4.10 RAILROAD ACCIDENTS

CPRI SCORE = 3.05

Description and History

Montana Rail Link (MRL) operates a rail line extending across the southern part of the Helena Valley, extending from the southeast corner of the county to the Continental Divide at the Mullan Tunnel. MRL also operates a couple of small industrial spurs in the vicinity. A rail yard and switching facility operated by MRL is located within the City of Helena. The Burlington Northern-Santa Fe Railroad (BNSF) operates a rail line extending from the northwest corner of the City of Helena northward, passing Silver City, Wolf Creek and Craig, and extending to Great Falls. This rail line is currently inactive but has served only freight movements through the county. Passenger rail service is not available in Lewis and Clark County.

A number of at-grade railroad crossings are located in the county. With a few exceptions, the majority of principal and minor arterials do not have bridges crossing over or under the rail lines so there are safety hazards, regular delays, and other conflicts between the trains and motor vehicles. The frequency and length of trains using the at-grade crossings have historically caused significant delays for drivers. **Table 4.10-1** presents statistics on accidents at railroad crossings in Lewis and Clark County.

TABLE 4.10-1
ACCIDENTS AT RAILROAD CROSSINGS IN LEWIS AND CLARK COUNTY

Date	Road Name	Fatalities	Injuries	Date	Road Name	Fatalities	Injuries
3/1/1976	National Ave.	-	-	9/27/1986	Main St.	-	-
4/3/1976	Montana Ave.	-	1	10/22/1988	Hwy 518	-	1
3/30/1977	E. Helena Crossing	1		11/23/1988	Roberts St.	-	-
10/2/1978	Benton Ave.	-	-	2/12/1993	McClellan Creek Rd.	1	-
2/14/1979	Montana Ave.		-	3/30/1993	Montana Ave.	1	-
2/23/1980	Carson	1	-	5/31/1995	Head Lane	-	1
3/1/1981	Carter St.	-	-	6/27/1999	Private	-	1
3/1/1983	Montana Ave.	-	-	8/12/2002	Roberts St.	-	-
4/21/1983	County Road	-	-	10/15/2002	National Ave.	-	-
9/5/1983	Benton Ave.	-	-	1/5/2004	Montana Ave.	-	-
4/18/1984	Kaiser Cement	-	1	6/10/2008	Paso Fino	-	-
12/16/1984	Benton Ave.	-	1	1/30/2009	Carter St.	-	-
					TOTAL	4	6

Source: Federal Railroad Administration, 2011; http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/gxrabbr.aspx

Table 4.10-2 presents statistics from the Federal Railroad Administration on railroad collisions and derailments in Lewis and Clark County.

TABLE 4.10-2
RAILROAD ACCIDENTS IN LEWIS AND CLARK COUNTY

Date	RR	Type	Cars	F	I	Date	RR	Type	Cars	F	I
1/14/1977	BNSF	Collision	0	0	0	6/24/1991	MRL	Other	2	0	0
12/6/1977	BNSF	Collision	1	0	1	11/30/1991	BNSF	Derailment	7	0	0
10/27/1978	BNSF	Derailment	1	0	0	1/10/1992	MRL	Derailment	2	0	0
1/30/1979	BNSF	Derailment	17	0	2	1/29/1992	MRL	Other	2	0	0
7/13/1979	BNSF	Derailment	2	0	0	1/29/1992	BNSF	Other	0	0	0
7/19/1979	BNSF	Derailment	7	0	0	5/5/1992	MRL	Derailment	10	0	0
1/27/1980	BNSF	Derailment	4	0	0	11/9/1992	BNSF	Other	0	0	0
3/3/1980	BNSF	Derailment	6	0	0	1/11/1993	MRL	Derailment	2	0	0
3/4/1980	BNSF	Derailment	2	0	0	1/12/1993	MRL	Other	0	0	0
3/15/1980	BNSF	Derailment	5	0	0	1/16/1993	MRL	Derailment	1	0	0
3/23/1980	BNSF	Collision	0	0	0	2/19/1993	MRL	Derailment	3	0	0
4/6/1980	BNSF	Derailment	8	0	0	4/23/1993	MRL	Derailment	1	0	0
4/22/1980	BNSF	Derailment	1	0	0	6/27/1993	MRL	Derailment	0	0	0
5/1/1980	BNSF	Derailment	10	0	0	7/14/1993	MRL	Derailment	7	0	0
12/29/1980	BNSF	Derailment	9	0	0	8/7/1993	MRL	Other	0	0	0
2/12/1981	BNSF	Derailment	10	0	0	12/16/1993	MRL	Collision	0	0	0
5/1/1981	BNSF	Derailment	7	0	0	7/22/1994	MRL	Derailment	2	0	0
7/18/1981	BNSF	Derailment	7	0	0	9/3/1994	MRL	Derailment	1	0	0
8/4/1981	BNSF	Derailment	5	0	0	9/14/1994	BNSF	Collision	0	0	1
2/17/1982	BNSF	Other	0	0	0	10/18/1994	MRL	Derailment	2	0	0
3/23/1982	BNSF	Collision	0	0	0	10/21/1994	MRL	Derailment	2	0	0
3/10/1983	BNSF	Collision	0	0	0	3/5/1995	MRL	Derailment	12	0	0
3/18/1983	BNSF	Derailment	2	0	0	6/8/1995	MRL	Other	0	0	0
4/17/1983	BNSF	Derailment	8	0	0	6/23/1995	MRL	Collision	7	0	0
5/24/1983	BNSF	Derailment	8	0	0	1/1/1996	MRL	Derailment	6	0	0
9/29/1983	BNSF	Other	0	0	0	10/18/1996	MRL	Collision	1	0	1
10/31/1983	BNSF	Derailment	6	0	0	4/8/1997	MRL	Collision	1	0	0
4/13/1984	BNSF	Derailment	8	0	0	7/26/1997	MRL	Derailment	3	0	0
6/10/1984	BNSF	Derailment	4	0	0	8/24/1997	MRL	Derailment	1	0	0
10/4/1984	BNSF	Derailment	6	0	0	9/7/1997	MRL	Derailment	16	0	0
1/20/1985	BNSF	Derailment	3	0	0	11/1/1997	MRL	Other	1	0	0
7/19/1985	BNSF	Derailment	6	0	0	11/5/1997	MRL	Derailment	5	0	0
9/12/1985	BNSF	Derailment	4	0	0	11/20/1997	MRL	Derailment	1	0	0
10/18/1985	BNSF	Derailment	1	0	0	4/21/1998	MRL	Derailment	2	0	0
5/20/1986	BNSF	Derailment	6	0	0	7/29/1999	MRL	Derailment	2	0	0
6/20/1986	BNSF	Derailment	3	0	0	11/29/2002	MRL	Derailment	1	0	0
9/13/1986	BNSF	Derailment	2	0	0	7/28/2004	MRL	Collision	5	0	0
2/1/1987	BNSF	Derailment	1	0	0	9/1/2004	MRL	Other	0	0	0
1/11/1988	MRL	Other	0	0	0	4/28/2005	MRL	Derailment	30	0	0
4/14/1988	MRL	Derailment	5	0	0	8/21/2005	MRL	Other	0	0	0
5/5/1988	MRL	Derailment	5	0	0	7/2/2006	MRL	Derailment	8	0	0
10/12/1988	MRL	Derailment	3	0	0	7/18/2006	MRL	Derailment	6	0	0
1/3/1989	MRL	Derailment	7	0	0	8/7/2007	MRL	Other	0	0	0
2/2/1989	MRL	Collision	22	0	4	1/18/2008	MRL	Derailment	2	0	0
6/18/1989	MRL	Derailment	4	0	0	1/27/2008	MRL	Collision	5	0	0
8/15/1989	MRL	Other	0	0	0	1/30/2008	MRL	Derailment	8	0	0
4/18/1990	MRL	Derailment	16	0	0	2/26/2008	MRL	Derailment	10	0	0
4/18/1990	MRL	Derailment	3	0	0	3/5/2008	MRL	Derailment	18	0	0
7/17/1990	MRL	Derailment	4	0	0	4/10/2008	MRL	Derailment	5	0	0
8/7/1990	MRL	Collision	2	0	0	6/10/2008	MRL	Other	0	0	0
8/27/1990	MRL	Derailment	2	0	0	6/15/2008	MRL	Collision	2	0	0
11/16/1990	MRL	Collision	0	0	0	10/9/2008	MRL	Derailment	3	0	0
1/30/1991	MRL	Derailment	35	0	0	2/6/2009	MRL	Derailment	2	0	0
3/31/1991	MRL	Derailment	8	0	0	4/9/2009	MRL	Derailment	11	0	0
4/21/1991	MRL	Collision	0	0	0	10/4/2010	MRL	Derailment	8	0	0
4/21/1991	BNSF	Collision	0	0	0			TOTALS	512	0	9

Source: Federal Railroad Administration, 2011;
http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/incabbr.aspx
Notes: RR = Railroad; MRL = Montana Rail Link; BNSF = Burlington Northern-Santa Fe; F = Fatalities; I = Injuries

A significant railroad accident occurred in Helena in 198**9, as des**cribed below. This event is also classified as a hazardous material incident but is reported in this section due to its significance.

February 1, 1989 - In the wee hours of the morning, a 48-car runaway freight train slammed into a parked train engine, setting off an explosion. Windows were blasted out up to three miles away from the impact near Carroll College. Most of the city lost power and residents were forced to evacuate in subzero weather. The wreck occurred when engineers traveling west toward Mullan Pass opted to switch the lead engine of a MRL train because it lacked a working heater. In the process, the rest of the train began rolling and kept going until it crashed in Helena. A tank carrying isopropyl alcohol caught fire, sparking an explosion in an adjacent tank of hydrogen peroxide. No major injuries were reported.

While responders were relieved the incident wasn't more of a disaster, they were struggling with the frigid weather. When they attempted to put out the flames from the explosion with water, it would freeze. Carroll College's St. Charles Hall shook when the trains hit. Many of the windows in the women's dorm, Guadalupe Hall, were blown out. Students were sheltered at the National Guard Armory, which still had heat.

Source: *20 years ago today, Helena shook, rattled and froze,* Helena Independent Record, February 1, 2009.

Vulnerability and Area of Impact

The major rail carriers in Lewis and Clark County are BNSF and MRL. The greatest risk associated with freight trains is a spill of hazardous materials. There is no passenger railroad service so a mass casualty incident is not a concern.

There are numerous rail crossings in Lewis and Clark County. These gated and ungated crossings include private, public, grade separated and at-grade crossings. 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.

To model the spatial distribution of the railroad accident risk in Lewis and Clark County a GIS data layer of railroad corridors was used, and then buffered by 0.25 miles. Building exposure was calculated by intersecting the railroad buffer with the MDOR parcel and critical facility datasets. Vulnerable population exposure was determined using the percent of each census block affected by the railroad buffer. **Table 4.10.3** presents the results of the vulnerability analysis.

GIS analysis of the railroad accident risk to Lewis and Clark County indicates that over 446,158 acres are within the railroad buffer, including 2,028 residences, 792 commercial, industrial and agricultural buildings, and 28 critical facilities. The *Railroad Accident Section* in **Appendix C** presents supporting documentation from the risk assessment including a list of critical facilities in the railroad buffer.

Probability and Hazard Magnitude

Lewis and Clark County is vulnerable to all types of railroad emergencies. The two major effects of railroad accidents are human injury and hazardous materials releases.

There have been no Presidential Disaster Declarations or State emergency declarations associated with the railroad accident hazard in Lewis and Clark County and the likelihood of a significant event resulting in a disaster declamation is considered “unlikely”.

Future Development

Lewis and Clark County does not have any ordinances or regulations requiring special considerations to mitigate the affects of railroad accidents.

TABLE 4.10-3

LEWIS AND CLARK COUNTY VULNERABILITY ANALYSIS – RAILROAD ACCIDENTS

JURISDICTION	RESIDENTIAL BUILDING EXPOSURE $	# RESIDENCES AT RISK	COMMERCIAL, INDUSTRIAL & AGRICULTURAL EXPOSURE $	# COMMERCIAL, INDUSTRIAL & AGRICULTURAL BUILDINGS AT RISK	CRITICAL FACILITIES EXPOSURE RISK $	# CRITICAL FACILITIES AT RISK	BRIDGE EXPOSURE $	# BRIDGES AT RISK	POPULATION AT RISK	PERSONS UNDER 18 AT RISK
Incorporated Communities & County										
East Helena	$29,932,068	378	$18,725,346	82	$3,087,536	4	$245,052	3	1,075	206
Helena	$155,207,222	1,345	$284,652,004	575	$145,726,631	22	$3,699,910	6	7,546	1,497
Remainder of County	$33,661,990	305	$34,302,362	135	$701,108	2	501,116	4	3,557	916
CENSUS Designated Places										
Augusta	$0	0	$0	0	$0	0	$0	0	0	0
Helena Valley Northeast	$0	0	$0	0	$0	0	$0	0	0	0
Helena Valley Northwest	$0	0	$0	0	$0	0	$0	0	0	0
Helena Valley Southeast	$0	0	$0	0	$0	0	$0	0	1,160	368
Helena Valley West Central	$0	0	$0	0	$0	0	$0	0	69	19
Helena West Side	$0	0	$0	0	$0	0	$0	0	1,088	242
Lincoln	$0	0	$0	0	$0	0	$0	0	0	0
Craig	$0	0	$0	0	$0	0	$0	0	0	0
Marysville	$0	0	$0	0	$0	0	$0	0	0	0
CENSUS County Divisions										
Augusta	$0	0	$0	0	$0	0	$0	0	0	0
Helena	$214,143,714	1,994	$337,665,170	790	$149,515,274	28	$4,446,078	13	11,655	2,508
Lincoln	$4,657,566	34	$14,542	2	$0	0	$0	0	523	111
Wolf Creek	$0	0	$0	0	$0	0	$0	0	0	0

4.11 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 in the identified hazard areas in Lewis and Clark County, or the Cities of Helena and East Helena. Annual loss estimates are presented for each hazard where damage data is available. Future development projects in Lewis and Clark 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 to them coincide, how frequently the hazards occur, and then estimating the magnitude of damage resulting from a hazard event. Annualized loss was computed for the hazards where damage data was available. *Section 4.1* presents the methodology for loss estimation calculations. **Tables 4.11-1 through 4.11-3** present annual loss for the various hazards for residential, commercial (including industrial and agricultural buildings), and critical facilities in the county and incorporated communities. **Appendix C** contains supporting information.

