

4.16.4.5 FUTURE DEVELOPMENT

The wildland urban interface is a very popular place to live as national trends show. More and more homes are being placed in this interface, particularly in Montana, and Park County is no exception. Development in the hazard areas has increased in recent years and has amplified the vulnerabilities in the unincorporated parts of Park County significantly. Regulating growth in these areas is a delicate balance between protecting private property rights and promoting public safety.

4.16.4.6 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	Park County	/ $500,000 losses / Structural losses / Contents losses / Critical functional losses / Critical data losses	/ $1,500,000 losses	Moderate
Critical Facilities	Livingston		/ $0 losses	Low
Critical Facilities	Clyde Park		/ $1,000,000 losses / Structural losses / Contents losses / Critical functional losses / Critical data losses	Low-Moderate
Critical Infrastructure	Park County	/ $500,000 losses / Road closures	/ $2,000,000 losses / Loss of electricity	Moderate
Critical Infrastructure	Livingston		/ $100,000 losses / Road closures	Low-Moderate

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Infrastructure	Clyde Park		/ $500,000 losses / Road closures / Loss of electricity / Loss of potable water	Moderate
Existing Structures	Park County	/ $3,169,876 losses / Structural losses / Contents losses / Displacement and functional losses	/ $31,698,765 losses	High
Existing Structures	Livingston		/ $500,000 losses / Structural losses / Contents losses / Displacement and functional losses	Low-Moderate
Existing Structures	Clyde Park		/ $3,000,000 losses / Structural losses / Contents losses / Displacement and functional losses	Moderate
Population	Park County, Clyde Park		/ Injuries / Fatalities	Moderate
Population	Livingston		/ Injuries / Fatalities	Low
Values	All	/ Agricultural losses / Reduced air quality / Restrictions on activities / Aesthetic value losses	/ Business disruption losses / Service industry losses / Habitat damages / Reduced water quality / Soil contamination / Historic structure losses / Historic site losses / Historic item losses / Emotional impacts / Cancellation of activities	Moderate-High
Future Structures	Park County, Clyde Park	/ Likely to occur in hazard areas	/ 2,747 undeveloped parcels in the	Moderate-High

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
		/ 1,822 undeveloped parcels in the High Hazard Areas / Subdivision regulations in place to mitigate some impacts	Moderate Hazard Areas	
Future Structures	Livingston		/ Somewhat likely to occur in hazard areas	Low-Moderate

[1] Impact in addition to probable (100-year) impacts

4.16.5 DATA LIMITATIONS

Data limitations include:

- / Lack of a comprehensive, multi-agency, historic wildfire digital database containing information on start location, cause, area burned, suppression costs, and damages.
- / Need for an improved wildland urban interface definition and associated analysis.

4.17 WIND

Table 4-54. Wind Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

4.17.1 DESCRIPTION

Park County is known for its wind. Strong winds regularly blow through the area, even when neighboring areas are experiencing near calm conditions. In addition to the high winds that can occur with severe thunderstorms, as described in the severe thunderstorm and tornadoes hazard profile, high winds can also occur with strong pressure gradients and gusty frontal passages. A study of high wind records from 1994-2003 showed that Park County was the third windiest county in Montana for synoptic scale winds. Over that ten-year period, Park County had 22 reports of wind gusts of 75 mph or greater from non-thunderstorm winds. (Montana Disaster and Emergency Services, 2004) Therefore, on average, at least two occurrences of greater than hurricane force winds can be expected each year. Livingston's windy conditions are primarily due to the topographical features of the area.

The strongest winds from the south to west directions in Livingston can be described in terms of the topography. During the winter, Yellowstone National Park gets very cold. As the air moves from the higher elevations into the valleys, it warms, accelerates, and gets funneled as it moves through the narrow Paradise Valley and constricts between the Wineglass Mountains and Livingston Peak. Like water in a hose, the constriction causes the air to move faster. Strong winds then rush through Livingston. As the winds from the west pass over the Gallatin Valley and Bozeman, the air piles up on the west side of the Bridger and Gallatin Mountain Ranges only being able to pass through at the lower elevations such as

Bozeman Pass which opens up to Livingston. The wind that does make it over the mountain ranges typically accelerates and rushes down the lee side of the mountains, creating strong surface winds throughout northern Park County.

Strong winds are so frequently over 30 mph in Park County that the National Weather Service increased their wind advisory and high wind warning thresholds for the county. A wind advisory is issued when sustained winds of at least 40 mph and gusts of 60 mph are expected for at least six hours. High wind warnings are issued when sustained winds of at least 50 mph are expected for an hour or more or wind gusts of 75 mph or greater are expected. In contrast, most locations in Montana start at 30 mph sustained for wind advisories and 40 mph sustained for high wind warnings.

All of Park County is considered at risk for high wind events. The most vulnerable areas, however, are in the Livingston area from south, southwest, and west winds and northern Park County from southwest and west winds. The base of the Crazy Mountains is also known to be particularly windy.

High winds can become particularly problematic when combined with falling snow or snow on the ground. Blizzard conditions from blowing and drifting snow can develop with the onset of strong winds. History also shows that the strong winds on Interstate 90 can lead to ground transportation or railroad accidents and possibly a hazardous materials release.

4.17.2 HISTORY

Park County has a long history of high wind events. In a study conducted for the State of Montana's Hazard Assessment, Park County ranked third in the state for number of non-thunderstorm wind events over hurricane force (74 mph) with 22 recorded events over a 10-year period. The strongest non-thunderstorm wind events in the past 25 years can be found in Table 4-55.

Table 4-55. Non-Thunderstorm Wind Events Greater than 80 mph (National Centers for Environmental Information, 2017).

Location	Date	Speed	Impacts / Additional Information
Livingston	11/03/1993	90 mph	Wind damage reported in Livingston.
Livingston	11/29/1994	92 mph	Several semi-trucks blown off Interstate 90, hanger roof blown off at Mission Field, spotty power outages, Interstate 90 closed for the evening. Damages estimated at $500,000.
South of Grey Owl Fishing Access	04/24/1996	100 mph	Wind speed estimated. Tree blown onto Highway 89.
Livingston	11/28/1996	81 mph	Measured at Mission Field.
Livingston	12/04/1996	100 mph	Measured at Mission Field.
Livingston	01/30/1997	85 mph	Measured at Mission Field.
Livingston	11/13/1998	85 mph	Measured at Mission Field.
Livingston, 6 miles S	02/01/1999	92 mph	Sustained winds of 50 mph and gusts to 89 mph in Livingston. Several trees and power lines downed. 1,500 homes were without power for 2 hours.

Location	Date	Speed	Impacts / Additional Information
Livingston	01/09/2000	84 mph	Measured at Mission Field.
Livingston	02/01/2000	84 mph	Measured at Mission Field. Winds sustained at 51 mph.
Livingston	01/10/2006	84 mph	Four trucks overturned on Interstate 90. Several power lines downed.
Chico, 9 miles ESE	02/16/2007	87 mph	Measured at Wicked Creek RAWS station.
Livingston	11/12/2007	85 mph	Measured at West Livingston I-90 DOT sensor. Power to Livingston was knocked out.
Livingston	01/30/2009	86 mph	Sustained winds of 50 mph with gusts to 86 mph were measured at Mission Field.
Livingston	01/24/2012	81 mph	Sustained winds of 50-61 mph with gusts up to 81 mph.
Livingston	12/19/2012	81 mph	Sustained winds of 58 mph with gusts of 75 mph and 81 mph were reported at the Livingston Airport.
Livingston	12/19/2016	83 mph	Wind gusts of 60 to 83 mph at the Livingston Airport.

4.17.3 PROBABILITY AND MAGNITUDE

Based on the ten-year historical record, the probabilities in Table 4-56 can be estimated.

Table 4-56. Non-Thunderstorm Wind Probabilities Based on Historical Occurrence.

Speed	Average Occurrences Per Year	Recurrence Interval
75 mph or greater (hurricane force)	2.2 events/year	5-6 month event
80 mph or greater	1 event/year	1-year event
90 mph or greater	0.5 events/year	2-year event
100 mph or greater	0.2 events/year	5-year event

According to the National Weather Service, November is historically the windiest month in Park County with winds from the southwest.

4.17.4 VULNERABILITIES

Since the threat from strong winds exists countywide, the vulnerabilities were assessed using two feasible scenarios. The first is a wind event of 85 mph overturning vehicles and causing power outages. The second scenario is for a wind gust well over 100 mph that creates widespread damages of roofs being blown off and structure collapse of weak buildings.

4.17.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

All the critical facilities in Park County are susceptible to high winds. The risk will be assumed to be the same countywide since high winds can strike anywhere. Given a history of power outages, the electrical

infrastructure is assumed to have a slightly greater risk to high winds than other types of infrastructure. The airport also has a history of wind-related losses.

4.17.4.2 EXISTING STRUCTURES

With wind problems occurring regularly in Park County, most structures are designed to withstand high winds. Therefore, the potential losses to structures are limited. They can, however, occur during some of the most extreme events. More often, the greatest threat is to high profile vehicles. During particularly severe winds, trucks are diverted from the Interstate through Livingston. An event severely damaging 10 structures could result in losses of about $2,169,000 (10 structures x $216,900/structure).

4.17.4.3 POPULATION

Since Park County regularly has high wind events, most residents are prepared for and acclimated to windy weather. In most synoptic scale wind events, the National Weather Service can provide ample warning through their wind advisories and high wind warnings. The Montana Department of Transportation also regularly posts weather messages on Interstate message boards.

4.17.4.4 VALUES

Winds strong enough to destroy structures could theoretically cause significant damages to businesses, including signs and other property, resulting in economic losses. Social values may also be impacted, especially if loss of life occurs.

4.17.4.5 FUTURE DEVELOPMENT

Future development would only be threatened if structures were built without consideration for wind. Since Park County regularly has strong winds, development typically occurs with that consideration, and therefore, is not often threatened by wind events. Developers are not required, however, to adhere to any structural building codes for most residential structures, except for within the City of Livingston and its donut area. The City of Livingston does require tie downs for mobile home parks. The particularly windy area at the base of the Crazy Mountains currently has large ranches, but should development occur in this area, wind would be a notable hazard requiring consideration.

4.17.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	All		/ $200,000 losses / Structural losses / Critical functional losses / Clean-up/debris removal costs	Low-Moderate
Critical Infrastructure	All	/ $500,000 losses / Road closures / Loss of electricity	/ $5,000,000 losses	Moderate-High

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Existing Structures	All		/ $1,000,000 losses / Structural losses / Contents losses / Displacement/functional losses / Clean-up/debris removal costs	Moderate
Population	All	/ Injuries	/ Fatalities	Moderate
Values	All	/ Business disruption losses / Restrictions on activities / Aesthetic value losses	/ Agricultural losses / Emotional impacts / Cancellation of activities	Moderate
Future Structures	Park County, Clyde Park		/ Likely to occur in hazard areas / Increases the total hazard exposure / Lacking building codes to minimize losses	Moderate
Future Structures	Livingston		/ Likely to occur in hazard areas / Increases the total hazard exposure / Enforces building codes to minimize losses	Low-Moderate

[1] Impact in addition to probable (100-year) impacts

4.17.6 DATA LIMITATIONS

Data limitations include:

- Severe wind events are only recorded if observed and reported to the National Weather Service; the rural nature of the area leaves many areas without weather spotters.
- Only a limited number of weather observation stations are located in the county.

