2017 UPDATE TO
PRE-DISASTER MITIGATION PLAN

FOR

JEFFERSON COUNTY, MONTANA
AND
CITY OF BOULDER & TOWN OF WHITEHALL

***Prepared for*:**

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LIST OF ACRONYMS

BCA	Benefit Cost Analysis
BLM	Bureau of Land Management
CDBG	Community Development Block Grant
CAA	Community Assistance Agreement
CDC	Centers for Disease Control
CDP	Census Designated Place
CEIC	Census and Economic Information Center
CLOMAR	Conditional Letter of Map Revision
CPAW	Community Planning Assistance for Wildfire
CPRI	Calculated Priority Risk Index
CRP	Conservation Reserve Program
CRS	Community Rating System
CWPP	Community Wildfire Protection Plan
DES	Disaster and Emergency Services
DFIRM	Digital Flood Insurance Rate Map
DMA	Department of Military Affairs
DMA	Disaster Mitigation Act
DNRC	MT Department of Natural Resources and Conservation
DOI	U.S. Department of Interior
DPHHS	MT Department of Health and Human Services
EAP	Emergency Action Plan
EMS	Emergency Medical Services
EMPG	Emergency Management Performance Grant
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right to Know Act
EQIP	Environmental Quality Incentives Program
ERC	Energy Release Component
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
FP&S	Fire Protection and Safety
FWS	U.S. Fish and Wildlife Service
GIS	Geographic Information Systems
HAZUS	Hazards of the United States
HMGP	Hazard Mitigation Grants Program
IBC	International Building Code
IDSA	Infectious Disease Society of America
IRC	International Residential Code
LEPC	Local Emergency Planning Committee
LiDar	Light Detection and Ranging

LIST OF ACRONYMS

MBMG	Montana Bureau of Mines and Geology
MDOR	Montana Department of Revenue
MDT	Montana Department of Transportation
NCDC	National Climatic Data Center
NDRP	National Drought Resilience Partnership
NFIP	National Flood Insurance Program
NFP	National Fire Plan
NFPA	National Fire Protection Association
NID	National Inventory of Dams
NISEE	National Information Service for Earthquake Engineering
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NRIS	Natural Resource Information System
NTSB	National Transportation Safety Board
NWS	National Weather Service
PDM	Pre-Disaster Mitigation
PDMC	Pre-Disaster Mitigation Competitive (grants program)
PGA	Peak Ground Acceleration
PPP	Population Protection Plans
RC&D	Resource Conservation and Development
RFA	Rural Fire Assistance
SHELDUS	Spatial Hazard Events and Losses Database for the United States
STD	Sexually Transmitted Disease
TCFSWG	Tri-County FireSafe Working Group
TRI	Toxic Release Inventory
UCF	Urban and Community Forestry
USDA	United State Department of Agriculture
USGS	United States Geologic Survey
VFD	Volunteer Fire Department
WHO	World Health Organization
WRN	Weather Ready Nation
WUI	Wildland Urban Interface

SECTION 1. INTRODUCTION

1.1 Background

In response to the requirements of the Disaster Mitigation Act of 2000 (DMA 2000), Jefferson County, the City of Boulder, and the Town of Whitehall, have developed this Multi-Jurisdictional Pre-Disaster Mitigation (PDM) Plan. DMA 2000 amends the Stafford Act and is designed to improve planning for, response to, and recovery from, disasters by requiring State and local entities to implement pre-disaster mitigation planning and develop PDM Plans. The Federal Emergency Management Agency (FEMA) has issued guidelines for development of PDM Plans. The Montana Disaster and Emergency Services (DES) supports plan development for jurisdictions in the State of Montana.

> ***Hazard Mitigation*** is any sustained action taken to reduce or eliminate the long term risk and effects that can result from specific hazards.
>
> FEMA defines a ***Hazard Mitigation Plan*** as the documentation of a state or local government evaluation of natural hazards and the strategies to mitigate

Jefferson County completed and adopted a PDM Plan in 2005, which was updated in 2011, to help guide and focus hazard mitigation activities. The County, working together with Tetra Tech Inc., has prepared this 2017 update to their PDM Plan to satisfy the requirement that PDM Plans be updated every five years. The 2017 Jefferson County PDM Plan profiles significant hazards to the community and identifies mitigation projects that can reduce those impacts. The purpose of the PDM Plan is to promote sound public policy designed to protect residents, critical facilities, infrastructure, private property, and the environment from natural and man-made hazards. The updated Jefferson County PDM Plan includes resources and information to assist residents, organizations, local government, and others interested in participating in planning for natural and man-made hazards. This 2017 updated PDM Plan supersedes the 2005 and 2011 PDM Plans.

1.2 Authority

The Jefferson County PDM Plan update has been developed pursuant to the requirements in the Interim Final Rule for hazard mitigation planning and the guidance in the State and Local Plan Interim Criteria under DMA 2000. The Plan also meets guidance developed by FEMA in June of 2008 for Multi-Jurisdictional Mitigation Planning.

The Jefferson County Board of County Commissioners have adopted this PDM Plan. Also adopting the Plan are the incorporated communities of Boulder and Whitehall. These governing bodies have the authority to promote sound public policy regarding natural and man-made hazards in their jurisdictions. Copies of the signed resolutions are included as **Appendix A** to this plan. The PDM Plan was adopted at the regularly scheduled County Commission and City/Town Council meetings, which were open to the public and advertised through the typical process the jurisdictions use for publicizing meetings.

Jefferson County will be responsible for submitting the adopted PDM Plan to FEMA for review. Upon acceptance by FEMA, Jefferson County and the incorporated communities of Boulder and Whitehall will remain eligible for mitigation project grants and post-disaster hazard mitigation grant projects.

1.3 Acknowledgements

Many groups and individuals have contributed to development of the Jefferson County PDM Plan. Jefferson County DES provided support for all aspects of plan development including providing digital locations and insurance values for the critical facilities and infrastructure used in the PDM analysis. The PDM Planning Team, comprised of various members of the Local Emergency Planning Committee (LEPC) and others, met on a regular basis to guide the project, identify the hazards most threatening to the County, develop and prioritize mitigation projects, review draft deliverables and attend the public meetings. The local communities participated in the planning process by attending public meetings and contributed to plan development by reviewing and commenting on the draft plan.

1.4 Scope and Plan Organization

The process followed to prepare the Jefferson County PDM Plan update included the following:

- Review and prioritize disaster events that are most probable and destructive,
- Update and identify new critical facilities,
- Review and update areas within the community that are most vulnerable,
- Update and identify new goals for reducing the effects of a disaster event,
- Review and identify new projects to be implemented for each goal,
- Review and identify new procedures for monitoring progress and updating the PDM Plan,
- Review the draft PDM Plan, and
- Adopt the updated PDM Plan.

The PDM Plan is organized into sections that describe the planning process (Section 2), community profile (Section 3), risk assessment and vulnerability analysis (Section 4), mitigation strategy (Section 5) and plan maintenance (Section 6). Appendices containing supporting information are included at the end of the plan.

SECTION 2. PLANNING PROCESS

The updated Jefferson County PDM Plan is the result of a collaborative effort between Jefferson County, the incorporated communities of Boulder and Whitehall, utilities, local agencies, non-profit organizations, businesses, and regional, state and federal agencies. The planning effort was facilitated by the contractor, Tetra Tech. Public participation played a key role in development of goals and mitigation projects, as outlined below. For the purposes of this planning effort, the public is defined as residents of Jefferson County, local departments, state and federal agencies that support activities in the County, neighboring communities and local partners.

2.1 PDM Planning Team

The Jefferson County DES Coordinator requested various members of the LEPC as well as several other individuals serve as the PDM Planning Team for the purposes of updating the PDM Plan. These individuals are listed in **Appendix B**. The affiliation of Planning Team participants are presented in **Table 2.1-1.**

Table 2.1-1. Agencies Represented on the PDM Planning Team

Organization / Department	Type of Organization
Jefferson County Commissioner / Bull Mountain Volunteer Fire Dept.	County Government & Rural Fire District
Jefferson County Disaster and Emergency Services	County Government
Jefferson County Fire Warden	County Government
Jefferson County Planning Department	County Government
Jefferson County Public Health / Boulder Ambulance	County & City Government
Jefferson County Sheriff & Dispatch	County Government
City of Boulder/ Council Member	City Government
Town of Whitehall / Floodplain Administrator	City Government
Montana City Volunteer Fire Department	Rural Fire District
Jefferson River Watershed Council	Local Organization
Natural Resources Conservation Service	Federal Government

Responsibilities of the Planning Team included attending meeting to discuss update of the Plan, providing data for analysis in the risk assessment, attending public meetings, providing input and feedback on mitigation strategies, review of the draft plan document, and supporting the plan throughout the adoption process. The PDM Planning Team will assist the Jefferson County DES in updating the Plan in the future.

The Planning Team met several times over the course of the project; once to rank the hazards, and two other times to update the mitigation strategy. Planning team meetings were held October 5th and 24th, and November 14th, 2016 at the Jefferson County DES office in Boulder. In advance of each meeting, an agenda and/or materials to be discussed (hazard maps, hazard ranking matrices, example mitigation strategies, etc.) were emailed to meeting participants. Planning Team meeting notes are presented in **Appendix B**.

Meeting were also held with the Tri-County FireSafe Working Group (TCFSWG) and Jefferson County Rural Fire Council to review and update the Jefferson County wildfire strategy. The TCFSWG meeting was held on September 8, 2016 at the Lewis & Clark County Law Enforcement Center and included

representatives from the City of Helena, Lewis & Clark County, U.S. Forest Service, Bureau of Land Management (BLM), Natural Resources Conservation Service (NRCS), FireSafe Montana, and Broadwater County Fire Department. The meeting with the Jefferson County Rural Fire Council was held on October 18, 2016 at the Montana City Fire Station and included representatives from the Jefferson County Commission, DES, Sheriff's Office and Fire Warden; Jefferson City, Montana City, and Clancy Volunteer Fire Departments; and, the U.S. Forest Service. Input from these meetings was incorporated into the 2017 Jefferson County mitigation strategy.

2.2 Project Stakeholders

The planning process was initiated by preparing a stakeholders list of individuals whose input was needed to help update the PDM Plan. Planning partners on the stakeholders list received a variety of information during the project including meeting notices, documents for review, and the draft mitigation strategy. **Appendix B** presents the stakeholders list for this project.

On the County level, project stakeholders included the Commissioners, County Attorney, Disaster and Emergency Services, Planning Department, Floodplain Administrator, Sheriff's Office, Roads Supervisor, Facility Manager, Public Health Department, Fire Warden and Rural Fire Districts, Environmental Health, GIS, Extension Service, and School Districts. These entities participated in the Planning Team, attended public meetings, and/or reviewed the draft PDM Plan.

Stakeholders from the incorporated communities of Boulder and Whitehall included: the Mayors, City/Town Councils, Police Departments, Ambulance, Public Works Departments, and the Floodplain Administrators. These entities participated in the planning process by either providing data, attending public meetings, participating on the PDM Planning Team, and/or reviewing the draft PDM Plan.

Stakeholders from federal agencies included representatives from: the National Weather Service (NWS), U.S. Forest Service, U.S. Bureau of Land Management (BLM), and the Natural Resources Conservation Service (NRCS). These agencies were attended public meetings, participated on the PDM Planning Team, and/or reviewed the draft PDM Plan.

Stakeholders from state agencies included representatives from: the Montana Department of Natural Resources and Conservation (DNRC), Montana Department of Transportation, Montana Disaster and Emergency Services, the Montana Developmental Center, and Riverside Youth Correctional Facility. These entities participated in the planning process by providing data for the plan, attending the public meetings and/or reviewing the draft PDM Plan.

Non-governmental stakeholders (non-profits, local organizations, utilities, businesses) included: the American Red Cross, Jefferson County Economic and Community Development Corp., Jefferson River Watershed Council, Boulder and Whitehall Medical Clinics, Ash Grove Cement, Marks-Miller Post and Pole, Montana Prescribed Fire Services, Advanced Fire Weed and Beetle, several nursing homes and assisted living facilities, Northwestern Energy, Intermountain West Energy and Vigilante Electric Co-op. Some of these entities provided information for plan development, attended the public meetings, participated on the PDM Planning Team, and/or reviewed the draft PDM Plan update.

Planning partners from adjoining jurisdictions included: the Deer Lodge, Butte-Silver Bow, Powell, Broadwater, Gallatin, Madison, and Lewis & Clark County DES Coordinators. These entities did not offer input on the Jefferson County PDM Plan update.

2.3 Review of Existing Plans and Studies

At the initiation of the project, planning documents and studies completed for Jefferson County were obtained from relevant websites and/or provided by the DES office. The plans and studies were reviewed in order to determine how mitigation could be integrated into this planning process and future local planning mechanisms and programs. Contributing plans/ordinances reviewed by the contractor included:

DAMS

- Emergency Action Plan, Park Lake Dam
- Emergency Action Plan, Delmoe Lake Dam
- Emergency Action Plan, Clark Canyon Dam, Beaverhead County
- Emergency Action Plan, Chessman Saddle and Main Dams, Lewis & Clark County
- Emergency Action Plan, Ruby Dam, Madison County
- Emergency Action Plan, Willow Creek Dam, Madison County

EMERGENCY OPERATIONS

- Jefferson County Emergency Operations Plan

FLOODPLAIN STUDIES

- Flood Insurance Study, Town of Whitehall, Jefferson County, 2007
- Flood Plain Management Study, Big Pipestone Creek, Jefferson County, 1984
- Jefferson River Watershed Restoration Plan, 2010

GROWTH POLICIES, ORDINANCES & REGULATIONS

- Jefferson County Growth Policy, 2009
- Jefferson County Subdivision Regulations, 1996
- Jefferson County Floodplain Regulations
- North Jefferson County Zoning Regulations, 2013
- Milligan Canyon/Boulder Valley Zoning Regulations, 2004
- Sunlight Zoning Regulations, 2010
- Town of Boulder Growth Policy
- Town of Boulder Zoning Regulations, 2008
- Town of Whitehall Growth Policy, 2009
- Town of Whitehall Zoning Regulations, 1994

HAZARD MITIGATION

- Jefferson County Hazard Mitigation Plan, 2011
- Tri-County Regional Community Wildfire Protection Plan, 2015

DROUGHT

- Jefferson River Water Council Drought Management Plan, 2012
- Missouri Headwaters – Mountain Watershed and Aquatic Habitat Response to Climate Variability and Change

OTHER

- Southwestern Montana Comprehensive Economic Development Strategy, 2012-2017
- Annual Comprehensive Economic Development Strategy and Progress Report, 2014-2015

Data obtained from the plan and regulation review was incorporated into various sections of the PDM Plan. *Section 4.0* contains reference to the plans and ordinances affecting management of the hazard. *Section 7.3* includes a discussion on how mitigation can be implemented through existing programs.

2.4 Project Website

A website was set up at the start of the project to provide information to project stakeholders and the citizens of Jefferson County. The project website can be viewed at: www.countypdm.com/ (password: Boulder). The website remained active during the course of the project through adoption of the plan.

The website contained a Home page and pages for: Contacts, PDM Planning Team, Meetings, Draft PDM Plan, Maps, and References. The Home page contained a letter inviting participation in development of the Plan. The Contacts page contained information on Tetra Tech and County personnel involved in management of the project. The Planning Team page contained the meeting schedule, agendas, handouts, and notes from the Planning Team meetings. The Meetings page contained the public meeting schedule, notes, handouts and presentations from the public meetings. The Draft PDM Plan page contained sections from the draft plan for stakeholder review. The Maps page contained draft versions of the critical facility and hazard maps prepared for the project. The References page contained the 2011 Jefferson County PDM Plan, FEMA guidance on preparing multi-jurisdictional hazard mitigation plans, the FEMA Region 8 Plan Review Guidance dated September 2011, FEMA Planning Process Bulletin dated July 2016, FEMA Risk Assessment Bulletin dated June 2016, and links to the State of Montana PDM Plan and FEMA websites.

2.5 Public Meetings

Two public meetings were conducted during development of the PDM Plan. The first public meeting was held to kick-off the project. At this meeting, the 2011 PDM plan was reviewed and hazard events over the past five years were discussed. The second public meeting was held to review the draft risk assessment and mitigation strategy and to kick-off the public review period for the draft PDM Plan. Sign-in sheets, handouts, presentations, and meeting notes are contained in **Appendix B** and posted on the project website.

The first public meeting was held on September 22, 2016 in the Jefferson County EOC, in the basement of the Law Enforcement Center in Boulder. The September 14, 2016 edition of the Whitehall Ledger and the September 21, 2016 edition of the Boulder Monitor/Jefferson County Courier newspapers published articles on the PDM Update project and advertised the public meeting.

A meeting notice was sent via e-mail to all project stakeholders and the meeting was posted on the project website. Media documentation is presented in **Appendix B**.

During the first public meeting, Tetra Tech made a presentation which reviewed and analyzed each section of the 2011 mitigation plan, outlined the background and rationale for updating the PDM Plan, the process and methodology for the plan update, and the project schedule. **Table 2.5-1** describes the outcome of the 2011 PDM Plan review.

Table 2.5-1. Review and Analysis of 2011 Pre-Disaster Mitigation Plan

2011 PDM Sections	How Reviewed and Analyzed
Section 1 – Introduction	Reviewed existing section through discussion at public meeting. No analysis needed.
Section 2 - Planning Process	Reviewed and analyzed existing section through discussion at public meeting. Planning process utilized stakeholders list, PDM Planning Team, public meetings, and project website.
Section 3 – Hazard Evaluation and Assessment	Reviewed and analyzed existing section through discussion during public meeting and Planning Team meetings. Reviewed and updated critical facility maps and bridges. Re-scoring hazards using Calculated Priority Risk Index. Reviewed and updated hazards updating sections with recent hazard data.
Section 4 - Mitigation Strategy	Reviewed at public meeting and updated by Planning Team during several meetings. New projects developed, existing projects re-worded and/or deleted, completed projects documented. Capability assessment updated.
Section 5 - Plan Maintenance Procedures	Reviewed and analyzed existing section through discussion during Planning Team meetings. Determined that plan maintenance procedures outlined in previous plan were implemented but not documented.

The meeting presentation was placed on the project website for stakeholders who could not attend the meeting (**Appendix B**). Approximately 17 individuals attended the public meeting including representatives from the Jefferson County Commission, DES Office, County Planning Department, Floodplain Administrator, Fire Warden, Public Health Department, and Sheriff's Office; the Boulder Mayor, Police Department, and City Council; Montana City Volunteer Fire Department; National Weather Service; and, Ash Grove Cement. The Town of Whitehall was represented by the Jefferson River Watershed Council.

A second public meeting to review the draft PDM Plan was held on December 12, 2016 at the Jefferson County Clerk & Record's conference room in Boulder. The public meeting was held at the beginning of the draft Plan public review period. A notice of the meeting was sent via email to the project stakeholders, advertised in an article in the November 30th and December 8th, 2016 editions of the Boulder Monitor/Jefferson County Courier and Whitehall Ledger newspapers, advertised on the Jefferson County website, via social media (Facebook), and on the project website. Tetra Tech presented results of the PDM risk assessment at the meeting as well as the updated mitigation strategy. Thirteen (13) individuals attended the public meeting including representatives from the Jefferson County Commission, DES, Planning Dept., Sheriff's Office, Public Health, and Clerk and Recorder's Office, the Jefferson River Water Council and two members of the public. Public meeting attendees networked before and after the meeting, listened to the presentation, and asked questions.

2.6 Plan Review

The planning process for the PDM Plan began on August 25, 2016 and lasted approximately nine months. The public was provided at least two opportunities for comment prior to adoption of the plan. The first opportunity was during the drafting process. A notice was placed in the newspaper, on the county website, and via social media regarding availability of the draft PDM Plan and that review copies were available in hard copy, electronically on compact disk (CD) upon request, or available on the project website. A hard copy of the draft Plan was available for review at the Jefferson County DES Office. An e-mail announcement was sent to the project stakeholders indicating the draft PDM Plan was available for review with instructions on how to comment.

The draft document was produced with line numbers to aid in the review process. Reviewers were asked to submit their comments on the draft plan to the Jefferson County DES Office after a review period of approximately 80-days (December 13, 2016 to February 28, 2017). The Jefferson County DES Coordinator reviewed the comments and in consultation with the Planning Team submitted a consolidated list of comments to the contractor and a plan revision was completed.

The final draft plan was posted on the project website and stakeholders were notified of its availability via an e-mail message and social media. At this point a second opportunity was provided to the public to comment on the PDM Plan. The final draft plan was available for a second review from March 15 to April 30, 2017, an approximate 45-day review period.

Concurrent with the public review period, the draft PDM Plan was submitted to the State Hazard Mitigation Officer and FEMA for compliance with the Region 8 Plan Review Guidance. The final draft Plan was placed on the project website and stakeholders were notified via email regarding its availability. Comments received from Montana DES and FEMA, along with comments received from the second public review of the final draft, were addressed in a second plan revision.

The final Plan was provided to the Jefferson County Board of County Commissioners, Boulder City Council, and Whitehall Town Council for adoption. After adoption, copies of the final Plan were submitted to Jefferson County, the incorporated communities, Montana DES and FEMA.

Future comments on the PDM Plan should be addressed to:

Jefferson County Disaster and Emergency Services
P.O. Box H, Boulder, Montana 59632
(406) 225-4035

SECTION 3. COMMUNITY PROFILE

Jefferson County is made up of a number of distinct "communities" or "vicinities". Some, like Basin and Clancy, are small unincorporated towns. Others, like Montana City and Toll Mountain are generally defined settlement areas associated with former towns or physical features. While others, such as Elk Park and Boulder Valley are ranching and farming areas covering thousands of acres. Two of the county's communities, Whitehall and Boulder, are incorporated municipalities with their own governing structures.

This section of the PDM Plan presents an overview of Jefferson County. Information is provided on the characteristics of the county, the economy and land use patterns, and presents the backdrop for this mitigation planning process.

3.1 Physical Setting

Jefferson County covers 1,657 square miles in the heart of western Montana and lies between the major metropolitan areas of Butte, Helena and Bozeman (**Figure 1**). Major waterways include the Jefferson River and the Boulder River and their tributaries. These waterways travel through Jefferson County on their way to the Missouri River. Major mountain areas include the Elkhorn Mountains, Bull Mountains and the Continental Divide, which serves as the western boundary of the county.

Mountainous topography extends through much of Jefferson County, from the northern end of the Jefferson Valley to the southern edge of the Helena Valley. The Boulder Batholith is a geologic feature of intrusive granite, giving the western third of the county a unique scattering of large boulder fields and outcroppings. The topography of the batholith is characterized by narrow gulches feeding into larger creek bottoms, bordered by steep hillsides that are sprinkled with high mountain parks, meadows, swamps, or lakes. The largest of the parks is Elk Park, a broad, high, level park surrounded by mountains and located along the east face of the Continental Divide.

Six main drainage basins broad enough and open enough to support varied agricultural uses are located partially or wholly in Jefferson County such as in Whitetail, Boulder, Jefferson, Headwaters, Broadwater and the Helena valleys. These drainage basins are of varying sizes, with the main portions of the larger valleys, (Helena, Jefferson, Headwaters, and Broadwater) predominately in neighboring counties.

The southeastern portion of the county is a series of high rolling hills with occasional sharp outcroppings of limestone. These limestone outcroppings rise to form a steep, narrow canyon for the Jefferson River along the southern boundary of the county, softening into gentler hills to the north. They form the boundary between the watersheds of the Boulder/Jefferson system and that of the Missouri. To the north, they form the divide between the Boulder and Broadwater Valleys and eventually meet the higher, more rugged mountains of the Elkhorn range.

Land ownership in Jefferson County is split as follows: 45 percent private, 52 percent federal, and 3 percent state. The federal ownership is administered by the U.S. Forest Service and Bureau of Land Management at 43 and 9 percent, respectively. **Figure 2** presents the county landownership.

Figure 1 – Location Map

Figure 2 – Land Use

Jefferson County is bordered by Lewis & Clark; Broadwater; Gallatin, Madison and Silver Bow; and, Deer Lodge and Powell counties on the north, east, south, and west, respectively.

3.2 Climate

The climate in Jefferson County is continental, characterized by warm summers, cold winters, and semiarid precipitation. The average high temperature in Boulder in January is 35 °F, and in July is 82 °F. Annual snowfall averages 33 inches. **Table 3.2-1** presents monthly averages for temperature and precipitation in Boulder.

Table 3.2-1. Jefferson County Climate Statistics – Boulder

Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average High (^{0}F)	35	39	47	55	64	73	82	82	71	58	42	33
Average low (^{0}F)	12	15	21	27	35	43	48	46	37	28	19	10
Avg. Precipitation (Inches)	0.31	0.28	0.47	0.83	0.75	2.01	1.65	1.34	0.98	0.63	0.47	0.31

Source: http://www.usclimatedata.com/climate/boulder/montana/united-states/usmt0036

For the purposes of this mitigation plan, weather is of interest when it threatens property or life and thus becomes a hazard. The National Weather Service provides short-term forecasts of hazardous weather to the public and also records weather and climatic data. Further information on NWS weather warning criteria is presented in the individual hazard profiles in *Section 4.*

Climate Change

Climate change will affect the people, property, economy and ecosystems of Jefferson County in a variety of ways. The most important effect for the development of this plan is that climate change will have a measurable impact on the occurrence and severity of natural hazards.

A climate change study by the University of Montana predicts warmer temperatures and associated drought over the course of the next century with annual temperatures projected to warm 3.6 to 7.2 degrees. Winters will be shorter and summers will be longer with spring snowmelt occurring four to six weeks earlier and summer drought periods lasting six to eight weeks longer.

Climate change indicators provide useful information about what is occurring in complex systems. These indicators include temperature and growing season, rainfall intensity, snowpack, streamflow, stream temperature, wildland fire occurrence, plants live cycle events, and forest health. The hazard profiles in *Section 4* provide climate change implications as they relate to hazard mitigation.

3.3 Critical Facilities and Infrastructure

Critical facilities are of particular concern because they provide essential products and services that are necessary to preserve the welfare and quality of life and fulfill important public safety, emergency response, and/or disaster recovery functions. Critical facilities include: the 911 emergency call center, emergency operations centers, police and fire stations, public works facilities, sewer and water facilities, hospitals and shelters; and facilities that, if damaged, could cause serious secondary impacts (i.e., hazardous material facilities). Critical facilities also include those facilities that are vital

to the continued delivery of community services or have large vulnerable populations. These facilities may include: buildings such as the jail, law enforcement center, public services buildings, senior centers, community corrections center, the courthouse, and juvenile services building and other public facilities such as hospitals, nursing homes and schools.

Critical facilities in Jefferson County are identified in **Appendix C.** Replacement values were collected where readily available; however, time and resource constraints prohibited the collection of values for all structures. A GIS layer of the critical facilities was used in the hazard risk assessment. This GIS layer should be updated on a regular basis for use in future analysis. Details on the county's critical facilities and infrastructure from the Jefferson County Growth Policy (2009), the Whitehall Growth Policy (2009) and the 2011 Jefferson County PDM Plan, are presented below.

3.3.1 Water and Wastewater Services

Public water supplies in the communities of Boulder, Basin, and Whitehall consist of wells and their respective distribution systems. Outside the municipal water service areas, the county population relies upon groundwater as a drinking water supply. The community of Corbin used to have a community water system.

The communities of Boulder, Basin and Whitehall are currently served by a central wastewater collection and treatment system. Sewage disposal within most other areas within the county are provided by individual septic systems.

3.3.2 Utilities

NorthWestern Energy operates the electrical distribution system and provides electrical power to Jefferson County residents. Natural gas is also distributed by NorthWestern Energy but is not available to all areas of the county. Telephone services are provided by a number of entities. Century Link is the principal provider and maintains a network of lines. Since deregulation of the industry and advancements in fiber optic and cellular communications technology, other providers are also servicing the area. Several communications towers have been cited in the area.

The Bonneville Power Administration maintains a major transmission line through central Jefferson County.

3.3.3 Law Enforcement and Emergency Services

The Sheriff's Office protects lives and property in Jefferson County and works to provide a safe and secure environment for all citizens of the county. Target Notification (Reverse 911) is an Emergency Preparedness Notification System available in Jefferson County. It is designed to rapidly notify an affected area of an emergency by sending a prerecorded message through the telephone system using the 9-1-1 database. Target Notification launches a prerecorded message to those "land-line" numbers in that specified area and the system will leave a message if an answering machine picks up. The system also has a callback feature that ensures the message is delivered.

The Town of Whitehall has an inter-local agreement with the Jefferson County Sheriff's Department for law enforcement coverage. On average there are 10 calls per week with an average response time of 5 minutes if the officer is on-duty and 15 minutes if the officer is off-duty. The Jefferson County

Sheriff's Department maintains a processing facility within the Town of Whitehall that houses four permanent deputies.

Fire Services

Fire protection services are provided by several entities in Jefferson County. The communities of Boulder and Whitehall have volunteer fire departments that serve the municipal jurisdictions. The remaining portions of the county are served by rural volunteer fire departments, including formal Fire Districts, Fire Service Areas, and Jefferson County. The Fire Departments provide personnel and equipment to suppress and prevent fires, conduct building inspections and fire investigation, and coordinate with contracted Emergency Medical Services.

Mutual-aid agreements are facilitated by each department and a state-wide mutual aid agreement. These agreements have proven essential to increasing the level of service provided to the area. The mutual-aid structure provides for assistance among fire departments, thus expanding the equipment and personnel resources available to respond to an incident. This mechanism allows for increased utilization of expensive capital equipment that is necessary for fire protection service and achieves a higher level of service in the county than could be achieved by any one fire protection entity.

Disaster and Emergency Services

The mission of Jefferson County DES is to protect lives and property through preparedness, response, recovery, and mitigation planning activities. Jefferson County DES operates a local office in Boulder in the basement of the Sheriff's Office at 110 S. Washington Street. DES provides the following services: plans, organizes, and manages the Jefferson County emergency preparedness program; evaluates, improves, and promotes comprehensive disaster planning efforts; organizes and facilitates effective operations of multi-jurisdiction, multi-discipline work groups and task forces; promotes interagency coordination; and develops and reviews polices, contracts, and interagency agreements. These efforts are designed to enhance the capacity of the local government to plan for, respond to, and mitigate the consequences of threats and disasters using an all-hazards framework. Overall, DES emphasizes preparedness in addressing potential natural threats (earthquakes, wildfires, flooding). The DES Coordinator delivers information to the public in coordination with fire protection agencies, law enforcement, and other emergency response providers.

The DES office also serves as the local Emergency Operations Center (EOC) in the event of an emergency. The EOC is a designated area established for facilitating the overall management of an emergency and provides a multi-agency coordination center where elected officials and senior agency representatives gather to: manage coordination, communications, data and information collection; design and disseminate public information; engage in strategic senior decision-making processes; and, provide the primary link to state and federal agencies.

3.4 Population Trends

Jefferson County is one of the fastest growing counties in Montana and the 18th most populous. According to the U.S. Census 2015 estimates, Jefferson County had a population of 11,645, a 2.1 percent increase from 2010. **Table 3.4-1** illustrates the change in population in Jefferson County compared to the United States and State of Montana.

Table 3.4-1. County, State and National Population Trends

Year	Jefferson Co. Population	% change from previous census	State of Montana Population	% change from previous census	United States Population	% change from previous census
2015	11,645	2.10%	1,032,949	4.40%	321,418,820	4.10%
2010	11,406	12%	989,415	9.67%	308,745,538	9.71%
2000	10,049	21%	902,190	12.91%	281,424,602	13.15%
1990	7,939	11%	799,065	1.57%	248,709,873	9.79%
1980	7,029	25%	786,690	13.29%	226,542,199	11.43%
1970	5,238	18%	694,409	2.91%	203,302,031	13.37%

Source: U.S. Census Bureau, 2016

From 1970 to 2015, Jefferson County grew by 6,407 people, a 122 percent increase in population. According to U.S. Census, the median age in Jefferson County is 47.6 years compared to 39.8 in the state and 37.4 in the nation. The population of Jefferson County under the age of 20 years is 24.3 percent. Population of the County over 65 years of age is 16.5 percent (U.S. Census, 2016).

Table 3.4-2 presents population statistics for the municipalities of Boulder and Whitehall, as well as the unincorporated communities in the county.

Table 3.4-2. Jefferson County Population Trends

Community	1980	% Change Since Last Census	1990	% Change Since Last Census	2000	% Change Since Last Census	2010	% Change Since Last Census	2015	% Change Since Last Census
Basin CDP	--	--	--	--	255	--	212	-20.3%	--	--
Boulder, City	1,441	6.9%	1,316	-9.5%	1,300	-1.2%	1,183	-9.9%	1,207	2.03%
Cardwell CDP	--	--	--	--	40	--	50	20%	--	--
Clancy CDP	--	--	--	--	1,406	--	1,661	15.3%	--	--
Elkhorn CDP	--	--	--	--	--	--	10	--	--	--
Jefferson City CDP	--	--	--	--	295	--	472	37.5%	--	--
Montana City CDP	--	--	--	--	2,094	--	2,715	22.9%	--	--
Rader Creek CDP	--	--	--	--	--	--	363	--	--	--
South Hills CDP	--	--	--	--	--	--	517	--	--	--
Whitehall, Town	1,030	-0.5%	1,067	3.5%	1,044	-2.2%	1,038	-0.6%	1,094	5.39%

Source: U.S. Census Bureau, 2016
Notes: CDP = Census Designated Place; -- = data not available; Changes in Place population between years may be due to population growth or decline, due to significant boundary changes, or a combination of factors.

The majority of the growth in Jefferson County over the past 10 years has taken place in the northern part of the county in the communities of Clancy, Jefferson City, and Montana City. Population in the county's incorporated communities of Boulder and Whitehall have increased population since the 2010 census, by 2.0 and 5.4 percent, respectively.

3.5 Housing Stock

The U.S. Census estimates in their *2019-2014 American Community Survey* that Jefferson County had 5,052 housing units with a median value of $239,500. A further breakdown of the housing units from the census is presented in **Table 3.5-1.** The housing data suggests that over 42 percent of the homes in Jefferson County were constructed after 1989.

Table 3.5-1. U.S. Census Housing Data; Jefferson County

Category		Jefferson County	Boulder, City	Whitehall, Town
Total Number of Housing Units		5,052	564	554
Median Value Housing Units (2010-2014)		$239,500	$128,700	$137,800
Year Structure Built				
	2010 or later	63	0	0
	2000 to 2009	926	33	19
	1990 to 1999	1,115	95	44
	1980 to 1989	801	76	80
	1970 to 1979	980	150	116
	1960 to 1969	395	91	34
	1950 to 1959	235	21	91
	1940 to 1949	167	0	64
	1939 or earlier	370	98	106

Source: U.S. Census Bureau, 2016, Quick Facts and 2010-2014 American Community Survey

3.6 Economy and Socioeconomics

The major industries in Jefferson County include agriculture, mining, timber, tourism, retail and home businesses, and county and state government. Employment in this area has included a large number of government workers employed by Jefferson County, by the Montana Development Center, Riverside Corrections, Youth Dynamics, and small retail businesses. A number of county residents commute to neighboring counties and communities to work.

Jefferson County ranks 13th in the State for average per capita income. However, per capita income in the communities of Boulder and Whitehall were 23 and 20 percent below the county average, respectively (**Table 3.6-1**). The towns of Boulder and Whitehall had 8.5 and 3.7 percent more individuals, respectively, living below the poverty level than the rest of the county.

The top private employers in Jefferson County in 2011, reported by the Montana Department of Labor and Industry were: Golden Sunlight Mine (100 to 249 employees); Ash Grove Cement and Elkhorn Health & Rehabilitation (50 to 99 employees); and Youth Dynamics, Boulder Hot Springs, Boyd Andrew Community Services, Bullock Contracting, Eagle Ambulance Service, Harlow's School Bus Service, Liberty Place, Montana City Grill & Saloon, Smith and Sons Construction, Stewart Title Company, Sussex Construction and Town Pump (20 to 49 employees). **Table 3.6-1** presents economic indicators for Jefferson County and the incorporated communities of Boulder and Whitehall, from 2010 to 2014.

Table 3.6-1. Economic & Socioeconomic Data; Jefferson County

Indicator	State of Montana	Jefferson County	Boulder, City	Whitehall, Town
Per capita income (2010-2014)	$25,977	$25,294	$19,517	$20,142
Median household income (2010-2014)	$46,766	$42,577	$37,375	$36,250
Persons living below poverty level (2010-2014)	15.3%	15.3%	23.8%	19.0%

Source: 2010-2014 American Community Survey; "--" = not available

3.7 Land Use and Future Development

The Jefferson County Growth Policy (2009) reports that much of the land in the county is still being used today as it has been in the past. Although substantial acreage has been converted to residential subdivisions, a majority of agricultural land is still being used to raise cattle and grow crops. Two major mining operations are still active and contribute to a large portion of the county's economic base. Timber harvest is still being practiced in the county and although most of the product is hauled to mills outside Jefferson County, a portion is milled in the county. Finally, most of the forested mountain land is utilized much as it was when the area was first settled—for hunting and outdoor enjoyment. The most obvious land use changes throughout Jefferson County have been to residential home sites. Since 1995, thousands of acres have been subdivided, primarily in the northern portion of the county.

The following sections provide details on the planning tools used by Jefferson County to manage growth.

3.7.1 Land Use Implementation Tools

Industrial, commercial and residential land use is managed with zoning and subdivision regulations in accordance with guidelines set forth in the County, City of Boulder, and Town of Whitehall's growth policies. State of Montana building codes also play an important role to ensure structures are constructed to safety standards.

Growth Policies

Jefferson County updated their Growth Policy in 2009 to help address growth pressures. The Growth Policy discusses several hazards including earthquake potential and threat of wildfire and outlines a number goals and objectives that support hazard mitigation, as follows.

- Preserve and enhance the rural, friendly and independent lifestyle currently enjoyed by Jefferson County's citizens.
  - ✓ Continue efforts to promote fire prevention measures throughout the county, giving special emphasis to the extreme fire hazards present at the wildland urban interface.
- Promote and maintain a transportation system that provides safety, efficiency, and is cost effective.
  - ✓ Develop secondary means of access, where practical, to settlements and subdivisions in order to improve safety and overall traffic circulation.
  - ✓ Coordinate transportation issues with wildfire and fire protection issues, policies and goals.
- Minimize risk of fire by management and planning, and to permit the effective and efficient suppression of fires in order to protect persons, property and forested areas.
  - ✓ Encourage fire protection measures throughout the county, giving special emphasis to the extreme fire hazards at the wildland/urban interface.
  - ✓ Complete fire hazard mapping for Jefferson County.
  - ✓ Encourage that all developments be within a fire protection district, or have a contract for service with a fire protection district.

  - ✓ Subdivisions should be planned, designed, constructed and maintained so as to minimize the risk of fire. Developers should submit a defensible space plan for each subdivision to the appropriate fire district for its review.
  - ✓ Encourage fire resistant construction.
  - ✓ Promote cooperation with local fire districts and state and federal agencies to develop and provide a wildfire educational program.
  - ✓ Promote fire services for all subdivisions.
  - ✓ Promote adequate water supply systems.
  - ✓ Support adequate ingresses and egresses in all subdivision planning.
  - ✓ Promote vegetation policies that reduce fire hazards.
- Protect surface and groundwater quality from pollution.
  - ✓ Promote investigation on stream setbacks and ensure that this issue be rewritten with reference to floodplain regulations. Recommend floodplain regulations be amended to coincide with state floodplain regulations.

The Jefferson County Planning Board recommends that the county develop and maintain a land use classification system that identifies basic resource areas subject to development and use constraints including steep slope, flood susceptibility, poor access, and lack of fire suppression capability to discourage development in hazard areas. They also recommend that attention be given to the slope, drainage, rock formations and other topographical characteristics, when a subdivision or larger development is proposed.

