

APPENDIX B

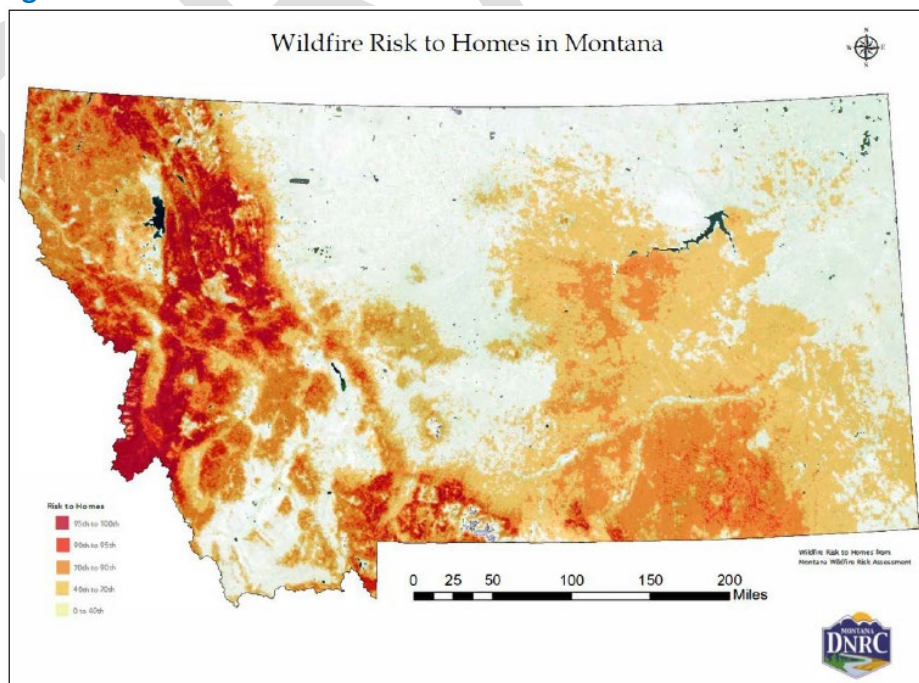
Montana Hazard Analysis, Mitigation Overview, & Capability Assessment

Montana has experienced and continues to be vulnerable to a multitude of emergency situations from natural, technological, and man-made causes. Most hazards Montana deals with are natural, but the possibility of a terrorist or man-made incident continually increases. Below is a summary of the most feasible events considered (information taken from the 2023 Montana Multi-Hazard Mitigation Plan):

Wildfires – In the past 30 years, Montana has experienced an increase in the size and intensity of fires due to changes in land management practices, forest health, and changing climate conditions. At the same time, the number of homes in moderate to high wildfire hazard areas has almost doubled since 1990. The rate of housing growth in moderate and high hazard areas far outpaces home development in low hazard areas. Currently, 16,683 homes are in high hazard areas, and 99,988 homes are in moderate hazard areas, with these numbers expected to increase.

In Montana, wildfires have burned approximately 1.3 million acres since 2018 [NIFC, 20221], threatening lives, destroying dozens of homes, and costing millions of dollars. Wildland fires in close proximity to communities may impact public health and safety, water quality, transportation infrastructure, regional economies, and quality of life. 2017 was a historic year for drought and fire in Montana that brought about 2,422 fires that burned approximately 1,366,498 acres. In 2021, the worst fire year since 2017, there were a total of 2,573 fires.