4.18 WINTER STORMS AND EXTENDED COLD

Table 4-57. Winter Storms and Extended Cold Federal Major Disaster and Emergency Declarations.

Declaration	Year	Casualties	Damages	Comments
None				

4.18.1 DESCRIPTION

Snow storms and bitterly cold temperatures are common occurrences in Park County and generally do not cause any problems as residents are used to winter weather and are prepared for it. Snow falls regularly during all seasons, except summer, and roads become slippery quite often. Residents understand that this is part of living in Montana. Sometimes, however, blizzards can occur and overwhelm the ability to keep roads passable. Heavy snow and ice events, particularly late season events, have the potential to bring down power lines and trees. The extreme wind chills, often dropping below zero, may harm residents if unprotected outdoors or if heating mechanisms are disrupted.

4.18.1.1 BLIZZARDS

Blizzards, as defined by the National Weather Service, are a combination of sustained winds or frequent gusts of 35 mph or greater and visibilities of less than a quarter mile from falling or blowing snow for three hours or more. A blizzard, by definition, does not indicate heavy amounts of snow, although they can happen together. The falling or blowing snow usually creates large drifts from the strong winds. The reduced visibilities make travel, even on foot, particularly treacherous. The strong winds may also support dangerous wind chills.

4.18.1.2 HEAVY SNOW

Large quantities of snow may fall during winter storms. In general, six inches or more in 12 hours or eight inches or more in 24 hours constitutes conditions that may significantly hamper travel or create hazardous conditions. Smaller amounts can also make travel hazardous, but in most cases, only results in minor inconveniences. Heavy wet snow before the leaves fall from the trees in the fall or after the trees have leafed out in the spring may cause problems with broken tree branches and power outages. These types of storms often cause the most winter storm related damages in Park County.

4.18.1.3 ICE STORMS

Ice storms develop when a layer of warm (above freezing), moist air aloft coincides with a shallow cold (below freezing) pool of air at the surface. As snow falls into the warm layer of air, it melts to rain, and then freezes on contact when hitting the frozen ground or cold objects at the surface, creating a smooth layer of ice. This phenomenon is called freezing rain. Similarly, sleet occurs when the rain in the warm layer subsequently freezes into pellets while falling through a cold layer of air at or near the Earth's surface. Extended periods of freezing rain can lead to accumulations of ice on roadways, walkways, power lines, trees, and buildings. Almost any accumulation can make driving and walking hazardous. Thick accumulations can bring down trees and power lines.

4.18.1.4 EXTREME COLD

Extended periods of cold temperatures frequently occur throughout the winter months in Park County. Heating systems compensate for the cold outside. Most people limit their time outside during extreme cold conditions, but common complaints usually include pipes freezing and cars refusing to start. When cold temperatures and wind combine, dangerous wind chills can develop.

Wind chill is how cold it "feels" and is based on the rate of heat loss on exposed skin from wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature, and eventually, internal body temperature. Therefore, the wind makes it feel much colder than the actual temperature. For example, if the temperature is 0°F and the wind is blowing at 15 mph, the wind chill is -19°F. At this wind

chill, exposed skin can freeze in 30 minutes. Wind chill does not affect inanimate objects. (National Weather Service, 2011c)

4.18.2 HISTORY

Snow and cold are normal occurrences in Park County throughout the late fall, winter, and early spring months. Summaries of the more significant events due to their extreme conditions or damages are shown in Table 4-58. The National Climatic Data Center also lists several other lower impact types of common winter weather events. Also note that the coding system used in this database for winter weather does not allow for a comprehensive search of winter weather events by county. Other significant events have likely occurred.

Table 4-58. Winter Weather Events (National Centers for Environmental Information, 2017).

Date	Type	Impacts
12/25/1996	Winter Storm	12 inches of snow in Livingston.
12/03-04/1998	Heavy Snow	16 inches of snow in Livingston.
12/07-08/1998	Blizzard	Visibilities near zero. Interstate 90 was closed between Columbus and Bozeman after numerous accidents were reported.
12/29-30/1998	Ice Storm	Portions of Interstate 90 were closed.
01/23/1999	Heavy Snow	14 inches of snow 10 miles east of Livingston.
05/13/1999	Heavy Snow	13 inches of snow in Cooke City.
04/16/2002	Heavy Snow	10 inches of snow in Cooke City.
05/08/2002	Heavy Snow	17 inches of snow in Wilsall.
11/23/2002	Heavy Snow	10 inches of snow in Cooke City.
03/06/2003	Heavy Snow	11 inches of snow in Cooke City.
03/09/2003	Heavy Snow	10 inches of snow in Wilsall.
03/27/2003	Heavy Snow	19 inches of snow 2 miles west of Cooke City. 17 Inches of snow 12 miles south of Livingston.
10/04/2005	Heavy Snow	11 inches of snow 6 miles southeast of Clyde Park. Many trees and branches heavily damaged with widespread power outages, some lasting 36-48 hours.
11/27/2005	Heavy Snow	21 inches of snow in Wilsall.
12/28/2006	Heavy Snow	12 inches of snow 10 miles south of Livingston.
02/26/2009	Heavy Snow	12 inches of snow in Wilsall.
03/29/2009	Winter Storm	7-17 inches of snow in the Livingston area.
04/14/2009	Heavy Snow	10 inches of snow in Wilsall.
11/12/2009	Heavy Snow	6-12 inches of snow in the Livingston area.
01/05/2010	Winter Storm	Significant drifting in Clyde Park.
11/18/2010	Heavy Snow	12 inches of snow in Wilsall.

Date	Type	Impacts
11/25/2010	Blizzard	Livingston area had sustained winds of 50 mph with gusts to 72 mph. Interstate 90 was closed due to severe blowing and drifting snow. Emergency travel only conditions existed throughout the county.
01/20/2011	Blizzard	Livingston area had wind gusts to 63 mph with blowing snow. Interstate 90 was closed from Springdale to Gallatin County.
02/06/2011	Heavy Snow	10 inches of snow in Clyde Park.
04/07/2011	Heavy Snow	12 inches of snow in Clyde Park.
10/03/2013	Heavy Snow	6+ inches of snow in Livingston with tree damages and power outages.
12/10/2013	Blizzard	Livingston area had frequent gusts over 70 mph. Interstate 90 was closed due to low visibility conditions.
12/18/2015	Blizzard	Livingston area had wind gusts of 50 to 65 mph. Interstate 90 was closed, and traffic was diverted through Livingston.
10/10/2016	Heavy Snow	6 to 13 inches reported in Livingston.
12/18/2016	Blizzard	Blizzard conditions resulted in impassable roads and dangerous conditions. Over 95 weather-related 911 calls were received. Search and rescue was dispatched to assist ambulance crews due to road and snow conditions.

Table 4-59. Winter Weather Records (Western Regional Climate Center, 2017).

Location	Period of Record	Low Temperature Record	Annual Snowfall Record
Wilsall, 8 miles ENE	1957-2012	-42°F, February 3, 1989	210.5 inches, 1975
Springdale	1951-2012	Not Applicable	55.5 inches, 1967
Livingston Airport	1948-2012	-41°F, December 24, 1983	113.9 inches, 1975
Livingston	1895-1981	-45°F, February 15, 1936	81.6 inches, 1916
Livingston, 12 miles S	1951-2010	-36°F, December 24, 1983	123.8 inches, 1975
Gardiner	1956-2012	-31°F, February 3, 1989	74.5 inches, 1967
Jardine	1951-1976	Not Applicable	138.6 inches, 1955
Yellowstone National Park, near Silver Gate	1948-1967	-51°F, January 12, 1963	226.0 inches, 1963
Cooke City, 2 miles W	1967-2010	-43°F, February 5, 1982	332.1 inches, 1977

4.18.3 PROBABILITY AND MAGNITUDE

The probability of winter storms each season is almost a certainty. The probability of an event that overwhelms the community capabilities, though, is harder to determine. To date, Park County has not had any winter weather events that have led to a Presidential Disaster Declaration, but such an event is certainly possible and cannot be overlooked.

4.18.4 VULNERABILITIES

Since the winter weather and extended cold risk extends countywide and the impacts can widely vary, to assess the vulnerabilities, two scenarios were considered. First is an extended, multi-day blizzard that closes roadways, creates major snow drifting, and isolates communities and residents. The second is a widespread power outage for a week or more during extreme cold and blizzard conditions, leaving most residents without heat and other supplies. Persistent heavy snow events may also create conditions favorable for roof collapses.

4.18.4.1 CRITICAL FACILITIES AND INFRASTRUCTURE

All critical facilities are assumed to have the same vulnerability from winter storms and cold temperatures. Those facilities with back-up generators are better equipped to handle a winter storm situation should the power go out. Otherwise, all are designed to withstand winter storms but may not be able to provide heat if electric service is lost.

4.18.4.2 EXISTING STRUCTURES

Snow in Park County generally does not cause the communities to shut down or disrupt activities. Occasionally, though, extreme winter weather conditions can cause problems. The most common incidents in these conditions are motor vehicle accidents due to poor road conditions. These losses are usually covered by insurance. Losses to structures are usually minimal. Most structures are built to withstand reasonable snow loads in this region.

4.18.4.3 POPULATION

Since winter storms and cold spells typically do not cause major structural damage, the greatest threat to the population is the potential for utility failure during a cold spell. Although cold temperatures and snow are normal for Park County, extremes can exist that would go beyond the capabilities of the community to handle. Should the temperatures drop below -15°F for several weeks or several feet of snow fall in a short period of time, the magnitude of frozen water pipes and sewer lines or impassable streets could result in disastrous conditions for many people. If power lines were to fail due to snow/ice load, winds, or any other complicating factor, the situation would be compounded. In the event power or other utilities were disrupted, many homes could be without heat or water. With temperatures frequently dropping below zero in a typical winter, an event where heating systems failed could send many residents to shelters for protection. Other residents may try to heat their homes through alternative measures, and thereby, increase the chance for structure fires or carbon monoxide poisoning.

Sheltering of community members would present significant logistical problems when maintained over a period of more than a day. Transportation, communication, energy (electric, natural gas, and vehicle fuels), shelter supplies, medical care, food availability and preparation, and sanitation issues all become exceedingly difficult to manage in extreme weather conditions. Local government resources could be quickly overwhelmed. Mutual aid and state aid might be hard to receive due to the regional impact of this kind of event.

4.18.4.4 VALUES

Extended winter storms and cold can force the closure of businesses due to road closures and power outages. Depending on the length of the event, several days' worth of business revenue could be lost.

These storms can often lead to substantial livestock losses and impact the agricultural economy. Activities such as school and sporting events may be cancelled or postponed.