The town of Whitehall's Growth Policy (2009) includes several goals and policies that support hazard mitigation, as summarized below.

- Protect environmentally sensitive and floodplain areas from adverse effects of development.
  - ✓ Support standards that limit adverse effects of development on natural resources and environmental quality.
- Encourage development in areas that minimize degradation of the natural environment.
  - ✓ New development should be encouraged in areas that are relatively free of environmental problems (e.g., soils, slope, bedrock, water table, and floodplain areas).
  - ✓ Residential development should be discouraged within the 100-year floodplain and prohibited in the floodway or any area that includes the center of the channel of the stream or river or carries the majority of water during a flood.
  - ✓ Increased storm water runoff from new development should not be allowed to adversely impact other properties.
  - ✓ Preserve existing drainage ways.
  - ✓ Preserve hazardous areas (subject to geologic and flood hazards) as open space wherever possible.
- Ensure that all fire service entities are providing adequate firefighting and emergency response services, apparatus, equipment, personnel, training and facilities.
  - ✓ Encourage the fire department to clearly define the level and types of services they provide and move toward development and adoption of a fire protection master plan for their service area.
  - ✓ Facilitate the completion of the fire protection facilities portion of the Whitehall Capital Improvement Program.

- ✓ Provide appreciation, support and assistance to ensure there are adequate volunteer personnel providing essential emergency services to the area.
- ✓ Maintain close coordination and cooperation between the Town and Rural Fire Department.

The City of Boulder has a minimal growth policy at this time.

Zoning Regulation Ordinances

Zoning is a tool used by local government to control and direct land use in communities, in order to protect the public health, safety and welfare. Zoning regulates where future growth should or should not be allowed (e.g., which areas of the county are most suitable for development as well as least suitable due to issues such as floodplains, seasonal high groundwater, steep slopes and wildland urban-interface areas).

Jefferson County has three zoning districts: one for the north portion of the county adopted in 2013, and the other for the south portion of the county adopted in 2004. The North Jefferson County zoning regulations comprise a comprehensive zoning plan made up of 10 land use classifications in several zoning districts. All land use classifications require a 20-foot setback from streams, rivers, and unprotected lakes that do not serve as property boundaries. The conserved space classification helps minimize residential development in areas prone to wildland fire. The Sunlight and Milligan canyon/Boulder Valley zoning regulate development in the southern portion of the County.

The Municipal Zoning Ordinance for the City of Boulder was adopted in 2008. This regulation addresses flood hazard areas and fire hazards. Zoning for the town of Whitehall, adopted in 1994, addresses drainage for residential, commercial, and industrial developments.

Subdivision Regulations

In contrast to zoning which regulates how existing lots may be used and developed, subdivision regulations govern the division of raw land into building lots. They typically identify areas with physical limitations that may not be suitable for development unless the hazards are eliminated or will be overcome by approved design and construction techniques.

Groundwater, floodplain and land use compatibility issues are critical considerations for future subdivisions in Jefferson County. The long term trend of subdivision activity and demand for residential land has changed very little in recent years in the southern portion of the county; however, subdivision activity in the northern portion of the county has increased.

Subdivision regulations for Jefferson County are currently being revised. The 1996 subdivision regulations were reviewed for this project and include sections on Fire Protection and Floodplain Provisions. Details from these regulations are presented in the hazard profiles in *Plan Section 4.2 and 4.5,* respectively.

Whitehall has their own subdivision regulations which include requirements for drainage. Boulder has adopted the State's model subdivision regulations, per their growth policy. There has been no subdivision activity in Boulder since the early 2000s.

Building Codes

Building codes are also a tool to control future development. The main purpose of building codes are to protect public health, safety and general welfare as they relate to the construction and occupancy of buildings and structures. They comprise a set of rules that specify the minimum acceptable level of safety for buildings and often contain requirements for snow and wind loads, roof construction, and seismic risk. Building codes are generally intended to be applied by architects and engineers, but are also used by building inspectors. Building codes have not been adopted by Jefferson County or the communities of Boulder and Whitehall. The State of Montana's Building Codes are used in lieu of local codes. The local entities refer to the State for any required building inspections.

Floodplain Regulations

Recurrent flooding of land resources causes loss of life, damage to property, disruption commerce and governmental services, and unsanitary conditions. These are all detrimental to the health, safety, welfare, and property of the occupants of flooded lands and the people of Jefferson County. It is in the public interest to manage regulation of flood prone lands and waters in a manner consistent with sound land and water use management practices which will prevent and alleviate flooding threats to life and health and reduce private and public economic losses.

Jefferson County and the Town of Whitehall have adopted floodplain regulations. These regulations are amended periodically to stay current with statutory amendments or other relevant changes. Floodplain regulations are enforced by the Jefferson County and Whitehall Floodplain administrators. Jefferson County and Whitehall participate in the National Flood Insurance Program.

3.7.2 Future Development

Jefferson County is one of the fastest growing counties in Montana. According to the county growth policy, the current rate of subdivision and development is anticipated to continue and most likely increase. The majority of the growth is taking place in the north portion of the county.

The City of Boulder has seen growth in affordable residential developments in recent years. The availability of water and sewer connections has been a limiting factor in enhanced growth.

According to the Whitehall Growth Policy, the increasing demand for rural development will create new subdivision activity in the rural area adjacent to the town limits since most of the land within the town limits has been developed. The Jefferson River and its floodplain occupy an area roughly southeast of the town limits. The potential for peripheral development on the south side of Whitehall is significantly limited by the course of the river and the location of the sewage lagoon, groundwater, and floodplain. Land use compatibility issues are critical considerations for future subdivisions proposed in this area.

Section 4.10 presents a hazard analysis of the proposed future development projects in Jefferson County.

SECTION 4. RISK ASSESSMENT AND VULNERABILITY ANALYSIS

Jefferson County is exposed to many hazards both natural and man-made. A risk assessment and vulnerability analysis was completed to help identify where mitigation measures could reduce loss of life or damage to property in the County, City of Boulder, and Town of Whitehall.

This section includes a description of the risk assessment methodology and a hazard profile for eight hazards organized from high to low by county priority: wildfire, hazardous material incidents, severe weather and drought, flooding and dam failure, transportation accidents, earthquake, terrorism, and communicable disease. The section is concluded with a risk assessment summary and discussion on the location of future development projects. Supporting documentation is presented in **Appendix C**.

4.1 Risk Assessment Methodology

A risk assessment was conducted to address requirements of the DMA 2000 for evaluating the risk to Jefferson County from natural and man-made hazards. DMA 2000 requires measuring potential losses to critical facilities and property resulting from natural hazards by assessing the vulnerability of these facilities to natural hazards. In addition to the requirements of DMA 2000, the risk assessment approach taken in this study evaluated risks to vulnerable populations and also examined the risk presented by several man-made hazards. The goal of the risk assessment process is to determine which hazards present the greatest risk and what areas are the most vulnerable to hazards.

The risk assessment approach used for this plan entailed using geographic information system (GIS) software and data to develop vulnerability models for people, structures, critical facilities, and evaluating those vulnerabilities in relation to hazard profiles that model where hazards exist. This type of approach to risk assessment is dependent on the detail and accuracy of the data used during the analysis. Additionally, some types of hazards are extremely difficult to model. Data limitations are described in *Section 4.1.7*.

4.1.1 Critical Facilities and Building Stock

Critical facilities were mapped using coordinates provided by Jefferson County. Mapping of these facilities allowed for the comparison of their location to the hazard areas where such hazards are spatially recognized. Construction type of critical facilities (e.g. steel, wood, masonry, etc.) has not been compiled and was therefore, not considered in the analysis. This data should be collected for future updates of this plan. Critical facility values were obtained, where readily available, from municipal departments. Many values were estimated based on similar structures in other counties where values were available.

Infrastructure, including bridges, water and wastewater facilities, and communication sites had digital mapping available and were therefore included in the analysis. Bridge data was obtained from the Montana Natural Resource Information System (NRIS) (data from Montana Department of Transportation) and the National Bridge Inventory while other data was obtained from the County.

Replacement values of critical facilities were used in the risk assessment where this information was readily available from the County, municipalities of Boulder and Whitehall, and the Montana Cadastral Mapping Program. **Figures 3 through 3C** present the location of critical facilities in Jefferson County, Boulder, Whitehall, and the unincorporated towns in the County. Bridge replacement values were extrapolated using unit costs (developed by Lewis and Clark County) for span length. **Figure 4** presents the bridge locations in Jefferson County. The Critical Facility section in **Appendix C** presents a key to the bridge inventory. The County may wish to enhance the bridge data for the 2022 PDM Plan update by adding the major culverts in the county.

Building stock data was obtained from the Montana Department of Revenue's (MDOR) cadastral mapping program. This system spatially recognizes land parcels within the County with a distinction between residential and other properties. Appraised building values are available on the parcel level and were used to determine exposure. The "other" building type includes all properties not designated as residential and in this study and consists of commercial, agricultural and industrial properties. The MDOR cadastral database does not spatially locate structures within each parcel. To reconcile this limitation for the flood analysis, the NRIS structures shapefile, which provides spatial locations of structures within each parcel, was linked to the MDOR cadastral database to obtain building values. Building exposure in the risk assessment is presented for the County and municipalities of Boulder and Whitehall.

4.1.2 Vulnerable Population

Data from the 2010 census was used in the analysis to determine vulnerable populations at risk in the hazard areas, as available. Census data was downloaded from the U. S. Census Bureau's website. Downloaded data included total population (by census block) and number of individuals under the age of 18 for Jefferson County, Boulder, and Whitehall. Vulnerable population was calculated based on the population in each census block intersected by the hazard area. Where hazard areas are restricted to discrete areas, such as for flooding, this approach may over report at-risk population. To reconcile this limitation, vulnerable population was calculated by intersecting the flood hazard area with the NRIS structures shapefile and estimates by the U.S. Census that 2.35 individuals reside in each structure, 22.5 percent of whom are under age 18.

4.1.3 Hazard Identification

The 2011 Jefferson County Hazard Mitigation Plan (Tetra Tech, 2011) identified nine hazards affecting Jefferson County, Boulder, and Whitehall (wildfire, hazardous material incidents, structure fire, severe summer weather, severe winter weather, flooding, earthquake, dam failure, and landslide/slope failure). These hazards were reviewed for the 2017 PDM update by the Planning Team who considered what other natural and manmade hazards might be of consequence since development of the original PDM Plan. Planning Team meeting notes in **Appendix B** describe the wide range of hazards considered for the PDM Plan.

Hazards profiled in the 2017 update include those from the 2011 PDM Plan with the following changes: a new hazard profile was added for transportation accidents to include aviation, highway and railroad accidents; one hazard profile was created for severe weather including summer and winter weather and drought; the flooding hazard included the dam failure hazard; a new hazard profile was created for the communicable disease hazard; and, a new hazard profile was created for

Figure 3 – Jefferson County Critical Facilities

Figure 3A – Boulder Critical Facilities

Figure 3B – Whitehall Critical Facilities

Figure 3C – Multi-Town Critical Facilities

Figure 4 - Bridges

the terrorism hazard. The Planning Team decided that several hazards should be de-emphasized in the 2017 PDM Plan because they either effect only a small segment of the population and/or occur infrequently with little damage, including; structure fire, and landslide/slope failure.

4.1.4 Hazard Profiles

Hazard profiles were prepared for each of the identified hazards and are presented within this section according to their prioritized rank (see *Section 4.1.6*). The level of detail for each hazard is generally limited by the amount of data available.

Each hazard profile contains a description of the hazard and the history of occurrence, the vulnerability and area of impact, the probability and magnitude of future events, and an evaluation of how future development is being managed to reduce risk. The methodology used to analyze each of these topics is further described below.

Description and History

A number of databases were used to describe and compile the history of hazard events profiled in this plan. This data was supplemented by input from the public, local officials, newspaper accounts, and internet research. The two primary databases used included the National Climatic Data Center (NCDC) Storm Events Database and Spatial Hazard Events and Losses Database for the United States (SHELDUS).

The NCDC Storm Events database receives Storm Data from the National Weather Service. The NWS receives their information from a variety of sources, including county, state and federal emergency management officials, local law enforcement officials, skywarn spotters, NWS damage surveys, newspaper clipping services, the insurance industry and the general public. Storm Data is an official publication of the National Oceanic and Atmospheric Administration (NOAA) which documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce.

SHELDUS is a county-level hazard data set for the United States for 18 different natural hazard event types. For each event, the database includes the date, location, property losses, crop losses, injuries, and fatalities that affected each county. The database includes every loss-causing and/or deadly event between 1960 through 1975 and from 1995 onward. Between 1976 and 1995, SHELDUS reflects only events that caused at least one fatality or more than $50,000 in property or crop damages.

Vulnerability and Area of Impact

Vulnerabilities are described in terms of critical facilities, structures, population, and socioeconomic values that can be affected by the hazard event. Hazard impact areas describe the geographic extent to which a hazard can impact a jurisdiction and are uniquely defined on a hazard-by-hazard basis. Mapping of the hazards, where spatial differences exist, allows for hazard analysis by geographic location. Some hazards can have varying levels of risk based on location. Other hazards cover larger geographic areas and affect the area uniformly.

Probability and Magnitude

Probability of a hazard event occurring in the future was assessed based on hazard frequency over a 100 year period. Hazard frequency was based on the number of times the hazard event occurred divided by the period of record. If the hazard lacked a definitive historical record, the probability was assessed qualitatively based on regional history and other contributing factors. Probability was broken down as follows:

- Highly Likely – greater than 1 event per year (frequency greater than 1).
- Likely – less than 1 event per year but greater than 1 event every 10 years (frequency greater than 0.1 but less than 1).
- Possible – less than 1 event every 10 years but greater than 1 event every 100 years (frequency greater than 0. 01 but less than 0.1).
- Unlikely – less than 1 event every 100 years (frequency less than 0.01)

The magnitude or severity of potential hazard events was evaluated for each hazard. Magnitude is a measure of the strength of a hazard event and is usually determined using technical measures specific to the hazard. Magnitude was calculated for each hazard where property damage data was available. Magnitude is expressed as a percentage according to the following formula:

- (Property Damage / Number of Incidents) / $ of Building Stock Exposure

Future Development

The impact to future development was assessed based on potential opportunities to limit or regulate development in hazardous areas such as zoning and subdivision regulations. The impacts were assessed through a narrative on how future development could be impacted by the hazard. Plans, ordinances and/or codes currently in place were identified that could be revised to better protect future development in Jefferson County from damage caused by natural and man-made hazards.

Climate Change

An essential aspect of hazard mitigation is predicting the likelihood of hazard events in a planning area. Typically, predictions are based on statistical projections from records of past events. This approach assumes that the likelihood of hazard events remains essentially unchanged over time. Thus, averages based on the past frequencies of, for example, floods are used to estimate future frequencies: if a river has flooded an average of once every 5 years for the past 100 years, then it can be expected to continue to flood an average of once every 5 years.

For hazards that are affected by climate conditions, the assumption that future behavior will be equivalent to past behavior is not valid if climate conditions are changing. As flooding is generally associated with precipitation frequency and quantity, for example, the frequency of flooding will not remain constant if broad precipitation patterns change over time. Specifically, as hydrology changes, storms currently considered to be a 100-year flood might strike more often, leaving many communities at greater risk. The risks of severe storms, extreme heat and wildfire are all affected by climate patterns as well. For this reason, an understanding of climate change is pertinent to efforts

to mitigate natural hazards. Information about how climate patterns are changing provides insight on the reliability of future hazard projections used in mitigation analysis.

At the end of each hazard profile in this section is a discussion on climate change. The information provides insight on how the hazard may be impacted by climate change and how these impacts may alter current exposure and vulnerability for the people, property, and critical facilities.

4.1.5 Hazard Ranking and Priorities

In ranking the hazards, the Planning Team completed a Calculated Priority Risk Index (CPRI) Work Sheet. The CPRI examines four criteria for each hazard (probability, magnitude/severity, warning time, and duration); the risk index for each according to four levels, then applies a weighting factor (**Table 4.1-1**). The result is a score that has been used to rank the hazards. Each hazard profile presents its CPRI score with a cumulative score sheet included in **Appendix C**. **Table 4.1-2** presents the results of the CPRI scoring for all hazards.

Table 4.1-1. Calculated Priority Risk Index

CPRI Category	Degree of Risk			Assigned Weighting Factor
	Level ID	Description	Index Value	
Probability	Unlikely	▪ Rare with no documented history of occurrences or events. ▪ Annual probability of less than 0.01.	1	45%
	Possibly	▪ Infrequent occurrences with at least one documented or anecdotal historic event. ▪ Annual probability that is between 0.1 and 0.01.	2	
	Likely	▪ Frequent occurrences with at least two or more documented historic events. ▪ Annual probability that is between 1 and 0.1.	3	
	Highly Likely	▪ Common events with a well documented history of occurrence. ▪ Annual probability that is greater than 1.	4	
Magnitude/ Severity	Negligible	▪ Negligible property damages (less than 5% of critical and non-critical facilities and infrastructure). ▪ Injuries or illnesses are treatable with first aid and there are no deaths. ▪ Negligible quality of life lost. ▪ Shut down of critical facilities for less than 24 hours.	1	30%
	Limited	▪ Slight property damages (greater than 5% and less than 25% of critical and non-critical facilities and infrastructure). ▪ Injuries or illnesses do not result in permanent disability and there are no deaths. ▪ Moderate quality of life lost. ▪ Shut down of critical facilities for more than 1 day and less than 1 week.	2	
	Critical	▪ Moderate property damages (greater than 25% and less than 50% of critical and non-critical facilities and infrastructure). ▪ Injuries or illnesses result in permanent disability and at least one death. ▪ Shut down of critical facilities for more than 1 week and less than 1 month.	3	
	Catastrophic	▪ Severe property damages (greater than 50% of critical and non-critical facilities and infrastructure). ▪ Injuries or illnesses result in permanent disability and multiple deaths. ▪ Shut down of critical facilities for more than 1 month.	4	
Warning Time	Less than 6 hours	Self explanatory.	4	15%
	6 to 12 hours	Self explanatory.	3	
	12 to 24 hours	Self explanatory.	2	
	More than 24 hours	Self explanatory.	1	
Duration	Less than 6 hours	Self explanatory.	1	10%
	Less than 24 hours	Self explanatory.	2	
	Less than one week	Self explanatory.	3	
	More than one week	Self explanatory.	4	

Table 4.1-2. Calculated Priority Ranking Index Summary; Jefferson County

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	CPRI Score
Wildfire	Highly Likely	Critical	<6 hours	> 1 week	3.7
Structure Fire	Highly Likely	Limited	<6 hours	< 24 hours	3.2
Transportation Accidents	Highly Likely	Limited	<6 hours	<6 hours	3.1
Severe Winter Weather	Highly Likely	Limited	12 - 24 hours	< 1 week	3.0
Hazardous Material Incidents	Likely	Limited	<6 hours	< 24 hours	2.75
Dam Failure	Possibly	Critical	<6 hours	< 1 week	2.7
Severe Summer Weather	Highly Likely	Negligible	6 -12 hours	<6 hours	2.65
Flooding	Likely	Limited	12 - 24 hours	< 1 week	2.55
Drought	Likely	Limited	>24 hours	> 1 week	2.5
Earthquake	Possibly	Limited	<6 hours	< 1 week	2.4
Terrorism, Violence, Civil Unrest	Unlikely	Critical	<6 hours	< 24 hours	2.15
Communicable Disease	Possibly	Limited	>24 hours	> 1 week	2.05
Volcanic Ash	Possibly	Negligible	6 -12 hours	< 24 hours	1.85
Landslide	Unlikely	Negligible	<6 hours	<6 hours	1.45
Avalanche	Unlikely	Negligible	<6 hours	<6 hours	1.45

The Calculated Priority Risk Index scoring method has a range from 0 to 4. "0" being the least hazardous and "4" being the most hazardous situation.

The Planning Team felt that with the CPRI ranking did not accurately represent Jefferson County's priorities; therefore, the list of hazards was re-prioritized and several hazards were combined into one profile, as shown below. The remainder of this section contains the hazard profiles in this order.

1 – Wildfire (*Section 4.2*)
2 – Hazardous Material Incidents (*Section 4.3*)
3 – Severe Weather and Drought (*Section 4.4*)
4 – Flooding and Dam Failure (*Section 4.5*)
5 – Transportation Accidents (*Section 4.6*)
6 – Earthquake (*Section 4.7*)
7 – Terrorism, Violence, Civil Unrest (*Section 4.8*)
8 – Communicable Disease (*Section 4.9*)

Profiles for two low priority hazards (Structure Fire, Landslide/Slope Failure) are included in **Appendix C**.

4.1.6 Assessing Vulnerability – Estimating Potential Losses

The methodology used in the vulnerability analysis presents a quantitative assessment of the building stock, population, and critical facility exposure to the individual hazards. Building stock data, available from the MDOR cadastral mapping program was used in the analysis. This data spatially recognizes land parcels along with the appraised value of building stock. Using GIS, hazard risk areas were intersected with the building stock data to identify the number of structures and exposure due to each hazard. Using GIS, hazard risk areas were also intersected with critical facility data to determine the number and exposure of critical facilities to each hazard. Various infrastructure (e.g. water systems, wastewater systems) were analyzed as part of the critical facility vulnerability analysis. A separate analysis was completed for Jefferson County's bridges.

For most hazards, vulnerable population was calculated based on the population in each census block intersected by the hazard area. For the flood hazard, vulnerable population was calculated by intersecting the flood hazard area with the NRIS structures shapefile and estimates by the U.S. Census that 2.35 individuals reside in each structure, 22.5 percent of whom are under age 18 and 17.4 percent of whom are over the age of 65.

For hazards that are uniform across the jurisdiction (i.e. severe summer weather and severe winter weather) the methodology presented below was used to determine annualized property loss.

- Exposure x Frequency x Magnitude

Where:

- Exposure = building stock, vulnerable population, or critical facilities at risk
- Frequency = annual number of events determined by calculating the number of hazard events / period of record
- Magnitude = percent of damage expected calculated by: (property damage/# incidents)/ building stock or critical facility exposure

For hazards that are not uniform across the jurisdiction and instead occur in specific areas (e.g. flooding, wildfire, hazardous material incidents, dam failure, etc.) the localized hazard area factored into the vulnerability assessment.

For hazards without documented property damage, magnitude could not be calculated and therefore, only the exposure of the building stock or population was computed. Annualized loss estimates cannot be calculated without property damage using this risk assessment approach.

4.1.7 Data Limitations

Risk assessment results are only a general representation of potential vulnerabilities and there are many inherent inaccuracies with the risk assessment methodology used. Output is only as good as the data sources used and Jefferson County may wish to consider alternate data for future PDM Plan updates.

The methodology used for the risk assessment has inherent limitations. Hazard layers were intersected with MDOR parcel data. The MDOR data does not locate structures within the parcel; therefore, any structures within a parcel "clipped" by the hazard layer were assumed to be vulnerable. Where parcels are large in size, it may be inaccurate to assume that all structures are actually within the hazard area. Therefore, exposure data for some hazards may over-report the number and value of structures at risk. This limitation was rectified for the flood analysis, where most evident, by using the NRIS structures shapefile, which spatially locates structures within each parcel, and linking this shapefile to the MDOR parcel database for building values.

There is also a limitation using census block data to estimate vulnerable population. Where census blocks are large, using a percentage of census block population to estimate number of individuals living in the hazard area may include more persons than actually reside in the hazard area where census blocks are large. This limitation was rectified for the flood analysis, where advanced GIS

analysis was conducted using the NRIS structures shapefile, which precisely locates structures within each parcel, and estimates by the U.S. Census that 2.35 individuals reside in each structure, 22.5 percent of whom are under age 18.

The remainder of this section presents hazard profiles organized by County priority followed by a risk assessment summary. Loss estimates, where applicable, are summarized at the end of this section.

4.2 Wildfire

CPRI SCORE = 3.7

Description and History

A wildfire is an unplanned fire, a term which includes grass fires, forest fires and scrub fires, both man-caused and natural in origin. Severe wildfire conditions have historically represented a threat of potential destruction within the region. Negative impacts of wildfire include loss of life, property and resource damage or destruction, severe emotional crisis, widespread economic impact, disrupted and fiscally impacted government services, and environmental degradation.

Wildfire risk is the potential for a wildfire to adversely affect things that residents value - lives, homes, or ecological functions and attributes. Wildfire risk in a particular area is a combination of the chance that a wildfire will start in or reach that area and the potential loss of human values if it does. Human activities, weather patterns, wildfire fuels, values potentially threatened by fire, and the availability (or lack) of resources to suppress a fire all contribute to wildfire risk. Fire season is the result of low rainfall, high temperatures, low humidity, and thunderstorms, high winds and lightning. Varied topography, semi-arid climate, and numerous human-related sources of ignition make this possible.

Roughly half of the fire starts in Jefferson County are human caused; people burning yard waste and fire escaping its boundaries, children playing with fireworks, campfire neglect, careless smokers, or heated catalytic converters in dry grass. Lightning also accounts for a high percentage of fire starts in the county. Only a fraction of fire starts are arson.

Major wildfires can occur at any time of year. **Table 4.2-1** presents warning and advisory criteria for wildfire and a description of prohibitions that land management agencies can put into effect to reduce fire risk and prevent wildfires during periods of high to extreme danger.

Table 4.2-1. Warning, Advisories and Restrictions for Wildfire

Warning/Advisory/ Restriction	Description
Fire Weather Watch	A fire weather watch is issued when Red Flag conditions (see Red Flag Warning) are expected in the next 24 to 72 hours.
Red Flag Warning	A red flag warning is issued when Red Flag criteria are expected within the next 12 to 24 hours. A Red Flag event is defined as weather conditions that could sustain extensive wildfire activity and meet one or more of the following criteria in conjunction with "Very High" or "Extreme" fire danger: • Sustained surface winds, or frequent gusts, of 25 mph or higher; • Unusually hot, dry conditions (relative humidities less than 20%); • Dry thunderstorm activity forecast during an extremely dry period; • Anytime the forecaster foresees a change in weather that would result in a significant increase in fire danger. For example, very strong winds associated with a cold front even though the fire danger is below the "Very High" threshold.
Fire Warning	A fire warning may be issued by local officials when a spreading wildfire or structure fire threat ens a populated area. Information in the warning may include a call to evacuate areas in the fire's path as recommended by officials according to state law or local ordinance.
Dense Smoke Advisory	Dense smoke advisories are issued when the widespread visibilities are expected at a ¼ mile or less for a few hours or more due to smoke.

Table 4.2-1. Warning, Advisories and Restrictions for Wildfire

Warning/Advisory/ Restriction	Description
Stage 1 Fire Restriction	No building, maintaining, attending, or using a fire, campfire, or stove fire without a permit except in Forest Service developed camp or picnic grounds. No smoking unless in an enclosed vehicle or building, a developed recreation site, or while stopped in an area at least three feet in diameter that is barren or cleared of all flammable material. No operation of welding, acetylene, or other torch with an open flame. No operation or using any internal or external combustion engine without a spark arresting devise properly installed, maintained and in effective working order.
Stage 2 Fire Restriction	No building, maintaining, attending or using open fire campfires or stove fires. No smoking unless in an enclosed vehicle or building, a developed recreation site, or within a three foot diameter cleared to mineral soil. No operation of welding, acetylene, or other torch with an open flame. No operation or using any internal or external combustion engine without a spark arresting devise properly installed, maintained and in effective working order.

Source: NWS, 2016; National Interagency Fire Center; (gacc.nifc.gov/.../r2ftc/documents/Fire_Restriction_Chart.pdf)

Jefferson County has large areas of government-owned lands. The federal government manages approximately 52.2 percent of the total land in the County including portions of the Helena and Beaverhead-Deerlodge National Forests totaling 460,626 acres and BLM land totaling 92,381 acres. The State of Montana manages 3.4 percent of County's acreage. This scattering of government and private ownership can present unique firefighting challenges.

Jefferson County has witnessed a number of wildfires that have destroyed property and affected wildlife habitat, scenic resources, and air quality. **Table 4.2-2** presents data from the DNRC and U.S. Forest Service on wildfires over 100 acres, with statistics on acres burned, cause, structures lost, and suppression cost, where available. This data indicates that in the past 35 years, 18 large wildfires have occurred in Jefferson County, burning over 71,751 acres and costing close to $10 million to suppress.

Table 4.2-2. Wildfire Listings >100 Acres or Lost Structures in Jefferson County

Date	Name	Acres	Cause	Structures Lost	Suppression Cost
1981	Johnny Gulch	1,300	Not reported	-	-
1985	Woodward Ranch	1,120	Not reported	-	-
1988	Sheep Creek	125	Not reported	-	-
1988	Whitehall	1,630	Not reported	-	-
1988	Warm Springs	46,900	Human	14 R	-
9/29/1992	Black Butte	1,466	Debris burning	-	$14,846
10/5/1996	Cavern Fire	135	Smoking	-	$11,964
8/29/1998	Greer Gulch	120	Lightning	-	$202,086
8/2/2000	High Ore Road	9,978	Miscellaneous	9 R	$3,430,559
8/2/2000	Boulder Hill	2,482	Miscellaneous	-	$1,433,088
8/14/2001	Wheat	150	Lightning	0	$3,169
6/1/2004	Wood Hauler	0.01	Debris burning	1 OB	$134
8/29/2005	518	169	Railroad	0	$22,016
8/6/2007	Goodwin	183	Lightning	0	$194,000
7/19/2008	Cactus	518	Lightning	0	$563,299
6/23/2012	Antelope Lane	707	Lightning	0	$512,600
8/28/2012	19 Mile	4,083	Lightning	10 R, 4 OB	$3,600,000
8/7/2016	Nez Perce Fire	687	Lightning	0	-
TOTAL		**71,751**		**33 R, 5 OB**	**$9,987,761**

Source: Tri-County Regional CWPP, 2015; DNRC, 2016; USFS, 2012. Notes: "-" = No Data Available; R = Residence; OB = Outbuilding.

The summer of 2000 was a devastating fire season in Montana. In Jefferson County, fire suppression agencies were involved in a lengthy response with huge blazes such as the High Ore Road Fire at 9,978 acres and the Boulder Hill Fire at 2,482 acres. The increase in wildland fires near population centers over the past decade has increased the level of awareness and the need for mitigation in the wildland urban interface (WUI) setting. A description of two significant wildfires that occurred in Jefferson County since the PDM Plan was last updated in 2011 are presented below.

August 29, 2012 - The 19-Mile Fire, 10 miles south/southeast of Butte near the town of Whitehall, threatened approximately 200 homes scattered throughout the timber and grasslands in the Toll Mountain area. The fire burned an estimated 4,083 acres, 40 percent on federal land and 60 percent on state and private land. The fire also threatened four high voltage transmission lines, roads and bridges in the area, as well as the Butte watershed. Ten (10) homes were lost in the lightning-caused fire. Suppression costs were approximately $3.6 million. Montana Standard, *9 Structures Confirmed Lost in 19 Mile Fire West of Whitehall*, August 30, 2012).

A cabin explodes in flames at the 19 Mile fire. Credit: Steve DiGiovanna

August 7, 2016 – The Nez Perce Fire, 11 miles northeast of Butte burned on the east side of Elk Park. The fire started when a lightning storm blew through the area and it smoldered and burned for about a month before flaring up. No structures were destroyed (Montana Standard, *Nez Perce Fire Near Butte Doubles to 687 Acres*, September 2, 2016).

A column of smoke rises from the Nez Perce Fire as seen from Interstate 15 in Elk Park, north of Butte. Credit: USFS

Jefferson County received a Presidential disaster declaration for the Boulder Complex Fires in 2000 and Fire Management Assistance declarations in 2000 for the MT Central Zone 3B Fire Complex and in 2012 for the 19-Mile Fire.

Fighting wildland fires in Jefferson County is primarily the responsibility of the U.S. Forest Service and the Montana DNRC. Additionally, local volunteer fire districts provide vital support. The Tri-County FireSafe Working Group (TCFSWG), Forest Service and DNRC have been instrumental in maximizing the efficiency of local fire districts in responding to wildfires.

Jefferson County, as part of a collaborative effort along with Lewis & Clark and Broadwater Counties, updated the Tri-County Regional Community Wildfire Protection Plan (CWPP) in 2015. This document is presented in **Appendix E**. The goals of the Tri-County Regional CWPP are to define the local WUI boundaries; reduce impacts to the communities from wildland fires; reduce hazardous fuels in the forest and rangeland areas; continue to assess and address current WUI problems at all levels; offer education and awareness programs for developers and homeowners in the WUI, and work with local fire jurisdictions to address their WUI issues. Mitigation projects identified in the CWPP are incorporated herein by reference.

Vulnerability and Area of Impact

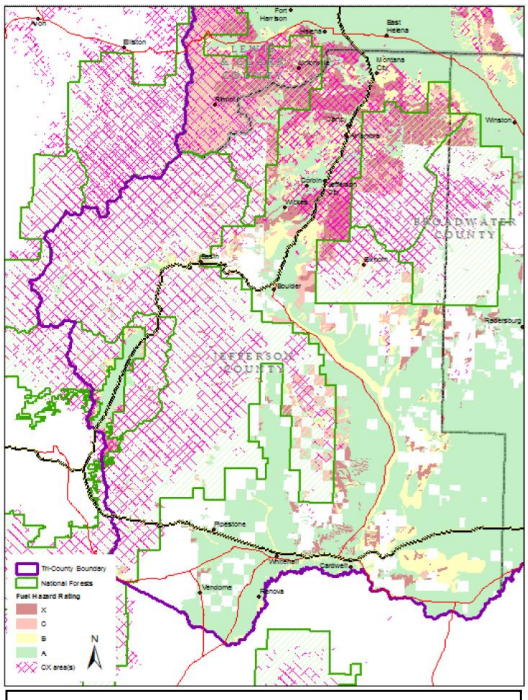
The WUI is a line, area or zone [per MCA 76-13-102(16)] where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. A WUI exists anywhere that structures are located close to natural vegetation and where a fire can spread from vegetation to structures, or vice versa. The most extreme situation with respect to fuel conditions and values at risk occurs where numerous high-value individual homes and subdivisions are located in the WUI in close proximity to the public land boundary. A significant loss of life could occur to residents, firefighters, and others who are in the wildfire area and do not evacuate.

People and structures near wildfires are threatened unless adequately protected through evacuation or mitigation. Should fires occur, structures within the WUI are very vulnerable. Some areas are a significant wildfire risk due to the slope of the landscape, human population densities adjacent or within forests, overall fuel hazards, and the accessibility of evacuation routes. The increase in wildland fires near population centers over the past decade has increased the level of awareness and the need for mitigation in the WUI setting. Mapping of the WUI is a political issue because it impacts residential insurance rates.

Regional electric infrastructure passing through wildland and non-irrigated agricultural areas are also at risk from wildfire. In particular, the electric substations, transmission lines, fuel tanks, and radio transmission towers are not often equipped to withstand the heat from a wildfire. A wildfire could disrupt electricity or communications should this infrastructure be damaged.

Another concern with wildfires is erosion and flash flooding in severely burned area. When moderate to heavy rains fall, an initial flush of ash can fill streams and rivers with ash and debris, which can adversely affect municipal water supplies as well as private domestic water supplies for subdivisions and private property owners.

The Tri-County CWPP identified a new condition class (CX, as shown by purple crosshatch on map) to represent forests that were infested with Mountain Pine Beetle and Spruce Bud Worm which are now dead trees with a receptive fuel bed of dead needles primed for easy ignition with unusually rapid rates of spread and burning intensity. The rate of heat release has been measured at two-times that of healthy green trees and the peak of heat release occurs much sooner than when green healthy trees burn. Fires in this fuel type have increased potential to grow big quickly, even with moderate fire weather and light wind. In addition to this obvious hazard to firefighters and civilians, the dead trees present and an additional hazard from blow-down (TCFSWG, 2015).



Wildland Fuel Hazard Rating Map
Source: Tri-County CWPP, 2015

Smoke from fires both within and outside of Jefferson County can create poor air quality and can affect sensitive groups such as the elderly and asthmatics. A recent study by Harvard-Yale Universities predicts that most of the smoke generated by West coast fires will flow towards western Montana as North America warms through the coming century. To identify the highest-risk areas,

the team used a fire prediction model and advanced atmospheric modeling to separate pollution caused by wildfires from other pollution sources. They also tracked the likely movement of smoke. They focused on what they called "smoke waves"– two or more consecutive days of unhealthy levels from fires. The study found that nationwide, the average length of the smoke-wave season is forecast to grow from 14 days a year to 29. Western Montana counties, however, could see smoke-wave seasons ranging from 25 to 69 days (Independent Record, *Wildfire Smoke Affecting Montana*, August 21, 2016).

Health effects associated with forest fire smoke exposure has been studied by the Centers for Disease Control (CDC). Researchers found the risk of hospital admission for respiratory and circulatory illness was greater during periods of heavy smoke than unexposed areas (CDC, 2001).

Although the primary concern is to structures and the interface residents, most of the costs associated with fires, come from firefighting efforts. Wildfires can also have a significant impact on the regional economy with the loss of timber, natural resources, recreational opportunities, and tourism. Smoke also affects things like road safety, tourism, and property values.

Probability and Magnitude

Property damage information is difficult to obtain for wildfires since it is typically the forest and agricultural resources that sustain the damage. As such, the magnitude of wildfire can be correlated with the acres burned and cost to suppress the fire by local, state, and federal agencies. **Tables 4.2-2 and 4.2-3** and research on Jefferson County wildfires indicate that in the past 25 years there have been at least 18 large fires burning 71,751 acres with 33 residences and many outbuildings lost. Suppression costs for these fires has amounted to almost $10 million.

Wildfire does not present a uniform risk across Jefferson County. The WUI map from the Tri-County Regional CWPP (2015) was used for the PDM analysis. This wildfire hazard area was developed by combining the Tri-County WUI and the U.S. Forest Service Healthy Forest Restoration Act WUI. The Tri-County WUI defines zones up to four miles from interface communities as areas where population density $\geq$ 250 people per square mile. Each four mile zone was divided into one mile buffers, each assigned a WUI risk class. The Forest Service WUI layer was created by buffering "Communities at Risk", population density $\geq$ 28 people, and major roads by ½ mile. The combined initial WUI was then buffered by an additional 1 mile for a total buffer distance of 1.5 miles. The WUI was then extended up to an additional mile where there were sustained steep slopes. **Figure 5** presents the wildfire hazard area used in the PDM vulnerability analysis.

To complete the vulnerability analysis for this project, GIS was used to intersect the WUI area with both the critical facility and MDOR cadastral parcel datasets. Estimates of vulnerable population were calculated by determining the percent exposure in each census block for the hazard area. Exposure values are presented in **Table 4.2-3**. Building exposure reflects only the monetary structure value and does not account for improvements or personal effects that may be lost to wildfire.

Table 4.2-3. Jefferson Co. Vulnerability Analysis; Wildfire (WUI)

Category	Jefferson County (balance)	Boulder (City)	Whitehall (Town)
Residential Property Exposure $	$635,528,119	$32,662,686	$33,969,396
# Residences At Risk	3,531	408	391
Commercial, Industrial & Agricultural Property Exposure $	$49,687,099	$7,588,581	$12,099,667

Table 4.2-3. Jefferson Co. Vulnerability Analysis; Wildfire (WUI)

Category	Jefferson County (balance)	Boulder (City)	Whitehall (Town)
# Commercial, Industrial & Agricultural Properties At Risk	252	62	67
Critical Facilities Exposure Risk $	$39,552,822	$108,107,706	$16,998,442
# Critical Facilities At Risk	58	25	26
Bridge Exposure $	$64,986,769	$994,686	$994,686
# Bridges At Risk	125	2	2
Persons At Risk	9,384	1,249	1,387
Persons Under 18 At Risk	2,202	244	302

GIS analysis of the wildfire risk to Jefferson County indicates that approximately 425,486 acres (40 percent) are within WUI areas. According to the vulnerability analysis, 4,330 residences, 381 commercial, industrial and agricultural buildings, and 109 critical facilities are located in the WUI areas. The Wildfire Section in **Appendix C** lists the critical facilities and bridges within the WUI.