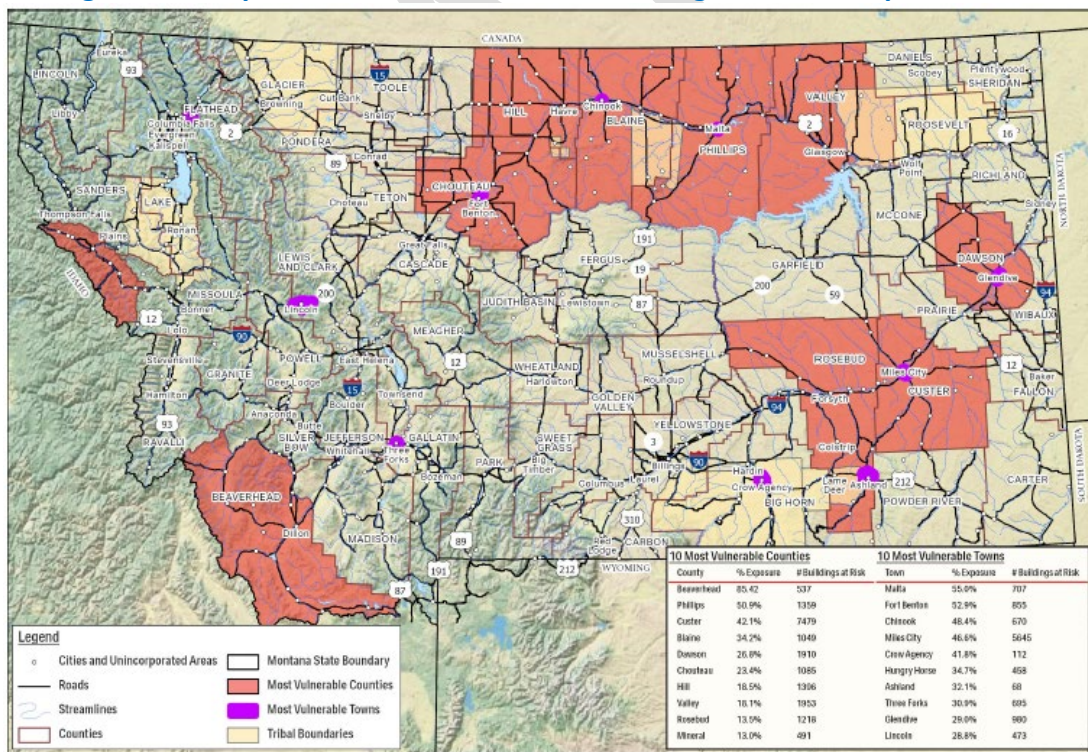
Figure B-1: Wildfire Risk to Homes in Montana



Flooding – Montana can experience flooding in almost any area at any time of the year. The types of flooding that affect Montana include regional flooding, flash floods, and ice-jam floods. Over 70% of all major disaster declarations for Montana are due to flooding. Montana has recorded more ice jam events than any other state in the United States, with over 4,500 ice jams reported since 1894 on 380 different streams. Ice jams occur most frequently in the months of February (20%) and March (43%). There are increased risks of flash flooding and debris flows in Montana because of recent active fire seasons. In general, post-fire debris flow risk lasts for two to five years after the fire event. After that period, the vegetation regrowth and soil recovery increase water absorption and significantly lower the post-fire risks [Montana DNRC, 2022].

NOAA’s data on Montana’s flood losses dated from 1996 to 2022 (adjusted for inflation) indicate there have been 6 fatalities (but all fatalities may not have been recorded) and \$43 million in property damage across the state. FEMA has paid a total amount of over \$15 million in loss coverage for property owners in the National Flood Insurance Program (NFIP) as of August 9, 2022. The United States Department of Agriculture (USDA) estimates over \$22 million in crop damage from 1989 - June 2022.

Figure B-2: Top Ten Counties and Towns with Highest Flood Exposure



Drought – Anywhere in Montana is vulnerable to drought. Weather cycles dictate the availability of water and temperatures that cause drought. Because Montana has a semi-arid climate, even in high moisture years, snowfall and rainfall may not provide a consistent, dependable water supply throughout the year. Severe drought, when several months pass

without significant precipitation, results in devastating economic consequences for agriculture, forestry, wildlife management, the environment and tourism. Periods of drought can lead to abnormally dry land that is more susceptible to wildfires. Drought can actually promote future flooding. Vegetation dies without water, and as a result, even average rain can cause flooding. Drought is such a potential danger to Montana that the state statutorily mandates a Drought Advisory Committee (DAC) to annually assess drought conditions and mitigate effects.