Future Development

Within the next 10 years, the following projects are proposed for development in Lewis and Clark County. These include new critical facilities, infrastructure improvements and commercial development.

- New Historical Society Museum in Helena
- New county fire station in Unionville
- New City of Helena fire station on the north side of town
- New City of Helena fire station on the east side of town
- New City of East Helena fire station on the east side of Prickly Pear Creek
- I-15 Interchange at Custer Avenue in Helena
- New Law Enforcement Center in Helena
- New Ambulance Building in Lincoln
- Commercial development around the Airport and north of Custer Ave. in Helena

Future residential developments within the next 10 years in Lewis and Clark County include:

- Subdivisions between Helena/East Helena south of Highway 12 to the county line
- Subdivision west of Helena between Ten Mile Creek and Fort Harrison
- Annexation to the City of Helena north of Custer Ave. between Green Meadow Drive and I-15.

Figures 10A and 10B present the composite of hazard prone areas with the identified future development projects in the county. **Table 4.11-4** presents a matrix of each future development project, and the potential hazards they may be affected by. Data on proposed construction method and estimated cost were not available.

TABLE 4.11-1
HAZARD VULNERABILITY SUMMARY; LEWIS AND CLARK COUNTY

Hazard	Residential Building Stock $ Exposure in Hazard Area	# Residences in Hazard Area	Residential Building Stock $ Annual Loss	Commercial, Industrial & Agricultural Building Stock $ Exposure in Hazard Area	# Commercial, Industrial & Agricultural Buildings in Hazard Area	Commercial, Industrial & Agricultural Building Stock $ Annual Loss	Critical Facility $ Exposure in Hazard Area	# Critical Facilities in Hazard Area	Critical Facilities $ Annualized Loss	Population at Risk	Under 18 in Hazard Area
Wildfire	$1,233,951,621	9,636	$211,525	$130,278,630	1,170	$22,332	$73,423,956	71	$12,586.41	31,731	7,950
Earthquake	$1,350,996,743	10,130	NA	$127,364,582	1,088	NA	$141,323,223	84	NA	33,440	8,348
Structure Fire	$1,517,793,347	11,781	$94,460	$141,941,722	1,438	$8,834	$7,595	95	$7,595	33,440	8,348
Flooding	$87,224,898	807	NA	$20,723,657	196	NA	$401,890	3	NA	8,423	1,965
Hazardous Material Incidents	$509,274,350	4,080	NA	$100,052,387	725	NA	$82,583,506	48	NA	20,276	4,766
Dam Failure	$113,428,353	924	NA	$174,436,839	2,679	NA	$30,697,101	17	NA	6,791	1,493
Severe Summer Weather	$1,517,793,347	11,781	$51,405	$141,941,722	1,438	$4,807	$122,042,641	95	$4,133	33,440	8,348
Severe Winter Weather	$1,517,793,347	11,781	$171,608	$141,941,722	1,438	$16,049	$122,042,641	95	$13,799	33,440	8,348
Railroad Accidents	$33,661,990	305	NA	$34,302,362	135	NA	$701,108	2	NA	3,557	916

NA = Not Available. Annual loss can not be computed due to the absence of historic property damage figures that are required to calculate magnitude. See Section 4.1 on page 4-1 which describes risk assessment methodology for additional information.
Wildfire exposure is presented for "Very High" hazard area.
Flooding exposure is presented for the 100-year event
It should be noted that 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 where census blocks are large.

TABLE 4.11-2
HAZARD VULNERABILITY SUMMARY; CITY OF HELENA

Hazard	Residential Building Stock $ Exposure in Hazard Area	# Residences in Hazard Area	Residential Building Stock $ Annual Loss	Commercial, Industrial & Agricultural Building Stock $ Exposure in Hazard Area	# Commercial, Industrial & Agricultural Buildings in Hazard Area	Commercial, Industrial & Agricultural Building Stock $ Annual Loss	Critical Facility $ Exposure in Hazard Area	# Critical Facilities in Hazard Area	Critical Facilities $ Annualized Loss	Population at Risk	Under 18 in Hazard Area
Wildfire	$1,055,814,324	7,404	$180,989	$973,513,449	1,916	$166,881	$862,592,085	127	$147,866.36	28,190	5,656
Earthquake	$1,055,814,324	7,404	NA	$973,513,449	1,916	NA	$862,592,085	127	NA	28,190	5,656
Structure Fire	$1,055,814,324	7,404	$65,709	$973,513,449	1,916	$60,587	$862,592,085	127	$53,683	28,190	5,656
Flooding	$1,749,553	14	NA	$117,900	2	NA	$0	0	NA	923	54
Hazardous Material Incidents	$503,214,546	4,024	NA	$794,464,719	1,499	NA	$396,079,938	76	NA	17,195	3,738
Dam Failure	$0	0	NA	$0	0	NA	$0	0	NA	0	0
Severe Summer Weather	$1,055,814,324	7,404	$35,758	$973,513,449	1,916	$32,971	$862,592,085	127	$29,214	28,190	5,656
Severe Winter Weather	$1,055,814,324	7,404	$119,375	$973,513,449	1,916	$110,070	$862,592,085	127	$97,528	28,190	5,656
Railroad Accidents	$155,207,222	1,345	NA	$284,652,004	575	NA	$145,726,631	22	NA	7,546	1,497

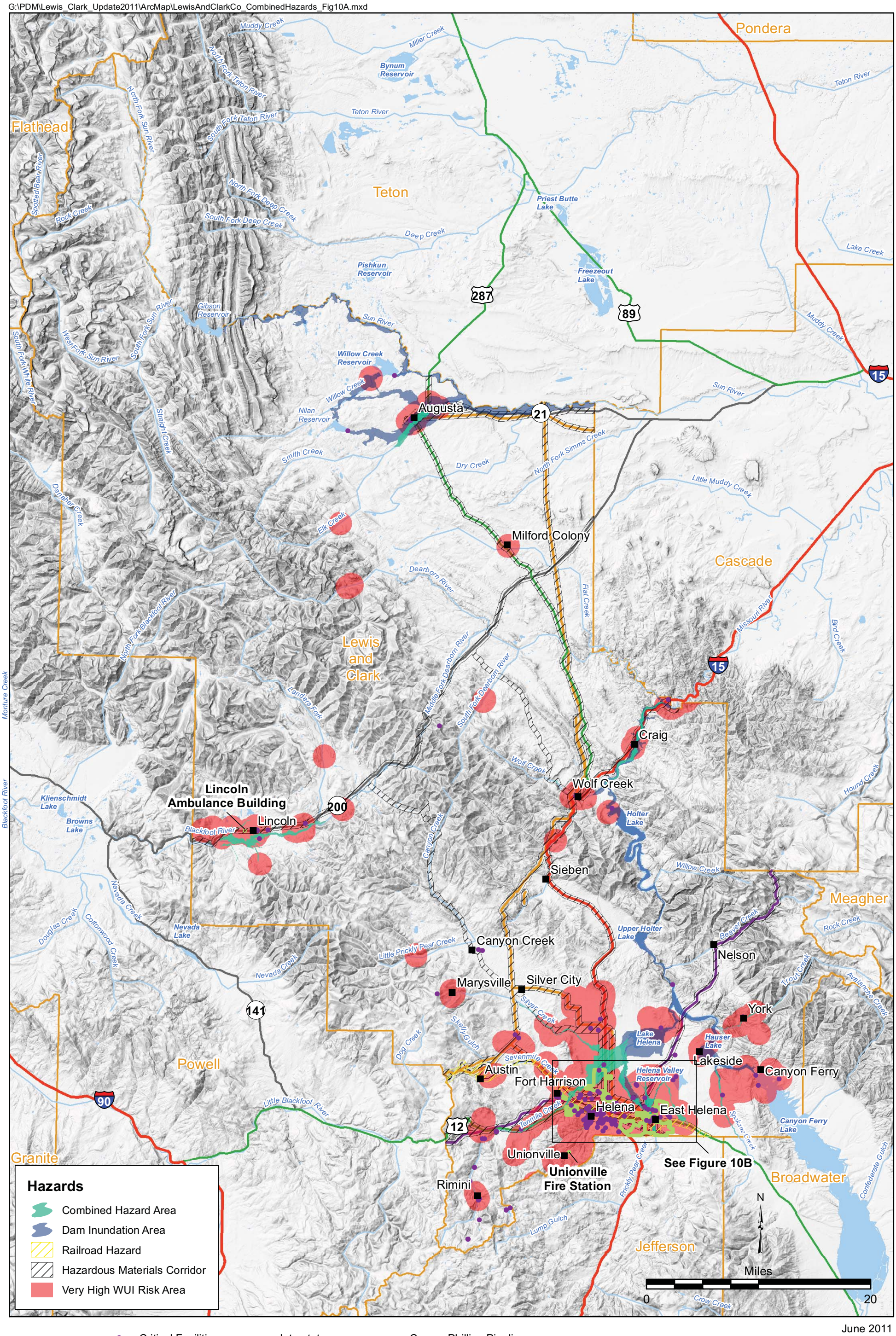
NA = Not Available. Annual loss can not be computed due to the absence of historic property damage figures that are required to calculate magnitude. See Section 4.1 on page 4-1 which describes risk assessment methodology for additional information.
Wildfire exposure is presented for "Very High" hazard area.
Flooding exposure is presented for the 100-year event
It should be noted that 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 where census blocks are large.

TABLE 4.11-3
HAZARD VULNERABILITY SUMMARY; CITY OF EAST HELENA

Hazard	Residential Building Stock $ Exposure in Hazard Area	# Residences in Hazard Area	Residential Building Stock $ Annual Loss	Commercial, Industrial & Agricultural Building Stock $ Exposure in Hazard Area	# Commercial, Industrial & Agricultural Buildings in Hazard Area	Commercial, Industrial & Agricultural Building Stock $ Annual Loss	Critical Facility $ Exposure in Hazard Area	# Critical Facilities in Hazard Area	Critical Facilities $ Annualized Loss	Population at Risk	Under 18 in Hazard Area
Wildfire	$57,693,923	666	$9,890	$30,011,517	129	$5,145	$22,219,536	9	$3,808.89	1,984	455
Earthquake	$57,693,923	666	NA	$30,011,517	129	NA	$22,219,536	9	NA	1,984	455
Structure Fire	$57,693,923	666	$3,591	$30,011,517	129	$1,868	$22,219,536	9	$1,383	1,984	455
Flooding	$5,012,016	60	NA	$3,861,424	9	NA	$152,483	1	NA	242	41
Hazardous Material Incidents	$48,846,778	579	NA	$27,446,236	116	NA	$11,939,536	7	NA	1,679	369
Dam Failure	$13,751,775	163	NA	$8,113,311	46	NA	$9,240,640	5	NA	671	153
Severe Summer Weather	$57,693,923	666	$1,954	$30,011,517	129	$1,016	$22,219,536	9	$753	1,984	455
Severe Winter Weather	$57,693,923	666	$6,523	$30,011,517	129	$3,393	$22,219,536	9	$2,512	1,984	455
Railroad Accidents	$29,932,068	378	NA	$18,725,346	82	NA	$3,087,536	4	NA	1,075	206

NA = Not Available. Annual loss can not be computed due to the absence of historic property damage figures that are required to calculate magnitude. See Section 4.1 on page 4-1 which describes risk assessment methodology for additional information.
Wildfire exposure is presented for "Very High" hazard area.
Flooding exposure is presented for the 100-year event
It should be noted that 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 where census blocks are large.