Wildfires generally occur more than once per year in Jefferson County and therefore, the probability of future events are rated as "highly likely". Jefferson County's history with wildfires, the mountainous terrain, and areas of the county encompassed by public land has prompted the community to identify wildfires as a significant hazard. Other losses from severe wildfire include loss of jobs, loss of taxable value, and a loss of sense of safety. Post-fire effects include flash flooding and erosion. Smoke from local and regional forest fires create public health emergencies.

Future Development

Wildfire disasters can be mitigated through comprehensive land use planning that includes housing development design, fuels management, and public education. Regulations and ordinances addressing these issues in future development can play a significant role to minimize the danger posed by fire to residents, homes, and firefighters.

The Jefferson County subdivision regulations address specific fire protection standards so all subdivisions are planned, designed, constructed, and maintained to minimize the risk of fire and to permit the effective and efficient suppression of fires in order to protect persons, property, and forested areas. Measures include:

- The placement of structures in such a manner so as to minimize the potential for flame spread and to permit efficient access for firefighting equipment.
- The presence of adequate firefighting facilities on site, when required by the governing body.
- An adequate water supply and water distribution system to fight fires on site, when required by the governing body.
- The availability, through a fire protection district or other means, of fire protection services adequate to respond to fires that may occur within a subdivision.

Special standards for subdivisions proposed in areas of high fire hazard including heads of draws, excessive slopes, dense forest growth or other hazardous wildfire components. For subdivisions proposed in areas subject to high wildfire hazard, the following standards apply:

- At least two entrance-exit roads to assure more than one escape route for residents and access routes by fire fighting vehicles.

- Road rights-of-way cleared of slash.
- Building sites prohibited on slopes greater than 30 percent and at the apex of "fire chimneys".
- Reduced densities in areas of steep slopes of dense forest growth through minimum lot standards.
- Open space, part land and recreation areas to separate residences and other buildings from densely forested areas.
- A water supply of sufficient volume for effective fire control in accordance with standards set by the local fire protection authority.
- Consultation with the local fire protection authority.

Climate Change

Wildfire is determined by climate variability, local topography, and human intervention. Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation. Additionally, changes in climate patterns may impact the distribution and perseverance of insect outbreaks that create dead trees (increase fuel). When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

There is no doubt in the scientific community that climate change will bring increased fire danger to southwest Montana. A combination of increased temperatures over extended periods of time will result in earlier snowmelt, lower humidity, drought, and decreased log moisture. The Forest Service has designed a series of measurements/calculations to represent fire danger both on a daily basis and into the future. The most important of these is the "Energy Release Component," the ERC. This is basically the intensity of the fire as it burns using a standard set of fuel characteristics. The higher the ERC, the greater the fire danger. A recent analysis from the Montana Fire Science Laboratory indicates that the fire season over the next 95 years will increase by 17 days (32% increase); fire danger (ERC) will increase by around 15 percent; drought will increase by 16 percent; and fuel moistures will decrease by 16 percent. Larger, more severe, and more frequent fires may impact the people, property and critical facilities by increasing the risk from ignition from nearby fire sources.

Additionally, secondary impacts such as air quality concerns and public health issues from smoke may increase. Wildfire smoke generates a lot of particulate matter 2.5 microns or less in diameter, known as PM2.5. Those particles are so small, they easily bypass most of the human body's defenses and move directly from the lungs into the bloodstream. A recent study demonstrates that smoke waves are likely to be longer, more intense, and more frequent under climate change, which raises health, ecologic and economic concerns.

Figure 5 – Wildfire

4.3 Hazardous Material Incidents

CPRI SCORE = 2.75

Description and History

A hazardous material release is the contamination of the environment (i.e. air, water, soil) by any material that because of its quantity, concentration, or physical or chemical characteristics threatens human health, the environment, or property. Hazardous materials, including petroleum products and industrial chemicals, are commonly stored and used in Jefferson County and are regularly transported via the regions roadways, railroads, and pipelines. A release of hazardous materials from both fixed and transportation incidents pose possible threats involving emergency response. Hazards range from small spills on roadways to major transportation releases on railways or pipeline ruptures contaminating land and water.

Jefferson County has several large mines which use and/or store hazardous materials; Ashgrove Cement in Montana City, the Montana Tunnels gold mine west of Jefferson City, and the Golden Sunlight gold mine north of Whitehall. Montana Tunnels is no longer operating but still has hazardous materials stored on-site. Records of hazardous material events from 1990 to 2016, available from the National Response Center database, are summarized in **Table 4.3-1**. Hazardous material incidents in Jefferson County have mostly been minor.

Table 4.3-1. Jefferson County Hazardous Material Incidents; 1990 – 2016

Incident Date	Type of Incident	Incident Cause	Location	Nearest City	Suspected Responsible Party	Quantity Spilled/ Material Name
4/21/1993	Dumping	Fixed	Doran Property	Three Forks	Unknown	Motor Oil, 2,4-D, Hydraulic Oil
3/23/1994	TA	Mobile	I-15 North, MM 15	Boulder	Cloverleaf	Oil: Diesel
10/18/1998	OE	Mobile	30 Miles from Butte	Whitehall	Roberts Express	Amines Liquid
6/21/1999	EF	Fixed	453 MT Hwy 2 E	Whitehall	Golden Sunlight Mine	Sodium Cyanide, Process Fluid
6/30/1999	Other	Fixed	84 MT Highway 2 W	Whitehall	Golden Sunlight Mine	HCn, NO_4; Anhydrous Ammonia
10/5/1999	OE	Fixed	Golden Sunlight Mine	Whitehall	Golden Sunlight Mine	Oil, Fuel: No. 2-D
12/8/1999	Other	Mobile	Main Street	Basin	Silver Saddle Bar	Oil, Fuel: No. 2
8/31/2000	EF	Fixed	453 MT Hwy 2 E	Whitehall	Golden Sunlight Mine	Sodium Cyanide
4/10/2001	OE	Fixed	116 Rail Ray St	Three Forks	Bullock Contracting	Mineral Oil
10/23/2001	Other	Fixed	Whitehorse Rd/Hwy 287		Montana Power Co	Transformer Oil
1/10/2005	TA	Mobile	I-15, Ext 187	Montana City	CHS Transportation	Gasoline
10/9/2006	OE	Mobile	140 Kountz Road	Whitehall	Freeman's Junk Yard	Motor Oil, Ethylene Glycol
5/3/2010	TA	Mobile	I-90, MM 233	Butte	Werner Enterprises	Oil: Diesel

Source: National Response Center, 2016 (http://www.nrc.uscg.mil/)
Notes: EF = Equipment Failure; OE = Operator Error; ST = Storage Tank; TA = Transportation Accident; US = Unknown Sheen.

December, 1999 - A fuel oil spill at the Basin Grade School required that students be transported to Jefferson High School to use the modular classrooms for approximately three months while clean-up took place. Something in the fuel feed system stuck open and fuel from a roof tank ran all over the inside the two-story school building The cost of the clean-up and rental of the classrooms cost over $46,000.

The Emergency Planning and Community Right-to-Know Act (EPCRA) was enacted in 1986 to inform communities and citizens of chemical hazards in their areas. Sections 311 and 312 of EPCRA require businesses to report the locations and quantities of chemicals stored on-site to state and local governments in order to help communities prepare to respond to chemical spills and similar emergencies. EPCRA Section 313 requires the U.S. Environmental Protection Agency (EPA) and the states to annually collect data on releases and transfers of certain toxic chemicals from industrial facilities, and make the data available to the public in the Toxics Release Inventory (TRI). In 1990 Congress passed the Pollution Prevention Act which required that additional data on waste management and source reduction activities be reported under TRI. The goal of TRI is to empower citizens, through information, to hold companies and local governments accountable in terms of how toxic chemicals are managed. There are two active TRI facilities in Jefferson County, as shown in **Table 4.3-2**.

Table 4.3-2 - Toxic Release Inventory – Total Aggregate Releases; 2011-2015

Facility/Year	Total On-Site Disposal or Other Releases	
Ash Grove Cement Co., Montana City Plant, 100 Highway 518, Clancy, MT		
2015	4,698 pounds	Chromium, lead compounds and mercury compounds
2014	23,376 pounds	Ammonia; chromium, lead compounds and mercury compounds
2013	46,061 pounds	Chromium, lead compounds and mercury compounds; sulfuric acid
2012	30,712 pounds	Chromium, lead compounds and mercury compounds; sulfuric acid
2011	4,425 pounds	Chromium, lead compounds and mercury compounds
Barrick Gold Corp-Golden Sunlight Mine, 453 Montana Highway 2 E, Whitehall, MT		
2015	4,349,322 pounds	Ammonia; arsenic, chromium, cobalt, copper, cyanide, lead, manganese, mercury, nickel, nitrate, and selenium compounds; and methanol
2014	3,909,679 pounds	Ammonia; arsenic, chromium, cobalt, copper, cyanide, lead, manganese, mercury, nickel, nitrate, and selenium compounds; and methanol
2013	2,462,964 pounds	Ammonia; arsenic, chromium, cobalt, copper, cyanide, lead, manganese, mercury, nickel, nitrate, and selenium compounds; and methanol
2012	1,841,200 pounds	Ammonia; chromium, copper, cyanide, lead, manganese, mercury, and nitrate compounds; nickel; and methanol
2011	2,281,207 pounds	Ammonia; chromium, copper, cyanide, lead, manganese, mercury, nickel, zinc, and nitrate compounds; and methanol

Source: U.S. EPA, 2016; (https://iaspub.epa.gov/triexplorer/tri_release.chemical

Many facilities in Jefferson County sell or use hazardous materials including the municipal water treatment facilities, industrial businesses, chemical dealers, and fuel distributors. Locations of facilities in Jefferson County with Tier II reporting requirements are listed in **Table 4.3-3.**

Table 4.3-3. Jefferson County Tier II Hazardous Material Reporters

Facility Name	Address	City
Ash Grove Cement Co - Montana City Plant	100 Hwy 518	Clancy
AT&T - MT3170	FT2W-HLNAMTMA	Basin
Boulder Community Dial Office CenturyLink	207 N. Madison Street	Boulder
Buckley Powder Co - URS Conda Site	1 Delmoe Lake Road	Whitehall
Clancy Community Dial Office CenturyLink	5 E. Clancy Street	Clancy
FedEx Freight, Inc. - BTE	119771 Rick Jones Way	Butte
Forterra Concrete Products Inc.	17 Thunder Road	Montana City
Golden Sunlight Mines, Inc.	453 MT Hwy 2 E	Whitehall
Marks-Miller Post & Pole, Inc.	15 Lump Gulch Rd	Clancy

Table 4.3-3. Jefferson County Tier II Hazardous Material Reporters

Facility Name	Address	City
Orica Mountain West, Inc., Whitehall	150 Sheep Camp Rd	Whitehall
Verizon Wireless Boulder	Lat: 46-15-35 N, Long:112-9-10 W	Boulder
Verizon Wireless Whitehall	Incorrect coordinates provided	Whitehall
Whitehall CenturyLink	305 W Legion Ave	Whitehall

Source: Jefferson County DES, 2016

There have been no Federal disaster or State emergency declarations associated with the Hazardous Material Incident hazard in Jefferson County and the likelihood of a significant event resulting in a disaster declamation is considered low. Regional hazardous-material response teams closest to Jefferson County are located in Helena and Bozeman.

Vulnerability and Area of Impact

Transportation of hazardous materials through Jefferson County on highways, pipelines, and by the railroads could result in an accident or derailment that would have the potential to impact Jefferson County residents. Large quantities of industrial chemicals are stored in various locations throughout the county. Although there is no history of significant incidents, the potential for a hazardous material accident in Jefferson County is present.

There are numerous abandoned mines around Jefferson County, many of which with waste rock and tailings that have contaminated soil, sediment, and groundwater with hazardous materials such as lead and arsenics. Sites with the most significant impacts have undergone hazardous material cleanup to remove toxic materials.

The volume and type of hazardous materials that flow into, are stored, and flow through communities will determine exposure to a potential release of hazardous materials. An accidental or intentional release of materials could produce a health hazard to those in the immediate area, downwind, and/or downstream. Some hazardous materials occur in the gaseous phase and are denser than air; therefore, having the potential to collect in low places.

Probability and Magnitude

To model the spatial distribution of hazardous material incident risk a GIS data layer of transportation arteries was used, which included the interstate highways, major roadways, and railroads. TRI and Tier II facilities were added to this layer and it was then buffered by 0.25 miles. Building exposure was calculated by intersecting the hazardous material buffer with the MDOR parcel and critical facility GIS layers. Population exposure was calculated by intersecting the hazardous material buffer with census block data. **Table 4.3-4** presents the results of the vulnerability assessment.

Table 4.3-4. Jefferson County Vulnerability Analysis; Hazardous Material Incidents

Category	Jefferson County (balance)	Boulder (City)	Whitehall (Town)
Residential Property Exposure $	$200,277,621	$23,944,791	$33,406,706
# Residences At Risk	1401	287	386
Commercial, Industrial & Agricultural Property Exposure $	$36,380,369	$6,514,816	$12,099,667
# Commercial, Industrial & Agricultural Properties At Risk	175	54	67
Critical Facilities Exposure Risk $	$26,298,858	$106,344,542	$14,792,805

Table 4.3-4. Jefferson County Vulnerability Analysis; Hazardous Material Incidents

Category	Jefferson County (balance)	Boulder (City)	Whitehall (Town)
# Critical Facilities At Risk	39	22	23
Bridge Exposure $	$61,901,214	$497,343	$994,686
# Bridges At Risk	109	1	2
Persons At Risk	6,193	966	1,387
Persons Under 18 At Risk	1,438	168	302

The GIS analysis indicates that there are over 71,232 acres in Jefferson County in the hazardous material buffer (6.7 percent) including 2,074 residences, 296 commercial, industrial and agricultural buildings, and 84 critical facilities. The Hazardous Material Incident Section in **Appendix C** lists the critical facilities and bridges within the hazardous material transportation buffer.

According to the U.S. Department of Transportation, Office of Hazardous Materials Safety, Jefferson County has had three hazardous material releases with reported damages in the past 25 years, as shown in **Table 4.3-5.**

Table 4.3-5. Jefferson County Hazardous Material Incidents with Damages

Date	Location	Carrier	Quantity Released	Commodity Released	Damages	Mode of Transport
10/18/1998	Whitehall	Roberts Express	200 gal	Amine Liquid	$25,000	Highway
1/10/2005	Montana City	CHS Inc.	3,048 gal	Gasoline	$269,215	Highway
3/7/2008	Whitehall	ICARE Transport	1,500 gal	Asphalt	$21,500	Highway
TOTAL					**$315,715**	

Source: U.S. Dept. Transportation, 2016; https://hazmatonline.phmsa.dot.gov/IncidentReportsSearch/IncrSearch.aspx
Notes: gas = gallons

The history of hazardous material events in Jefferson County indicates 48 incidents have occurred over the past 25 years. Therefore, the probability of future events is rated as "highly likely". The PDM Planning Team rated this hazard as "likely". The magnitude of any hazardous material event would depend on the amount and material spilled.

Future Development

Jefferson County has no land use regulations that specifically restrict building around industrial facilities or along transportation routes or in the vicinity of facilities that store large quantities of hazardous materials or petroleum products. However, impacts to public health and safety are considered for all new subdivisions.

Climate Change

Hazardous material incidents are not expected to increase as a result of climate change. No increase in exposure or vulnerability to the population, property, or critical facilities are expected to occur.

Figure 6 – Haz Mat - County

4.4 Severe Weather and Drought

CPRI SCORES
SEVERE SUMMER WEATHER = 2.65
SEVERE WINTER WEATHER = 3.0
DROUGHT = 2.5

Description and History

Severe weather hazards have become more significant in recent years due to climate change. Natural resource trends indicate the mean annual precipitation has been below average and the mean annual temperatures have been above average for the past five years. Severe storms are not common; however, thunderstorms, hailstorms, high winds, heavy snow, freezing rain and sleet do occur. Available wind information indicates wind gusts in excess of 60 mph are not uncommon. The trend of variable weather conditions is expected to continue.

The winter weather hazard includes several weather conditions that occur from late fall through early spring in Jefferson County (November through April). Snow, blizzards, extended cold and high winds frequently occur together but also occur independent of one another during these months. Severe summer weather includes thunderstorms, wind, hail, lightning, tornadoes, and microbursts that typically occur between May and October of each year. Drought is a consequence of severe weather. Further details on these severe weather hazards are profiled below.

Severe Winter Weather

Winter storms and blizzards follow a seasonal pattern that begins in late fall and lasts until early spring. These storms have the potential to destroy property, and kill livestock and people. Winter storms may be categorized as sleet, ice storms or freezing rain, heavy snowfall or blizzards, and low temperatures. Blizzards are most commonly connected with blowing snow and low visibility. Winter also brings sustained straight line winds that can exceed 50 mph.

A severe winter storm is generally a prolonged event involving snow or ice and extreme cold. The characteristics of severe winter storms are determined by the amount and extent of snow or ice, air temperature, wind speed, and event duration. Severe winter storms create conditions that disrupt essential regional systems such as public utilities, telecommunications, and transportation routes.

A combination of temperatures to 30 below zero and high winds can close roads, threaten disruption of utilities, limit access to rural homes, impede emergency services delivery and close businesses. Such storms also create hazardous travel conditions, which can lead to increased vehicular accidents and threaten air traffic. Additionally, motorists stranded due to closed roads and highways may present a shelter problem.

The National Weather Service provides short-term forecasts of hazardous weather to the public by producing regularly-scheduled severe weather outlooks and updates on various forms of hazardous weather including blizzards and wind chill. Warning and Advisory Criteria for winter weather is presented in **Table 4.4-1**.

Table 4.4-1. Warning and Advisory Criteria for Severe Winter Weather

Winter Weather	Weather Advisory
Winter Storm Watch	Issued to give the public 12-48 hours of advance notice of the potential for snow 6 inches or more in 12 hours or 8 inches or more in 24 hours AND sustained or frequent wind gusts of 25 – 34 mph occasionally reducing visibilities to ¼ mile or less for three hours or more.
Winter Weather Advisory	Issued when a combination of winter weather elements that may cause significant inconveniences are occurring, imminent, or have a high probability of occurring.

Table 4.4-1. Warning and Advisory Criteria for Severe Winter Weather

Winter Weather	Weather Advisory
Winter Storm Warning	Issued when snow 6 inches or more in 12 hours or 8 inches or more in 24 hours AND sustained or frequent wind gusts of 25-34 mph occasionally reducing visibilities to ¼ mile or less for three hours or more are occurring, imminent, or have a high probability of occurring.
Blizzard Watch	Issued to give the public 12-48 hours of advance notice of possible blizzard conditions (sustained winds or frequent gusts of 35 mph or greater and visibilities of less than a quarter mile from falling and/or blowing snow for 3 hours or more).
Blowing Snow Advisory	Issued for visibilities intermittently at or below ½ mile because of blowing snow.
Blizzard Warning	Issued when blizzard conditions (sustained winds or frequent gusts of 35mph or greater and visibilities of less than a quarter mile from falling and/or blowing snow for 3 hours or more) are occurring, imminent, or have a high probability of occurring.
Freezing Rain Advisory	Issued when an accumulation of ice will make roads and sidewalks slippery, but significant and damaging accumulations of ice are not expected.
Ice Storm Warning	Issued when a significant and damaging accumulation of ice is occurring, imminent or has a high probability of occurring.
Snow Advisory	Issued when snow accumulations of 2-5 inches in 12 hours are expected.
Sleet Advisory	Issued when sleet accumulations causing hazardous conditions are expected.
Heavy Snow Warning	Issued when snow accumulations of 6 inches or more in 12 hours or 8 inches or more in 24 hours are expected.
Wind Chill Watch	Issued to give the public 12-48 hours advanced notice of the potential for wind chills of -40°F or colder with a wind speed of 10 mph or higher and a duration of 6 hours or more.
Wind Chill Advisory	Issued when wind chills of -20°F to -39°F with a wind speed of 10 mph or higher and a duration of 6 hours or more are expected.
Wind Chill Warning	Issued when wind chills of -40°F or colder with a wind 10 mph wind in combination with precipitation.

Source: National Weather Service, 2016

Snow storms and bitterly cold temperatures are common occurrences in Jefferson County and generally do not cause any problems as residents are used to winter weather and are prepared for it. Sometimes, however, blizzards can occur and overwhelm the ability to keep roads passable. Heavy snow and ice events also have the potential to bring down power lines and trees. Extreme wind chill temperatures may harm residents if unprotected outdoors or if heating mechanisms are disrupted.

State-wide winter storm disasters were declared in 1978, 1989 and 1996. **Table 4.4-2** presents the severe winter weather events in Jefferson County since 2000.

Table 4.4-2. Jefferson County Severe Winter Weather Events (~November-April)

Date	Event	Date	Event	Date	Event	Date	Event
12/15/2000	Blizzard	11/8/2005	Heavy Snow	4/29/2010	Winter Storm	9/25/2013	Heavy Snow
3/30/2001	Heavy Snow	12/5/2005	Winter Storm	5/5/2010	Winter Storm	10/2/2013	Heavy Snow
6/3/2001	Heavy Snow	4/6/2006	Heavy Snow	11/15/2010	Winter Storm	10/3/2013	Heavy Snow
6/13/2001	Heavy Snow	4/23/2006	Heavy Snow	11/22/2010	Winter Storm	10/27/2013	Heavy Snow
12/28/2001	Heavy Snow	9/14/2006	Winter Storm	2/4/2011	High Wind	12/6/2013	Cold/Wind Chill
1/12/2002	High Wind	1/6/2007	High Wind	2/6/2011	Winter Storm	1/11/2014	High Wind
2/21/2002	High Wind	5/21/2007	Heavy Snow	4/7/2011	Winter Storm	1/29/2014	Heavy Snow
2/23/2002	Winter Storm	6/6/2007	Heavy Snow	4/21/2011	Winter Storm	2/20/2014	Heavy Snow
2/28/2002	Winter Storm	11/19/2007	Heavy Snow	4/29/2011	Winter Storm	2/23/2014	Heavy Snow
3/7/2002	Winter Storm	1/4/2008	High Wind	5/9/2011	Winter Storm	3/1/2014	Extreme
4/17/2002	Winter Storm	1/17/2008	Heavy Snow	12/3/2011	Winter Storm	3/17/2014	Heavy Snow
5/22/2002	Winter Storm	1/19/2008	Heavy Snow	12/29/2011	High Wind	11/9/2014	Heavy Snow
10/29/2002	Winter Storm	1/28/2008	Winter Storm	1/18/2012	Winter Storm	11/25/2014	Heavy Snow
11/23/2002	Heavy Snow	4/19/2008	Heavy Snow	2/22/2012	High Wind	11/28/2014	Heavy Snow

Table 4.4-2. Jefferson County Severe Winter Weather Events (~November-April)

Date	Event	Date	Event	Date	Event	Date	Event
1/22/2003	Winter Storm	6/11/2008	Heavy Snow	3/13/2012	High Wind	4/14/2015	Winter Storm
3/3/2003	Winter Storm	12/13/2008	Blizzard	4/5/2012	Winter Storm	11/3/2015	Winter Storm
3/7/2003	Winter Storm	3/16/2009	Winter Storm	11/8/2012	Heavy Snow	11/24/2015	Winter Storm
11/11/2003	High Wind	3/28/2009	Winter Storm	12/2/2012	High Wind	12/13/2015	Winter Storm
1/1/2004	Winter Storm	4/14/2009	Winter Storm	12/7/2012	Heavy Snow	2/15/2016	High Wind
12/29/2004	Winter Storm	4/27/2009	Winter Storm	1/10/2013	Heavy Snow	4/5/2016	High Wind
1/13/2005	Winter Storm	10/4/2009	Winter Storm	1/26/2013	Heavy Snow	4/15/2016	Winter Storm
4/19/2005	Winter Storm	10/27/2009	Heavy Snow	2/9/2013	Heavy Snow	5/9/2016	Winter Storm
4/27/2005	Winter Storm	4/13/2010	Winter Storm	2/9/2013	Heavy Snow		

Source: NCDC, 2016

An instance of severe winter weather in Jefferson County that caused a fatality is described below:

May 11, 2016 – A Clancy woman left her house to walk the dogs when a large branch fell from a tree and hit her in the head. The tree was weighted down by heavy snow. She died of injuries she suffered in the incident.

Severe Summer Weather

A severe thunderstorm is defined by the National Weather Service as a thunderstorm that produces wind gusts at or greater than 58 mph (50 knots), hail 1-inch or larger, and/or tornadoes. Thunderstorms can also produce intense downbursts, lightning, and microburst wind. Strong winds can occur outside of thunderstorms when the overall weather conditions are favorable. Lighting is also the cause of many of the wildfires in the area.

Tornadoes are the most concentrated and violent storms produced by the earth's atmosphere. They are created by a vortex of rotating wind and strong vertical motion, which possess remarkable strength and can cause widespread damage. The most violent tornadoes are capable of tremendous destruction with wind speeds of 300 mph or more. Maximum wind speeds in tornadoes are confined to small areas and vary over short distances. Thunderstorms can produce deadly and damaging tornadoes. As of February 1, 2007, the NWS began using the Enhanced Fujita Scale for Tornado damage. Tornadoes are not common in Jefferson County but high winds occur frequently.

A microburst is a very localized column of sinking air, producing damaging divergent and straight-line winds at the surface that are similar to, but distinguishable from, tornadoes. The scale and suddenness of a microburst makes it a great danger to aircraft due to the low-level wind shear caused by its gust front, with several fatal crashes having been attributed to the phenomenon over the past several decades. Microbursts in forested regions have flattened acres of standing timber.

The National Weather Service provides short-term forecasts and warnings of severe summer weather to the public by producing regularly-scheduled severe weather outlooks and updates on various forms of hazardous weather including tornado warnings, as shown in **Table 4.4-3.**

Table 4.4-3. Warning and Advisory Criteria for Severe Summer Weather

Summer Weather	Weather Advisory
Hazardous Weather Outlook	Hazardous weather outlooks alert the public to the possibility for severe weather in the area from one to seven days in advance.
Severe Thunderstorm Watch	Issued when conditions for severe thunderstorms appear favorable for an area over the next several hours. Watches are typically in effect for 4-6 hours.
Severe Thunderstorm Warning	Issued when Doppler radar indicates or the public reports a thunderstorm with wind gusts of 5 8 mph or greater and/or hail 1-inch or larger in diameter. The warning is usually valid for 30-60 minutes.
High Wind Watch	Issued when conditions are favorable for non-thunderstorm sustained winds of 40 mph or greater or gusts of 58 mph or greater for a period of one hour or more, but the timing, location, and/or magnitude are still uncertain.
High Wind Warning	Issued when non-thunderstorm sustained winds of 40 mph or greater or gusts of 58 mph or greater for a period of one hour or more are expected.
Tornado Watch	Issued when conditions for tornadoes appear especially favorable for an area over the next several hours. Watches are typically in effect for 4-6 hours.
Tornado Warning	Issued when Doppler radar indicates or the public reports a tornado. The warning is usually valid for 15-45 minutes.

Source: National Weather Service, 2016

There have been no Federal disaster or State emergency declarations issued for the severe summer weather hazard in Jefferson County. Since the 2011 Jefferson County PDM Plan was completed, numerous incidents of severe summer weather have affected the county. **Table 4.4-4** presents severe summer storm events from the NCDC database indicating the magnitude of these events.

Table 4.4-4. Jefferson County Severe Summer Weather Reports (~May-October)

Date	Event	Magnitude	Date	Event	Magnitude	Date	Event	Magnitude
11/24/1958	Tstorm Wind	65 kts	6/15/1995	Tstorm Wind	-	8/6/2009	Hail	1 in
6/16/1959	Hail	1 in	6/25/1996	Hail	2 in	8/7/2009	Tstorm	55 kts
8/14/1960	Tstorm Wind	56 kts	7/3/1998	Hail	1.75 in	5/3/2010	High Wind	55 kts
9/4/1960	Tstorm Wind	63 kts	7/27/1998	Hail	0.75 in	6/20/2010	Hail	1 in
6/27/1963	Hail	1 in	8/4/2001	Hail	1.75 in	7/1/2010	Hail	1.5 in
6/26/1964	Tstorm Wind	50 kts	10/23/2001	High Wind	52 kts	9/14/2010	Hail	1 in
7/24/1966	Tstorm Wind	-	10/23/2001	High Wind	55 kts	6/29/2011	Tstorm	51 kts
6/6/1967	Hail	0.75 in	6/21/2002	Tstorm Wind	52 kts	8/3/2011	Hail	1 in
9/10/1967	Tstorm Wind	51 kts	8/7/2002	Hail	0.75 in	7/11/2012	Hail	1 in
7/11/1968	Tstorm Wind	59 kts	9/1/2002	High Wind	56 kts	10/16/2012	High Wind	67 kts
4/23/1969	Tstorm Wind	50 kts	10/29/2003	High Wind	56 kts	9/5/2013	Tstorm	69 kts
6/27/1970	Tstorm Wind	63 kts	8/3/2004	Hail	1 in	6/13/2014	Hail	0.88 in
7/20/1970	Tstorm Wind	57 kts	6/16/2005	Hail	1 in	7/23/2014	Hail	0.88 in
6/21/1976	Hail	2 in	5/10/2007	Tstorm Wind	87 kts	8/21/2014	Heavy Rain	-
7/9/1977	Hail	0.75 in	8/18/2007	Hail	0.88 in	8/22/2014	Heavy Rain	-
5/27/1994	Tstorm Wind	-	7/6/2009	Hail	1 in	10/15/2014	High Wind	62 kts
8/20/1994	Tstorm Wind	-						

Source: NCDC, 2016. Notes: Tstorm = Thunderstorm; in = inch; kts = knots

Drought

Drought is an extended period of unusually dry weather and is a special type of disaster because its occurrence does not require evacuation of an area nor does it constitute an immediate threat to life or property. People are not suddenly rendered homeless or without food and clothing. The basic effect of a drought is economic hardship, but it does, in the end, resemble other types of disasters in that victims can be deprived of their livelihoods and communities can suffer economic decline.

The effects of drought become apparent when they are in longer duration because more and more moisture-related activities are affected. Non-irrigated croplands are most susceptible to moisture shortages. Rangeland and irrigated agricultural lands do not feel the effects as quickly as the non-irrigated, cultivated acreage, but their yields can also be greatly reduced due to drought.

Typically, federal drought declarations are not issued by the Presidential, but by the U.S. Department of Agriculture. Conservation Reserve Program (CRP) grazing may be opened to livestock owners for feed but other than this, the only real help for producers and growers is the fact that federal low interest loans are made available.

In periods of severe drought, range fires can destroy the economic potential of the agricultural industry, and wildlife habitat in, and adjacent to, the fire areas. Under extreme drought conditions, lakes, reservoirs, and rivers can be subject to severe water shortages. Insect infestation is an additional hazard resulting from drought. **Table 4.4-5** presents the National Weather Service warnings and advisories that relate to drought.

Table 4.4-5. Warning and Advisory Criteria for Drought

Summer Weather Warning	Warning Description
Blowing Dust Advisory	Issued for widespread or localized blowing dust reducing visibilities to less than a mile but greater than ¼ mile with sustained winds of 25 mph or greater.
Dust Storm Warning	Issued when widespread or localized blowing dust reduces visibilities to less than ¼ mile with sustained winds of 25 mph or greater.
Heat Advisory	Issued when conditions are favorable for heat index values reaching 105 degrees or greater for three days or more.
Heat Warning	Issued when high temperatures are expected to be over 105 degrees and low temperatures are expected to be over 80 degrees for three days or more.

Source: National Weather Service, 2016

The State of Montana established a Drought Advisory Committee and developed a Drought Plan to address the hazard. Information from the National Drought Mitigation Center also identifies Montana as a drought prone state. Temperatures can reach 100°F in the summer with extremely low humidities and high winds. Such dry, hot conditions contribute to drought conditions.

The history of drought in Montana, as presented in the State of Montana Natural Hazards Mitigation Plan (DES, 2001) is summarized below.

In the 1930's, the "Dust Bowl" drought affected the State of Montana, including Jefferson County. This nationwide drought produced erosion problems in the creation of dust storms throughout the State. Again in the mid 1950's, Montana had a period of reduced rainfall; however, Jefferson County did not suffer as severely as those counties in the eastern and central portions of the state.

Drought struck Jefferson County again in 1961, and by July, the State's Crop and Livestock Reporting Service called it the worst drought since the 1930's. Better conservation practices such as strip cropping were used to lessen the impacts of the water shortages. Five years later in 1966, the entire state was experiencing yet another episode of drought. Although water shortages were not as great as in 1961, a study of ten weather recording stations across Montana showed all had recorded below normal precipitation amounts for a ten month period.

Then in the 1970's, a seven month survey ending in May of 1977 estimated that over 250,000 acres of Montana farmland had been damaged by winds. Inadequate crop cover and excessive tillage

practices had resulted in exaggerated soil damage due to low soil moisture. The State of Montana began taking protective measures to conserve water.

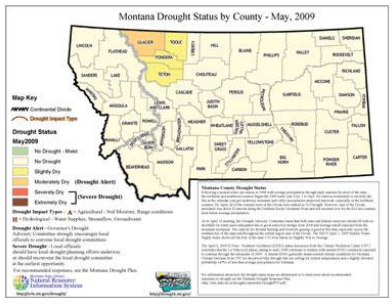
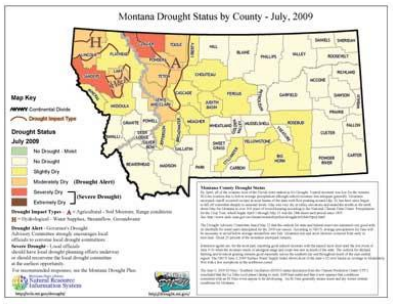
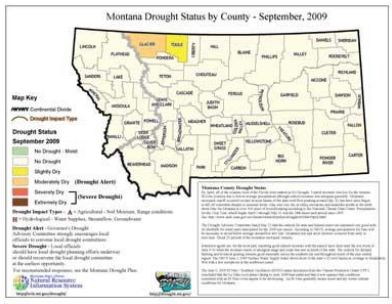
Jefferson County was severely affected by drought again in 1985 and received a federal drought disaster declaration. For a typical 2,500 acre Montana farm/ranch, the operator lost more than $100,000 in equity over the course of that year. The state's agriculture industry lost nearly $3 billion in equity.

Jefferson County had drought conditions from 2000 through 2007 and received several U.S. Department of Agriculture (USDA) disaster declarations since then. The State of Montana received a total of $152.4 million in disaster assistance from the Farm Service Agency in 2004, 2005, and 2006. This history shows that the county experiences drought almost once every decade and the drought may last for several years. Since the Jefferson County PDM Plan was completed in 2011, severe drought conditions have not impacted the county.

Table 4.4-6 shows the Montana drought status for the period 2009-2016. **Table 4.4-7** summarizes drought conditions in Jefferson County during this period.