4.18.4.5 FUTURE DEVELOPMENT

Future development should have little to no impact from winter storms and extended cold weather. The most significant challenge may be, as homes go up in more remote parts of the county, to access those residents should sheltering or emergency services be needed in an extreme event. Future structures in Park County and Clyde Park are more vulnerable to structure collapses due to heavy snow loads since these jurisdiction lack building codes.

4.18.5 VULNERABILITIES AND IMPACTS

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
Critical Facilities	All		/ $0 losses	Low
Critical Infrastructure	All	/ Road closures	/ $1,000,000 losses / Loss of electricity / Loss of potable water / Loss of sanitary sewers / Loss of telephone service / Loss of internet service / Fuel/energy shortages	Moderate-High
Existing Structures	All		/ · $500,000 losses / Structural losses / Contents losses / Displacement/functional losses	Low-Moderate
Population	All	/ Injuries / Fatalities		Moderate
Values	All	/ Business disruption losses / Service industry losses / Agricultural losses / Cancellation of activities / Restrictions on activities	/ Emotional impacts	Moderate
Future Structures	Park County, Clyde Park		/ Likely to occur in hazard areas	Low-Moderate

Type	Jurisdiction(s)	Probable (100-year) Impact	Extreme (500-year) Impact[1]	Rating
			/ Increases the total hazard exposure / Lacking building codes to minimize losses	
Future Structures	Livingston		/ Likely to occur in hazard areas / Increases the total hazard exposure / Enforces building codes to minimize losses	Low

[1] Impact in addition to probable (100-year) impacts

4.18.6 DATA LIMITATIONS

Data limitations include:

- / Severe weather events are only recorded if observed and reported to the National Weather Service; the rural nature of the area leaves many areas without weather spotters.
- / The zone system of the historic winter weather events National Climatic Data Center does not allow for easy queries on a countywide basis.
- / Lack of a countywide, multi-agency, historic winter weather database containing information on the winter weather conditions (snow depth, temperature, wind, snowfall rates, water content, and duration) and the associated problems (number of accidents, conditions of roadways, and services needed).

4.19 RISK ASSESSMENT SUMMARY

The risk assessment represents an approximate history and estimated vulnerabilities to Park County, the City of Livingston, and the Town of Clyde Park from the hazards identified. Table 4-60 provides a summary of federal major disaster and emergency declarations. As with any assessment involving natural or human-caused hazards, all potential events may not be represented here, and an actual incident may occur in a vastly different way than described. This assessment, however, will be used, where possible, to minimize damages from these events in the future.

Table 4-60. Major Disaster and Emergency Declarations.

Declaration	Year	Cause/Additional Information	Casualties	Damages/Assistance
FEMA-DR-1105	1996	Flood Public Assistance	None	$146,379 state/local share (Park County) $36,287 state/local share (Livingston) Total damages estimated over $1,275,000

FEMA-DR-1183	1997	Flood Public Assistance	None	Total damages estimated over $616,000
FEMA-DR-1340	2000	Wildfire Individual Assistance for nearly the entire state	None	$11,579,000 federal assistance statewide
FEMA-FSA-2321	2000	Wildfire Fire Suppression Assistance	None	$18,783 in federal assistance to Park and Gallatin Counties $91,940 in federal assistance to MT DNRC
FEMA-DR-1996	2011	Flood Public Assistance Individual Assistance	None	Unknown
FEMA-4172-DR	2014	Flood Public Assistance	None	Total damages estimated over $66,200

Every type of event is different, ranging from population to property to economic impacts. Incidents also have different probabilities and magnitudes even within hazards. For example, a light snowstorm will be different than a blizzard and a moderate flood will be different from both of those. Some hazards have estimates of dollar losses and population impacts whereas others are more qualitatively assessed based on the information available during the risk assessment process.

The hazards are prioritized using the best possible information on risks and vulnerabilities to provide guidance when selecting mitigation strategies. Generally, an evaluation of a specific mitigation activity will capture the benefits of such actions, including considering the probability of the hazard occurring and the disaster losses to be mitigated.

The following factors were considered when prioritizing the hazards:

- Probability of a "Disastrous"/High Impact Event
- Vulnerability (considers probable impacts to critical facilities, critical infrastructure, structures, the population, economic, ecologic, historic, and social values, and future development)

For more information on these determinations, see the individual hazard profiles.

Table 4-61 shows the hazard prioritizations for Park County and Table 4-62 and Table 4-63 are specific to the City of Livingston and the Town of Clyde Park, respectively.

Table 4-61. Park County Hazard Ratings.

Hazard	Probability of High Impact Event	Vulnerability	Overall Hazard Rating
Flooding	Moderate-High	High	High
Wildfire	Moderate-High	Moderate-High	High
Earthquake	Moderate	High	High
Hazardous Materials Release	Moderate	Moderate-High	High

Hazard	Probability of High Impact Event	Vulnerability	Overall Hazard Rating
Wind	Moderate-High	Moderate	High
Winter Storms and Extended Cold	Moderate-High	Moderate	High
Severe Thunderstorms and Tornadoes	Moderate	Moderate-High	Moderate
Communicable Disease and Bioterrorism	Moderate	Moderate	Moderate
Avalanche and Landside	Low-Moderate	Moderate	Moderate
Drought	Moderate	Low-Moderate	Moderate
Ground Transportation Accident	Moderate	Low-Moderate	Moderate
Urban Fire	Moderate	Low-Moderate	Moderate
Dam Failure	Low-Moderate	Moderate	Moderate
Utility Outage	Low-Moderate	Low-Moderate	Low
Volcano	Low	Moderate	Low
Terrorism, Civil Unrest, and Violence	Low	Low-Moderate	Low
Aviation Accident	Low	Low	Low
Railroad Accident	Low	Low	Low

Table 4-62. Livingston Hazard Ratings.

Hazard	Probability of High Impact Event	Vulnerability	Overall Hazard Rating
Flooding	Moderate-High	Moderate-High	High
Earthquake	Moderate	High	High
Hazardous Materials Release	Moderate	Moderate-High	High
Wind	Moderate-High	Moderate	High
Winter Storms and Extended Cold	Moderate-High	Moderate	High
Communicable Disease and Bioterrorism	Moderate	Moderate	Moderate
Severe Thunderstorms and Tornadoes	Moderate	Moderate	Moderate
Urban Fire	Moderate	Moderate	Moderate
Drought	Moderate	Low-Moderate	Moderate
Utility Outage	Low-Moderate	Moderate	Moderate
Ground Transportation Accident	Low-Moderate	Low-Moderate	Low
Wildfire	Low-Moderate	Low-Moderate	Low

Hazard	Probability of High Impact Event	Vulnerability	Overall Hazard Rating
Aviation Accident	Low	Moderate	Low
Terrorism, Civil Unrest, and Violence	Low	Moderate	Low
Railroad Accident	Low-Moderate	Low-Moderate	Low
Volcano	Low	Low-Moderate	Low
Avalanche and Landside	Not Applicable	Not Applicable	Not Applicable
Dam Failure	Not Applicable	Not Applicable	Not Applicable

Table 4-63. Clyde Park Hazard Ratings.

Hazard	Probability of High Impact Event	Vulnerability	Overall Hazard Rating
Severe Thunderstorms and Tornadoes	Moderate	Moderate-High	High
Flooding	Moderate	Moderate	High
Urban Fire	Moderate	Moderate	High
Wildfire	Moderate	Moderate	High
Wind	Moderate	Moderate	High
Winter Storm and Extended Cold	Moderate-High	Low-Moderate	Moderate
Hazardous Materials Release	Low-Moderate	Moderate-High	Moderate
Communicable Disease and Bioterrorism	Moderate	Moderate	Moderate
Drought	Moderate	Moderate	Moderate
Dam Failure	Low-Moderate	Moderate	Moderate
Earthquake	Low-Moderate	Moderate	Moderate
Ground Transportation Accident	Low-Moderate	Low-Moderate	Low
Utility Outage	Low-Moderate	Low-Moderate	Low
Aviation Accident	Low	Moderate	Low
Volcano	Low	Low-Moderate	Low
Terrorism, Civil Unrest, and Violence	Low	Low	Low
Avalanche and Landslide	Not Applicable	Not Applicable	Not Applicable
Railroad Accident	Not Applicable	Not Applicable	Not Applicable

5.0 MITIGATION STRATEGY

Hazard mitigation, as defined by the Disaster Mitigation Act of 2000, is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Studies on hazard mitigation show that for each dollar spent on mitigation, society saves an average of four dollars in avoided future losses. (Multi-hazard Mitigation Council, 2005) Mitigation can take many different forms from construction projects to public education.

The development of a mitigation strategy allows Park County, the City of Livingston, and the Town of Clyde Park to create a vision for preventing future disasters, establish a common set of mitigation goals, prioritize projects, and evaluate the success of such projects. The mitigation strategy is based on the results of the risk assessment and recommendations by stakeholders and the public. The goals are broad, visionary, forward-looking statements that outline in general terms what the county, city, and town would like to accomplish. Goals are usually not measurable or fully attainable but rather ideals to which the county, city, and town should strive for as they develop and implement mitigation projects.

Rather than wait until a disaster occurs, Park County, the City of Livingston, and the Town of Clyde Park have developed this strategy to move in a more proactive direction for disaster prevention. All losses cannot be entirely mitigated, however, some actions can be taken, as funding and opportunities arise, that may reduce the impacts of disasters, thus, saving lives and property.

Initially, the mitigation strategies were developed in 2005 based on the results of the risk assessment and recommendations by knowledgeable community members through the Local Emergency Planning Committee and public meetings and existing studies and plans. In 2011 and 2017, those mitigation goals, objectives, and project ideas were reviewed by the public, refined in public meetings during which suggestions from the attendees were incorporated, taking into account recommendations from existing policies, plans, and studies.

The overarching mission of this mitigation strategy is to reduce or prevent losses from disasters. Many of the mitigation actions were carried over from the 2005 and 2011 plans, and new ones were developed based on direct input from stakeholders; the projects were then prioritized. Some projects that were completed or considered no longer effective were removed. Those goals, objectives, and projects that remain are considered to be valid and effective mitigation strategies. More information on the specific changes to the mitigation strategy since 2005 can be found in Appendix H.

5.1 GOALS, OBJECTIVES, AND PROPOSED PROJECTS

The mitigation goals, objectives, and proposed projects for Park County, the City of Livingston, and the Town of Clyde Park follow. Each of the projects specifies the jurisdiction or jurisdictions involved, the type of project, its priority, the responsible agencies and partners, resources needed, and the goal timeframe.