G:\PDM\Lewis_Clark_Update2011\ArcMap\LewisAndClarkCo_CombinedHazards_Fig10A.mxd



Critical Facilities
Future Development
Place Names
Interstate
U.S. Highway
Montana Highway
Railroad
ConocoPhillips Pipeline
Northwestern Energy LLC Pipeline

June 2011

Figure 10A

Hazard Composite with Future Development

Lewis and Clark County, Montana

Pre-Disaster Mitigation Plan

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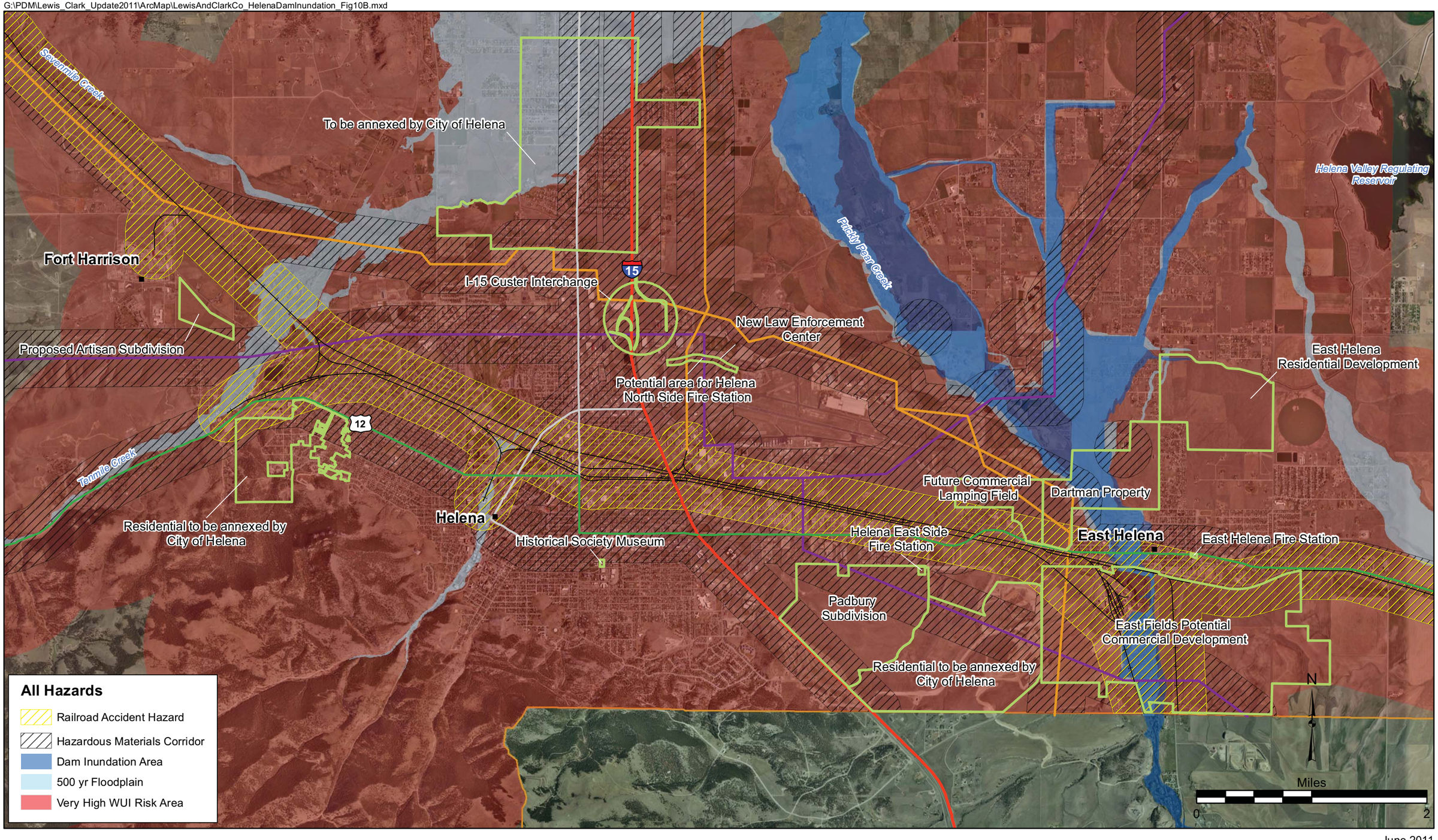

Future Development
County Boundary
Interstate
U.S. Highway
Montana Highway
Railroad
ConocoPhillips Pipeline
Northwestern Energy LLC Pipeline

June 2011

Figure 10B

Hazard Composite with Future Development

Lewis and Clark County, Montana

Pre-Disaster Mitigation Plan

TABLE 4.11-4
FUTURE DEVELOPMENT SUMMARY

Proposed Project/ Construction Type/ Estimated Cost	Hazards								
	Wildfire (Very High Risk)	Earthquake (20-30%g)	Structure Fire	Flooding (100-Year Flood Plain)	Hazardous Material Incidents	Dam Failure	Severe Summer Weather	Severe Winter Weather	Railroad Accidents
New Historical Society Museum , Helena	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No
New county fire station, Unionville	Yes	Yes	Yes	No	No	No	Yes	Yes	No
New city fire station on north side of town, Helena	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes
New city fire station east side of town, Helena	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No
New city fire station east side of Prickly Pear Creek, East Helena	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes
I-15 Interchange at Custer Ave., Helena	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No
New Law Enforcement Center in Helena	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No
New Ambulance Building in Lincoln	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No
Commercial development around Airport, Helena	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No
Subdivisions between Helena/East Helena south of Highway 12 to county line	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes
Artisan Subdivision west of Helena	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No
Dartman Property, East Helena	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Annexation to City of Helena north of Custer Ave. between Green Meadow Drive and I-15	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Future Commercial Lamping Field, East Helena	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes

4.6 HAZARDOUS MATERIAL INCIDENTS

CPRI SCORE = 3.05

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 agricultural chemicals, are commonly stored and used in Lewis and Clark 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 to the county. Hazards range from small spills on roadways to major transportation releases on railways. Illegal methamphetamine operations have also become a concern. Hazardous material incidents occur periodically in Lewis and Clark County, although most are minor.

Records of hazardous material events, available from the National Response Center (NRC) database are summarized in **Table 4.6-1.**

TABLE 4.6-1
LEWIS AND CLARK COUNTY HAZARDOUS MATERIAL INCIDENTS

Incident Date	Type Of Incident	Incident Cause	Location	Nearest City	Suspected Responsible Company	Medium Affected	Material Name
9/1/1990	Fixed	Equipment Failure	Shoco Fertilizer Plant	Augusta	Shoco Fertilizer Plant	Air	Ammonia, Anhydrous
9/18/1990	Mobile	Transport Accident	LCG- Euclid-Henderson	Helena		Unknown	Calcium Oxide
10/22/1990	Fixed	Equipment Failure	Smelter Ave	E. Helena	Asarco Inc.	Air	Sulphur Trioxide
1/30/1991	Railroad	Unknown	2nd Subdivision	East Helena	Montana Rail Link	Land	Diesel, Petrol. Wax
3/18/1991	Fixed	Equipment Failure	Smelter Avenue	E. Helena	Asarco Inc.	Air	Sulfur Trioxide
4/21/1991	Railroad	Unknown	MM 14.5	Helena		Rail Report	
5/10/1991	Fixed	Equipment Failure	3122 Prospect	Helena	Russ Oil Co	Land	Oil, Fuel: No. 2
7/23/1991	Fixed	Equipment Failure	Smelter Ave	E. Helena	Asarco Inc.	Air	Sulfur Trioxide
1/10/1992	Railroad	Equipment Failure		Helena	Montana Rail Link	Land	$C_3Cl_3N_3O_3$
5/5/1992	Mobile	Equipment Failure	Masonic Home Road	Helena	Bahny Construction	Land	Oil: Diesel
10/30/1992	Fixed	Unknown	1021 Chestnut	Helena	US West	Subsurface	Gasoline
2/19/1993	Railroad	Other	Helena Rail Yard	Helena	Montana Rail Link	Land	Oil: Diesel
3/3/1993	Railroad	Unknown		Helena		Rail Report	
4/23/1994	Fixed	Unknown	Plant Highway 12 East	East Helena	Asarco Inc.	Air	Unknown Material
5/12/1994	Railroad	Unknown		Helena		Rail Report	
7/15/1994	Unknown Sheen	Dumping		Lincoln	Riverside Contracting	Land	Asphalt, Unknown Oil
7/20/1994	Fixed	Unknown	Unknown	East Helena	Asarco Inc.	Air	Unknown Material
7/25/1994	Railroad	Natural	15th Subdivision, S 33	Craig		Rail Report	Oil: Diesel
9/3/1994	Fixed	Dumping	North Montana Ave	Helena	Golden Eagle	Land	Oil, Misc: Motor
9/24/1994	Fixed	Dumping	Glass Dr	Helena		Land	Unknown Oil
3/10/1995	Unknown Sheen	Unknown	100 Smelter Ave	E Helena	Asarco Inc.	Water	As, Cd, Pb
6/23/1995	Railroad	Unknown		Helena	Montana Rail Link	Land	Jet Fuel, Oil, Fuel
7/19/1995	Fixed	Other	100 Smelter Ave	E Helena	Asarco Inc.	Water	Arsenic, Lead
6/9/1996	Fixed	Unknown	3122 Hwy 12 East	Helena	City Service Inc.	Subsurface	Gasoline
2/3/1997	Fixed	Unknown	Post Office Harris St	Helena		Land	Unknown Material
2/14/1997	Fixed	Equipment Failure	100 Smelter Ave	East Helena	Asarco Inc.	Land	Sulfuric Acid
7/18/1997	Mobile	Dumping	York Bridge Fishing Access	Helena		Water	Lubricating Oil; Ethylene Glycol; Gas
8/19/1997	Unknown Sheen	Unknown	4920 Highway 12 West	Helena	Broadwater Athletic	Unknown	Cl, HCl

TABLE 4.6-1
LEWIS AND CLARK COUNTY HAZARDOUS MATERIAL INCIDENTS

Incident Date	Type Of Incident	Incident Cause	Location	Nearest City	Suspected Responsible Company	Medium Affected	Material Name
9/12/1997	Fixed	Equipment Failure	7150 Hauser Rd	Helena	Nicholson Const.	Water	Hydraulic Oil
11/30/1997	Fixed	Equipment Failure	100 Smelter Ave	East Helena	Asarco Inc.	Air	Sulphur Trioxide
12/8/1997	Fixed	Unknown	402 West Main	East Helena	Asarco Inc.	Air	Unknown Material
1/5/1998	Fixed	Equipment Failure	100 Smelter Ave	East Helena	Asarco Inc.	Land	Arsenic
1/22/1998	Fixed	Other	7150 Hauser Rd	Helena	Nicholson Const.	Water	Diesel; Sulfuric Acid
1/28/1998	Fixed	Unknown	100 Smelter Ave	East Helena	Asarco Inc.	Land	Sulfuric Acid
2/3/1998	Fixed	Unknown	100 Smelter Ave	East Helena	Asarco Inc.	Land	Process Water
4/21/1998	Pipeline	Equipment Failure	100 Smelter Ave	East Helena	Asarco Inc.	Land	Sulfuric Acid
7/28/1998	Fixed	Other	100 Smelter Ave	East Helena	Asarco Inc.	Air	Sulfur Trioxide
8/13/1998	Pipeline	Equipment Failure	100 Smelter Ave	East Helena	Asarco Inc	Land	Sulfuric Acid
8/21/1998	Fixed	Operator Error	100 Smelter Ave	East Helena	Asarco Inc.	Air	AsO_3; As, Cd, Pb
10/12/1998	Fixed	Operator Error	100 Smelter Ave	East Helena	Asarco Inc	Water	Arsenic; Waste Water
11/9/1998	Fixed	Other	100 Smelter Ave	East Helena	Asarco Inc	Land	Cadmium Water
12/5/1998	Fixed	Equipment Failure	Hauser Hydro Plant	Helena	Montana Power Co	Water	Transformer Oil
12/18/1998	Mobile	Natural	Rogers Pass, Hwy 200	Lincoln	Montana Refining Co	Unknown	Oil: Diesel
12/29/1998	Pipeline	Equipment Failure	100 Smelter Ave	East Helena	Asarco Inc.	Land	Sulfuric Acid
5/23/1999	Fixed	Equipment Failure	100 Smelter Ave	East Helena	Asarco Inc.	Land	Plant Water
5/28/1999	Fixed	Equipment Failure	100 Smelter Ave	East Helena	Asarco Inc.	Land	Hazardous Waste
7/11/1999	Fixed	Other	100 Smelter Ave	East Helena	Asarco Inc.	Land	Sulfuric Acid
1/24/2000	Fixed	Other	100 Smelter Ave	East Helena	Asarco Inc.	Air	Bag House Dust
3/28/2000	Fixed	Other	Lewis and Clark County			Other	Meth Chemicals
5/28/2000	Fixed	Equipment Failure	100 Smelter Ave	East Helena	Asarco Inc.	Land	Plant Water
6/20/2000	Fixed	Operator Error	100 Smelter Ave	East Helena	Asarco Inc.	Land	Plant Water
8/17/2000	Continuous	Other	100 Smelter Ave.	East Helena	Asarco Inc.		AsO_3; AsS_3; NO
9/6/2000	Fixed	Unknown	100 Smelter Ave	East Helena	Asarco Inc.	Land	Plant Water
11/7/2000	Storage Tank	Unknown	608 North Main Street	Helena		Land	Gasoline
12/13/2000	Storage Tank	Unknown	3180 Hwy 12 East	Helena	Conoco Inc.	Land	Gasoline
12/20/2000	Fixed	Equipment Failure	100 Smelter Ave	East Helena	Asarco Inc.	Soil	Plant Water
2/4/2001	Pipeline	Operator Error		Montana City		Air	Natural Gas
2/7/2001	Fixed	Equipment Failure	100 Smelter Ave	East Helena	Asarco Inc.	Other	Plant Water
3/1/2001	Fixed	Equipment Failure	Hydro Electric Facility	Helena	PPL Montana	Water	Transformer OIl
12/1/2001	Mobile	Other	2850 Skyway Dr	Helena	Horizon Air	Land	Propylene Glycol
3/11/2002	Fixed	Equipment Failure	100 Smelter Ave	East Helena	Asarco Inc.	Land	Plant Water
3/13/2003	Fixed	Other	100 Smelter Ave	East Helena	Asarco Inc.	Water	Heavy Metals
6/9/2003	Fixed	Other	7150 Hauser Dam Rd	Helena	Colstrip Electric	Other	Mineral Oil
7/18/2003	Fixed	Other	3424 Highway 12 East	Helena	Dick Anderson Const.	Air	Organic Peroxide
2/3/2004	Pipeline	Other	100 Smelter Avenue	East Helena	Asarco Inc.	Land	Plant Water
6/30/2006	Fixed	Unknown	2960 Washington Ave	Helena	IHOP	Water	Anti-Freeze
11/17/2006	Mobile	Unknown	7150 Hauser Dam Rd	Helena	O'Keefe Drilling Co.	Water	Motor Oil
2/16/2007	Mobile	Transport Accident	Hwy 200, MM 77	Lincoln	B & J Trucking	Water	Oil: Diesel
5/4/2007	Storage Tank	Equipment Failure	N. of Canyon Ferry Dam	Helena		Land	Oil: Diesel
3/16/2009	Fixed	Equipment Failure	100 Smelter Avenue	East Helena	Asarco Inc.	Soil	Lead Based Water