Table 4.4-6. Montana Drought Status; 2009 – 2016

2009 Montana County Drought Status

May	July	September
		

2010 Montana County Drought Status

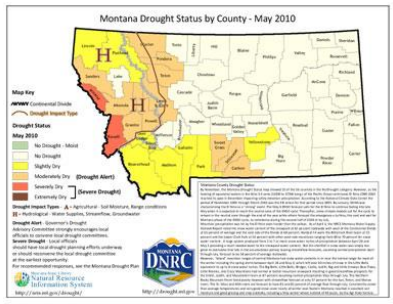
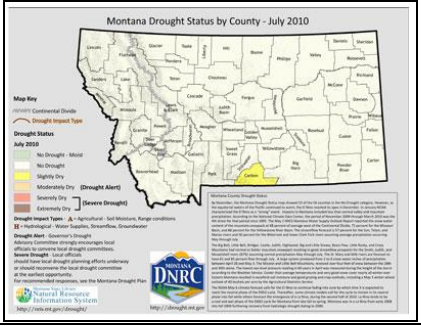
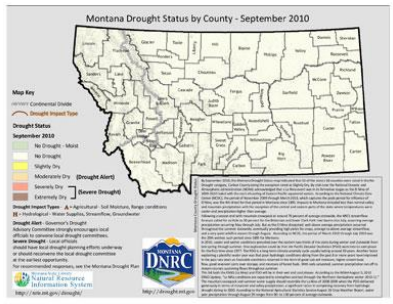
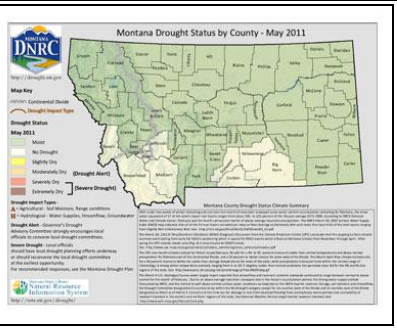
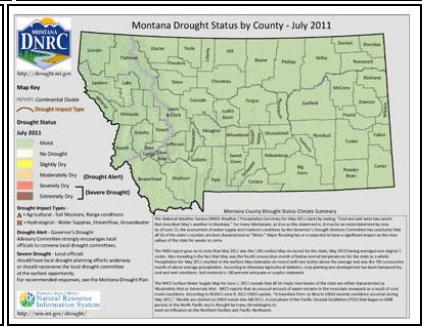
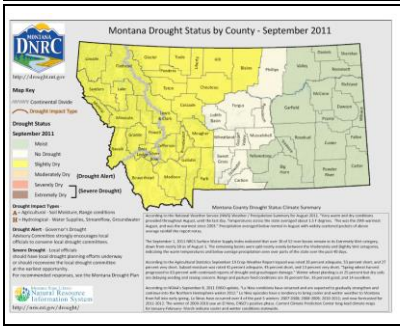
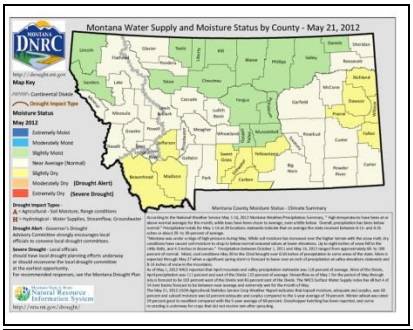
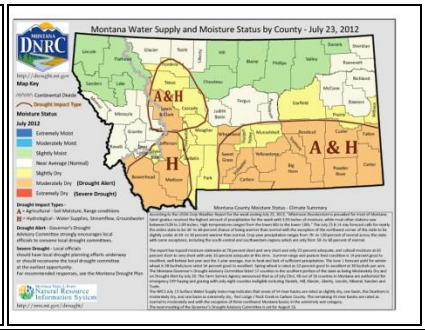
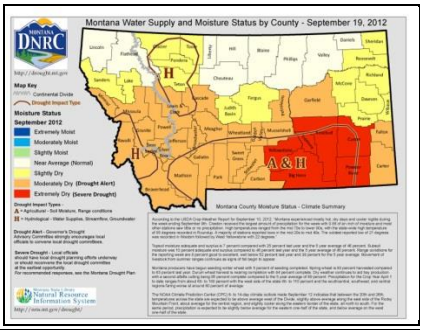
May	July	September
		

Table 4.4-6. Montana Drought Status; 2009 – 2016

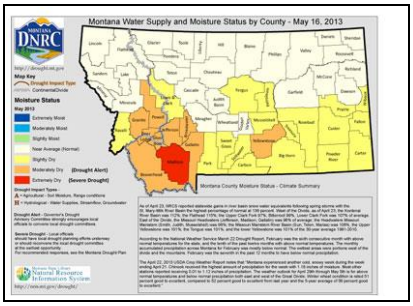
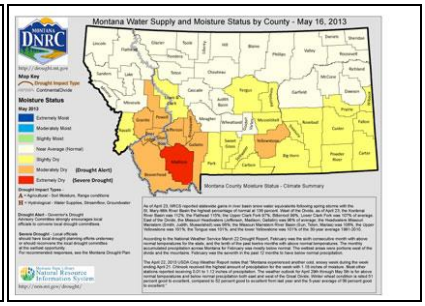
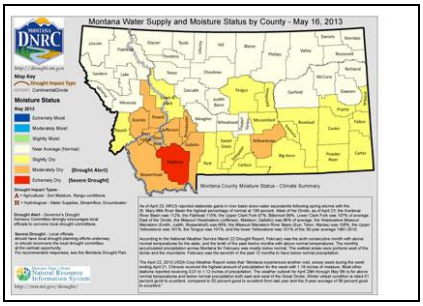
2011 Montana County Drought Status

May	July	September
		

2012 Montana County Drought Status

May	July	September
		

2013 Montana County Drought Status

May	July	September
		

2014 Montana County Drought Status

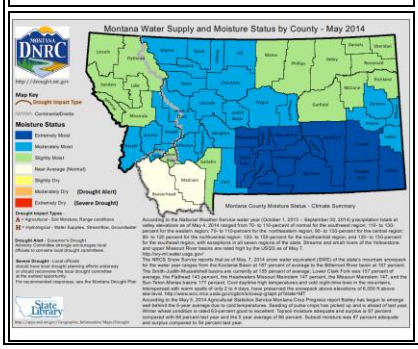
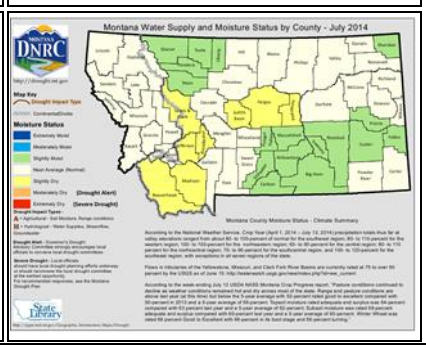
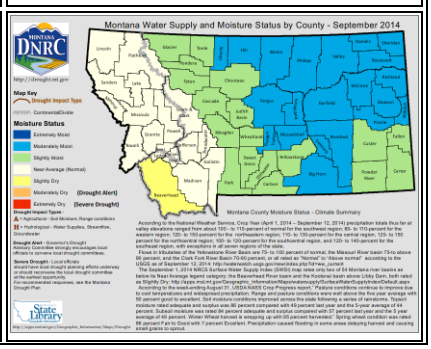
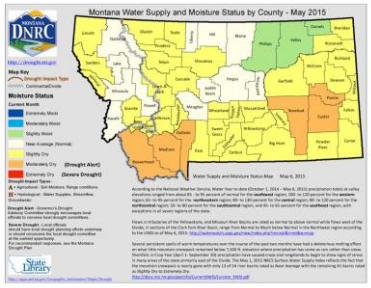
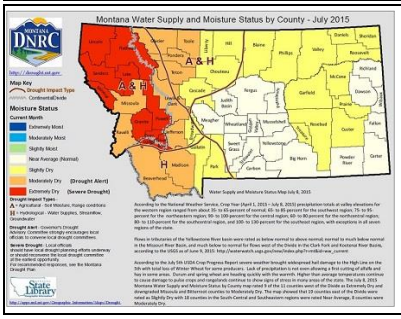
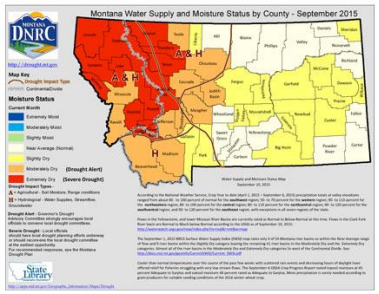
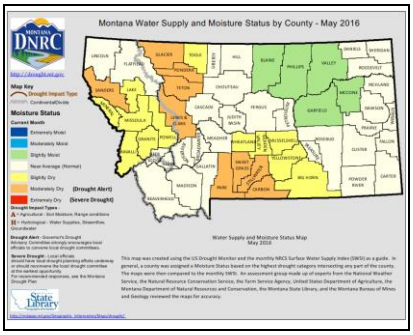
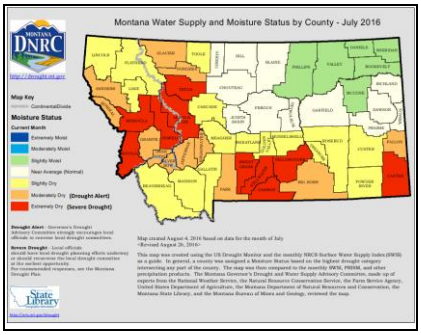
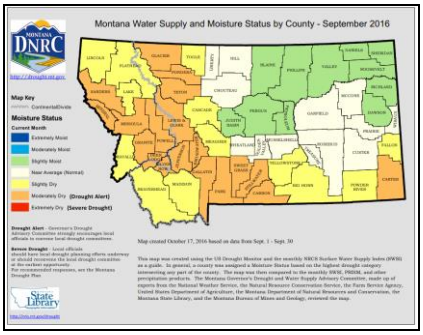
May	July	September
		

Table 4.4-6. Montana Drought Status; 2009 – 2016

2015 Montana County Drought Status

May	July	September
		

2016 Montana County Drought Status

May	July	September
		

Source: Montana Drought Website, 2016. https://mslservices.mt.gov/Geographic_Information/Maps/drought/

Table 4.4-7. Jefferson County Drought Summary

Moisture	Alerts	2009			2010			2011			2012			2013			2014			2015			2016		
		May	July	Sept	May	July	Sept	May	July	Sept	May	July	Sept	May	July	Sept	May	July	Sept	May	July	Sept	May	July	Sept
Moderately Moist																									
Slightly Moist																									
No Drought																									
Slightly Dry																									
Moderately Dry	Drought Alert																								
Extremely Dry	Severe Drought																								

Vulnerability and Area of Impact

Based on review of historic weather data, the entire county has been classified with a uniform risk for severe weather events. Structures, utilities, and vehicles are most at risk from the wind component of these storms, with crops and livestock being additionally threatened by hail and drought. Winter storm events may affect the higher regions with more snowfall but the population is concentrated in the lower elevations so the hazard risk area is considered uniform.

Drought affects all facets of our society, from food production to water quality to public health, and there is a growing need to help communities, agriculture, businesses, and individuals threatened by drought to plan accordingly. From 1980-2000, major droughts and heat waves within the U.S. alone resulted in costs exceeding $100 billion. In 2012, approximately two-thirds of the continental U.S.

was affected by chronic drought. Severe droughts are projected for the next several decades, impacting the nation's communities and economy (NDRP, 2016).

Drought is a hazard that does not normally cause structural damage but can have significant population and economic effects. Jefferson County communities rely on water for irrigation and public water supplies. A drought or blight could also have significant impacts on the agricultural community. Economic losses could result from loss of pasture and food supply for livestock. These losses would be in addition to those losses associated with lower crop yields due to drought conditions.

Another major impact of drought is to the natural resources of the area. As river and stream levels drop, fish populations and other natural resources are impacted. A hazard directly related to drought is wildfire. Drought conditions increase the chances that a major wildfire will threaten the community. Unlike many other events, drought evolves slowly, and therefore, the direct impact to the population (i.e. loss of life, injuries) would be low.

On March 21, 2016, President Obama signed a Presidential Memorandum directing Federal agencies to build national capabilities for long-term drought resilience. The President tasked the National Drought Resilience Partnership (NDRP) to work collaboratively to deliver on a Federal Action Plan including six goals and 27 associated actions to promote drought resilience nationwide. Importantly, these goals reflect many of the priorities identified by the on-the-ground leaders and experts who work daily to build a more resilient future for their communities. The actions are designed to complement state, regional, tribal and local drought preparedness, planning and implementation efforts.

Federal agencies have mobilized to provide improved information and data, emergency and planning assistance, landscape-scale land management improvements, and investments in new technologies and approaches to water resource management. Continued drought conditions in the West and projections of more extreme droughts in the future underscore the urgency to pursue long term solutions for protecting our water resources and the communities and ecosystems that depend on them. In partnership with the Montana DNRC and other state and local collaborators, the Missouri Headwaters Basin was selected as a national drought resilience pilot project. Partners are leveraging multiple resources to engage communities in drought preparedness planning and to implement projects that build resiliency. Goals of the project include:

- Providing tools for monitoring, assessing and forecasting;
- Developing local and regional capacity to plan for drought; and,
- Implementing local projects to build regional resilience.

The Jefferson River Water Council has a Drought Management Plan which includes the southern portion of Jefferson County. The purpose of the plan is to reduce resource damage and to aid in the equitable distribution of water resources during water critical periods.

Probability and Magnitude

Table 4.4-8 and 4.4-9 present severe weather events with reported damages from winter and summer events, respectively, from the SHELDUS and NCDC databases. The dataset used to populate

SHELDUS typically includes every loss causing and/or deadly event between 1960 through 1975 and from 1995 onward. Between 1976 and 1995, SHELDUS reflects only events that caused at least one fatality or more than $50,000 in property or crop damages. The NCDC data contains sporadic damage figures which were added to the dataset when they represented a unique damaging event. The SHELDUS and NCDC data suggest that that the last year for severe weather events with reported damages in Jefferson County was in 2000.

Table 4.4-8. Jefferson County Severe Winter Weather Events with Damages

Date	Injuries	Fatalities	Property Damage (2016 $)	Crop Damage (2016 $)	Remarks
2/25/1961	0	0	$859	$859	High Wind
3/1/1961	0.04	0	$1,682	$0	High Wind
12/21/1961	0.07	0	$96	$0	High Wind
1/5/1962	0.13	0	$49,964	$0	High Gusty Wind
1/22/1962	0	0	$1,738	$0	High Wind
2/22/1962	0	0	$78	$0	High Wind, Snow, Blowing Snow
11/19/1962	0.07	0	$7,013	$0	High Winds
2/1/1963	0.04	0	$146	$0	Freezing Rain, High Wind, Snow
4/5/1964	0	0	$32	$0	Snow and Drifting Snow
5/3/1964	0	0.04	$14,422	$0	Snow and High Wind
12/15/1964	0	0	$68,316	$0	High Wind, Blowing Snow, Severe
1/15/1967	0	0	$6,341	$0	High Wind
9/19/1968	0	0	$2,478	$24,777	Heavy Snow, Wind
1/1/1969	0	0	$577	$0	Cold and Snow
1/26/1969	0	0	$6	$0	Lightning
3/3/1971	0	0	$994	$0	Wind, Snow
1/9/1972	0	0	$5,066	$0	Strong Winds
1/16/1972	0	0	$9,626	$0	Strong Winds
2/16/1972	0	0	$996	$0	High Wind
2/22/1972	0.18	0	$2,625	$0	High Wind
3/5/1972	0	0	$963	$0	High Winds
4/18/1973	0	0	$56,641	$0	Blizzard
1/29/1974	0	0	$4,372	$0	Wind
12/26/1974	0	0	$844	$0	High Winds
4/7/1975	0	0	$46,745	$0	Winter Storm (Severe Blizzard)
10/15/1980	0	0	$7,325	$0	Snow
9/18/1983	0	0	$6,379	$638	Severe Storm-Snow
3/2/1985	0	0	$4	$0	Heavy Snow
2/15/1988	0	0	$182	$0	High Winds
5/30/1988	0	0	$1,276	$0	Heavy Snow
9/17/1988	0	0	$51,020	$0	Severe Storm-Snow
12/13/1988	0	0	$1,276	$1,276	High Wind
1/15/1989	0	0	$12	$0	High Winds
1/31/1989	0	0	$29,500	$295	Blizzard
2/1/1989	0	0	$170,789	$171	Severe Cold
4/27/1989	0	0	$250	$0	Winter Storm
5/28/1989	0	0	$3,894	$0	Winter Storm
10/28/1989	0	0	$6,490	$0	Heavy Snow
11/9/1989	0	0	$122	$0	High Wind
11/26/1989	0	0	$46	$0	Heavy Snow
1/8/1990	0	0	$11,545	$0	High Wind

Table 4.4-8. Jefferson County Severe Winter Weather Events with Damages

Date	Injuries	Fatalities	Property Damage (2016 $)	Crop Damage (2016 $)	Remarks
1/10/1990	0	0	$924	$0	High Wind
3/12/1990	0	0	$201	$0	Winter Storm
4/27/1990	0	0	$2,886	$0	Winter Storm
11/9/1990	0	0	$924	$0	High Winds
11/22/1990	0	0	$24,962	$0	High Winds
11/29/1990	0	0	$6,157	$0	High Winds
12/18/1990	0	0	$115	$0	Heavy Snow
3/11/1991	0	0	$403	$0	Heavy Snow
1/23/1992	0	0	$3	$0	High Winds
8/22/1992	0	0	$374	$37,409	Winter Storm
8/25/1992	0	0	$0	$1,509	Frost/Freeze
2/18/1993	0	0	$1,044	$0	Heavy Snow
2/23/1994	0	0	$14,290	$0	Winter Storm
3/19/1994	0	0	$102	$0	Heavy Snow
3/23/1994	0	0	$54	$0	Heavy Snow
2/2/1999	0	0	$36,229	$0	High Wind
1/9/2000	0	0	$17,525	$0	High Wind
3/14/2000	0	0	$1,753	$0	High Wind
TOTAL	**0.53**	**0.04**	**$680,677**	**$66,933**	

Source: SHELDUS, 2016 (adjusted to 2016 dollars). Note: Often casualties and damage information are listed without sufficient spatial reference. In order to assign the damage amount to a specific county, the fatalities, injuries and dollar losses were divided by the number of counties affected from this event.

Snow generally does not cause the communities to shut down or disrupt activities. Occasionally though, extreme winter weather conditions can cause problems. The most common incident in these conditions are motor vehicle accidents due to poor road conditions. Such incidents normally involve passenger vehicles; however, an incident involving a commercial vehicle transporting hazardous materials or a vulnerable population such as a school bus is also possible. Road closures associated with mountain passes do occur and can create issues. During the winter of 2016, a large tree fell and killed a Clancy woman.

Sheltering of community members could 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.

The American Red Cross has a presence in Jefferson County and has the capacity to provide care for the duration of a severe weather event if need be through pre-determined sheltering agreements in accordance with national standards.

Windstorms and microbursts affect areas with significant tree stands, as well as areas with exposed property, major infrastructure, and aboveground utility lines. Severe hailstorms can also cause considerable damage to buildings and automobiles, but rarely result in loss of life. Nationally, hailstorms cause nearly $1 billion in property and crop damage annually, as peak activity coincides with peak agricultural seasons. **Table 4.4-9** presents severe summer weather events in Jefferson

County with reported damages since 1960. The SHELDUS and NCDC data suggest that that the last year for severe summer events with reported damages in Jefferson County was in 1999.

Table 4.4-9. Jefferson County Severe Summer Weather Events with Damages

Date	Injuries	Fatalities	Property Damage (2016 $)	Crop Damage (2016 $)	Remarks
5/10/1961	0	0	$1,682	$0	High Winds And Thunderstorms
5/30/1961	0	0	$859	$8,590	Thunder, Heavy Rain, Hail Storms
6/29/1961	0	0	$859	$8,590	Thunder, High Wind, Hail, Heavy
6/6/1964	0	1.2	$0	$0	Heavy Rain
7/2/1964	0	0	$0	$1,622	Hail, Thunderstorms
8/18/1964	0	0	$0	$1,622	Lightning
7/14/1967	0	0	$3,614	$36,142	Hail, Heavy Rain
7/19/1968	0	0	$1,196	$0	High Wind, Thunderstorms
6/27/1970	0	0	$66,195	$66,195	Strong Winds, Hail
6/30/1973	0.09	0	$247	$0	Lightning
9/12/1973	0	0	$17	$0	Wind Storm
7/26/1974	0	0	$816	$0	High Winds
6/30/1975	0.5	0	$112,188	$112	Thunderstorm, Hail
8/7/1975	0	0	$467	$4,675	Hail and Wind
5/21/1981	0	0	$885,325	$0	Heavy Rains
6/20/1985	0.02	0	$2,609	$2,609	Hail/Wind
10/16/1991	0	0	$180,877	$0	Wind
5/15/1994	0	0	$28,983	$0	Thunderstorm Winds
5/27/1994	0	0	$1,682	$0	Thunderstorm Winds
8/20/1994	0	0	$859	$8,590	Thunderstorm Winds
10/31/1999	0	0	$859	$8,590	High Wind
TOTAL			**$1,285,935**	**$130,158**	

Source: SHELDUS, 2016 (adjusted to 2016 dollars). Note: Often casualties and damage information are listed without sufficient spatial reference. In order to assign a damage amount to a specific county, fatalities, injuries and dollar losses were divided by the number of counties affected from the event.

Annual loss was computed for the severe summer and winter weather hazard in Jefferson County using SHELDUS data and the formula: Frequency x Magnitude x Exposure = Annual Loss, as further explained in *Section 4.1.6*. **Table 4.4-10** presents the results of the calculations.

Table 4.4-10. Jefferson County Severe Weather Annual Loss

No. of Events	Period of Record (Yrs)	Frequency	Damage	Magnitude	Exposure	Annual Loss
Severe Summer Weather						
49	58	0.845	$1,416,093	0.003544%	$815,524,185	$24,420
Severe Winter Weather						
91	16	5.688	$747,610	0.001007%	$815,524,185	$46,730

The National Drought Mitigation Center tracks indemnity payments for losses suffered due to drought on a county basis. **Table 4.4-11** presents drought damages for a 25 year period (1989 to 2014) for Jefferson County and the State of Montana.

Table 4.4-11. Drought Insurance Claims; Jefferson County 1989 - 2014

Year	Montana	Jefferson Co.	Year	Montana	Jefferson Co.	Year	Montana	Jefferson Co.
1989	$14,361,948	$80,963	1998	$18,201,060	$2,178	2007	$22,015,676	$0
1990	$29,146,575	$90,255	1999	$19,189,328	$67,128	2008	$74,979,811	$7,244
1991	$2,775,746	$105,106	2000	$44,989,149	$78,750	2009	$30,435,526	$12,545
1992	$37,767,835	$0	2001	$131,976,513	$55,965	2010	$5,289,266	$0
1993	$344,432	$0	2002	$108,139,519	$5,938	2011	$52,075,321	$0
1994	$5,539,598	$1,795	2003	$41,148,170	$30,369	2012	$10,055,101	$216,375
1995	$2,413,758	$8,831	2004	$29,427,194	$0	2011	$11,670,134	$283,683
1996	$10,637,521	$5,583	2005	$5,905,724	$5,756	2014	$5,289,266	$19,483
1997	$3,830,310	$0	2006	$41,483,327	$0	**TOTAL**	**$759,087,808**	**$1,077,947**

Source: National Drought Mitigation Center, 2016;
http://drought.unl.edu/Planning/Impacts/DroughtIndemnityData.aspx

The NOAA's Paleoclimatology Program has studied 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 1950's 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 1950's drought situation could be expected approximately once every 50 years or a 20 percent chance every 10 years. An extreme drought, worse than the 1930's "Dust Bowl" has an approximate probability of occurring once every 500 years or a 2 percent chance of occurring each decade (NOAA, 2004).

Severe weather occurs in Jefferson County multiple times each year. Therefore, the probability of a severe storm in either the winter or summer is rated as "highly likely". Based on historic conditions, the probability of future drought events in Jefferson County are ranked as "likely", occurring more than once every 10 years but not every year.

Future Development

The State of Montana has adopted the 2012 International Building Codes (IBC) which include a provision that buildings must be constructed to withstand a wind load of 75 mph constant velocity and three second gusts of 90 mph and must be designed to withstand a snow load of 30 pounds per square foot minimum. The IBC does not cover single-family residences.

The State of Montana has adopted the 2012 International Residential Code (IRC) for one and two family residences and townhouses. Local jurisdictions (cities, counties and towns) can elect to become certified to take on enforcement of single-family residences. Boulder and Whitehall are not certified to enforce building codes. Jefferson County does not have a building department and therefore, has no enforcement capabilities to ensure State building codes are followed.

Jefferson County subdivision regulations require utilities to new developments to be located underground and for adequate access to the subdivision and lots to be provided year-round.

Drought could have an effect on future development with regards to groundwater availability. New domestic water wells could use up more of the groundwater resource, particularly during periods of drought.

Climate Change

Climate change presents a challenge for risk management associated with severe weather and drought. The frequency of severe weather events has increased steadily over the last century. The number of weather-related disasters during the 1990s was four times that of the 1950s, and cost 14 times as much in economic losses. Historical data shows that the probability for severe weather events increases in a warmer climate.

With a warmer climate, droughts could become more frequent, more severe, and longer-lasting. According to the National Climate Assessment, "higher surface temperatures brought about by global warming increase the potential for drought. Evaporation and the higher rate at which plants lose moisture through their leaves both increase with temperature. Unless higher evapotranspiration rates are matched by increases in precipitation, environments will tend to dry, promoting drought conditions (Globalchange.gov, 2016).

Population exposure and vulnerability to severe weather and drought are likely to increase as a result of climate change. Severe weather events may occur more frequently which would lead to increased exposure and vulnerability. Although all people may be affected by the health-related impacts of climate change, the elderly, young children, and people with weakened immune systems are often the most susceptible. Indirect influences of climate change may create conditions that are more favorable to disease vectors. Some people without access to backup water supplies, may suffer water shortages during severe droughts. A greater number of people may need to engage in behavior change, such as water conservation.

Property exposure and vulnerability may increase as a result of increased severe weather and drought resulting from climate change. Increased structure damage from high winds and hail could result as well as damage to crops and landscaping. Secondary impacts, such as wildfire, may increase and threaten structures.

The effects of climate change can harm agricultural activities, both crops and livestock. The changes in temperature and precipitation brought on by climate change can make it harder to grow some crops. Intense rains can increase runoff and deprive plants of nutrient-rich topsoil and changes in temperatures may cause crops to mature earlier, which can expose them to harsh weather. Warmer temperatures can introduce new agricultural pests to the region or make conditions better for pests already present, including weeds and invasive plants that can crowd out crops. Maintaining agricultural activities on marginal lands may no longer be sustainable (FEMA, 2016).

Changes to the frequency, severity, and affected area of climate-related hazards may have economic consequences. Potential decreases in agricultural outputs may affect the economy in farming and ranching areas. Communities that rely on tourism may see a decrease in visitors due to severe weather, and areas that are popular sites for water recreation can be negatively affected by droughts. If these economic effects become widespread, the impacts could be felt at a statewide or regional level (FEMA, 2016).

Critical facility exposure and vulnerability would be unlikely to increase as a result of climate change impacts to the severe weather and drought; however, critical facility owners and operators may experience more frequent disruption to the services they provide. For example, extreme heat can decrease the effectiveness of electrical equipment, including power lines, which can lead to blackouts during very hot conditions. An increase in requests for medical assistance during a heat wave may challenge emergency response capabilities. In addition, critical facility operators may need to alter standard management practices and actively manage resources, particularly in water-related service sectors.

4.5 Flooding and Dam Failure

CPRI SCORES:
DAM FAILURE = 2.70
FLOODING = 2.55

Description and History

A flood is a natural event for rivers and streams. Excess water from snowmelt and rainfall accumulates and overflows onto the banks and adjacent floodplains. Floodplains are lowlands, adjacent to rivers and lakes that are subject to recurring floods. A flash flood generally results from a torrential (short duration) rain or cloudburst on a relatively small drainage area. Ice jam flooding occurs when pieces of floating ice carried by the streams current accumulate at an obstruction to the stream. The water held back can cause flooding upstream, and if the obstruction suddenly breaks, flash flooding can then occur downstream as well. Dam failure is also a possibility with areas in the dam's inundation area subject to flooding.

It is estimated that flooding causes 90 percent of all property losses from natural disasters in the United States and kill an average of 150 people a year nationwide. Most injuries and deaths occur when people are swept away by flood currents and most property damage results from inundation by sediment-laden water. Faster moving floodwater 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 to the structure and systems of a building.

Warming periods, which may be accompanied by rainfall, cause tributaries to swell rapidly. The resulting flood flows may be localized or basin-wide and may last from hours to several days depending on temperature, amount of rainfall, soil moisture content, and soil permeability.

The National Weather Service provides short-term forecasts and warnings of hazardous weather to the public by producing regularly-scheduled severe weather outlooks and updates on various forms of hazardous weather including heavy rain and flooding. A "watch" is issued when conditions are favorable for severe weather in or near the watch area. A "warning" is issued when the severe weather event is imminent or occurring in the warned area. Warning and Advisory Criteria for flooding is presented in **Table 4.5-1.**

Table 4.5-1. Warning and Advisory Criteria for Flooding

Flooding	Warning Description
Flash Flood Watch	Issued when conditions are favorable for flash flooding. It does not mean that flash flooding will occur, but it is possible
Flash Flood Warning	Flash flooding is imminent, water levels rise rapidly with inundation occurring in less than 6 hours.
Flood Watch	Issues when conditions are favorable for flooding. It does not mean flooding will occur, but it is possible.
Flood Warning	Flooding is expected to occur more than 6 hours after the causative event.

Source: National Weather Service, 2016

Flooding has historically been a challenge in Jefferson County with the Jefferson, Boulder and Little Boulder rivers and Prickly Pear, Basin, Cataract, Whitetail, and Big Pipestone creeks overflowing their banks in times of high water and ice jams. Presidential disasters due to flooding were declared in Jefferson County in 1975, 1981, 1996, 2011, and 2014, as listed in **Table 4.5-2**. Some of these events are described below.

Table 4.5-2. Federal Disaster Declarations for Flooding

Year	Event	FEMA Disaster	Details
1981	Flood	DR-640	Montana Severe Storms, Flooding
1996	Flood	DR-1105	Montana Storms, Flooding
2011	Flood	DR-1996	Severe Storms and Flooding
2014	Flood	DR-4172	Ice Jams and Flooding

May 1981 - The flood of 1981 caused much damage to the highway between Boulder and Basin, Cataract Road, Basin Creek Road and access to the roads along Prickly Pear Creek. Significant "rip-rap" work was done when the repairs were accomplished, and the area is now much better protected. However, a large snow pack and heavy spring rains could bring water out of the Elkhorn Mountains and cause flooding from Jefferson City north to East Helena, and then the Helena Valley along Prickly Pear Creek.

In the Whitehall area, the flood of May 1981 was caused almost entirely by rainfall with little or no contribution from snowmelt. The major rainstorm produced flood peaks of 100-year frequencies. While escaping major flooding, there was still enough flow to cause considerable concern and some flood damages on Big Pipestone Creek. There was enough runoff created to cause the emergency spillway to flow 2 or 3 feet deep at Delmoe Lake Dam. This runoff severely eroded the hillside below the dam where flows were returned to the channel from the spillway. The flow washed out a 6-foot by 8-foot arch culvert at the Smith Ranch crossing. Additional material was eroded out of the straightened section of the channel west of Whitehall. Buildings and houses above the county road upstream from Montana Highway 55 were flooded. In Whitehall, there was water under trailers, in some garages, and in yards along Big Pipestone Creek. In addition, two residences had basement flooding because of high water tables.

June 2011 - Creeks breeched their banks in the Basin area. A logjam caused flooding at a Cataract Creek bridge. More flooding was reported on Warm Springs Creek, north of Basin and private roads and driveways were covered with water. (Independent Record, *Flooding Reported Near Basin*, June 7, 2011). Road damage occurred in Boulder and a bridge on the south end of town was threatening to break free. Many homes, land, and the museum flooded along Big Pipestone Creek in Whitehall. The 2011 flood in Whitehall was determined to have been a 10-year event.

A culvert on Prickly Pear Creek washed out near Tizer Gardens and flooded fields on both sides of Tizer Road near Jefferson City. A large portion of Tizer Botanic Garden and Arboretum, was destroyed. A rare plant collection, paths, and displays all washed away. Volunteers filled hundreds of sandbags in an attempt to preserve bridges and buildings from the devastating power of the water. In 1981 similar high water happened in the area but not with the devastating effects like in 2011 (http://tizergardens.com/2011flood.html). Since the 2011 flood, rip-rap was installed and vegetation was planted to stabilize the site.

March 2014 – A flash flood in Jefferson County was a rain on snow event and part of a state-wide Federal flood disaster declaration. Further details on damage were not available.

Dams have been placed around Montana for many reasons including recreation, flood control, irrigation, water supply, hydroelectricity, and mining. Dams are built and owned by a variety of entities such as private individuals, utilities, and the government. Dams come in all shapes and sizes

from small earthen dams to large concrete structures. The structural integrity of a dam depends on its design, maintenance, and weather/drainage situation. Problems arise when a dam fails and people and/or property lie in its inundation area. Dams can fail for a variety of reasons including seismic activity, poor maintenance, overwhelming weather and flow conditions, or by an intentional act. 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. Other dams may be located in areas that result in little if any damages during a failure.

The U.S. Army Corps of Engineers, National Inventory of Dams (NID) website keeps a record of dams across the country. Montana DES also keeps an extensive library of Emergency Action Plans for the state's high hazard dams. Hazard ratings areen to those dams for emergency management planning purposes. These ratings, high, significant, and low, are based on the potential for loss of life and property damage from the failure of the dam, not the condition or probability of the dam failing, as described in **Table 4.5-3.**

Table 4.5-3. Hazard Ratings for Dams

Rating	Description
Low Hazard Potential	Dams assigned the low hazard potential classification are those where failure or misoperation 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 misoperation results in no probable loss of human life but can cause economic loss, environmental 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 misoperation will probably cause loss of human life.

Source: National Inventory of Dams, 2016

Jefferson County has six high hazard dams within the county and several high-hazard dams in adjoining counties with the potential to impact Jefferson County. **Table 4.5-4** presents details on these dams and **Figure 8** shows the location of the dams in Jefferson County.

Table 4.5-4. Dams in and Affecting Jefferson County

Dam Name	County	Nearest Town	Drainage	Height (feet)	Maximum Storage (acre-ft)	Purpose	Type	Owner
Delmoe Lake Dam	Jefferson	Whitehall	Big Pipestone Creek	60	9,900	Irrigation	Earth	Pipestone Water Users
Golden Sunlight #2 Tailings Dam	Jefferson	Whitehall	--	--	--	Tailings	Earth	Golden Sunlight
Montana Tunnels Tailings Dam	Jefferson	Jefferson City	--	--	--	Tailings	Earth	Montana Tunnels
Northern Pacific Reservoir Dam	Jefferson	East Helena	McClellan Creek	35	173	Water Supply	Gravity	Ash Grove Cement
Park Lake Dam	Jefferson	Clancy	Lump Gulch	21.6	423	Recreation	Earth	Montana FWP
Chessman Saddle Dam	Lewis & Clark	Helena	Buffalo Creek	27	1,870	Water Supply	Earth	City of Helena
Chessman Main Dam	Lewis & Clark	Helena	Beaver Creek	57	2,370	Water Supply	Earth	City of Helena

Table 4.5-4. Dams in and Affecting Jefferson County

Dam Name	County	Nearest Town	Drainage	Height (feet)	Maximum Storage (acre-ft)	Purpose	Type	Owner
Ruby Dam	Madison	Ruby	Ruby River	111	58,400	Irrigation	Earth	State of Montana
Willow Creek Dam	Madison	Willow Creek	Willow Creek	105	26,600	Irrigation	Earth	State of Montana
Clark Canyon Dam	Beaverhead	Grant	Beaverhead River	148	328,979	Irrigation, Recreation	Earth	U.S. BOR

Source: DNRC, 2016. Notes: "-" = Not Available.

Emergency Action Plans (EAPs) for several high hazard dams in Jefferson County have not been completed and may not be required due to their size and location on federal land. No inundation mapping has been completed for the Northern Pacific dams, so the extent of impacts from potential failure of this structure is not known.

There is no record of a dam failure in Jefferson County. During a flood event in June, 2011, a dike at the Northern Pacific Dam failed, as described below.

June 8, 2011 – A dam built by the Northern Pacific railroad decades ago contributed to a surge of water that raced down Prickly Pear Creek into East Helena. Years ago, Asarco built a causeway across the reservoir, slightly higher than the dam, so vehicles could access a quarry on the other side of the reservoir. The haul road had culverts beneath so water could flow through and fill the reservoir. The Northern Pacific dam had gates to release water which hadn't worked for years, so Ash Grove left them wide open. Water was still held back by the causeway, but flowed through the culverts. Heavy rains proved to be too much for the culverts, and water started flowing over the causeway. It washed out a portion of the road, which led to a flush of water downstream. (Independent Record, *Dam a Factor in Surge of Water in East Helena,* June 8, 2011). In 2012, the Northern Pacific Dam was cut down and it doesn't hold back much water anymore; however, it is still classified as a high-hazard dam.

Causeway above old Northern Pacific Dam. Photo courtesy of Independent Record. June 8, 2011

Vulnerability and Area of Impact

Some floodplains in the county are developed and have the potential for severe flooding. Most of these are in the Whitehall/Cardwell area. There are also two irrigation ditches that border the east and west side of the town of Whitehall that have caused flooding problems. In addition, structures in the Pipestone Creek drainage and along the Boulder River as it flows past Basin could be affected by flooding.

A Floodplain Management Study was completed for Big Pipestone Creek in 1984 (USDA, 1984). This report indicates that flooding has posed some minor, but increasing problems to those who live near

Big Pipestone Creek in the vicinity of Whitehall. Flooding potential has increased to some degree because of partial filling of the channel from upstream erosion.

The 1984 floodplain study indicates that a 100-year event on Big Pipestone Creek would cause serious erosional damage and some flood damage. Flood depths would be about one foot deeper than they were in the 1981 flood and flooding would extend farther north into the residential area of Whitehall, spreading into most of the first block, which borders the stream. All roads except Highway 55 and Highway 10 would be overtopped and could wash out. The 100-year flood is predicted to inundate a total of 580 acres in the Big Pipestone Creek area including about 11 acres of residential area in or near Whitehall. Approximately 51 residences and two businesses would be flooded.

The 1984 floodplain report states that the origin of the Big Pipestone Creek flooding can be tied to two severe channel changes, particularly in the upper part west of Whitehall, that have led to some dramatic consequences. The early-day construction of the Burlington Northern Railroad placed the railroad bed parallel to the Big Pipestone Creek channel from Whitehall upstream. This construction served to cut off part of the floodplain available for flood flows. The second channel change occurred about one-half mile below the Smith Ranch in the fall of 1947. This change was made to move the stream from the middle of a pasture out to the north edge of the pasture along the railroad to allow easier access. The stream was diverted directly down the south borrow ditch of the railroad and created a 1.3 mile straightened reach. These channel changes amounted to a 43 percent reduction in channel length which resulted in greatly increasing channel slope and flow velocities. The stream responded rapidly and started headcuts which have progressed upstream in the straightened channel reaches, eroding tremendous volumes of material by vertical deepening and lateral bank movement (USDA, 1984).

Jefferson County conducted a watershed assessment of the Jefferson Slough and main stem of Big Pipestone Creek (Great West Engineering, 2013). The goal of the assessment was to define specific, feasible projects that mitigate sedimentation and loss of habitat. Projects include the restoration of channelized reaches to former locations, the replacement of numerous culverts and irrigation diversions, riparian land use management, and beaver management planning.

The 2013 report describes the root causes for the flooding. Channelization and down-cutting upstream in Big Pipestone Creek has disconnected the channel from the floodplain and allows more water to move downstream within the stream. Excess sediment has, in places, raised the base of the stream. Irrigation diversions act as grade controls that further backup water. The railroad grade and possibly Kountz Road completely block the floodplain, so overbank water cannot pass downstream efficiently. In addition, levees have been constructed in inappropriate locations, which forces water into residential areas and severely limits access to the floodplain. The railroad bridge appears to have sufficient hydraulic capacity, but the channel near the bridge commonly becomes clogged with sediment. The reduction of sediment in the system would be helpful, but reconnecting the floodplain and removing barriers to flow are also integral solutions (Great West Engineering, 2013).

Three mitigation projects are currently being implemented in the Whitehall area to accommodate a 10-year flood: the Kountz Bridge replacement, Montana Rail Link is reducing the height of their siding, and, a diversion is being replaced on the Smith Ranch. Further details on these projects is presented in *Section 5.1*.

Dams with the highest risk to life and property, were they to breach, are rated as high hazard dams. Those areas directly downstream from high hazard dams would be the areas most at risk for loss of life and structural damage. **Figure 7** presents the inundation area associated with the high hazard dams in and affecting Jefferson County, with the exception of Northern Pacific, Montana Tunnels and Golden Sunlight tailings dams where inundation mapping has not been completed. It should be noted that much of the dam inundation affecting Jefferson County would flow down through the Jefferson Valley where the Clark Canyon and Ruby dams would inundate to. Jefferson County DES has Emergency Action Plans (EAPs) for most of the high hazard dams in and affecting the county and conducts regular exercises with the dam owner(s) and other emergency response personnel.

Floodplain and Floodway Management

A FEMA Flood Insurance Study of Whitetail Creek in the vicinity of Whitehall was completed in 2007 and Big Pipestone Creek was studied by the USDA Soil Conservation Service in 1984. No other floodplain studies exist for Jefferson County. Flood Insurance Rate maps (FIRMs) from 1986 are available but no flood mapping has been completed for the northern portion of the County. These maps have been digitized and were used in the PDM analysis. Light Detection and Ranging (LiDAR) data, developed for a Conditional Letter of Map Revision (CLOMAR), is available from Pipestone to Cardwell.

The National Flood Insurance Program (NFIP) encourages local governments to adopt "sound" floodplain management programs to reduce private and public property losses due to floods. Jefferson County, Boulder and Whitehall participate in the NFIP. **Table 4.5-5** presents statistics on flood insurance policies and losses.

Table 4.5-5. National Flood Insurance Program Statistics (through 8/31/2016)

Jurisdictions	Policies in Force	Insurance in Force	Number of Losses	Total Payments
Jefferson County	21	$ 3,980,000	4	$4,997
City of Boulder	2	$215,000	0	$0
Town of Whitehall	10	$ 1,693,100	2	$3,375

Source: FEMA, 2016. http://bsa.nfipstat.fema.gov/reports/1011.htm#MTT; http://bsa.nfipstat.fema.gov/reports/1040.htm#30

Jefferson County has a Floodplain and Floodway Management Ordinance to comply with the Montana Floodplain and Floodway Management Act and to ensure compliance with requirements for continued participation in the NFIP. The floodplain ordinance identifies land use regulations to be applied to all identified 100-year floodplains within local jurisdictions. Most construction within the 100-year floodplain or floodway requires a permit obtained through the office of the Floodplain Program Administrator.

According to Montana DNRC, there are no repetitive loss properties in Jefferson County. A repetitive loss property is any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978. There are no severe repetitive loss properties in Jefferson County. Severe repetitive loss properties have had at least four NFIP claim payments over $5,000 each and the cumulative amount exceeding $20,000; or, where at least two separate claim payments have been made with the cumulative amount exceeding the market value of the building.

The NFIP's Community Rating System (CRS) recognizes community efforts (beyond minimum standards) by reducing flood insurance premiums for the community's property owners. CRS discounts on flood insurance premiums range from 5 percent up to 45 percent. Those discounts provide an incentive for new flood protection activities that can help save lives and property in the event of a flood. To participate in the CRS, a community can choose to undertake some of the 18 public information and floodplain management activities. Based on the total number of points a community earns, the CRS assigns you to one of ten classes. The discount on flood insurance premiums is based on your CRS class. Jefferson County does not participate in the CRS.

Probability and Magnitude

Flood listings with associated property damage from the SHELDUS database is presented in **Table 4.5-6**. Damage data from the Presidential disaster declarations is not available.