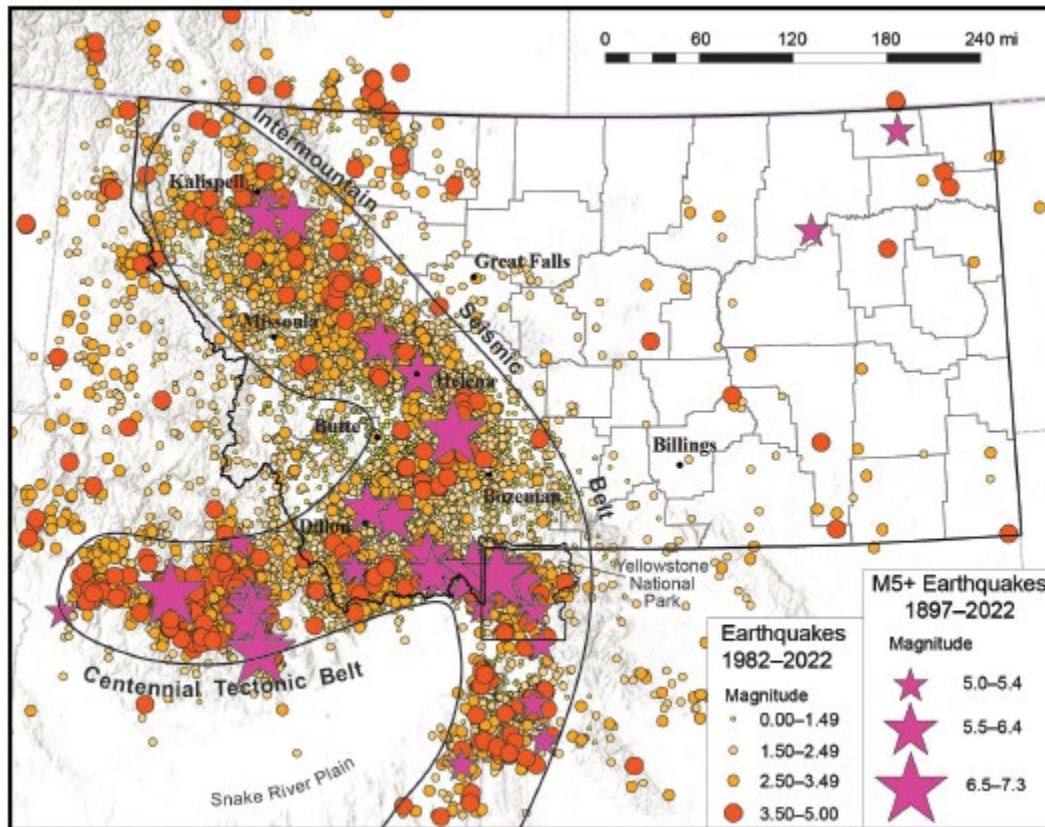
The USDA Risk management Agency (RMA) tracks up-to-date indemnity payments for losses suffered due to drought on a county basis. Data shows that 2021 had the greatest indemnity payments from drought for the state, with \$ 437 million, followed by 2017, with \$231 million. From the table, it is observed that 2020 saw the lowest indemnity payments for the state, at \$15 million. Over this 7-year period, the top four counties with the most indemnity pay-outs were Valley County at \$151 million, followed by Roosevelt County with \$102 million, Sheridan County with \$90 million, and Powder River County at \$47 million. As such, it may be determined that the Central and Eastern Disaster and Emergency Services (DES) Districts suffer the most economic hardship in the event of drought.

Severe Weather – Severe weather leads to millions of dollars in property and crop damage as well as life lost. Severe winter weather presents one of the greatest threats to life of any hazard in Montana with blowing and drifting snow, extreme cold, hazardous driving conditions, and utility interruption being common. From 2018 until November 2022 there were a total of 186 severe winter weather events. Of these, 10 events lead to loss of life or injury, summing to 11 deaths in this time frame according to the National Centers for Environmental Information.

A 2022 report from the Montana Department of Transportation (MDT) attributed 46 fatal car crashes to winter weather in 2020 alone. Further, the report states that the average number of fatal crashes due to winter weather between 2011 and 2020 was 43 per year. In June of 2021, several severe thunderstorms impacted five east central Montana counties: Dawson, Garfield, McCone, Richland, and Roosevelt with hail as large as three inches in diameter and recorded wind speeds of 70-90 mph with winds up to 115 mph that caused damages to over 800 power poles and lines. Extensive power outages left too many residents without power to not declare a disaster.