For clarification and prioritization purposes, each project is categorized by type. The types of projects include:

- Supportive: Usually supportive projects are important components of all types of mitigation activities. For example, a coordinator or staff position is often critical to applying for and implementing mitigation grants.
- Educational/Informational: These projects typically do not mitigate a hazard directly, however, by educating the public or others, those individuals may then take their own mitigation actions. These types of projects may also be used by governing bodies and other authorities to make decisions or develop new policies or projects.
- Policy/Regulatory: Policies and regulations created, updated, or enforced by government entities can have powerful hazard mitigation impacts. Their benefits can often be difficult to measure. Conservation easements are an example of a land use change mechanism enforced by regulatory authorities.
- Property Protection: These projects often directly reduce future property losses through physical changes. Such changes can reduce or eliminate the threat to property.
- Infrastructure Protection: These projects often physically reduce losses to critical infrastructure. Hardening or improvements to infrastructure can reduce the likelihood of losses to important lifeline systems from the various hazards.
- Population Protection: Generally, population protection measures reduce the loss of life and injury by physically changing a threat to people or by prompting a person to take immediate action. For example, warning systems may alert people to imminent hazards.

Additional information on the priorities and goal timeframes can be found in the sections that follow.

5.1.1 GOAL 1: REDUCE DAMAGES FROM FLOODING

5.1.1.1 OBJECTIVE 1.1: PREVENT FLOOD DAMAGES TO CRITICAL FACILITIES, CRITICAL INFRASTRUCTURE, AND FUTURE DEVELOPMENT THROUGH GOVERNMENT RESOURCES, SERVICES, AND AUTHORITIES.

Project 1.1.1 River Crossing Improvements:

- Lessen the hydraulic impacts when bridges crossing water bodies are replaced.
- Remove abandoned bridge abutments and piers.
- Consider zero backwater standards during bridge reconstruction.

Jurisdiction(s): Park County, City of Livingston
Project Type: Infrastructure Protection
Responsible Agencies and Partners: Montana Department of Transportation Planners and Engineers; Park County Road Foreman; Livingston Public Works Director
Resources Needed: Staff time and expertise
Potential Funding Sources: Montana Department of Transportation; County and City Budgets
Goal Timeframe: Ongoing - Already initiated and continuing; Post-Disaster: During bridge reconstruction/repairs
Priority: High

Project 1.1.2 Floodplain Ordinances:

- Continue compliance with the National Flood Insurance Program and local flood ordinances.
- Consider more restrictive floodplain development regulations, such as freeboard.
- Update flood ordinances to exclude school facilities as an appropriate floodplain use.
- Consider joining the Community Rating System volunteer incentive program.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Policy/Regulatory
Responsible Agencies and Partners: Park County Commission, Floodplain Administrator, and Planners; Livingston City Commission, Floodplain Administrator, and Planners; Clyde Park Town Council and Floodplain Administrator
Resources Needed: Staff time and expertise
Potential Funding Sources: None needed
Goal Timeframe: Near Term - initiated within 0-3 years
Priority: High

Project 1.1.3 Conservation Easements:

- Protect values along the rivers and streams through conservation easements.
- If necessary, consider a local bond to generate funds.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Policy/Regulatory
Responsible Agencies and Partners: Park County Commission, Floodplain Administrator, and Planners; Livingston City Commission, Floodplain Administrator, and Planners; Clyde Park Town Council; Private Conservation Groups
Resources Needed: Staff time and expertise; Funding for easement purchases (amount depends on the market and size of purchase)
Potential Funding Sources: Local Bonds; County, City, and Town Budgets; Private Conservation Organizations
Goal Timeframe: Ongoing - already initiated and continuing; Post-Disaster: when landowners are most interested
Priority: Low

Project 1.1.4 Water Body and Ditch Maintenance:

- Remove debris from water bodies, ditches, and storm drains, as needed, to protect public safety.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Infrastructure Protection
Responsible Agencies and Partners: Park County Road Foreman; Livingston Public Works Director; Clyde Park Public Works Director
Resources Needed: Staff time and expertise
Potential Funding Sources: County, City, and Town Budgets for staff and equipment time
Goal Timeframe: Ongoing - already initiated and continuing
Priority: Medium

Project 1.1.5 Bridge, Culvert, and Road Improvements:

- Upgrade bridges, culverts, and roads to allow sufficient passage of floodwaters.
- Install culverts in areas prone to washouts or drainage problems.
- Stabilize roadsides that are prone to mudslides and/or landslides.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Infrastructure Protection
Responsible Agencies and Partners: County, City, and Town Road/Street Foremen
Resources Needed: Staff time and expertise; Funding for projects (amount highly variable depending on the project)
Potential Funding Sources: Federal Emergency Management Agency mitigation grants; County, City, and Town Budgets
Goal Timeframe: Near Term—initiated within 0-3 years; Post-Disaster—during bridge, culvert, and/or road repairs
Priority: High

Project 1.1.6 Livingston Berm Alternatives:

- Study the need for the temporary berm constructed during Yellowstone River flood threats to protect areas of Livingston.
- Evaluate possible alternatives that are more sustainable and cost-effective in the long term.
- Implement reasonable solutions that more permanently mitigate the threat.

Jurisdiction(s): Park County, City of Livingston
Project Type: Property Protection
Responsible Agencies and Partners: Park County Disaster and Emergency Services, County and City Road/Street Foremen
Resources Needed: Staff time and expertise; Funding for study and potential projects (amount highly variable depending on the project)
Potential Funding Sources: Federal Emergency Management Agency mitigation grants; County and City Budgets
Goal Timeframe: Near Term - initiated within 0-3 years
Priority: High

5.1.1.2 OBJECTIVE 1.2: PROVIDE THE PUBLIC WITH INFORMATION AND MEANS TO PREVENT PRIVATE FLOOD LOSSES.

Project 1.2.1 River Bank Stabilization and Flood Mitigation Program:

- Establish a Bank Stabilization Information Clearinghouse.
- Establish financial incentives for landowners to remove, modify, or replace obsolete and non-functioning flood control and bank stabilization structures.
- Continue studying project effectiveness and impacts on ecological health.
- Explore alternative flood mitigation measures for individual property owners.

Jurisdiction(s): Park County
Project Type: Property Protection
Responsible Agencies and Partners: Park County Commission, Floodplain Administrator, and Planners; US Army Corps of Engineers

Resources Needed: Staff time and expertise; Funding for bank stabilization projects
Potential Funding Sources: Federal Emergency Management Agency mitigation grants; River Conservation groups
Goal Timeframe: Mid Term - initiated within 3-6 years; Post-Disaster - during bank repairs
Priority: Medium

Project 1.2.2 Flood-prone Property Acquisition Program:

- Generate interest in flood acquisition and/or relocation opportunities with property owners in flood-prone areas, especially those that have experienced repetitive losses such as Ninth Street Island.
- Pursue acquisitions and/or relocations as funding and interest allows.

Jurisdiction(s): Park County
Project Type: Property Protection
Responsible Agencies and Partners: Park County Commission, Floodplain Administrator, and Disaster and Emergency Services Coordinator; Montana Disaster and Emergency Services Hazard Mitigation Officer
Resources Needed: Staff time and expertise; Funding for acquisitions/relocations
Potential Funding Sources: Federal Emergency Management Agency mitigation grants; Montana Department of Natural Resources Renewable Resource grant
Goal Timeframe: Mid Term - initiated within 3-6 years; Post-Disaster - when landowners are most interested
Priority: Medium

Project 1.2.3 Flood Insurance Education:

- Educate property owners and tenants on the availability and importance of flood insurance.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Educational/Informational
Responsible Agencies and Partners: Park County Commission, DRNC, Floodplain Administrator, and Disaster and Emergency Services Coordinator
Resources Needed: Staff time and expertise
Potential Funding Sources: None needed
Goal Timeframe: Mid Term - initiated within 3-6 years; Post Disaster - when property owners and tenants are most interested
Priority: Medium

5.1.2 GOAL 2: PREVENT LOSSES FROM WILDFIRES

5.1.2.1 OBJECTIVE 2.1: INCREASE UNDERSTANDING OF THE WILDFIRE HAZARD AREAS.

Project 2.1.1 Fuels and Fire Mapping:

- Develop digital maps of wildfire hazard areas, such as fuels and condition classes.
- Use the mapping for land management and project development.
- Develop a centralized, countywide wildfire history database.
- Develop mapping of treatments conducted by all land management agencies.
- Develop an improved wildland urban interface map.

Jurisdiction(s): Park County
Project Type: Educational/Informational
Responsible Agencies and Partners: Park County Fire Warden; Park County Fire Chiefs; US Forest Service; US Bureau of Land Management; Montana DNRC; Park County GIS Coordinator
Resources Needed: Staff time and expertise; Funding for GIS services
Potential Funding Sources: US Forest Service; US Bureau of Land Management; Montana DNRC Goal
Timeframe: Ongoing - already initiated and continuing
Priority: Medium

5.1.2.2 OBJECTIVE 2.2: REDUCE PRIVATE LOSSES IN THE WILDLAND URBAN INTERFACE.

Project 2.2.1 Fuel Reductions:

- Pursue wildland urban interface fuel reduction projects in high-risk areas around the county, including near structures, road rights-of-way, utility rights-of way, and along federal and state lands.

Jurisdiction(s): Park County
Project Type: Property Protection
Responsible Agencies and Partners: Northern Rocky Mountain Resources Conservation and Development Area Program Coordinator; Park County FireSafe Council; Park County Fire Warden; Park County Fire Chiefs; US Forest Service; US Bureau of Land Management; Montana DNRC
Resources Needed: Staff time and expertise; Funding for fuel reduction projects (about $100-$200 per acre)
Potential Funding Sources: Northern Rocky Mountain Resources Conservation and Development Area Hazardous Fuels Assistance Program; US Forest Service; US Bureau of Land Management; Montana DNRC Western States Wildland Urban Interface grant
Goal Timeframe: Ongoing - already initiated and continuing
Priority: High

Project 2.2.2 Regional Water Sources:

- Develop regional water sources within the wildland urban interface to supply substantial amounts of water within a reasonable distance for wildland firefighting efforts.

Jurisdiction(s): Park County
Project Type: Property Protection
Responsible Agencies and Partners: Park County FireSafe Council; Park County Fire Warden; Park County Fire Chiefs; Park County Commission
Resources Needed: Staff time and expertise; Funding for water source projects
Potential Funding Sources: Homeowners' Association Fees; Special Tax Districts
Goal Timeframe: Long Term - initiated within 7-10 years
Priority: Low

Project 2.2.3 Ingress/Egress Road Improvements:

- Improve critical ingress/egress roadways in the wildland urban interface with activities such as road widening and the addition of turnarounds, particularly in the Mountain Sky, West Boulder, and Main Boulder areas.
- Where feasible, construct a second access road into a subdivision.