Table 4.5-6. Jefferson County Flood Events with Damages

Date	Injuries	Fatalities	Property Damage	Crop Damage	Remarks
3/17/1969	0	0	$5,771	$0	Flooding
1975	-	-	NA	NA	Presidential Disaster
5/1981	-	-	NA	NA	Presidential Disaster
2/24/1986	0	0	$44,056	$0	Flood
3/10/1989	0	0	$8,113	$0	Flooding
7/26/1989	0	0	$10,817	$108	Flooding
1996	-	-	NA	NA	Presidential Disaster
7/2/1998	0	0	$148,115	$0	Flash Flood
6/2011	0	0	NA	NA	Presidential Disaster
3/2014	0	0	NA	NA	Presidential Disaster
TOTAL	**0**	**0**	**$216,872**	**$108**	

Source: SHELDUS, 2016 (adjusted to 2016 dollars). Notes: NA = Not Available.

Figures 7 and 7A present the flood-prone areas within Jefferson County and Whitehall, respectively. These maps were developed from FIRMs digitized for the Whitehall area. Since there is no flood mapping in the northern part of the county, results of a FEMA run HAZUS flood model was used to depict the flood hazard area for the PDM vulnerability analysis (FEMA, 2011). The HAZUS model approximated 100-year flood using the National Elevation Dataset, a flood frequency discharge table that references a specific discharge per return period for a given point (stream gage derived), and regression equations between stream gage areas. Using GIS, the flood hazard area was intersected with the critical facility database and NRIS structures shapefile which was linked to the MDOR cadastral database for building values (**Table 4.5-7**). Vulnerable population was calculated using the NRIS structures shapefile and estimates by the U.S. Census that 2.35 individuals reside in each structure, 22.5 percent of whom are under age 18.

Table 4.5-7. Jefferson County Vulnerability Analysis; Flooding (100-Year Floodplain)

Category	Jefferson County (balance)	Boulder (City)	Whitehall (Town)
Residential Property Exposure $	$8,997,763	$4,514,480	$2,187,926
# Residences At Risk	135	68	42
Commercial, Industrial & Agricultural Property Exposure $	$348,240	$358,854	$229,240
# Commercial, Industrial & Agricultural Properties At Risk	14	7	2
Critical Facilities Exposure Risk $	$1,930,306	$77,880,882	$369,770

Table 4.5-7. Jefferson County Vulnerability Analysis; Flooding (100-Year Floodplain)

Category	Jefferson County (balance)	Boulder (City)	Whitehall (Town)
# Critical Facilities At Risk	5	3	2
Bridge Exposure $	$23,593,634	0	$994,686
# Bridges At Risk	54	0	2
Persons At Risk	245	124	77
Persons Under 18 At Risk	72	36	22

The GIS analysis indicates that about 19,376 acres in Jefferson County (1.8 percent) are located within the 100-year flood hazard area including parcels with: 245 residences, 23 commercial, industrial and agricultural buildings, and 10 critical facilities. The *Flood* section in **Appendix C** presents supporting documentation from the risk assessment including the critical facilities and bridges located in the 100-year flood hazard area.

The dam inundation hazard layer is shown in **Figure 8**. The dam failure hazard map was developed by compiling electronic and digitized hard copy inundation maps included in EAPs, as available. The dam failure hazard area was intersected with the critical facility and MDOR parcel datasets using GIS (**Table 4.5-8**). Vulnerable population was calculated based on the percentage of the dam inundation area in each census block.

Table 4.5-8. Jefferson County Vulnerability Analysis; Dam Failure

Category	Jefferson County (balance)	Boulder (City)	Whitehall (Town)
Residential Property Exposure $	$56,842,529	$0	$24,011,824
# Residences At Risk	396	0	304
Commercial, Industrial & Agricultural Property Exposure $	$15,323,324	$0	$9,700,044
# Commercial, Industrial & Agricultural Properties At Risk	39	0	58
Critical Facilities Exposure Risk $	$3,071,328	$0	$7,508,256
# Critical Facilities At Risk	7	0	21
Bridge Exposure $	$10,882,921	0	$994,686
# Bridges At Risk	26	0	2
Persons At Risk	2,812	0	1,169
Persons Under 18 At Risk	625	0	270

The GIS analysis indicates that 26,399 acres in Jefferson County (2.5 percent) are located in the dam inundation hazard area including 700 residences, 97 commercial, industrial and agricultural buildings, and 28 critical facilities. This analysis has similar limitations as those described for flooding. The *Dam Failure* section in **Appendix C** presents supporting documentation from the risk assessment including the critical facilities and bridges located in the dam inundation hazard area.

Based on the frequency of past events, the probability of flooding in Jefferson County is rated as "likely"; an event that occurs more than once per decade but not every year. A dam failure event may allow for some advanced warning to the public, and therefore, the potential impact to the population is considered moderate. The probability of a high hazard dam breach in Jefferson County was ranked as "possible" by the PDM Planning Team.

Future Development

Jefferson County subdivision regulations indicate that land located in the floodway of a 100-year flood, or deemed subject to flooding, shall not be subdivided for building or residential purposes that may increase or aggravate flood hazards to life, health or property. If any portion of a proposed subdivision is within 2,000 horizontal feet and 20 vertical feet of a stream draining an area of 25 square miles or more, and no official floodway delineation or floodway studies have been made, the subdivider must furnish survey data to the Montana DNRC who will delineate the floodway. In Jefferson County, permits are required for all proposed structures, placement of manufactured homes, and other development within mapped floodplain areas.

The history of flooding on the Jefferson River around Whitehall has shown that severe limitations exist that must be addressed before development plans can be implemented. The flood-affected area includes areas on Big Pipestone Creek and Whitetail Creek on the fringes of Whitehall as well as most of the area along the Jefferson River south and east of the town. Future land use planning in the floodplain area should follow the recommendations of a Floodplain Management Plan by controlling the location of structures in the floodplain and working to maintain enforceable regulations that deal effectively with the specific problems of the Whitehall area (Whitehall Growth Policy, 2009).

The Whitehall zoning ordinance provides drainage standards for residential, commercial, and industrial developments indicating that sites should be graded and appropriate culverts or other drainage facilities be provided to remove surface run-off in a manner that will not adversely affect adjacent properties or public roads. Whitehall subdivision guidelines require that all mobile/trailer home lots contain appropriate culverts or other drainage facilities to provide for adequate surface runoff.

The Boulder zoning ordinance states that no building or structure may be built or located in a flood hazard area. Any construction or location of buildings within the 100-year floodplain must conform to the city or county floodplain management regulations.

Neither Jefferson County, Boulder, nor Whitehall have zoning or subdivisions regulations that prevent new construction in dam inundation areas.

Climate Change

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Going forward, model calibration or statistical relation development must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted.

The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain areas to contribute to peak storm runoff. High frequency flood events (e.g. 10-year floods) in particular will likely increase with a changing climate. Along with reductions in the amount of the

snowpack and accelerated snowmelt, scientists project greater storm intensity, resulting in more direct runoff and flooding. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

As hydrology changes, what is currently considered a 1-percent-annual-chance (100-year flood) may strike more often, leaving many communities at greater risk. Planners will need to factor a new level of safety into the design, operation, and regulation of flood protection facilities such as dams, bypass channels and levees, as well as the design of local sewers and storm drains.

Small changes in rainfall, runoff, and snowpack conditions may have significant impacts for water resource systems, including dams. Dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hygrograph changes, it is conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard. If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream.

Dams are constructed with safety features known as "spillways." Spillways are put in place on dams as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events, often referred to as "design failures," result in increased discharges downstream and increased flooding potential. Although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures.

Population, property, and critical facility exposure and vulnerability may increase as a result of climate change impacts to the flood hazard. Runoff patterns may change resulting in flooding in areas where it has not previously occurred with an increased risk to facilities that have not historically flooded. Additionally, changes in the management and design of flood protection critical facilities may be needed as additional stress is placed on these systems.

Population and property exposure and vulnerability to the dam failure hazard is unlikely to change as a result of climate change. The exposure and vulnerability of critical facilities are unlikely to change as result of climate change. Dam owners and operators may need to alter maintenance and operations to account for changes in the hydrograph and increased sedimentation.

Figure 7 – Flooding – County

Figure 7A – Flooding – Whitehall

Figure 8 – Dam Inundation County

4.6 Transportation Accidents

CPRI SCORE = 3.1

Description and History

The source and location of transportation accidents vary but the response is typically the same. Response is focused on determining the presence of hazardous materials and then assisting the injured. This Transportation Accident hazard profile covers highway accidents, railroad accidents, and aircraft accidents. *Section 4.3* presents the hazard profile for Hazardous Material Incidents.

Jefferson County has two interstation highways; Interstate-90 (I-90) which runs east-west through Whitehall in the southern portion of the county, and Interstate-15 (I-15) which runs north-south through the central portion of the county. I-90 is the east–west transcontinental interstate, which links Seattle, WA to Boston, MA. The portion in Montana is 554.10 miles long, linking 14 counties through central and southern Montana. I-90 enters Jefferson County on the west, passing over the Continental Divide at Homestake Pass (6,375-foot high) and leaves the county east of Cardwell.

I-15 is a major interstate highway in the western United States that begins near the Mexico–US border in California and stretches north to Alberta, Canada. I-15 passes through Montana for 396 miles and enters Jefferson County at the 6,368-foot high Elk Park Pass. I-15 passes through forest and plains before winding along Bison Creek and the Boulder River and passing through the town of Basin before leaving the mountains and providing access to Boulder. Paralleling Prickly Pear Creek, I-15 winds through the hills before passing through Jefferson City, Clancy, Montana City, and into Helena.

Jefferson County has several Montana Highways including Highway 69 from Boulder south to Whitehall, Highway 55 from Whitehall south along the Jefferson River into Madison County, and Highway 2 from Silver Bow County over Pipestone Pass through Whitehall, Cardwell, the Jefferson River Canyon and into Gallatin County. There are also several secondary highways that provide access through Jefferson County.

Vehicular accidents occur for a number of reasons including distracted drivers, driver fatigue, drunk driving, speeding, aggressive driving, and weather. In Montana vehicle collisions with wildlife are a common occurrence. Statistics on highway accidents in Jefferson County over the past 10 years are presented in **Table 4.6-1**. There is no history of a mass casualty accident in Jefferson County involving a school bus or tour bus; however, school events use bus transport during winter months when severe weather can pose an extreme risk.

Table 4.6-1. Jefferson County Vehicular Crash Data; 2006 - 2015

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	TOTAL
All Crashes											
Fatal Crash	3	7	5	8	6	7	6	3	4	3	**52**
Serious Injury Crash	27	21	22	16	29	22	28	20	20	25	**230**
Total # of Crashes	**392**	**311**	**364**	**311**	**337**	**356**	**324**	**350**	**395**	**371**	**3,511**
Nighttime Crashes											
Fatal Crash	1	4	1	3	2	0	2	1	2	2	**18**
Serious Injury Crash	7	7	4	6	9	6	8	9	5	5	**66**
Total # of Crashes	**157**	**126**	**137**	**114**	**138**	**141**	**131**	**162**	**156**	**152**	**1,414**
Rural Roadway Crashes											
Fatal Crash	3	7	5	8	6	7	6	3	4	3	**52**
Serious Injury Crash	27	21	22	16	29	22	28	20	20	23	**228**

Table 4.6-1. Jefferson County Vehicular Crash Data; 2006 - 2015

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	TOTAL
Total # of Crashes	**392**	**304**	**362**	**309**	**337**	**350**	**324**	**350**	**378**	**360**	**3,466**
Winter Crashes											
Fatal Crash	1	2	0	3	0	0	1	2	0	0	**9**
Serious Injury Crash	10	5	7	3	10	3	3	4	2	8	**55**
Total # of Crashes	**161**	**142**	**176**	**103**	**142**	**144**	**123**	**149**	**201**	**163**	**1,504**
Wild Animal Involved Crashes											
Fatal Crash	0	0	0	0	0	0	0	0	0	-	**0**
Serious Injury Crash	2	2	1	0	1	0	4	1	1	-	**12**
Total # of Crashes	**88**	**58**	**69**	**88**	**70**	**80**	**85**	**108**	**88**	**-**	**7,34**

Source: MDT, 2016 (http://www.mdt.mt.gov/publications/datastats/crashdata.shtml); Notes "-" = Data Not Available

A short segment of railroad passes through the north portion of Jefferson County, while the Burlington Northern-Santa Fe and Montana Rail Link mainlines pass through the southern portion of the county. **Table 4.6-2** lists railroad accidents in Jefferson County with details on which of those involved hazardous materials.

Table 4.6-2. Jefferson County Railroad Accidents; 1990 – 2016

Date	Nearest Town	Injuries	Fatalities	Cars Carrying Haz-Mat	Haz-Mat Cars Damaged	Comments
7/10/1976	Whitehall	0	0	0	--	BN – 7 cars derailed
10/20/1976	Cedric	0	0	0	--	Milwaukee – 1 car derailed
2/14/1977	Cedric	0	0	0	--	Milwaukee – 1 car derailed
3/10/1977	Cedric	0	0	0	--	Milwaukee – 1 car derailed
7/13/1977	Cedric	0	0	0	--	Milwaukee – 1 car derailed
3/23/1978	Piedmont	0	0	0	--	Milwaukee collision. 6 cars derailed.
10/19/1984	Whitehall	0	0	0	--	BN – 3 cars derailed
8/25/2004	Whitehall	0	0	0	--	MRL train ran thru culvert that had been washed out
4/26/2011	Whitehall	0	0	0	--	MRL – 1 locomotive and 2 cars derailed.

Source: Federal Railroad Administration, 2016
http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/incabbr.aspx

Table 4.6-3 presents accidents at railroad crossings in the county. According to the National Transportation Safety Board (NTSB), 60 percent of all railroad accidents occur at unprotected or passive crossings.

Table 4.6-3. Jefferson County Accidents at Railroad Crossings: 1990 – 2016

Date	Nearest Town	Road	Road Type	Fatalities	Injuries	Crossing Protection
9/10/1990	Montana City	Highway 518	Public	0	0	Flashing Lights
1/30/1991	Cardwell	Highway 289	Public	0	0	Gates
1/19/1993	Whitehall	Mayflower Road	Public	1	0	Cross Bucks
10/19/1993	Waterloo	Private	Private	0	0	None
2/5/2004	Montana City	Ashgrove Entrance	Private	0	0	None
TOTAL				**1**	**0**	

Source: Federal Railroad Administration, 2016;
http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/gxrabbr.aspx

Aviation accidents can occur for a multitude of reasons from mechanical failure to poor weather conditions to pilot error. They are often fatal to the occupants. Jefferson County is served by the Bert Mooney Airport in Butte-Silver Bow County and the Helena Regional Airport in Lewis & Clark County. Boulder and Whitehall both have small airports.

The mountainous terrain of Jefferson County makes the area particularly hazardous for aircraft. Varying weather conditions and sharp changes in elevation do not allow pilots much flexibility during takeoffs and landings. Federal Aviation Administration (FAA) database listings for aircraft accidents in Jefferson County are presented in **Table 4.6-4.**

Table 4.6-4. Jefferson County Aircraft Accidents

Date	Location	Fatalities	Aircraft Type
4/10/1999	Boulder	0	Piper PA-18
5/23/2008	Boulder	1	Maule MX-7-235
2/4/2009	Whitehall	0	Ercouple 415D
7/9/2010	Whitehall	0	Ercoupe 415
TOTAL		**1**	

Source: FAA, 2016; http://www.faa.gov/data_research/accident_incident/

There have been no Federal disaster or State emergency declarations associated with the Transportation Accident hazard in Jefferson County and the likelihood of an event resulting in a disaster declaration is considered low.

Vulnerability and Area of Impact

Privately-owned vehicles provide transportation for individuals in Jefferson County using the federal interstate and state highway systems as well as county and private roads. Trucks and trailers carry interstate and intrastate cargo. Highway accidents caused by severe weather and high speeds occur frequently. Railroad related hazards such as derailments, toxic spill contamination, and vehicle collisions are a threat to Jefferson County residents. According to the NTSB, more than 80 percent of public railroad crossings do not have lights and gates, and 60 percent of all railroad accidents occur at these unprotected crossings.

The PDM analysis performed for Hazardous Material Incident hazard buffered the highways and railroads in Jefferson County by 0.25 mile and using GIS intersected this layer with the MDOR parcel database and census data to determine the number of building stock and population vulnerable to this hazard. This analysis is also appropriate for the Transportation Accident hazard. See *Section 4.3* for the results of this analysis.

Probability and Magnitude

Jefferson County is vulnerable to all types of transportation emergencies. The magnitude of a transportation accident event would be determined by many factors including the location of impact and number of passengers. Little, if any, warning exists for transportation accidents. The greatest magnitude event would be one where mass fatalities result. A mass casualty incident involving a school bus is also a possibility and a concern since rural locations have limited resources making response time slow which could delay treatment of the injured.

In the past 10 years, there have been 3,511motor vehicle accidents that resulted in 52 fatalities and 230 serious injuries in Jefferson County. Therefore, the probability of future highway accidents is rated as "highly likely".

Future Development

Jefferson County has no land use regulations that restrict building around industrial facilities or along transportation routes.

Climate Change

Climate change is not anticipated to directly impact the transportation accident hazard. Secondary impacts to public health may result due to increased smoke from wildfire activity which may increase highway accidents.

4.7 Earthquake

CPRI SCORE = 2.4

Description and History

An earthquake is ground shaking and radiated seismic energy caused most commonly by a sudden slip on a fault, volcanic or magmatic activity, or other sudden stress changes in the earth. An earthquake of magnitude 8 or larger on the Richter Scale is termed a great earthquake. Montana has not experienced a great earthquake in recorded history. A major earthquake (magnitude 7.0-7.9) occurred near Hebgen Lake (Gallatin County) in 1959 and dozens of active faults have generated magnitude 6.5-7.5 earthquakes during recent geologic time.

The earthquake hazard is defined as any physical phenomenon associated with an earthquake that may produce adverse effects on human activities. This includes surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, tsunami, and seiche and their effects on land use, manmade structures, and socioeconomic systems. Populations have little or no warning prior to an earthquake, so the impact to that population could be considered high with little time to take protective actions.

Earthquakes are measured by two variables, magnitude and intensity. The magnitude of an earthquake, as measured on the Richter scale, reflects the energy release of an earthquake. The intensity of an earthquake is gauged by the perceptions and reactions of observers as well as the types and amount of damage. The intensity of an earthquake is rated by the Modified Mercalli Scale. This scale ranks the intensity from I to XII. An earthquake rated as a I, would not be felt except by very few people under especially favorable circumstances. An intensity rating of XII on the other hand would result in total destruction. Damage is predicted to be slight in buildings designed especially for the seismic zone. Buildings not constructed to meet the standards for the seismic zone would experience considerable damage with partial collapse.

Montana ranks fifth in the nation in terms of number of historic earthquakes greater than magnitude 6. A map from the Montana Bureau of Mines and Geology (MBMG) website shows the location and magnitude of earthquakes in Montana. Jefferson County lies within what is called the Intermountain Seismic Belt. This belt of seismicity extends from western Montana south to southern Nevada. Earthquake density within the Intermountain Seismic Belt is anomalous within North America, and eight of the 16 largest historic earthquakes in the belt occurred in Montana (Stickney, 2007).

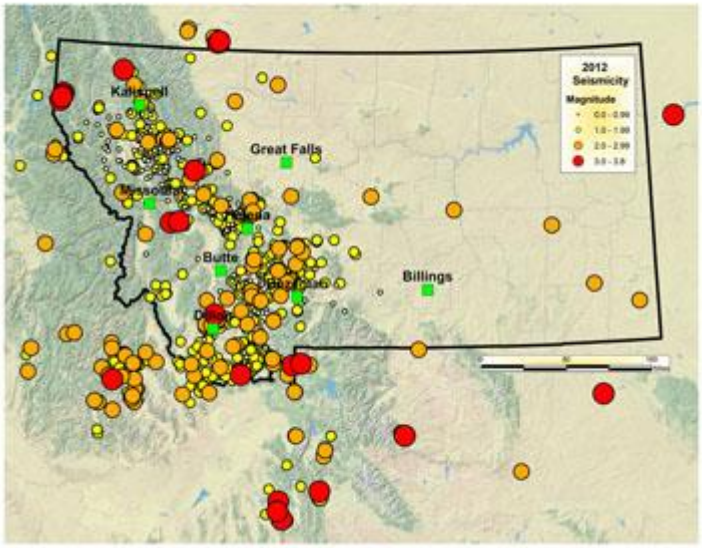


Table 4.7-1 presents the historic earthquakes which have occurred in Montana and surrounding region since 1900 with a magnitude of 5.5 or greater. Although one significant earthquake occurred in eastern Montana in 1909, the majority have occurred along the Intermountain Seismic Belt and Centennial Tectonic Belt in western Montana.

Table 4.7-1. Historic Earthquakes of Montana and Surrounding Regions with Magnitudes of 5.5 or Greater Since 1900

Date	Magnitude	Approximate Location	Date	Magnitude	Approximate Location
05/16/1909	5.5	Northeast Montana	08/18/1959	6.0	Hebgen Lake
06/28/1925	6.6	Clarkston Valley, MT	08/18/1959	5.6	Hebgen Lake
02/16/1929	5.6	Clarkston Valley, MT	08/18/1959	6.3	Hebgen Lake
10/12/1935	5.9	Helena	08/19/1959	6.0	Hebgen Lake
10/19/1935	6.3	Helena	10/21/1964	5.6	Hebgen Lake
10/31/1935	6.0	Helena	06/30/1975	5.9	Yellowstone Park
07/12/1944	6.1	Central Idaho	12/08/1976	5.5	Yellowstone Park
02/14/1945	6.0	Central Idaho	10/28/1983	7.3	Challis, ID
09/23/1945	5.5	Flathead Valley	10/29/1983	5.5	Challis, ID
11/23/1947	6.1	Virginia City	10/29/1983	5.5	Challis, ID
04/01/1952	5.7	Swan Range	08/22/1984	5.6	Challis, ID
08/18/1959	7.5	Hebgen Lake	07/26/2005	5.6	Beaverhead County
08/18/1959	6.5	Hebgen Lake			

Source: Stickney and others, 2000

Three of the largest recorded earthquakes in Montana had epicenters within 125 miles of Jefferson County; the 7.5 and 6.5 magnitude Hebgen Lake earthquakes in Gallatin County; the 6.3, 6.0 and 5.9 magnitude Helena earthquakes; and, the 6.6 and 5.6 magnitude Clarkston Valley earthquakes in 1925 north of Three Forks. Damage reports for Jefferson County from these earthquakes are not documented. No Federal disasters or State emergencies have been declared in Jefferson County associated with an earthquake. Accounts of the Clarkston Valley and Helena earthquakes are summarized below.

July 1, 1925 - Damage done to the Chicago, Milwaukee & St. Paul railroad by the Clarkston Valley earthquake shocks took several weeks to repair with a loss estimated as high as a million dollars. Between six and seven hundred men, recruited from the Butte mines worked day and night shifts clearing away the huge boulders and stones that covered the right-of-way in Sixteen Mile canyon (between Maudlow and Lombard) which destroyed the railroad tunnel. The damage included collapse of the rocky cliff, through a part of which the tunnel was built, and covering the right-of-way with the debris for a considerable distance. The fallen rocks and earth formed a dam in Sixteen Mile creek and backed the water up to the mouth of the tunnel, forming a miniature lake, between 40 and 50 feet deep. (Missoulian, *Milwaukee Slides Will Cost Railway Million to Remove, Company Recruits Laborers Wherever Available; Lake Formed by Damming Creek Retards Work*, July 1, 1925)

October, 1935 – Starting with a small tremor on October 3, the City of Helena suffered through a devastating series of several hundred earthquake shocks in the month of October, 1935, including one major earthquake with multiple aftershocks with magnitudes of 5.9, 6.3, and 6.0 on October 12th, 18th, and 31st. Although no surface ruptures occurred during this earthquake sequence, shaking

from the earthquakes damaged more than half of Helena's buildings. The epicenters of the 1935 earthquake series is not precisely known, but were probably located about 3.7 to 14 miles north of the city, possibly along the Prickly Pear fault zone (Qamar and Stickney, 1983) and the Helena Valley fault (Doser, 1989). Damage in Helena included collapsed chimneys, fallen parapets, gables, and end walls, shattered walls parallel to interior framing, with partial or total collapse of structures. Most buildings with unreinforced masonry-bearing walls were severely damaged by the earthquake and month long barrage of aftershocks. The worst wreckage occurred in structures on the softer alluvial soil toward the valley, notably the new high school and Bryant Elementary School. Four people were killed and property damage exceeded $4 million ($60.7 million in adjusted dollars) (NISEE, 1998).

Vulnerability and Area of Impact

Many of Jefferson County's critical facilities have not been seismically assessed. The loss figures in **Table 4.7-2** below, suggest that much damage could result from a seismic event. Many of the existing homes, businesses, and critical facilities may not be structured to withstand seismic shaking.

Numerous active fault lines have been identified throughout Jefferson County. Other faults may exist but their locations are speculative at this time. Most earthquakes in Montana cannot be correlated to specific faults visible at the surface, except for those with magnitudes over 7.0. Small to moderate magnitude earthquakes occur at depths of three to 10 miles below the surface on small, discontinuous faults. Since the PDM Plan was completed in 2011, there have only been minor earthquakes (less than magnitude 3.0) that have occurred in Jefferson County with epicenters in the northern portion of the county.

Probability and Hazard Magnitude

Earthquake damages can be hard to predict and assess without detailed structure information or a damage model. The FEMA Hazards of the United States (HAZUS) earthquake loss estimation methodology was used in the 2011 PDM Plan to model the effect an earthquake would have on Jefferson County critical facilities. HAZUS is a software program that uses mathematical formulas and information about building stock, local geology and the location and size of potential earthquakes, economic data, and other information to estimate losses from a potential earthquake.

The model earthquake used for analysis was a magnitude 6.3, shallow, crustal, extensional earthquake that occurred on October 19, 1935 in the Helena area. This earthquake scenario was selected based on consultation with Mike Stickney with the MBMG during development of the 2011 PDM Plan. A "Level Two" HAZUS analysis was conducted that required input of specific information about building characteristics. Results of the Level 2 critical facility analysis showing buildings which would sustain over $1 million in damage and those which would sustain greater than 40 percent damage are summarized in **Table 4.7-2**.

Table 4.7-2. Highest Dollar Loss Buildings (Over $1 Million) – Jefferson County Critical Facility Analysis

Facility	Location	Economic Loss	% Loss
Montana City School	Montana City	$387,854	5.42%
Clancy Grade School	Clancy	$350,701	4.71%
Riverside Corrections	Boulder	$221,271	0.28%
Jefferson High School	Boulder	$185,441	1.48%
Jefferson County Courthouse	Boulder	$119,949	2.64%
MT Department of Transportation	Boulder	$110,704	0.27%
Montana Developmental Center	Boulder	$88,918	0.28%
Jefferson County Sheriff/DES	Boulder	$88,858	2.29%
Youth Dynamics	Boulder	$43,255	0.94%
Montana City Fire Dept Station 2	Montana City	$19,129	5.03%
Whitehall Middle School	Whitehall	$14,820	0.25%
Courthouse Annex	Boulder	$11,738	1.17%

Source: HAZUS in Tetra Tech, 2011; Earthquake Scenario: 6.3 Magnitude Earthquake that occurred in Helena, October 18, 1935

FEMA completed a regional HAZUS evaluation in 2014 which included Jefferson County in addition to nine other counties in Montana. The scenario used was a magnitude 6.7 shallow crustal earthquake on the Canyon Ferry fault. Results are not presented by county; instead, regional data was aggregated. HAZUS estimates there are 126 thousand buildings in the region, of which 79 percent are wood frame construction. Under this earthquake scenario, 2 percent of the buildings in the region would be damaged. The model estimates that a total of 50,000 tons of debris would be generated; brick/wood comprised 41 percent of the total, with the remainder being reinforced concrete/steel. If the earthquake was to occur at 2 pm it is estimated there would be one fatality and six individuals would need hospitalization with non-life threatening injuries. Total building-related losses for the region would be $222 million (FEMA, 2014).

The U.S. Geological Survey (USGS) National Seismic Hazard Mapping Project has created peak ground acceleration (PGA) maps that show the strength of seismic shaking with a 10 percent probability of being exceeded in a 50 year period. The strength of the shaking is measured as a percent of the acceleration of gravity (%g). **Figure 9** shows PGA shake maps for Jefferson County which indicate the intensity of shaking from a seismic event increases from northwest to southeast across the county. Most of the populated portions of Jefferson County 19-20%g shake zone while area around Cardwell could be exposed to 21-30%g shaking.

According to Qamar (2008), at 9.2%g the earthquake is felt by all with many frightened. Some heavy furniture is moved with a few instances of fallen plaster. Damage is considered slight. At 18%g, damage is negligible in buildings of good design and construction, slight to moderate in well-built ordinary structures, and considerable in poorly-built or badly designed structures. Some chimneys may be broken, and the shaking is noticed by people driving cars. At 34%g, damage is slight in specially designed structures, considerable in ordinary substantial buildings with partial collapse, and great in poorly built structures. Chimneys and walls may fall and heavy furniture is overturned.

To complete the earthquake vulnerability analysis for the 2017 PDM Plan, GIS was used to intersect the USGS PGA maps with both the critical facility and MDOR cadastral parcel datasets. Estimates of

vulnerable population were calculated by determining the percent exposure in each census block for the hazard area. Exposure values are presented in **Table 4.7-3**.

Table 4.7-3. Jefferson County Vulnerability Analysis; Earthquake (21-30%g)

Category	Jefferson County (balance)	Boulder (City)	Whitehall (Town)
Residential Property Exposure $	$22,311,876	$0	$0
# Residences At Risk	160	0	0
Commercial, Industrial & Agricultural Property Exposure $	$1,439,888	$0	$0
# Commercial, Industrial & Agricultural Properties At Risk	24	0	0
Critical Facilities Exposure Risk $	$1,246,293	$0	$0
# Critical Facilities At Risk	2	0	0
Bridge Exposure $	$10,231,140	$0	$0
# Bridges At Risk	24	0	0
Persons At Risk	788	0	0
Persons Under 18 At Risk	177	0	0

GIS analysis of the earthquake risk to Jefferson County indicates that 142,592 acres (13.4 percent) are located within the PGA shaking zone over 21-30% g. According to the vulnerability analysis, 160 residences, 24 commercial, industrial and agricultural buildings 2 critical facilities are located in the 21-30% g PGA shake zone. The *Earthquake Section* in **Appendix C** presents supporting documentation from the risk assessment including a list of critical facilities and bridges in the various seismic zones.

The MBMG searched their catalog for earthquakes within and immediately surrounding Jefferson County in an attempt to calculate the return interval for earthquakes in the area. The catalog period reviewed covered January 1, 1982 through February 14, 2011 (approximately 29 years) and revealed 4,657 earthquakes ranging in magnitude from 0.0 to 4.85. The analysis suggests that an earthquake of magnitude 5.0 might occur within or near Jefferson County once in an 80-year period, and that a magnitude 6.0 earthquake might occur once in a 974-year period. These results represent minimum return times given the greater levels of historic seismicity (Stickney, personal communication, 2010).

Hazard probability was assessed based on hazard frequency over a 10 year period. Since the earthquake hazard does not occur with an intensity to cause significant property damage or loss of life more than once every 10 years it was given a "possible" probability rating.

Future Development

The State of Montana has adopted the 2012 International Building Code (IBC) which has seismic provisions for new commercial construction. The State of Montana has also adopted the 2012 International Residential Code (IRC) for one and two family residences and townhouses.

Local jurisdictions (cities, counties and towns) can elect to become certified to take on enforcement of single-family residences. Boulder and Whitehall are not certified to enforce building codes. Jefferson County does not have a building department and therefore, has no seismic provisions for development.

Climate Change

The impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity, according to research into prehistoric earthquakes and volcanic activity. NASA and USGS scientists found that retreating glaciers in southern Alaska may be opening the way for future earthquakes (NASA, 2004).

Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms or heavy precipitation could experience liquefaction or an increased propensity for slides during seismic activity due to the increased saturation. Dams storing increased volumes of water due to changes in the hydrograph could fail during seismic events.

Because impacts on the earthquake hazard are not well understood, increases in exposure and vulnerability of the local resources are not able to be determined.

Figure 10 - Earthquake

4.8 Terrorism, Civil Unrest and Violence

CPRI SCORE: 2.15

Description and History

Terrorism is defined in the Code of Federal Regulations as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives". Terrorists look for visible targets where they can avoid detection before or after an attack such as international airports, large cities, major international events, resorts, and high-profile landmarks. Bombings involving detonated and undetonated explosive devices, tear gas, and pipe and fire bombs have been the most frequently-used terrorist method in the United States. Other possible methods include attacks on transportation routes, utilities, or other public services, or incidents involving chemical or biological agents.

Lone gunman shootings (active shooters) are another form of terrorism. In the U.S., lone gunman shooting have occurred at schools, movie theaters, and other locations. Most lone gunman shootings occur where a specific place was deliberately selected as the location for the attack and was not simply a random site of opportunity. These shootings have sparked a political debate over gun violence, whether firearms should be allowed in the classroom and whether there should be stricter gun control. Jefferson County has conducted armed intruder exercises with most of the schools in the county.

Eco-terrorism is the use or threatened use of violence of a criminal nature against innocent victims or property by an environmentally-oriented, subnational group for environmental-political reasons, or aimed at an audience beyond the target, often of a symbolic nature. An example of eco-terrorism are the Rainbow Gatherings which have been held in Montana several times in the past decade. Rainbow Gatherings started in the late 1960s as an outgrowth of the anti-war and hippy movements and have occurred every July since 1972 in a different National Forest, bringing together upwards of 10,000 “Rainbows”. Environmental impact and crime are difficulties associated with Rainbow Gatherings, and has resulted in strained relations between Rainbow Gathering participants and local communities. Media coverage is often unfavorable, focusing on drug use, nudity, assaults, fugitives, serious traffic charges such as drunken driving and the countercultural aspects of the assemblage. Rainbow gatherings have been held in Montana several times in the last decade.

Civil unrest typically occurs when large groups, organizations, or distraught individuals take action with potentially disastrous or disruptive results. Civil unrest can be the product of another event that creates panic in the community. Within the past year there have been several instances of civil unrest that have gained national attention; an armed standoff in defiance of federal land policies at the Malheur National Wildfire Refuse near Burns Oregon, and the Dakota Access Pipeline Standing Rock protest over a potential impacts to drinking water and cultural sites, to name a few. An incidence of civil unrest occurred in the town of Lincoln (Lewis & Clark County) in 2015 involving a public land dispute by miners, as described below.

August 2015 – Members of the Oath Keepers, self-described constitutional advocates, came to Lincoln to intercede in a dispute between miners and the U.S. Forest Service. The noncompliance issues included construction of a garage without authorization, locking and posting gates into the claim, failure to remove explosives and needed reclamation of a road. The miners said that regulations do not apply because the mine claims predate 1955 regulations granting surface rights

to the Forest Service. The Oath Keepers and other constitutionalist groups have since provided an armed security detail at the mine site. (Independent Record, *Judge Urges Settlement in Lincoln-area Mining Dispute*, September 4, 2015).

According to the Southern Poverty Law Center (2016), an organization devoted to tracking hate groups in the United States, eight hate groups were active in Montana during 2014, including four White Nationalist organizations in the Flathead: National Policy Institute in Whitefish, Pioneer Little Europe in Kalispell, Washington Summit Publishers in Whitefish, and Radix Journal in Whitefish; two Neo-Nazi groups Creativity Alliance, National Socialist Movement; and two Ku Klux Klan groups in Great Falls.

Violent protests and riots resulting from police brutality against African Americans gained widespread notoriety in the 2010s, and the tensions ignited after particular incidents such as the killings of Trayvon Martin (2012), Micheal Brown, Jr (2014) and Freddie Gray (2015). The Black Lives Matter Movement, originating in the African-American community in 2013, campaigns against violence and systemic racism toward black people. The movement regularly protests police killings of black people and broader issues of racial profiling, police brutality, and racial inequality in the United States criminal justice system. Due to the demographics of Jefferson County, racial violence is not likely to present a great risk.

Cyberterrorism is the act of Internet terrorism in terrorist activities, including acts of deliberate, large-scale disruption of computer networks, especially of personal computers attached to the Internet, by the means of tools such as computer viruses. Cybersecurity has become a U.S. government priority in the past year, after a string of denial of service attaches on government computers and hacking attempts.

No disaster declarations have been issued to Jefferson County for terrorism or civil unrest. Emergency declarations in Montana for terrorism and civil unrest are summarized in **Table 4.8-1**.

Table 4.8-1. Montana Terrorism and Civil Unrest Declared Disasters and Emergencies

Declaration	Date	Magnitude	Comments
N/A	Jan-Feb 1979	Activation of National Guard for State Institutions strike	No casualties; $1,393,714 costs
State EO-03-91	April 1991	Activation of National Guard and Assistance Statewide for State Institutions Strike	No casualties
State EO-10-96	April 23,1996	Incident Response for Anniversary of Waco and Oklahoma City Incidents	No casualties; $4,368 costs
State EO-23-01	September 11, 2001	Emergency Declaration following the World Trade Center and Pentagon terrorist attacks	No casualties
State EO 26-01	September 28, 2001	National Guard activation to provide personnel for airport security	No casualties

Source: DMA, 2016

Vulnerability and Area of Impact

The origins and targets for terrorism and civil unrest are difficult to predict. Individuals or groups that feel oppressed on any issue can resort to violent acts to inflict harm and damage in an attempt to gain publicity or affect policy. 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, such as environmental extremists. According to the

Southern Poverty Law Center, an organization that tracks hate groups in the U.S., no hate groups have been active in Jefferson County.

As a whole, Jefferson County is at a very low risk of terrorism in comparison to other parts of the country. Jefferson County hosts a few large events each year which bring in thousands of people to the county, making it more at risk of becoming a terrorist target.

The effects of civil unrest and violence are typically felt by the population. The greatest risk is to human lives during times of unrest. Looting is commonly found in association with these types of events. Therefore, this hazard places both the population and property at risk. Urban areas and places of public gathering are generally areas of greatest risk.

Probability and Magnitude

The probability of a terrorist or civil unrest event affecting Jefferson County directly is difficult to determine. The county is not considered a specific terrorist target not is it an area of high risk for civil unrest. As with any area, a shooting by a disgruntled person, employee, or student is always possible. A large-scale attack cannot be ruled out, and therefore, a small probability exists. Of greater probability is a terrorist attack that has an indirect effect on the county through its economy.

The effects of terrorism can vary significantly from loss of life and injuries to property damage and disruptions in services such as electricity, water supply, public transportation, and communications. Cyber-terrorism could involve destroying the actual machinery of the information infrastructure, remotely disrupting the information technology underlying the Internet, government computer networks, or critical civilian systems such as financial networks or mass media, or using computer networks to take over machines that control traffic lights, power plants, or dams. If cyber-terrorists managed to disrupt financial markets or media broadcasts, an attack could undermine confidence and cause panic. Attacks could also involve remotely hijacking control systems, with potentially dire consequences, such as breaching dams, colliding airplanes, or shutting down the power grid.

Due to the lack of past events in Jefferson County, the probability of future terrorism events is rated as "infrequent". The PDM Planning Team rated the terrorism hazard as "unlikely". Terrorism is considered an emerging hazard with little to no history in the region but sporadic incidents occurring with more frequency across the nation.

Future Development

Future development should have little to no impact on the terrorism or violence threat. Given the goals of eco-terrorists; however, future development could serve as the basis for an event over controversial development.

Climate Change

Terrorism and civil unrest are not expected to increase the vulnerability of structures from climate change. However, man-made global warming could have a profound impact on national security, both in the United States and abroad.