Earthquake – Montana is one of the most seismically- active states in the United States. Since 1925, the state has experienced five shocks that reached an intensity of VIII or greater (Modified Mercalli Scale). During the same interval, hundreds of less severe tremors were felt within the state. Montana's earthquake activity is concentrated mostly in the mountainous western third of the state, which lies within the Intermountain Seismic Belt. The largest earthquake in Montana, the 1959 Hebgen Lake event, caused more than \$11 million in damage (\$93.7 million in 2018 dollars). The second most-damaging earthquakes were the October 1935 Helena earthquakes, which caused more than \$4 million in damage (\$72.4 million in 2018 dollars).

Figure B:3: Intermountain Seismic Belt



Disease – Diseases when on a pandemic or epidemic scale can lead to high infection rates in the population, causing isolation, quarantines, and large numbers of fatalities, all of which have been observed in the COVID-19 pandemic. History has shown that disease outbreaks are frequent enough to pose a risk to Montana socially, politically, and economically. Although it has been extremely costly to both human health and the economy of Montana, the COVID-19 pandemic has served as a reminder of the potential magnitude and severity of disease outbreaks that not just the state, but the whole world, may encounter. In 2020, the Montana economy suffered an average employment decline of more than 50,000 jobs, representing a 7.3 percent decline. Most job losses occurred in the industries for accommodations, food service, retail, arts and entertainment, and personal services businesses. The Montana tourism industry reported 70 percent fewer bookings for June of 2020 compared to a year prior. Visitor spending in Montana in 2020 decreased by 12% annually compared to 2019.

Hazardous Materials and Transportation Accidents – The most likely locations for transportation-related hazardous material releases are along Montana’s highways, railroads, and pipelines. From 2008 to 2021 there were 738 releases reported to the National Response Center (NRC). Of these, 322 were from fixed facilities, 158 from Mobile facilities, 84 from pipelines, 68 from Railroads, 68 from Storage Tanks and 38 from miscellaneous spills. Car crashes occur across the nation and can be devastating to families, friends, and communities. It is estimated that vehicle crashes cost the State over \$35 million each year on emergency department encounters and inpatient hospital admissions for injuries caused by motor vehicle

crashes. Vehicular accidents occur for a number of reasons including distracted drivers, driver fatigue, drunk driving, speeding, aggressive driving, weather, and collisions with wildlife.

Table B-1: Montana Vehicular Crash Data; 2011-2020.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
All Crashes											
Fatal Crash	211	205	229	192	224	190	186	182	184	212	2,015
Serious Injury	967	1,129	1,101	964	999	834	730	769	709	730	8,932
Total # Crashes	45,150	42,406	43,488	46,387	47,074	46,482	49,726	47,638	46,846	40,134	455,331
Top Counties with Fatal & Serious Injury Crashes	Missoula 11.8%, Yellowstone 9.5%, Flathead 8.9%, Gallatin 5.7%, Lewis & Clark 4.8%										
Nighttime Crashes											
Fatal Crash	92	88	110	72	85	84	71	78	70	90	840
Serious Injury	265	364	345	275	273	249	218	223	208	250	2,670
Total # Crashes	11,162	11,059	10,814	11,608	12,276	12,011	12,939	12,111	11,731	11,355	117,066
Top Counties with Fatal & Serious Injury Crashes	Yellowstone 11.3%, Flathead 9.3%, Missoula 8.2%, Gallatin 5.5%, Cascade 5.0%										
Rural Roadway Crashes											
Fatal Crash	175	189	209	174	199	176	164	151	160	198	1,795
Serious Injury	785	921	906	763	781	653	546	559	552	585	7,051
Total # Crashes	18,437	18,064	18,986	20,194	20,929	21,361	23,908	23,180	23,998	22,483	211,540
Top Counties with Fatal & Serious Injury Crashes	Flathead 9.5%, Yellowstone 6.6%, Missoula 6.5%, Gallatin 5.5%, Ravalli 4.6%										
Winter Crashes (Nov, Dec, Jan & Feb)											
Fatal Crash	56	43	54	41	41	47	43	57	37	54	473
Serious Injury	233	315	278	260	265	206	159	170	179	198	2,263
Total # Crashes	17,621	15,477	15,974	19,131	17,455	16,737	20,007	17,883	17,694	14,132	172,111
Top Counties with Fatal & Serious Injury Crashes	Missoula 11.7%, Yellowstone 10.5%, Flathead 8.9%, Gallatin 5.8%, Lewis & Clark 5.7%										
Wild Animal Involved Crashes											
Fatal Crash	4	3	8	1	2	6	2	2	7	5	40
Serious Injury	26	39	36	30	30	28	23	26	23	29	290
Total # Crashes	3,086	3,325	3,356	3,502	4,795	5,121	5,411	5,279	4,666	5,166	43,707
Top Counties with Fatal & Serious Injury Crashes	Lincoln 9.5%, Flathead 8.5%, Ravalli 8.2%, Sanders 7.8%, Missoula 7.5%										