Jurisdiction(s): Park County
Project Type: Population Protection
Responsible Agencies and Partners: Park County FireSafe Council; Park County Fire Warden; Park County Fire Chiefs; Park County Road Foreman; US Forest Service; US Bureau of Land Management; Montana DNRC; Homeowners Associations
Resources Needed: Staff time and expertise; Funding for projects
Potential Funding Sources: US Forest Service; US Bureau of Land Management; Montana DNRC Western States Wildland Urban Interface grant; Homeowners' Association Fees; Special Tax Districts
Goal Timeframe: Mid Term - initiated within 3-6 years
Priority: Medium

5.1.3 GOAL 3: REDUCE POTENTIAL LOSSES FROM EARTHQUAKES

5.1.3.1 OBJECTIVE 3.1: PREVENT EARTHQUAKE LOSSES TO CRITICAL FACILITIES, VULNERABLE POPULATIONS, AND INFRASTRUCTURE.

Project 3.1.1 Critical Facility Seismic Retrofits:

- Conduct earthquake risk assessments at each critical facility.
- Perform simple mitigation activities such as filming windows and securing equipment and furniture that could fall during an earthquake.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Property Protection
Responsible Agencies and Partners: Park County Disaster and Emergency Services; County, City, and Town Department Directors and Facility Managers; Private Facility Managers
Resources Needed: Staff time and expertise; Funding for supplies
Potential Funding Sources: Federal Emergency Management Agency mitigation grants
Goal Timeframe: Near Term - initiated within 0-3 years (Park County and Livingston); Mid Term - initiated within 3-6 years (Clyde Park)
Priority: Medium-High

Project 3.2.1 Infrastructure Seismic Improvements:

- Prioritize and make improvements to bring vulnerable infrastructure up to seismic code.
- Inspect key bridges for seismic stability and make improvements during upgrades.
- Anchor or stabilize electric transformers and generators for seismic motion during maintenance and new installations.
- Install expansion joints in underground utilities during new or replacement construction.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Infrastructure Protection
Responsible Agencies and Partners: Park County Disaster and Emergency Services; County, City, and Town Road and Public Works Directors; Private Utility Companies
Resources Needed: Staff time and expertise; Funding for improvements
Potential Funding Sources: Federal Emergency Management Agency mitigation grants; County, City, and Town Budgets for staff and equipment time and supplies
Goal Timeframe: Near Term - initiated within 0-3 years (Park County and Livingston); Mid Term - initiated within 3-6 years (Clyde Park); Post Disaster - when making repairs
Priority: Medium-High

5.1.3.2 OBJECTIVE 3.2: MINIMIZE PRIVATE EARTHQUAKE LOSSES.

Project 3.2.1 Earthquake Retrofit Education:

- Educate home and business owners on simple earthquake retrofits.
- Survey commercial structures for earthquake stability and recommend retrofits.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Educational/Informational
Responsible Agencies and Partners: Park County Disaster and Emergency Services; Business Groups
Resources Needed: Staff time and expertise; Funding for engineers/specialists to conduct surveys
Potential Funding Sources: Federal Emergency Management Agency mitigation grants; Small Business Administration Pre-Disaster Mitigation loans
Goal Timeframe: Mid Term - initiated within 3-6 years (Park County and Livingston); Long Term - initiated within 7-10 years (Clyde Park)
Priority: Low-Medium

Project 3.2.2 Earthquake Retrofit Program:

- Create a financial incentive program for major earthquake retrofits in the priority hazard areas.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Educational/Informational
Responsible Agencies and Partners: Park County Disaster and Emergency Services
Resources Needed: Staff time and expertise; Funding for retrofits
Potential Funding Sources: Federal Emergency Management Agency mitigation grants; Small Business Administration Pre-Disaster Mitigation loans
Goal Timeframe: Mid Term - initiated within 3-6 years; Post Disaster - when most property owners are interested
Priority: Medium

5.1.4 GOAL 4: REDUCE LOSSES FROM TRANSPORTATION AND HAZARDOUS MATERIALS RELEASE ACCIDENTS

5.1.4.1 OBJECTIVE 4.1: ALLOW FOR EMERGENCY TRAFFIC AND EVACUATION ROUTES DURING A HAZARDOUS MATERIALS OR GROUND TRANSPORTATION INCIDENT.

Project 4.1.1 Railroad Crossing:

- Construct an additional railroad crossing in Livingston.

Jurisdiction(s): City of Livingston
Project Type: Population Protection
Responsible Agencies and Partners: Livingston Public Works Director; Livingston Fire Chief; Montana Rail Link; Montana Department of Transportation
Resources Needed: Staff time and expertise; Funding for construction
Potential Funding Sources: Montana Department of Transportation; Montana Rail Link; City Budget
Goal Timeframe: Near Term—initiated within 0-3 years
Priority: High

5.1.5 GOAL 5: PROMOTE EFFECTIVE MULTI-HAZARD MITIGATION MEASURES

5.1.5.1 OBJECTIVE 5.1: IMPROVE WARNING CAPABILITIES.

Project 5.1.1 Storm Ready Community:

- Become a National Weather Service Storm Ready Community through evaluation of and improvements to public weather warning capabilities.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Population Protection
Responsible Agencies and Partners: Park County Disaster and Emergency Services Coordinator; National Weather Service Warning Coordination Meteorologist
Resources Needed: Staff time and expertise
Potential Funding Sources: None needed
Goal Timeframe: Near Term - initiated within 0-3 years
Priority: High

5.1.5.2 OBJECTIVE 5.2: INCREASE EMERGENCY MANAGEMENT AND DISASTER SERVICE CAPABILITIES TO PREVENT ADDITIONAL LOSSES IN A DISASTER.

Project 5.2.1 Generators:

- Install generators at critical facilities and vulnerable population locations.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Population Protection
Responsible Agencies and Partners: Park County Disaster and Emergency Services Coordinator; County, City, and Town Department Heads and Facility Managers
Resources Needed: Staff time and expertise; Funding for generators (about $5,000 - $15,000 per site)
Potential Funding Sources: Unknown
Goal Timeframe: Near Term - initiated within 0-3 years; Post Disaster - when funding may be available
Priority: High

5.1.5.3 OBJECTIVE 5.3: IMPROVE DIGITAL DATA FOR ASSESSING ALL HAZARDS.

Project 5.3.1 HAZUS-MH GIS Data:

- Develop GIS data that can be used with FEMA's HAZUS loss estimated models.

Jurisdiction(s): Park County
Project Type: Educational/Informational
Responsible Agencies and Partners: Park County GIS Coordinator; Park County Disaster and Emergency Services Coordinator
Resources Needed: Staff time and expertise; Funding for education and data development
Potential Funding Sources: Federal Emergency Management Agency mitigation grants
Goal Timeframe: Long Term - initiated within 7-10 years
Priority: Low

5.1.5.4 OBJECTIVE 5.4: MITIGATE THE IMPACT OF HAZARDS ON FUTURE DEVELOPMENT THROUGH LAND USE AND BUILDING REGULATIONS.

Project 5.4.1 Building Codes:

- Adopt and enforce the state building code.

Jurisdiction(s): Park County, Town of Clyde Park

Project Type: Policy/Regulatory
Responsible Agencies and Partners: Park County Commission; Clyde Park Town Council
Resources Needed: Staff time and expertise; Funding for education and program development
Potential Funding Sources: County and Town Budgets
Goal Timeframe: Near Term - initiated within 0-3 years
Priority: High

Project 5.4.2 Subdivision Regulations and Growth Policies:

- Continue to make improvements to the subdivision regulations for disaster resistance.
- Ensure the new state requirements for wildfire considerations in growth policies are met.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Policy/Regulatory
Responsible Agencies and Partners: Park County Commission and Planners; Livingston City Commission and Planners; Clyde Park Town Council; Park County Fire Warden; Park County Fire Chiefs; County, City, and Town Attorneys
Resources Needed: Staff time and expertise
Potential Funding Sources: None needed
Goal Timeframe: Near Term - initiated within 0-3 years (Park County and Clyde Park); Mid Term - initiated within 3-6 years (Livingston)
Priority: Medium-High

5.1.5.5 OBJECTIVE 5.5: EDUCATE BUSINESSES AND THE PUBLIC ON SIMPLE MITIGATION ACTIVITIES.

Project 5.5.1 Mitigation Education:

- Develop a comprehensive public education program, including the use of social media as appropriate, that highlights a variety of mitigation topics including, but not limited to:
  - 72-Hour preparedness kits
  - Seasonal, hazard-specific information (avalanche, drought, flood, severe thunderstorms, wildfire, winter weather)
  - Smart building practices (specific to flood, wildfire, and/or wind)

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Educational/Informational
Responsible Agencies and Partners: Park County Disaster and Emergency Services Coordinator and the relevant subject matter experts: Park County Fire Warden, Park County Fire Chiefs, National Weather Service Warning Coordination Meteorologist, Montana Disaster and Emergency Services, Park County Public Health Nurse
Resources Needed: Staff time and expertise; Funding for materials
Potential Funding Sources: FEMA; USFS, BLM, and/or DNRC (for wildfire); DES or DNRC (for flooding)
Goal Timeframe: Near Term—initiated within 0-3 years; Post Disaster—when interest is greatest
Priority: High

Project 5.5.2: Active Shooter Preparedness and Education:

- Provide local authorities with ongoing active shooter response training.
- Assist local police in acquiring necessary equipment to effectively respond to and neutralize an active shooter.
- Promote education within schools to teach educators, students, and parents how to respond in an active shooter scenario.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Educational/Informational
Responsible Agencies and Partners: Park County Disaster and Emergency Services; Park County, Livingston, and Clyde Park Emergency Response authorities; Park County Public Schools
Resources Needed: Staff time and expertise; Funding for materials
Potential Funding Sources: US Justice Department, Department of Homeland Security, Bureau of Justice
Goal Timeframe: Near Term - initiated within 0-3 years
Priority: Low

5.1.5.6 OBJECTIVE 5.6: PROTECT CRITICAL INFRASTRUCTURE FROM A VARIETY OF HAZARDS.

Project 5.6.1 Electric and Communications Infrastructure Burying:

- Bury electric and communications lines in hazardous areas (wildland urban interface, near trees, etc.).

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Infrastructure Protection
Responsible Agencies and Partners: Electric Companies, Communications Companies, Park County Disaster and Emergency Services Coordinator, Park County Fire Warden
Resources Needed: Staff time and expertise; Funding for burying (about $1 million per mile)
Potential Funding Sources: Federal Emergency Management Agency mitigation grants
Goal Timeframe: Near Term - initiated within 0-3 years; Post Disaster - when repairing infrastructure
Priority: High

Project 5.6.2 Snow Fences:

- Install snow fences (living or artificial) along critical roadways prone to drifting snow and strong winds.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Infrastructure Protection
Responsible Agencies and Partners: Montana Department of Transportation; County, City, and Town Road/Street Foremen
Resources Needed: Staff time and expertise; Funding for fences and installation
Potential Funding Sources: Federal Emergency Management Agency mitigation grants; Montana Department of Transportation
Goal Timeframe: Near Term - initiated within 0-3 years (Park County and Livingston); Mid Term - initiated within 3-6 years (Clyde Park); Post Disaster - when funding may be available
Priority: Medium-High

Project 5.6.3 Cyber Security Enhancement

- Implement equipment and technology to enhance cyber security throughout the County.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Infrastructure Protection
Responsible Agencies and Partners: Park County Commission and Planners; Livingston City Commission and Planners; Clyde Park Town Council
Resources Needed: Staff time and expertise; Funding for equipment and training
Potential Funding Sources: Department of Homeland Security grants
Goal Timeframe: Mid Term - initiated within 3-6 years
Priority: Low

5.1.5.7 OBJECTIVE 5.7: PROMOTE PUBLIC HEALTH.

Project 5.7.1 Suicide Prevention and Education:

- Encourage schools and parents to screen adolescents for symptoms of depression.
- Implement automatic depression screening for all hospital patients upon intake.
- Provide students who show signs of depression with enhanced school resources, such as counselling and/or psychiatric referrals.