Source: National Response Center, 12/8/2009

The Yellowstone Pipe Line (YPL) Company operates a 725-mile petroleum products pipeline system that originates from refineries in Billings and transports product to markets in Montana, northern Idaho and eastern Washington. The pipeline crosses through Lewis and Clark County and is related to the bulk storage facilities (Conoco-Phillips and Exxon-Mobil) located at the east edge of the City of Helena. Other facilities maintaining bulk hazardous material storage consist of the various propane distributors found around the county.

The U.S. Environmental Protection Agency (EPA) maintains the Toxic Release Inventory (TRI) of facilities that have released contaminants to the environment. TRI listings for Lewis and Clark County are presented in **Table 4.6-2**.

TABLE 4.6-2
TOXIC RELEASE INVENTORY

Facility Name and City/Town	Total On-site Disposal (pounds)	Total Off-site Disposal (pounds)	Total On- & Off-site Disposal (pounds)	Chemicals/ Compounds Released
American Chemet Corp, East Helena	13,047	10	13,057	copper, lead, zinc compounds
Columbia Paint & Coatings Co, Helena	NA	NA	NA	ethylene glycol

Source: Envirofacts (http://www.epa.gov/enviro/html/tris/tris_query.html)

The Montana Department of Justice maintains a list of clandestine methamphetamine drug laboratory sites. Lab sites in Lewis and Clark County are listed in **Table 4.6-3**. Methamphetamine labs typically require a hazardous material response.

TABLE 4.6-3
METHAMPHETAMINE LABORATORY SITES IN LEWIS AND CLARK COUNTY

Date	City	Address	Date	City	Address
12/28/2005	Helena	1601 Aspen	12/5/2007	Helena	675 Star Rd
2/6/2006	Helena	200 N Rodney #6	3/7/2008	Helena	1050 Mill Rd
4/27/2006	Helena	1035 12th Ave	3/19/2009	Helena	2211 Country Club Ave
3/14/2007	East Helena	2733 1/2 Elkview Rd	10/21/2009	East Helena	2389 Buckboard St
10/1/2007	Helena	1998 Euclid #7			

Source: Montana Dept. Justice (http://svc.mt.gov/deq/methquery/)

Two significant hazardous material incidents occurred in Lewis and Clark County in the past 25 years, including a train derailment near Carroll College in 1989 and a fuel spill at the ConocoPhillips Terminal in Helena. The train derailment incident is described under *Railroad Accidents* in Section 4.10. The December 13, 2000 Conoco-Phillips event is described below.

December 13, 2000 Fuel Spill – Conoco-Phillips, through human, system and procedural error, spilled 60,000 to 100,000 gallons of gasoline from a storage tank at their Helen terminal, forcing the evacuation of nearby residences and businesses. According to a company spokesman, the flow was stopped within 24 hours and the spill was contained within a protective berm surrounding the tank. County officials reported that gasoline had initially spilled from two overflow holes at the top of the storage tank. According to reports, 100 to 400 residents living within a half-mile radius were evacuated. Fire suppression foam was sprayed on the spill to reduce the threat of fire or explosion. A nearby highway was closed after motorists complained of fumes. Aircraft were temporarily barred from the airspace above the plant, and Montana Rail Link halted its trains from entering the area to avoid sparks. *Source: 400 Evacuate Following Conoco Gasoline Spill in Montana,* AcuSafe Incident News, December 14, 2000 and, U.S. Environmental Protection Agency, *Oil Spill Program Update*, Vol. 4, No.2, April 2001.

The Helena Fire Department has a Haz-Mat Team which responds to hazardous material incidents in the county.

Vulnerability and Area of Impact

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.

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 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. 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. As shown in **Table 4.6-2**, two facilities in Lewis and Clark County are listed in the TRI Inventory.

To model the spatial distribution of hazardous material incident risk in Lewis and Clark County a GIS data layer of transportation arteries was used, which included highways, major roadways, pipelines and railroads. Facilities where large quantities of hazardous materials or petroleum products are stored were added to this layer and it was then buffered by 0.25 miles. **Figures 8A and 8B** present the hazardous material buffer used in the analysis. Building exposure was calculated by intersecting the hazardous material buffer with the MDOR parcel and critical facility datasets. Vulnerable population exposure was determined using the percent of each census block affected by the hazardous material buffer. **Table 4.6-4** presents the results of the vulnerability analysis.

The GIS analysis indicates that there are over 129,803 acres of the county in the hazardous material buffer including 8,683 residences, 2,340 commercial, industrial and agricultural buildings, and 131 critical facilities. The *Hazardous Material Incident Section* in **Appendix C** presents supporting documentation from the risk assessment including a list of critical facilities in the hazardous material buffer.

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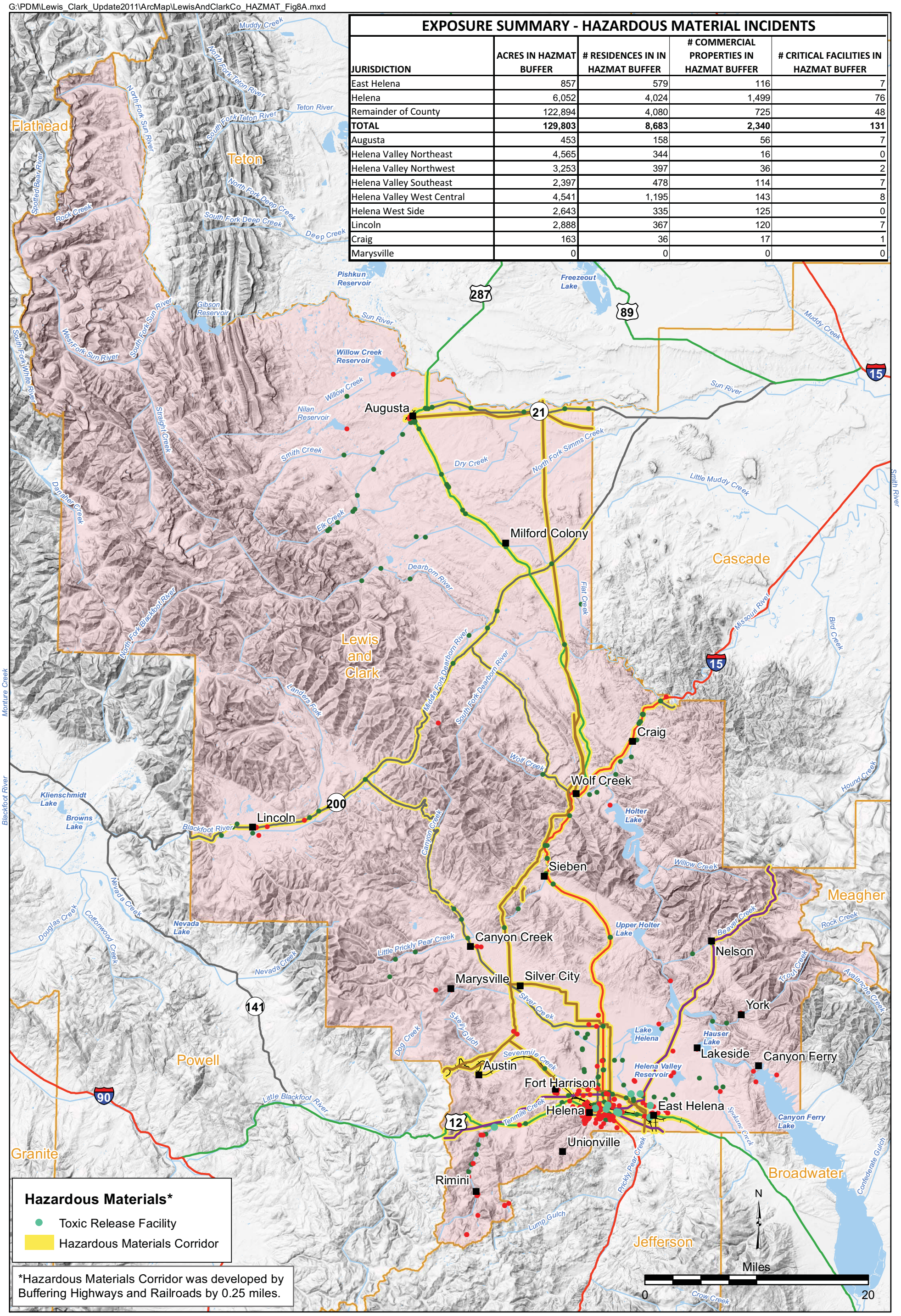
EXPOSURE SUMMARY - HAZARDOUS MATERIAL INCIDENTS

JURISDICTION	ACRES IN HAZMAT BUFFER	# RESIDENCES IN IN HAZMAT BUFFER	# COMMERCIAL PROPERTIES IN HAZMAT BUFFER	# CRITICAL FACILITIES IN HAZMAT BUFFER
East Helena	857	579	116	7
Helena	6,052	4,024	1,499	76
Remainder of County	122,894	4,080	725	48
TOTAL	**129,803**	**8,683**	**2,340**	**131**
Augusta	453	158	56	7
Helena Valley Northeast	4,565	344	16	0
Helena Valley Northwest	3,253	397	36	2
Helena Valley Southeast	2,397	478	114	7
Helena Valley West Central	4,541	1,195	143	8
Helena West Side	2,643	335	125	0
Lincoln	2,888	367	120	7
Craig	163	36	17	1
Marysville	0	0	0	0



- Critical Facilities
- Bridges
- Place Names
- River/Stream
- Lake/Reservoir
- County Boundary
- Interstate
- U.S. Highway
- Montana Highway
- Railroad
- ConocoPhillips Pipeline
- Northwestern Energy LLC Pipeline