Terrorism, Violence, Civil Unrest, and Cyber Security – Civil unrest, violence and terrorism are not common hazards affecting Montana, but over the short history of Montana, some events have occurred. Labor strikes have caused economic disruption, threats of terrorism have disrupted community security, and large-scale violence has claimed several lives. Montana’s sparse population and relatively small cities may limit the state as a terrorist target, however the state’s rural nature has attracted terrorist and extremist groups. According to the Montana Board of Crime Control, there were 29 hate crimes reported in 2020, up from seven reported in 2018 and nine reported in 2019 [Montana Board of Crime Control, 2020]. While these numbers remain low, Montana hate crimes have seen a noteworthy increase of 400% between 2018 and 2020. A reported 4,645 violent crimes occurred in 2020, up from 4,085 in 2019, showing a 13.7% increase in just one year. According to the Federal Bureau of Investigation Internet Crime Complaint Center’s (IC3) 2021 Annual Report, a total of over \$8.6 million of losses occurred in Montana because of cyberattacks, with 46% of the losses experienced by individuals over 60 years of age

From 1978 to 1995, Ted Kaczynski, commonly known as the Unabomber, killed three people, and injured 22 others across the county with mail bombs while he resided in a cabin near Lincoln. In the spring of 1996, hundreds of FBI agent surrounded the Ralph Clark ranch complex near Jordan for a total siege of 81 days. The government alleged that the nearly 30 people inside were of a radical anti-government and racist religious sect who had written bad checks

and threatened judges, among other things. In 1986, the first school shooting in Montana occurred in Lewistown. In the event, a substitute teacher, Henrietta Smith, was killed, and the vice-principal, John Moffatt, was injured.

Dam Failure – Aging infrastructure is the main cause of failed dams in Montana. There have been numerous minor failures related to the deterioration of corrugated metal pipe outlet works, leading to a slow release of reservoir contents along the outside of the outlet pipe, with minimal downstream property damage but serious damage to the structure. Dams located in high-risk areas are subject to stringent permitting, inspection, operation, and maintenance requirements. The dam condition assessments, that were last completed between 2015 and 2022, revealed 19 of the high hazard dams are in poor condition. Further, 1 high hazard dam is in unsatisfactory condition.