Jurisdiction(s): Park County, City of Livingston, Town of Clyde Park
Project Type: Population Protection
Responsible Agencies and Partners: DPHHS, Livingston HealthCare, Park County Public Schools
Resources Needed: Staff time and expertise
Potential Funding Sources: None needed
Goal Timeframe: Near Term - Initiated within 0-3 years
Priority: Low

5.2 PROJECT PRIORITIZATION

Each of the proposed projects has value and is important enough to be included in the strategy; however, time and financial constraints and competition with other community priorities do not permit all proposed actions to be implemented immediately. By prioritizing the actions, the most critical, cost effective projects can be achieved in the short term. The prioritization of the projects serves as a guide for choosing and funding projects, however, depending on the funding sources, some actions may be best achieved outside the priorities established here.

To ensure that community goals and other factors are considered when prioritizing projects, a prioritization model that uses the following factors has been developed: cost, staff time, feasibility, population benefit, property benefit, values benefit, maintenance, and hazard rating. Cost considers the direct expenses associated with the project such as material and contractor expenses. Staff time evaluates the amount of time needed by a local government employee to complete or coordinate the project. Feasibility assesses the political, social, and/or environmental ramifications of the project and the likelihood such a project would proceed through permitting, public review processes, and/or private business implementation. The feasibility factor is essentially a summarization of FEMA's Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE) evaluation criteria as shown in Table 5-1. Population benefit considers the possible prevention of deaths and injuries through the

project's implementation. Property benefit estimates the reduction of property losses, including structures and infrastructure, from the hazard being mitigated. Values benefit considers the economic, ecologic, historic, and social benefits of the project. Maintenance rates the amount of work required to keep the mitigation measure effective and useful. The hazard rating is based on the results of the risk assessment and is a measure of the history, probability, magnitude, and vulnerabilities of the hazard.

Table 5-1. FEMA STAPLEE Criteria (FEMA, 2003).

Criteria	Considerations
Social	Community Acceptance Effects on Segment of Population
Technical	Technical Feasibility Long-Term Solution Secondary Impacts
Administrative	Staffing Funding Allocated Maintenance/Operations
Political	Political Support Local Champion or Proponent Public Support
Legal	State Authority Local Authority Subjectivity to Legal Challenges
Economic	Benefit of Action Cost of Action Contribution to Economic Goals Outside Funding Requirement
Environmental	Effects on Land/Water Bodies Effects on Endangered Species Effects on Hazardous Material and Waste Sites Consistency with Community Environmental Goals Consistency with Federal Laws

Each factor was ranked qualitatively for each of the projects. The methods used to assign a category and the associated score can be generally defined as shown in Table 5-2. The highest possible score is 30 for projects in which all factors are applicable. Some factors have a greater range than others, thus indicating a higher weighting. These weightings allow for appropriate prioritization of the project. More specifically, 11 of 30 points account for benefits (population benefit, property benefit, and values benefit), 11 of 30 points account for direct and indirect costs (cost, staff time, and maintenance), 5 of 30 points account for the hazard rating (incorporates hazard probability and impacts; see Section 4.19), and 3 of 30 points account for project feasibility.

The projects were prioritized by comparing the scores of projects of similar type. This method allows for more even prioritization of a variety of projects. In order for a project to receive a "high" priority, it also needed to mitigate a "high" rated hazard for the jurisdiction. When evaluating projects for grant applications, established cost-benefit analyses requiring detailed project-specific data should be used.

Note that all projects listed in the strategy have value and are worthy of inclusion in this plan. A low priority does not mean the project is not important, rather, compared to the other projects, its score using the described methodology was lower. Even low priority projects are encouraged immediately should funding, resources, and opportunities allow.

Table 5-2. Prioritization Criteria.

Factor	Threshold	Rating	Score
Cost (Range 1-5)	Little to no direct expenses	Low	5
	Less than $5,000	Low-Moderate	4
	$5,000-$25,000	Moderate	3
	$25,001-$100,000	Moderate-High	2
	Greater than $100,000	High	1
Staff Time (Range 1-3)	Less than 10 hours of staff time	Low	3
	10-40 hours of staff time	Moderate	2
	Greater than 40 hours of staff time	High	1
Feasibility (Range 1-3)	Positive support for the project	High	3
	Neutral support for the project	Moderate	2
	Negative support for the project	Low	1
Population Benefit (Range 1-4)	Potential to reduce more than 20 casualties	Very High	4
	Potential to reduce 6-20 casualties	High	3
	Potential to reduce 1-5 casualties	Moderate	2
	No potential to reduce casualties	Low	1
Property Benefit (Range 1-4)	Potential to reduce losses to more than 20 buildings or severe damages to infrastructure	Very High	4
	Potential to reduce losses to 6-20 buildings or substantial damages to infrastructure	High	3
	Potential to reduce losses to 1-5 buildings or slight damages to infrastructure	Moderate	2
	No potential to reduce property losses	Low	1
Values Benefit (Range 1-3)	Provides significant benefits to economic, ecologic, historic, or social values	High	3
	Provides some benefits to economic, ecologic, historic, or social values	Moderate	2
	No or very little benefit to economic, ecologic, historic, or social values	Low	1
Maintenance (Range 1-3)	Requires very little or no maintenance	Low	3
	Requires less than 10 hours per year	Moderate	2
	Requires more than 10 hours per year	High	1
Hazard Rating (Range 1-5)	see Section 4.19	High	5
	see Section 4.19	Moderate	3
	see Section 4.19	Low	1

Table 5-3. Hazards and Development Mitigated by Each Proposed Project.

	Cost	Staff Time	Feasibility	Population Benefit	Property Benefit	Values Benefit	Maintenance	Hazard Rating	Total Score
Educational/Informational									
Project 1.2.3: Flood Insurance Education	5	2	2	1	3	2	1	5	21
Project 2.1.2: Fuels and Fire Mapping	3	2	3	1	3	3	1	5	21
Project 3.2.1: Earthquake Retrofit Education	5	1	2	2	2	2	1	5	20
Project 5.3.1: HAZUS-MH GIS Data	3	2	3	1	1	2	2	5	19
Project 5.5.1: Mitigation Education	5	1	2	3	2	2	1	5	21
Project 5.5.2: Active Shooter Education	4	1	3	4	1	3	1	1	18
Policy/Regulatory									
Project 1.1.2: Floodplain Ordinances	5	1	2	2	3	3	2	5	23
Project 1.1.3: Conservation Easements	1	2	2	2	3	3	3	5	21
Project 5.4.1: Building Codes	5	1	1	3	3	2	1	5	21
Project 5.4.2: Growth Policies and Subdivision Regulations	5	1	2	2	3	2	2	5	22
Property Protection									
Project 1.1.6: Livingston Berm Alternatives	2	2	3	2	3	2	3	5	22
Project 1.2.1: River Bank Stabilization and Flood Mitigation Program	2	1	3	2	2	3	2	5	20
Project 1.2.2: Flood-prone Property Acquisition Program	1	2	2	2	2	3	3	5	20
Project 2.2.1: Fuel Reductions	3	2	2	2	2	2	1	5	19
Project 2.2.2: Regional Water Sources	3	2	2	2	2	1	2	5	19
Project 3.1.1: Critical Facility Seismic Retrofits	4	2	3	2	2	2	3	5	23
Project 3.2.2: Earthquake Retrofit Program	2	2	2	2	2	2	3	5	20
Infrastructure Protection									
Project 1.1.1: River Crossing Improvements	1	2	3	2	2	3	3	5	21
Project 1.1.4: Water Body and Ditch Maintenance	4	1	3	2	2	2	1	5	20
Project 1.1.5: Bridge, Culvert, and Road Improvements	2	2	3	2	2	2	3	5	21
Project 3.1.2: Infrastructure Seismic Improvements	3	2	3	2	3	2	3	5	23

	Cost	Staff Time	Feasibility	Population Benefit	Property Benefit	Values Benefit	Maintenance	Hazard Rating	Total Score
Project 5.6.1: Electric and Communications Infrastructure Burying	1	2	2	2	3	2	3	5	20
Project 5.6.2: Snow Fences	3	2	3	2	2	2	2	5	21
Project 5.6.3: Cyber Security Equipment	2	2	3	1	2	3	2	1	16
Population Protection									
Project 2.2.3: Ingress/Egress Road Improvements	2	2	2	3	1	1	2	5	18
Project 4.1.1: Railroad Crossing	1	2	2	3	1	2	3	5	19
Project 5.1.1: Storm Ready Community	5	1	3	2	1	2	2	5	21
Project 5.2.1: Generators	3	2	2	3	2	2	2	5	21
Project 5.7.1: Suicide Prevention and Education	5	1	3	4	1	3	1	1	19

Following are the top priorities by hazard and jurisdiction. These priorities were established based on the high hazards for each jurisdiction and the basic review of cost versus benefit for that hazard and jurisdiction. The priorities were reviewed at open public meetings.

5.2.1 PARK COUNTY

Flooding

- Project 1.1.2: Floodplain Ordinances
- Project 1.1.6: Livingston Berm Alternatives
- Project 1.1.1: River Crossing Improvements
- Project 1.1.5: Bridge, Culvert, and Road Improvements

Wildfire

- Project 5.4.2: Growth Policies and Subdivision Regulations
- Project 2.2.1: Fuel Reductions

Earthquake

- Project 3.1.1: Critical Facility Seismic Retrofits
- Project 3.1.2: Infrastructure Seismic Improvements

Hazardous Materials Release

- Project 5.1.1: Storm Ready Community

Wind

- Project 5.5.1: Mitigation Education
- Project 5.4.1: Building Codes
- Project 5.6.1: Electric and Communications Infrastructure Burying

Winter Storms and Extended Cold

- Project 5.5.1: Mitigation Education
- Project 5.4.1: Building Codes
- Project 5.6.2: Snow Fences
- Project 5.2.1: Generators

5.2.2 CITY OF LIVINGSTON

Flooding

- Project 1.1.2: Floodplain Ordinances
- Project 1.1.6: Livingston Berm Alternatives
- Project 1.1.1: River Crossing Improvements
- Project 1.1.5: Bridge, Culvert, and Road Improvements

Earthquake

- Project 3.1.1: Critical Facility Seismic Retrofits
- Project 3.1.2: Infrastructure Seismic Improvements

Hazardous Materials Release

- Project 5.1.1: Storm Ready Community
- Project 4.1.1: Railroad Crossing

Wind

- Project 5.5.1: Mitigation Education
- Project 5.6.1: Electric and Communications Infrastructure Burying

Winter Storms and Extended Cold

- Project 5.5.1: Mitigation Education
- Project 5.6.2: Snow Fences
- Project 5.2.1: Generators

5.2.3 TOWN OF CLYDE PARK

Severe Thunderstorms and Tornadoes

- Project 5.5.1: Mitigation Education
- Project 5.4.1: Building Codes
- Project 5.1.1: Storm Ready Community
- Project 5.6.1: Electric and Communications Infrastructure Burying

Flooding

- Project 1.1.2: Floodplain Ordinances
- Project 1.1.5: Bridge, Culvert, and Road Improvements

Urban Fire

- Project 5.5.1: Mitigation Education
- Project 5.4.1: Building Codes

Wildfire

- Project 5.4.2: Growth Policies and Subdivision Regulations

Wind

- Project 5.5.1: Mitigation Education
- Project 5.6.1: Electric and Communications Infrastructure Burying

5.3 PROJECT IMPLEMENTATION

A critical component of any mitigation program is the implementation of the mitigation projects. Maintenance of this Hazard Mitigation Plan is the responsibility of Park County Disaster and Emergency Services (DES) in coordination with other appropriate agencies. Once a mitigation project is identified, however, DES generally steps back from the leadership role and assumes the role of team participant. The lead role in project development should then shift to the department or agency responsible for the project management.