June 2011

Figure 8A

Hazardous Materials Buffer

Lewis and Clark County, Montana

Pre-Disaster Mitigation Plan

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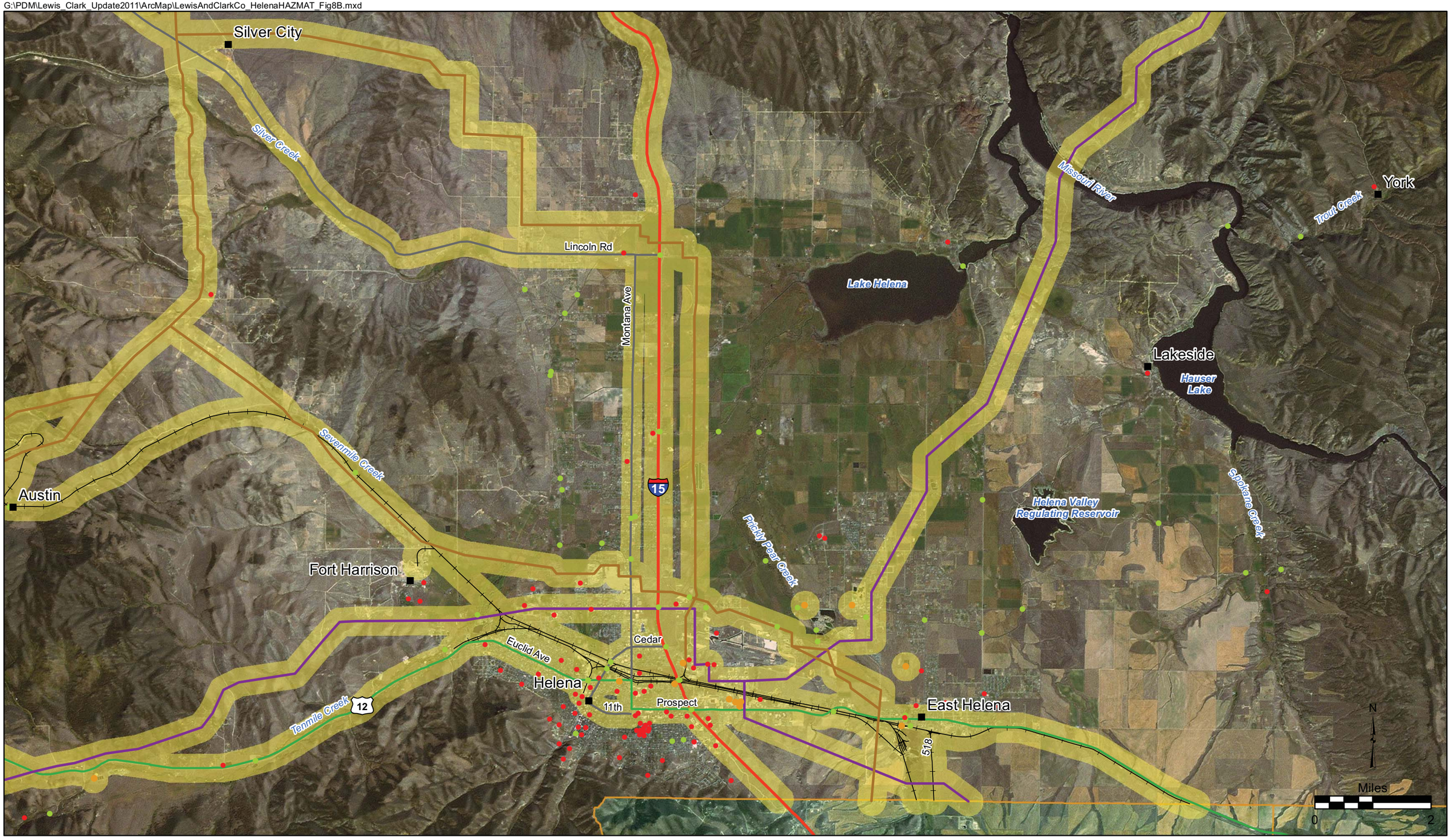

- Toxic Release Facility
- Critical Facilities
- Bridges
- Place Names
- Interstate
- U.S. Highway
- Montana Highway
- ConocoPhillips Pipeline
- Northwestern Energy LLC Pipeline

*Hazardous Materials Corridor was developed by Buffering Highways, Pipelines, and Railroads by 0.25 miles.

June 2011

Figure 8B

Helena Hazardous Materials

Lewis and Clark County, Montana

Pre-Disaster Mitigation Plan

TABLE 4.6-4

LEWIS AND CLARK COUNTY VULNERABILITY ANALYSIS – HAZARDOUS MATERIAL INCIDENTS

JURISDICTION	RESIDENTIAL BUILDING EXPOSURE $	# RESIDENCES AT RISK	COMMERCIAL, INDUSTRIAL & AGRICULTURAL BUIDLINGEXPOSURE $	# COMMERCIAL, INDUSTRIAL & AGRICULTURAL BUIDLINGS AT RISK	CRITICAL FACILITIES EXPOSURE RISK $	# CRITICAL FACILITIES AT RISK	BRIDGE EXPOSURE $	# BRIDGES AT RISK	POPULATION AT RISK	PERSONS UNDER 18 AT RISK
Incorporated Communities & County										
East Helena	$48,846,778	579	$27,446,236	116	$11,939,536	7	$245,052	3	1,679	369
Helena	$503,214,546	4,024	$794,464,719	1,499	$396,079,938	76	$5,004,366	13	17,195	3,738
Remainder of County	$509,274,350	4,080	$100,052,387	725	$82,583,506	48	$19,368,804	83	20,276	4,766
CENSUS Designated Places										
Augusta	$8,821,124	158	$3,841,030	56	$475,814	7	$90,612	2	302	41
Helena Valley Northeast	$57,440,747	344	$4,193,676	16	$0	0	$271,876	3	1,811	443
Helena Valley Northwest	$55,908,571	397	$3,600,092	36	$3,284,608	2	$251,152	1	2,394	638
Helena Valley Southeast	$54,423,351	478	$22,222,300	114	$32,675,693	7	$147,800	3	3,635	1,045
Helena Valley West Central	$152,813,702	1,195	$51,719,878	143	$10,279,697	8	$369,412	5	5,434	1,368
Helena West Side	$35,673,548	335	$23,044,440	125	$0	0	$172,364	2	1,440	312
Lincoln	$30,447,737	367	$12,060,906	120	$5,961,274	7	$73,748	3	860	136
Craig	$2,776,430	36	$1,124,484	17	$475,000	1	$0	0	43	2
Marysville	$0	0	$0	0	$0	0	$0	0	0	0
CENSUS County Divisions										
Augusta	$16,168,819	230	$4,448,201	78	$475,814	7	$1,109,532	22	684	125
Helena	$887,221,290	7,116	$895,261,494	1,997	$478,607,186	108	$7,011,906	34	33,255	7,602
Lincoln	$122,447,342	1,054	$17,261,691	191	$9,870,882	11	$2,564,268	13	4,402	1,015
Wolf Creek	$35,498,223	283	$4,991,956	74	$1,649,097	5	$13,932,516	30	809	131

Probability and Hazard Magnitude

Hazardous materials incidents can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. The magnitude of the hazard is often expressed as a percentage of property damage caused by the incident. Damage associated with hazardous material incidents is typically handled by the insurance company of the responsible party; therefore, little data is available to document property loss from hazardous materials incidents in Lewis and Clark County.

The history of hazardous material events in Lewis and Clark County over the past 20 years indicates 70 incidents have occurred. Therefore, the probability of future events is rated as "highly likely". Using the Calculated Priority Risk Index, the PDM Planning Team ranking the probability of hazardous material incidents as "likely."

Future Development

There are no land use regulations that restrict building along transportation routes or in the vicinity of facilities which store large quantities of hazardous materials/petroleum products.

4.7 DAM FAILURE

CPRI SCORE = 3.0

Description and History

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. Others 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. The Montana DES Division maintains an extensive library of Emergency Action Plans (EAPs) for the state's high hazard dams. Hazard ratings are also given 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 below.

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, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

High Hazard Potential: Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

Lewis and Clark County has 13 high hazard dams, as shown in **Table 4.7-1**. In addition, there are several high hazard dams in adjoining Jefferson and Teton counties that have the potential to impact Lewis and Clark County (**Table 4.7-1)**. **Figures 9A and 9B** show dam inundation areas in the county and the Cities of Helena and East Helena, respectively. The Scott Reservoir Dam, was rated as a high hazard dam in 2011 and does not currently have an EAP with inundation map.

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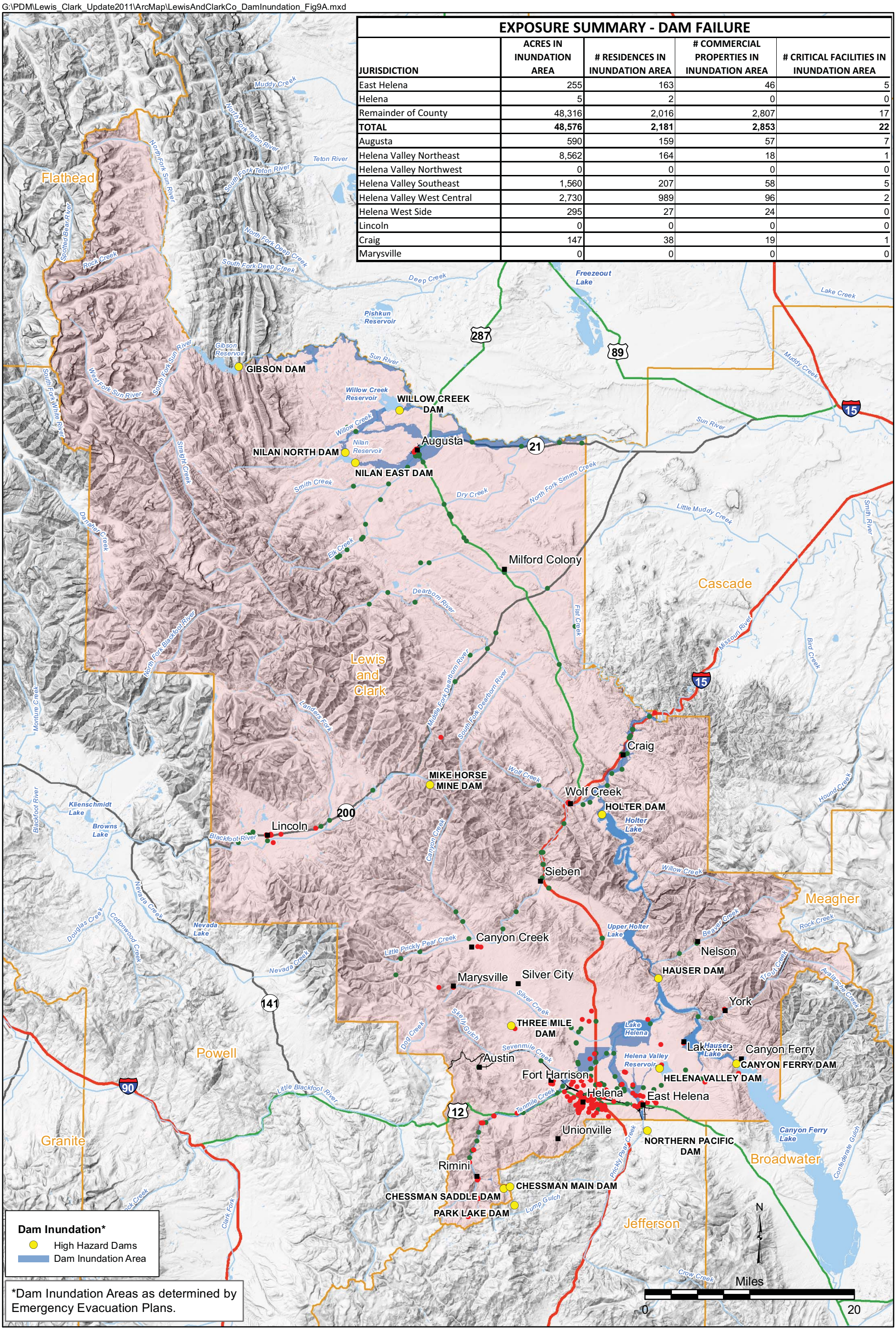

EXPOSURE SUMMARY - DAM FAILURE

JURISDICTION	ACRES IN INUNDATION AREA	# RESIDENCES IN INUNDATION AREA	# COMMERCIAL PROPERTIES IN INUNDATION AREA	# CRITICAL FACILITIES IN INUNDATION AREA
East Helena	255	163	46	5
Helena	5	2	0	0
Remainder of County	48,316	2,016	2,807	17
TOTAL	**48,576**	**2,181**	**2,853**	**22**
Augusta	590	159	57	7
Helena Valley Northeast	8,562	164	18	1
Helena Valley Northwest	0	0	0	0
Helena Valley Southeast	1,560	207	58	5
Helena Valley West Central	2,730	989	96	2
Helena West Side	295	27	24	0
Lincoln	0	0	0	0
Craig	147	38	19	1
Marysville	0	0	0	0

Critical Facilities
Bridges
Place Names
River/Stream
Lake/Reservoir
County Boundary
Interstate
U.S. Highway
Montana Highway
Railroad