According to a U.S. Department of Defense contractor: "While it is unlikely that the physical impacts of climate change will have a direct effect on conflict, there are a number of plausible causal

mechanisms that run through intermediate variables, such as population exposure and human health, economic growth, institutional capacity and governance, and other known conflict predictors. Additionally, there is growing consensus that the anticipated physical effects of climatic changes will have serious implications for human wellbeing and security, but quantitative efforts to assess how the impacts will influence the future probability of armed conflict is relatively limited. Improving the understanding of these dynamics as well as forecasting how conflicts will emerge as the impacts of climate change are realized over the next few decades is critical for developing interventions and adaptations to mitigate these risks. (Gilmore, 2013).

4.9 Communicable Disease

CPRI SCORE = 2.05

Description and History

Communicable diseases, sometimes called infectious diseases, are illnesses caused by organisms such as bacteria, viruses, fungi and parasites. Sometimes the illness is not due to the organism itself, but rather a toxin that the organism produces after it has been introduced into a human host. Communicable disease may be transmitted (spread) either by: one infected person to another, from an animal to a human, from an animal to an animal, or from some inanimate object (doorknobs, table tops, etc.) to an individual. A pandemic is a global disease outbreak. Human diseases, particularly epidemics, are possible throughout the nation and Jefferson County is not immune to this hazard. In addition, livestock and animal disease could have a devastating effect on the economy and food supply in Jefferson County and beyond. Highly contagious diseases are the most threatening to both populations.

Communicable disease or biological agents could be devastating to the population or economy of Jefferson County. Human diseases when on an epidemic scale, can lead to high infection rates in the population causing isolation, quarantines and potential mass fatalities. Diseases that have been eliminated from the U.S. population, such as smallpox, could be used in bioterrorism.

The following list gives examples of biological agents or diseases that could occur naturally or be used by terrorists as identified by the Centers for Disease Control and Prevention (2011).

Category A

Definition - The U.S. public health system and primary healthcare providers must be prepared to address various biological agents, including pathogens that are rarely seen in the United States. High-priority agents include organisms that pose a risk to national security because they:

- Can be easily disseminated or transmitted from person to person;
- Result in high mortality rates and have the potential for major public health impact;
- Might cause public panic and social disruption; and
- Require special action for public health preparedness.

Agents/Diseases:

- Anthrax (Bacillus anthracis)
- Botulism (Clostridium botulinum toxin)
- Plague (Yersinia pestis)
- Smallpox (variola major)
- Tularemia (Francisella tularensis)
- Viral hemorrhagic fevers (filoviruses [e.g., Ebola, Marburg] and arenaviruses [e.g., Lassa, Machupo])

Category B

Definition - Second highest priority agents include those that:

- Are moderately easy to disseminate;
- Result in moderate morbidity rates and low mortality rates; and
- Require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance.

Agents/Diseases:

- Brucellosis (Brucella species)
- Epsilon toxin of Clostridium perfringens
- Food safety threats (e.g., Salmonella species, Escherichia coli O157:H7, Shigella)
- Glanders (Burkholderia mallei)
- Melioidosis (Burkholderia pseudomallei)
- Psittacosis (Chlamydia psittaci)
- Q fever (Coxiella burnetii)
- Ricin toxin from Ricinus communis (castor beans)
- Staphylococcal enterotoxin B
- Typhus fever (Rickettsia prowazekii)
- Viral encephalitis (alphaviruses [e.g., Venezuelan equine encephalitis, eastern equine encephalitis, western equine encephalitis])
- Water safety threats (e.g., Vibrio cholerae, Cryptosporidium parvum)

Category C

Definition - Third highest priority agents include emerging pathogens that could be engineered for mass dissemination in the future because of:

- Availability;
- Ease of production and dissemination; and
- Potential for high morbidity and mortality rates and major health impact.

Agents:

- Emerging infectious diseases such as Nipah virus and hantavirus

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

Historically, the Spanish influenza outbreak after World War I in 1918-1919 caused 9.9 deaths per 1,000 people in the State of Montana (Brainerd and Siegler, 2002). Historical records from newspapers show that the influenza outbreak was so bad in 1918 that residents were quarantined from November 30 to December 17 after 18 people died and 53 new cases were discovered.

Influenza is a highly contagious viral infection of the nose, throat, and lungs that occurs most often in the late fall, winter, and early spring. It is a serious infection that affects between 5-20 percent of the U.S. population annually. Each year, more than 200,000 individuals are hospitalized and 3,000-49,000 deaths occur from influenza-related complications (IDSA, 2016). The Montana Department of Public Health and Human Services (DPHHS), maintains statistics of influenza cases in Montana counties. Recent data for Jefferson County is summarized below:

- 2012-2013 season: 29 cases in the County with 15 fatalities across the State.
- 2013-2014 season: 9 cases in the County with 8 fatalities across the State.
- 2014-2015 season: 12 cases in the County with 33 fatalities across the State.
- 2015-2016 season: 12 cases in the County with 24 fatalities across the State.

Norovirus is the leading cause of illness and outbreaks from contaminated food in the United States. Most outbreaks happen when infected people spread the virus to others. Health care facilities, including nursing homes and hospitals, are the most commonly reported settings for norovirus outbreaks.

The Montana Department of Public Health and Human Services manages a database of reportable communicable disease occurrences. The communicable disease summary for Jefferson County between 2006 and 2015 is presented in **Table 4.9-1.**

Table 4.9-1. Jefferson County Communicable Disease Summary

Disease	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Vaccine Preventable Diseases										
Hepatitis C, chronic	2	-	-	-	-	-	4	6	16	4
Meningitis	-	-	-	-	-	-	2	1	-	-
Meningococcal	-	-	1	-	-	-	-	-	-	-
Pertussis	-	-	-	-	-	1	6	8	6	3
Strep Pneumonia	-	-	-	-	-	-	2	-	2	-
Tuberculosis	-	-	-	-	-	-	-	-	-	-
Varicella	1	8	8	2	-	3	1	-	-	1
Enteric Diseases										
Campylobacter	-	2	2	1	-	-	1	-	2	4
E Coli	-	-	-	-	-	1	1	-	-	1
Giardia	-	-	-	-	-	-	-	-	1	-
Salmonella	2	-	-	-	-	1	1	1	2	2
Other Communicable Diseases										
Hantavirus	-	-	-	-	-	1	-	-	-	-
STD	12	6	16	17	14	11	16	13	30	18
West Nile Virus	-	-	-	-	-	-	-	-	-	-

Source: Montana DPHHS Communicable Disease Summaries, 2006 – 2015
Notes: STD = Sexually Transmitted Disease

According to the Montana Department of Livestock, known livestock and animal diseases such as Foot and Mouth, Bovine Spongiform Encephalopathy (Mad Cow Disease), Exotic Newcastle, Rabies, Scabies, and Brucellosis could have damaging effects on the livestock population. Losses from these diseases would be devastating and could have an economic effect county-wide.

Vulnerability and Area of Impact

Diseases threaten the population, plants, and animals of Jefferson County as opposed to structures. The entire population is at risk for contracting disease. Many Jefferson County residents travel to Helena for work which, as an urban center, is more prone to rapidly spreading and highly contagious diseases than other more rural parts of the county. In addition, tourist visits in the county could introduce a disease to the local population. The number of fatalities in the county would depend on

the mortality (disease/agent attack) rate and the percentage of the population affected. The ability to control the spread of disease will be dependent on the contagiousness of the disease and movement of the population. Given the uncertain nature of diseases, Jefferson County is assumed to have the same communicable disease risk county-wide.

Probability and Magnitude

The magnitude of a communicable disease outbreak varies from common viral outbreaks to widespread bacterial infection. During the 1918 influenza pandemic, infection rates approached 28 percent in the United States (Billings, 1997). Other pandemics produced infection rates as high as 35 percent of the total population (World Health Organization (WHO), 2009). Such a pandemic affecting Jefferson County represents a severe magnitude event. Almost any communicable disease that enters the regional population could overwhelm local health resources as would any rapidly spreading bioterrorism event for which there is no available vaccine or containment capability.

While the U.S. saw an Ebola outbreak in 2014, news of an Ebola virus for the state of Montana was minimal. The health department said the likelihood of Ebola showing up in Montana is small.

Montana's local and state public health officials are monitoring developments regarding Zika virus closely. At this time, the impact of Zika in Montana will likely be confined to individuals returning from or planning travel to Zika-affected areas and Montana's mosquitoes are not expected to be able to transmit the virus.

The probability of an epidemic in Jefferson County is difficult to assess based on history and current data. Individual infectious diseases will likely be reported on an annual basis giving this hazard a probability rating of "highly likely".

Future Development

There are no land use regulations for future development that could impact the communicable disease hazard. New residents and population add to the number of people threatened in the county, but the location of such population increases would not increase their vulnerability to the hazard.

Climate Change

Many prevalent human infections are climate sensitive. In some cases, this is in part because the disease is transmitted by mosquitoes which cannot survive if temperatures are too low. For others, climate restricts where an infection can occur because it limits the distribution of other species that are required for disease transmission.

Although some evidence indicates that warming may be causing infectious disease to spread, predicting how climate change will ultimately influence the incidence of diseases transmitted by insects remains challenging. More predictable as climate change unfolds is the spread of so-called waterborne infections. These infections most often cause diarrheal illness and flourish in the wake of heavy rainfalls as runoff from land enters into and may contaminate water supplies. Many pathogens that cause diarrheal disease reproduce more quickly in warmer conditions as well (Harvard School of Public Health, 2016).

The effects of climate change on the communicable disease hazard are mainly to the population. Outbreaks of insect- and water-borne infection associated with higher temperatures and/or flooding could increase population exposure; especially vulnerable would be the young and elderly. Property and critical facilities are not expected to have an increase in exposure or vulnerability due to the effects of climate change on communicable disease.

4.10 Risk Assessment Summary

This section summarizes the results of the individual risk assessments presented under the hazard profiles. There have been no repetitive loss properties due to flooding in Jefferson County, Boulder or Whitehall. Jefferson County, Boulder, and Whitehall do not have repetitive loss properties associated with other hazards either. Annual loss estimates are presented for each hazard where damage data is available. Future development projects in Jefferson County are discussed as they relate to the hazard areas.

Vulnerability Analysis - Loss Estimation Summary

Estimating potential losses and calculating risk requires evaluating where hazard areas and vulnerabilities coincide, how frequently the hazards occur, and then estimating the magnitude of damage resulting from a hazard event. Rather than estimating loss, a vulnerability assessment was completed which estimates building stock exposure. *Section 4.1* presents the methodology for the vulnerability assessment completed for the 2017 PDM Plan. **Tables 4.10-1 through 4.10-3** present the results of the vulnerability assessment for the each hazard for residential and commercial/ industrial/agricultural structures, critical facilities, bridges, and population in Jefferson County, Boulder and Whitehall, respectively. **Appendix C** contains supporting information.

Composite Hazard Map and Future Development

Figure 10 present the composite of hazard prone areas in Jefferson County which is an overlay of the wildfire, hazardous material, flooding, earthquake, and dam failure hazard areas.

The Jefferson County Planning Department was consulted on future development projects being considered in the county. There are currently three subdivisions being reviewed and no schools or fire stations being proposed. Future residential development is expected to continue in the northern portion of the county. Future commercial development is most apt to occur around the I-15 interchanges at Montana City, Clancy, and Jefferson City. These areas are shown on **Figure 10. Table 4.10-4** indicates which hazards these developments would be exposed to.

Table 4.10-1. Hazard Vulnerability Summary; Jefferson County (balance)

Hazard	Residential Building Stock - $ Exposure in Hazard Area	# Residential Structures in Hazard Area	Commercial, Industrial & Agricultural Building Stock - $ Exposure in Hazard Area	# Commercial, Industrial & Agricultural Structures in Hazard Area	Critical Facility $ Exposure in Hazard Area	# Critical Facilities Exposure in Hazard Area	Bridge Exposure $	# Bridges in Hazard Area	Persons in Hazard Area	Under 18 in Hazard Area
Wildfire	$635,528,119	3,531	$49,687,099	252	$39,552,822	58	$64,986,769	125	9,384	2,202
Hazardous Material Incidents	$200,277,621	1,401	$36,380,369	175	$26,298,858	39	$61,901,214	109	6,193	1,438
Severe Weather & Drought	$678,719,136	3,913	$50,484,719	281	$39,893,955	65	$79,574,829	159	9,966	2,337
Flooding	$8,997,763	135	$348,240	14	$1,930,306	5	$23,593,634	54	245	72
Dam Failure	$56,842,529	396	$15,323,324	39	$3,071,328	7	$10,882,921	26	2,812	625
Transportation Accidents	$200,277,621	1,401	$36,380,369	175	$26,298,858	39	$61,901,214	109	6,193	1,438
Earthquake	$22,311,876	160	$1,439,888	24	$1,246,293	2	$10,231,140	24	788	177
Terrorism	$678,719,136	3,913	$50,484,719	281	$39,893,955	65	$79,574,829	159	9,966	2,337
Communicable Disease	$678,719,136	3,913	$50,484,719	281	$39,893,955	65	$79,574,829	159	9,966	2,337

NOTES:

Critical facility values shown are likely higher than reported since replacement values were not available for many privately-owned facilities.

There are some inherent inaccuracies using a percentage of census block population to compute the number of individuals living in the hazard area. More persons than actually reside in the hazard area may be calculated where census blocks are large.

Table 4.10-2. Hazard Vulnerability Summary; City of Boulder

Hazard	Residential Building Stock - $ Exposure in Hazard Area	# Residential Structures in Hazard Area	Commercial, Industrial & Agricultural Building Stock - $ Exposure in Hazard Area	# Commercial, Industrial & Agricultural Structures in Hazard Area	Critical Facility $ Exposure in Hazard Area	# Critical Facilities Exposure in Hazard Area	Bridge Exposure $	# Bridges in Hazard Area	Persons in Hazard Area	Under 18 in Hazard Area
Wildfire	$32,662,686	408	$7,588,581	62	$108,107,706	25	$994,686	2	1,249	244
Hazardous Material Incidents	$23,944,791	287	$6,514,816	54	$106,344,542	22	$497,343	1	966	168
Severe Weather & Drought	$32,662,686	408	$7,588,581	62	$108,107,706	25	$994,686	2	1,249	244
Flooding	$4,514,480	68	$358,854	7	$77,880,882	3	$0	0	124	36
Dam Failure	$0	0	$0	0	$0	0	$0	0	0	0
Transportation Accidents	$23,944,791	287	$6,514,816	54	$106,344,542	22	$497,343	1	966	168
Earthquake	$0	0	$0	0	$0	0	$0	0	0	0
Terrorism	$32,662,686	408	$7,588,581	62	$108,107,706	25	$994,686	2	1,249	244
Communicable Disease	$32,662,686	408	$7,588,581	62	$108,107,706	25	$994,686	2	1,249	244

NOTES:

Critical facility values shown are likely higher than reported since replacement values were not available for many privately-owned facilities.

There are some inherent inaccuracies using a percentage of census block population to compute the number of individuals living in the hazard area. More persons than actually reside in the hazard area may be calculated where census blocks are large.

Table 4.10-3. Hazard Vulnerability Summary; Town of Whitehall

Hazard	Residential Building Stock - $ Exposure in Hazard Area	# Residential Structures in Hazard Area	Commercial, Industrial & Agricultural Building Stock - $ Exposure in Hazard Area	# Commercial, Industrial & Agricultural Structures in Hazard Area	Critical Facility $ Exposure in Hazard Area	# Critical Facilities Exposure in Hazard Area	Bridge Exposure $	# Bridges in Hazard Area	Persons in Hazard Area	Under 18 in Hazard Area
Wildfire	$33,969,396	391	$12,099,667	67	$16,998,442	26	$994,686	2	1,387	302
Hazardous Material Incidents	$33,406,706	386	$12,099,667	67	$14,792,805	23	$994,686	2	1,387	302
Severe Weather & Drought	$33,969,396	391	$12,099,667	67	$16,998,442	26	$994,686	2	1,387	302
Flooding	$2,187,926	42	$229,240	2	$369,770	2	$994,686	2	77	22
Dam Failure	$24,011,824	304	$9,700,044	58	$7,508,256	21	$994,686	2	1,169	270
Transportation Accidents	$33,406,706	386	$12,099,667	67	$14,792,805	23	$994,686	2	1,387	302
Earthquake	$0	0	$0	0	$0	0	$0	0	0	0
Terrorism	$33,969,396	391	$12,099,667	67	$16,998,442	26	$994,686	2	1,387	302
Communicable Disease	$33,969,396	391	$12,099,667	67	$16,998,442	26	$994,686	2	1,387	302

NOTES:

Critical facility values shown are likely higher than reported since replacement values were not available for many privately-owned facilities.

There are some inherent inaccuracies using a percentage of census block population to compute the number of individuals living in the hazard area. More persons than actually reside in the hazard area may be calculated where census blocks are large.

Figure 10– Composite Hazards & Future Development – Jefferson County

Table 4.10-4. Future Development Summary

Proposed Project	Hazard Areas							
	Wildfire	Haz-Mat Incidents	Severe Weather	Flooding/ Dam Failure	Transporta-tion Accident	Earthquake	Terrorism	Commun-icable Disease
I-15 interchange at Montana City	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
I-15 interchange at Clancy	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
I-15 interchange at Jefferson City	Yes	Yes	Yes	Yes	No	No	Yes	Yes

SECTION 5. MITIGATION STRATEGIES

This section presents mitigation actions for Jefferson County and the municipalities of Boulder and Whitehall to reduce potential exposure and losses from natural, man-made, and technological hazards. The PDM Planning Team reviewed the Risk Assessment to identify and develop the mitigation actions comprising the Jefferson County mitigation strategy.

This section includes:

1. Background and Past Mitigation Accomplishments
2. General Mitigation Planning Approach
3. Mitigation Goals and Objectives
4. Capability Assessment
5. Mitigation Strategy Development

Hazard mitigation reduces the potential impacts of, and costs associated with, emergency and disaster-related events. Mitigation actions address a range of impacts, including impacts on the population, property, the economy, and the environment.
Mitigation actions can include activities such as: revisions to land-use planning, training and education, and structural and nonstructural safety measures.

5.1 Background and Past Mitigation Accomplishments

In accordance with DMA 2000 requirements, a discussion regarding past mitigation activities and an overview of past efforts is provided as a foundation for understanding the mitigation goals, objectives, and activities outlined in this Plan. The County, through previous and ongoing hazard mitigation activities, has demonstrated that it is pro-active in protecting its physical assets and citizens against losses from natural hazards. Ongoing and mitigation projects completed since the 2011 PDM Plan was adopted include the following:

Wildfire

- Fuel mitigation has been performed in the WUI on evacuation routes and initial attack roads in the Upper Jackson Creek area by the BLM, the McClellan/Upper Warm Springs area by the U.S. Forest Service, and from Jefferson City two miles to the north. Grants funding some of these projects are summarized in **Table 5.1-1**.

Table 5.1-1. Jefferson County Fuel Mitigation Program Accomplishments

Grant	Defensible Space Sites	Acres Treated	Grant Amount	Total with Match	Location/Comments
BLM CAA	19	83.4	$86,668	$64,218	
BLM CAA	34	66.5	$55,000	$71,890	Clancy/Unionville #1
NFP #6	3	21.5	$29,750	$44,625	
NFP #9	15/ 0.2 mi	74.55	$43,595	$87,190	
NFP #16	5	16.5	$29,750	$29,750	
BLM South #8	13	64.5	$108,236	$162,354	
TOTAL	**89**	**326.95**	**$352,999**	**$460,027**	

Source: Lewis & Clark Co. DES, 2016. Notes: BLM = Bureau of Land Management; CAA = Community Assistance in Agriculture; NFP = National Fire Plan.

- Grants and cost-share supported a number of landowner projects to create survivable space around their residences with funding from the TCFSWG, NRCS, and BLM. Many of these projects were funded by the grants summarized in **Table 5.1-1,** above.

- Fuel mitigation has been completed around the communities of Clancy, Montana City and Jefferson City.
- The U.S. Forest Service has completed fuel mitigation projects in the Brooklyn Bridge area south of Unionville, Clancy-Unionville, Park Lake, Clancy and Montana City.
- TCFSWG has provided education to landowners on wildfire mitigation around homes and evacuation routes. They have sponsored TV commercials, radio PSAs, newspaper ads and held workshops. An open house was held at the Montana City VFD on 9/10/2016 and *Living with Fire and Evacuation* pamphlets were distributed.
- Montana DNRC has pre-identified water supplies for fire fighters and the Jefferson County fire depts. have put in dry hydrants.
- Updated fuel mapping was completed for the 2015 update to the Tri-County Regional CWPP.
- Fire Council purchased banners to advertise that volunteers are needed.

Hazardous Material Incidents

- Annual haz-mat training has been provided to the Volunteer Fire Department, County Solid Waste, Public Health, Sheriff, Ambulance, and Road Departments and to Boulder Police.
- There is now an alternate route for cyanide trucks going to the Golden Sunlight Mine to stay on highways instead of going through the town of Whitehall.

Flooding

- Floodplain maps from the 1984 Big Pipestone Creek Flood Study have been digitized and are now used in planning.
- South of Boulder, Highway 69 was elevated and new bridges and culverts installed to improve drainage.
- Culverts were replaced on Clancy Creek above the school.
- The Cataract Creek bridge was replaced in 2015.
- The wastewater plant in Boulder was upgraded and the lagoons located in the floodplain are no longer needed.
- A metal bridge that was slipping into the river west of Boulder was removed.
- The Town of Whitehall removed beaver dams on Pipestone Creek twice in 2016.
- In 2014, debris was removed on Prickly Pear Creek by the Clancy Fire Hall.
- Jefferson County hired a consultant to work with irrigators to determine the feasibility of projects to mitigate flooding in the Whitehall area. Several projects have been implemented, including:
  - ✓ A culvert on Kountz Road will be replaced with a bridge which will mitigate flooding of the museum.
  - ✓ Montana Rail Link has agreed to lower their siding and add culverts through the dike to accommodate a 10-year event.
  - ✓ The Jefferson River Water Council met with MDT to see about the possibility of constructing an emergency channel for Big Pipestone Creek south of Whitehall.

Earthquakes

- Jefferson County participated in the Great Montana Shakeout for the past two years. County personnel and the schools were involved in the exercise.
- The County's Safety Coordinator reviewed county facilities for non-structural mitigation projects. All recommended changes were implemented.

Terrorism

- The Sheriff's office has conducted armed intruder training with schools and teachers in Montana City, Boulder, Cardwell and Clancy.

All Hazards

- Self-start generators have been purchased for the FM radio antennas.
- The list of emergency shelters has been updated.
- Disaster-related education has been provided to schools by the Volunteer Fire Departments.

5.2 General Mitigation Planning Approach

The overall approach used to update the Jefferson County mitigation strategy was based on FEMA guidance regarding local mitigation plan development, including:

- DMA 2000 regulations, specifically 44 CFR 201.6 (local mitigation planning)
- FEMA "Local Mitigation Planning Handbook", March 2013
- FEMA "Integrating Hazard Mitigation into Local Planning", March 2013
- Identifying Mitigation Actions and Implementing Strategies (FEMA 386-3)
- FEMA "Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards", January 2013

The mitigation strategy approach includes the following steps that are further detailed in later sections of this Plan:

- Review and update mitigation goals and objectives.
- Identify mitigation capabilities, and evaluate their capacity and effectiveness to mitigate and manage hazard risk.
- Identify past and ongoing mitigation activities throughout the County.
- Identify appropriate county and local mitigation strategies to address the regions risk to natural and man-made hazards.
- Prepare an implementation strategy, including the prioritization of projects in the mitigation strategy.

5.3 Mitigation Goals and Objectives

This section documents the efforts to develop hazard mitigation goals and objectives established to reduce or avoid long-term vulnerabilities to the identified hazards.

According to CFR 201.6(c)(3)(i): "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards." For the purposes of this plan, goals are general guidelines that explain what is to be achieved. They are usually broad, long-term, policy-type statements and represent global visions. Goals help define the benefits that the plan is trying to achieve. The success of the plan, once implemented, should be measured by the degree to which its goals have been met (that is, by the actual benefits in terms of hazard mitigation).

The 2011 Jefferson County PDM Plan had nine goals; one goal specific to each of eight hazards according to their rank (wildfire, hazardous material incidents, structure fire, severe summer weather, severe winter weather, flooding, earthquakes, and dam failure) and one all-hazard goal. This structure was maintained for the 2017 PDM update; however, several new hazards were added to the Plan while others were dropped and/or consolidated and the hazards were re-ranking. Goals for the 2017 PDM Plan are shown in Table **5.3-1**.

FEMA defines ***Goals*** as general guidelines that explain what should be achieved. Goals are usually broad, long-term, policy statements, and represent a global vision.
FEMA defines ***Objectives*** as strategies or implementation steps to attain mitigation goals. Unlike goals, objectives are specific and measurable, where feasible.
FEMA defines ***Mitigation Actions*** as specific actions that help to achieve the mitigation goals and objectives.

Mitigation objectives developed for the original PDM Plan were generally revised for this 2017 update. Where appropriate, mitigation objectives reflect FEMA's "Local Mitigation Planning Handbook, March 2013" guidelines (see *Section 5.5.1*) as either: Public Education and Awareness, Property Protection, Prevention, Structural, Natural Resource Protection, or Emergency Services. Tetra Tech also included an objective for Mapping, Analysis and Planning Projects. Mitigation objectives for the 2017 Plan are presented in **Table 5.3-1**.

Table 5.3-1. Summary of Goals and Objectives for 2017 PDM Plan

Goal #	Goal Statement	Objective #	Objective Statement
1	Reduce the Impact of Wildland Fires on the Community	1.1	Implement Property Protection Projects to Reduce Wildfire Impacts
		1.2	Implement Public Education and Awareness Project to Reduce Impacts from Wildfire
		1.3	Implement Structural Projects to Reduce Impacts from Wildfire
		1.4	Implement Prevention Measures to Reduce Impacts from Wildfire
		1.5	Enhance Emergency Service Capabilities to Reduce Impacts from Wildfire
		1.6	Implement Mapping/ Analysis/Planning Projects to Reduce Impacts from Wildfire
2	Reduce Impacts from Hazardous Material Incidents	2.1	Implement Public Outreach and Education Projects to Reduce Impacts from Hazardous Material Incidents
		2.2	Enhance Emergency Service Capabilities to Reduce Impacts from Hazardous Material Incidents
3	Reduce Impacts from Severe Weather and Drought	3.1	Implement Public Outreach and Education Projects to Reduce Impacts from Severe Weather Hazards and Drought
		3.2	Support Mapping/ Analysis/Planning Projects to Reduce Impacts from Drought
		3.3	Implement Structural Projects to Reduce Impacts from Drought
4	Reduce Impacts from Flooding and Dam Failure	4.1	Implement Property Protection Projects to Reduce Impacts from Flooding
		4.2	Implement Public Outreach and Education Projects to Reduce Impacts from Flooding and Dam Failure
		4.3	Implement Structural Projects to Mitigate Impacts from Flooding
		4.4	Implement Prevention Projects to Reduce Impacts from Flooding and Dam Failure
		4.5	Implement Mapping/ Analysis/Planning Projects Reduce Impacts from Flooding and Dam Failure

Table 5.3-1. Summary of Goals and Objectives for 2017 PDM Plan

Goal #	Goal Statement	Objective #	Objective Statement
5	Reduce Impacts from Transportation Accidents	5.1	Implement Projects to Prevent Impacts from Transportation Accidents
		5.2	Implement Public Outreach and Education Projects to Reduce Impacts from Transportation Accidents
6	Reduce Impacts from Earthquakes	6.1	Implement Property Protection Projects to Reduce Impacts from Earthquakes
		6.2	Implement Public Outreach and Education Projects to Reduce Impacts from Earthquakes
7	Reduce Impacts from Terrorism, and Violence	7.1	Enhance Emergency Services Capabilities to Reduce Impacts from Terrorism
		7.2	Implement Property Protection Projects to Reduce Impacts from Terrorism
8	Reduce Impacts from Communicable Disease	8.1	Implement Projects to Prevent Communicable Disease
		8.2	Implement Public Outreach and Education Projects to Reduce Impacts from Communicable Disease
9	Reduce Impacts from All Hazards	9.1	Enhance Emergency Services Capabilities to Reduce Impacts from All Hazards
		9.2	Implement Public Outreach and Education Projects to Reduce Impacts from All-Hazards

5.4 Capability Assessment

The goals and objectives used to mitigate natural and technological hazards build on the community's existing capabilities. Jefferson County's capabilities to support and implement mitigation projects include the programs and resources of various local, regional, state, and federal partners and the administrative and technical capabilities of County and City/Town staff who implement the legal and regulatory requirements used to manage growth (zoning, building codes, subdivision regulations, and floodplain ordinances).

Jefferson County's hazard mitigation capabilities are summarized below. These resources have the responsibility to provide overview of past, current, and ongoing pre- and post-disaster mitigation projects including capital improvement programs, wildfire mitigation programs, stormwater management programs, and NFIP compliance projects. The fiscal capabilities of the County to support hazard mitigation and provide the funding to implement the Jefferson County mitigation strategy are also described below.

5.4.1 Summary of Programs and Resources Available to Support Mitigation

A number of programs and resources in Jefferson County support mitigation efforts. These are described below.

National Flood Insurance Program (NFIP)

The NFIP is aimed at reducing the impact of flooding on private and public structures. This is achieved by providing affordable insurance for property owners and by encouraging communities to adopt and enforce floodplain management regulations. These efforts help mitigate the effects of flooding on new and improved structures. Overall, the program reduces the socio-economic impact of

disasters by promoting the purchase and retention of Risk Insurance in general, and NFIP in particular.

NFIP Community Rating System

As an additional component of the NFIP, the Community Rating System is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance.

5.4.2 Administrative and Technical Capabilities

Jefferson County's administrative and technical capabilities to implement mitigation projects include community planners, engineers, floodplain managers, GIS personnel, emergency managers, and financial, legal and regulatory requirements. Expertise from local and regional planning partners also contribute to the County's mitigation capabilities. Several of these entities are described below.

Jefferson County Disaster and Emergency Services

The mission of Jefferson County DES is to save lives, prevent injury, and protect property and the environment by taking reasonable and affordable measures to mitigate, prepare for, respond to and recover from disasters. The Jefferson County DES Coordinator is responsible for the planning, coordination, and implementation of all emergency management and Homeland Security-related activities for the county. Other responsibilities include coordination of activities for the county's EOC. The EOC, when activated, is a central location where representatives of local government and private sector agencies convene during disaster situations to make decisions, set priorities and coordinate resources for response and recovery. These efforts are designed to enhance the capacity of the local government to plan for, respond to, and mitigate the consequences of threats and disasters using an all-hazard framework.

Jefferson County DES staff includes one part-time staff position, the coordinator, who devotes 100 percent of his 20 hours per week to emergency management. The position is funded 50 percent federal through the Emergency Management Performance Grant (EMPG) program and 50 percent through the County's general fund.

Local Emergency Planning Committee

The mission of the Jefferson County LEPC is to provide resources and guidance to the community through education, coordination and assistance in hazmat planning; and to assure public health and safety. They do not function in actual emergency situations, but attempt to identify and catalogue potential hazards, identify available resources, and mitigate hazards when feasible. The LEPC consists of representatives from businesses, local government, emergency responders and citizen groups located in Jefferson County. Monthly meetings are held at either the EOC in Boulder, the alternate EOC in Montana City, or the Alternate EOC in Whitehall.

Tri-County FireSafe Working Group

Jefferson County participates in the TCFSWG. Membership includes individual citizens, local government, state and federal agencies, interested contractors, and fire suppression departments from Jefferson, Lewis & Clark, and Broadwater Counties. The group has had the primary mission of fire prevention education and helping homeowners survive a wildland residential interface fire. Much of the group's efforts are directed toward educating homeowners about reducing and managing fuel buildup, building and maintaining adequate road systems, providing adequate water supplies, and the use of fire-resistant materials and designs for homes and outbuildings. The group meets on a monthly basis. The Tri-County Regional Community Wildfire Protection Plan (CWPP) is a product of TCFSWG.

Jefferson County Planning Board

The mission of the Jefferson County Planning Board is to sustain and improve the health, safety, convenience and welfare of the citizens of Jefferson County and to plan for the future development of the communities. The legally mandated role of the Planning Board is to assure the promotion of public health, safety, morals, convenience, order, or the general welfare and for the sake of efficiency and economy in the process of community development. The Planning Board is preparing a revision to the Growth Policy and serves in an advisory capacity to the County Planning Department. The Planning Board of Jefferson County is committed to developing programs and strategies that will provide for responsible growth and retain the rural character and sense of community of small towns.

The Planning Department provides community planning and development services to Jefferson County. The Department completes a formal review of development proposals for compliance with the community's goals, objectives and policies as identified in the Jefferson County Growth Policy. The Planning Department is responsible for: general long-range planning, growth policy development and implementation; developing and reviewing new planning regulations and regulation updates; revisions and amendments; subdivision review, zoning administration and permitting; survey review committee; rural improvement districts and rural management districts; and, permit coordination.

Jefferson County Fire Protection Services

Fire protection services in Jefferson County are provided by 10 volunteer fire departments (VFD), and is supported by mutual aid agreements with other jurisdictions as well as state and federal partners. Fire departments serving the county include Basin VFD, Boulder VFD, Bull Mountain VFD, Clancy VFD, Elk Park VFD, Jefferson City VFD, Jefferson River VFD, Jefferson Valley VFD, Montana City VFD, and Willow Creek VFD. Jefferson County is also served by a Fire Warden, appointed by the County Commissioners, and a DES Coordinator, an employee of the Sheriff's Office.

The above departments meet on a quarterly basis at the Jefferson County Rural Fire Council. The Fire Warden and DES Coordinator are also members of the Tri-County FireSafe Working Group (see description above).

Montana DNRC and Federal Land Management Agencies

The Forestry Division, of the Montana DNRC is responsible for planning and implementing forestry and fire management programs through an extensive network of staff located in field offices across

the state. The Fire and Aviation Management Bureau provides resources, leadership and coordination to Montana's wildland fire services to protect lives, property, and natural resources; working with local, tribal, state, and federal partners to ensure wildfire protection on all state and private land in Montana. There are numerous programs aimed at effective fire preparedness and capacity building. The Fire Preparedness effort is focused in four areas:

- Fire Prevention Program seeks to educate Montanans about fire risk, the wildland urban interface and reducing human-caused fires;
- Fire Training Program provides statewide training opportunities for DNRC and local government personnel;
- Equipment Development Center builds and maintains wildland fire equipment and radio communications;
- Fire Support Programs provide financial and technical expertise to assist all fire programs in meeting their respective goals and mandates. These include, but not limited to: Fire Assessment fees, GIS, repair and maintenance of radio systems and rolling stock equipment.

The U.S. Forest Service and BLM are involved in planning activities for public land area within Jefferson County.

Jefferson River Watershed Council

Jefferson River Watershed Council, a 501 (c)3 no++n-profit organization, strives to achieve better water quality and quantity while enhancing the area's natural resources and natural wildlife along the upper Jefferson River. Originally made up of irrigators who wanted to ensure that water was plentiful and safe for all uses, JRWC now consists of recreationalists, sportsmen's groups, federal and state agencies and others. Ultimately, the council seeks to develop practical solutions to difficult problems which impact the upper Jefferson River. The JRWC is involved with flood and drought mitigation in Jefferson County.

Headwaters Resource Conservation & Development (RC&D)

Headwaters RC&D is an economic development organization serving southwest Montana including Jefferson County. Appendix D of their Comprehensive Economic Development Strategy outlines their Disaster and Economic Recovery and Resiliency Strategy, as summarized below.

In the event of a disaster, Headwaters is committed to: providing local officials, business leaders and other community partners with access to regional demographic, economic and hazard vulnerability data; developing technical expertise and economic analysis tools for conducting initial disaster assessments and long-term economic impact analysis; establishing collaborative relationships with local government officials and non-government organizations that may provide data, funding, technical expertise and other resources essential to intermediate and long-term economic recovery following a disaster event; offering grant writing expertise and technical assistance to regional and local entities, both for pre-disaster resiliency initiatives as well as post-disaster recovery efforts; establishing familiarity with traditional economic and community recovery funding sources, including resources for business development assistance programs, such as the Economic Development Administration's Revolving Loan Fund programs as well as private, nonprofit and philanthropic resources; providing technical support to impacted businesses; encouraging concepts and principles of economic resiliency strategies into the existing planning and development plans

and activities within the region; leveraging assets; and, offering a neutral forum to convene diverse stakeholders and facilitate discussion and planning initiatives around the issues of economic resiliency preparedness and recovery.

FireSafe Montana

FireSafe Montana is a private, non-profit organization coordinating and supporting a statewide coalition of diverse interests working together to help Montanans make their homes, neighborhoods, and communities fire safe. FireSafe Montana actively encourages and assists in the development of local FireSafe councils across the state. These councils are key to raising public awareness of local wildland fire threats and issues, motivating residents to take positive action, and providing access to the expertise and resources homeowners need to get the job done. When people take personal responsibility for applying and maintaining Firewise practices on their property, they greatly increase the chances of their homes surviving a wildfire.

Through its public information programs and materials, website, newsletter, and special events, as well as its active involvement in federal, state, and local fire mitigation efforts, FireSafe Montana is working hard to reduce the potential loss of life and property from wildfire in Montana.

National Fire Prevention Association's FireWise Communities Program

NFPA's Firewise Communities Program encourages local solutions for safety by involving homeowners in taking individual responsibility for preparing their homes from the risk of wildfire. Firewise is a key component of Fire Adapted Communities – a collaborative approach that connects all those who play a role in wildfire education, planning and action with comprehensive resources to help reduce risk. The program is co-sponsored by the U.S. Forest Service, the U.S. Department of the Interior, and the National Association of State Foresters. To save lives and property from wildfire, NFPA's Firewise Communities program teaches people how to adapt to living with wildfire and encourages neighbors to work together and take action now to prevent losses. They advocate playing a role in protecting ourselves and each other from the risk of wildfire.

NOAA Weather-Ready Nation (WRN) Program

The Weather-Ready Nation Ambassador initiative is NOAA's effort to formally recognize NOAA partners who are improving the nation's readiness, responsiveness, and overall resilience against extreme weather, water, and climate events. As a WRN Ambassador, partners commit to working with NOAA and other Ambassadors to strengthen national resilience against extreme weather. In effect, the WRN Ambassador initiative helps unify the efforts across government, non-profits, academia, and private industry toward making the nation more ready, responsive, and resilient against extreme environmental hazards. WRN is a strategic outcome where society's response should be equal to the risk from all extreme weather, water, and climate hazards.

WRN Ambassadors serve a pivotal role in affecting societal change — helping to build a nation that is ready, responsive, and resilient to the impacts of extreme weather and water events.
To be officially recognized as a WRN Ambassador, an organization must commit to:

- Promoting Weather-Ready Nation messages and themes to their stakeholders;
- Engaging with NOAA personnel on potential collaboration opportunities;
- Sharing their success stories of preparedness and resiliency;

Serving as an example by educating employees on workplace preparedness.

5.4.3 Fiscal Capabilities

Mitigation projects and initiatives are largely or entirely dependent on available funding. Jefferson County is able to fund mitigation projects though existing local budgets, local appropriations (including referendums and bonding), and through a myriad of Federal and State loan and grant programs. A number of these funding opportunities are described below.

FEMA Hazard Mitigation Funding Opportunities

Federal mitigation grant funding is available to all communities with a current hazard mitigation plan (this plan); however most of these grants require a "local share" in the range of 10-25 percent of the total grant amount. The FEMA mitigation grant programs are described below.