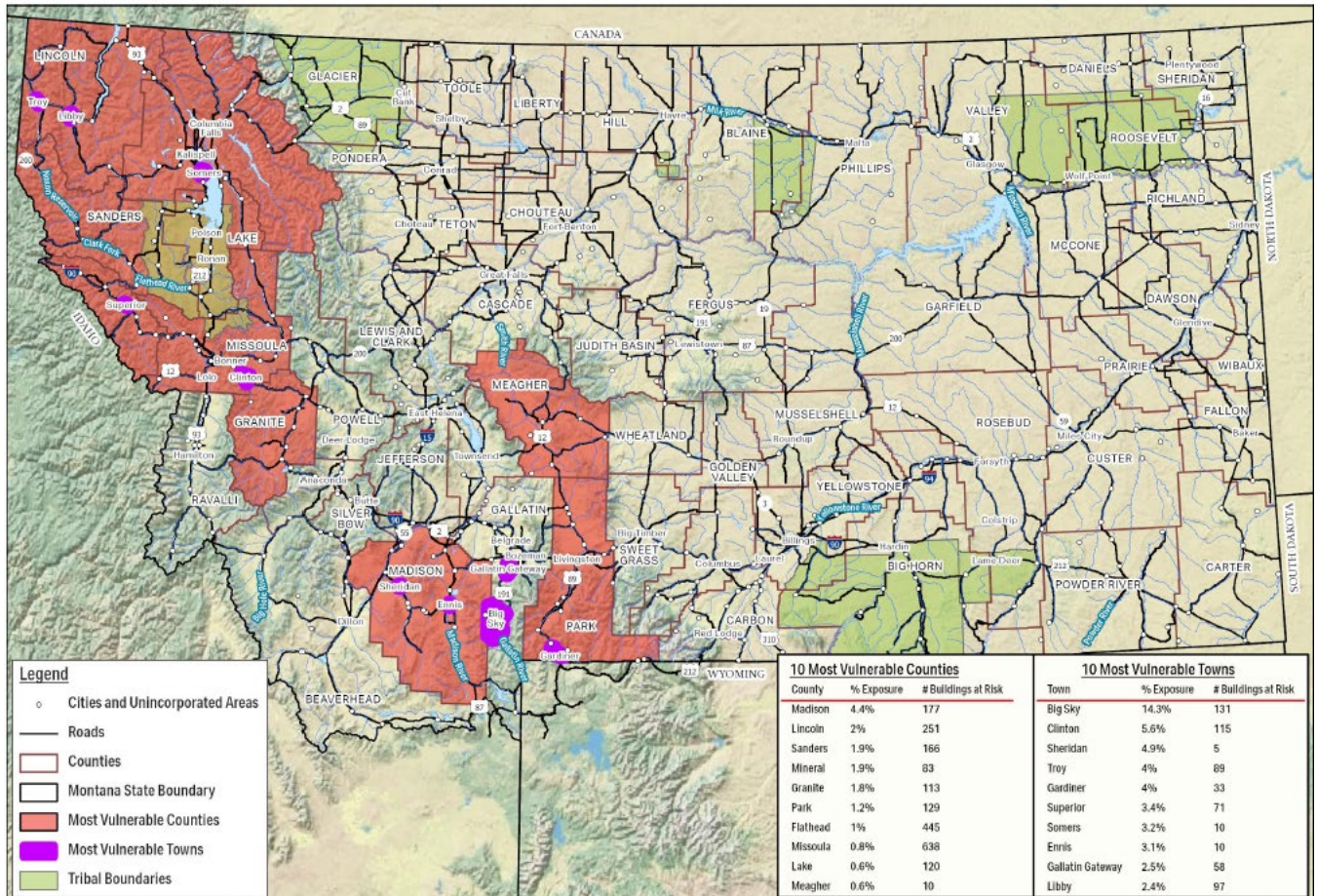
Table B-2: Montana Dam Failures and Incidents

Date	Description of Event
4/14/1908	Hauser Dam north of Helena in Lewis and Clark County failed after water pressure undermined masonry footing of dam causing 300-foot breach.
6/4/1908	White's Reservoir Dam near Butte failed leaving the city without phones, telegraphs, electricity, street cars, or railroad service.
7/11/1916	Superior Dam, north of Meaderville, broke and flooded northeast Butte with mine tailings. \$8,000 in damages.
1927	Pattengail Creek Dam in Beaverhead County failed causing 4 known deaths and near complete destruction of the towns of Dewey and Wise River.
March-1937	Midway Dam, 40 miles northwest of Nashua in Valley County, breached during the Porcupine Creek flood when the spillway was undermined by huge floating ice cakes. When the dam failed, a four-foot liquid wall swept down the valley causing extensive damage.
July-1946	Carrol Dam, located eight miles northwest of Plentywood (Sheridan Co.), failed following several inches of rain in a short timeframe. There were no fatalities, but destruction was evident throughout the 15-mile valley which took the brunt of the flood including the destruction of homes and farm building.
April-1952	Frenchman Dam on Frenchman Creek failed upstream of the Milk River, in Phillips County, 20 miles north of Saco. The dam failure caused the highest peak ever recorded on the Milk River below its confluence with Frenchman Creek. Damage was estimated at \$150,000.
8/30/1959	Hebgen Dam in Gallatin County was damaged due to earthquake which killed 28 people. Four hydraulic gates failed which allowed 3,400 cfs of water to be released into Madison River.
8/6/1964	Failure of Swift Reservoir on Birch Creek in Pondera County and Two Medicine Dam on Two Medicine Creek in Glacier County resulted in the loss of 32 lives on the Blackfeet Reservation, 265 homes and 20,000 acres of hay land.
6/20/1984	Browns Lake Dam, located in Beaverhead County, was overtopped resulting in washed out roads and bridges downstream. Property damage was estimated at \$100,000.
6/1/1998	Incident Response for Tin Cup Dam (EO 9-98). State response to a leak in Tin Cup Dam, located in the Selway-Bitterroot Wilderness Area of the Bitterroot National Forest, Ravalli County.
Spring 1998	Anita Dam outlet failure north of Chinook in Blaine County. Evacuation necessary.
6/23/2002	Failure of Ross Dam in Garfield County; evacuation necessary but limited damage downstream. One house flooded. Downstream stock dams broke, gravel roads washed out.
5/11/2018	Badger Creek irrigation reservoir dam (small low hazard dam) in Meagher County failed from dam overtopping during flood event.
11/30/2021	A malfunction at the Hebgen Dam caused the Madison River flows to drop significantly creating low water levels.