June 2011

Figure 9A

Dam Inundation Areas

Lewis and Clark County, Montana

Pre-Disaster Mitigation Plan

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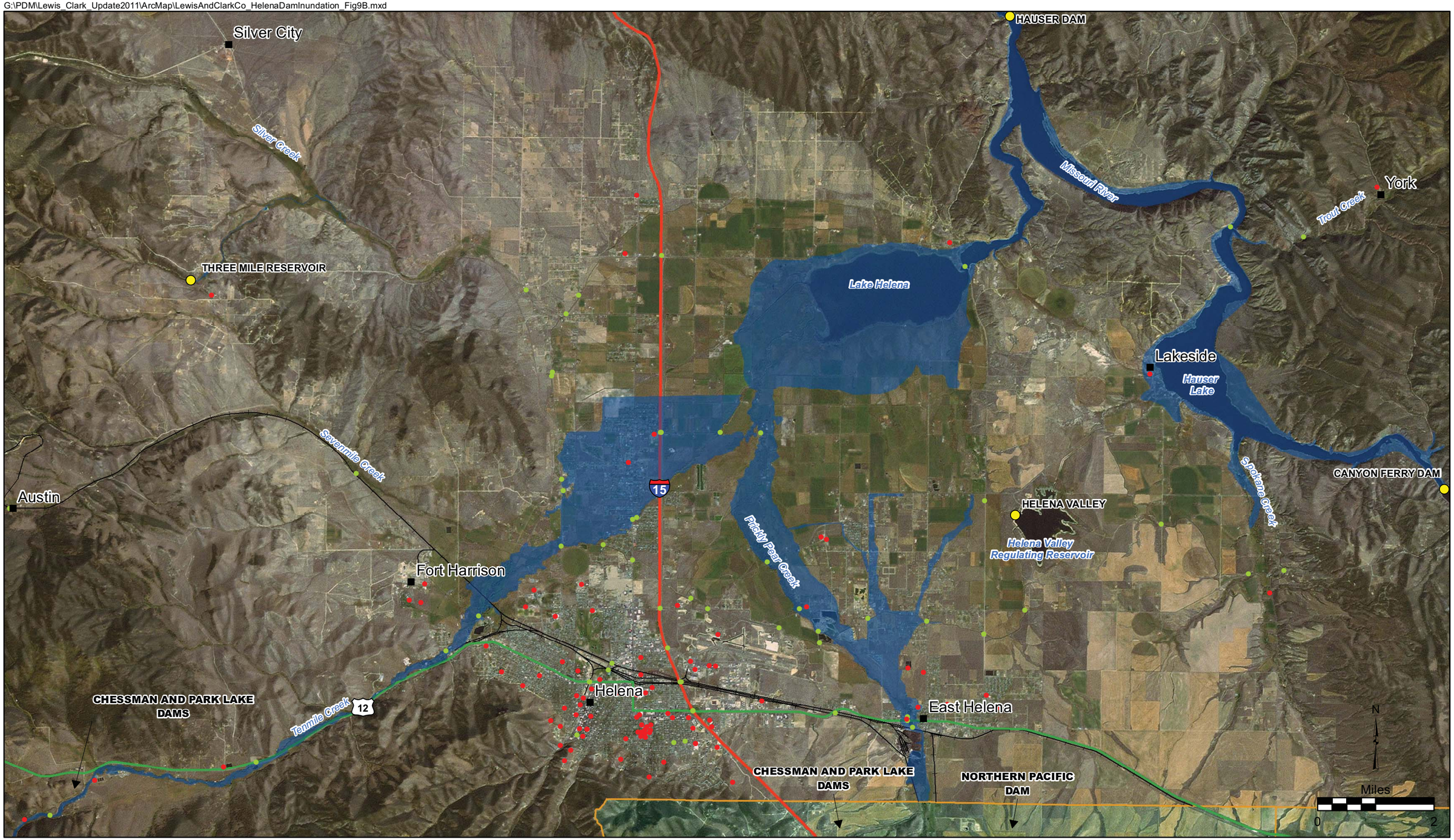


High Hazard Dams
Critical Facilities
Bridges
Place Names
Dam Inundation Area
County Boundary
Interstate
U.S. Highway
Montana Highway
Railroad

*Dam Inundation Areas as determined by Emergency Evacuation Plans.

June 2011

Figure 9B

Helena Dam Inundation

Lewis and Clark County, Montana

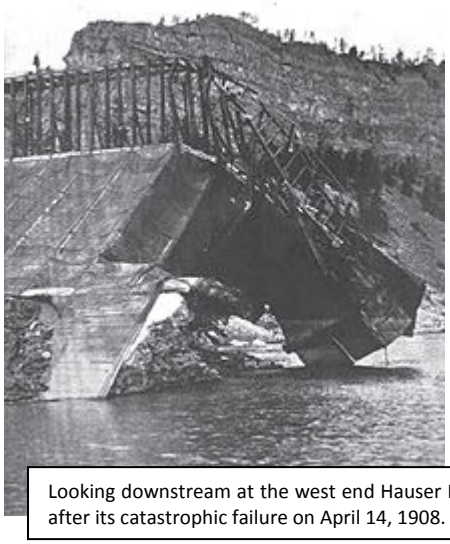
Pre-Disaster Mitigation Plan

TABLE 4.7-1
HIGH HAZARD DAMS IN OR AFFECTING LEWIS AND CLARK COUNTY

Dam Name	County	Drainage	NID Height (feet)	NID Storage (acre-ft)	Purpose	Type	Owner
Canyon Ferry	Lewis & Clark	Missouri River	225	2,051,000	Hydroelectric	Concrete	BuRec
Chessman Main Dam	Lewis & Clark	Ten Mile Creek	57	2,370	Water Supply	Earthfill	City of Helena
Chessman Saddle Dam	Lewis & Clark	Ten Mile Creek	27	1,870	Water Supply	Earthfill	City of Helena
Hauser Dam	Lewis & Clark	Missouri River	80	98,000	Hydroelectric	Concrete	PPL MT
Holter Dam	Lewis & Clark	Missouri River	124	243,000	Hydroelectric	Concrete	PPL MT
Helena Valley	Lewis & Clark	Ten Mile Creek	94	10,702	Irrigation	Earthfill	BuRec
Helena Valley Dike	Lewis & Clark	Ten Mile Creek	30				
Nilan East Dam	Lewis & Clark	Trib-Elk Creek	51	15,600	Irrigation	Earthfill	State of MT
Nilan North Dam	Lewis & Clark	Trib-Willow Creek					
Scott Reservoir Dam	Lewis & Clark	Ten Mile Creek	32	595	Water Supply	Earthfill	City of Helena
Three Mile Reservoir	Lewis & Clark	Three Mile Creek	70	300	Irrigation	Earthfill	Hardie Ranch
Willow Creek	Lewis & Clark	Willow Creek	93	39,800	Irrigation	Earthfill	BuRec
Gibson Dam	Teton	Sun River	199	99,100	Irrigation	Concrete	BuRec
Northern Pacific Dam	Jefferson	McClellan Creek	35	173	Water Supply	Gravity	Ash Grove Cement
Park Lake Dam	Jefferson	Trib-Lump Gulch	21.6	423	Recreation	Earthfill	MFWP

There have been three dam disasters which have impacted Lewis and Clark County. These events, as well as a fourth less severe incident, are described below.

Hauser Dam - On April 14, 1908, at about 2:30 PM, Hauser Dam failed after water pressure undermined the masonry footings (the steel dam itself being structurally sound). The first sign of trouble was when silt-heavy water began gushing from the base of the dam near the powerhouse. A power company employee, spotting the problem, ran into the powerhouse and told everyone to flee for their lives. About 15 minutes later, the masonry footings gave way, causing the upstream section of the dam to settle and a 30-foot wide breach to open in the dam. The water pouring through the breach further undermined the dam's footing, and six minutes later a 300-foot wide section of the dam tore loose. The powerhouse was only slightly damaged. A surge of water 25 feet to 30 feet high swept downstream. The remaining sections of the dam, anchored to bedrock, helped hold back some of the water for a time, reducing



Looking downstream at the west end Hauser Dam after its catastrophic failure on April 14, 1908.

the destructiveness of the flood. A Great Northern Railway locomotive was dispatched to the City of Great Falls, 70 miles downstream in Cascade County, warning stations along the way about the dam break.

The warnings and the geology of the Missouri River below Hauser Dam helped save numerous lives. The construction camp at Holter Dam (then being built) was swept away. The flood reached the small town of Craig around 7:00 PM, but the narrow canyons of the Missouri River above the town helped hold back part of the floodwaters and dissipated much of their energy. The residents of the town had received plenty of warning, and were evacuated. At first, the press reported that the town had been swept away, but this proved inaccurate as only a few shacks and the railroad station had been uprooted. The Craig Bridge (normally 25 feet above water) had more than 2 feet of water over its deck and was feared doomed, but it held. Damages were estimated at more than $1 million. (http://www.metnet.mt.gov/special/quarries%20from%20the%20gulch/htm/hauser.shtml)

Gibson Dam - In June 1964, a combination of heavy rains along the Continental Divide and rapid snowmelt caused widespread flooding of many watersheds. Fourteen (14) inches of rain fell during a 37 hour period. The water level in Gibson Reservoir rose three feet over the top of the dam spilling 60,000 cubic feet per second (cfs) of floodwater into the Sun River drainage in Cascade County.

Mike Horse Dam – In 1975, heavy rain resulted in the failure of the Mike Horse Dam, a USFS-owned tailings dam on Beartrap Creek northeast of Lincoln. Failure of the earthfill dam resulted in the release of approximately 100,000 tons of metal-laden material into the headwaters of the Blackfoot River causing an ecological disaster.

ASARCO Dam - A small earthen dam located on Prickly Pear Creek just inside the upstream East Helena corporate limits failed during the 1981 flood. The dam stored water for use in smelter facilities, but provided no appreciable flood storage or flood regulation.

Vulnerability and Area of Impact

Those areas directly downstream from the high hazard dams would be the areas most at risk for loss of life and structural damage. The Lewis and Clark County DES office maintains Emergency Action Plans for these dams.

To model the exposure from a breach of the high hazard dams in Lewis and Clark County, a GIS data layer was created for this project. Dam inundation areas from the EAPs were digitized and intersected with the critical facility and MDOR parcel datasets to determine exposure of the county's building stock. Vulnerable populations were calculated based on the percent census block in the inundation areas. Exposure values are presented in **Table 4.7-2**.

TABLE 4.7-2

LEWIS AND CLARK COUNTY VULNERABILITY ANALYSIS – DAM FAILURE

JURISDICTION	RESIDENTIAL BUILDING EXPOSURE $	# RESIDENCES AT RISK	COMMERCIAL, INDUSTRIAL & AGRICULTURAL BUILDING EXPOSURE $	# COMMERCIAL, INDUSTRIAL & AGRICULTURAL BUILDINGS AT RISK	CRITICAL FACILITIES EXPOSURE RISK $	# CRITICAL FACILITIES AT RISK	BRIDGE EXPOSURE $	# BRIDGES AT RISK	POPULATION AT RISK	PERSONS UNDER 18 AT RISK
Incorporated Communities & County										
East Helena	$13,751,775	163	$8,113,311	46	$9,240,640	5	$245,052	3	671	153
Helena	$439,643	2	$0	0	$0	0	$0	0	2	0
Remainder of County	$113,428,353	2,016	$174,436,839	2,807	$30,697,101	17	$13,909,688	36	11,814	2,633
CENSUS Designated Places										
Augusta	$8,968,514	159	$3,841,341	57	$475,814	7	$243,008	4	309	41
Helena Valley Northeast	$29,229,238	164	$1,558,055	18	$0	1	$476,356	6	1,030	207
Helena Valley Northwest	$0	0	$0	0	$0	0	$0	0	0	0
Helena Valley Southeast	$22,376,031	207	$10,540,596	58	$29,436,287	5	$135,232	3	3,224	845
Helena Valley West Central	$119,123,609	989	$14,977,712	96	$0	2	$436,468	5	4,168	973
Helena West Side	$3,651,551	27	$11,126,436	24	$7,617,120	0	$172,364	2	399	84
Lincoln	$0	0	$0	0	$0	0	$0	0	0	0
Craig	$2,956,295	38	$1,126,892	19	$475,000	1	$0	0	43	2
Marysville	$0	0	$0	0	$0	0	$0	0	0	0
CENSUS County Divisions										
Augusta	$16,557,908	221	$4,143,596	71	$475,814	7	$777,004	13	512	62
Helena	$204,406,369	1,657	$41,561,040	124	$38,986,927	11	$3,791,696	25	10,722	2,503
Lincoln	$256,836	2	$154,865,139	2,475	$0	1	$0	0	553	123
Wolf Creek	$38,699,876	301	$2,923,266	55	$475,000	3	$10,904,268	17	700	98

GIS analysis of the dam failure risk to Lewis and Clark County indicates that over 43,996 acres are within the inundation areas of the high hazard dams, including 1,087 residences, 2,725 commercial, industrial and agricultural buildings, and 22 critical facilities. The Dam Failure Section in Appendix C presents supporting documentation from the risk assessment including a list of critical facilities in the inundation areas.

Probability and Hazard Magnitude

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 significant dam breach in Lewis and Clark was ranked as "unlikely" by the Planning Team.

A high magnitude dam failure can represent more than one threat of damage. The most obvious threat is the floodwater generated by sudden breaching of the dam which can result in direct damage due to submergence, hydraulic damage, and loss of life or property damage. A less obvious threat is sedimentation which can threaten the integrity of a downstream structure.

Future Development

Lewis and Clark County and the cities of Helena and East Helena do not have zoning or subdivision regulations to prevent new construction in dam inundation areas.

4.8 SEVERE SUMMER WEATHER

CPRI SCORE = 2.95

Severe summer weather includes thunderstorms, wind, hail, lightning, and microbursts that typically occur between May and October of each year.

Description and History

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. Although not considered "severe", lightning and heavy rain can also accompany thunderstorms. Thunderstorms can produce intense downburst and microburst wind. In addition, high winds, defined below, can occur outside of thunderstorms when the overall weather conditions are favorable.

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.

The Augusta area experiences strong winds associated with the east side of the Rocky Mountains. Winds are generally westerly to southwesterly and frequently cause property damage.

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, as listed below.

- *Severe Thunderstorm Warning*: Any thunderstorm wind gust equal to or greater than 58 mph; any hail size 1-inch or larger.
- *High Wind*: Sustained winds of 40 mph for an hour or any gust to 58 mph (non-convective winds).