The proposed and prioritized projects are shown in Table 5-4 with the associated goal timeframes for the actions. The timeframes are defined as follows and are generally based on the nature of the project and its priority:

- Near Term: Initiated within 0-3 years
- Mid Term: Initiated within 3-6 years
- Long Term: Initiated within 7-10 years
- Ongoing: Already initiated and continuing
- Post Disaster: May best be initiated during the recovery process

Some projects may be best achieved outside of the goal timeframes depending on the funding and staff resources available. Others may not be feasible in the goal timeframe due to financial, staff, or political limitations. This prioritized list, however, allows the county, city, and town to focus on the types of projects with the greatest benefits.

Table 5-4. Implementation Scheme for Mitigation Projects.

Proposed Action	Jurisdiction(s)	Priority	Goal Timeframe
Educational/Informational			
Project 5.5.1: Mitigation Education	All	High	Near Term, Post Disaster
Project 1.2.3: Flood Insurance Education	All	Medium	Mid Term, Post Disaster
Project 2.1.2: Fuels and Fire Mapping	Park County	Medium	Ongoing
Project 3.2.1: Earthquake Retrofit Education	Park County Livingston	Medium	Mid Term
Project 3.2.1: Earthquake Retrofit Education	Clyde Park	Low	Long Term
Project 5.3.1: HAZUS-MH GIS Data	Park County	Low	Long Term
Project 5.5.2: Active Shooter Education	All	Low	Near Term

Proposed Action	Jurisdiction(s)	Priority	Goal Timeframe
Policy/Regulatory			
Project 1.1.2: Floodplain Ordinances	All	High	Near Term
Project 5.4.1: Building Codes	Park County Clyde Park	High	Near Term
Project 5.4.2: Growth Policies and Subdivision Regulations	Park County Clyde Park	High	Near Term
Project 5.4.2: Growth Policies and Subdivision Regulations	Livingston	Medium	Mid Term
Project 1.1.3: Conservation Easements	All	Low	Ongoing, Post Disaster
Property Protection			
Project 2.2.1: Fuel Reductions	Park County	High	Ongoing
Project 3.1.1: Critical Facility Seismic Retrofits	Park County Livingston	High	Near Term
Project 1.1.6: Livingston Berm Alternatives	Park County Livingston	High	Near Term
Project 1.2.1: River Bank Stabilization and Flood Mitigation Program	Park County	Medium	Mid Term, Post Disaster
Project 1.2.2: Flood-prone Property Acquisition Program	Park County	Medium	Mid Term, Post Disaster
Project 3.1.1: Critical Facility Seismic Retrofits	Clyde Park	Medium	Mid Term
Project 3.2.2: Earthquake Retrofit Program	All	Medium	Mid Term, Post Disaster
Project 2.2.2: Regional Water Sources	Park County	Low	Long Term
Infrastructure Protection			
Project 3.1.2: Infrastructure Seismic Improvements	Park County Livingston	High	Near Term, Post Disaster
Project 1.1.1: River Crossing Improvements	Park County Livingston	High	Ongoing, Post Disaster
Project 1.1.5: Bridge, Culvert, and Road Improvements	All	High	Near Term, Post Disaster
Project 5.6.2: Snow Fences	Park County Livingston	High	Near Term, Post Disaster
Project 5.6.1: Electric and Communications Infrastructure Burying	All	High	Near Term, Post Disaster
Project 3.1.2: Infrastructure Seismic Improvements	Clyde Park	Medium	Mid Term, Post Disaster
Project 5.6.2: Snow Fences	Clyde Park	Medium	Mid Term, Post Disaster

Proposed Action	Jurisdiction(s)	Priority	Goal Timeframe
Project 1.1.4: Water Body and Ditch Maintenance	All	Medium	Ongoing
Project 5.6.3: Cyber Security Equipment	All	Low	Mid Term
Population Protection			
Project 5.1.1: Storm Ready Community	All	High	Near Term
Project 5.2.1: Generators	All	High	Near Term, Post Disaster
Project 4.1.1: Railroad Crossing	Livingston	High	Near Term
Project 2.2.3: Ingress/Egress Road Improvements	Park County	Medium	Mid Term
Project 5.7.1: Suicide Prevention and Education	All	Low	Near Term

5.4 FUNDING SOURCES

Funding for mitigation projects exists from a multitude of sources. Some sources may be specifically designed for disaster mitigation activities, while others may have another overarching purpose that certain mitigation activities may qualify for. Most mitigation funding sources are recurring through legislation or government support. Some, however, may be from an isolated instance of financial support. Whenever possible, creative financing is encouraged. Often, additional funding sources are found through working with other agencies and businesses to identify common or complementary goals and objectives. Table 5-5 shows the programs that may be available to Park County, the City of Livingston, and the Town of Clyde Park. Note, many of the grant programs have a cash or in-kind match requirement.

This list of potential funding sources is certainly not all inclusive. Many opportunities for mitigation funding exist both in the public and private sectors such as businesses, foundations, and philanthropic organizations.

Table 5-5. Mitigation Funding Sources.

Name	Description	Managing Agencies
AmeriCorps	Provides funding for volunteers to serve communities, including disaster prevention.	Corporation for National & Community Service
Assistance to Firefighters Grants	Provides funding for fire prevention and safety activities and firefighting equipment.	US Department of Homeland Security
Clean Water Act Section 319 Grants	Provides grants for a wide variety of activities related to non-point source pollution runoff mitigation.	US Environmental Protection Agency

Name	Description	Managing Agencies
Community Development Block Grant (CDBG)	Provides funding for sustainable community development, including disaster mitigation projects.	US Housing and Urban Development
Conservation District "HB 223" Grants	Provides funding for projects sponsored by conservation districts	Montana Department of Natural Resources and Conservation
Economic Development Administration (EDA) Grants and Investments	Invests and provides grants for community construction projects, including mitigation activities.	US Economic Development Administration
Education Mini-Grants	Provides grants to conservation districts for projects that focus on water and other natural resources	Montana Department of Natural Resources and Conservation
Emergency Watershed Protection	Provides funding and technical assistance for emergency measures such as floodplain easements in impaired watersheds.	US Natural Resources Conservation Service
Environmental Quality Incentives Program	Provides funding and technical assistance to farmers and ranchers to promote agricultural production and environmental quality as compatible goals.	US Natural Resources Conservation Service
Flood Mitigation Assistance Program (FMA)	Provides pre-disaster flood mitigation funding (with priority for repetitive flood loss properties under the National Flood Insurance Program).	Montana Department of Natural Resources and Conservation FEMA – Region VIII
Hazard Mitigation Grant Program (HMGP)	Provides post-disaster mitigation funding statewide.	Montana Disaster & Emergency Services FEMA – Region VIII
Hazardous Fuels Mitigation Program	Provides funding for the reduction of hazardous wildfire fuels.	US Bureau of Land Management
Hazardous Materials Planning and Training Grants	Provides funding for planning and training for hazardous materials releases.	Montana Disaster & Emergency Services
Homeland Security Grants	Through multiple grants, provides funding for	Montana Disaster & Emergency Services

Name	Description	Managing Agencies
	homeland security activities. Some projects can be considered mitigation.	US Department of Justice US Department of Homeland Security
Housing and Urban Development (HUD) Grants	Provides several grants related to safe housing initiatives.	US Housing and Urban Development
Individual Assistance (IA)	Following a disaster, funds can mitigate hazards when repairing individual and family homes.	Montana Disaster & Emergency Services FEMA – Region VIII
Jumpstart Grants	Provides grants for forest stewardship and fuel reduction projects.	Montana Department of Natural Resources and Conservation
Law Enforcement Support Office 1033 Program	Provides surplus military property to local law enforcement agencies.	Montana Public Safety Service Bureau
Map Modernization Program	Provides funding to establish or update floodplain mapping.	Montana Department of Natural Resources and Conservation FEMA – Region VIII
National Wildlife Wetland Refuge System	Provides funding for the acquisition of lands into the federal wildlife refuge system.	US Fish and Wildlife Service
North American Wetland Conservation Fund	Provides funding for wetland conservation projects.	US Fish and Wildlife Service
NRCS Conservation Programs	Provides funding through several programs for the conservation of natural resources.	US Natural Resources Conservation Service
Partners for Fish and Wildlife	Provides financial and technical assistance to landowners for wetland restoration projects in "Focus Areas" of the state.	US Fish and Wildlife Service
PPL Montana Community Fund	Provides grants to Montana organizations in the areas of education, environment, and economic development.	PPL Montana
Pre-Disaster Mitigation (PDM) Grants	Provides grants through a competitive process for specific mitigation projects, including planning.	Montana Disaster & Emergency Services FEMA – Region VIII

Name	Description	Managing Agencies
Public Assistance (PA)	Following a disaster, funds can be used to mitigate hazards when repairing damages to public structures or infrastructure.	Montana Disaster & Emergency Services FEMA – Region VIII
Reclamation and Development Grants Program	Provides funding from the interest income of the Resource Indemnity Trust Fund to local governments for dam safety and other water related projects.	Montana Department of Natural Resources and Conservation
Renewable Resource Development Grant	Provides funding to protect, conserve, or develop renewable resources, including water.	Montana Department of Natural Resources and Conservation
Repetitive Flood Claims (RFC) Grant	Provides funding to reduce flood damages to insured properties that have had one or more claims to the NFIP.	Montana Department of Natural Resources and Conservation FEMA – Region VIII
Rural Development Grants	Provides grants and loans for infrastructure and public safety development and enhancement in rural areas.	US Department of Agriculture, Rural Development
Rural Fire Assistance (RFA) Grant	Funds fire mitigation activities in rural communities.	National Interagency Fire Center
SBA Pre-Disaster Mitigation Loan Program	Provides low-interest loans to small businesses for mitigation projects.	US Small Business Administration (SBA)
Severe Repetitive Loss (SRL) Grant	Provides funding to reduce flood damages to residential insured properties that have had at least four claims to the NFIP.	Montana Department of Natural Resources and Conservation FEMA – Region VIII
Small Flood Control Projects	Authority of USACE to construct small flood control projects.	US Army Corps of Engineers (USACE)
Streambank & Shoreline Protection	Authority of USACE to construct streambank stabilization projects.	US Army Corps of Engineers (USACE)
Volunteer Fire Assistance (VFA) Grants	Provides funding for wildfire prevention and suppression projects.	Montana Department of Natural Resources and Conservation

Name	Description	Managing Agencies
Watershed Planning Assistance	Provides funding for watershed planning activities through conservation districts.	Montana Department of Natural Resources and Conservation
Western States Wildland Urban Interface Grant	Provides funding for pre-disaster wildfire mitigation.	Montana Department of Natural Resources and Conservation
Wetland Program Development Grants (WPDGs)	Provides funding for studies related to water pollution prevention.	US Environmental Protection Agency
Woody Biomass Utilization and Fuels for Schools and Beyond Programs	Facilitates and promotes the beneficial use of woody biomass created by forest management treatments.	Montana Department of Natural Resources and Conservation

5.5 EXISTING PLANNING MECHANISMS AND CAPABILITIES

Implementing mitigation projects requires cooperation and coordination between a variety of agencies, organizations, and the public. Most mitigation projects are time consuming and may require the attention of local officials with many other priorities. Incorporating mitigation ideas and information into existing planning mechanisms and programs is one way to use existing resources to achieve mitigation objectives.