Hazard Mitigation Grant Program (HMGP). The HMGP is a post-disaster mitigation program. It is made available to states by FEMA after each Federal disaster declaration. The HMGP can provide up to 75 percent funding for hazard mitigation measures. The HMGP can be used to fund cost-effective projects that will protect public or private property in an area covered by a federal disaster declaration or that will reduce the likely damage from future disasters. Examples of projects include acquisition and demolition of structures in hazard prone areas, flood-proofing or elevation to reduce future damage, minor structural improvements and development of state or local standards. Projects must fit into an overall mitigation strategy for the area identified as part of a local planning effort. All applicants must have a FEMA-approved Hazard Mitigation Plan (this plan).

Applicants who are eligible for the HMGP are state and local governments, certain nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf. Applications are submitted to Montana DES and placed in rank order for available funding and submitted to FEMA for final approval. Eligible projects not selected for funding are placed in an inactive status and may be considered as additional HMGP funding becomes available.

Flood Mitigation Assistance (FMA) Program. The FMA combines the previous Repetitive Flood Claims and Severe Repetitive Loss Grants into one grant program. FMA provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA is funded annually; no federal disaster declaration is required. Only NFIP insured homes and businesses are eligible for mitigation in this program. Funding for FMA is very limited and, as with the HMGP, individuals cannot apply directly for the program. Applications must come from local governments or other eligible organizations. The federal cost share for an FMA project is 75 percent. At least 25 percent of the total eligible costs must be provided by a non-federal source. Of this 25 percent, no more than half can be provided as in-kind contributions from third parties. At minimum, a FEMA-approved local flood mitigation plan is required before a project can be approved. FMA funds are distributed from FEMA to the state. Montana DES serves as the grantee and program administrator for FMA.

FEMA, Pre-Disaster Mitigation Competitive (PDMC) Grant Program**.** The PDM program is an annually funded, nationwide, competitive grant program. No disaster declaration is required. Federal funds will cover 75 percent of a project's cost up to $3 million. As with the HMGP and FMA, a FEMA-approved local Hazard Mitigation Plan is required to be approved for funding under the PDM program.

FEMA, Readiness, Response and Recovery Directorate, Fire Management Assistance Grant Program. This program provides grants to states, tribal governments and local governments for the mitigation, management and control of any fire burning on publicly (non-federal) or privately owned forest or grassland that threatens such destruction as would constitute a major disaster. The grants are made in the form of cost sharing with the federal share being 75 percent of total eligible costs. Grant approvals are made within 1 to 72 hours from time of request.

Fire Prevention and Safety Grants. The Fire Prevention and Safety Grants (FP&S) are part of the Assistance to Firefighters Grants, and are administered by the FEMA. FP&S Grants support projects that enhance the safety of the public and firefighters from fire and related hazards. The primary goal is to target high-risk populations and reduce injury and prevent death. Eligibility includes fire departments, national, regional, state, and local organizations, Native American tribal organizations, and/or community organizations recognized for their experience and expertise in fire prevention and safety programs and activities. Private non-profit and public organizations are also eligible. Interested applicants are advised to check the website periodically for announcements of grant availability. More information: https://www.fema.gov/welcome-assistance-firefighters-grant-program

Other Mitigation Funding Opportunities

Grant funding is available from a variety of federal and state agencies for training, equipment, and hazard mitigation activities. Several of these programs are described below.

Program 15.228: Wildland Urban Interface Community and Rural Fire Assistance. This program is designed to implement the National Fire Plan and assist communities at risk from catastrophic wildland fires. The program provides grants, technical assistance, and training for community programs that develop local capability, including: Assessment and planning, mitigation activities, and community and homeowner education and action; hazardous fuels reduction activities, including the training, monitoring or maintenance associated with such hazardous fuels reduction activities, on federal land, or on adjacent nonfederal land for activities that mitigate the threat of catastrophic fire to communities and natural resources in high risk areas; and, enhancement of knowledge and fire protection capability of rural fire districts through assistance in education and training, protective clothing and equipment purchase, and mitigation methods on a cost share basis. More information: http://www.federalgrantswire.com/wildland-urban-interface-community-and-rural-fire-assistance.html#.WCx8ekYzWUk

Secure Rural Schools and Community Self-Determination Act - Title III- County Funds. The Self-Determination Act has recently been reauthorized and now includes specific language regarding the Firewise Communities program. Counties seeking funding under Title III must use the funds to perform work under the Firewise Communities program. Counties applying for Title III funds to implement Firewise activities can assist in all aspects of a community's recognition process, including

conducting or assisting with community assessments, helping the community create an action plan, assisting with an annual Firewise Day, assisting with local wildfire mitigation projects, and communicating with the state liaison and the national program to ensure a smooth application process. Counties that previously used Title III funds for other wildfire preparation activities such as the Fire Safe Councils or similar would be able to carry out many of the same activities as they had before. However, with the new language, counties would be required to show that funds used for these activities were carried out under the Firewise Communities program. More information: http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_AI8zPwhQoY6BdkOyoCAPkATlA!/?ss=119985&navtype=BROWSEBYSUBJECT&cid=FSE_003853&navid=091000000000000&pnavid=null&position=BROWSEBYSUBJECT&ttype=main&pname=Secure%20Rural%20Schools-%20Home

Community Planning Assistance for Wildfire - Established in 2015 by Headwaters Economics and Wildfire Planning International, Community Planning Assistance for Wildfire (CPAW) works with communities to reduce wildfire risks through improved land use planning. CPAW is a grant-funded program providing communities with professional assistance from foresters, planners, economists and wildfire risk modelers to integrate wildfire mitigation into the development planning process. All services and recommendations are site-specific and come at no cost to the community. More information: http://planningforwildfire.org/what-we-do/

Urban and Community Forestry (UCF) Program - A cooperative program of the U.S. Forest Service that focuses on the stewardship of urban natural resources. With 80 percent of the nation's population in urban areas, there are strong environmental, social, and economic cases to be made for the conservation of green spaces to guide growth and revitalize city centers and older suburbs. UCF responds to the needs of urban areas by maintaining, restoring, and improving urban forest ecosystems on more than 70 million acres. Through these efforts the program encourages and promotes the creation of healthier, more livable urban environments across the nation. These grant programs are focused on issues and landscapes of national importance and prioritized through state and regional assessments. Information: http://www.fs.fed.us/managing-land/urban-forests/ucf

Western Wildland Urban Interface Grants - The National Fire Plan (NFP) is a long-term strategy for reducing the effects of catastrophic wildfires throughout the nation. The Division of Forestry's NFP Program is implemented within the Division's Fire and Aviation Program through the existing USDA Forest Service, State & Private Forestry, State Fire Assistance Program.

Congress has provided increased funding assistance to states through the U.S. Forest Service State and Private Forestry programs since 2001. The focus of much of this additional funding was mitigating risk in WUI areas. In the West, the State Fire Assistance funding is available and awarded through a competitive process with emphasis on hazard fuel reduction, information and education, and community and homeowner action. This portion of the National Fire Plan was developed to assist interface communities manage the unique hazards they find around them. Long-term solutions to interface challenges require informing and educating people who live in these areas about what they and their local organizations can do to mitigate these hazards.

The 10-Year Comprehensive Strategy focuses on assisting people and communities in the WUI to moderate the threat of catastrophic fire through the four broad goals of improving prevention and suppression, reducing hazardous fuels, restoring fire-adapted ecosystems, and promoting

community assistance. The Western States Wildland Urban Interface Grant may be used to apply for financial assistance towards hazardous fuels and educational projects within the four goals of: improved prevention, reduction of hazardous fuels, restoration of fire-adapted ecosystems and promotion of community assistance. Information: http://forestry.alaska.gov/fire/cwpp/wuigrants

U.S. Fish & Wildlife Service, Rural Fire Assistance Grants. Each year, the U.S. Fish & Wildlife Service (FWS) provides Rural Fire Assistance (RFA) grants to neighboring community fire departments to enhance local wildfire protection, purchase equipment, and train volunteer firefighters. Service fire staff also assist directly with community projects. These efforts reduce the risk to human life and better permit FWS firefighters to interact and work with community fire organizations when fighting wildfires. The Department of the Interior (DOI) receives an appropriated budget each year for an RFA grant program. The maximum award per grant is $20,000. The DOI assistance program targets rural and volunteer fire departments that routinely help fight fire on or near DOI lands. More information: http://www.fws.gov/fire/living_with_fire/rural_fire_assistance.shtml

U.S. Bureau of Land Management, Community Assistance Program. BLM provides funds to communities through assistance agreements to complete mitigation projects, education and planning within the WUI. More information: http://www.blm.gov/nifc/st/en/prog/fire/community_assistance.html

Fire Management Assistance Program. This program is authorized under Section 420 of the Stafford Act. It allows for the mitigation, management, and control of fires burning on publicly or privately owned forest or grasslands that threaten destruction that would constitute a major disaster. More information: http://www.fema.gov/fire-management-assistance-grant-program

NOAA Office of Education Grants - The Office of Education supports formal, informal and non-formal education projects and programs through competitively awarded grants and cooperative agreements to a variety of educational institutions and organizations in the United States. More information: http://www.noaa.gov/office-education/grants

NRCS Environmental Quality Incentives Program (EQIP). The Environmental Quality Incentives Program, administered through the NRCS, is a cost-share program that provides financial and technical assistance to agricultural producers to plan and implement conservation practices that improve soil, water, plant, animal, air and related natural resources on agricultural land and non-industrial private forestland. Owners of land in agricultural or forest production or persons who are engaged in livestock, agricultural or forest production on eligible land and that have a natural resource concern on that land may apply to participate in EQIP. Eligible land includes cropland, rangeland, pastureland, non-industrial private forestland and other farm or ranch lands. EQUIP is another funding mechanism for landowner fuel reduction projects. More information: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/

U.S. Department of Agriculture, Community Facilities Loans and Grants. Provides grants (and loans) to cities, counties, states and other public entities to improve community facilities for essential services to rural residents. Projects can include fire and rescue services; funds have been provided to purchase fire-fighting equipment for rural areas. No match is required. More information: http://www.usda.gov/wps/portal/usda/usdahome?navid=GRANTS_LOANS

General Services Administration, Sale of Federal Surplus Personal Property. This program sells property no longer needed by the federal government. The program provides individuals, businesses and organizations the opportunity to enter competitive bids for purchase of a wide variety of personal property and equipment. Normally, there are no restrictions on the property purchased. More information: http://www.gsa.gov/portal/category/21045

Hazardous Materials Emergency Preparedness Grants. Grant funds are passed through to local emergency management offices and HazMat teams having functional and active LEPC groups. More information: http://www.phmsa.dot.gov/hazmat/grants

U.S. Department of Homeland Security. Enhances the ability of states, local and tribal jurisdictions, and other regional authorities in the preparation, prevention, and response to terrorist attacks and other disasters, by distributing grant funds. Localities can use grants for planning, equipment, training and exercise needs. These grants include, but are not limited to areas of Critical Infrastructure Protection Equipment and Training for First Responders, and Homeland Security Grants. More information: http://www.dhs.gov/

Community Development Block Grants (CDBG). The U.S. Department of Commerce administers the CDBG program which are intended to provide low and moderate-income households with viable communities, including decent housing, as suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, planning, and administration. Public improvements may include flood and drainage improvements. In limited instances, and during the times of "urgent need" (e.g. post disaster) as defined by the CDBG National Objectives, CDBG funding may be used to acquire a property located in a floodplain that was severely damaged by a recent flood, demolish a structure severely damaged by an earthquake, or repair a public facility severely damaged by a hazard event. CDBG funds can be used to match FEMA grants. More Information:
http://www.hud.gov/offices/cpd/communitydevelopment/programs/

Volunteer Fire Assistance Program Grants. The purpose of these grants is to organize, train and equip local firefighters to prevent and suppress wildfires. Communities under 10,000 in population are eligible for the funding. Smaller communities may join together in a group and or county effort to submit an application, even if their combined population is over 10,000. There is no pre-set award amount. Financial assistance on any project, during any fiscal year, requires a non-federal match for project expenditures. More information: http://dnrc.mt.gov/grants-and-loans

Conservation District Grants. This program provide funds to increase conservation district employee's hours to assist in planning, securing funding, and implementing programs that improve public outreach, improve conservation district administrative capabilities, and implement conservation plans. There is a $10,000 award amount. More information:
http://dnrc.mt.gov/grants-and-loans

Western States Wildland Urban Interface. National Fire Plan funds are available to mitigate risk from wildland fire within the WUI. Funds are awarded through a competitive process to 22 western states and territories through the Western Wildland Urban Interface Grant Program. Each year, the Montana Department of Natural Resources and Conservation accepts proposals from partners around the state for submission to the National Fire Plan competitive process. The State scores and

prioritizes these proposals before sending them on to the national competitive process. Non-profit organizations, conservation districts, county and municipal governments, and fire departments. Individual landowners may not apply but may be eligible for cost-share opportunities through this program. Each grant request is limited to a maximum of $300,000. More information: http://dnrc.mt.gov/grants-and-loans

Hazardous Fuel Reduction Grants. These grants are for hazardous fuel reduction on private lands to protect communities adjacent to National Forest System Lands where prescribed fire activities are planned. Prescribed fire activities must be imminent (to take place within 3 years of the award). Non-profit organizations, conservation districts, county and municipal governments, fire departments are eligible for this funding. Award amounts typically range from $50,000 to $100,000 depending upon availability of funding. More information: http://dnrc.mt.gov/grants-and-loans

Renewable Resource Grant Program. Administered by the Montana DNRC, this program provides both grant and loan funding for public facility and other renewable resource projects. Projects that conserve, manage, develop or protect Montana's renewable resources are eligible for funding. Numerous public facility projects including drinking water, wastewater and solid waste development and improvement projects have received funding through this program. Other projects that have been funded include irrigation rehabilitation, dam repair, soil and water conservation and forest enhancement. More information: http://dnrc.mt.gov/grants-and-loans

5.5 Mitigation Strategy Development

This subsection discusses the identification, prioritization, analysis and implementation plan of mitigation actions for Jefferson County and the municipalities of Boulder and Whitehall.

5.5.1 Mitigation Strategy Update and Reconciliation

The Planning Team reviewed the list of mitigation actions (projects) from the 2011 PDM Plan and determined which were complete, should be deleted, or reworded for the 2017mitigation strategy during Planning Team conference calls held during September through November, 2016. **Appendix C** presents a reconciliation of mitigation projects and their status.

Concerted efforts were made to assure that the county develop mitigation strategies that included activities and initiatives covering the range of mitigation action types described in recent FEMA planning guidance (FEMA "Local Mitigation Planning Handbook" March 2013), specifically:

- Prevention Projects – These actions include governmental regulatory authorities, including policies or codes that influence the way land and buildings are being developed and built.
- Property Protection Projects – Actions that involve the modification of existing buildings or structures to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocations, structural retrofits, storm shutters, and shatter-resistant glass.
- Structural Projects - These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure.

This type of action also involves projects to construct manmade structures to reduce the impact of hazards.

- Natural Resource Protection Projects – These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.
- Education and Awareness Programs – These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as the National Flood Insurance Program and Community Rating System, StormReady (NOAA) and Firewise (NFPA) Communities.
- Emergency Service Projects – These are actions to enhance community preparedness through training and acquisition of equipment.
- Mapping/Analysis/Planning Projects – These actions include development of mapping and planning documents to assist with implementation of mitigation strategies.

In consideration of federal and state mitigation guidance, the PDM Planning Team recognized that all communities would benefit from the inclusion of certain mitigation actions. These include initiatives to address vulnerable public and private properties, including repetitive loss properties; initiatives to support continued and enhanced participation in the NFIP; improved public education and awareness programs; and initiatives to support countywide and regional efforts to build greater local mitigation capabilities.

Mitigation actions included in the 2017 Jefferson County mitigation strategy are presented in **Table 5.5-2** at the end of this Section. **Appendix D** contains a mitigation action plan with individual project worksheets.

5.5.2 Mitigation Strategy Benefit/Cost Review and Prioritization

Each of the proposed mitigation actions has value; however, time and financial constraints do not permit all projects to be implemented immediately. By prioritizing the actions, the most critical, cost effective projects can be achieved in the short term. Mitigation actions retained and developed for this updated PDM Plan were re-prioritized to reflect current conditions and anticipated needs over the next five years.

Section 201.6.c.3iii of 44CFR requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a cost/benefit review of the proposed projects and their associated costs. Stated otherwise, cost-effectiveness is one of the criteria that must be applied during the evaluation and prioritization of all actions comprising the overall mitigation strategy.

The benefit/cost review applied in used for the evaluation and prioritization of projects in this plan was qualitative; i.e. it does not include the level of detail required by FEMA for project grant eligibility under the HMGP and PDM grant programs.

- **Costs** are the total cost for the action or project, and may include administrative costs, construction costs (including engineering, design and permitting), and maintenance costs.
- **Benefits** are the savings from losses avoided attributed to the implementation of the project, and may include life-safety, structure and infrastructure damages, loss of service or function, and economic and environmental damage and losses.

When available, jurisdictions were asked to identify the actual or estimated dollar value for project costs and associated benefits. Having defined costs and benefits allows a direct comparison of benefits versus costs, and a quantitative evaluation of project cost-effectiveness. Often, however, numerical costs and/or benefits have not been identified, or may be impossible to quantitatively assess.

For the purposes of this planning process, a cost-benefit matrix was developed to rank the mitigation projects using the following criteria. Each project was assigned a "high", "medium", or "low" rank for *Population Impacted, Property Impacted*, *Project Feasibility* and *Cost*, as described below:

- For the *Population Protected* category, a "high" rank represents greater than 50 percent of County residents would be protected by implementation of the mitigation strategy; a "medium" rank represents 20 to 50 percent of County residents would be protected; and, a "low" rank represents less than 20 percent of County residents would be protected.
- For the *Property Protected* category, a "high" represents that greater than $500,000 worth of property would be protected through implementation of the mitigation strategy; "medium" represents that $100,000 to $500,000 worth of property would be protected; and, "low" would be less than $100,000 would be protected.
- For the *Project Feasibility* category a "high" rank represents that technology is available and implementation is likely; a "medium" rank indicates technology may be available but implementation could be difficult; and, a "low" rank represents that no technology is available or implementation would be unlikely.
- For the *Project Cost* category, a "high" represents that the mitigation project would cost more than $500,000; a "medium" rank represents the project cost would be between $100,000 and $500,000; and, "low" represents the project would cost less than $100,000.

The overall cost-benefit was then calculated by summing the total score for each project. **Table 5.5-1** presents the cost-benefit scoring matrix. The mitigation action plans in **Appendix D** present the scoring of each project.

Table 5.5-1. Cost-Benefit Scoring Matrix

Score	Population Protected	Property Protected	Project Feasibility	Cost
High	3	3	3	1
Medium	2	2	2	2
Low	1	1	1	3

After considering all mitigation projects, the PDM Planning Team prioritized the projects as high, medium, or low based on which projects were most needed to protect life and property. Prioritization of the projects serves as a guide for choosing and funding projects. **Table 5.5-2** presents the County priority for each project.

Each year, FEMA partners with the State on training courses designed to help communities be more successful in their applications for grants, including the Unified Hazard Mitigation Grant Assistance Application Development Course and the Benefit Coast Analysis (BCA) course. The State Hazard Mitigation Officer can provide the course offering schedule.

5.5.3 Project Implementation

The PDM Planning Team reviewed the projects and assigned a corresponding County, City, or Town department responsible for its implementation. Cooperating organizations for implementation may also include local, federal or regional agencies that are capable of implementing activities and programs. The Planning Team identified a schedule for implementation and potential funding sources. The schedule for implementation included several categories including: "ongoing" for projects that are part of the County's emergency management program; "short-term" for projects to be completed within 1-2 years; "mid-term" for projects to be completed within 3-4 years; and, "long-term" for projects to be completed in 5 or more years.

Implementation details are shown in **Table 5.5-3** and in the mitigation action plans in **Appendix D.** The Jefferson County DES Coordinator will be responsible for mitigation project administration.

Table 5.5-2. Jefferson County 2017 Mitigation Strategy

Goal	Objective	Project	Hazard	Jurisdiction	Benefit-Cost Ranking/Score	County Priority
Goal 1 – Reduce the Impact of Wildland Fires on the Community	Objective 1.1 - Implement Property Protection Projects to Reduce Wildfire Impacts	Project 1.1.1 - Perform fuel mitigation on evacuation routes, initial attack roads, power lines, and communication sites in the WUI.	Wildfire	County	High/10	High
		Project 1.1.2 - Encourage creation of survivable space in current developments through coordinated landowner mitigation projects.	Wildfire	County	High/12	High
		Project 1.1.3 - Perform fuel mitigation around historic sites (Comet, Elkhorn).	Wildfire	County	Medium/7	Low
		Project 1.1.4 - Perform fuel mitigation around the town of Basin and other vulnerable communities.	Wildfire	County	Medium/9	High
		Project 1.1.5 - Collaborate with and assist with design of fuel mitigation on federal and state lands in Jefferson County.	Wildfire	County	High/12	High
	Objective 1.2 - Implement Public Education and Awareness Project to Reduce Impacts from Wildfire	Project 1.2.1 - Support the Tri-County FireSafe Working Group to assist private property owners.	Wildfire	County, Boulder, Whitehall	High/12	High
		Project 1.2.2 - Support volunteer fire department fire prevention activities.	Wildfire	County, Boulder, Whitehall	High/12	High
		Project 1.2.3 - Provide outreach to citizens on wildfire mitigation techniques.	Wildfire	County, Boulder, Whitehall	High/12	High
	Objective 1.3 - Implement Structural Projects to Reduce Impacts from Wildfire	Project 1.3.1 - Collaborate with state and federal partners to maintain initial attack roads and install culverts where needed.	Wildfire	County	High/10	Medium
	Objective 1.4 - Implement Prevention Measures to Reduce Impacts from Wildfire	Project 1.4.1 - Encourage Planning Board to adopt subdivision regulations that require vegetation management plans to create and maintain survivable space, roof covering requirements, and fire protection covenants.	Wildfire	County	High/10	High
	Objective 1.5 - Enhance Emergency Service Capabilities to Reduce Impacts from Wildfire	Project 1.5.1 - Provide adequate water supply to create water sources for fighting fires in current and future developments.	Wildfire	County	Medium/9	High
		Project 1.5.2 - Upgrade the water supply in communities as needed to more effectively assist with wildfire suppression.	Wildfire	County	Medium/9	Medium

Table 5.5-2. Jefferson County 2017 Mitigation Strategy

Goal	Objective	Project	Hazard	Jurisdiction	Benefit-Cost Ranking/Score	County Priority
Goal 1 – Reduce the Impact of Wildland Fires on the Community	Objective 1.5 - Enhance Emergency Service Capabilities to Reduce Impacts from Wildfire	Project 1.5.3 - Work with Planning Department to create legal basis for Improvement Districts that would assess impact fees on existing subdivisions to fund development of fire protection water supplies.	Wildfire	County	High/10	High
	Objective 1.6 - Implement Mapping/ Analysis/ Planning Projects to Reduce Impacts from Wildfire	Project 1.6.1 - Continue to update and maintain fire hazard mapping project as well as compilation of completed fuel mitigation projects.	Wildfire	County, Boulder, Whitehall	Medium/9	High
Goal 2 – Reduce Impacts from Hazardous Material Incidents	Objective 2.1 - Implement Public Outreach and Education Projects to Reduce Impacts from Hazardous Material Incidents	Project 2.1.1 - Provide outreach to schools on how to limit exposure during a hazardous material incident.	Hazardous Material Incidents	County, Boulder, Whitehall	High/10	High
		Project 2.1.2 - Provide information to citizens on hazardous material incident awareness.	Hazardous Material Incidents	County, Boulder, Whitehall	High/10	High
	Objective 2.2 - Enhance Emergency Service Capabilities to Reduce Impacts from Hazardous Material Incidents	Project 2.2.1 - Continue providing awareness training to emergency responders.	Hazardous Material Incidents	County, Boulder, Whitehall	High/10	High
		Project 2.2.2 - Explore alternate routes for haz-mat traffic.	Hazardous Material Incidents	County, Whitehall	Medium/7	Medium
Goal 3 – Reduce Impacts from Severe Weather and Drought	Objective 3.1 - Implement Public Outreach and Education Projects to Reduce Impacts from Severe Weather Hazards and Drought	Project 3.1.1 - Promote National Weather Service Severe Weather Awareness Week.	Severe Weather	County, Boulder, Whitehall	High/10	Medium
		Project 3.1.2 - Attempt to become a National Weather Service Storm Ready Community.	Severe Weather	County, Boulder, Whitehall	High/10	Medium
		Project 3.1.3 - Provide public outreach on hazardous tree mitigation to enhance life safety and reduce property damage.	Severe Weather	County, Boulder, Whitehall	High/11	Medium
	Objective 3.2 - Support Mapping/Analysis/ Planning Projects to Reduce Impacts from Drought	Project 3.2.1 - Support drought programs implemented through the Conservation District, FSA, NRCS, MSU Extension, DNRC and Jefferson River Water Council.	Drought	County	Medium/9	High
		Project 3.2.2 - Pursue Drought Resiliency Planning Committee and Drought Coordinator position for Jefferson County.	Drought	County	Medium/9	High
		Project 3.2.3 - Support initiative of prescribed burning program to reduce conifer encroachment which impacts water availability.	Drought	County	Medium/9	Medium

Table 5.5-2. Jefferson County 2017 Mitigation Strategy

Goal	Objective	Project	Hazard	Jurisdiction	Benefit-Cost Ranking/Score	County Priority
Goal 3 – Reduce Impacts from Severe Weather and Drought	Objective 3.2 - Support Mapping/ Analysis/ Planning Projects to Reduce Impacts from Drought	Project 3.2.4 - Support water storage projects to enhance late summer flows.	Drought	County	Medium/6	Medium
	Objective 3.3 - Implement Structural Projects to Reduce Impacts from Drought	Project 3.3.1 - Create infiltration basins to capture early spring runoff.	Drought	County	Medium/7	High
Goal 4 - Reduce Impacts from Flooding and Dam Failure	Objective 4.1 - Implement Property Protection Projects to Reduce Impacts from Flooding	Project 4.1.1 - Install culverts and upgrade streets and roads for runoff management.	Flooding	County, Boulder, Whitehall	High/10	Medium
		Project 4.1.2 - Improve storm water systems in Boulder.	Flooding	Boulder	Medium/8	Medium
		Project 4.1.3 - Protect county/town infrastructure from flooding.	Flooding	County, Boulder, Whitehall	High/10	Medium
		Project 4.1.4 - Clear debris from stream channels, as needed.	Flooding	County, Boulder, Whitehall	Medium/9	High
		Project 4.1.5 - Evaluate feasibility of creating a flood channel to redirect a portion of Big Pipestone Creek to south side of Whitehall.	Flooding	County, Whitehall	Medium/9	High
		Project 4.1.6 - Promote personal responsibility to protect individual private property from flooding.	Flooding	County, Boulder, Whitehall	High/10	High
		Project 4.1.7 - Improve stormwater system in Whitehall.	Flooding	Whitehall	Medium/9	High
	Objective 4.2 - Implement Public Outreach and Education Projects to Reduce Impacts from Flooding and Dam Failure	Project 4.2.1 - Promote participation in the National Flood Insurance Program.	Flooding	County, Whitehall	High/10	Medium
		Project 4.2.2 - Educate people downstream of dams that they live in the inundation area.	Dam Failure	County, Whitehall	Medium/8	Medium
	Objective 4.3 - Implement Structural Projects to Mitigate Impacts from Flooding	Project 4.3.1 - Analyze bridge integrity and replace as necessary.	Flooding	County, Boulder, Whitehall	Medium/9	Medium
		Project 4.3.2 - Repair Renova irrigation structure on Jefferson River to allow natural channel migration and reduce potential flood damages.	Flooding	County	Medium/8	Medium
	Objective 4.4 - Implement Prevention Projects to Reduce Impacts from Flooding and Dam Failure	Project 4.4.1 - Consider providing Planning Board with dam inundation maps to use when reviewing subdivision applications.	Dam Failure	County, Whitehall	Medium/8	High

Table 5.5-2. Jefferson County 2017 Mitigation Strategy

Goal	Objective	Project	Hazard	Jurisdiction	Benefit-Cost Ranking/Score	County Priority
Goal 4 - Reduce Impacts from Flooding and Dam Failure	Objective 4.5 - Implement Mapping/ Analysis/ Planning Projects Reduce Impacts from Flooding and Dam Failure	Project 4.5.1 - Encourage DNRC/FEMA to update Jefferson County floodplain maps.	Flooding	County	Medium/7	High
		Project 4.5.2 - Ensure owners of high hazard dams update EAPs and provide copies to DES.	Dam Failure	County, Whitehall	Medium/8	High
Goal 5 - Reduce Impacts from Transportation Accidents	Objective 5.1 - Implement Projects to Prevent Impacts from Transportation Accidents	Project 5.1.1 - Encourage MDT to obtain electronic signs for Boulder Hill and Canyon through Basin to Elk Park.	Transportation Accidents	County	High/10	Medium
		Project 5.1.2 - Encourage MDT to look at game fences or underpass to avoid vehicle/game collisions.	Transportation Accidents	County	Medium/8	Medium
	Objective 5.2 - Implement Public Outreach and Education Projects to Reduce Impacts from Transportation Accidents	Project 5.2.1 - Obtain equipment and provide training for responding agencies.	Transportation Accidents	County, Boulder, Whitehall	Medium/9	High
Goal 6 – Reduce Impacts from Earthquakes	Objective 6.1 - Implement Property Protection Projects to Reduce Impacts from Earthquakes	Project 6.1.1 - Identify need for structural retrofits on schools and critical facilities.	Earthquakes	County, Boulder, Whitehall	High/10	Medium
		Project 6.1.2 - Implement non-structural projects in schools and critical facilities.	Earthquakes	County, Boulder, Whitehall	High/11	Medium
	Objective 6.2 - Implement Public Outreach and Education Projects to Reduce Impacts from Earthquakes	Project 6.2.1 - Conduct educational earthquake awareness and preparedness in schools and for the general public.	Earthquakes	County, Boulder, Whitehall	High/10	High
Goal 7 - Reduce Impacts from Terrorism and Violence	Objective 7.1 - Enhance Emergency Services Capabilities to Reduce Impacts from Terrorism	Project 7.1.1 - Continue armed intruder training.	Terrorism	County, Boulder, Whitehall	High/10	High
		Project 7.1.2 - Procure equipment and train to reduce impacts from terrorism.	Terrorism	County, Boulder, Whitehall	High/10	High
		Project 7.1.3 - Continue to train with DPHHS on strategic national stockpile.	Terrorism	County	High/10	Medium
	Objective 7.2 - Implement Property Protection Projects to Reduce Impacts from Terrorism	Project 7.2.1 - Install security fence around Boulder water tanks.		Boulder	Medium/9	High
Goal 8 - Reduce Impacts from Communicable Disease	Objective 8.1 - Implement Projects to Prevent Communicable Disease	Project 8.1.1 - Promote immunizations and disseminate information.	Communicable Disease	County, Boulder, Whitehall	High/10	High

Table 5.5-2. Jefferson County 2017 Mitigation Strategy

Goal	Objective	Project	Hazard	Jurisdiction	Benefit-Cost Ranking/Score	County Priority
Goal 8 - Reduce Impacts from Communicable Disease	Objective 8.1 - Implement Projects to Prevent Communicable Disease	Project 8.1.2 - Continue mosquito mitigation projects around the county.	Communicable Disease	County	Medium/8	High
	Objective 8.2 - Implement Public Outreach and Education Projects to Reduce Impacts from Communicable Disease	Project 8.2.1 - Support Public Health Departments public education programs on communicable diseases.	Communicable Disease	County, Boulder, Whitehall	High/10	High
Goal 9 - Reduce Impacts from All-Hazards	Objective 9.1 - Enhance Emergency Services Capabilities to Reduce Impacts from All Hazards	Project 9.1.1 - Recruit and train emergency response personnel.	All Hazards	County, Boulder, Whitehall	Medium/9	High
		Project 9.1.2 - Update templates for messaging system that could be used for transmission on radio stations (road reports, weather forecasts and conditions, emergency conditions and events, and public services).	All Hazards	County, Boulder, Whitehall	High/10	High
		Project 9.1.3 - Obtain self-start generators for FM radio antennas.	All Hazards	County, Boulder, Whitehall	High/10	Medium
		Project 9.1.4 - Obtain self-start generators for schools/shelters.	All Hazards	County, Boulder, Whitehall	Medium/9	Medium
		Project 9.1.5 - Enhance communications throughout County.	All Hazards	County	High/10	High
		Project 9.1.6 - Update local hazard communication plan that establishes protocol for providing information to residents.	All Hazards	County, Boulder, Whitehall	High/10	High
		Project 9.1.7 -Encourage citizens to register cell phones to receive 911 notifications.	All Hazards	County, Boulder, Whitehall	High/10	High
		Project 9.1.8 - Update resource list for emergency response.	All Hazards	County, Boulder, Whitehall	High/10	High
		Project 9.1.9 - Identify and develop emergency shelters within the County.	All Hazards	County, Boulder, Whitehall	High/10	High
		Project 9.1.10 - Update animal annex in EOP to include current animal rescue organizations.	All Hazards	County, Boulder, Whitehall	Medium/9	Medium

Table 5.5-2. Jefferson County 2017 Mitigation Strategy

Goal	Objective	Project	Hazard	Jurisdiction	Benefit-Cost Ranking/Score	County Priority
Goal 9 - Reduce Impacts from All-Hazards	Objective 9.1 - Enhance Emergency Services Capabilities to Reduce Impacts from All Hazards	Project 9.1.11 - Update EOC volunteer staff directory.	All Hazards	County, Boulder, Whitehall	High/10	High
		Project 9.1.12 - Assist special needs caregivers to develop plans for disaster preparedness.	All Hazards	County, Boulder, Whitehall	Medium/8	High
	Objective 9.2 - Implement Public Outreach and Education Projects to Reduce Impacts from All-Hazards	Project 9.2.1 - Promote disaster-related educational programs through the school system.	All Hazards	County, Boulder, Whitehall	Medium/9	High

Notes: DES =Disaster and Emergency Services; DNRC = Montana Department of Natural Resources and Conservation; DPHHS = Montana Department of Public Health and Human Services; EAP = Emergency Action Plan; EOC = Emergency Operations Center; EOP = Emergency Operations Plan; FEMA = Federal Emergency Management Agency; MDT = Montana Department of Transportation; WUI = Wildland Urban Interface.