Table 4.8-1 presents severe summer storm events (May through October) from the NCDC database indicating the magnitude of these events.

TABLE 4.8-1
LEWIS AND CLARK COUNTY SEVERE SUMMER WEATHER REPORTS (MAY-OCTOBER)

Date	Location	Magnitude	Date	Location	Magnitude	Date	Location	Magnitude
7/25/1955	Hail	0.75 in.	8/22/1994	High Winds	60 kts.	7/23/2003	Tstm Wind	61 kts.
8/5/1957	Hail	1.00 in.	6/15/1995	Tstm Wind	50 kts.	8/6/2003	Hail	0.75 in.
6/21/1959	Hail	1.00 in.	6/15/1996	Hail	0.75 in.	8/13/2003	Lightning	N/A
7/22/1960	Tornado	F0	6/25/1996	Hail	2.00 in.	8/22/2003	Hail	0.75 in.
7/14/1964	Hail	1.75 in.	6/26/1996	Hail	1.00 in.	8/22/2003	Tstm Wind	50 kts.

TABLE 4.8-1
LEWIS AND CLARK COUNTY SEVERE SUMMER WEATHER REPORTS (MAY-OCTOBER)

Date	Location	Magnitude	Date	Location	Magnitude	Date	Location	Magnitude
5/30/1966	Hail	2.50 in.	6/4/1997	Hail	1.75 in.	9/25/2003	High Wind	50 kts.
7/27/1970	Hail	1.00 in.	6/6/1997	Hail	3.00 in.	10/12/2003	High Wind	52 kts.
5/23/1974	Tstm Wind	--	9/14/1997	Hail	1.25 in.	10/29/2003	High Wind	69 kts.
5/15/1975	Tstm Wind	60 kts.	9/15/1997	Hail	0.75 in.	6/25/2004	Hail	0.75 in.
6/30/1975	Hail	2.75 in.	5/26/1998	Tstm Wind	63 kts.	7/15/2004	Hail	1.75 in.
6/30/1975	Tstm Wind	56 kts.	6/30/1998	Hail	1.00 in.	8/3/2004	Hail	1.00 in.
7/1/1975	Hail	3.00 in.	7/3/1998	Hail	1.00 in.	8/5/2004	Hail	0.88 in.
7/3/1975	Tstm Wind	70 kts.	6/18/1999	Tstm Wind	52 kts.	8/5/2004	Tstm Wind	58 kts.
8/17/1975	Tstm Wind	52 kts.	6/24/1999	High Wind	69 kts.	6/5/2005	Hail	1.75 in.
6/6/1976	Hail	1.00 in.	8/7/1999	Hail	2.00 in.	6/16/2005	Hail	1.00 in.
6/28/1982	Hail	3.00 in.	9/25/1999	High Wind	56 kts.	6/27/2005	Hail	1.75 in.
6/28/1982	Tstm Wind	--	10/31/1999	High Wind	57 kts.	7/8/2005	Tstm Wind	52 kts.
6/29/1982	Hail	1.75 in.	6/5/2000	Tstm Wind	50 kts.	7/24/2005	Tstm Wind	52 kts.
7/7/1982	Tstm Wind	--	8/7/1999	Hail	2.00 in.	5/21/2006	Tstm Wind	60 kts.
8/21/1982	Tstm Wind	50 kts.	7/2/2000	Hail	1.75 in.	6/4/2006	Tstm Wind	52 kts.
5/30/1984	Tstm Wind	60 kts.	7/8/2000	Hail	1.75 in.	6/29/2006	Tstm Wind	54 kts.
8/24/1984	Tstm Wind	64 kts.	7/13/2000	Tstm Wind	70 kts.	7/23/2006	Tstm Wind	61 kts.
8/27/1985	Hail	1.00 in.	8/11/2000	Hail	0.75 in.	5/10/2007	Hail	0.75 in.
6/8/1988	Tstm Wind	58 kts.	5/19/2001	High Wind	57 kts.	6/16/2007	Hail	1.50 in.
7/3/1988	Hail	1.75 in.	5/25/2001	Hail	1.00 in.	6/16/2007	Tstm Wind	56 kts.
7/5/1988	Hail	1.00 in.	5/28/2001	Hail	0.75 in.	8/19/2007	Tstm Wind	52 kts.
5/10/1989	Tstm Wind	52 kts.	7/12/2001	Hail	1.75 in.	5/20/2008	Tstm Wind	52 kts.
6/15/1989	Hail	1.50 in.	7/13/2001	Tstm Wind	52 kts.	5/30/2008	Hail	1.00 in.
6/15/1989	Tstm Wind	--	7/15/2001	Tstm Wind	52 kts.	6/21/2008	Tstm Wind	53 kts.
7/15/1989	Tstm Wind	55 kts.	7/16/2001	Hail	0.75 in.	7/4/2008	Hail	1.75 in.
7/23/1989	Tstm Wind	50 kts.	8/4/2001	Hail	1.50 in.	7/4/2008	Tstm Wind	52 kts.
7/26/1989	Tstm Wind	54 kts.	10/23/2001	High Wind	62 kts.	8/9/2008	Tstm Wind	56 kts.
7/30/1989	Hail	1.00 in.	6/21/2002	Tstm Wind	56 kts.	8/19/2008	Hail	0.75 in.
7/2/1990	Tstm Wind	57 kts.	6/27/2002	Tstm Wind	52 kts.	8/19/2008	Tstm Wind	50 kts.
8/20/1990	Hail	1.25 in.	7/14/2002	Hail	1.75 in.	5/3/2010	High Wind	52 kts.
5/18/1991	Tstm Wind	--	7/14/2002	Tstm Wind	51 kts.	6/20/2010	Hail	1.00 in.
5/25/1991	Hail	1.00 in.	7/23/2002	Tstm Wind	56 kts.	6/29/2010	High Wind	56 kts.
6/19/1991	Hail	1.75 in.	8/5/2002	Hail	1.00 in.	6/29/2010	Tstm Wind	76 kts.
6/20/1991	Hail	1.00 in.	8/16/2002	High Wind	63 kts.	7/19/2010	Hail	1.00 in.
6/9/1992	Tstm Wind	70 kts.	6/19/2003	Tstm Wind	53 kts.	7/31/2010	High Wind	50 kts.
8/19/1992	Tstm Wind	50 kts.	6/20/2003	Tstm Wind	61 kts.	8/5/2010	Tstm Wind	52 kts.

Source: National Weather Service (NCDC, 2010)
Notes: Tstm = Thunderstorm; kts. = knots; in. = inches

Since the 2005 PDM Plan was adopted, a number of severe summer storm events have affected Lewis and Clark County; however, most of these have not caused significant damage. There have been no Presidential Disaster Declarations or State Disasters issued for the severe summer weather in Lewis and Clark County. Some severe summer weather events are described below.

July 4, 2008 - A very unstable air mass covering most of North central Montana allowed widespread severe weather to develop. Numerous severe thunderstorms were reported. Hail the size of golf balls and wind gusts in excess of 70 mph were common. A severe thunderstorm dropped 1.75 inch diameter hail near Augusta.

May 3, 2010 - High winds toppled a semi-trailer on Interstate 15 near the South Helena Interchange. Wind gusts in excess of 60 mph were common. Many trees were downed by the winds in Helena as were power poles resulting in thousands of customers losing service.

Table **4.8-2** presents severe summer weather with reported damages, injuries, or fatalities since 1960.

TABLE 4.8-2
LEWIS AND CLARK COUNTY SEVERE SUMMER STORM EVENTS WITH DAMAGES (~MAY-OCTOBER)

Date	Injuries	Fatalities	Property Damage	Crop Damage	Remarks
8/14/1960	0	0	$5,000	$0	Wind
10/24/1960	0	0	$500	$0	Strong Wind
5/10/1961	0	0	$208	$0	High Winds and Thunderstorms
5/30/1961	0	0	$106	$1,064	Thunder, Heavy Rain, Hail Storms
6/29/1961	0	0	$106	$1,064	Thunder, High Wind, Hail, Heavy Rain
6/28/1963	0	0	$3,333	$33,333	Thunderstorms, High Wind, Hail
6/6/1964	0	1.2	$0	$0	Heavy Rain
7/2/1964	0	0	$0	$208	Hail, Thunderstorms
8/18/1964	0	0	$0	$208	Lightning
7/8/1965	0	1	$0	$0	Lightning
6/12/1965	0	5	$0	$0	Thunderstorm and Wind
7/24/1966	0	0	$0	$5,000	Thunderstorm, Gusty Wind
7/19/1968	0	0	$172	$0	High Wind, Thunderstorms
6/27/1970	0	0	$10,638	$10,638	Strong Winds, Hail
9/19/1971	0	0	$294	$0	Wind
9/12/1973	0	0	$3	$0	Wind Storm
7/26/1974	0	0	$167	$0	High Winds
6/30/1975	0.5	0	$25,000	$25	Thunderstorm, Hail
7/1/1975	0	0	$4,167	$4,167	Wind, Hail
7/3/1975	0	0	$5,000	$5,000	Wind And Rain
8/7/1975	0	0	$104	$1,042	Hail And Wind
8/17/1975	1	0	$5,000	$0	Thunderstorm
6/6/1976	2	0	$500,000	$0	Hail
6/16/1977	0	0	$42	$4,167	Hail
5/21/1981	0	0	$333,333	$0	Heavy Rains
6/28/1982	0	0	$5,000,000	$50,000	Hail
8/3/1982	0	0	$50,000	$0	Wind
7/20/1983	0	1.5	$0	$0	Wind
6/20/1985	0.02	0	$1,163	$1,163	Hail/Wind
8/8/1986	3	2	$0	$0	High Wind
7/2/1990	0	0	$50,000	$50,000	Thunderstorm Winds
10/16/1991	0	0	$102,041	$0	Wind
5/15/1994	0	0	$500,000	$0	Thunderstorm Winds
6/6/1994	0	0	$50,000	$0	Thunderstorm Winds
6/26/1994	0	0	$4,167	$0	High Winds
6/27/1997	0	0	$2,000	$0	Tornado
8/7/1999	0	0	$2,000	$0	Hail
10/3/1999	0	0	$12,500	$0	High Wind
10/31/1999	0	0	$80,000	$0	High Wind
7/13/2000	0	0	$10,000	$0	Thunderstorm Wind
6/20/2003	0	0	$10,000	$0	Thunder Storm - Wind
8/13/2003	5	0	$0	$0	Lightning

TABLE 4.8-2 LEWIS AND CLARK COUNTY SEVERE SUMMER STORM EVENTS WITH DAMAGES (~MAY-OCTOBER)					
Date	**Injuries**	**Fatalities**	**Property Damage**	**Crop Damage**	**Remarks**
5/1/2008	0	0	$1,000	$0	Dust Devil
TOTAL	**11.52**	**10.7**	**$6,868,045**	**$167,079**	

Source: SHELDUS, 2010 (adjusted to 2009 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.

Vulnerability and Area of Impact

According to FEMA's wind zone classifications the entire county is in Zone II (160 mph Design Wind Speeds). http://www.fema.gov/plan/prevent/saferoom/tsfs02_wind_zones.shtm. Based on review of historic weather data, the entire project area has been classified with a uniform risk for severe summer 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. Mostly likely, though, only isolated areas would be affected by these types of storms rather than encompassing the entire county. Annualized loss estimates are presented in the Risk Assessment Summary Tables in *Section 4.11* (**Tables 4.11-1 through Table 4.11-3**). The *Severe Summer Weather Section* in **Appendix C** presents additional information from the risk assessment.

Probability and Hazard Magnitude

Windstorms 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. Utility interruption is a notable affect of severe summer storms. Nationally, hailstorms cause nearly $1 billion in property and crop damage annually, as peak activity coincides with peak agricultural seasons.

The history of thunderstorm, wind and hail events in Lewis and Clark County indicate that they occur more than once per year. Therefore, the probability of this hazard occurring in the future is rated as "highly likely".

Future Development

The State of Montana has adopted the 2009 International Building Code which stipulates that buildings throughout the state must be constructed to withstand a constant velocity of 75 mph and three second gusts of 90 mph. The cities of Helena and East Helena have building departments which require permits and inspections to ensure the codes are followed.

4.9 SEVERE WINTER WEATHER

CPRI SCORE = 2.85

The winter weather hazard profiled below includes several weather conditions that occur from late fall through early spring in Lewis and Clark County (November through April). Snow, blizzards, extended cold and high winds frequently occur together but also occur independent of one another during these months.

Description and History

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 be well over 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.

An important element of winter weather is the wind. Lewis and Clark County lies within the Chinook zone, which is associated with 160 mph wind speeds. Chinook winds during the winter and early spring can lead to significant snow melt and flooding of small streams and rivers. Average wind speeds range from 10 to 15 mph depending on the exposure of the location. Average and peak sustained winds tend to be much stronger and have been responsible for significant property damage in the past.

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 4.9-1**.