Landslide and Avalanche – Landslides are among the most common geologic hazards in Montana, causing damage in rural and urban areas of the state. The Hebgen Lake earthquake of August 18, 1959, triggered the largest landslide in Montana history, where nearly 1.25 miles of the Madison River and Montana Highway 287 were buried to depths as great as 394 feet. The Beartooth Highway landslide cost \$15.2 million to repair.

Avalanches are often the result of severe winter weather in Montana. Avalanche hazards most directly threaten winter recreationists and communication and transportation networks in mountainous regions. Two of Montana’s ski areas, Bridger Bowl, and Big Sky are respectively the second and fourth most avalanche-prone ski resorts in the United States. Where developments have encroached into steep mountainous terrain, the vulnerability for avalanches increases. Every year at least one winter recreationist dies from an avalanche in Montana’s backcountry. Damage to infrastructure (railroad) **has** occurred near Glacier National Park in Flathead County. Costs associated with the 2014 Mount Jumbo avalanche in Missoula are not available; but one home was damaged. Three other homes, several vehicles and an apartment building were also damaged by the avalanche. Costs incurred by local law enforcement and search and rescue outweigh the structural damage.

Figure B-4: Top Ten Counties with High Residential and Commercial Exposure to Landslides



Volcanic Ash – Volcanic eruptions are generally not a major concern in Montana due to the relatively low probability (compared with other hazards) of events in any given year. However, Montana is within a region with a significant component of volcanic activity and has experienced the effects of volcanic activity as recently as 1980 when Mount St. Helens erupted in Washington state. After the eruption of Mount St. Helens in May 1980, a coating of up to 0.2

inches of ash fell on Western Montana. Ash deposits were thickest in the western portions of the state, tapering to near zero on the eastern part of the state.

EIS estimated that the ashfall cost Missoula County nearly \$6 million in cleanup and lost work time. Statewide cost from this event has been estimated at between \$15 and \$20 million. Travel was restricted in Western Montana for over a week because of concerns for public health; the ash was determined to be a physical respiratory irritant but not a toxic substance. The main hazards in western Montana included reduced visibility (and resulting closed roads and airports), clogging of air filters, and a health risk to children, the elderly, and people with cardiac or respiratory conditions, such as asthma, chronic bronchitis, and emphysema. Claims for State facilities totaled approximately \$55,000.

Table B-3: Recent Volcanic Ash Events Affecting Montana

Volcano	Most Recent Eruption (Yrs before Present)	Location Affected	Thickness of Ash in Montana
Yellowstone Caldera	665,000	Eastern Montana	-
Glacier Peak	14,500	Western Montana	1.2 inches (compacted)
Crater Lake (Mt. Mazama)	7,600	Western Montana	Up to 6 inches (compacted)
Mount St. Helens	38	Entire State	Up to 0.2 inches (uncompacted)

Mitigation Overview

For in-depth information on these and other hazards refer to the 2023 [State of Montana Multi-Hazard Mitigation Plan](#).

Capability Assessment

The Threat & Hazard Identification & Risk Analysis (THIRA) is a process used to assess capability and resource requirements to address anticipated and unanticipated hazards. The Stakeholder Preparedness Review (SPR), in reference to the THIRA, provides an assessment of statewide capability strengths and gaps required for prevention, protection, mitigation, response, and recovery. In depth information on the THIRA and SPR is available at MT DES.