Park County primarily consists of rural areas and has a relatively small tax base that limits the number of resources and amount of time that can be devoted to mitigation, or even planning and emergency management for that matter. Similarly, the City of Livingston, although more developed, is still a relatively small community with the Town of Clyde Park being very small in comparison. These jurisdictions may require additional assistance and support to perform the most basic mitigation activities such as grant applications or community outreach. Park County has one full-time coordinator, assisted by a part-time deputy, to manage Disaster and Emergency Services activities for the county, city, and town. Each jurisdiction participates in the National Flood Insurance Program (NFIP) and has a designated floodplain administrator; however, floodplain administration is only one of many responsibilities for these individuals.

A variety of legislation enables the implementation of mitigation activities including, but not limited to:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act
- Presidential Executive Order 12898, Environmental Justice
- Presidential Executive Order 11988, Floodplain Management
- Presidential Executive Order 11990, Protection of Wetlands
- Montana Code Annotated, Title 10, Chapter 3, Disaster and Emergency Services
- Montana Code Annotated, Title 76, Chapter 5, Flood Plain and Floodway Management
- Montana Code Annotated, Title 50, Chapter 60, Building Construction Standards
- Montana Code Annotated, Title 76, Chapter 2, Planning and Zoning
- Park County Floodplain Ordinance

- Park County Subdivision Regulations
- City of Livingston Building Code
- City of Livingston Floodplain Ordinance
- City of Livingston Subdivision Regulations
- City of Livingston Zoning Ordinance

As the jurisdictions develop new plans and existing plans are updated, the new plans and updates will utilize the hazard information and actions identified in this mitigation plan for consideration and inclusion. Given that limited planning mechanisms exist in the county, city, and town, the information in this mitigation plan will be valuable for future planning efforts. Most of the integration of mitigation into existing plans will be done by the local planning departments and/or boards as the plans are updated or created, however, for more comprehensive integration, local officials and other departments will also need to consider mitigation when making decisions and updating codes, regulations, policies, and plans. Table 5-6 shows examples of how mitigation can be incorporated into existing and future planning documents. Note that some proposed mechanisms may not be feasible at this time, or any time soon, due to the staff, technical expertise, political, and financial resources needed to implement the program.

Table 5-6. Incorporation into Existing and Future Plans.

Existing or Anticipated Plan	Mitigation Strategies
Building Codes	Adopt and enforce the state building code. This activity will reduce the risks to future development from hazards such as earthquakes, tornadoes, strong winds, heavy snow, terrorism, urban fire, and volcanic ashfall.
Capital Improvement Plans	When updated, consider and include projects related to hazard mitigation, such as transportation and public utility infrastructure and building improvements, in the capital improvements schedule.
Community Wildfire Protection Plan	When updated, continue to emphasize mitigation activities in the strategy portion of the plan.
Economic Development Strategies	When developed or updated, include elements of the risk assessment and mitigation strategy into the strategy, considering sustainability and disaster resistance a top priority since disasters often lead to economic problems.
Emergency Operations Plans	Integrate the operational, response, training, and preparedness needs that are not directly tied to mitigation into the county's emergency operation plan or Local Emergency Planning Committee strategic plan.
Growth Policies	When updated, include elements of the risk assessment and mitigation strategy into the growth policy, considering sustainability and disaster resistance a top priority.
Subdivision Regulations	When updated, incorporate elements of the risk assessment and mitigation strategy into the subdivision regulations, considering sustainability and disaster resistance a top priority.
Zoning / Ordinances / Municipal Codes	Adopt ordinances that create disaster resistance such as fire reduction ordinances, flood ordinances, and open space zoning in hazard areas.

Note: Some activities such as building codes and land use regulations are more easily implemented by some communities than others because of the community, planning, and enforcement resources available.

6.0 PLAN MAINTENANCE

An important aspect of any useable plan is the maintenance and upkeep of the document. The Park County Commission, Livingston City Commission, and Clyde Park Town Council are ultimately responsible for ensuring this plan is kept up to date. To facilitate and ensure the plan will remain viable for jurisdictions for many years, the plan maintenance responsibilities are delegated to the Park County Disaster and Emergency Services (DES) Coordinator and the Local Emergency Planning Committee (LEPC) Chairperson as co-leads. The LEPC meets regularly and is responsible for coordinating emergency planning issues for the county and communities. Given the broad representation of agencies and jurisdictions, this committee is a good fit, has many members that participated in the plan development, and eliminates the need for an additional committee. All Local Emergency Planning Committee meetings are open to the public.

6.1 PLAN MONITORING

The plan will be monitored by the Park County DES Coordinator and the Park County LEPC, and mitigation progress will be discussed through agency/department reports at each LEPC meeting, usually monthly. The status of projects will be reported on and new projects will be initiated during this time.

The Park County DES Coordinator and the Park County LEPC will review the goals, objectives, and projects, as needed, such as when a mitigation grant application opportunity exists, to determine if the actions for which funding exist are proceeding as planned and if new projects should be initiated. The DES Coordinator and LEPC will review any new risk information and modify the plan as indicated by the emergence of new vulnerabilities. Review of ongoing projects will be conducted to determine their status, their practicality, and which actions should be revised. If needed, site visits will be conducted and/or relevant state or federal program specialists will be invited to speak to the LEPC and local officials regarding mitigation opportunities. Reporting requirement for federal mitigation grants and such are the responsibility of the jurisdiction and agency applying for and receiving the grant, unless other arrangements have been made. Also, land use, comprehensive, and strategic plans will be monitored as related to the Hazard Mitigation Plan, and similarly, local planning boards and departments will be encouraged to participate in all plan review and updates.

Available resources working on mitigation activities will be evaluated periodically by the Park County DES Coordinator and Park County LEPC to determine if a mitigation or project subcommittee or additional resources are needed to apply for and implement a particular project. Additional resources will be requested, as applicable.

6.2 PLAN EVALUATION

The evaluation of the plan will be conducted by the Park County DES Coordinator and the Park County LEPC, possibly with assistance from consultants, as needed and at a minimum of once every five years, at LEPC and other public meetings. At these meetings, the methods of implementing and maintaining the plan will be evaluated for successes and improvements. Changes to the implementation schedule or plan

maintenance will be made as needed to ensure hazard mitigation activities continue. The evaluation will consider the following:

- Changes in land development,
- If the nature or magnitude of risks has changed,
- If the goals and objectives address current and expected conditions,
- The effectiveness of the programs,
- If outcomes have occurred as expected,
- If other agencies and partners have participated as originally planned,
- If current resources are adequate for implementing the plan,
- If other programs exist that may affect mitigation priorities.

New stakeholders and interested parties will be identified and invited to participate in the implementation process. The Park County DES Coordinator and the Park County LEPC maintain a contact list of mitigation stakeholders. Should a hazard event have occurred in which a mitigation project was a factor, either positive or negative, a summary report, including avoided losses, will be written and included in the updated plan.

6.3 PLAN UPDATES

As disasters occur, projects are completed, and hazard information is improved, the Park County Hazard Mitigation Plan will need to be updated. To remain an active and approved plan, an updated plan must be submitted to Montana Disaster and Emergency Services (DES) and the Federal Emergency Management Agency (FEMA) every five years. The next formal submission is required in 2023. To provide enough time for a full update before this plan expires, the following schedule is recommended:

- Pre-Disaster Mitigation Planning Grant Application Preparations: late 2021
- Pre-Disaster Mitigation Planning Grant Application: early 2022
- Contracting for Professional or Technical Services (if needed): July-August 2022
- Plan Reviews and Modifications: September 2015 - May 2023
- Montana DES and FEMA Reviews: June-July 2023
- Final Revisions and Adoption: August 2023
- Final Plan Approval: September 2023

To facilitate the update process, annual updates to the plan are recommended. Table 6-1 shows the schedule of plan updates. All jurisdictions must participate in the plan update process for the plan to remain approvable for each jurisdiction.

Table 6-1. Schedule of Plan Updates.

Plan Section	Post-Disaster	Annually	Every 5 Years
Introduction			X
Planning Process and Methodologies	X	X	X
Critical Facilities and Infrastructure			X
Population and Structures			X

Plan Section	Post-Disaster	Annually	Every 5 Years
Economic, Ecologic, Historic, and Social Values			X
Current Land Use			X
Recent Development		X	X
Future Development			X
Hazard Profiles	X		X
Risk Assessment Summary			X
Mitigation Strategy	X	X	X
Plan Maintenance			X
Appendices	X	X	X

6.4 PUBLIC INVOLVEMENT

Park County, the City of Livingston, and the Town of Clyde Park are dedicated to involving the public directly in the review and updates of the Hazard Mitigation Plan. A copy of the Hazard Mitigation Plan will be available for review at the Park County Disaster and Emergency Services' Office, the Park County Commissioners' Office, Livingston City Manager's Office, and the Town of Clyde Park Office. The public is also invited to attend all Local Emergency Planning Committee meetings to provide input and feedback. In an effort to solicit involvement, appropriate public notices will be distributed prior to public meetings for plan updates, encouraging the public to attend and provide comment. Written comments may also be submitted at any time to the Park County Local Emergency Planning Committee at:

Park County Local Emergency Planning Committee
c/o Park County Disaster and Emergency Services 414 East Callender Street
Livingston, MT 59047
406-222-4190
des@parkcounty.org

Comments will be reviewed and incorporated into the plan as applicable during the five-year update, or sooner if required.