TABLE 4.9-1
WARNING AND ADVISORY CRITERIA FOR WINTER WEATHER

Winter Weather	Weather Advisory/Watch	Weather Warning
Snow	2-5 inches of snow in 12 hours	6 inches or more in 12 hours, or 8 inches in 24 hours
Blizzard	(see blowing snow)	Sustained winds or frequent gusts to 35 mph with visibility below a ¼ mile for three hours or more
Blowing Snow	Visibility at or less than a ½ mile.	Visibility at or less than a ½ mile in combination with snowfall at or greater than 6 inches and/or freezing precipitation
High Wind	Conditions are favorable for high winds in and close to the watch area in the next 12 to 48 hours.	Sustained winds ≥ 40 mph for at least 2 hours or any gust ≥ 58 mph
Ice/Sleet	(see freezing rain/drizzle)	Accumulations of ¼ inch or more of ice.
Freezing Rain/ Drizzle	Light precipitation and ice forming on exposed surfaces.	None
Wind Chill	Wind chills of -20 to -39 degrees with a 10 mph wind in combination with precipitation	Wind chills -40 degrees or colder with a 10 mph wind in combination with precipitation.

Source: National Weather Service (NWS, 2010)

Snow storms and bitterly cold temperatures are common occurrences in Lewis and Clark 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. **Table 4.9-2** presents winter weather events, including high wind, from the NCDC database indicating the magnitude of the events.

TABLE 4.9-2
LEWIS AND CLARK COUNTY SEVERE WINTER WEATHER REPORTS

Date	Event	Date	Event	Date	Event
1/4/1994	High Wind	3/29/2000	Heavy Snow	12/5/2005	Winter Storm
2/23/1994	Winter Storm	5/11/2000	Heavy Snow	4/6/2006	Heavy Snow
11/18/1996	Winter Storm	11/8/2000	Heavy Snow	4/16/2006	Heavy Snow
11/20/1996	Heavy Snow, High Wind	12/15/2000	Blizzard	9/14/2006	Winter Storm
12/14/1996	Heavy Snow	2/6/2001	Heavy Snow	11/6/2006	High Wind (50 kts.)
12/15/1996	Heavy Snow	2/14/2001	Heavy Snow	11/13/2006	High Wind (57 kts.)
12/17/1996	Heavy Snow	3/13/2001	High Wind (47 kts.)	11/24/2006	Heavy Snow
12/18/1996	Heavy Snow	4/2/2001	Heavy Snow	12/13/2006	High Wind (67 kts.)
12/21/1996	Heavy Snow	4/12/2001	Heavy Snow	12/14/2006	Winter Storm
12/24/1996	Winter Storm	6/3/2001	Heavy Snow	12/15/2006	High Wind (59 kts.)
12/26/1996	Heavy Snow	6/12/2001	Heavy Snow	1/2/2007	High Wind (56 kts.)
12/27/1996	Heavy Snow	10/23/2001	Winter Storm	1/5/2007	Winter Storm
12/28/1996	Heavy Snow	11/24/2001	Heavy Snow	1/6/2007	, High Wind (61 kts.)
12/29/1996	Winter Storm	1/12/2002	High Wind (60 kts.)	1/7/2007	High Wind (56 kts.)
12/31/1996	High Wind (69 kts.)	1/25/2002	Winter Storm	1/10/2007	High Wind (37 kts.)
1/1/1997	Heavy Snow	2/5/2002	High Wind (56 kts.)	2/16/2007	High Wind (56 kts.)
1/7/1997	Heavy Snow	2/10/2002	High Wind (68 kts.)	3/12/2007	High Wind (53 kts.)
1/8/1997	Winter Storm	2/21/2002	High Wind (100 kts.)	4/17/2007	Heavy Snow
1/10/1997	Heavy Snow	2/23/2002	Winter Storm	5/21/2007	Heavy Snow

TABLE 4.9-2
LEWIS AND CLARK COUNTY SEVERE WINTER WEATHER REPORTS

Date	Event	Date	Event	Date	Event
1/15/1997	Heavy Snow	3/5/2002	Winter Storm	11/4/2007	High Wind (37 kts.)
1/21/1997	Heavy Snow	3/7/2002	Winter Storm	11/12/2007	High Wind (52 kts.)
1/24/1997	Heavy Snow	3/19/2002	Winter Storm	11/19/2007	Heavy Snow
1/25/1997	Heavy Snow	4/1/2002	Winter Storm	11/26/2007	Winter Storm
2/27/1997	Heavy Snow	4/13/2002	High Wind (65 kts.)	12/29/2007	Heavy Snow
3/11/1997	Heavy Snow	4/17/2002	Winter Storm	1/19/2008	Heavy Snow
3/12/1997	High Wind (50 kts.)	5/7/2002	Winter Storm	2/7/2008	Heavy Snow, High Wind
3/26/1997	Heavy Snow	5/22/2002	Winter Storm	3/4/2008	Heavy Snow
4/1/1997	Heavy Snow	10/29/2002	Winter Storm	4/5/2008	Heavy Snow
4/4/1997	Winter Storm	11/16/2002	High Wind (63 kts.)	4/19/2008	Heavy Snow
4/17/1997	High Wind	11/23/2002	Heavy Snow	6/11/2008	Heavy Snow
4/20/1997	High Wind (50 kts.)	1/22/2003	Winter Storm	11/12/2008	High Wind (50 kts.)
3/4/1998	Heavy Snow	2/1/2003	Winter Storm	12/1/2008	Winter Storm
3/28/1998	Heavy Snow	3/3/2003	Winter Storm	12/2/2008	Winter Storm
11/21/1998	High Wind (52 kts.)	3/7/2003	Winter Storm	12/13/2008	Blizzard
12/3/1998	Heavy Snow	3/11/2003	Winter Storm	12/27/2008	High Wind (61 kts.)
1/23/1999	Heavy Snow	10/29/2003	Winter Storm	1/6/2009	Winter Storm
2/2/1999	High Wind (61 kts.)	11/10/2003	Winter Storm	1/7/2009	High Wind
2/23/1999	Heavy Snow	11/18/2003	High Wind (68 kts.)	1/27/2009	High Wind
4/29/1999	Heavy Snow	12/13/2003	Winter Storm	3/15/2009	Winter Storm
5/9/1999	Winter Storm	1/1/2004	Winter Storm	3/28/2009	Winter Storm
5/30/1999	Winter Storm	12/19/2004	High Wind (73 kts.)	4/29/2009	Winter Storm
1/9/2000	High Wind (70 kts.)	1/13/2005	Winter Storm	12/4/2009	Winter Storm
2/2/2000	Heavy Snow	3/17/2005	Winter Storm	12/12/2009	Winter Storm
2/24/2000	Heavy Snow	3/23/2005	Winter Storm	4/3/2010	High Wind
3/14/2000	High Wind (54 kts.)	4/27/2005	Winter Storm	4/8/2010	High Wind
3/19/2000	High Wind (52 kts.)	11/8/2005	Heavy Snow		

Source: National Weather Service (NCDC, 2010)

Table 4.9-3 presents winter weather events with reported damages 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 representing a unique damaging event.

TABLE 4.9-3
LEIWIS AND CLARK COUNTY SEVERE WINTER WEATHER EVENTS WITH DAMAGES

Date	Inj	Ftl	PD	CD	Remarks	Date	Inj	Ftl	PD	CD	Remarks
2/25/1961	0	0	$106	$106	High Wind	12/13/1979	0	0	$5,556	$0	Wind
3/1/1961	0.04	0	$208	$0	High Wind	10/11/1981	0.16	1	$2,632	$0	Heavy Snow
1/5/1962	0.13	0	$6,250	$0	High Wind	1/18/1983	0.33	0	$16,667	$167	Wind
1/22/1962	0	0	$217	$0	High Wind	9/17/1988	0	0	$25,000	$0	Severe Storm
2/22/1962	0	0	$10	$0	High Wind, Snow and Cold	1/31/1989	0	0	$15,152	$152	Blizzard
11/19/1962	0.07	0	$877	$0	High Winds	2/1/1989	0	0	$87,719	$88	Severe Cold
2/1/1963	0.04	0	$19	$0	High Wind, Snow	5/28/1989	0	0	$2,000	$0	Winter Storm
4/5/1964	0	0	$4	$0	Drifting Snow	10/28/1989	0	0	$3,333	$0	Heavy Snow
5/3/1964	0	0.04	$1,852	$0	High Wind	1/8/1990	0	0	$5,000	$0	High Wind

TABLE 4.9-3
LEIWIS AND CLARK COUNTY SEVERE WINTER WEATHER EVENTS WITH DAMAGES

Date	Inj	Ftl	PD	CD	Remarks	Date	Inj	Ftl	PD	CD	Remarks
12/15/1964	0	0	$8,772	$0	High Wind, Severe Cold	4/27/1990	0	0	$1,613	$0	Winter Storm
1/15/1967	0	0	$877	$0	High Wind	11/22/1990	0	0	$13,514	$0	High Winds
1/19/1967	0	0	$278	$0	High Wind	11/29/1990	0	0	$3,125	$0	High Winds
9/19/1968	0	0	$357	$3,571	Heavy Snow	8/22/1992	0	0	$217	$21,739	Winter Storm
1/1/1969	0	0	$88	$0	Cold and Snow	8/25/1992	0	0	$0	$877	Frost/Freeze
1/26/1969	0	0	$1	$0	Lightning	2/23/1994	0	0	$5,000,000	$0	Winter Storm
3/3/1971	0	0	$167	$0	Wind, Snow	1/28/1996	0	1	$0	$0	Extreme Cold
11/25/1971	0.37	0	$185	$0	Hoarfrost, Ice	4/17/1997	0	0	$2,000	$0	High Wind
1/9/1972	0	0	$877	$0	Strong Winds	11/21/1998	0	0	$20,000	$0	High Wind
1/16/1972	0	0	$1,667	$0	Strong Winds	2/2/1999	0	0	$25,000	$0	High Wind
2/16/1972	0	0	$172	$0	High Wind	12/15/1999	0	0	$15,000	$0	High Wind
3/5/1972	0	0	$167	$0	High Winds	1/9/2000	1	0	$50,000	$0	High Wind
4/18/1973	0	0	$10,417	$0	Blizzard	3/14/2000	0	0	$5,000	$0	High Wind
1/29/1974	0	0	$893	$0	Wind	1/4/2001	0	0	$35,000	$0	Wind
5/19/1974	0	0	$55,556	$0	Snowstorm	3/13/2001	0	0	$1,000	$0	Wind
12/26/1974	0	0	$172	$0	High Winds	1/12/2002	4	2	$0	$0	High Winds
4/7/1975	0	0	$10,417	$0	(Severe Blizzard	6/8/2002	0	0	$800,000	$0	Winter Storm
10/21/1975	0	0	$500,000	$5,000	Snow	3/6/2003	0	0	$3,750	$0	Winter Storm
3/22/1976	1	0	$5,000	$0	Wind	11/13/2006	0	0	$250	$0	High Wind
11/4/1978	0	0	$0	$0	Strong Winds	11/15/2006	0	0	$7,143	$0	High Wind
12/4/1979	0	0	$5,556	$0	Wind	1/1/2007	0	0	$43,750	$0	High Wind
						TOTAL	**3.14**	**2.04**	**$6,800,580**	**$31,700**	

Notes: Inj = Injuries; Ftl = Fatalities; PD = Property Damage; CD = Crop Damage

Source: SHELDUS, 2010 (adjusted to 2009 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.

The data above indicate that winter storms, high winds, and extended cold have affected Lewis and Clark County on numerous occasions. However, no Presidential Disaster Declaration has been warranted. State-wide winter storm disasters were declared in 1978, 1989 and 1996 (DMA, 2011).

Vulnerability and Area of Impact

Lewis and Clark County is equally exposed to effects of extended cold and winter storms during the winter months. Although winter storm events may affect the higher regions with more snowfall, the hazard area for winter storms is considered uniform for the entire county because the population is concentrated in the lower elevations. Annualized loss estimates are presented in the Risk Assessment Summary Tables in *Section 4.11* (**Tables 4.11-1 through 4.11-3**). The Severe *Winter Weather Section* in **Appendix C** presents supporting documentation from the risk assessment.

Probability and Hazard Magnitude

Severe winter storms and extended periods of extreme cold occur in Lewis and Clark County multiple times each year. Therefore, the probability of a severe winter storm event occurring in the future is rated as “highly likely”.

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.

Since winter storms and cold spells typically do not cause major structural damage, the greatest threat to the population is the potential for utility failure from a high wind event during a cold spell. Although cold temperatures and snow are normal in the county, handling the extremes can go beyond the capabilities of the community. Should the temperatures drop below -15 for over 30 days or several feet of snow fall in a short period of time, the magnitude of frozen water pipes and sewer lines or impassable streets could result in disastrous conditions for many people. If power lines were to fail due to snow/ice load, winds, or any other complicating factor, the situation would be compounded. In the event power or other utilities were disrupted, many homes could be without heat. With temperatures frequently dropping below zero in a typical winter, an event where heating systems failed could send many residents to shelters for protection. Other residents may try to heat their homes through alternative measures and increase the chance for structure fires or carbon monoxide poisoning.

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.

Future Development

Lewis and Clark County does not have any ordinances or regulations requiring special considerations to mitigate the affects of severe winter weather or high winds.

The Cities of Helena and East Helena require permits and inspections to ensure the 2009 International Building Codes are followed. These codes 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. Buildings must be designed to withstand a snow load of 30 pounds per square foot minimum.