Table 5.5-3. Jefferson County 2017 Mitigation Strategy – Implementation Details

Project	Jurisdiction	Responsible Agency / Department	Progress Made	Planned Activities	Schedule	Potential Funding Source
WILDFIRE MITIGATION PROJECTS						
Project 1.1.1 - Perform fuel mitigation on evacuation routes, initial attack roads, power lines, and communication sites in the WUI.	County	TCFWG, Headwaters RC&D	Completed projects include: Upper Jackson Creek (BLM), McClellan/Upper Warm Springs (Forest Service), Jefferson City 2 miles to north.	Priority areas include: Warm Springs Creek, Basin Area, Little Boulder area south of Boulder.	Ongoing	FEMA, BLM, USFS, DNRC, Private
Project 1.1.2 - Encourage creation of survivable space in current developments through coordinated landowner mitigation projects.	County	TCFWG, Rural Fire Districts	Completed projects include: Two-Chief project. Travis Creek area had several landowners complete projects.	Priority areas include: South Hills/Montana City areas, Clancy, and Jefferson City areas in north part of county and Whiskey Gulch in south.	Ongoing	FEMA, BLM, USFS, DNRC, Private
Project 1.1.3 - Perform fuel mitigation around historic sites (Comet, Elkhorn).	County	USFS, TCFWG	No progress to report.	Coordinate private, state, federal owners. Request that Elkhorn Restoration Committee take lead on this project.	Mid-term	FEMA, BLM, USFS, DNRC, Private
Project 1.1.4 - Perform fuel mitigation around the town of Basin and other vulnerable communities.	County	TCFWG, Headwaters RC&D	Nothing done in Basin. BLM and private landowners have done some work around Clancy, Montana City and Jefferson City.	Continue to promote work in Basin. Saddle Mountain to Interstate is another priority area (BLM), back side of Jack Mountain, Rader Creek, Cedar Hills Estate (Whitehall area).	Ongoing	FEMA, BLM, USFS, DNRC, Private
Project 1.1.5 - Collaborate with and assist with design of fuel mitigation on federal and state lands in Jefferson County.	County	TCFWG	Completed USFS projects include: Brooklyn Bridge area south from Unionville, Clancy-Unionville, Park Lake, Clancy and Montana City projects. See BLM projects above.	Priority areas include: North Elkhorns, South Hills, Warm Springs Creek, Strawberry, Shingle Butte, and Gruber Estates. Beaverhead-Deerlodge National Forest has other projects.	Ongoing	FEMA, BLM, USFS, DNRC, Private
Project 1.2.1 - Support the Tri-County FireSafe Working Group to assist private property owners.	County, Boulder, Whitehall	Rural Fire Council	Planning partners from Jefferson County, Boulder and Whitehall attend monthly meetings.	Continue same.	Ongoing	County resources
Project 1.2.2 - Support volunteer fire department fire prevention activities.	County, Boulder, Whitehall	Rural Fire Council	TCFSWG does this through monthly meetings and the outreach activities listed below.	Continue same.	Ongoing	County resources
Project 1.2.3 - Provide outreach to citizens on wildfire mitigation techniques.	County, Boulder, Whitehall	TCFWG	TCFSWG has sponsored TV commercials, radio PSAs, and newspaper advertisements as well as holding workshops. Saturday workshops were well attended.	Continue same.	Ongoing	FEMA, BLM, NFPA
Project 1.3.1 - Collaborate with state and federal partners to maintain initial attack roads and install culverts where needed.	County	County Road Dept., Private	County Road Dept. may have details on completed projects.	Tizer Road, Wicks going onto Occidental Plateau, Bluebell,	Long-term	FEMA, County resources

Table 5.5-3. Jefferson County 2017 Mitigation Strategy – Implementation Details

Project	Jurisdiction	Responsible Agency / Department	Progress Made	Planned Activities	Schedule	Potential Funding Source
Project 1.4.1 - Encourage Planning Board to adopt subdivision regulations that require vegetation management plans to create and maintain survivable space, roof covering requirements, and fire protection covenants.	County	County Planning Dept.	Subdivision regulations are currently being worked on.	Adopt subdivision regulations that have been updated to include WUI requirements.	Short-term	County resources
Project 1.5.1 - Provide adequate water supply to create water sources for fighting fires in current and future developments.	County	Rural Fire Council, County	No progress made. There hasn't been much subdivision activity in the past 5 years.	Subdivision regulation update will provide for water supplies in new subdivisions.	Long-term	FEMA, DNRC
Project 1.5.2 - Upgrade the water supply in communities as needed to more effectively assist with wildfire suppression.	County	Water Boards, Homeowners Associations, Towns	DNRC has pre-identified water supplies for fire fighters. County fire depts. have put in dry hydrants.	Need to find money to do put in water supplies. See project 1.5.3.	Mid-term	FEMA, DNRC
Project 1.5.3 - Work with Planning Department to create legal basis for Improvement Districts that would assess impact fees on existing subdivisions to fund development of fire protection water supplies.	County	Commissioners, Planning Dept.	New Project for 2017 Plan.	Create agenda item for Commissioners, County Planner, and County Attorney to discuss. Seek public input. Make changes to regulations.	Mid-term	County resources
Project 1.6.1 - Continue to update and maintain fire hazard mapping project as well as compilation of completed fuel mitigation projects.	County	TCFWG, Headwaters RC&D	Updated fuel mapping was completed for 2015 update to Tri-County CWPP. Ongoing	Develop map of completed fuel mitigation projects. PDM project will compile completed projects.	Ongoing	County resources
HAZARDOUS MATERIAL INCIDENT MITIGATION PROJECTS						
Project 2.1.1 - Provide outreach to schools on how to limit exposure during a hazardous material incident.	County, Boulder, Whitehall	DES, LEPC, Local Fire Depts.	All hazard discussion with students during annual fire prevention assembly.	Tie haz-mat into fire prevention classes. Recommend haz-mat be part of schools EOP.	Ongoing	County resources
Project 2.1.2 - Provide information to citizens on hazardous material incident awareness.	County, Boulder, Whitehall	DES, LEPC	Discussed at LEPC meeting but didn't implement outreach project.	Push out via social media. DES will continue to participate in Whitehall Health & Safety Fair.	Ongoing	County resources
Project 2.2.1 - Continue providing awareness training to emergency responders.	County, Boulder, Whitehall	DES	Annual training for VFD, Solid Waste, Public Health, Sheriff, Ambulance, Roads, Boulder Police. HMEP grant received for 3 years.	Continue same.	Ongoing	State of Montana
Project 2.2.2 - Explore alternate routes for haz-mat traffic.	County, Boulder, Whitehall	DES	New project for 2017 Plan.	Determine existing routes for haz-mat deliveries. Consider whether reroutes could avoid schools or other vulnerable facilities.	Short-term	County resources

Table 5.5-3. Jefferson County 2017 Mitigation Strategy – Implementation Details

Project	Jurisdiction	Responsible Agency / Department	Progress Made	Planned Activities	Schedule	Potential Funding Source
SEVERE WEATHER AND DROUGHT MITIGATION PROJECTS						
Project 3.1.1 - Promote National Weather Service Severe Weather Awareness Week.	County, Boulder, Whitehall	DES, LEPC, NWS	No progress to report.	Push out NWS messages via social media and on FM radio.	Ongoing	County resources
Project 3.1.2 - Attempt to become a National Weather Service Storm Ready Community.	County, Boulder, Whitehall	DES, NWS	Scheduled weather spotter training in 2015 and no one came.	Push out NWS message via social media. Attempt to hold another weather spotter training.	Ongoing	County resources
Project 3.1.3 - Provide public outreach on hazardous tree mitigation to enhance life safety and reduce property damage.	County, Boulder, Whitehall	DES	No progress to report. Jefferson County had fatality in 2016 from falling tree during winter.	Push out info via social media on hazardous tree maintenance. Public info in fire dept. newsletters and local newspapers.	Ongoing	County resources
Project 3.2.1 - Support drought programs implemented through the Conservation District, FSA, NRCS, MSU Extension, DNRC and Jefferson River Water Council.	County	Extension Office	New project for 2017 Plan	Push out info via social media on drought to support other programs. Equip cost shared program under NRCS	County resources	County resources
Project 3.2.2 - Pursue Drought Resiliency Planning Committee and Drought Coordinator position for Jefferson County.	County	DES	New project for 2017 Plan	January 2017 put out RFP for coordinator position. Develop drought resiliency plan through committee and series of meetings.	County resources, DNRC, JRWC	County resources, DNRC, JRWC
Project 3.2.3 - Support initiative of prescribed burning program to reduce conifer encroachment which impacts water availability.	County	Elected officials	New project for 2017 Plan	Encourage state to provide insurance for prescribed burning. Review results of pilot project to be conducted at Whiskey Gulch in Jefferson County.	County resources, DNRC, NRCS, JRWC	County resources, DNRC, NRCS, JRWC
Project 3.2.4 - Support water storage projects to enhance late summer flows.	County	Extension Office	New project for 2017 Plan	Support projects that will retain water in spring and release later in summer. Provide input on issues such as liability/cost/water rights. Consider promoting flood irrigation in Boulder Valley which will recharge groundwater early in spring.	County resources, DNRC, NRCS, JRWC	County resources, DNRC, NRCS, JRWC
Project 3.3.1 - Create infiltration basins to capture early spring runoff.	County	UJRWC, LJRWC	New project. Project identified by MBMG study.	Identify location. Liability and Water Rights need to be investigated. Divert water where study has identified recharge is happening.	Long-term	County resources, DNRC, NRCS, JRWC

Table 5.5-3. Jefferson County 2017 Mitigation Strategy – Implementation Details

Project	Jurisdiction	Responsible Agency / Department	Progress Made	Planned Activities	Schedule	Potential Funding Source
FLOODING & DAM FAILURE						
Project 4.1.1 - Install culverts and upgrade streets and roads for runoff management.	County, Boulder, Whitehall	City & County Road Depts.	Beaver problem in Whitehall is an ongoing mitigation effort. South of Boulder, Highway 69 was elevated and new bridges and culverts installed improve drainage. Culverts replaced above Clancy Creek school.	Damaged culvert needs to be replaced where Highway 282 crosses under I-15 at Haab Lane. County Road Dept. may have other ideas for planned projects.	Mid-term	County and City/Town resources, FEMA
Project 4.1.2 - Improve storm water systems in Boulder.	Boulder	City Road Dept.	Boulder maintains storm drainage systems which reduces drainage problems.	Update system as needed.	Mid-term	City resources
Project 4.1.3 - Protect county/town infrastructure from flooding.	County, Boulder, Whitehall	County & City Road Depts.	Wastewater plant upgraded in Boulder. Lagoons in floodplain are no longer needed. Whitehall Museum flooding should be mitigated by Kountz bridge project.	Determine whether Whitehall pump house is at risk of flooding and what can be done.	Mid-term	County, City/Town resources, FEMA
Project 4.1.4 - Clear debris from stream channels, as needed.	County, Boulder, Whitehall	County, NRCS	Metal bridge that was slipping into river taken out west of Boulder. Town of Whitehall removed beaver dams on Pipestone Creek twice in 2016. In 2014, debris removed on Prickly Pear Creek by Clancy Fire Hall.	Continue same, as needed.	Ongoing	County resources, NRCS
Project 4.1.5 - Evaluate feasibility of creating a flood channel to redirect a portion of Big Pipestone Creek to south side of Whitehall.	County, Whitehall	JRWC	JRWG met with MDT to see if there is possibility of constructing an emergency channel south of Whitehall.	Hire contractor to develop conceptual design to see whether project is feasible. Coordinate with Town of White, MDT, and landowners. Prepare FEMA grant for funding.	Mid-term	FEMA, County
Project 4.1.6 - Promote personal responsibility to protect individual private property from flooding.	County, Boulder, Whitehall	DES	New project for 2017	Push out info via social media and website on availability of sand bags.	Ongoing	County resources
Project 4.1.7 - Improve stormwater system in Whitehall.	Whitehall	Whitehall Public Works	New project for 2017	Whitehall Public Works has specific projects.	Mid-term	Town resources, grants
Project 4.2.1 - Promote participation in the National Flood Insurance Program.	County, Whitehall	DES	County/City/Town have FEMA brochures available for public on NFIP.	Continue same.	Ongoing	
Project 4.2.2 - Educate people downstream of dams that they live in the inundation area.	County, Whitehall	DES	DNRC held educational meeting with residents downstream of Delmoe Lake dam.	Continue same.	Ongoing	

Table 5.5-3. Jefferson County 2017 Mitigation Strategy – Implementation Details

Project	Jurisdiction	Responsible Agency / Department	Progress Made	Planned Activities	Schedule	Potential Funding Source
Project 4.3.1 - Analyze bridge integrity and replace as necessary.	County, Boulder, Whitehall	City & County Road Depts., MT Dept. Transportation	Kountz bridge on Jefferson River is bid out to be replaced. Highway 69 south of Boulder had several bridges replaced in 2016. Cataract Creek bridge replaced in 2015.	Bridge replacing culvert is scheduled for Big Pipestone Creek south of Whitehall.	Ongoing	FEMA, MDT, County resources
Project 4.3.2 - Repair Renova irrigation structure on Jefferson River to allow natural channel migration and reduce potential flood damages.	County	JRWC	New project for 2017. County hired consultant to work with irrigators to determine feasibility of project.	Review outcome of consultant report and take appropriate actions.	Mid-term	County resources, FEMA
Project 4.4.1 - Consider providing Planning Board with dam inundation maps to use when reviewing subdivision applications.	County	County Planning	No progress to report.	Provide Planning Team with inundation map used in 2017 PDM analysis. Update map when new EAPs received.	Short-term	County resources
Project 4.5.1 - Encourage DNRC/FEMA to update Jefferson County floodplain maps.	County	County Planning	New project for 2017. Jefferson County has been asking DNRC and FEMA for updated flood maps for 15 to 20 years.	Continue to request that FEMA complete DFIRMs for Jefferson County.	Short-term	County resources
Project 4.5.2 - Ensure owners of high hazard dams update EAPs and provide copies to DES.	County, Whitehall	DES	New project for 2017. DES Coordinator is missing several EAPs and others are out dated.	Determine which EAPs are missing or outdated. Coordinate with DNRC on missing EAPs. Request dam owners update outdated EAPs.	Short-term	County resources
TRANSPORTATION ACCIDENT MITIGATION PROJECTS						
Project 5.1.1 - Encourage MDT to obtain electronic signs for Boulder Hill and Canyon through Basin to Elk Park.	County	DES	New Project for 2017 Plan	Draft letter for Commissioners to send to MDT. Follow-up with meeting to discuss.	Mid-term	County resources
Project 5.1.2 - Encourage MDT to look at game fences or underpass to avoid vehicle/game collisions.	County	DES	New Project for 2017 Plan	Draft letter for Commissioners to send to MDT. Follow-up with meeting to discuss.	Long-term	County resources
Project 5.2.1 - Obtain equipment and provide training for responding agencies.	County, Boulder, Whitehall	DES, VFD	New Project for 2017 Plan	Determine what equipment is needed. Look for funding opportunities. Network with state and other counties on training schedule.	Ongoing	County resources
EARTHQUAKE MITIGATION PROJECTS						
Project 6.1.1 - Identify need for structural retrofits on schools and critical facilities.	County, Boulder, Whitehall	DES, School District, County, City/Town Public Works	No progress to report.	Look for funding for Courthouse, and Borden's Hotel (alternate EOC) to do structural evaluation. Boulder City Hall.	Long-term	FEMA, Schools, County & City/Town resources

Table 5.5-3. Jefferson County 2017 Mitigation Strategy – Implementation Details

Project	Jurisdiction	Responsible Agency / Department	Progress Made	Planned Activities	Schedule	Potential Funding Source
Project 6.1.2 - Implement non-structural projects in schools and critical facilities.	County, Boulder, Whitehall	DES, School District, City/Town Public Works	Safety coordinator with County has reviewed county facilities. All recommended changes were implemented.	Provide training to school/city/ town maintenance personnel on actions needed. Conduct inspections and prepare action list. Implement actions and report results.	Mid-term	FEMA, County resources, City/Town resources
Project 6.2.1 - Conduct educational earthquake awareness and preparedness in schools and for the general public.	County, Boulder, Whitehall	DES, School District	DES Great Montana Shakeout each year via direct contact with schools and County social media.	Get Whitehall and Boulder involved.	Ongoing	County resources
TERRORISM MITIGATION PROJECTS						
Project 7.1.1 - Continue armed intruder training.	County, Boulder, Whitehall	County Sheriff's office	New Project for 2017 Plan. Sheriff's office does training with schools (armed intruder) and teachers. Just did MT City. Last year did Boulder. Cardwell School, Clancy done.	Conduct training in Whitehall during spring 2017.	Ongoing	County resources
Project 7.1.2 - Procure equipment and train to reduce impacts from terrorism.	County, Boulder, Whitehall	County Sheriff's office	New Project for 2017 Plan	Look for funding for bullet proof vests. Be aware of when large events come to the county. Implement "Stop the Bleed" program.	Short-term	County resources
Project 7.1.3 - Continue to train with DPHHS on strategic national stockpile.	County	County Public Health	New Project for 2017 Plan	Network with State on training schedule. Participate in training and provide outcome/after action report to LEPC.	Short-term	County resources
Project 7.2.1 - Install securityfence around Boulder water tanks.	Boulder	City Public Works	Strengthened locking system on tank.	Secure funding to erect fence.	Mid-term	City resources
COMMUNICABLE DISEASE MITIGATION PROJECTS						
Project 8.1.1 - Promote immunizations and disseminate information.	County, Boulder, Whitehall	County Public Health	New Project for 2017 Plan.	Conduct mass immunization clinics at schools. Request that Blue Cross-Blue Shield bus brought to schools to assist with clinic.	Ongoing	County resources
Project 8.1.2 - Continue mosquito mitigation projects around the county.	County	County Public Health, Mosquito Districts	New Project for 2017 Plan	Look for funding so county's three mosquito district can continue spraying problem areas. Provide outreach on threat of Zika virus via social media.	Ongoing	County resources
Project 8.2.1 - Support Public Health Departments public education programs on communicable diseases.	County, Boulder, Whitehall	County Public Health	New Project for 2017 Plan	Implement social media campaign about seasonal risks and throughout year. Promote Health Fair in Boulder.	Ongoing	County resources

Table 5.5-3. Jefferson County 2017 Mitigation Strategy – Implementation Details

Project	Jurisdiction	Responsible Agency / Department	Progress Made	Planned Activities	Schedule	Potential Funding Source
ALL-HAZARD MITIGATION PROJECTS						
Project 9.1.1 - Recruit and train emergency response personnel.	County, Boulder, Whitehall	Ambulance & Fire Services	Fire Council purchased banners to advertise that volunteers are needed.	Continue same. Departments use social media and open houses to inform public.	Ongoing	VFD budgets
Project 9.1.2 - Update templates for messaging system that could be used for transmission on radio stations (road reports, weather forecasts and conditions, emergency conditions and events, and public services).	County, Boulder, Whitehall	DES	Templates are included in Emergency Operations Plan.	Update as needed.	Short-term	County resources
Project 9.1.3 - Obtain self-start generators for FM radio antennas.	County, Boulder, Whitehall	DES	Generators have been purchased.	Install generators. Funding has been received via mill levy that was recently passed.	Long-term	County resources
Project 9.1.4 - Obtain self-start generators for schools/shelters.	County, Boulder, Whitehall	DES	Have been in touch with Boulder and Whitehall high schools regarding their interest.	Look into Homeland Security grants for funding. Schools will need to dedicate budget to maintain equipment.	Long-term	County resources, Schools
Project 9.1.5 - Enhance communications throughout County.	County	County Sheriff's Office	Basin got a new repeater.	Identify areas with limited communication and work to enhance. Update radios from analog to digital.	Short-term	County resources
Project 9.1.6 - Update local hazard communication plan that establishes protocol for providing information to residents.	County, Boulder, Whitehall	DES	Communication Plan is part of Emergency Operations Plan.	Update as needed.	Mid-term	County resources
Project 9.1.7 -Encourage citizens to register cell phones to receive 911 notifications.	County, Boulder, Whitehall	DES	New Project for 2017 Plan	Push info out via social media and on county website.	Short-term	County resources
Project 9.1.8 - Update a resource list for emergency response.	County, Boulder, Whitehall	DES, LEPC	Resource list in Emergency Operations Plan is outdated.	Update as needed.	Ongoing	County resources
Project 9.1.9 - Identify and develop emergency shelters within the County.	County, Boulder, Whitehall	DES, County Public Health, ARC	Shelter list has been updated.	Go through shelter designation process with ARC.	Short-term	County resources
Project 9.1.10 - Update animal annex in EOP to include current animal rescue organizations.	County, Boulder, Whitehall	DES	New Project for 2017 Plan	Conduct research to update annex. Incorporate new content. Present to Commissioners for approval.	Mid-term	County resources
Project 9.1.11 - Update EOC volunteer staff directory.	County, Boulder, Whitehall	DES	New Project for 2017 Plan	Identify individuals interested in volunteering in the EOC. Provide training. Keep list current with contact info.	Short-term	County resources

Table 5.5-3. Jefferson County 2017 Mitigation Strategy – Implementation Details

Project	Jurisdiction	Responsible Agency / Department	Progress Made	Planned Activities	Schedule	Potential Funding Source
Project 9.1.12 - Assist special needs caregivers to develop plans for disaster preparedness.	County, Boulder, Whitehall	DES	New Project for 2017 Plan	Coordinate with caregivers and review their existing plans. Put Plan template on website. Provide input if plans deficient.	Short-term	County resources
Project 9.2.1 - Promote disaster-related educational programs through the school system.	County, Boulder, Whitehall	DES, School District	Continues to be done at fire department level.	Continue same.	Ongoing	County resources, Schools, VFD budgets
Notes: ARC = American Red Cross; BLM = Bureau of Land Management; CWPP = Community Wildfire Protection Plan; DES = Disaster and Emergency Services; DNRC = Montana Department of Natural Resources and Conservation; EAP = Emergency Action Plan; EOC = Emergency Operations Center; EOP = Emergency Operations Plan; FEMA = Federal Emergency Management Agency; FSA = Farm Service Agency; HMEP = Hazardous Material Emergency Preparedness; JRWC = Jefferson River Water Council; LEPC = Local Emergency Planning Committee; LJRWC = Lower Jefferson River Water Council; MBMG = Montana Bureau of Mines and Geology; MDT = Montana Dept. of Transportation; MSU = Montana State University; NFIP = National Flood Insurance Program; NFPA = National Fire Protection Agency; NRCS = Natural Resources Conservation Service; NWS = National Weather Service; PDM = Pre-Disaster Mitigation; PSA = Public Service Announcement; RC&D = Resource Conservation and Development; TCFSWG = Tri-County FireSafe Working Group; UJRWC = Upper Jefferson River Water Council; USFS = U.S. Forest Service; VFD = Volunteer Fire Department; WUI = Wildland Urban Interface						

SECTION 6. PLAN MAINTENANCE PROCEDURES

The plan maintenance section details the formal process that will ensure that the Jefferson County PDM Plan remains an active and relevant document. The maintenance process includes a schedule for monitoring and evaluating the plan and producing a plan revision every five years. The plan can be revised more frequently than five years if the conditions under which it was developed change significantly (e.g. a major disaster occurs and projects are accomplished and/or new projects need to be identified, or funding availability changes). This section also describes how Jefferson County will monitor the progress of mitigation activities and be incorporated into existing planning mechanisms. The final section describes how the Jefferson County will integrate public participation throughout the plan maintenance process.

6.1 Monitoring, Evaluating and Updating the Plan

The evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, if the Plan goals are being reached, and whether changes are needed.

6.1.1 2011 PDM Plan

The 2011 PDM Plan was monitored and evaluated occasionally at LEPC meetings since it was updated in 2011. The entire plan was reviewed and hazard priorities and mitigation projects discussed, as needed. The DES Coordinator admits that the PDM Plan wasn't a document that was as high on the LEPC agenda but he aims to change that. The LEPC felt the hazard ranking in the 2011 PDM Plan was a bit askew, but it was never formally changed. The plan was kept alive by accomplishing some of the mitigation projects. Mitigation projects completed during this period are shown in *Section 5.1*.

6.1.2 2017 PDM Plan

The updated PDM Plan should be reviewed at meetings of the LEPC. A different hazard profile should be reviewed quarterly by the LEPC. The plan review should consider any new hazards and vulnerabilities as well as document completed mitigation projects, identify new mitigation projects and evaluate mitigation priorities. The review should determine whether a plan update is needed prior to the required five-year update.

The Jefferson County DES Coordinator will be responsible for ensuring the PDM Plan review is on the agenda at the LEPC meetings so that applicability of the plan can be evaluated. The DES Coordinator should prepare a status report summarizing the outcome of the plan review and the minutes should be made available to interested stakeholders and kept in a permanent file designated for the next (2022) PDM Plan update.

The PDM Plan will also be evaluated and revised following any major disasters, to determine if the recommended actions remain relevant and appropriate. The risk assessment will also be revisited to see if any changes are necessary based on the pattern of disaster damages. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

Three years after adoption of the PDM Plan, the Jefferson County DES Coordinator may decide to apply for a planning grant through FEMA to start the 2022 PDM Plan update. Upon receipt of funding, the County will solicit bids in accordance with applicable contracting procedures and hire a contractor to assist with the project. The proposed schedule for completion of the plan update is one year from award of a contract, to coincide with the five-year adoption date of the 2017 PDM Plan Update.

The Jefferson County DES Coordinator will be responsible for the plan update. Before the end of the five-year period, the updated plan will be submitted to FEMA for approval. When concurrence is received that the updated plan complies with FEMA requirements, it will be submitted to the Jefferson County Board of County Commissioners, Boulder City Council, and Whitehall Town Council for adoption. The DES Coordinator will send an e-mail to individuals and organizations on the stakeholder list to inform them that the updated plan is available on the County website.

As part of the next PDM update, FEMA recommends that the story of mitigation for each jurisdiction be told describing success stories as well as challenges with implementation. In a direct, easily accessible method, an explanation should be given whether each project from the 2017 plan was implemented. As part of the next Plan update, the bulk of the Planning Team's time should be spent developing action plans for each mitigation strategy, i.e. really think through the steps that would be required for implementing the mitigation actions rather than updating the risk assessment.

6.2 Monitoring Progress of Mitigation Activities

The process for monitoring and evaluating mitigation projects is the responsibility of the LEPC, an organization comprised of individuals from Jefferson County, Boulder, and Whitehall local government departments, emergency response entities, local businesses, and non-profit organizations who meet on a regular basis.

6.2.1 2011 PDM Plan

Since development of the 2011 PDM Plan, several mitigation projects were completed in Jefferson County while a number of other projects are on-going and will continue through the next planning period. Completed projects are identified in *Section 5.1*.

The Jefferson County DES Coordinator has monitored completion of most of these activities; however, the initiation, status, and completion of mitigation projects was not documented as set forth in the 2011 PDM Plan. Each department or organization generally monitors the completion of mitigation projects under their purview; the Tri-County FireSafe Working Group monitors wildfire projects; and, Jefferson County Public Works Department monitors bridge and culvert upgrades and infrastructure projects within county. In addition to completed projects from the 2011 PDM Plan, the Jefferson County Emergency Operations Plan was updated in 2011 and hazard-specific annexes were reviewed and revised.

The Jefferson River Watershed Council has been instrumental in accomplishing the coordination, planning, and oversight of flood mitigation projects in Whitehall, as outlined in the 2011 PDM Plan.

6.2.2 2017 PDM Plan

The LEPC will review the mitigation goals, objectives, and activities to ensure progress is being made. They will evaluate the feasibility of the mitigation projects, monitor resources, budgets, and schedules, and document project completion. This group will provide a venue for reporting and accountability.

Minutes should be prepared from these meetings and should be distributed to interested stakeholders as well as kept in a permanent file for the next PDM Plan update (2022). Agencies and organizations "assigned" responsibility for various aspects of the mitigation strategy will have the opportunity to coordinate with the LEPC on challenges, success and opportunities.

The information that the LEPC shall be expected to document, as needed and appropriate, include:

- Any grant applications filed on behalf of any of the participating jurisdictions;
- Hazard events and losses occurring in their jurisdiction;
- Progress on the implementation of mitigation actions, including efforts to obtain outside funding;
- Obstacles or impediments to implementation of actions;
- Additional mitigation actions believed to be appropriate and feasible; and
- Public and stakeholder input.

Mitigation project evaluations will assess whether:

- Goals and objectives address current and expected conditions.
- The nature or magnitude of the risks has changed.
- Current resources are appropriate for implementing the PDM Plan and if different or additional resources are now available.
- Actions were cost effective.
- Schedules and budgets are feasible.
- Implementation problems, such as technical, political, legal or coordination issues with other agencies are presents.
- Outcomes have occurred as expected.
- New agencies/departments/staff should be included.

Individual projects will be monitored by the department implementing the project or the grant. Generally, HMGP and PDMC projects will be monitored by the DES Coordinator and any National Fire Plan projects or Community Assessment Agreements will be monitored by the Tri-County FireSafe Working Group, U.S. Forest Service, BLM and/or DNRC. Each organization will track projects through a central database and issue quarterly reports to federal agencies.

The PDM Planning Team will continually observe the processes for implementation of the mitigation projects. By monitoring project implementation, the Planning Team will then be able to evaluate them at the time of the plan update and determine if any changes are needed.

Jefferson County may want to consider measuring their mitigation success by participating in the STAR Community Rating System. Local leaders can use the STAR Community System to assess how sustainable they are, set goals for moving ahead and measure progress along the way. To get started, go to http://starcommunities.org/get-started.

6.3 Implementation through Existing Programs

Jefferson County will have the opportunity to implement hazard mitigation projects through existing programs and procedures through plan revisions or amendments. The PDM Plan will be incorporated into the plans, regulations and ordinances as they are updated in the future or when new plans are developed. **Table 6.3-1** presents a summary of existing plans and ordinances and how integration of mitigation projects will occur.

A summary of how the PDM Plan can be integrated into the legal framework is presented below:

- Partner with other organizations and agencies with similar goals to promote building codes that are more disaster resistant on the State level.
- Develop incentives for local governments, citizens, and businesses to pursue hazard mitigation projects.
- Allocate County resources and assistance for mitigation projects.

  Partner with other organizations and agencies in northwestern Montana to support hazard mitigation activities.

Table 6.3-1. Implementation of Mitigation into Existing Plans and Codes

Type	Name	Integration Technique
Plans		
Emergency Operations	Jefferson County Emergency Operations Plan, 2011	Integrated by reference in PDM Plan.
	Emergency Action Plan, Park Lake Dam	Dam failure mitigation projects should be integrated in EAPs when these documents are revised.
	Emergency Action Plan, Delmoe Lake Dam	
	Emergency Action Plan, Chessman Saddle and Main Dams, Lewis & Clark County	
	Emergency Action Plan, Ruby Dam, Madison County	
	Emergency Action Plan, Clark Canyon Dam, Beaverhead Co.	
	Emergency Action Plan, Willow Creek Dam, Madison Co.	
Growth Policies	Jefferson County Growth Policy, 2009	Integration of mitigation strategies will occur when growth policies are revised.
	Whitehall Growth Policy, 2009	
	Boulder Growth Policy	
Wildfire Mitigation	Tri-County Regional Community Wildfire Protection Plan, 2015	Wildfire mitigation projects will be incorporated when plan is revised.
Economic Development	Southwestern Montana Comprehensive Economic Development Strategy 2012-2017	Integration of mitigation strategies will occur, as appropriate, when plan is revised.
Severe Weather	Jefferson River Water Council Drought Management Plan, 2012	Mitigation projects associated with drought will be integrated during plan revision.
Flooding	Flood Insurance Study, Town of Whitehall, Jefferson County, 2007	Mitigation projects associated with flooding will be integrated into plans during revision.
	Flood Plain Management Study, Big Pipestone Creek, Jefferson County, 1984	
	Jefferson River Watershed Restoration Plan, 2010	

Table 6.3-1. Implementation of Mitigation into Existing Plans and Codes

Type	Name	Integration Technique
Codes, Regulations & Ordinances		
Zoning	North Jefferson County Zoning Regulations, 2013	Hazard areas will be incorporated into revisions of zoning ordinances.
	Milligan Canyon/Boulder Valley Zoning Regulations, 2004	
	Sunlight Zoning District Regulations, 2010	
	Boulder Zoning Regulations, 2008	
	Whitehall Zoning Regulations, 1994	
Subdivisions	Jefferson County Subdivision Regulations, 1996	Hazard areas will be incorporated into revisions of subdivision regulations.
Floodplain	Jefferson County Floodplain Regulations	Flood mitigation projects will be incorporated into revisions of floodplain regulations.
	Whitehall Floodplain Regulations	

Jefferson County uses a Growth Policy to guide development. The Town of Whitehall also has a Growth Policy but the City of Boulder does not. Typically, a Growth Policy will address hazards; specifically, that life and property be protected from natural disasters and man-caused hazards. Mitigation goals in the PDM Plan will be recommended for incorporation into future revisions of these growth policies to ensure that high-hazard areas are being considered for low risk uses.

To ensure that the requirements of the PDM Plan are incorporated into other planning mechanisms and remain an on-going concern in Jefferson County, job descriptions of various staff will be enhanced to include a mitigation component. The job descriptions of Jefferson County Planner will be augmented to include involvement in the LEPC. Participation in this group will provide an awareness of new and on-going mitigation initiatives for the purpose that they be integrated into plans, codes and regulations during revision. The job description of the GIS Manager, will include responsibilities for management and update of the spatial data compiled for the hazard analysis including coordinates of critical facilities and digital floodplain, inundation, and wildfire layers so this data can be integrated into other planning efforts. The job description of the DES Coordinator will include responsibilities for implementing outreach activities for risk reduction in the County, coordinating with the Board of County Commissioners to secure funding for mitigation projects, ensure mitigation projects are implemented, and updating the PDM Plan. The DES Coordinator will also be responsible for maintaining permanent master file for the PDM planning process, which will include damage figures from hazard events, records of mitigation projects, and notes/minutes from relevant meetings.

Meetings of the Board of Commissioners will provide an opportunity for the Jefferson County DES Coordinator to report back on the progress made on the integration of mitigation planning elements into County planning documents and procedures.

6.4 Continued Public Involvement

Jefferson County is dedicated to involving the public directly in review and updates of the PDM Plan. The public will have many opportunities to provide feedback about the plan. Hard copies of the plan will be kept at appropriate Jefferson County, Boulder and Whitehall municipal offices. An electronic copy of the plan will be available on the Jefferson County website. The existence and location of plan hard copies will be publicized on the Jefferson County website. *Section 2.0* includes the address and

the phone number of the Jefferson County DES Coordinator who will be responsible for keeping track of public comments on the plan.

The public will be invited to meetings of the LEPC when the PDM Plan is discussed. The meetings will provide the public a forum for which they can express concerns, opinions, or ideas about the plan. The DES Coordinator will be responsible for using County resources to publicize the public meetings and maintain public involvement through the newspapers, radio and Internet. Social media will be used to stay in touch with the public.

The PDM Planning Team will continually observe the processes for public outreach. By monitoring these activities, the Planning Team will then be able to evaluate them at the time of the plan update and determine if any changes are needed.

SECTION 7. REFERENCES

Billings, Molly. 1997. The Influenza Pandemic of 1918. URL: http://www.stanford.edu/group/virus/uda/

Boulder Growth Policy, no date.

Brainerd, Elizabeth and Mark V. Siegler. 2002. The Economic Effects of the 1918 Influenza Epidemic.

Centers for Disease Control and Prevention (CDC), 2011. Description of communicable disease. http://www.cdc.gov/DiseasesConditions/index.html

Centers for Disease Control (CDC), 2001. EPI-AID Investigations of Health Effects Associated with Forest Fire Smoke Exposure, U.S., 1999-2001. PowerPoint Presentation by Josh Mott, NCEH, CDC.

Doser, D.I., 1989. Source Parameters of Montana Earthquakes (1925-1964) and Tectonic Deformation in the Northern Intermountain Belt: Bulletin of the Seismological Society of America, v. 79, no. 1

Federal Aviation Administration, 2016. http://www.faa.gov/data_research/accident_incident/

Federal Emergency Management Agency (FEMA), 2016. Climate Change and Hazard Mitigation.

Federal Emergency Management Agency (FEMA), 2016. Declared Disasters. https://www.fema.gov/disasters/grid/year)

Federal Emergency Management Agency (FEMA), 2016. National Flood Insurance Program Statistics. http://bsa.nfipstat.fema.gov/reports/1011.htm#MTT; http://bsa.nfipstat.fema.gov/reports/1040.htm#30

Federal Emergency Management Agency (FEMA), 2014. Hazus-MH: Earthquake Event Report. Canyon Ferry Scenario. M6.7 Canyon Ferry ShakeMap. October 2, 2014.

Federal Emergency Management Agency (FEMA), 2013a. Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, January 2013

Federal Emergency Management Agency (FEMA), 2013b. Integrating Hazard Mitigation into Local Planning, March 2013.

Federal Emergency Management Agency (FEMA), 2013c. Local Mitigation Planning Handbook, March 2013.

Federal Emergency Management Agency (FEMA), 2010. HAZUS Flood Data. Jesse Rozelle, Bismarck, North Dakota. March, 2010.

Federal Emergency Management Agency (FEMA), 2007. Flood Insurance Study. Town of Whitehall, Jefferson County, Montana. 300120V000A

Federal Emergency Management Agency (FEMA), no date. Identifying Mitigation Actions and Implementing Strategies (FEMA 386-3).

Federal Railroad Administration. 2016. Safety Data. http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/incabbr.aspx; http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/gxrabbr.aspx

Gilmore, 2013. Forecasting Civil Conflict under Different Climate Change Scenarios. University of Maryland. U.S. Department of Defense Contract.

Great West Engineering, 2013. Jefferson County, Big Pipestone Creek General Procedures and Findings Report. Revised February 2013.

Harvard School of Public Health, 2016. Center for Health and Global Environmental. http://www.chgeharvard.org/topic/climate-change-and-infectious-disease

Independent Record, 2016. *Wildfire Smoke Affecting Montana*, August 21, 2016.

Independent Record, 2015. *Judge Urges Settlement in Lincoln-area Mining Dispute*, September 4, 2015.

Independent Record, 2011. *Flooding Reported Near Basin*, June 7, 2011.

Independent Record, 2011. *Dam a Factor in Surge of Water in East Helena,* June 8, 2011.

Infectious Disease Society of America (IDSA), 2016. Influenza statistics.

Jefferson County, 2016. Tier II Hazardous Material Reporters.

Jefferson County Disaster and Emergency Services (DES), 2016. Tier II Hazardous Material Reporters.

Jefferson County Growth Policy, 2009.

Jefferson County Subdivision Regulations. 1996.

Jefferson River Watershed Council. 2012. Drought Management Plan.

Jefferson River Watershed Council. 2010. Watershed Restoration Plan.

Lewis & Clark County Disaster and Emergency Services (DES), 2016. Fuel Mitigation Accomplishments.

Missoulian, 1925. *Milwaukee Slides Will Cost Railway Million to Remove, Company Recruits Laborers Wherever Available; Lake Formed by Damming Creek Retards Work*, July 1, 1925

Montana Census and Economic Information Center (CEIC). 2016. http://ceic.mt.gov/

Montana Department of Labor and Industry, 2012. Montana County Fliers, Economic and Demographic Information for Jefferson County. June 2012.

Montana Department of Natural Resources and Conservation (DNRC), 2016. Wildfire statistics and suppression data from DNRC, Forestry Division.

Montana Department of Natural Resources and Conservation (DNRC), 2016. Dam details. Provided by C. Hill and A. Powers. Dam Safety Division.

Montana Department of Public Health and Human Services (DPHHS), 2016. 2006-2015 Communicable Disease Summary.

Montana Department of Revenue (MDOR), 2016. Cadastral Mapping Program. http://gis.mt.gov/

Montana Department of Transportation (MDT), 2016. Montana Department of Transportation (MDT), Highway Accident Data. http://www.mdt.mt.gov/publications/datastats/crashdata.shtml

Montana Department of Military Affairs (DMA), 2016. Database of declared disasters.).

Montana Disaster and Emergency Services (DES), 2013. State of Montana Multi-Hazard Mitigation Plan and State-wide Hazard Assessment. Montana Department of Military Affairs, Disaster and Emergency Services.

Montana Disaster and Emergency Services (DES), 2001. State of Montana Natural Hazards Mitigation Plan. Prepared by Division of Disaster and Emergency Services and Montana's Hazard Mitigation Team, October, 2001.

Montana Drought Website, 2016. https://mslservices.mt.gov/Geographic_Information/Maps/drought/

Montana Natural Resource Information System (NRIS), 2016. Transportation GIS layer with bridge data. http://nris.mt.gov/gis/gisdatalib/gisDataList.aspx

Montana Standard, 2016. *Nez Perce Fire Near Butte Doubles to 687 Acres*, September 2, 2016.

National Climatic Data Center (NCDC), 2016. Storm Events database. http://www.ncdc.noaa.gov/oa/climateresearch.html; http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms

National Drought Mitigation Center. 2016. http://drought.unl.edu/Planning/Impacts/DroughtIndemnityData.aspx

National Drought Resilience Partnership (NDRP), 2016. https://www.drought.gov/drought/what-nidis/national-drought-resilience-partnership

National Information Service for Earthquake Engineering (NISEE). 1998. Helena, Montana, 1935. By Charles James and Lydia Hernandez, National Information Service for Earthquake Engineering, University of California, Berkeley. http://www.nisee.org/montana/montana.html

National Interagency Fire Center, 2016. Red Flag Warnings gacc.nifc.gov/.../r2ftc/documents/Fire_Restriction_Chart.pdf

National Inventory of Dams, 2016. http://nid.usace.army.mil/cm_apex/f?p=838:12

National Oceanic and Atmospheric Administration (NOAA). 2004. National Weather Service, Climate Prediction Center, U.S. Drought Assessment and On-Line Data. http://www.ncdc.noaa.gov/oa/climate/climatedata.html

National Response Center, 2016. Database of Hazardous Material Incidents.

http://www.nrc.uscg.mil/foia.html

National Weather Service (NWS), 2016. National Weather Service, Warnings and Advisories. http://www.weather.gov/

Qamar, Anthony. 2008. Earthquake Hazards in the Pacific Northwest. University of Washington. Cascadia Region Earthquake Workgroup. January 2008. http://www.crew.org/ep/hazards.html

Qamar, Anthony I. and Michael C. Stickney, 1983. Montana Earthquakes, 1869-1979. Historical Seismicity and Earthquake Hazard. Montana Bureau of Mines and Geology. Memoir 51.

Sears, Traci, personal communication. November 18, 2016. Floodplain specialist with Montana DNRC. Information on repetitive loss properties and floodplain issues. With: D. Digrindakis, Tetra Tech, Helena, MT.

SHELDUS. 2016. Spatial Hazard Events and Losses Database for the United States (SHELDUS). www.sheldus.org

Southern Poverty Law Center, 2016. http://www.splcenter.org/get-informed/hate-map#s=MT

Stickney, Mike. personal communication. 2010. Earthquake Specialist, Montana Bureau of Mines and Geology. Conversation with C. Richardson and D. Digrindakis, Tetra Tech, Inc. Helena, MT during development of 2011 Jefferson County PDM Plan.

Stickney, M.C. 2007. Historic Earthquakes and Seismicity in Southwestern Montana: Northwestern Geology, v.36, p. 167-186.

Stickney, M.C., Haller, K.M. and Machette, M.N. 2000. Quaternary faults and seismicity in western Montana: 1:750,000 scale map with text, MBMG Special Publication No. 114.

Tetra Tech, 2011. Pre-Disaster Mitigation Plan for Jefferson County, City of Boulder, and Town of Whitehall, Montana.

Tizer Garden, 2016. http://tizergardens.com/2011flood.html

Tri-County FireSafe Working Group (TCFSWG), 2015. Tri-County Regional Community Wildfire Protection Plan.

U.S. Bureau of Labor Statistics, 2016. Consumer Price Index Inflation Calculator. http://www.bls.gov/data/inflation_calculator.htm

U.S. Census Bureau. 2016. Quick Facts and American Community Survey 2010-2014. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

U.S. Climate Data, 2016. http://www.usclimatedata.com/climate/boulder/montana/united-states/usmt0036.

U.S. Department of Agriculture, Soil Conservation Service. 1984. Flood Plain Management Study, Big Pipestone Creek, Jefferson County, Montana.

U.S. Department of Transportation, Office of Hazardous Materials Safety, 2016. Incidents Reports Database Search. https://hazmatonline.phmsa.dot.gov/IncidentReportsSearch/search.aspx

U.S. Environmental Protection Agency (EPA), 2016. Toxic Release Inventory Data, Envirofacts, http://www.epa.gov/enviro/html/tris/tris_query.html.

U.S. Forest Service, 2013. Wildfire data 1986 – 2012. Compiled by M. Mitzkus.

U.S. Global Change Research Program, 2016. http://www.globalchange.gov/.

Whitehall Growth Policy, 2009. Prepared by Whitehall Planning Board and Great West Engineering.

World Health Organization (WHO), 2009. Pandemic statistics. http://www.who.int/csr/disease/swineflu/en/